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Ministry of Health

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CLINICAL PRACTICE  
GUIDELINE

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*FOR*

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PAEDIATRIC

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*April 2013*



Ministry of Health

# CLINICAL PRACTICE GUIDELINE FOR PAEDIATRIC

*April 2013*

# Pediatrics CPGs 89 (including National Program' CPGs)

## Content

### I. EMERGENCY

1. Paediatric Basic Life Support.....	1
2. Management of Pediatric Cardiac Arrest .....	7
3. Emergency Management of Shock.....	11
4. Children and Infant with Seizures .....	18
5. Detresse Respiratoire Aigue Du Nourrisson Et De L'enfant .....	24
6. Choking .....	28
7. Drowning.....	32
8. Poisoning.....	38
9. Caustic Ingestion in Children.....	46
10. Snakebite .....	52
11. Fièvre Aigue et Critères de Gravité.....	61
12. D'un Syndrome Infectieux Chez L'enfant .....	61
13. Recognition of the Critically Ill Child.....	66
14. Traumatismes Craniens de L'enfant .....	72
15. Cardiac Beriberi or Shoshin Beriberi .....	79

### II. RESPIRATORY DISEASES

1. Rhinitis and Rhinopharyngitis (Common Cold) .....	85
2. Acute Sinusitis.....	88
3. Acute Pharyngitis .....	91
4. CROUP.....	94
5. Acute Otitis Media (AOM) .....	99
6. Bronchitis .....	102
7. Bronchiolitis .....	105
8. Community Acquired Pneumonia.....	111
9. Empyema.....	117
10. Empyema.....	123
11. Pneumothorax.....	129
12. Childhood Asthma.....	135

### III. GASTROINTESTINAL DISORDER

1. Dysentery.....	144
2. Gastroesophageal Reflux Diseases (GERD) .....	148
3. Peptic Ulcer Disease in Children.....	156
4. Gastro-intestinal Bleeding.....	162
5. Gastritis .....	170
6. Stomatitis.....	175

7. Pancreatitis .....	178
8. Acute Cholecystitis.....	183
9. Liver Abscess .....	187
<b>IV. CARDOVASCULAR DISEASES</b>	
1. Hypertention in Children .....	193
2. Valvular Heart Disease.....	198
3. Overview on Congenital Heart Diseases in Infant and Children.....	205
4. Congestive Heart Failure in Children.....	216
5. Pediatric Arrhythmia .....	220
<b>V. INFECTIOUS DISEASES</b>	
1. Bacterial Meningitis .....	232
2. Poliomyelitis.....	236
3. Cellulitis .....	240
4. Osteomyelitis .....	244
5. Septic Arthritis.....	248
6. Typhoid Fever .....	254
7. Tetanus .....	259
8. Measles .....	266
9. Varicella.....	269
10. Pertusis .....	273
11. Mumps/Parotitis .....	277
12. Antibiotic Guidelines 2012.....	280
13. Rickettsial Diseases .....	302
14. Melioidosis .....	307
15. Parasitic Infections .....	313
<b>VI. ENDOCRINE DISEASES</b>	
1. Type 1 Diabetes Mellitus in Children (Insulin Dependent Diabetes Mellitus, Juvenile diabetes).....	321
2. Goitre .....	326
3. Adrenocortical Insufficiency (Adrenal Crisis, Addison's Disease) .....	336
4. Diabetes Insipidus .....	340
5. Pediatric Hypoglycemia .....	346
6. Obesity.....	350
<b>VII. RENAL DISEASE</b>	
1. Kidney Stone in Children .....	357
2. Urinary Tracts Infection .....	361
3. Acute Renal Failure in Children.....	365
4. Syndrome Nephrotique Idiopathique De L'enfant (SNI).....	372
5. Acute Poststreptococcal Glomerulonephritis (AGN).....	382

VIII. HEMATOLOGY	
1. Anemia .....	388
2. Immune Thrombocytopenic Purpura.....	398
3. Aplatic Anemia.....	402
4. Acute Lymphoblastic Leukemia .....	405
5. Approach to a Bleeding Child.....	410
IX. RHEUMATOLOGICAL DISEASES	
1. Acute Rheumatic Fever .....	414
2. Juvenile Idiopathic Arthritis.....	420
3. Systemic Lupus Erythematosus.....	428
X. NUTRITIONAL DISORDER	
1. Severe Acute Malnutrition .....	434
XI. NEONATOLOGY	
1. Newborn Resuscitation and Post Resuscitation Care.....	472
2. Neonatal Jaundice.....	481
XII. VACCINATION .....	487





# EMERGENCY

1. Paediatric Basic Life Support .....	1
2. Management of Pediatric Cardiac Arrest .....	7
3. Emergency Management of Shock.....	11
4. Children and Infant with Seizures .....	18
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7. Drowning .....	32
8. Poisoning .....	38
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11. Fièvre Aigue et Critères de Gravité.....	61
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15. Cardiac Beriberi or Shoshin Beriberi .....	79

# PAEDIATRIC BASIC LIFE SUPPORT

By Dr. Chheng Kheng and Dr. Lorntry Patrich

## INTRODUCTION

Basic Life support (BLS) is a technique that can be employed by a single rescuer to support *respiratory and circulatory function of a collapsed child using no equipment.*

The outcome for children following cardiac arrest is generally poor, therefore early recognition that a child's condition is deteriorating and provide appropriate management as soon as possible is crucial.

### Steps in Pediatric Basic Life Support: DRS ABC

<b>D:</b>	<b>Dangers?</b>
<b>R:</b>	<b>Responsive?</b>
<b>S:</b>	<b>Send for help</b>
<b>A:</b>	<b>open Airway</b>
<b>B:</b>	<b>Breathing normally?</b>
<b>C:</b>	<b>Check pulse, start CPR (Cardiopulmonary Resuscitation)</b>

### Dangers?

It is essential that the rescuer does not become a second victim and that the child is removed from continuing danger as quickly as possible.

### Responsive?

#### Checking for response: Are you alright?

- To determine responsiveness gently tap the infant/child's shoulders, speak to the person by name if it is known. Ask loudly "are you alright?"
- Note that infants and children who cannot talk yet and older children who are scared are unlikely to reply meaningfully but may make some sound or open their eyes to the rescuers voice.
- **Do not** shake infants or children.

If responsive	If unresponsive
<ul style="list-style-type: none"><li>• Make the infant/child comfortable and observe ABC</li><li>• Call for nursing/medical help to review infant/child promptly.</li><li>• Monitor his/her condition regularly</li></ul>	<ul style="list-style-type: none"><li>• Assess ABC</li><li>• If more than 1 rescuer available, send one rescuer to call for Ambulance</li></ul>

**Send for help:**

Help should be summoned rapidly. If more than one rescuer are available at the scene, sending for help should be done while at least one rescuer need to be with the victim to perform successive life support.

**Airway: Opening Airway**

When a child is unconscious, all muscles are relaxed. If the infant/child is lying on their back the tongue falls against the back of the throat and obstructs the airway.

To open the airway

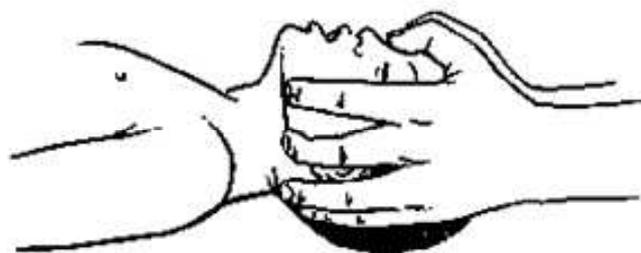
- Lay infant/child flat on the back on a firm surface
- apply head tilt/chin lift and/or jaw thrust in case of trauma
- Positioning: neutral position in infant, and sniffing position in children (see pictures)



Picture: Neutral position in infant



Picture: Sniffing position in children



Picture: Jaw Thrust

A blind 'finger sweep' technique should not be used as it can damage soft palate, and bleeding from within the mouth which can worsen the situation. Furthermore, foreign bodies may be forced further down the airway; they can become lodged below the vocal cords (vocal folds) and be even more difficult to remove.

### Breathing normally?

Once the airway is cleared and open, check for **normal breathing** for no more than 10 seconds, using the following method.

- **Look:** for movement of lower chest or upper abdomen
- **Listen:** for escape of air from nose and mouth
- **Feel:** for movement of chest and upper abdomen

**Note that an occasional gasp or noisy breathing is not considered normal breathing.**

If breathing normally	If not breathing normally
<ul style="list-style-type: none"> <li>• Put the victim in recovery position</li> </ul>	<ul style="list-style-type: none"> <li>• Start rescue breath with mouth to mouth or mouth to mouth and nose ventilation</li> <li>• Can give up to 5 initial rescue breaths (with repositioning of airway if fail to make chest rise) to get 2 effective breaths</li> </ul>



Mouth to mouth ventilation



Mouth to mask ventilation

### Circulation:

If there are no signs of life (unconsciousness, no movement, no normal breathing or coughing), check for a pulse (for no more than 10 seconds). In children the carotid pulse can be palpated. In infants the neck is generally short and fat and the carotid pulse may be difficult to identify.

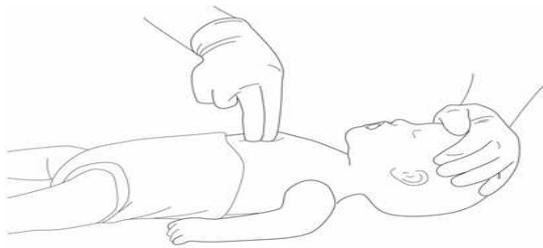
Therefore the brachial pulse or the femoral pulse should be felt.

Start chest compression if:

- No pulse
- Slow pulse less than 60 per minute

- No signs of life

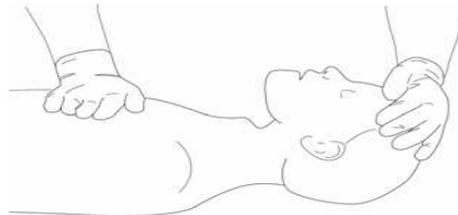
	Infant	child
<b>Pulse check</b>	Brachial or femoral	Carotid
<b>Landmark</b>	lower half of sternum	lower half of sternum
<b>Technique</b>	Two fingers or encircling	One hand or 2 hands
<b>Depth of compression</b>	1/3 to 1/2 of chest depth	1/3 to 1/2 of chest depth
<b>Rate of compression</b>	100 per minute	100 per minute
<b>Ratio</b>	30:2 (single rescuer) 15:2 (2 rescuers)	30:2 (single rescuer) 15:2 (2 rescuers)



Infant 2 fingers technique



Infant 2 hand circling technique



Child 1 hand technique

#### **DURATION OF CPR:**

Rescuers should minimize interruption of chest compression, and CPR should not be interrupted to check for response or breathing as this is associated with lower survival rates.

If multiple rescuers available, rescuers should be changed at least every 2 minutes to prevent rescuer fatigue and deterioration in chest compression quality.

Rescuers should continue CPR until:

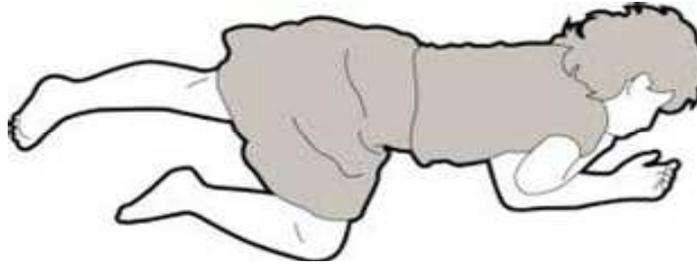
- The victim responds or starts breathing normally
- It is impossible to continue (exhaustion, the scene becomes unsafe...)
- A health professional arrives and takes over the CPR

#### **RESCUE BREATHING WITHOUT CHEST COMPRESSIONS:**

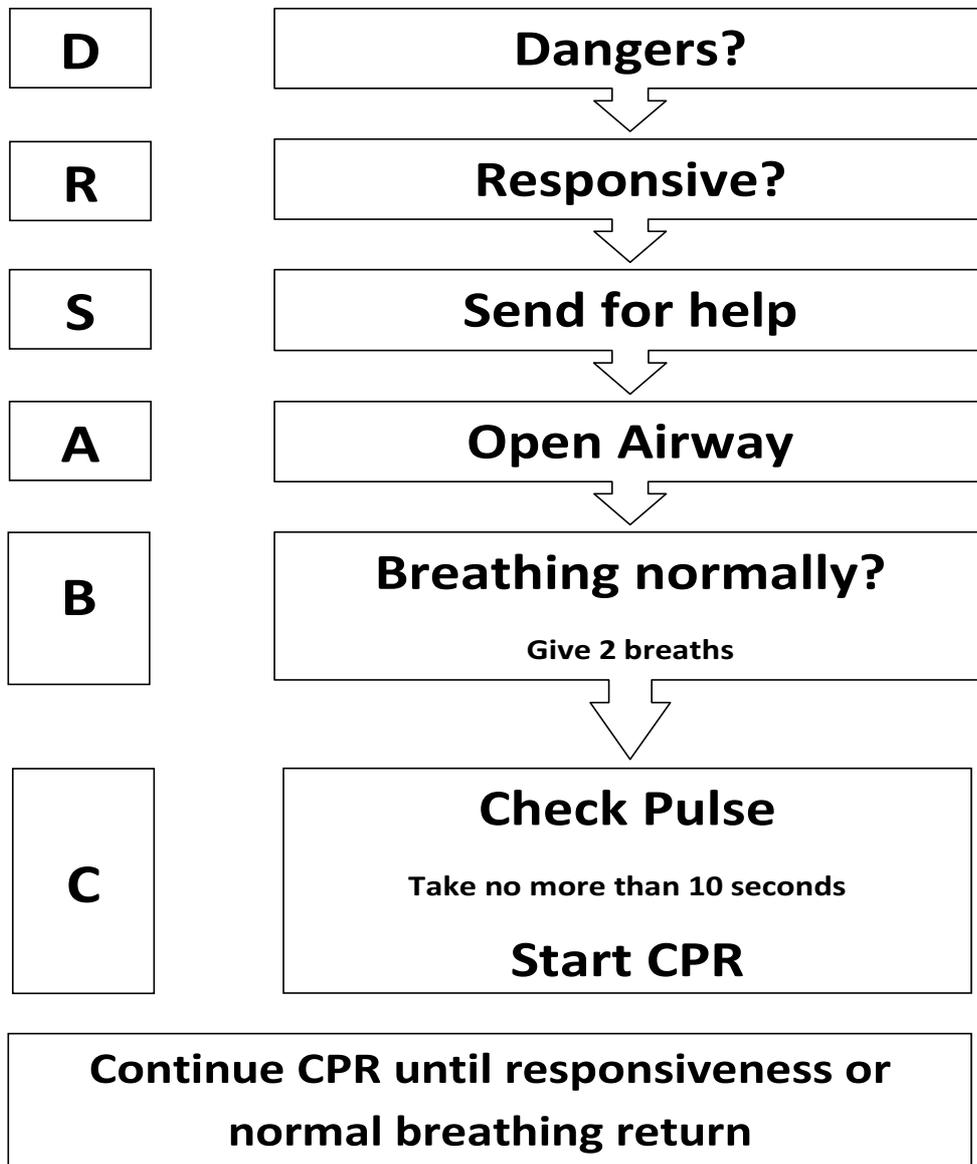
In the event it is determined that an infant or child has signs of circulation but do not demonstrate adequate respirations, rescue breathing should continue using the following:

- Rescue breaths can be delivered at a rate of 20 breaths per minute

- Each breath should be of sufficient volume to see the chest rise. If the chest does not rise, head tilt /chin lift and mask seal should be rechecked
- Avoid inflating lungs with too much force as there is a risk that air will inflate the stomach resulting in regurgitation of stomach contents and aspiration into the lungs;
- Reassess for a pulse every 10 breaths but spend no more than 10 seconds doing so;
- Be prepared to commence compressions if a pulse is no longer palpable
- If the person resumes breathing normally, put him/her in recovery position

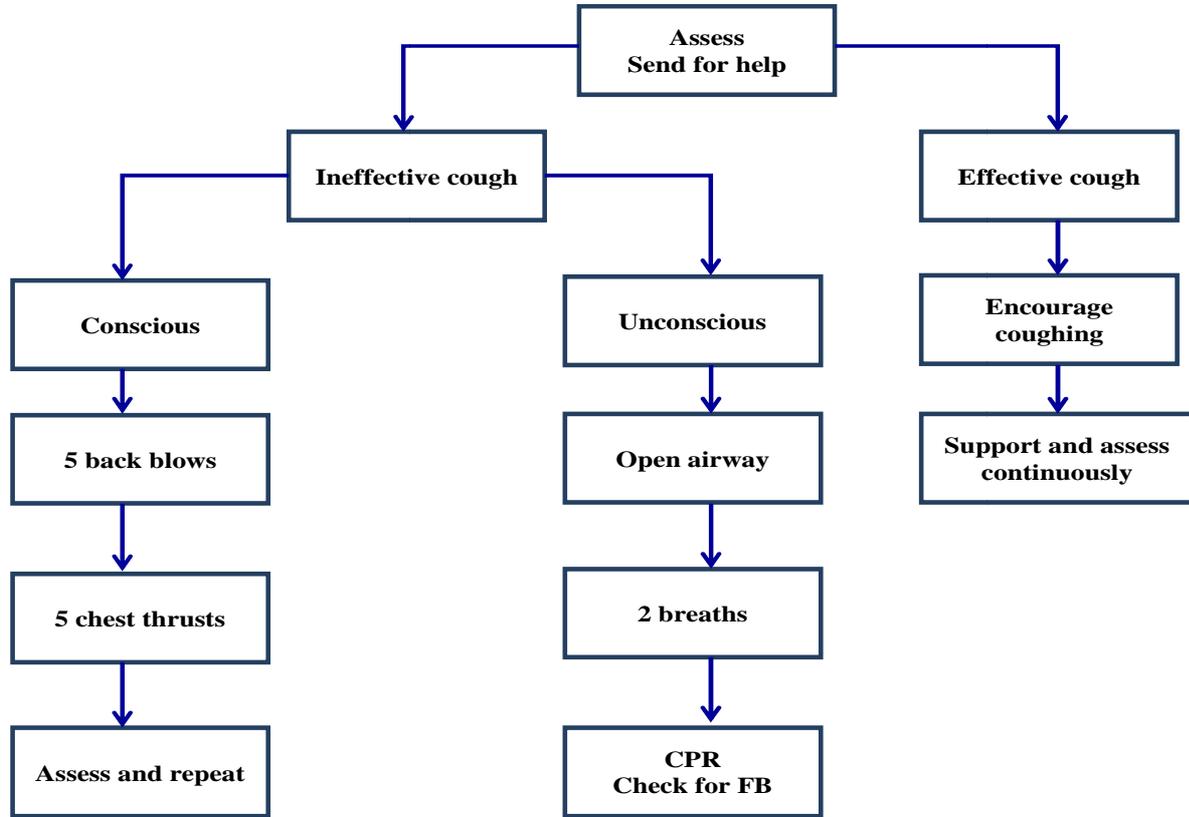


Picture of recovery position



## CHOKING OR FOREIGN BODY AIRWAY OBSTRUCTION (FBAO)

The diagnosis of foreign body aspiration is clear-cut (the onset of respiratory compromise is sudden and is associated with coughing, gagging, stridor) and dyspnea is increasing and apnea can occur.



**Note:** Abdominal thrust should be discouraged as it is associated with injury to internal organ.



chest thrust

### REFERENCES

1. Advanced Pediatric Life Support: Basic Life Support Section modified April 2011 from Australian Resuscitation Council and New Zealand Resuscitation Council for use by trained health professionals.
2. American Heart Association CPR guideline 2010
3. UK Resuscitation Council 2010 Resuscitation Guideline
4. Australian Resuscitation Council 2010 Resuscitation Guideline

# MANAGEMENT OF PEDIATRIC CARDIAC ARREST

By Dr. Kheng Chheng

## I- INTRODUCTION

In contrast to adults, cardiac arrest in infants and children does not usually result from a primary cardiac cause. More often it is the terminal result of progressive respiratory failure or shock, also called an asphyxia arrest.

Cardiac arrest has occurred when there is no effective cardiac output. Before any specific treatment is started, effective basic life support must be established (see BLS guideline).

## II- SEQUENCE OF ACTIONS IN CARDIAC ARREST

1. Start basic life support (see pediatric BLS guideline)
2. Oxygenate, ventilate, and start chest compression:
  - Provide ventilation initially by bag and mask with high oxygen concentration. Ensure a patent airway by using an airway maneuver as described in the pediatric basic life support guideline.
  - Ensure that ventilation remains effective when continuous chest compressions are started.
  - If airway cannot be well secured, intubation should be performed. This will both control the airway and enable chest compression to be given continuously, thus improving coronary perfusion pressure.
  - Once the child has been intubated and compressions are uninterrupted, use a ventilation rate of approximately 12 per minute.
3. Attach to monitor or defibrillator: assess the cardiac rhythm to identify shockable or non-shockable rhythm.
  - i. **Non-shockable rhythm (Asystole/PEA):** more common finding in children.
    - a) Perform continuous CPR:
      - Continue to ventilate with high-concentration oxygen.
      - 15 compressions to 2 ventilations (15:2)
      - Use a compression rate of 100/min
      - Once the child has been intubated and compressions are uninterrupted use a ventilation rate of approximately 12/min

- b) Give Adrenaline
  - If venous or intraosseous (IO) access has been established, give Adrenaline 0.1 ml/kg of 1:10 000 solution
  - If circulatory access is not present, and cannot be obtained quickly, but the patient has a tracheal tube in place, consider giving Adrenaline 1 ml/kg of 1:10 000 solution via the tracheal tube.
  - Give Adrenaline every 3 minutes
- c) Continue CPR, only pausing briefly every 2 min to check for rhythm change
- d) Consider and correct reversible causes (4H 4T):
  - Hypoxia
  - Hypervolemia
  - Hyper/hypokalemia
  - Hypothermia
  - Tension pneumothorax
  - Toxic/therapeutic disturbance
  - Tamponade (cardiac)
  - Thromboembolism
- e) Consider the use of other medications such as alkalizing agents (Sodium Bicarbonate 1mmol/kg) slow iv in case of:
  - prolonged resuscitation
  - known or suspected hyperkalemia
  - Tricyclics antidepressant overdose

Note that:

- Bicarbonate must not be given in the same intravenous line as calcium because precipitation will occur.
- Sodium bicarbonate inactivates Adrenaline and dopamine, so the line must be flushed with saline if these drugs are subsequently given.
- Bicarbonate must not be given by intratracheal route

ii. **Shockable rhythm (VF/VT)**: less common in pediatric cardiac arrest.

- a) Continue CPR until a defibrillator is available.
- b) Defibrillate the heart:
  - Give 1 shock of 4J/kg
- c) Resume CPR:
  - Without reassessing the rhythm or feeling for a pulse, resume CPR immediately, starting with chest compression.
  - Continue CPR for 2 min, then pause briefly to check the monitor:
    - If still VF/VT, give a second shock of 4J/kg
    - Without reassessing the rhythm or feeling for a pulse, resume CPR immediately, starting with chest compression. Consider about reversible causes (4H 4T).
  - Give Adrenaline 0.1 ml/kg (1:10 000) iv or IO after the 2nd shock, once chest compressions have resumed.
  - Repeat Adrenaline every 3 minutes until ROSC.
  - Give Amiodarone 5 mg/kg after 3<sup>rd</sup> shock and one more time after the 5th shock if still in a shockable rhythm.
  - Continue giving shocks every 2 min, continuing compressions and minimizing the breaks in chest compression as much as possible.
  - Note: After each 2 min of uninterrupted CPR, pause briefly to assess the rhythm.
  - If still VF/VT: Continue CPR with the shockable (VF/VT) sequence.
  - If asystole: Continue CPR and switch to the non-shockable (asystole or PEA) sequence as above.
  - If organized electrical activity is seen, check for signs of life and a pulse:
    - If there is ROSC, continue post-resuscitation care.

- If there is no pulse (or a pulse rate of < 60/min), and there are no other signs of life, continue CPR and continue as for the non-shockable sequence above.

### **III- WHEN TO STOP RESUSCITATION**

Resuscitation efforts are unlikely to be successful and cessation can be considered if there is no return of spontaneous circulation at any time with up to 20 minutes of cumulative life support and in the absence of recurring or refractory VF/VT. Exceptions are patients with a history of poisoning or hypothermia in whom prolonged attempts may occasionally be successful.

### **IV-PARENTAL PRESENCE**

Family members should be offered the opportunity to be present during the resuscitation of their child. The presence of parents at the child's side during resuscitation enables them to gain realistic understanding of the efforts made to save their child and they may show less anxiety and depression afterward.

Important points:

- A staff member must be with the parents to support and explain the events to them.
- The team leader, not the parents, decides when it is appropriate to stop the resuscitation. If the presence of the parents is impeding the progress of the resuscitation, they should be asked to leave.

### **REFERENCES**

1. Advanced Pediatric Life Support: The Practical Approach 5<sup>th</sup> Edition (April 2011) by Advanced Life Support Group.
2. Pediatric Advanced Life Support: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care
3. Pediatric Advanced Life Support: 2010 Resuscitation Council, UK
4. European Resuscitation Council Guidelines for Resuscitation 2010 Section 6. Pediatric Life Support



Protocol for pediatric cardiac arrest

VF: Ventricular Fibrillation  
 VT: Ventricular Tachycardia  
 ROSC: Return of spontaneous circulation  
 CPR: Cardiopulmonary Resuscitation  
 PEA: Pulseless Electrical Activity

# EMERGENCY MANAGEMENT OF SHOCK

*By Prof. Srour Yina*

## I. INTRODUCTION

Shock is defined as a state of inadequate tissue perfusion due to poor circulatory flow or increased cellular needs. A series of compensatory mechanisms are activated to cope with the initial shock state which results in clinical manifestations. Untreated, shock states can rapidly deteriorate into failure of multiple organ systems and eventually irreversible shock. Recognition of pre-shock states is important so early goal-directed therapy can be instituted. The regime of resuscitation includes fluid boluses, airway intervention and inotropic support. The key is early shock recognition and prompt action.

## II. DIAGNOSIS

### 1. Recognize some of the following:

- Sick-looking/lethargy
- Tachypnoea
- Tachycardia/Hypotension
- Pallor
- Cyanosis (if Haemoglobin (Hb) adequate)
- Poor capillary refill
- Acidemia (metabolic or mixed acidosis)
- CNS disturbance
- Oliguria
- Agitation or depression

### 2. Investigations

- Blood:
  - FBC
  - Blood gases and acid base
  - Electrolytes, Blood Urea Nitrogen (BUN), creatinine
  - Coagulation profile
  - Group and cross-match, if necessary
- CXR
- Cultures from blood, urine, respiratory secretions; full septic workup if appropriate
- Consider:
  - Disseminated Intravascular Coagulation (DIC) screen
  - Liver Function Test

- Serum cortisol
- Serum lactate
- Mixed venous saturation
- Further management based on diagnostic clues and response to initial therapy

### III. FORMS OF SHOCK

- Hypovolemic
- Septic
- Cardiogenic
- Anaphylactic
- Neurogenic

### IV. IMMEDIATE TREATMENT

#### 1. Improve Oxygenation and Ventilation

- Oxygen by mask, nasal cannula or hood
- Consider intubation
- Ventilate if there is severe hypoxia, respiratory failure, severe respiratory distress or marked acidaemia. Ventilation will reduce work of breathing and cardiac demands, especially in cardiogenic and septic shock

#### 2. Volume Replacement

- Establish IV access; perform blood work including microbiological cultures
- Replete circulating blood volume with normal saline, plasma, albumin or blood in hypovolaemic shock
- In septic shock, volume status must be restored quickly and should be given before starting inotropes
- In cardiogenic shock, fluid resuscitation should be given with caution. Dobutamine or epinephrine is usually started once volume state is optimised
- Start with aliquots of 10–20ml/kg and reassess
- In early resuscitation, both colloids and crystalloids can be given.
- Subsequent fluid therapy in post-resuscitation stabilisation period will usually require a combination of colloids and crystalloids, depending on the clinical state and disease pathophysiology. Blood products should be considered in cases of anaemia, ongoing blood loss or bleeding tendency
- Rate of infusion depends on clinical state; in acute resuscitation, volume should be given as IV push/bolus; in shock states, each fluid bolus can be given over 15 minutes; in less acute situations, the timing may be prolonged to one hour

#### 3. Increase Cardiac Contractility

- Correct pH:
  - Ventilate if respiratory acidosis
  - NaHCO<sub>3</sub> if pH is still < 7.20 and ventilation is adequate  
[(Weight) x (Base Deficit) x 0.15]mEq
  - Repeat if necessary
- Inotrope infusion (see appendix) : Inotrope therapy is usually indicated if the perfusion remains poor after fluid state is restored or there is poor or no response after fluid therapy of 60ml/kg in septic shock. In cardiogenic shock, inotropes should be considered early:
  - Dopamine 5–10µg/kg/min
  - Dobutamine 5–10µg/kg/min
  - Milrinone 0.3–0.7µg/kg/min
  - Noradrenaline 0.1–1.0µg/kg/min

- Adrenaline 0.1–1.0µg/kg/min
- In patients with cardiogenic shock whose cardiac contractility is decreased, adrenaline should be started. Afterload reduction agents (dobutamine and/or milrinone) are useful to decrease the work against which the ventricles must perform, thereby decreasing myocardial oxygen consumption and increasing cardiac output
- Paediatric septic shock, unlike adults, presents usually as cold shock rather than warm shock. In cold shock, circulatory flow is decreased either from poor myocardial effort or increased systemic vascular resistance. When BP is decreased, epinephrine can be titrated to achieve normal BP limits. When BP is normal, an afterload reduction agent e.g. dobutamine or milrinone can improve cardiac output by decreasing systemic vascular resistance (SVR)
- In warm shock, the cardiac output is increased but end organ perfusion is diminished because the SVR is low. Using a vasopressor agent will increase SVR and improve flow. Noradrenaline at lower doses (< 0.5µg/kg/min) or adrenaline at high doses (> 0.4µg/kg/min) will have such effects. In adult studies, dobutamine with noradrenaline have been shown to improve splanchnic flow
- When high doses of inotropes are needed or the shock state does not respond to inotrope therapy, other therapeutic measures should be considered:
  - Vasopressin at low dose of 0.001µg/kg/min
  - Hydrocortisone should be given initially to all patients who are at risk of adrenal insufficiency e.g. prolonged steroid use. This group of patients will require stress doses of hydrocortisone. In addition, certain patients with septic shock who require high catecholamine support may have relative adrenal insufficiency. These patients have low baseline cortisol levels (< 18mg/dl) or poor Adrenocorticotrophic Hormone (ACTH) stimulation response (< 9mg/dl increase after ACTH). These patients may benefit from hydrocortisone given at higher doses
- Inotropes, with the exception of dobutamine and milrinone, should always be administered through a central line, though in an emergency lower doses (dopamine < 10µg/kg/min, noradrenaline and adrenaline < 0.1µg/kg/min) may be administered peripherally for a short period until central venous access is established

#### 4. Monitoring

- All patients with shock who require > 20ml/kg fluid resuscitation should be considered for CICU admission. Upon admission, they should be on hourly parameters, saturation monitoring and strict input-output (I/O) charting
- Urinary catheterisation is needed to quantify output and for initial urine cultures
- Arterial line should be inserted for invasive BP monitoring
- Central venous pressure can be trended via central venous access
- Nasogastric tube and empty stomach to decrease risk of aspiration
- Mixed venous saturations and serum lactate levels may be useful to gauge end-organ oxygen deficit
- Serum cortisol levels should be taken before hydrocortisone treatment

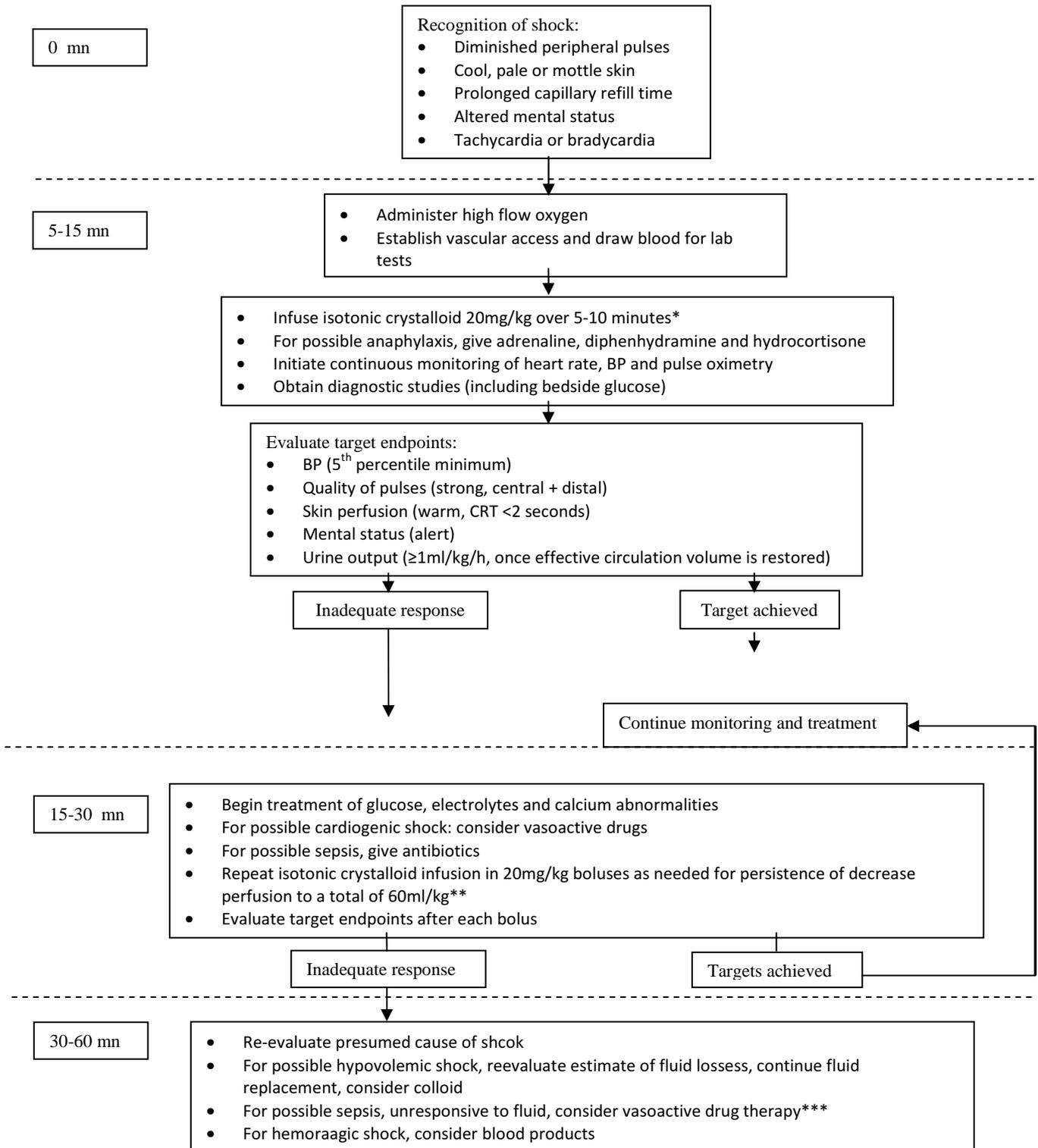
## V. FURTHER MANAGEMENT

- Detailed history, best obtained by another doctor during initial resuscitation
- Detailed physical examination should proceed as the resuscitation process progresses
- Assess neck veins, fontanelle, mucous membranes, skin turgor for signs of hypovolaemia

Note: beware pneumothorax and/or cardiac tamponade if full neck veins and shock are both present

- Fever, focal signs of infection (may be minimal); beware rash consistent with meningococemia
- Signs of heart failure, especially gallop rhythm, cardiomegaly, pulse differential, lung crackles, hepatomegaly.
- Urticaria, mucosal oedema, bronchospasm in anaphylaxis

## Approach to the initial management of shock in children

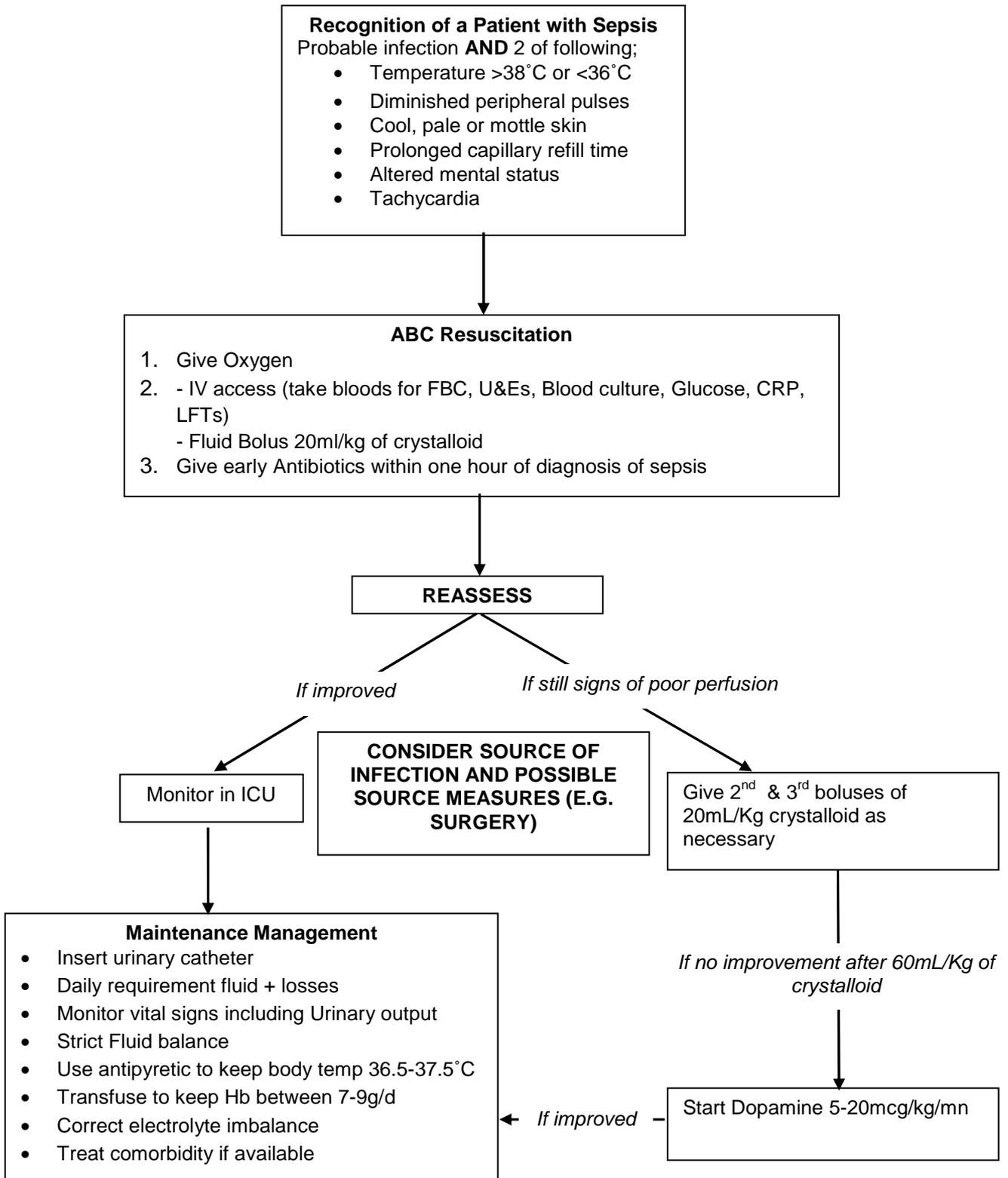


\* For possible cardiogenic shock with hypovolemia, give 5 to 10mL/kg, infused over 10 to 20 minutes. Evaluate target end points and slowly give another 5 to 10 cc/kg if there has been improvement or no change.

\*\* For patients with DKA who do not improve with 20 mL/kg, look for another cause of shock before administering additional crystalloid. For possible cardiogenic shock, slowly give another 5 to 10 mL/kg if there has been improvement or no change.

\*\*\*Dopamine if normotensive, noradrenaline if hypotensive and vasodilated, and adrenaline if hypotensive and vasoconstricted.

### Management of suspected septic shock



## Appendix:

Drug	Preparation	Route	Dosage	Remarks
Adrenaline	Inj 1:10,000 1mg/10ml 1:1,000 1mg/ml vial	IV	Bradycardia/hypotension: 0.1ml/kg IV/IO 1: 10,000 or 0.1ml/kg ET 1:1,000, and subsequently 0.1ml/kg 1:10,000 IV/IO every 3–5 mins. Infusion: 0.1–2µg/kg/min titrated to effect.	May be given via ETT in higher doses (0.1ml/kg 1:1,000 diluted with 2–5mls N/S). For asystole/pulseless arrest, increased dosage no longer routinely recommended.
Dobutamine	250mg/5ml vial	IV infusion	5–20µg/kg/min.	Contraindicated in hypertrophic cardiomyopathy. Half-life 2 mins.
Dopamine	200mg/5ml vial	IV infusion	Low dose: 2–5µg/kg/min.  Intermediate dose: 5–15µg/kg/min.  High dose > 20µg/kg/min.	Increases renal blood flow. Minimal effect on HR and cardiac output. Increases renal blood flow, HR, cardiac output and contractility. Decreases renal perfusion, prominent alpha adrenergic effects.
Isoprenaline	0.2mg/ml	IV infusion	0.1–2.0µg/kg/min. Start with low dose, increasing every 5 mins until desired effects or arrhythmias or HR > 180/min.	Use with care in CHF, ischaemia, or aortic stenosis. Monitor for arrhythmias, hypertension and myocardial ischaemia. Not used in cardiac arrests unless bradycardia due to heart block
Milrinone	10mg/10ml	IV infusion	50µg/kg over 10 min (loading), 0.25–0.75µg/kg/min (maintenance), max 1.13mg/kg/day.	
Noradrenaline	Inj 4mg/4ml	IV infusion	0.05–0.5µg/kg/min.	
Vasopressin	Inj 20U/ml	IV infusion	0.0003U/kg/min for augmentation of vasopressor response.	

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# CHILDREN AND INFANT WITH SEIZURES

By Dr. Chea Peuv

## I. INTRODUCTION

Seizures are a common occurrence in children. About 8% will have at least one seizure by 15 years of age. Many underlying conditions and neurological challenges may provoke seizures. In over 50% of children seizures are isolated events associated with a high fever or minor head injury in young children. Most seizures in children are brief, terminate spontaneously and do not need any treatment.

Seizures that persist beyond five minutes may not stop spontaneously, so it is usual practice to institute anti-convulsive treatment.

## II. DEFINITION

A seizure may be defined as a sudden attack of altered behavior, consciousness, sensation or function produced by a transient disruption of brain function.

Generalized convulsion (tonic-clonic) **status epilepticus** is defined as a generalized convulsion lasting 30 minutes or longer or when successive convulsions occur frequently over a 30 minute period and the patient does not recover consciousness between them.

## III. EPIDEMIOLOGY

Of all children, 3 to 5 percent will have a single febrile seizure in the first five years of life; 30 percent will have additional febrile seizures, and 3 to 6 percent of those with febrile seizures will develop afebrile seizures or epilepsy.

## IV. ETIOLOGY

### 1- Febrile convulsion (6 months to less than 6 years)

- Febrile convulsions are common in children 6 months to less than 6 years old.
- The convulsion is usually short and generalized. The child may sleep following the convulsion, but can be aroused and there are no localized neurological signs.

The generally accepted criteria for febrile seizures include:

- A convulsion associated with an elevated temperature greater than 38°C per axilla
- A child younger than six years of age
- No central nervous system infection or inflammation
- No acute systemic metabolic abnormality that may produce convulsions
- No history of previous afebrile seizures

**2- Convulsion due to infectious causes (other than febrile convulsion)**

- Severe malaria
- Meningitis (including tuberculosis)
- Encephalitis

**3- Afebrile convulsion**

- **Hypoglycemia convulsion** may occur in malnutrition, malaria and other severe infection. *Always* confirm the diagnosis by using a glucometer or taking venous blood.
- **Hyponatraemic convulsion**
- **Hypocalcaemia convulsion** may occur with severe malnutrition including Rickets. It can occur also after repeated blood transfusion.
- **Convulsion due to intoxication or poisoning** (see Intoxication CPG)
- **Convulsion due to epilepsy** (see Epilepsy CPG)
- **Head trauma including child abuse**

**V. APPROACH TO DIAGNOSIS**

**History:**

- Gestation, birth, general health, growth and development
- Current medication; allergies
- Previous history of convulsion
- Precipitating factors:
  - Fever
  - Preceding illness
  - Sleep deprivation
  - Recent head trauma
  - Ingestion/poisoning
  - Change in antiepileptic medication

**Physical examination:**

- Vital signs: temperature, respiratory rate, heart rate, blood pressure
- Complete Neurological examination: pupillary asymmetry, altered mental status, signs of meningism, fixed eye deviation, focal motor weakness
- Signs of head trauma or child abuse: retinal hemorrhages, evidence of increase intracranial pressure
- Head circumference: microcephaly or hydrocephalus
- Complete general examination looking for infectious causes and other diseases
- Skin examination: café au lait spots, facial hemangioma, purpura
- Convulsions: focal or generalized

**Investigations**

- bedside glucose
- malaria smear (if in malaria area)
- FBC
- Where possible
  - Electrolytes
  - sepsis screening (e.g. blood culture, CSF, urine etc)
  - calcium

## VI. TREATMENT

The priorities are:

1. Initial resuscitation
2. Stop convulsion
3. Find and treat the cause of convulsion

### 1 Initial resuscitation:

The first step in the management of the patient who is having a seizure is to assess and support airway, breathing and circulation. This will ensure that the seizure does not compromise supply of oxygenated blood to the brain and is not secondary to hypoxia and/or ischemia.

- Airway = A
- Breathing = B
- Circulation = C

#### **Airway:**

- Open and maintain airway with simple maneuver (see basic life support CPG)
- Secretion clearance with gentle suction
- Put the child in recovery position (left lateral decubitus) to minimize the risk of aspiration once the child is breathing satisfactorily.

#### **Breathing:**

- High flow oxygen via face mask with reservoir as soon as the airway is opened adequately
- Support respiration with bag-valve mask ventilation and consider intubation if the child is hypoventilating.

#### **Circulation**

- Gain iv or intraosseous access
- Treat hypoglycemia (glycemia < 3mmol/l) with D10% 2ml/kg bolus and D10% 1/2NSS 5ml/kg/h infusion (without follow on infusion there is a risk of rebound hypoglycemia)
- Give NSS 20 ml/kg bolus to any patient with signs of shock (except cardiogenic shock, DKA, trauma and severe malnutrition – 10 ml/kg NSS bolus).(Refer to shock CPG)

### 2 Stop convulsion:

Start anticonvulsant medication (midazolam 0.2mg/kg IM or diazepam 0.25mg/kg IV or 0.5 mg/kg PR) if the convulsion lasts more than 5 minutes. Usually if the convulsion started pre hospital, then the duration might already be longer than 5 minutes before the arrival of the patient. In this case, start anticonvulsant medication immediately IM (midazolam) or diazepam IV or rectally if cannot access IV immediately

Repeat the dose if the seizure continues. If after 2 doses the child is still seizing, treat with Phenytoin 20mg/kg IV over 20 minutes (max 1g) or Phenobarbital 15-20mg/kg IV over 20 minutes or via NGT (max 1g).

**Monitor respiratory rate and have resuscitation facilities available including endotracheal tube as all these drugs cause respiratory depression.**

(see the algorithm on management of convulsion below).

### 3 Find and treat the cause:

Once the convulsion has stopped, the effort of management depends on finding and treating the causes of convulsion. If the patient is diagnosed as having a febrile convulsion, then the attempt to find the cause of fever should be made.

- Give antibiotic (Ceftriaxone if > 2 months or Ampicillin/Gentamycin for infant < 2 months (see meningitis CPG)) to any patients thought to have infection leading to convulsion are likely.
- Treat hyponatraemia (if presenting with seizure) with IV 3% NaCl 4ml/kg over 15 minutes
- Treat **confirmed** hypocalcemia with 10% Calcium gluconate 0.5ml/kg, maximum 10ml over 15 minutes

Specialist consultation or transfer should be made in:

- Children with compromise of vital functions
- Prolonged seizures lasting more than 30 minutes
- Seizure continuing after two doses of a benzodiazepam
- Suspected serious underlying cause of seizures e.g meningitis, encephalitis, metabolic abnormality and head injury.
- unable to determine the cause e.g. lack laboratory support to help with diagnosis (no blood gases, cannot check sodium, calcium level etc)

#### 4 Monitoring

Reassess ABC

The vital signs should be reassessed frequently in addition to continuous monitoring with ECG and oximetry:

- After each dose of anticonvulsant medication
- Continuous monitoring while the seizure continues
- Every 15 minutes for at least an hour after a seizure until level of consciousness returns to normal.



## VII. COMPLICATIONS

There are many complications including:

- a. obstruction of the airway and hypoxia
- b. aspiration pneumonia
- c. respiratory depression.

## VIII. EDUCATION

- If the child has had a febrile convulsion, inform the parent convulsion can recur when the child is less than 6 years old.
- When fever, reduce temperature by bath sponging
- give paracetamol to reduce the fever
- Bring the child immediately to health care facility.
- If the child is experiencing of tonic-clonic seizure:
  - Remain calm
  - Roll on to their side immediately if they vomit
  - Protect the child from harm

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# DETRESSE RESPIRATOIRE AIGUE DU NOURRISSON ET DE L'ENFANT

*By Prof. Srour Yina*

## I- INTRODUCTION - DEFINITION

La détresse respiratoire est une insuffisance respiratoire aiguë qui survient brusquement. C'est l'incapacité de l'appareil respiratoire à apporter la quantité d'O<sub>2</sub> nécessaire à l'organisme et/ou l'incapacité à éliminer le CO<sub>2</sub> dans des conditions métaboliques usuelles.

C'est une urgence fréquente et angoissante en pratique quotidienne. Elle impose d'en reconnaître la cause par une analyse méthodique rapide, d'en évaluer la gravité, de débiter sans tarder un traitement et d'en surveiller son efficacité.

## II- DIAGNOSTIC

### 1- Diagnostic positif

La détresse respiratoire est marquée par la survenue :

- D'une modification du **rythme respiratoire**:
  - Le plus souvent par la survenue d'une polypnée, c'est à dire une élévation du rythme respiratoire, qui est normalement chez le jeune enfant de 15 à 20 cycles/mn, chez le nourrisson (enfant âgé de moins d'un an) de 20 à 30 cycles /mn et chez le nouveau né (enfant âgé de moins d'un mois) de 40 cycles /mn.
  - Exceptionnellement peut survenir une bradypnée, témoin alors de l'épuisement.
- De la survenue de **signe de lutte**, témoin de la mise en jeu des muscles respiratoires accessoires :
  - Battement des ailes du nez (dilatation de l'orifice des narines à chaque inspiration)
  - Tirage ou dépression visible des parties molles : sus-sternal, sous sterna (xyphoïdien), intercostal.
  - Parfois geignement chez le nouveau né (liés à une contraction expiratoire paradoxale des cordes vocales)

### 2- Diagnostic de gravité

La recherche de signe de gravité doit être systématique. Il importe d'apprécier:

- L'importance de la polypnée (supérieure à 60 cycles/mn)
- L'importance des signes de lutte (**voir score de Silverman**) ou au contraire leur diminution avec la survenue d'une bradypnée, voir de la survenue d'apnée témoin de l'épuisement et de l'arrêt respiratoire imminent.

- La présence d'une cyanose, d'une agitation, de troubles de la vigilance, témoins de l'hypoxie
- La présence de sueurs, d'une tachycardie, d'une hypertension artérielle, témoins de l'hypercapnie

Leur présence exige un traitement symptomatique et étiologique urgent. Leur persistance malgré un traitement adapté peut conduire à des mesures de réanimation avant transfert en soins intensifs.

### Le score de Silverman

Le score de Silverman un score d'évaluation de la fonction respiratoire, et uniquement de celle-ci, ce chiffre permettant d'apprécier, la gravité d'un syndrome de détresse respiratoire, la normale est de 0.

Le score de Silverman			
Paramètres	0	1	2
1- Tirage intercostals	Absent	modéré	intense et sus-sternal
2- Entonnoir xiphoïdien	Absent	modéré	intense
3- Balancement thoraco-abdominal	respiration synchrone	thorax immobile	respiration paradoxale
4- Battement des ailes du nez	Absent	modéré	intense
5- Geignement expiratoire	Absent	audible au stéthoscope	audible à l'oreille

### 3- Diagnostic étiologique

Dès l'inspection de l'enfant dévêtu, l'analyse méthodique permet de reconnaître le mécanisme de l'atteinte respiratoire.

- **La dyspnée** est bruyante et s'accompagne d'un wheezing (sifflement expiratoire audible à l'oreille) ou d'un cornage, traduisant le passage de l'air à travers des voies aériennes rétrécies. Associée à des **signes de luttés marqués** elle traduit une origine obstructive.

L'analyse du temps (freinage) prédominant permet de préciser le niveau de cette obstruction, qui peut être:

- **Une dyspnée inspiratoire** témoigne d'une **obstruction haut située**
  - **Nasale chez le jeune nourrisson** (*qui n'a pas le reflexe d'ouvrir la bouche*) avec parfois tirage sous mandibulaire: rhinopharyngite hypersecrétante, atrésie partielle des choanes, hypertrophie adénoïdienne (caractérisée par la présence de sécrétions muco-purulentes pharyngées issus du cavum ou "jetage postérieur", et d'une obstruction nasale persistante marquée par des ronflements, et une respiration buccale).
  - **Pharyngée** chez l'enfant plus grand: hypertrophie amygdalienne, abcès rétropharyngé, corps étrangers, ... Il peut s'agir d'un épisode aigue d'hypertrophie amygdalienne dont la cause est souvent une mononucléose infectieuse. Il peut s'agir également d'un accès aigu provoqué par une infection virale simple sur une obstruction chronique jusqu'à présent bien tolérée; il faut alors savoir reconnaître un éventuel syndrome d'apnées obstructives du sommeil (SAOS), liés le plus souvent à une hypertrophie amygdalienne associé à une hypertrophie adénoïdienne.

- **Laryngée**, la plus fréquente: laryngite sous glottique (cornage), épiglottite, corps étrangers, ...
- **Une dyspnée aux deux temps** témoigne d'une obstruction **trachéale**: corps étrangers, compression vasculaire ou tumorale
- **Une dyspnée expiratoire** témoin d'une obstruction **bronchique: bronchiolite chez le nourrisson, asthme chez l'enfant plus grand, corps étranger**.
- Une polypnée, avec des signes de lutte peu marqués, peut être la conséquence:
  - D'une altération **mécanique ostéo-musculaire** de l'appareil respiratoire due à:
    - Une atteinte osseuse : fracture, volet costal
    - Une atteinte musculaire : lésion neurologique, atteinte diaphragmatique, ...
    - Une atteinte pleurale : épanchement liquidien, pneumothorax
  - D'une altération **parenchymateuse**, due à :
    - Une atteinte alvéolaire: pneumopathies infectieuse, alvéolites de causes diverses
  - D'une altération **vasculaire**, due à :
    - Un collapsus vasculaire: choc septique, accident hémorragique, déshydratation, ...
    - Une atteinte cardiaque : insuffisance cardiaque, malformation, myocardite, ...
- Une polypnée sans signes de lutte, doit faire évoquer une **dyspnée dite "sine materia"**. Il peut s'agir :
  - D'une altération **centrale**, due à une atteinte du système nerveux central: traumatisme crânien, méningite, encéphalite,
  - D'une **acidose métabolique**: maladie métabolique, diabète, intoxication ...

### En pratique:

L'interrogatoire, l'examen clinique et les examens complémentaires n'ont souvent qu'une valeur d'appoint dans ce contexte.

- L'interrogatoire des parents peut apporter des éléments complémentaires sur
  - Les antécédents d'épisodes de détresses respiratoires (laryngites récidivantes, crises d'asthmes, ...). En cas de suspicion de SAOS l'interrogatoire doit rechercher la notion d'apnée ou d'accès de tirage pendant le sommeil, des difficultés d'endormissement, des cauchemars, avant que celui-ci ne retentisse sur la croissance, ou s'accompagne d'un ralentissement intellectuel, ou de manifestations plus graves (mort subite).
  - Les circonstances de survenue, aigu avec syndrome de pénétration suggérant fortement un corps étranger, ou progressive avec de la fièvre par exemple évoquant un processus infectieux.
- L'examen clinique doit comporter:
  - Une auscultation pulmonaire à la recherche d'une abolition du murmure vésiculaire, de sibilants ou de crépitations, en appréciant le caractère symétrique ou non des anomalies.
  - Un examen cardiaque: auscultation à la recherche d'un souffle; fréquence cardiaque ; TA.
- Les examens complémentaires
  - La radiographie thoracique confirme le mécanisme évoqué
  - La mesure de la SaO<sub>2</sub> (oxymétrie) ou la mesure directe des gaz du sang confirment les signes cliniques de gravité: PaO<sub>2</sub> < 60 mmHg, PaCO<sub>2</sub> > 60 mmHg
  - L'endoscopie confirmera un corps étranger en assurera le traitement

### III- TRAITEMENT

Les mesures symptomatiques comprendront:

- De placer l'enfant en position proclive
- De rassurer

- D'assurer une désobstruction des voies aériennes: désinfection rhino-pharyngées à l'aide de sérum physiologique en cas de rhino-pharyngite du nourrisson

En cas d'hospitalisation, pourront être réalisés :

- Libération des voies aériennes
- Oxygénothérapie par lunette nasale
- Apports hydriques et caloriques adaptés en fractionnant les prises alimentaires chez le nourrisson ; ou en cas d'impossibilité d'alimentation en raison de la polypnée, par gavage ou par voie veineuse.

- Traitement étiologique

La surveillance de l'évolution se basera sur la mesure régulière, adaptée à la gravité, de:

- La fréquence respiratoire
- Les signes de lutte
- La fréquence cardiaque
- Les signes de gravité: état de vigilance, agitation, cyanose, irrégularité du rythme respiratoire
- SaO<sub>2</sub>

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# CHOKING

*By Prof. IV Malene and Prof. YAY Chantana*

## I. DEFINITION

- Choking is the mechanical obstruction of the flow of air from the environment into the lungs.
- Choking is a true medical emergency that required fast, appropriate action by anyone available.
- Choking prevents breathing and can be partial or complete, with partial choking allowing some flow of air into the lungs. Prolonged or complete choking results in asphyxia which leads to anoxia and is potentially fatal. Oxygen stored in the blood and lungs keep the victim alive for several minutes after breathing is stopped completely.
- Children aged 6months to 4years are at high risk.

## II. CAUSES

- Physical obstruction of the airway by a foreign body (food, toys, household objects). In one study, peanuts were the most common obstruction.
- Respiratory disease that involve obstruction of the airways.
- Compression of the laryngo-pharynx, larynx or vertebral trachea in strangulation.

## III. SYMPTOMS AND CLINICAL SIGNS

If an infant is choking, more attention must be paid to an infant's behavior. They can't be taught the universal sign.

- Difficult breathing.
- Weak cry, weak cough, or both.

- **Sites of obstruction:**

- **In the upper respiratory tract:**

The diagnosis is established by acute onset of choking along with inability to vocalize or cough and cyanosis with marked distress (complete obstruction), or with drooling, stridor, and ability to vocalize (partial obstruction). Onset is generally abrupt, with a history of the child running with food in the mouth or playing with seeds, small coins, and toys.

Without treatment, progressive cyanosis, loss of consciousness, seizures, bradycardia and cardiopulmonary arrest follow.

- **In the lower respiratory tract:**

Respiratory signs vary depending on the site of obstruction and the duration following the acute episode. For example, a large or central airway obstruction may cause marked distress. The acute

cough or wheezing caused by foreign body in the lower respiratory tract may diminish over time only to recur later and present as chronic cough or persistent wheezing. Long-standing foreign bodies may lead to bronchiectasis or lung abscess. Hearing asymmetrical breath sounds or localized wheezing also suggests a foreign body.

#### IV. TREATMENT

If complete obstruction is present, then one must intervene immediately.

##### - What to do if a person starts to choke?

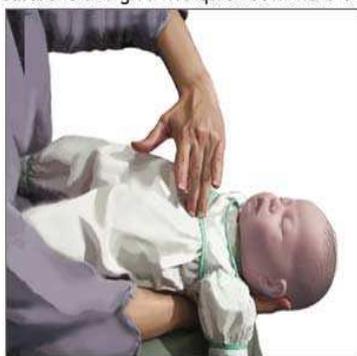
- It's best not to do anything if the person is coughing forcefully and not turning a bluish color. Ask "are you choking?", if the person is able to answer you by speaking, it is a partial airway obstruction. Stay with the person and encourage him or her to cough until the obstruction is cleared.
- Do not give the person any to drink because fluids may take up space needed for the passage of air.
- Someone who can't answer by speaking and can only nod the head has complete airway obstruction and need emergency help.
- Do abdominal thrust for adults and children older than 1 year (Heimlich maneuver).

##### - How to perform back slaps?

It is used for the babies younger than 1 year of age.

- Lay the infant on your arm or thigh in a head down position,
- Give 5 blows to the infant's back with heel of Hand,
- If obstruction persists, turn infant over and give 5 chest thrusts with 2 fingers, one finger breadth below nipple level in midline,
- If obstruction persists, check infant's mouth for any obstruction which can be removed,
- If necessary, repeat sequence with back slaps again.

Place two fingers in the middle of the infant's breastbone and give five quick downward thrusts



ADAM.

Place the infant stomach-down across your forearm and give five thumps on the infant's back with heel of your hand



ADAM.

##### - How to perform abdominal thrust?

- Lean the person forward slightly and stand behind him or her. Make a fist with one hand. Put your arms around the person and grasp your fist with your other hand in the midline just below the ribs. Make a quick, hard movement inward and upward in an attempt to assist the person in coughing up the object. This maneuver should be repeated until the person is able to breathe.
- If the person loses consciousness, gently lay him or her on their back on the floor. To clear the airway, kneel next to the person and put the heel of your hand against the middle of the abdomen, just below the ribs. Place your other hand on top and press

inward and upward five times with both hands. If the airway clears and the person is still unresponsive, begin cardiopulmonary resuscitation (CPR).

- CPR involves both chest compression and artificial respiration. These actions are often enough to dislodge the item sufficiently for air to pass it, allowing gaseous exchange into the lungs.

At hospital, several tests and procedure may be performed to find out what caused the choking and make sure no other objects are blocked the airway:

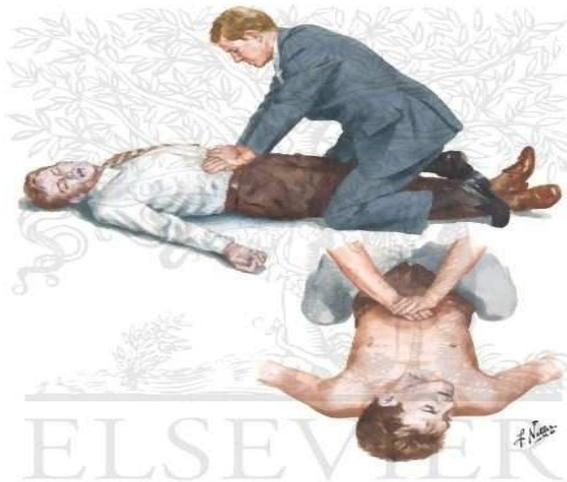
- X ray of the chest or neck (for radiodense objects)
- Laryngoscopy with which the foreign body can be directly visualized
- Bronchoscopy is indicated if clinical suspicion of foreign body aspiration (history of possible aspiration, focal abnormal lung exam or abnormal chest radiography).
- Following the removal of the foreign body, beta-adrenergic nebulization treatments followed by chest physiotherapy are recommended to help clear related mucus or treated bronchospasm.



**Heimlich with Adult**



**Heimlich with Child**



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# DROWNING

*By Prof. IV Malene and Prof. YAY Chantana*

## I. INTRODUCTION

- Drowning remains a significant public health concern, as it is a major cause of disability and death, particularly in children. At least one third of survivors sustain moderate to severe neurologic sequelae.
- It immediately threatens include effects on the central nervous and cardiovascular systems. Thus, the most critical actions in the immediate management of drowning victims include prompt correction of hypoxemia and acidosis.
- The degree of central nervous system (CNS) injury depends on the severity and duration of hypoxia. Post-hypoxic cerebral hypoperfusion may occur. Long-term effects of cerebral hypoxia, including vegetative survival are the most devastating.

## II. DEFINITION

- **Drowning** is death within 24 hours from suffocation by submersion in a liquid, normally fresh water or sea water.
- **Near drowning** is survival for more than 24 hours (even if temporary) from suffocation by submersion.
- **Secondary drowning** is a nonspecific term for death after 24 hours from complications of submersion.
- **Immersion syndrome** is sudden cardiac arrest on cold immersion.

## III. EPIDEMIOLOGY

- International statistics annually, approximately 150,000 deaths are reported worldwide from drowning; the actual incidence is probably closer to 500,000.
- It is the fourth most common injury after road traffic accidents in USA, self-inflicted injuries and violence. It is more common than war deaths.
- In 2007, there were 3,443 fatal unintentional drowning (non-boating related) in the United States statistics and an additional 496 drowning deaths in boating-related incidents.
- Young children (< 5 years) and older adults were shown to be at highest risk.

## IV. ETIOLOGY

Causes tend to vary with the person's age.

- Infants most often drown in bathtubs or buckets of water.
- The children aged 1-5 years; residential swimming pools are the most common venue.

- All age groups typically drown in ponds, lakes, rivers, and oceans: cervical spine injuries and head trauma, alcohol, drug ingestion, seizures, syncope, psychiatric illness, severe arthritis, neuromuscular disorder, diabetes mellitus, cardiac disease, hypothermia, hypoglycemia, which result from diving into water.
- Drowning is a well-recognized complication of natural disasters, such as hurricanes and earthquakes (Natural disasters).
- Suicide

## V. PATHOPHYSIOLOGY

- The most important contributory factors to morbidity and mortality from drowning are hypoxemia and acidosis and the multiorgan effects of these processes. Central nervous system (CNS) damage may occur because of hypoxemia sustained during the drowning episode (primary injury) or may result from arrhythmias, ongoing pulmonary injury or multiorgan dysfunction (secondary injury), particularly with prolonged tissue hypoxia.
- Two minutes after immersion, a child will lose consciousness.
- Irreversible brain damage usually occurs after 4-6 minutes. Most children who survive are discovered within 2 minutes of submersion. Most children who die are found after 10 minutes.
- 85% of cases, asphyxia leads to relaxation of the airway before inspiratory efforts have ceased, and the lungs fill with water.
- [Pulmonary oedema](#) is a common insult. Surfactant loss occurs, producing areas of atelectasis and exudate can flood the alveoli. Further fluid shifts into the alveoli as pulmonary vessels constrict in response to the hypoxia and intravascular pressures rise. In addition, foreign body aspiration, laryngospasm or bronchospasm may worsen the hypoxia.
- [Hypothermia](#), if it occurs, leads to a slowing of the metabolic rate but respiration is slowed even more so and hypoxia and hypercapnia develop. Prolonged hypoxia can lead to CNS and renal damage.
- In addition, haemolysis occasionally occurs after freshwater near drowning. Freshwater drowning can be much faster than salt water drowning. Salt water has a higher osmolarity than plasma and tends to draw water out of the erythrocytes. Freshwater is hypotonic; water is drawn into erythrocytes that swell and burst releasing potassium. This induces [hyperkalaemia](#) that can stop the heart.

## VI. CLINICAL PRESENTATION

- **History:**
  - Mechanism and duration of submersion.
  - Type and temperature of water.
  - Time to institution of CPR.
  - Time to first spontaneous breath.
  - Time to return of spontaneous cardiac output.
  - Vomiting.
  - Likelihood of associated trauma, other precipitants (arrhythmia, myocardial infarction, seizure, nonaccidental injury, etc.).
  - All aspects of the drowning episode should be determined including the circumstances around the actual submersion.
- A drowning victim may be classified initially into 1 of the following 4 groups:
  - Asymptomatic
  - Symptomatic
  - Cardiopulmonary arrest
  - Obviously dead
- Symptomatic patients may exhibit the following:
  - Altered vital signs (eg, hypothermia, tachycardia or bradycardia)

- Anxious appearance
- Cough
- Wheezing
- Hypothermia
- Vomiting, diarrhea, or both
- Tachypnea, dyspnea, or hypoxia: If dyspnea occurs, no matter how slight, the patient is considered symptomatic
- Metabolic acidosis (may exist in asymptomatic patients as well)
- Altered level of consciousness, neurologic deficit
- Apnea

## VII. INVESTIGATIONS

- **ECG:** note rate, rhythm, evidence of ischemia.
- **Bloods:** arterial blood gas, electrolytes, renal function, glucose, osmolarity, alcohol level, FBC, coagulation screen, blood cultures.
- **Radiology:** CXR, also C-Spine and possibly head CT scan if indicated.
- **Bronchoscopy** is indicated if a foreign body is suspected.

## VIII. COMPLICATIONS

There are many possible complications:

- Cardiac: cardiac arrest, bradycardia, myocardial infarction.
- Pulmonary: pulmonary edema, pneumonia.
- Neurological: stroke, cerebral hypoxia, cerebral oedema.
- Renal: renal failure.
- Haematological: haemolysis.
- Metabolic: hyperkalaemia, acidosis.
- Infections: pneumonia, septicaemia.

## IX. TREATMENT

### 1. The immediate action:

- If a victim is in water and not breathing, resuscitation should be started by the rescuer whilst still in the water, as this improves outcome.
  - Start Basic Life Support at the scene (*see basic life support CPG*).
  - Remember the cervical spine may be injured.
  - Initial resuscitation must focus on rapidly restoring oxygenation, ventilation, and adequate circulation. The airway should be clear of vomits or foreign material, which may cause obstruction or aspiration.
- Do not be too eager to abandon resuscitation as hopeless, especially with co-existent hypothermia. Children can have remarkably good recovery after prolonged resuscitation with no neurological problems; however, the outcome is variable. It is not possible to predict at an early stage that will have good outcome and so aggressive resuscitation should be given to all.
- Victims in cardiac arrest require aggressive or prolonged resuscitation and have a high risk of multi-organ system complications, major neurological morbidity or death.
- All pediatric submersion victims probably should be hospitalized or observed for at least 6–12 hr, even if they are asymptomatic on presentation.
- Several important modalities of treatment.
  - Serial monitoring of vital signs (respiratory rate, heart rate, blood pressure, pulse oxymetry and temperature)
  - Rewarming measures.
  - Oxygenation
  - Intravenous fluids are required to improve circulation and perfusion.
  - Nasogastric tube +/- urinary catheter.

- Instigate or continue resuscitation as required. Intubate if unconscious.
- Treat hypothermia, [hypoglycaemia](#), seizures, hypovolaemia, and hypotension, if they occur.
- Both hyperglycemia and hypoglycemia are considered detrimental to the injured brain. Assessment of blood glucose should be obtained in the field and monitored frequently thereafter to maintain normoglycemia. If a child is found to be hypoglycemic, 2ml/kg intravenous dextrose 10% should be administered.
- Antibiotics should be given if fever develops or there is grossly contaminated aspirated water, and then targeted towards the likely pathogens. *Pneumonia* can be a major problem and even a fatal complication. (*See antibiotics treated Pneumonia in CPG*)
- **Bronchospasm** after drowning:  $\beta_2$ -agonist therapy (Salbutamol):
  - Salbutamol inhalation (Ventoline): 0.05 - 0.15 mg/kg/dose of solution 2.5mg/2.5ml
  - Initial dose: 5mcg/kg for 5min followed by maintenance dose 0.1 – 0.3mcg/kg/min IV
  - Salbutamol oral or IV: 0.15mg/kg/dose (max 4mg) 6 hourly
- Epinephrine IV: 0.01 mg/kg of 1: 10,000 solution given every 3–5 min as needed (usually the drug of choice, use with cardiopulmonary arrest, be required to augment myocardial function and support blood pressure). Epinephrine can be given intratracheally (ETT dose is 0.1–0.2 mg/kg of 1: 1,000 solution) if no intravenous access is available.
- The routine use of diuretics or corticosteroids for pulmonary edema or lung injury is not recommended.
- Dialysis for renal failure.
- If the patient is awake and alert, observe for at least 6 hours. Pulmonary oedema may develop late (it usually develops within four hours).
- Otherwise, the following may be needed: continuous positive airway pressure (CPAP), intubation and mechanical ventilation with high positive end expiratory pressure (PEEP), or even extracorporeal membrane oxygenation (ECMO) for severe pulmonary oedema (not available).

## 2. Transfer

Patients must be treated in a facility capable of providing appropriate, age-related intensive care if they exhibit any of the following:

- Significant hypoxia that requires intubation
- Worsening dyspnea with the potential for intubation
- Evidence of hypoxic cerebral injury
- Evidence of renal insufficiency
- Evidence of hemolysis
- Severe hypothermia requiring cardiopulmonary bypass

## X. PROGNOSIS

- Patients who are alert or mildly obtunded at presentation have an excellent chance for full recovery.
- Patients who are comatose, those receiving CPR at presentation to the emergency department (ED) or those who have fixed and dilated pupils and no spontaneous respirations have a poor prognosis.
- Pediatric studies indicate that mortality is at least 30% in children who require specialized treatment for drowning in the pediatric intensive care unit (PICU). Severe brain damage occurs in an additional 10-30%.

## XI. PATIENT EDUCATION

- Drowning of children is often called “**silent death**” or the “**silent killer**”. That is because children just sink and drown. It happens quickly, silently and without notice. There’s no splashing to alert anyone that the child is in trouble.”
- Prevention is key, and community education is the key to prevention.
- Toddlers should not be allowed near bathrooms or buckets of water outside without immediate adult supervision.
- Children should never swim alone or unsupervised, and children younger than 4 years and any children who are unable to swim should be accompanied by a responsible adult within arm's reach. Adults should know their own and their children's swimming limits.
- Appropriate barriers must be used around pools, wading pools, and other water-containing devices at home.
- Children should be taught safe conduct around water and during boating and jet- or water-skiing.
- Use of alcohol or other recreational drugs is not appropriate when swimming or engaging in other water sports, as well as when operating or riding in motorized watercraft. Appropriate boating equipment should be used, including personal flotation devices, and all boaters must understand weather and water conditions.
- Parents should seriously consider learning CPR and water safety training in case rescue and resuscitation are needed.

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## ANNEXE

### Essential Factors Concerning Submersion Incidents

FACTOR	IMPLICATIONS
<b>Submersion duration</b>	Submersion duration <5 min associated with favorable outcome. Submersion duration >10 min highly associated with poor outcome.
<b>Resuscitation duration</b>	Resuscitation duration <10 min for return of spontaneous circulation associated with favorable outcome. Resuscitation duration >25 min highly associated with poor outcome.
<b>Scene CPR</b>	Children with good outcome more likely to have received immediate bystander CPR. Delays in the institution of CPR associated with worse outcomes.
<b>Core body Temperature</b>	Hypothermia very common in pediatric submersion and can affect vital signs, mental status, and resuscitative efforts.
<b>Cardiac rhythm at scene</b>	Patients with normal sinus rhythm at scene likely to have good outcome.
<b>Neurologic responsiveness at scene</b>	Patients with neurologic responsiveness and reactive pupils at scene likely to have good outcomes.
<b>Circumstances of Incident</b>	Consider cervical trauma in shallow water and diving incidents. In boating accidents, consider trauma and carbon monoxide intoxication.

<b>Gastric aspiration</b>	Emesis and subsequent aspiration of gastric contents common during resuscitative efforts.
<b>Nature of fluid medium</b>	Consider possibility of caustic or toxic substance aspiration, such as in bucket drowning. Also, consider possible infectious pathogens that may pose a higher risk in some mediums, such as hot tubs, lakes, and rivers.
<b>Temperature of fluid Medium</b>	Patients drowning in icy water (<5°C) may have potential for neuroprotective effects from rapid cooling of core body temperature.
<b>Concomitant medical conditions</b>	Consider factors that may contribute to submersion events, such as alcohol or drug intoxication, trauma, epilepsy, airway foreign body, and prolonged QT syndrome.
<b>Child abuse</b>	High index of suspicion and careful evaluation needed. Most abusive events involving submersion occur in bathtubs in older toddlers (>15 mo).

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# POISONING

*By Dr. Ngoun Chanpheaktra*

## I- INTRODUCTION

- Accidental and intentional poisoning or drugs overdose constitute a significant source of increase morbidity and mortality and health care expenditure over the world.
- Suspected poisoning in children is common
- Accidental poisoning: most frequently is child 1-5 year olds usually involve household substances.
- Children are rarely intentional poisoned, but by older children or adults or as part of abuse.
- Intentional overdose: suicide children or adolescent should undergo psychiatric assessment.

## II- DEFINITION

- Poisoning occurs when any substance interferes with normal body functions after it is swallowed, inhaled, injected, or absorbed.

## III- DESCRIPTIONS

- ◊ History difficult, know or unknown, suspicious
- ◊ Types of Exposure :
  - Ingestion
  - Ocular (eyes) exposure
  - Topical (skin) exposure
  - Inhalation
  - Envenomation ( i.e. Snake bite)
  - Tranplacental

## IV- EPIDEMIOLOGY

- ◊ Poisoning is a significant global public health problem.
- ◊ In 2004 an estimated 346,000 people died worldwide from intentional poisoning and 91% occurred in low and middle income countries.
- ◊ There is no statistic about the incident of poisoning in Cambodia and no poisoning center available.

## V- SIGNS AND SYMPTOMS OF POISONING

- ◇ Sudden unexplained illness in the previous healthy child
  - Drowsy or coma                      Tachycardia or flushing
  - Convulsion                            Cardiac arrhythmia
  - Ataxia                                    Hypo or hypertensive
  - Hypo/hyperthermia                  Abnormal behavior
  - Tachypnea/ bradycardia              Pupillary abnormalities
- ◇ Toxidromes
  - Sympathomimetic
  - Narcotic
  - Sedative/hypnotic
  - Anticholinergic
  - Cholinergic

## VI- DIAGNOSIS OF EVALUATION

- ◇ History and clinical features
- ◇ CBC
- ◇ Serum electrolytes, glucose, RFTs( Urea & Creatinine)
- ◇ LFTs, coagulation parameters ( PT & APTT)
- ◇ Blood gas: metabolic acidosis
- ◇ Drugs levels ( if possible)

## VII- DIFFERENTIAL DIAGNOSIS

- ◇ Head injury
- ◇ CNS infection (meningitis, encephalitis..)
- ◇ Hypo or hyperthermia
- ◇ Ictal and post-ictal
- ◇ Metabolic
  - Hypo or hyperglycemia
  - Hyper or hyponatraemia
  - Acute renal failure

## VIII- GENERAL MANAGEMENT

- ◇ **Initial assessment and stabilization: Primary survey ABCD**  
 Child suspected poisoning; the first step is prompt recognition and intervention in life- threatening condition.  
**A: Airway:** Look, Listen and Feel.  
**B: Breathing:** Effort, Efficacy and Effects of inadequate respiratory.  
**C: Circulation:** Pulse, CRT, BP and cardiac rhythm.  
**D: Disability:** Mental status/ conscious level (AVPU/CGS), Posture and Pupils size.  
 Plus **Blood glucose** and **Temperature**.
- ◇ **Secondary survey:** Completed history and examination
  - **History:** More focus history to determine substances, quantity and time of ingestion.
  - **Examination:** Vital signs and physical examination and Full neurology examination.
    - Mental status / level of conscious: CGS
    - Pupils size

- Muscle tone/movement
- Focal signs
- Evidence of trauma
- Skin: color, sweating, bulla or rashes
- Bowel sound
- Urine

◆ **SUPPORTING CARE**

- Airway:** Clear airway, intubation  
**Breathing:** Oxygen, ventilation  
**Circulation:** Intravenous fluid, inotrope, control hypertension  
**Metabolic:** Treat hypoglycemia and electrolytes abnormality  
**Convulsion/sedation:** IV benzodiazepam  
**Temperature:** Warming or cooling  
**Renal function:** Hydration, hemodialysis

◆ **ADMINISTRATION ANTIDOTE**

- According to the poison
- Only give when full information and the poison is available
- Opiate overdose: Naloxone 10mcg/kg IV repeat up to maximum dose 2mg.
- Benzodiazepines poisoning: Flumazenil: 10mcg/kg IV slowly
- If substance is corrosive, there may be serious injury to the mouth, throat, airway and esophagus or stomach (NaOH/KOH clean fluid or bleach, disinfectants):
  - Do not give emetics
  - Give milk or water as soon as possible to dilute the corrosive agent.

◆ **GASTROINTESTINAL DECONTAMINATION**

- **Gastric lavage**
  - Use large Oro-gastric tube with saline or water ( 50-100ml in young children and 150-250ml for big child)
  - No definite indications with studies showed variable efficacy.
  - Lavage may consider is ingestion within 1 hour, when emesis is contraindication.
  - Contraindication: caustic agents, hydrocarbon, inability to protect airway.
- **Active Charcoal**
  - Dose: 1g/kg is effective give early within 4 hours PO or NG-tube every 1-6 hours.
  - For adolescents or adult give: 50-100g.
  - Be careful use with antidote: at least give one hour apart.
  - More effective if give within an hour of ingestion.
  - Contraindications: corrosive substances/ hydrocarbon and heavy metals and altered mental status with unprotected airway.
  - Complication: bowel obstruction, bowel perforation, pulmonary hemorrhage and electrolytes disorder.

◆ **Enhances Elimination**

- Repeated dose active charcoal
- Urinary alkalization with force diuresis (Sodium bicarbonate 1-2mEq/kg IV over 1-2 hours and maintain urine pH 7.5-7.7)

- Hemodialysis and hemofiltration

## IX- COMPLICATION PIOSONING

- ◇ Pulmonary aspiration
- ◇ Rhabdomyoysis
- ◇ Acute renal failure/ liver failure
- ◇ Compartment syndromes (snake, spider bite)
- ◇ Hypoxic brain injury

## X- SPECIFIC PIOSONING

### 1- PARACETAMOL

Major toxicity: hepatic damage and dysfunction

Toxic dose: acute ingestion more than 150mg/kg/dose in healthy children & 7-10g for healthy adult.

- ◇ Clinical findings:
  - First 12-24 hours: nausea, vomiting, anorexia, pallor, diaphoresis
  - Patient then develops latent phase
    - Feels well for 1-4 days
    - Gradually develops jaundice & liver tenderness
  - 2-4% of patients with significant overdose develop liver failure
  - Risk of severity may be predicted by amount ingested & plasma levels.
  - Single ingestions < 150 mg/kg likely to be harmless
  - Plasma level at 4 hours after ingestion is the most reliable indicator of toxicity in single overdoses
- ◇ Managements:
  - Decontamination: activated charcoal: If acute; not for chronic.
  - Antidote: N-acetylcysteine: Start as soon as possible within 8 hours of ingestion.
  - Indicated when levels are in toxic range
  - If no levels: history is high-risk for toxicity or signs of liver failure
  - Dose: Load 140 mg/kg PO, then 70 mg/kg PO q4 hs x 17 doses

### 2- ASPIRINE

Acute toxic dose: ingestion 150-200mg/kg/dose mild intoxication and severe intoxication  
ingestion 300-500mg/kg/dose.

Chronic intoxication: ingestion more than 100mg/kg/day for 2days or more

- ◇ Clinical signs:
  - Metabolic acidosis
  - Respiratory alkalosis from hyperventilation
  - CNS depression, seizures, hypoglycemia, hyperthermia
  - Coagulopathy, nausea/vomiting, dehydration
- ◇ Managements:
  - Activated charcoal: multiple doses if needed
  - Blood and urine alkalinization with NaHCO<sub>3</sub>
    - Blood alkalinization removes ASA from tissues
    - Urine alkalinization promotes excretion

### 3- ALCOHOLE/GLYCOLS

Ethanol is the most commonly ingested alcohol

- ◇ Clinical:

- Adolescents: coma, sensory or motor impairment, intoxication, vomiting, seizures, loss of protective airway reflexes
- Infants and toddlers: respiratory depression, coma, hypothermia, hypoglycemia, seizures, metabolic acidosis
- ◇ Managements:
  - Fast recognition and evaluation of blood glucose and electrolytes
    - Treat hypoglycemia
    - Treat electrolytes imbalance
  - Glucose and Thiamine to treat coma, stupor and seizures
  - Airway and breathing: may need intubation
  - Warm the patient
  - Charcoal not effective
- ◇ Alcohols & Glycols: Methanol
  - Primary use is industrial solvent
    - Also found in fuels for stoves, paint removers
    - Methanol not dangerous but its metabolites are
  - Clinical: CNS depression, vision changes, seizures, pancreatitis, metabolic acidosis, arrhythmias
  - Managements:
    - Sodium bicarbonate to correct acidosis
    - Folate and Thiamine to help eliminate toxic metabolite
    - Fomepizol or Ethanol to prevent toxic metabolite formation
    - Charcoal not effective

#### 4- HYDROCARBONS

Carbon compounds - liquid at room temp

- ◇ Toxicities:
  - Chemical pneumonitis if aspirated (can be fatal)
  - Mental status changes (drowsy, confusion, coma)
  - Examples:
    - Solvents ? Lamp oils
    - Fuels ? Household cleaners
    - Polishes ? Baby oils
    - Lighter fluids ? Camphor
    - Organophosphates
- ◇ Managements:
  - Prevent vomiting
    - Decrease risk of secondary aspiration
  - CXR if symptomatic or after 6 hours if asymptomatic
    - May develop to ARDS later
  - Skin & eyes contamination: remove the cloth and wash exposure skin with water and soap. Irrigate exposure eyes with water and saline
  - Charcoal not effective

#### 5- IRON

- ◇ Directly damages GI mucosa
  - Hemorrhagic necrosis of stomach and intestine
  - Ingestion more than 40mg/kg/dosed is considered potentially serious.
- ◇ Clinical:

- Phase 1: GI upset ( Nausea, Vomiting, diarrhea, hemorrhage abdominal pain), encephalopathy, shock, coma for ~6hrs
- Phase 2: feel better, can resolve or go to...
- Phase 3: systemic shock, metabolic acidosis, CNS depression, hepatic dysfunction, coagulopathy.
- If symptomatic: can be life threatening
- If asymptomatic at 6 hours: unlikely to develop systemic illness
- Complications: pyloric stenosis, bowel obstruction.
- ◇ Managements:
  - Fluid resuscitation
  - Inotropes support
  - Treat hypoglycemia (Dextrose solution: 10-25%)
  - If severe signs of toxic: emesis, GI bleeding, shock, coma
    - GI Decontamination ( recommend lavage gastric only)
    - Obtain abdominal X-ray
    - Antidote: **Deferoxamine : 90mg/kg/dose IM** ( maximum 6g/24h) q8hs. If severe IV infusion 15mg/kg/h ( 6g/ 24 hours)
    - Whole bowel irrigation: if iron visible on radiographic.
  - Charcoal not effective

## 6- ISONIAZID (INH)

- ◇ Isoniazid >20 mg/kg/dose in children can be toxic
  - Toxicity from reversal of Vit. B<sub>6</sub> activity
  - Decrease effects synthesis of catecholamine and neurotransmitter GABA (gamma-aminobutyric acid) pathway.
- ◇ Clinical Triad: seizures, metabolic acidosis , coma
- ◇ Managements:
  - Decontamination: Active charcoal
  - Lavage gastric: if massive ingestions
  - NaHCO<sub>3</sub> (treat acidosis)
  - Anticonvulsants for seizures
  - Pyridoxine (70 mg/kg/day up to 5g )
  - The concomitant treat Diazepam and Pyridoxine may improve outcome.

## 7- ORGANOPHOSPHATES

- ◇ Lipid soluble insecticides
- ◇ Absorbed by inhalation, ingestion, and skin penetration
- ◇ May have hydrocarbon aspiration as co-morbidity
- ◇ Clinical:
  - CNS: dizziness, headache, ataxia, seizures and coma
  - Nicotinic signs: sweating, muscle twitching, tremors, weakness, paralysis
  - Muscarinic signs: “ **DUMBELS**”
    - Diaphoresis and Diarrhea
    - Urination
    - Miosis
    - Bradycardia, Bronchospasm, Brochorrhea
    - Emesis ( GI upset)
    - Lacrimation
    - Salivation
- ◇ Managements:

- ABCD
- Decontamination: activated charcoal if ingestion
  - Remove contaminated clothing and wash
  - Make sure no further exposure to caregivers & health worker.
- Atropine: 0.05-0.1 mg/kg/dose IV every 5min
  - Can repeat doses until no more cholinergic symptoms and clearing of bronchial secretions and pulmonary edema
  - Can treat severe poisonings with Pralidoxime

## 8- INHALANTS

- ◇ Used as recreational drugs
  - World-wide problem
  - Cheap, easy to get
- ◇ Solvents: paint thinners, gasoline, glue, correction fluid, whiteout
- ◇ Aerosol sprays: hair spray, cigarette lighter
- ◇ Other gases: ether, nitrous oxide, chloroform
- ◇ Sniffing: direct from the open container
- ◇ Bagging: concentrating vapor in a bag and inhaling
- ◇ Huffing: cloth soaked in liquid & held to mouth
- ◇ Spraying: spraying directly into the mouth
- ◇ Toxicity:
  - Inebriation, light-headedness, euphoria, hallucination, confuse and disorientation.
  - Cardio toxicity, V-fib, respiratory arrest, suffocation from “bagging”
  - Suddenly sniffing death syndrome
  - Chronic use: Leukoencephalomalacia with cerebral atrophy
- ◇ Managements:
  - ABCD
  - IV access, oxygen
  - Cardiac monitoring for arrhythmias
  - Electrolytes, blood glucose, LFTs, urea/creatinine
  - No need for charcoal
  - Psychosocial evaluation and support

## XI- SPECIFIC ANTIDOTES

1- Isoniazid (INH)	Pyridoxine
2- Iron	Deferoxamine
3- Acetaminophen	N-acetylcysteine
4- Salicylate	Sodium bicarbonate
5- Amphetamine, Cocaine	Benzodiazepine
6- Benzodiazepine	Flumazenil
7- Cyanide	Na nitrite; thiosulfate
8- Opioids	Naloxone
9- Calcium channel blockers	Calcium, Glucagon
10-Organophosphates	Atropine, Pralidoxime
11-Methanol, Ethylene glycol	Fomepizole, Ethanol
12-Carbon Monoxide	Oxygen
13-Heparin	Protamine

## **XII- EDUCATIONS**

- ◇ Children's education program is very important as children under the age of 6 are the most frequent victims of poisonings.
  - Teach young children the dangers of poisons
  - Get poison prevention information to children home by distributing materials at school and day care center.
  - Educate parents to keep the drugs or chemical substances out of children reach.
  - Health professional provide poisoning education to the parents.

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# CAUSTIC INGESTION IN CHILDREN

*By Prof. Heng Sothy*

## I. INTRODUCTION

- Caustics and corrosives cause tissue injury by a chemical reaction. The vast majority of caustic chemicals are acidic or alkaline substances that damage tissue by accepting a proton (alkaline substance) or donating a proton (acidic substance) in an aqueous solution.
- Caustic ingestions occur most commonly in children, especially those less than 6 years of age. In this age group ingestions are primarily accidental.

## II. EPIDEMIOLOGY

- Reported to US poison control centers ingestions of caustic substances accounted for more than 200,000 exposures per year. Approximately 80% of caustic ingestions occur in children younger than 5 years.
- Mortality/Morbidity: The alkali drain cleaners and acidic toilet bowl cleaners are responsible for the most fatalities from corrosive agents:
  - Approximately 10% of caustic ingestions result in severe injury requiring treatment.
  - Between 1% and 2% of caustic ingestions results in stricture formation.
- In Cambodia, lye or lye solution “Toeuk Kpong” has been used traditionally in the purpose of making some Cambodian cakes and implicated in traditional treatment of silk product in Khmer culture. Accidental ingestion of corrosive substance is almost alkali-based solution, which caused esophageal stricture being the common motif of hospitalization in pediatrics. Incidence of hospitalized caustic-esophageal stricture was 31 cases (40%) compared with a total numbers of caustic ingestion with 77 cases during 3 year period from July 2008 to May 2011 in Jayavarman VII children hospital Siem Reap-Angkor.

## III. ETIOLOGY

- Common alkaline-containing sources
  - Drain cleaning products
  - Ammonia-containing products
  - Oven cleaning products
  - Swimming pool cleaning products
  - Automatic dishwasher detergent
  - Hair relaxers
  - Cement
- Common acid-containing sources
  - Toilet bowl cleaning products
  - Automotive battery liquid
  - Rust removal products

- Metal cleaning products
- Cement cleaning products
- Drain cleaning products
- Soldering flux containing zinc chloride

#### IV. PATHOPHYSIOLOGY

Caustic chemicals produce tissue injury by altering the ionized state and structure of molecules and disrupting covalent bonds.

- **Alkaline ingestions**

- Severe injury occurs rapidly after alkaline ingestion, within minutes of contact. Tissue edema occurs immediately, may persist for 48 hours, and may eventually progress sufficiently to create airway obstruction.
- The ingestion of a strong alkali results in liquefaction necrosis, which is associated with deep penetration of the lining of the bowel and may result in perforation.
- Injury most typically involves the esophagus, but gastric injury may also occur.
- Over the next 2-4 weeks, any scar tissue formed initially remodels and may thicken and contract enough to form strictures. The likelihood of stricture formation primarily depends upon burn depth. Superficial burns result in strictures in fewer than 1% of cases, whereas full-thickness burns result in strictures in nearly 100% of cases. The most severe burns also may be associated with esophageal perforation.
- Absorption of caustic alkali may result in thrombosis of blood vessels, which further impedes the blood flow to already damaged tissue.
- Alkalis are usually odorless and tasteless. This may result in consumption of a large volume of a caustic in cases of accidental ingestion.
- Alkalis with a pH between 9 and 11, including many household detergents, rarely cause serious injury following ingestion.
- Ingestion of even small quantities of an alkali with a pH above 11 may cause severe burns.

- **Acid ingestions**

- Acid ingestions cause tissue injury by coagulation necrosis, which causes desiccation or denaturation of superficial tissue proteins, often resulting in the formation of an eschar or coagulum. This eschar may protect the underlying tissue from further damage.
- Unlike alkali ingestions, the stomach is the most commonly involved organ following an acid ingestion. This may be due to some natural protection of the esophageal squamous epithelium.
- Small bowel exposure also occurs in about 20% of cases. Emesis may be induced by pyloric and antral spasm.
- The eschar sloughs in 3-4 days and granulation tissue fills the defect. Perforation may occur at this time. A gastric outlet obstruction may develop as the scar tissue contracts over a 2- to 4-week period. Acute complications include gastric and intestinal perforation and upper gastrointestinal hemorrhage.
- Endoscopic view of the esophagus after ingestion of an acid is shown in the images below.

#### V. COMPLICATIONS AND PROGNOSIS

- Airway edema or obstruction may occur immediately or up to 48 hours following an alkaline exposure.
- Gastroesophageal perforation may occur acutely.
  - Secondary complications include mediastinitis, pericarditis, pleuritis, tracheoesophageal fistula formation, esophageal-aortic fistula formation, and peritonitis.
  - Delayed perforation may occur as many as 4 days after an acid exposure.

- Deep circumferential or deep focal burns may result in strictures in more than 70% of patients; these strictures typically develop 2-4 weeks postingestion.
- Gastric outlet obstruction may develop 3-4 weeks after an acid exposure.
- Upper gastrointestinal hemorrhage may occur acutely in caustic exposures.
- Delayed upper GI bleeding may occur in acid burns 3-4 days after exposure as the eschar sloughs.
- Though many button batteries may pass through the GI tract without causing damage, they can result in perforation at any time during their course through the gastrointestinal system, particularly if they are damaged.
- Long-term risks include squamous cell carcinoma, which occurs in 1-4% of all significant exposures and may occur as late as 40 years after exposure

## VI. CLINICAL MANIFESTATION

- The physician should try to identify the specific agent ingested, as well as the concentration, pH, and amount of substance ingested. The time, nature of exposure, duration of contact, and any immediate on-scene treatment are important in determining management of toxicity.
- The presence or absence of the following symptoms should be determined since the presence of any of these symptoms suggests the possibility of significant internal injury. However, their absence does not preclude significant injury.
- The most common symptoms following a caustic ingestion are :
  - Stridor, Hoarseness, dysphonia or aphonia
  - Cough,
  - respiratory distress, tachypnea, hyperpnea, dyspnea dysphagia,
  - Drooling,
  - feeding refusal,
  - retrosternal pain,
  - abdominal pain nausea and vomiting Hematemesis
- Although minor symptoms do not rule out the presence of relevant injury, an increased number of symptoms correlate with a greater likelihood of significant injury.
- Severe symptoms and complications reported following a caustic ingestion include hemolysis, disseminated intravascular coagulation, renal failure, liver failure, perforated viscus, peritonitis, mediastinitis, and death.

## VII. INVESTIGATION

### 1- Laboratory Studies

- pH testing of product
  - A pH less than 2 or greater than 12.5 indicates greater potential for severe tissue damage.
  - A pH outside of this range does not preclude significant injury.
- Complete blood count (CBC), electrolyte levels, BUN levels, creatinine level, and ABG levels may all be helpful as baseline values and as indications of systemic toxicity.
- Liver function tests and DIC panel may also be helpful to establish baselines or, if abnormal, confirm severe injury following acid ingestions.
- Urinalysis and urine output may help guide fluid replacement.
- In cases of hydrofluoric acid (HF) ingestion, precipitous falls in calcium level may lead to sudden cardiac arrest. Although ionized calcium levels are likely to have too long a turnaround to be clinically useful, cardiac monitoring and serial ECGs may help anticipate this event.

### 2- Imaging Studies

- Chest radiography: Obtain an upright chest radiograph in all cases of caustic ingestion. Findings may include pneumomediastinum or other findings suggestive of mediastinitis, pleural effusions, pneumoperitoneum, aspiration pneumonitis, or a button battery (metallic

foreign body). However, the absence of findings does not preclude perforation or other significant injury.

- Abdominal radiography: Findings may include pneumoperitoneum, ascites, or an ingested button battery (metallic foreign body).
- If contrast studies are obtained, water-soluble contrast agents are recommended because they are less irritating to the tissues in cases of perforation.
- CT (chest and abdomen) will often be able to delineate small amounts of extraluminal air, not seen on plain radiographs
- Endoscopy is generally indicated for the following patients:
  - Small children
  - Symptomatic older children and adults
  - Patients with abnormal mental status
  - Those with intentional ingestions
  - Patients in whom injury is suspected for other reasons (eg, ingestion of large volumes or concentrated products)
- However, because of the risk of increased injury, esophagoscopy should not be performed in patients with evidence of esophageal or gastrointestinal perforation, significant airway edema, or necrosis and in those who are hemodynamically unstable.
- Obtaining meaningful information from endoscopy after treatment with activated charcoal is very difficult. Routine use of activated charcoal is not recommended in caustic ingestions.
- Endoscopic ultrasonography has been shown to more accurately show the depth of lesions than endoscopy alone.[6] Further studies will be necessary to determine the utility of this procedure in aiding in diagnosis and treatment.

## VIII. DIFFERENTIAL DIAGNOSIS

- Gastroenteritis
- Gastrointestinal Bleeding
- Perforated Peptic Ulcer
- Toxicity, Iron
- Plant Poisoning, Oxalates
- Croup or HYPERLINK "<http://emedicine.medscape.com/article/800866-overview>"Laryngotracheobronchitis

## IX. MANAGEMENT

### 1. Prehospital Care

- Attempt to identify the specific product, concentration of active ingredients, and estimated volume and amount ingested.
- Do not induce emesis or attempt to neutralize the substance by using a weak acid or base. This induces an exothermic reaction, which can compound the chemical injury with a thermal injury. It may also induce emesis re-exposing tissue to the caustic agent.

### 2. Medication

- Supportive care, rather than specific antidotes, is the mainstay of management following caustic ingestions:
  - Give IV fluid.
  - Nasogastric tube inserted with endoscopic examination for nutritional support and prevention infection.
  - The most significant therapeutic option in the acute post-injury phase (48–72 hours after ingestion), was a surgical gastrostomy, performed in children unable to swallow liquids or saliva, to achieve adequate nutritional support.
  - When patients arrived at the hospital after a delay of 72 hours to 3 weeks after ingestion, endoscopy was not carried out due to the high risk of perforation. A

gastrostomy was performed in the presence of severe dysphagia or after an unsuccessful dilatation attempt in children admitted late at more than 3 weeks after the injury, with swallowing problems.

- The first dilatation was always carried out at least 3 weeks after ingestion.

- **Steroids**

May be used in an attempt to decrease stricture formation: **Solucortef: 20mg/kg/d, bid** (10 days, then prednisone 1mg/kg/d bid for 3 weeks).

- **Antibiotics:** May be used in severe cases to prevent secondary infection. These agents should be administered if evidence of perforation exists.

- Cephalosporin: Ceftriaxone 100mg/kg/d, one time per day for 10 days or
- Ampicillin: 100mg/kg/d, one time per day for 10 days.

- **Proton Pump Inhibitor and H2 blocker**

Proton pump inhibitors reduce exposure of injured esophagus to gastric acid, which may result in decreased stricture formation. It is indicated for short-term treatment of GERD associated with erosive esophagitis. Also effective in treating gastric ulcers, including those caused by *H pylori*.

- Omeprazole: 1mg/kg/day for 10 days
- Tagamet: 20mg/kg/day bid for 10 days

- **Morphine : 0.1-0.2 mg/kg/dose IV/IM/SC 3 to 4 times per day**

- Analgesic Narcotic analgesics should be used to reduce the pain associated with these ingestions.

- Discharged patients should be able to ingest oral fluids without difficulty, demonstrate easy speech, be reliable, and be familiar with and able to return should any delayed symptoms occur.

- Obtain a psychiatric evaluation for all patients with intentional ingestion.

- Arrange for a follow-up esophagram 3-4 weeks postingestion.

## X. PATIENT EDUCATION AND PREVENTION

- Caustic substances should be kept in their original labeled containers to avoid accidental ingestion. They should be stored out of reach of toddler-aged children.
- Workplace policies and procedures need to be developed and disseminated, so that employee exposures can be treated quickly and effectively.

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# SNAKEBITE

By Prof. CHAN Sary

## I. INTRODUCTION

Snakebite is one of the most neglected public health issues in the poor rural communities living in Cambodia. The true burden of snakebite is not known because of large-scale misreporting.

Cambodia is a heavily affected region due to widespread agriculture activities with home environmental exposure to hidden place of snakes, numerous venomous snake species and lack of functional snakebite control programs.

Snake envenoming is a potential life threatening condition. It is characterized by systemic effects ranged from non-specific signs such as nausea, vomiting to coagulopathy, neurotoxicity, myotoxicity and renal damage [1, 2].

In Cambodia, snakebites increase perceptibly during the rainy season particularly in provinces along the Mekong and Tonle Sap floodplains [3]. Despite this perception, snakebite incidence, disability, mortality are not currently reported due to lack of accurate data within health referral offices as well as the Ministry of Health. A majority of snakebites injuries are not treated in health facilities and naturally the victims seek traditional healers [3].

Seeing the burden and complications of envenomed cases with a challenging outcome of snakebites under conventional treatment by antibiotic application and surgical procedures (debridement, Fasciotomy), Kantha Bopha Hospital has adapted a protocol of treatment based on specific antivenom serums since the beginning of year 2010. Over the year 2010, 46 snakebite cases which were subjective to a retrospective study, were treated in Kantha Bopha Hospital-Phnom Penh.

## II. DEFINITION

According to the International Classification of Diseases code (E905 and E906) for bites and stings, a snakebite is definite if a snake bit or spat and was seen, probable if a snake was seen nearby with fang marks or clinical effects suggestive of snakebite without fang marks and possible if a snake was not seen but definite fang marks were found [4].

- **Dry bites** are bites not accompanied by any local effect because no venom is injected or the snake is non-venomous [5].
- **Local envenoming** is defined as only local effects such as pain, swelling, blisters or tissue necrosis without systemic abnormalities because insufficient venom is injected [1, 2].

- **Systemic envenoming** is defined as both local effects and at least one of coagulopathy, neurotoxicity, myotoxicity and renal impairment or non-specific signs (nausea, vomiting, abdominal pain, dizziness and headache) [1, 2].

### III.EPIDEMIOLOGY [6]

#### Venomous snakes of Cambodia

Cambodia shares many aspects of its venomous snake fauna with neighbouring Thailand, Vietnam and Laos. There are approximately 86 different snake species including 17 species that are known to be venomous [6]. Among 17 venomous snakes, 6 species are responsible for the majority of all severe illness and 5 species can cause potentially fatal illness. Cambodia's venomous snakes belong to 2 main groups such as Elapidae and Viperidae that are easily distinguished on the basis of external morphology:

#### External morphology



#### Elapidae

- Rectangular head
- Round pupil
- Immobile, short fangs



#### Viperidae

- Triangular head
- Elliptical pupil
- Mobile, long fangs

#### 1. Hematotoxic snakes



## 2. Neurotoxic snakes



**Banded krait**



**Red-headed krait**



**Malayan or blue krait**

## IV. PHYSIOPATHOLOGY [6]

### Actions of snake venom

#### General effects of snake venoms

- Cytotoxins: destroy cell tissue by increasing membrane permeability and cell membrane hydrolysis & proteolysis
  - Haemorrhagins: damage blood vessel walls
  - Haemolysins: damage blood cell membranes
  - Procoagulant toxins:
    - disruption of normal haemostasis by causing abnormal activation of blood clotting factors
    - factor depletion (consumptive coagulopathy)
  - Platelet toxins: destroy platelets, may either initiate aggregation or inhibit aggregation.
  - Neurotoxins:
    - α-neurotoxins (postsynaptic- reversible) block acetylcholine binding to receptors in neuromuscular synaptic
    - β-Neurotoxins (pre synaptic- irreversible) target nerve terminals and destroy them from inside after being internalized by endocytosis
  - Myotoxins: Rhabdomyolysis can lead to indirect nephrotoxicity due to accumulation of cellular debris in kidney nephrons
  - Nephrotoxins: induce direct nephrotoxicity by causing renal tubular necrosis
  - Cardiotoxins: poisoning general myocardial cell membranes causing irreversible cellular depolarization.
    - \*\*\* Commonly bites by the Viperidae result in hemotoxicity while bites by the Elapidae cause neurotoxicity.
- Understanding the actions of venoms of each type of snake can sometimes help identification of the species responsible.

## V. SYMPTOMATOLOGY [1, 3]

### 1- Symptoms & signs of Viper bite (Hematotoxic snake):

- **Dry bite:** no local effects
- **Local envenoming:** starts progressively in hours after bite: pain-edema-blisters-necrosis
- **Systemic envenoming:**
  - Coagulopathy:** Local bleeding, systemic bleeding (skin ecchymosis – gum bleeding, GI bleeding)
  - Nephrotoxicity:** Russel’s viper can cause nephrotoxicity and **neurotoxicity**. Severe rhabdomyolysis often cause renal failure



### 2- Symptoms & signs of Elapid bite (Neurotoxic snake):

- **Dry bite:** no local effects
- **Local envenoming:** starts progressively in hours after bite: pain-edema-blisters-necrosis (for cobras), numbness (for kraits)
- **Systemic envenoming:**
  - Neurotoxicity:** starting from drowsiness to descending paralysis: face-respiratory –trunk & limb Blurring of vision, pupillary abnormalities (some patients may have long-term pupil dilation after krait envenoming), abnormalities of taste & smell (may persist for many months after bite), urinary retention
  - Cardiotoxicity:** arrhythmias:



## VI. DIAGNOSIS [6]

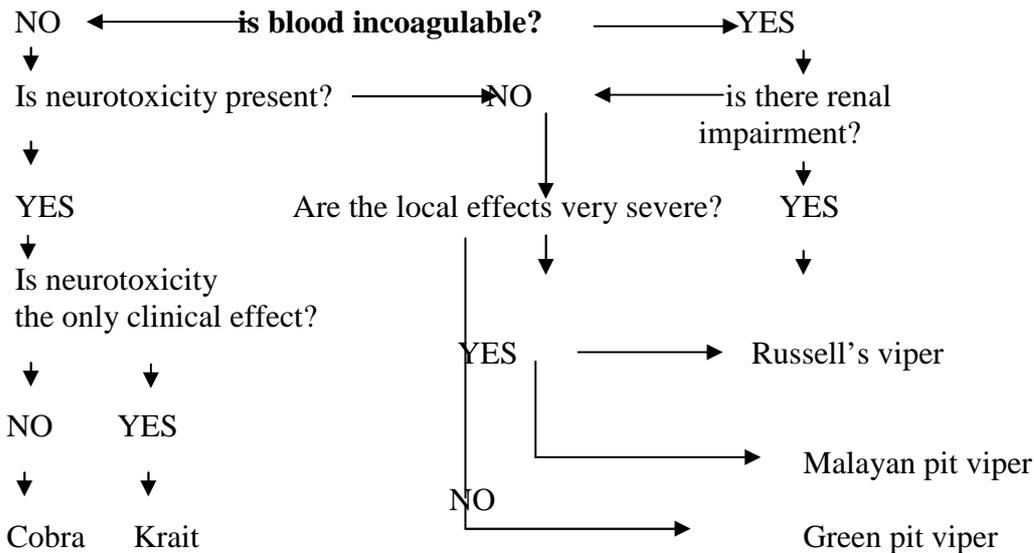
### 6.1. Snakebite identification

- Identify the likely snake responsible for bite: Have the victim or entourage describe or point the snake species (on pictures of snakes) that he or they have seen on spot.
- Usually two fang marks are found.
- All patients will be kept the patient under 24 h observations
- Determine the exact time of the bite

➤ **Timing of onset of toxinodromes after bite**

- Coagulopathy: 1-2h.
- Neurotoxicity: 3-4h
- Cytotoxicity- Myotoxicity: hours
- Nephrotoxicity: 12-24h.
- Cardiotoxicity : 2-6h

**6.2. Presumptive identification**



**6.3. Laboratory investigations**

➤ **20-minute whole blood clotting test (20' WBCT)**

If the 2 ml of freshly sampled venous blood in a small, dry, glass vessel left undisturbed for 20 minutes is still unclotted and runs out, the patient has hypofibrinogenaemia as a result of venom-induced consumption coagulopathy. In Cambodia, incoagulable blood is diagnostic of a viper bite and rules out an elapid bite.



- **Prothrombin Time (PT):** Normal range is 12-16 seconds.
- **Partial Thromboplastin Time (PTT):** Normal range is 25-47 seconds.
- **Fibrinogen level:** Normal range is 1.5-4.5 g/L. In DIC involving defibrination, the fibrinogen level will be critically below these ranges, and is often undetectable.
- **Fibrin-degradation products (FDP):** Normal range is < 10 µg/ml. In DIC involving defibrination, the FDP levels may be extremely high.
- **Whole blood cell count**
- **CK, Kaliemia ,Urea-Creatinemia**
- **ECG, X ray- Ultrasound- CT scan** (If distant bleeding is suspected)

**VII- FIRST AID TREATMENT PROTOCOL**

### 7.1. Recommended Method for Cambodia: “Do it R.I.G.H.T”

- Reassure the patient: 80% of all Cambodian snakes are non- venomous. Only 60% of bites by venomous species actually envenomate the patient
- Immobilize in the same way as a fractured limb, use bandages
- Get to **H**ospital immediately
- Tell the doctor of symptoms

### 7.2. Discarded Method

- Tourniquets
- Cutting and Suction
- Electrical Therapy and Cryotherapy

### 7.3. Newer Method

- Immobilisation for viper bites or unidentified snakebite
- Pressure Immobilisation bandages (PIB) for Elapid bites

### 7.4. Snakebite Prevention

- Footwear
- Use a torch at night
- Walk with a heavy step
- Pay close attention to the leaves and sticks collecting
- Avoid sleeping on the ground

## VIII. SNAKEBITE TREATMENT PROTOCOL

### 8.1. Patient assessment on arrival

- Resuscitation of ABC (Airway, Breathing, Circulation)
- Tetanus vaccination (after ASV if clotting disorder)
- Antibiotics: Ceftriaxone(100mg/kg/day)+ Metronidazole(30mg/kg/day) if large wound injuries
- Pain killer: Tylenol (20mg/kg/dose)
- Handling Tourniquets: sudden removal of the tourniquet can lead to hypotension/ respiratory distress due to massive surge of venom, but it is safe to remove it slowly or after ASV (anti-snake venom).

### 8.2. Antivenom treatment

#### 8.2. 1. Choice of anti-snake venom (ASV)



For viper bites



For Elapid bites

**. 8.2.2. ASV indication:** Best results when given early! Never delay! If either:

- Severe current local envenoming (swelling >50% of the limb) or
- Systemic envenoming: coagulopathy, neurotoxicity, cardiotoxicity nephrotoxicity, rhabdomyolysis

**8.2.3. ASV dosage- no ASV test doses**

Children should receive the same initial dose of ASV as adults, as snakes inject the same amount of venom into children as adults.

Snake species	Antivenom	Starting dose: IV in 30-1h
Malayan pit viper	TRC Hemato Polyvalent	10 vials
Russell's viper	TRC Hemato Polyvalent	10 vials
Green pit viper	TRC Hemato Polyvalent	2-5 vials
Monocellate cobra	TRC Neuro Polyvalent	10 vials
Spitting cobra	TRC Neuro Polyvalent	10 vials
King cobra	TRC Neuro Polyvalent	20 vials
All species of kraits	TRC Neuro Polyvalent	5 vials

**. 8.2.4. Treatment of ASV reactions**

ASV reactions: fever, chills, urticaria, itching or itchy throat. Monitor closely vital signs during infusion of ASV: watch for stridor, wheezing, dyspnea, syncope or arrhythmias.

- 1- Discontinue ASV
- 2- H1 Antihistamine: Promethazin/ Chlorpheniramine maleate (0.2mg/kg IV) + Paracetamol PO (20mg/kg/dose)
- 3- Hydrocortisone IV: 10mg/kg
- 4- Restart ASV after recovery.
- 5- Adrenaline IM 0,01mg/kg is reserved for moderate to severe anaphylaxis.

**8.2.5. Recovery phase**

Reassessment, if an adequate dose of appropriate ASV:

- a) Systemic bleeding stops within 15-30 mn.
- b) 20' WBCT (-) in 6 h.
- c) Paralysis by Cobra improves in 30' or hours.
- d) Paralysis by Krait improves in considerable time
- e) Active haemolysis & rhabdomyolysis cease within a few hours
- f) Shock disappears after 30 mn.
- g) Rising platelet rate is not significantly accelerated and blood CK was not decreased after ASV.

**8.2.6. Repeat ASV doses**

- **Persistent bleeding:**

- Same dose every 6h until coagulation has been restored (max dose: 30 vials)
- Vitamin K (10mg IV)/ others haemostatic agents
- Use Fresh Frozen Plasma if available.

-Blood products: only use if severe uncontrollable bleeding or adequate ASV has been given

○ **Persistent neurotoxicity:**

-Same dose after 1-2h (maximum dose: 20 vials)

-Neostigmine IM (0,04mg/ kg) + Atropine IV (0,05mg/kg) half hourly x 8h

(Neostigmine is an anticholinesterase that prolongs the life of acetylcholine and can therefore reverse the respiratory failure and neurotoxic symptoms.

### 8.2.7. Others treatments

➤ **Rhabdomyolysis:**

-Mild (no complication): Rehydration

-Severe: Alkalinize urines by IV fluids (30ml of 8, 4%NaHCO<sub>3</sub>/l of serum) or hemodialysis

➤ **Hyperkalemia:**

-Mild (no ECG changes): Diet, stop medications responsible

-Severe: Diuretic (Lasix: 1mg/kg/dose) or (Glucose and Insulin, Ca, NaHCO<sub>3</sub>)

➤ **Hypotension:**

Beside a number of causes, Russell's viper is known to cause acute pituitary adrenal insufficiency. So Dopamine and Hydrocortisone are helpful.

➤ **Renal failure:** Diuretic, Dialysis. ASV has no efficacy

➤ **Serum sickness:** Antihistaminic/ Prednisolone(1mg/kg/day) x 5days

➤ **Wound care**

-Prevent rupture of bullae; aspirate aseptically if large

-Clean skin daily gently with Betadine or soap & water

-Elevate limbs to reduce bleeding & swelling

➤ **Surgical intervention :** when stable after ASV:

-Debridement: if tissue necrosis

-Fasciotomy: if compartment syndrome

-Skin Grafting: if loss of tissues

-Amputation: if gangrene

➤ **Rehabilitation & Follow-up:** kinesis, next tetanus toxoid dose.

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# FIÈVRE AIGUE ET CRITÈRES DE GRAVITÉ D'UN SYNDROME INFECTIEUX CHEZ L'ENFANT

By Prof. Kdan Yuvatha

## I- DEFINITION ET INTRODUCTION

- La fièvre est l'élévation de la température corporelle centrale au delà de **38° C**.
- On parle de fièvre aiguë quand le symptôme dure depuis moins de 5 jours ; au delà de 21 jours on parle de fièvre prolongée ou de fièvre au long cours.
- C'est un symptôme extrêmement fréquent car il accompagne :
  - *un grand nombre de maladies infectieuses le plus souvent bénignes et ,*
  - *particulièrement banales dans la petite enfance.*
- Ainsi la fièvre est le premier motif :
  - *de consultation chez l'enfant*
  - *d'admission dans les services d'urgences pédiatriques.*

Certains enfants justifient une prise en charge "médicalisée" du fait de la gravité potentielle des infections :

- les petits nourrissons (âge < 3 mois) chez qui peuvent se révéler tardivement des infections bactériennes d'origine périnatale (Listéria, Streptocoque B).
- les nourrissons de moins de 6 mois chez qui les infections bactériennes peuvent entraîner une décompensation rapide.
- les enfants porteurs d'un déficit immunitaire susceptibles de développer des infections graves ou à germes inhabituels.

## II- ÉTIOLOGIES

Dans la grande majorité des cas, il existe des signes fonctionnels ou physiques qui orientent vers le site de l'infection.

### 1. Infections de la sphère ORL :

Ce sont sans doute les plus fréquentes :

- rhinite et rhino-pharyngite. - otite moyenne aiguë,
- angine, - laryngite.
- sinusite, - .....

Chez le nourrisson les otites sont une cause très fréquente de fièvre apparemment isolée, et il faut apporter un soin particulier à l'examen otoscopique.

## 2. Infections broncho-pulmonaires:

La toux est un symptôme presque constant dans les infections de la sphère respiratoire :

- bronchite, - broncho-pneumonie,
- bronchiolite, - abcès du poumon,
- pneumonie, - .....

## 3. Infections digestives:

- gastro-entérites, - dysentérie,
- diarrhée, - .....

## 4. Infection urinaire

## 5. Autres Infections :

- infection virale (rougeole, rubeole,...)
- Fièvre typhoid,
- paludisme,
- méningite,
- .....

## III- DIAGNOSTIC

La fièvre est diagnostiquée sur la base :

### 1. Examen Physique (sensation par palpation)

- d'utilisation de thermomètre:
  - oral
  - rectal,
  - oreille,
  - aisselle, (*Températures orales sont généralement d'environ 0,5 ° C (0,9 ° F) inférieure à la température rectale*)

### 2. Examen Paracliniques

- **CRP** sont des marqueurs d'inflammation.
  - une élévation modérée (20 à 50 mg/L) compatible avec une affection virale ou un foyer bactérien ouvert (bronchite, rhino-pharyngite),
  - une élévation franche (>50 mg/L) doit faire rechercher un foyer bactérien "fermé" ou parenchymateux.
- **NFS** apporte plusieurs renseignements.
  - une hyperleucocytose à polynucléaires neutrophiles évoque principalement une infection bactérienne.
  - la présence de polynucléaires non segmentés signe une infection bactérienne aiguë.
  - une majorité de lymphocytes est compatible avec infection virale et une lymphocytose comportant des lymphocytes activés définit le syndrome mononucléosique.
  - parfois, la présence de cellules anormales permet le diagnostic d'une hémopathie maligne.

- **Hémocultures** permettent de rechercher les bactériémies occultes, d'établir le diagnostic de certaines infections systémiques (brucellose, typhoïde) et de documenter au plan bactériologique certaines infections focalisées (ostéomyélite, pneumonie).
- **ECBU et bandelette réactive urinaire** recherche la présence de nitrites ou une leucocyturie qui amènent à rechercher une infection urinaire.
- **Ponction lombaire** sera réalisée largement avant l'âge de 6 mois, chez qui une méningite peut avoir des signes frustes et dont l'évolution peut être ensuite rapide.
- **Dipstick et Frottis sanguine** (recherché Plasmodium) si suspecter paludisme.,
- **Échographie abdominale** doit être faite devant une fièvre dont l'origine bactérienne est suspectée et qui ne fait pas sa preuve, pouvant notamment conduire à la découverte d'une néphrite ou de signes de pyélite.
- **Radiographie thoracique** cherche une opacité alvéolaire focalisée, des opacités bronchiques ou interstitielles, un abcès.
- **Radiographie des sinus** n'est indiquée qu'après l'âge de 3 ans à la recherche d'une sinusite maxillaire (incidence de Blondeau) ou ethmoïdale (incidence de face).

#### IV- TRAITEMENT

##### 1. Surveiller

En absence de signe de gravité et d'infection identifiée, il faut savoir attendre et répéter l'examen clinique (une fois à 2 fois par jour) et établir une courbe thermique.

##### 2. Traitement de la fièvre

###### a. Moyens physiques :

- dévêtir l'enfant,
- enveloppements frais,
- bain tiède (température corporelle - 1°C) *sont surtout utiles en urgence si la température est très élevée et qu'il existe un risque important de convulsion hyperthermique.*

###### b. Antithermiques :

- Paracétamol :
  - 40 à 60 mg/kg/jour, en 4 prises si nécessaire (par voie orale, rectale, i.m).
- Ibuprofène :
  - 20 à 30 mg/kg/jour, en 2-3 prises si nécessaire (par voie orale).
- Aspirine:
  - 50 mg/kg/jour, en 4 prises si nécessaire (par voie orale). *Son usage a beaucoup diminué à cause de complication de syndrome de Reye et est déconseillé en cas de dengue hémorragique*

###### c. Diazépam (Valium):

- 0,5 mg/kg/dose en cas de convulsions (par voie rectale). Voir le chapitre "Convulsion"

### **3. Traitement étiologique**

- Le traitement étiologique repose sur les agents anti-infectieux que l'on choisi selon le type d'infection et son site en tenant compte des germes habituellement responsables.
- Nous rappellerons enfin qu'il n'y a pas d'indication d'antibiothérapie en absence d'infection identifiée.

## **V- EDUCATION AUX PARENTS**

- Diminuer la fièvre en utilisant:
  - o paracetamol (15mg/kg/dose) par voie oral ou rectale. "Eviter le surdosage"
  - o dévertir les vêtements,
  - o bain froide
  - o Encourager l'enfant à boire des liquides pour éviter la déshydratation,
- Surveiller l'enfant des signes graves (comme refroidissement des extrémités, convulsion...)
- Si présence des signes graves ci-dessus, il faut emmener l'enfant à l'hôpital pour avoir la conformation du diagnostique et du traitement appropriés.

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### Abbreviation:

- CRP : C réactive protéine
  - NFS : Numération formule sanguine
  - ECBU : Examen cyto-bact urinaire
-

# RECOGNITION OF THE CRITICALLY ILL CHILD

*By Prof. Srour Yina*

## I. INTRODUCTION

Children are often unable, or unwilling to verbalize complaints. In addition, symptoms and signs of sepsis or cardio-respiratory compromise are often vague and subtle in children.

The ability to assess and recognize an ill child early allows for simple interventions and therapy such as ventilatory support, fluid resuscitation or early antibiotics to reverse potentially life-threatening cardiopulmonary instability.

## II. ANATOMIC AND PHYSIOLOGICAL CONSIDERATIONS

**The paediatric respiratory system** is ill-designed to cope with an increased work of breathing. The reasons are multi-factorial and include a relatively large tongue and floppy epiglottis, small airways with increased airway resistance, and increased chest wall compliance due to a cartilaginous chest wall.

**Cardiac output** is a function of stroke volume and heart rate. An infant has a limited ability to increase stroke volume in response to shock, and therefore mounts a tachycardia response to compensate for a drop in cardiac output. In addition, children have a higher oxygen consumption per kilogramme body weight than adults. As a result, they tolerate hypoxia poorly, and may manifest with tachycardia as a first sign of compensated shock.

## III. HISTORY

Functionality of the child is a simple but effective measure of how ill the child is. Questions to ask include:

- Level of activity/play
- Conscious level/irritability
- Feeding/fluid intake
- Urine output

**Danger signs** in the history include:

- High-pitched cry/inconsolable crying
- Grunting

- Cyanosis
- Apnoeic episodes
- Pallor, cool and clammy peripheries
- Shortness of breath or dyspnoea
- Acute change in mentation
- Focal seizures
- Bloody stool in a neonate

**Is there** a significant medical history such as:

- Maternal history of GBS or other neonatal infection risk factor (in a neonate)
- Congenital cardiac defects
- Primary immunodeficiency syndromes
- Chronic steroid usage
- Haem-oncological disorders on active chemotherapy
- History of adreno-cortical deficiency e.g. hypopituitarism, congenital adrenal hyperplasia, hypothalamic or pituitary lesions

#### IV. VITAL PARAMETERS

**Hypotension** is defined as systolic BP:

< 60mmHg in a neonate

< 70mmHg in infants (one to 12 months)

< 70mmHg + [2 x (Age in Years)] in children one to ten years

< 90mmHg in children > ten years age

**Mean arterial pressure** can be calculated as  $\{50 + [2 \times (\text{Age in Years})]\}$  mmHg.

Pulse pressure (systolic minus diastolic BP) is usually greater than 20mmHg. A widened pulse pressure is present in distributive shock, a narrow pulse pressure may suggest hypovolemic or cardiogenic shock. Unexplained tachycardia may be one of the first signs of compensated shock.

**Table of normal hearth rate, respiratory rate and systolic blood pressure by age**

Age	Heart rate (bpm)	Respiratory rate (min)	Systolic blood pressure (mmHg)
Neonate	120-180	40-60	60-80
Infant (1month-1year)	110-160	30-40	70-90
Toddler (>1y - 2y)	100-150	25-35	80-95
Young child (>2y - 7y)	95-140	25-30	90-110
Older child (>7y - 12y)	80-120	20-25	100-120

#### V. PHYSICAL EXAMINATION

Clinical states which can rapidly progress and are life-threatening include:

- Impending respiratory arrest
- Cardiovascular instability/cardiogenic shock
- Sepsis/septic shock
- Severe dehydration
- Seizures/altered mental state

- Trauma

**Danger signs** in the physical examination which may indicate an unwell child include:

- General appearance:
  - Mottling of the skin
  - Pallor
  - Cool peripheries
  - Lethargy/irritability
  - Bulging tense fontanelles
  - Purpuric rash
  - Bruising/petechial rash
  - Hyper-pyrexia ( $> 40^{\circ}\text{C}$ )
- Respiratory system:
  - Cyanosis
  - Tachypnoea/bradypnoea by age
  - Kussmaul's respirations
  - Grunting
  - Nasal flaring
  - Retractions
  - Audible stridor with drooling
- Cardiovascular:
  - Delayed capillary refill time ( $>$  two seconds)
  - Weak/thready pulses
  - Tachycardia/bradycardia by age
  - Cardiac arrhythmias
  - New onset murmur
  - Gallop rhythm
  - Absent femoral pulses (neonate)
- Neurological:
  - Focal neurological signs
  - Rapidly decreasing conscious level or Glasgow Coma Score (GCS)  $< 13$
  - Change in mentation
  - Asymmetrical pupillary reflex
- Trauma:
  - Penetrating injury of chest or abdomen
  - Suspected spinal cord injury
  - Flail chest
  - Skull fracture
  - Facial burns or burns involving  $> 10\%$  Body Surface Area (BSA)

If a **danger sign** is present in the history and/or physical examination, consider the following:

- Admit for observation
- Call for senior help if there is evidence of severe respiratory distress, poor perfusion and/or hypotension, obtundation/change in mentation, prolonged seizure or cardiac arrhythmias

## VI. INVESTIGATIONS

- Blood sugar: Exclude hypoglycaemia or DKA as a cause for obtundation
- Blood gas analysis with electrolytes: Evaluate for severe acidosis, sodium/potassium/calcium derangements
- Full Blood Count, U/E/Cr and group and match
- Imaging: CXR to exclude pulmonary pathology, cardiomegaly. CT head if there are concerns regarding intracranial pathology

- Septic screen including blood and urine cultures if sepsis is suspected. Consider CSF cultures if an intra-cranial infection is suspected
- LFT/coagulation profile if suspected liver dysfunction/bleeding diathesis
- Serum lactate if available. This reflects tissue hypoperfusion and can be used as a marker of response to therapy
- Metabolic screen if there is unexplained severe metabolic acidosis/ hypoglycaemia
- Drug toxicology screen if suspected

## VII. ACUTE TREATMENT

- Ensure adequate oxygenation: Administer 100% oxygen nonrebreather facemask if hypoxia is present
- Assess and maintain a patent airway: Consider intubation and assisted ventilation if there are concerns about hypoventilation or inability to maintain airway reflexes
- Evaluate for haemodynamic compromise: Secure IV access early, consider intra-osseous access if venous access is difficult. Administer fluid resuscitation if there are signs of shock e.g. tachycardia, prolonged capillary refill time, cool peripheries. Give IV crystalloids in aliquots of 20ml/kg boluses and watch for response. If there is suspicion of cardiogenic shock, give fluids cautiously and consider early inotropic support (see management of shock).
- Correct rapidly reversible, potentially life-threatening derangements. This includes:
  - Hypoglycaemia: IV dextrose 10% 4–5ml/kg or dextrose 25% 1–2ml/kg
  - Hyponatraemia: IV 3% NaCl 2ml/kg over 30 minutes
  - Hyperkalaemia: IV insulin 0.1units/kg + IV dextrose 50% 2ml/kg and/or sodium polystyrene sulphonate (kayexalate) PR/oral 0.5–1g/kg
  - Hypocalcaemia: IV 10% Calcium chloride 0.2ml/kg over ten minutes)
- Early antibiotic therapy if sepsis is suspected
- Transfer patient to an appropriate care facility after initial stabilisation

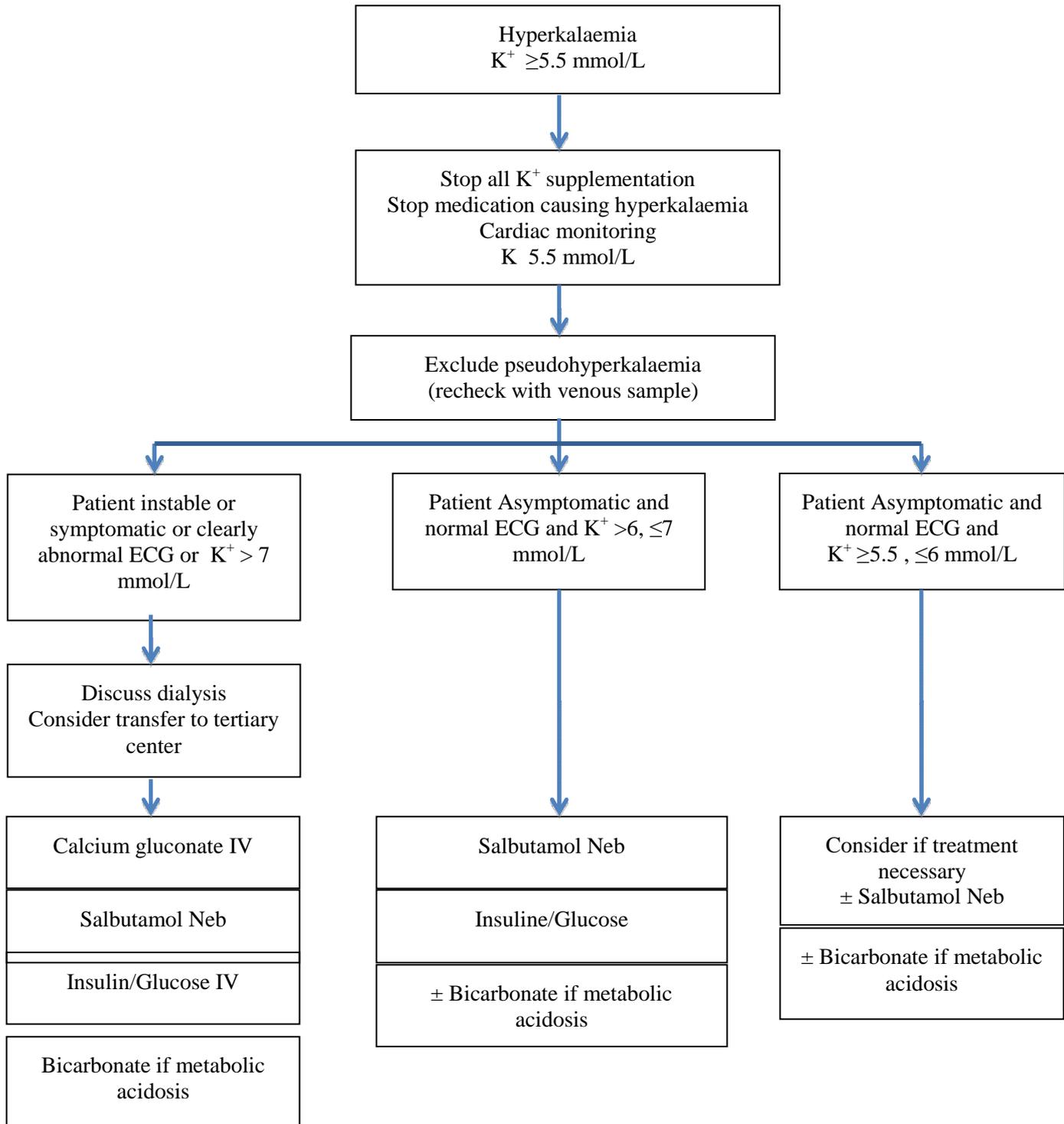
## VIII. MONITORING

- Continuous pulse oximetry, heart rate and respiratory rate monitoring
- Close BP monitoring: Consider invasive BP monitoring if there are concerns about haemodynamic instability
- Conscious level monitoring
- Urine output as a marker of perfusion and end-organ function

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Appendix 1: Algorithm for management of hyperkalaemia



Appendix 2: Dosage of medication used for management of hyperkalaemia

**CALCIUM:**

- Calcium Gluconate 10%: 0.5 ml/kg slow IV injection
  - 2-5 minutes if unstable, over 15-20min if stable (Max: 20ml)
  - NOT to be given simultaneously with bicarbonate
  - NOT to be given if digital toxicity
  - Onset of Action: <3 minutes, should see normalisation of ECG. If not: repeat dose (twice)
  - Duration: ~30 minutes

**SALBUTAMOL:**

- Salbutamol: nebulisation
  - Less than 5 years old: 2.5 mg neb every 1-2h
  - More than 5 years old: 5mg neb every 1-2h
- Onset of Action: 30 minutes, should reduced intravascular K<sup>+</sup> of 0.5-1.5mmol/L
- Duration: 2-3 hours

**INSULIN/GLUCOSE** to be given at the same time

If SEVERE HYPERKALAEMIA:

- Dextrose 10% : 5ml/kg IV bolus (if no hyponatremia)
- Insulin short action: 0.1 U/kg IV bolus (Max 10 units)

Then followed by infusion insulin/glucose (see below)

If MODERATE HYPERKALAEMIA:

- Dextrose 10% IV at maintenance (with Normal Saline or half normal saline)
- Insulin short action infusion : 0.1 U/kg/h IV

Note: Close monitoring of glucose every 30-60 minutes

Onset of Action: 15 minutes, should reduced intravascular K<sup>+</sup>, reduction of 0.5-1.5 mmol/L  
Duration: peak 60 minutes, 2-3hours

**BICARBONATE**

In metabolic acidosis only.

SEVERE HYPERKALAMIA and metabolic acidosis

- Sodium Bicarbonate 8.4% 1mmol/ml : 1-3ml/kg IV over 5 minutes

MILD TO MODERATE HYPERKALAEMIA and metabolic acidosis:

- Sodium Bicarbonate 8.4% 1mmol/ml : 1ml/kg in slow IV infusion over 30 minutes

Note: NOT to give simultaneously with Calcium

Onset of Action: 30-60 minutes, should reduced intravascular K<sup>+</sup> of 0.5

Duration: 2-3 hours

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# TRAUMATISMES CRÂNIENS DE L'ENFANT

By Dr. Heng Sothy

## I- INTRODUCTION

Les traumatismes crâniens (TC) sont les lésions traumatiques les plus fréquentes de l'enfant. Leur incidence dans la population pédiatrique est de 2 à 3 pour mille.

L'évaluation initiale des TC repose sur le score de Glasgow (1).

- Formes graves avec un score de Glasgow inférieur à 8 (9 % des cas)
- Formes modérées (score de Glasgow entre 9 et 13) (11 % des cas)
- 4/5 des TC sont dits mineurs (score de Glasgow de 14 à 15).

Le risque de lésion intracrânienne (LIC) est faible mais responsable d'une mortalité de 0 à 2 %. De même, une fracture du crâne peut se compliquer s'il existe un enfoncement ou embarrure, ou très exceptionnellement si la dure-mère fait hernie dans le trait de fracture (fracture évolutive).

## II- EPIDEMIOLOGIE

Head injuries result in about 600,000 visits to the emergency department, and 250,000 hospitalizations annually. The majority of head injuries (90%) fall into the minor category. The leading causes of head injury in children ages 5 years or less than in USA are:

- Falls 50,6 per 100,000
- Motor vehicle accident 25,9 per 100,000
- Suspected inflicted head injury 12,8 per 100,000.

The most common cause of head injury in children < 1 year is physical assault by a carrier. About 50% extra cranial lesions of cases have been seen in severe infant head trauma. Cervical spine lesions are about 2-10% and medullar lesions about 6-38%. (SFAR 2010)

## III- DIAGNOSTIQUE

### 1. Signs and Symptomes

#### a. *Anamnèse*: (trop souvent négligée)

- Circonstances et la date et de l'heure de l'accident.
- Mécanismes de la blessure: impact direct focal ou processus d'accélération célation.
- Il faut préciser le type d'impact (hauteur de la chute, nature du sol...) et sa cinétique (accident de la voie publique : piéton/véhicule à grande vitesse, présence d'autres blessés graves...). Un mécanisme lésionnel violent conduit à une plus grande

vigilance même si l'examen neurologique est parfaitement normal.

**b. Symptomatologie:**

- La perte de conscience initiale (PCI) n'est pas significativement associée à une lésion intracrânienne (LIC). Mais une PCI de plus d'une minute est un signe de gravité.
- Les vomissements ne sont pas significatifs d'une LIC ; cependant, il est important de considérer leur répétition (> 5 reprises) ou plus de 6 heures après le trauma.
- L'examen neurologique complet recherche un signe de localisation. Une conscience ralentie ou une agitation, une convulsion sont des signes de gravité peu sensibles car inconstants chez les jeunes enfants.
- La palpation du crâne recherche une déformation, un bombement de la fontanelle. Un volumineux hématome du cuir chevelu ou une large plaie doivent faire suspecter une fracture.
- Un examen clinique normal n'élimine pas avec une certitude une LIC ou une fracture. Cette certitude pourrait être obtenue par l'imagerie.

**Tableau 1 : Signes pertinents à l'examen clinique de l'enfant atteint d'un traumatisme crânien**

**Examen physique**

- Bradycardie, hypotension, hypertension
- Bombement de la fontanelle chez l'enfant de moins d'un an
- Hémotympan et ecchymoses ou hématomes mastoïdiens (fracture du rocher)
- Ecchymoses ou hématomes périorbitaires (fracture de l'ethmoïde)
- Otorrhée ou rhinorrhée de liquide céphalorachidien
- Enfoncement du crâne, plaie pénétrante du cuir chevelu ou céphalhématome (fracture de la voûte)

**Examen neurologique**

- Score de Glasgow <14
- Asymétrie pupillaire
- Hémorragies rétiniennes (possibilité de mauvais traitements)
- Anomalies à l'examen des nerfs crâniens (par exemple : présence de strabisme, de mydriase, d'hypoacousie ou de paralysie faciale) Paralysie ou déficit neurologique focal
- Asymétrie des réflexes ostéotendineux
- Signe de Babinski au réflexe cutané plantaire

**2. Catégories des traumatisme crânien:**

*Le score de Glasgow* permet de classer les traumatismes crâniens en trois catégories :

- TC majeur (de 3 à 8),
  - TC modéré (de 9 à 13) et
  - TC mineur (14 ou 15), incluant les traumatismes légers et minimes.

Cette classification ainsi que la marche à suivre et le traitement sont résumés aux *tableaux III et IV*.

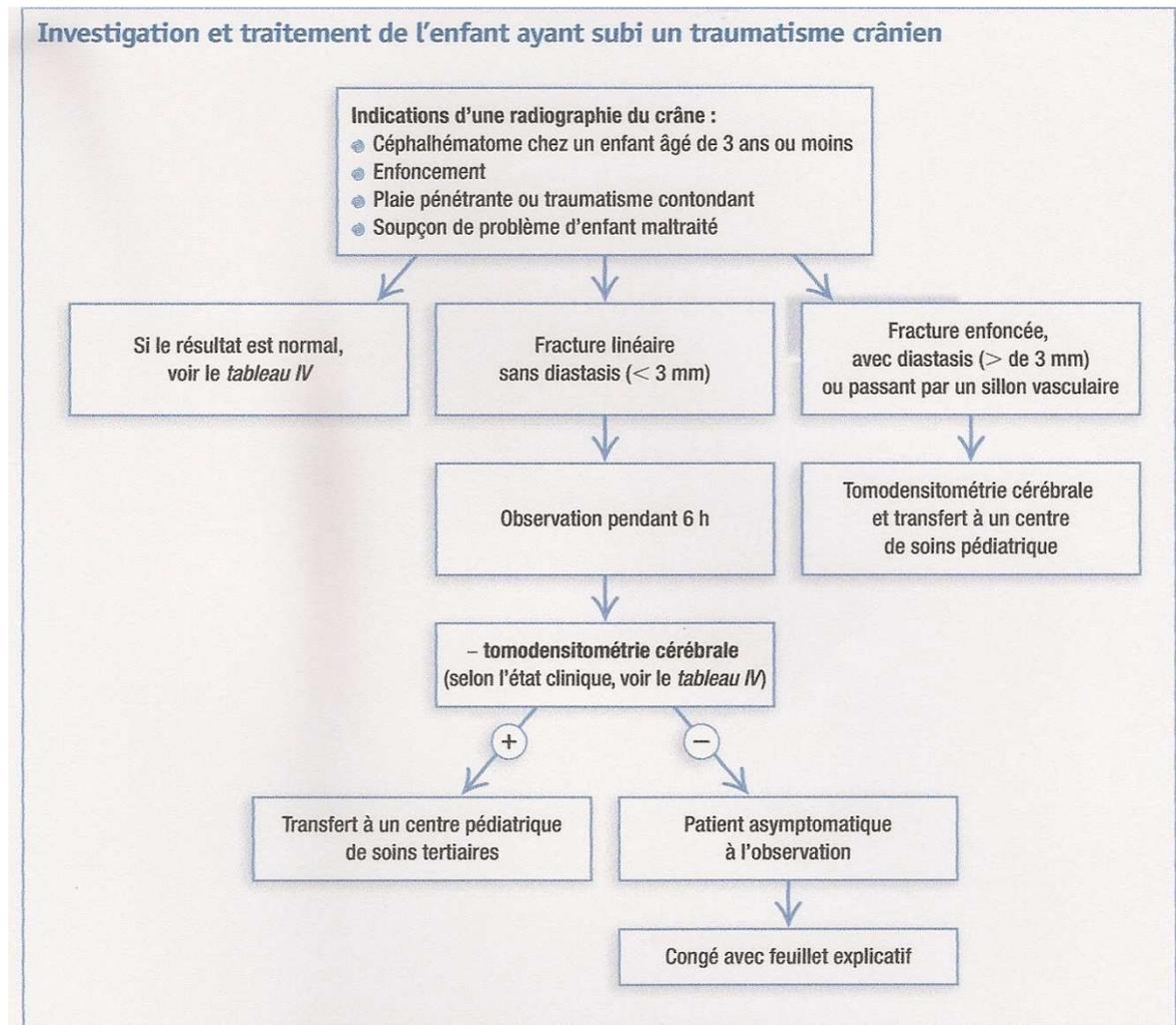
T A B L E A U II					
Échelle de Glasgow standard (> cinq ans)		Échelle de Glasgow (de 2 à 5 ans)		Échelle de Glasgow (de 0 à 2 ans)	
<b>Ouverture des yeux</b>		<b>Ouverture des yeux</b>		<b>Ouverture des yeux</b>	
Spontanément	4	Spontanément	4	Spontanément	4
Aux stimuli verbaux	3	Aux stimuli verbaux	3	Lorsqu'il pleure	3
Aux stimuli douloureux	2	Aux stimuli douloureux	2	Aux stimuli douloureux	2
Aucune réponse	1	Aucune réponse	1	Aucune réponse	1
<b>Réponse verbale</b>		<b>Réponse verbale</b>		<b>Réponse verbale</b>	
Est orienté et parle	5	Mots appropriés, sourit, fixe et suit du regard	5	Agit normalement	5
Est désorienté et parle	4	Mots inappropriés, pleure, est consolable	4	Pleure	4
Paroles inappropriées	3	Hurle, est inconsolable	3	Hurllements inappropriés	3
Sons incompréhensibles	2	Gémit aux stimuli douloureux	2	Gémissements ( <i>grunting</i> )	2
Aucune réponse	1	Aucune réponse	1	Aucune réponse	1
<b>Réponse motrice</b>		<b>Réponse motrice</b>		<b>Réponse motrice</b>	
Répond aux demandes	6	Répond aux demandes	6	Mouvements spontanés intentionnels	6
Localise la douleur	5	Localise la douleur	5	Se retire au toucher	5
Se retire à la douleur	4	Se retire à la douleur	4	Se retire à la douleur	4
Flexion à la douleur (décortication)	3	Flexion à la douleur (décortication)	3	Flexion anormale (décortication)	3
Extension à la douleur (décérébration)	2	Extension à la douleur (décérébration)	2	Extension anormale (décérébration)	2
Aucune réponse	1	Aucune réponse	1	Aucune réponse	1
<b>Total (entre 3 et 15)</b>		<b>Total (entre 3 et 15)</b>		<b>Total (entre 3 et 15)</b>	

### 3. Imagerie

a. **Radiographie du crâne:** doit être faite en présence d'un céphalématome (sensibilité de ce signe physique de 80 à 100 % pour la détection d'une fracture) ou s'il y a enfoncement à la palpation du crâne chez tout enfant de moins de trois ans. Elle sert principalement à diagnostiquer les fractures, surtout celles qui sont accompagnées d'un diastasis de plus de 3 mm, qui risquent de se compliquer d'un kyste leptoméningé dans 3% des cas.

b. **Tomodensitométrie:** La tomodensitométrie cérébrale est l'examen de référence (*gold standard*) pour l'évaluation de l'atteinte intracrânienne due à un traumatisme. Tout patient ayant un score de Glasgow inférieur ou égal à 13, un déficit neurologique focal, une coagulopathie confirmée, ou qui présente des convulsions tardives, répétitives ou prolongées doit automatiquement subir cet examen.

c. **Résonance magnétique nucléaire (RMN):** des études récentes indiquent que la RMN a une meilleure sensibilité que la tomodensitométrie pour détecter les lésions axonales diffuses, les atteintes du parenchyme cortical et du tronc cérébral ainsi que les hématomes intracrâniens de petite taille.



#### IV- PRISE EN CHARGE

##### 1. Traumatisme crânien majeur et modéré:

###### 1.1- Hospitaliser ou transférer à un hôpital de référence (pédiatrique):

- Score de Glasgow  $\leq 13$
- Chute de deux points dans les mesures sériées du score de Glasgow initial
- Déficit neurologique
- Fracture du crâne enfoncée, avec diastasis ou basilaire
- Plaie craniocérébrale ouverte (avec écoulement de liquide céphalo-rachidien)
- Résultat de tomographie axiale cérébrale positif
- Possibilité de problème d'enfant maltraité
- Polytraumatisme.

###### 1.2- Comment opérer le transfert:

- **Score de Glasgow  $\leq 8$**  (traumatisme crânien majeur)
  - A** - Intubation orotrachéale (séquence rapide incluant l'administration de lidocaïne en prémédication) avec mesures de protection de la colonne cervicale ;
    - Tube nasogastrique (orogastrique s'il y a soupçon de fracture de la base du crâne) ;
    - Collet cervical rigide.
  - B** - Maintien de la PO<sub>2</sub> à 100 mmHg (saturométrie  $\geq 95\%$ ) et de la PCO<sub>2</sub> idéale à 35 mmHg.

**C** - Établir deux lignes de perfusion intraveineuse de soluté physiologique (NaCl à 0,9 %) avec apport hydrique se situant entre 75 et 100 % des besoins d'entretien si l'état du patient est hémodynamiquement stable, ou en bolus s'il est instable.

- Sonde vésicale (évaluation de la diurèse).
- Sédation postintubation (transfert)
  - + Perfusion de midazolam (0,2 mg/kg/h) AND/OR
  - + Perfusion de fentanyl (3 à 5 µg/kg/h).
- **Score de Glasgow entre 9 et 13** (traumatisme crânien modéré)
  - Intubation orotrachéale si les voies aériennes ne sont pas protégées.
  - ABC
  - I.3- Prévention des lésions secondaires**
    - Utilisation d'une sédation appropriée lors de l'intubation orotrachéale (éviter l'augmentation de la pression intracrânienne).
    - Éviter :
      - + l'hypoxémie
      - + une hypercapnie ou une hypocapnie exagérée
      - + l'hyperthermie
      - + l'hypovolémie ou l'hyperlémie
      - + les déséquilibres électrolytiques.

La lésion cérébrale secondaire résultant de l'hypotension systémique est le facteur pronostique le plus néfaste des traumatismes crâniens majeurs.

- Surélever la tête de 20 à 30 degrés en laissant les jugulaires libres.
- Placer la tête en position neutre.
- Réduire les stimuli au minimum (succion, mouvement, douleur).
- Après discussion avec le neurochirurgien en pédiatrie : administrer 1g/kg de mannitol en bolus si l'on soupçonne un engagement.
- **Ne pas donner de stéroïdes aux victimes d'un traumatisme crânien.**
- Administrer un anticonvulsivant s'il y a crise convulsive objectivée ou si la tomodynamométrie montre une contusion corticale :
  - Diazepam : dose ?
  - Phenobarbital : dose ?
  - Dilantin en bolus : 18 mg/kg
- En présence d'une plaie craniocérébrale ouverte ou d'une fistule de liquide céphalorachidien, une antibioprofylaxie est généralement donnée même si ce sujet demeure controversé.

T A B L E A U III		
Prise en charge de l'enfant ayant subi un traumatisme crânien majeur ou modéré		
Type	Majeur (score de Glasgow entre 3 et 8)	Modéré (score de Glasgow entre 9 et 13)
Prise en charge initiale	<ul style="list-style-type: none"> <li>● Intubation endotrachéale</li> <li>● Ventilation (avec monitoring : oxymétrie et capnométrie)</li> <li>● Réanimation liquidienne (NaCl à 0,9 %) pour obtenir une stabilité hémodynamique</li> <li>● Soupçon d'hypertension intracrânienne :               <ul style="list-style-type: none"> <li>○ Mesures de base (voir le texte)</li> <li>○ Hyperventilation (Pco<sub>2</sub> 35 mmHg)</li> </ul> </li> <li>● Communiquer avec le neurochirurgien et le centre de traumatologie               <ul style="list-style-type: none"> <li>○ 1g/kg de mannitol en bolus si l'état du patient est hémodynamiquement stable</li> <li>○ Antibioprophylaxie (plaie craniocérébrale)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Assurer la perméabilité des voies aériennes</li> <li>● Intubation oro-trachéale               <ul style="list-style-type: none"> <li>○ Si les voies aériennes ne sont pas protégées et si le score de Glasgow se détériore</li> <li>○ Si le patient est agité et non coopératif pour les examens d'investigation ou le transfert</li> </ul> </li> <li>● Soupçon d'hypertension intracrânienne :               <ul style="list-style-type: none"> <li>○ Mesures de base (voir le texte)</li> <li>○ Hyperventilation (Pco<sub>2</sub> 35 mmHg)</li> </ul> </li> <li>● Communiquer avec le neurochirurgien et le centre de traumatologie</li> </ul>
Investigation	<ul style="list-style-type: none"> <li>● Radiographie de la colonne cervicale (latérale)</li> <li>● Tomodensitométrie cérébrale et cervicale jusqu'à C1-C2 si possible (ne devrait pas retarder le transfert)</li> </ul>	<ul style="list-style-type: none"> <li>● ± Radiographie de la colonne cervicale (latérale) si le patient est inconscient ou a une cervicalgie</li> <li>● Tomodensitométrie cérébrale et cervicale (C1-C2)</li> </ul>
Conduite à tenir	<ul style="list-style-type: none"> <li>● Transfert dès que l'état du patient est stable au centre pédiatrique de soins tertiaires ou à un centre de soins tertiaires doté de spécialistes en chirurgie pédiatrique</li> </ul>	<ul style="list-style-type: none"> <li>● Transfert</li> </ul>
Suivi	<ul style="list-style-type: none"> <li>● Suivi à long terme (séquelles probables) par une équipe multidisciplinaire (physiatre, orthophoniste, physiothérapeute, ergothérapeute, neuropsychologue, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>● Un suivi à long terme (&gt; un an) peut être nécessaire dans certains cas.</li> </ul>

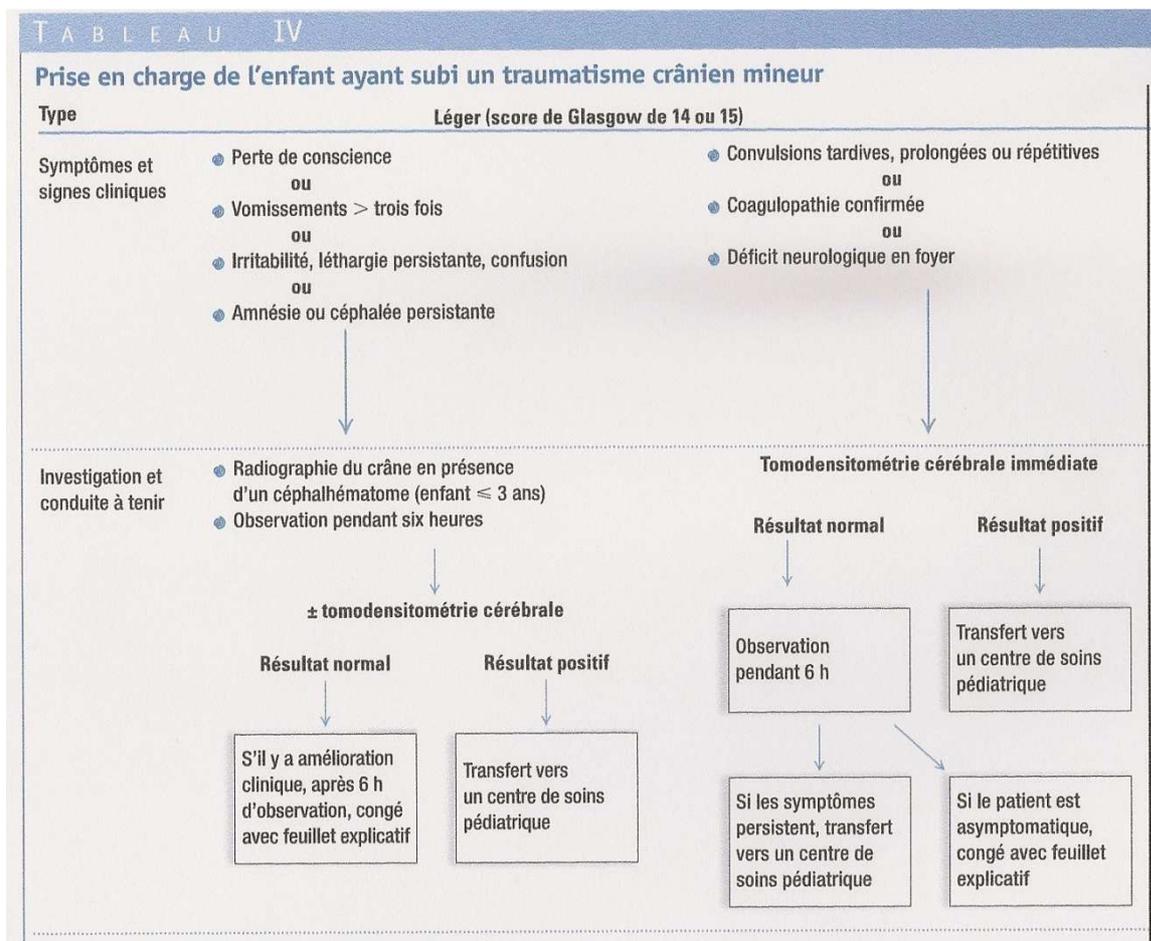
## 2. Traumatismes crâniens mineurs (score de Glasgow de 14 ou 15)

- Les patients ayant subi un traumatisme crânien mineur (léger ou minime):

- . Mécanisme mineur (chute < 1mètre)
- . Pas de perte de conscience
- . ≤ 3vomissements
- . Absence d'amnésie
- . Pas de céphalématome
- . Bonne orientation, résultat de l'examen neurologique normal
- . Patient asymptomatique au moment de l'évaluation (>2h après trauma)

Ils peuvent avoir leur congé après être restés en observation de deux à six heures.

- La prise en charge des traumatismes crâniens mineurs (score de Glasgow de 14 ou 15) dépend de l'évolution de l'état du patient durant la période d'observation et des résultats radiologiques (*tableau IV*).



## V- SUIVI

Une deuxième tomодensitométrie cérébrale de contrôle en période aiguë après un premier résultat d'examen normal n'est indiquée qu'en cas de détérioration neurologique.

Les fractures accompagnées d'un diastasis de plus de 3 mm nécessitent un suivi radiologique et neurochirurgical, comme nous l'avons dit précédemment. Le suivi des fonctions neurocognitives par une équipe multidisciplinaire spécialisée est recommandé dans les cas de traumatismes crâniens majeurs et modérés à plus haut risque de séquelles neurologiques.

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# CARDIAC BERIBERI OR SHOSHIN BERIBERI

*By Dr. Lorntry Patrich*

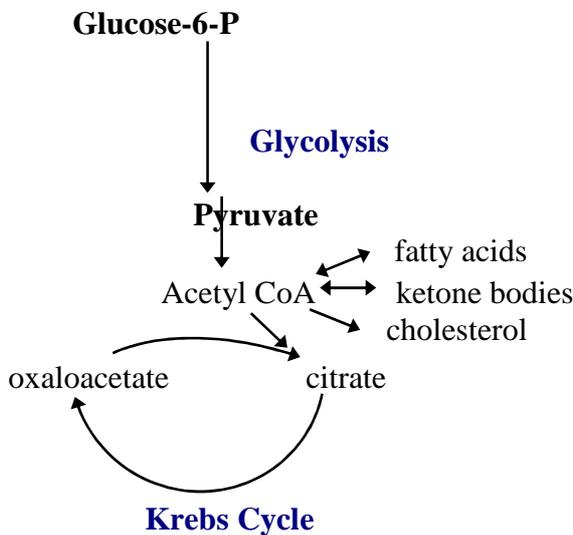
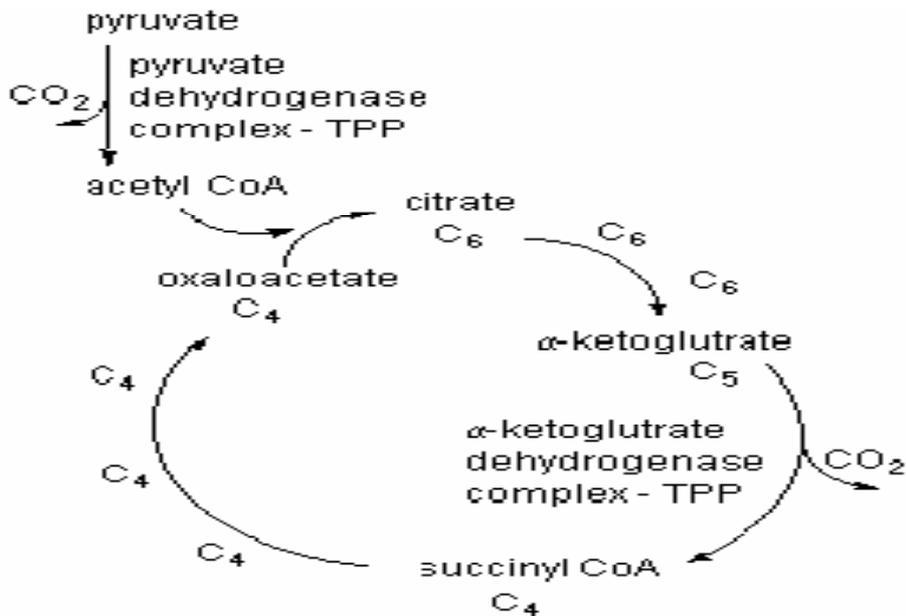
## **I. DEFINITION :**

Infant Beriberi, a disease caused by the mother's thiamine deficiency. The heart of infant is primarily affected and these infants have classical heart failure and sudden death.

## **II. ETIOLOGY**

- Beriberi can occur in breast-fed infants when the mother's body is lacking in thiamine. The condition can also affect infants who are fed unusual formulas that don't have enough thiamine.
- Beriberi may be found in mother whose diet consists mainly of polished *white rice*, which is very low in thiamine because the thiamin-bearing husk has been removed.
- It can also be seen in mother chronic alcoholics, arsenic poisoning
- A rare condition known as genetic beriberi is passed down through families. People with genetic beriberi lose the ability to absorb thiamine from foods
- The peak prevalence of this form occurs in fat breastfed babies of 2-12 months with predominant pick of 3 months of age.(14)

## **III. PATHOPHYSIOLOGY**



- Thiamin acts as coenzyme to produce acetylcholine, a neurotransmitter(messenger between nerve fibers) :
  - It is needed as TTP for nerve and muscle function..TTP (thiamin triphosphate ) activates ion channels in nerve and muscle cells by phosphorylating them. The flow of the electrolytes, such as sodium and potassium in and out of the cell plays a role in nerve impulse conduction and voluntary muscle action
  - It is essential as TPP for metabolism of carbohydrates into simple sugars, such as glucose. Thiamin Pyrophosphate is a coenzyme for pyruvate dehydrogenase complex and alpha-ketoglutarate dehydrogenase complex which is required in the Citric Acid Cycle(Krebs cycle ) to extract energy from food . In this process TPP acts as a dehydrogenase and removes CO<sub>2</sub> .
  - Phosphorylation- the process of transferring a phosphate group,from one molecule to another. In this illustration the phosphate is being taken from the Adenosine Triphosphate and placed on the protein leaving Adenosine Diphosphate .
- Deficiency of thiamine affects the cardiovascular, muscular, nervous, and GI systems :
  - *Cardiomegaly* and *congestive heart failure*, with a characteristic high cardiac output presumablyrelated to low peripheral resistance, is seen in thiamin deficiency and is termed cardiac (Shoshin) beriberi.

- Lactate acidosis : due to pyruvate dehydrogenase complex activity decreased, acetic acid and pyruvic acid increase . the accumulation of lactic acid in the brain, may lead to impairment of respiratory and kidney function.
- Gastrointestinal System: Thiamin deficiency can also lead to nausea, lack of appetite, weight loss and constipation . Carbohydrate digestion and the metabolism of glucose are diminished.
- Neurologic Problems : reduces absorption ,alters metabolism and depletes body stores. *mental confusion, visual disturbances , staggering gait*, depression, irritability and reduced ability to concentrate are later followed by fatigue, muscle cramps and various pains.

#### IV. CLINICAL ASSESSMENT

##### 1. High risk mother:

- Low socio-economic status
- Peripheral oedema and tender sole
- Intermittent paraesthesiae in the hands and feet during and after pregnancy without subjective or clinical evidence of neurological deficit.
- Excessive alcohol intake

##### 2. Infant present history

- Breast feeding from high risk mother
- Sibling died with the same symptoms

##### 3. Urgent clinical signs and symptoms

- **Acute respiratory distress and characteristic horse voice** (Aphonic beriberi)<sup>14</sup>
- Lethargy or drowsiness<sup>14</sup>
- Shortness of breath (clear lung) with or without shock<sup>7</sup>
- Central and peripheral cyanosis<sup>10, 11, 12</sup>
- Liver enlarged and low urine output<sup>14,7</sup>
- Convulsion<sup>14</sup>
- Poor feeding<sup>10, 11, 12,13</sup>

##### 4. Imaging Studies

- Chest radiography: cardiomegaly (mean cardiothoracic ratio 56,1%)
- Heart ultrasound<sup>14</sup>:
  - Cardiomegaly (right ventricular hypertrophy and dilatation)
  - Pulmonary arterial hypertension
  - Tricuspid valve regurgitation
- MRI descriptions in this condition. These infants had involvement of the frontal lobes and basal ganglia, in addition to the lesions present in the periaqueductal region, thalami, and the mammillary bodies that have been described in adults. The lesions that have been noted were described as symmetric and hyperdense. Brainstem involvement was noted. In small numbers of patients severe frontal damage was noted in long term follow-up with a loss of parenchyma and atrophy of the basal ganglia and thalami in some.

##### 5. Laboratory Study

- Thrombocytosis ( Platelet count > 400000/mm<sup>3</sup> 80% of cases)<sup>14</sup>
- Metabolic acidosis (62% of cases)<sup>14</sup>
- Thiamin in blood or urine
- Erythrocyte transketolase (ETK) activity test
- Blood lactate & pyruvate

**Note:** *The most rapid, and thus the best diagnostic test for beriberi in urgent situations, is observing a clinical response to administration of intravenous thiamine (few hours duration)*

## V. MANAGEMENT:

### Assess ABCD:

#### A – Airway

- Position the head - neutral position (<1 year old), or sniffing position (1 year of age)
- Open airway - Head tilt and chin lift, or jaw thrust
- Use oro-pharyngeal airway if required.

#### B – Breathing

- If respiration is adequate, administer oxygen by facemask at 10 l/min.
- If the child is not breathing, commence **artificial ventilation** ( See APLS)
- Intubation should only be attempted by those credentialed and skilled to do (see APLS)

#### C – Circulation

- If there are no signs of circulation, i.e. no pulse, slow pulse (<60) or you are not sure, commence CPR (cardiopulmonary resuscitation), and determine the cardiac rhythm - display the ECG

#### D- Drugs to consider: Thiamine<sup>2</sup>

- Day 1: Dilute 1 ml of thiamine (vial 1 ml - 100 mg) with 9 ml of water for injection. Inject 1 ml of this diluted solution (10-mg thiamine) by slow IV. Repeat after 30 minutes. Then, give 25 mg by IM to complete the first day treatment. **If IV access is not possible, give 50 mg/day by IM divided in 2 injections over the first 24 hours.**  
After thiamine administration, the smaller dose sodium bicarbonate may also be prescribed for management of lactic acidosis<sup>13</sup>
- Day 2: It is usually possible to switch to PO treatment:
  - If the infant is breast-fed: treat the mother with thiamine PO 100 mg/day for 1 month.
  - If the child has been weaned: treat the child: with thiamine PO 10 mg/day for 1 month.

## VI. PATIENT/PARENT EDUCATION:

Population at risk must be educated regarding:

- The diversification of diet.
- The incorporation of foods rich in thiamine (liver, brown rice, green leaves, and potatoes).
- Proper food preparation (shorter cooking time for vegetables, reduction in amount of rice washing prior to cooking).
- The value of whole grains.
- Avoidance of alcohol.
- Thiamine supplementation.

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# RESPIRATORY DISEASES

1. Rhinitis and Rhinopharyngitis (Common Cold).....	85
2. Acute Sinusitis .....	88
3. Acute Pharyngitis.....	91
4. CROUP .....	94
5. Acute Otitis Media (AOM).....	99
6. Bronchitis .....	102
7. Bronchiolitis.....	105
8. Community Acquired Pneumonia .....	111
9. Empyema .....	117
10.Empyema .....	123
11.Pneumothorax .....	129
12.Childhood Asthma .....	135

# RHINITIS AND RHINOPHARYNGITIS (COMMON COLD)

By Dr. Lorntry Patrich

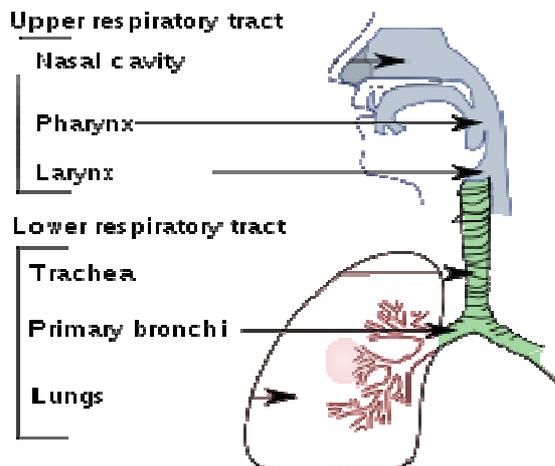
## I. DEFINITION

- The **common cold** ( **nasopharyngitis, acute viral rhinopharyngitis, acute coryza, or a cold**), is a viral [infectious disease](#) of the upper [respiratory system](#), caused primarily by [rhinoviruses](#) and [coronaviruses](#).
- Rhinitis is inflammation of the nasal mucosa
- Rhinopharyngitis is inflammation of the nasal and pharyngeal mucosa
- However, the common cold may be an early sign of another infection (measles or influenza) or may be complicated by a bacterial infection (otitis media or sinusitis).
- Most common cold are self-diagnosed and self-treated at home. Patients who present with common cold often benefit from reassurance, education, and instructions for symptomatic home treatment.

## II. EPIDEMIOLOGY

- The incidence of the common cold varies by age. Rates are highest in children younger than 5 years. Children who attend school or daycare are a large reservoir for URIs, and they transfer infection to those who care for them. Children have about 3-8 viral respiratory illnesses per year. Adolescents and adults have approximately 2-4 colds a year, and people older than 60 years have fewer than 1 cold per year.
- Estimated that up to 75% of children with asthma also have allergic rhinitis

## III. PATHOPHYSIOLOGY



- The common cold virus is transmitted mainly from contact with saliva or nasal secretions of an infected person, either directly, when a healthy person breathes in the virus-laden [aerosol](#) generated when an infected person coughs or sneezes, or by touching a contaminated surface and then touching the nose or eyes.
- The major entry point for the virus is normally the nose, but can also be the eyes (in this case drainage into the [nasopharynx](#) would occur through the [nasolacrimal duct](#)). From there, it is transported to the back of the nose and the [adenoid](#) area.
- The common cold is self-limiting, and the host's [immune system](#) effectively deals with the infection. Within a few days, the body's [humoral](#) immune response begins producing specific [antibodies](#) that can prevent the virus from infecting cells. Additionally, as part of the cell-mediated immune response, [leukocytes](#) destroy the virus through [phagocytosis](#) and destroy infected cells to prevent further viral replication. In healthy, immunocompetent individuals, the common cold resolves in seven days on average

#### IV. RISK FACTORS

- Touching eyes, nose, or mouth with contaminated fingers
- Environmental factors such as passive smoking and exposure to pollutants
- Low humidity increases viral transmission rates
- Spending time in an enclosed area with an infected person or in close contact with an infected person
- Lack of breast-feeding.
- Familial predisposition with immunological defects or anatomical and/or physiological features

#### V. CAUSES

- Indoor allergens: house dust mite, cockroaches, animal dander, cigarette smoke, hair spray, paint, molds
- Pollens: tree pollens in early spring, grass in late spring and early summer, ragweed in late summer and autumn
- Multiple environmental factors
- Changes in air temperature

#### VI. CLINICAL ASSESSMENT

##### 1- History

- Patient often reports stuffy nose, sneezing, itching, runny nose, noisy breathing, snoring, cough, halitosis, and repeated throat clearing. Sensation of plugged ears and wheezing may occur.
- Family history of atopic disease, such as asthma or atopic dermatitis

##### 2- Physical Examination

- Runny nose (nasal discharge or obstruction, which may be accompanied by sore throat, Fever, cough, lacrimation, and diarrhoea in infant). Purulent nasal discharge is not indicative of a secondary bacterial infection.
- In children under 5 years, routinely check the tympanic membranes to look for an associated otitis media.
- Assess for pneumonia if the child has cough or difficult breathing
- Assess for streptococcal pharyngitis if the child has a sore throat
- Often accompanied by conjunctivitis .It may be the prodromal phase of influenza or measles.

## **VII. MANAGEMENT**

- Treat at home and parent education
- Antibiotic treatment is not recommended : it is not promote recovery nor prevent complications.
- For high fever or pain, give Paracetamol : 60 mg/kg/day in divided in 4 or 6 divided (4)
- Clear the nose if discharge interferes with feeding nasopharyngeal lavage using a syringe filled with isotonic solution (Normo saline 0.9% or ringer Lactate) 4 to 6 times a day.

## **VIII. PARENT EDUCATION**

- Not to buy medicated nose drops these can be harmful
- Address the patient's expectations about antibiotic therapy. Validate the patient's symptoms and their severity, listen to the concerns expressed, and educate about possible consequences of inappropriate antibiotic use, including consequences affecting the patient and the community.
- Reassure the patient about access to clinical care and follow-up in the event that symptoms progress. Briefly explore factors that may have contributed to the current infection, and address prevention for the future.
- Should be counseled on handwashing and proper methods for covering coughs and sneezes.
- Contacts: Patients with common cold should reduce contact with others to avoid the spread of infection
- Irritant avoidance: Parent should avoid nasal irritants, such as cigarette smoke and indoor and outdoor air pollutants
- Should be instructed to follow up when indicated or if symptoms worsen

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# ACUTE SINUSITIS

*By Dr. Lorntry Patrich*

## I. DEFINITION AND CAUSES

- Infection of the sinus mucosa with purulent nasal discharge .May originate from(1,4) :
  - The nose: rhinitis, allergic rhinitis, nasal obstruction (e.g foreign body, malformation, trauma, polyp)
  - Teeth: dental caries with arthritis and/or osteitis
- In general, sinusitis can be managed on an outpatient basis. In cases of resistant organisms or for patients with orbital or intracranial complications, inpatient treatment with intravenous antibiotics may be necessary.

## II. EPIDEMIOLOGY

- Although the exact incidence of sinusitis in the pediatric population is unclear, it is diagnosed commonly, most often following a viral URTI. The number of URTIs that an individual has per year may be as high as 25 (children will have on average 6-8 per year); the number depends on a several factors, including age, day care attendance, and number of siblings. Approximately 5-13% of URTIs are complicated by bacterial sinusitis. Many viral URTIs are mislabeled early in their course as acute sinusitis and are inappropriately treated with antibiotics.(2)
- Children are also susceptible to more serious sequelae from a complication of sinusitis such as orbital cellulites (in about 9.3% of the cases) and intracranial complications (in 3.7-11% of patients). With close follow-up care, counseling of the family, and proper medical treatment, morbidity from this disease should be very low.(2)

## III. CLINICAL FEATURES (2,4,1)

Facial pain or ache and purulent nasal discharge

- Older children
  - Purulent rhinorrhea with pain
  - Facial pain in maxillary
  - Nasal Obstruction and moderate fever
  - Periorbital edema and pain
  - Pain on pressure over, under border of the orbit or cheek
  - Purulent secretions in the meatus and inflammation of the mucosa
  - The most common causes are Haemophilus influenzae and Pneumococci
- Infant and small children
  - Acute ethmoidite : high fever, inflammation and swelling of the lower eyelids and the bridge of nose, purulent nasal discharge.

- Risk of infection spreading to the neighbouring bony structures, orbits and the meninges.
- The most common causes are Haemophilus influenza, Pneumococci and Staphylococci.

#### IV. MANAGEMENT (1,4,7)

- Nasal irrigation with 0.9% sodium chloride or ringer Lactate 4 to 6 times/day to clear the airway and parent education
- Pain and fever give Paracetamol : 60 mg/kg/day in divided in 4 or 6 divided (4)
- If there is a dental focus of infection: extraction of tooth under antibiotic cover.
- Antibiotic treatment:
  - a. First line
    - i. Amoxicilline : PO: 30-50 mg/kg/day in 2 or 3 divided doses for 7 to 10 days  
**OR**
    - ii. Erythromycin PO 30 – 50 mg/kg/day in 2 to 3 divided doses for 7 to 10 days
  - b. Second- line
    - i. Amoxicillin/clavulanic acid (45 mg/kg per day divided in two doses alone or in combination with amoxicillin (45 mg/kg per day divided in two doses)  
AND
    - ii. Amoxicillin or clindamycin plus a third-generation cephalosporin
- For sinusitis secondary to dental infection: dental extraction while under antibiotic treatment.
- In infant with Complication(ethmoiditis, central nervous system or orbital involvement) strong antibiotic treatment is necessary:  
Intravenous antibiotics and hospitalization
  - i. Ceftriaxone :IV/IM 100mg/kg/day in 1 or 2 injections for 10 days or Cefotaxime (300 mg/kg per day divided into four doses) for 10 days  
**OR**
  - ii. Vancomycin (60 mg/kg per day divided into four doses) is added to cefotaxime if source of infection is known or highly likely to be caused by penicillin-resistant Streptococcus pneumonia

#### V. PARENT EDUCATION

- Good nasal hygiene and use of saline irrigations may be critical for the prevention of exacerbations of acute or chronic sinusitis.
- Maximize control of associated conditions and warn patients to avoid exposure to environmental irritants such as cigarette smoke.

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# ACUTE PHARYNGITIS

By Dr. Lorntry Patrich

## I. DEFINITION AND CAUSES

- Acute pharyngitis is acute inflammatory of the tonsils and pharynx. The majority of cases are of viral origin and do not require antibiotic treatment.
- Group A streptococcus is the main bacterial cause, and mainly affects children age 3 to 14 years. Acute rheumatic fever, a serious late complication of streptococcal pharyngitis, is common in developing countries, and can be prevented with antibiotic therapy.

## II. EPIDEMIOLOGY

- Approximately 10% of children evaluated by medical care providers each year are evaluated for pharyngitis, and 25-50% of them have GABHS(Group A Beta Hemolytic Streptococcus). However, it is important to note that approximately 20% of asymptomatic children are long-term carriers of GABHS.
- Pharyngitis occurs in all age groups. Streptococcal infections have the greatest incidence in those aged 5-18 years. In children younger than 2 years, most pharyngitis is of viral etiology, although GABHS rarely can occur in this younger age group.

## III. COMPLICATION

**Local complication:** Peritonsillar abscess : Fever, intense pain, horse voice, trismus (limitation of mouth opening) unilateral deviation of the uvula.

Mal treatment: Complication like: Rheumatism fever, Acute Glomerulonephritis

## IV. CLINICAL FEATURES

- Common signs of streptococcal pharyngitis(5,6,7):
  - The incubation period and thus the start of symptoms for strep throat is between one to three days post contact
  - Sore Throat
  - Fever of greater than 38 °C
  - Tonsillar exudates (pus on the tonsils) and large cervical lymph nodes.
  - Headache
  - Nausea, vomiting
  - Abdominal pain
  - Myalgia

- Scalatiniiform rash or palatal petechiae, the latter being a an uncommon but highly specific finding



- Specific features, depending on the cause:
  - **Commons forms :**
    - Erythematous*** : (red throat) or exudative (red throat and whitish exudates) pharyngitis: since this appearance is common to both viral and streptococcal pharyngitis , other criteria should be considered to distinguish between them :
      - In children under 3 years, Streptococcal pharyngitis is rare and pharyngitis is almost exclusively viral.
      - In children from 3 to 14 years, the presence at least 3 of following features (***absence of cough, fever above 38 °c , at least one enlarged and tender anterior cervical lymph node, presence of an exudates***) favours streptococcal pharyngitis. Conversely, presence of cough, runny nose, conjunctivitis or enlarged posterior cervical lymph nodes favours viral pharyngitis.
      - In patient over 14 years, the probability of streptococcal pharyngitis is low.
      - Infectious mononucleosis (IM) due to the Epstein-barr virus should be suspected in adolescents and young adults with extreme fatigue, generalized adenopathy and often splenomegaly.
      - Erythematous or exudative pharyngitis may also be associated with gonococcal or primary HIV infection. In this cases, the diagnosis is mainly prompted by the patients history.
    - Pseudomembranous pharyngitis*** : (red tonsils/pharynx covered with adherent grayish white false membrane)
  - **Less common forms**
    - Vesicular pharyngitis*** (cluster of tiny blisters on the tonsils): always viral (Coxsackie virus or primary herpetic infection).
    - Ulceronecrotic pharyngitis*** : *hard* and painless syphilitic chancre of the tonsil; tonsillar ulcer soft on palpation in a patient with poor oral hygiene and malodorous breath (Vincent tonsillitis)

### Clinical signs and symptoms of GABSH pharingitis, their sensitivity and specificity(3)

Symptoms and Clinical Findings	Sensitivity (%)	Specificity(%)
Absence of cough	51-79	36-68
Anterior cervical nodes swollen or enlarged	55-82	34-73
Headache	48	50-80
Myalgia	49	60
Palatine petechiae	7	95
Pharyngeal exudates	26	88

Fever >38°C	22-58	52-92
Tonsillar exudates	36	85

V. M

### ANAGEMENT

- Treat fever and pain : Paracetamol : 60mg/kg/day divided 4-6 times.
- Viral pharyngitis is usually a self-limited illness. Spontaneous resolution typically occur within a few days : no antibiotic therapy .
- Choice of antibiotic treatment for streptococcal pharyngitis:
  - If single-use injection equipment is available, Benzathine benzylpenicilline is the drug of choice as streptococcus . A resistance to penicillin remains rare, it is the only antibiotic proven effective in reducing the incidence of rheumatism fever, and the treatment is administered as single dose.
  - Penicillin V is the oral reference treatment, but poor adherence is predictable due to the length of treatment :
    - **Phenoxymethylpenicillin (Penicillin V) PO for 10 days**
      - < 1 years : 250 mg/day in 2 divided doses
      - 1 – 5 years : 500 mg/day in 2 divided doses
      - 6 – 12 years : 1 g/day in 2 divided doses
  - Amoxicillin is an alternative and the treatment has advantage of being relatively short, However, it can cause adverse skin reactions in patient with undiagnosed IM has not been excluded.
    - **Amoxicillin PO for 6 days : 50 mg/Kg/day in 2 divided doses**
  - Resistance to macrolides is frequent, Erythromycin and Azithromycin should be reserved for penicillin allergic patients. Poor adherence with erythromycin is predictable due to the length of treatment. Azithromycin treatment has the advantage of being short .
    - Erythromycin PO for 10 days 30-50 mg/kg/day in 2 to 3 divided doses
    - Azithromycin PO for 3 days : 10-20mg/kg/day

### VI. PARENT EDUCATION

- Hand washing, hygiene, and need to complete antibiotic regimen

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# CROUP

(Not to be confused with “croup” in French which mean laryngeal diphtheria)

By Prof. Eap Tek Chheng

## I. DEFINITIONS

Croup, also known as **laryngotracheobronchitis**, is a common childhood respiratory illness caused by a range of viruses. Viral infection causes inflammation of the upper airway, which is characterised by barking cough, inspiratory stridor, hoarseness and respiratory distress. Most cases of croup are relatively mild and self limiting. However, croup can occasionally cause severe respiratory obstruction and rarely, death.

## II. EPIDEMIOLOGY AND ETIOLOGY

Croup is the most common pediatric illness that causes acute stridor, accounting for approximately 15% of clinic and emergency department visits for pediatric respiratory tract infection. It is primarily a disease of infants and toddlers, with a peak incidence from age 6 months to 36 months (3 years).

Viruses causing acute infectious croup are spread through either direct inhalation from a cough and/or sneeze or by contamination of hands with then touching the mucosa of the eyes, nose, and/or mouth. ***The parainfluenza viruses (types 1, 2, 3) are responsible for as many as 80% of croup cases, with parainfluenza type 1 accounting for about 66% of cases, as well as for the majority of hospitalizations.*** Other infectious causes of croup include: adenovirus, respiratory syncytial virus (RSV), enterovirus, coronavirus, rhinovirus, echovirus, reovirus, metapneumovirus, Influenza A and B. Rarer causes are measles virus, herpes simplex virus and varicella. ***Influenza A is associated with severe disease***; it has been implicated in children with severe respiratory compromise. *Mycoplasma pneumoniae* has been implicated in a few cases of croup.

## III. COMPLICATIONS

Complications in croup are rare. In most series, less than 5% of children who were diagnosed with croup required hospitalization and less than 2% of those who were hospitalized were intubated. Death occurred in approximately 0.5% of intubated patients.

Bacterial superinfection may result in pneumonia or bacterial tracheitis, a life-threatening infection that can arise after an acute viral respiratory infection. These patients usually have a toxic appearance and do not respond well to nebulized adrenaline. Pulmonary edema, pneumothorax, lymphadenitis, and [otitis media](#) have also been reported in croup.

#### IV. PATHOGENESIS

Viruses enter the host through the inhalation of infected droplet nuclei. Virus multiplication occurs throughout the tracheobronchial tree, inducing the production of mucus. The vocal cords of the larynx become grossly swollen, causing obstruction to the inflow of air, which is manifested by inspiratory stridor. In adults, the virus is usually limited to causing inflammation in the upper parts of the respiratory tract. In infants and young children, the bronchi, bronchioles and lungs are occasionally involved, which may reflect on the small size of the airways and the relative immunological immaturity.

#### V. DIAGNOSIS

*Croup is a clinical diagnosis.* Croup usually begins with nonspecific respiratory symptoms, including rhinorrhea, sore throat, and cough. Fever is generally low grade (38-39°C) but can exceed 40°C. Within 1-2 days, the characteristic signs of hoarseness, barking cough, and inspiratory stridor develop, often suddenly, along with a variable degree of respiratory distress. Symptoms are perceived as worsening at night, with most ED visits occurring between 10 pm and 4 am. Symptoms typically resolve within 3-7 days but can last as long as 2 weeks.

Spasmodic croup typically presents at night with the sudden onset of "croupy" cough and stridor. The child may have had mild upper respiratory complaints prior to this but more often has acted and appeared completely well prior to the onset of symptoms.

Clinically useful *severity assessment* has been developed by the Alberta Clinical Practice Guideline Working Group. Using this classification scheme, 85% of children in 21 general emergency departments in Alberta, Canada, were determined to have mild croup, and less than 1% had severe croup. The assessment is as follows:

- **Mild severity** - Occasional barking cough, no audible stridor at rest, and either no or mild suprasternal and/or intercostal retractions
- **Moderate severity** - *Frequent barking cough, easily audible stridor at rest, and suprasternal and sternal wall retractions at rest*, with no or minimal agitation
- **Severe severity** - Frequent barking cough, prominent inspiratory (and occasionally expiratory) stridor, *marked sternal wall retractions, significant agitation and distress*
- **Impending respiratory failure** - Barking cough (often not prominent), audible stridor at rest, sternal wall retractions may not be marked, *lethargy or decreased consciousness, and often dusky appearance without supplemental oxygen support.*

Neck radiography is not necessary, unless the diagnosis is in doubt, such as in the exclusion of a foreign body.

#### VI. DIFFERENTIAL DIAGNOSIS

- High fever, toxic appearance, and poor response to nebulized Adrenaline suggests **bacterial tracheitis**,
- Sudden onset of symptoms with high fever, absence of barking cough, dysphagia, drooling, anxious appearance, and sitting forward in "sniffing position" suggests **epiglottitis**,
- Other potential causes of stridor which are rare but should be considered include **foreign body lodged in upper esophagus, retropharyngeal abscess, laryngo-tracheomalacia and hereditary angioedema.**

#### VII. PROGNOSIS

The prognosis for croup is excellent, and recovery is usually complete. The majority of patients are managed successfully as outpatients, without the need for inpatient hospital care. Hospitalization rates vary widely among communities, ranging from 1.5-30% and typically averaging 2-5%.

## VIII. MANAGEMENT

Children with croup should be kept calm, and distressing procedures kept to a minimum as agitation may worsen airway obstruction.

The current cornerstones of treatment in the urgent care clinics or emergency departments are **corticosteroids** and **nebulized adrenaline (also known as epinephrine)**; steroids have proven beneficial in severe, moderate, and even mild croup.

### Corticosteroids

Corticosteroids are beneficial due to their anti-inflammatory action, whereby laryngeal mucosal edema is decreased. They also decrease the need for salvage nebulized adrenaline.

***Dexamethasone (cheapest, most literature, easiest), 0.15–0.6 mg/kg; higher doses have been traditional care, but studies have proven 0.15 mg/kg has equal efficacy. Single dose, IV/IM/PO have proven equal efficacy.***

Patients given a **single oral dose** of prednisolone (1 mg/kg) were found to have made more return visits than did those who received a single oral dose of dexamethasone (0.15 mg/kg). This is due to the lesser potency to reduce inflammation and shortened half-life of prednisolone (18-36 h) when compared with dexamethasone (36-54 h).

Inhaled budesonide has also proven to be effective but is more expensive; in one study, oral dexamethasone resulted in better improvement than did nebulized budesonide.

### Adrenaline

Its use is **typically reserved for patients in the hospital setting with moderate-to-severe respiratory distress**. Adrenaline works by adrenergic stimulation, which causes constriction of the precapillary arterioles, thereby decreasing capillary hydrostatic pressure. This leads to fluid resorption from the interstitium and improvement in the laryngeal mucosal edema. Adrenaline's beta2-adrenergic activity leads to bronchial smooth muscle relaxation and bronchodilation. Its effectiveness is immediate and lasts from 90-120 minutes.

Patients who receive nebulized adrenaline in the emergency department should be observed for at least 3 hours post last treatment because of concerns for a rebound phenomenon of bronchospasm, worsening respiratory distress, and/or persistent tachycardia. Patients can be discharged home only if they demonstrate healthy color, good air entry, baseline consciousness, and no stridor at rest and have received a dose of corticosteroids.

**Adrenaline Nebulization:** 1:1000 solution diluted in 3 mL NSS

- <4 years old: 0.5 mg/kg via nebulizer; no more than 2.5 mL (2.5 mg)/dose
- >4 years old: 0.5 mg/kg via nebulizer; no more than 5 mL (5 mg)/dose

There is one published report of an otherwise normal child with severe croup treated with three nebulization of adrenaline within one hour who developed ventricular tachycardia and a myocardial infarction. Therefore, Nebulized adrenaline can be repeated only if the patient has near respiratory failure. The treating physician should contact a pediatric intensivist as soon as possible regarding further treatment and transport.

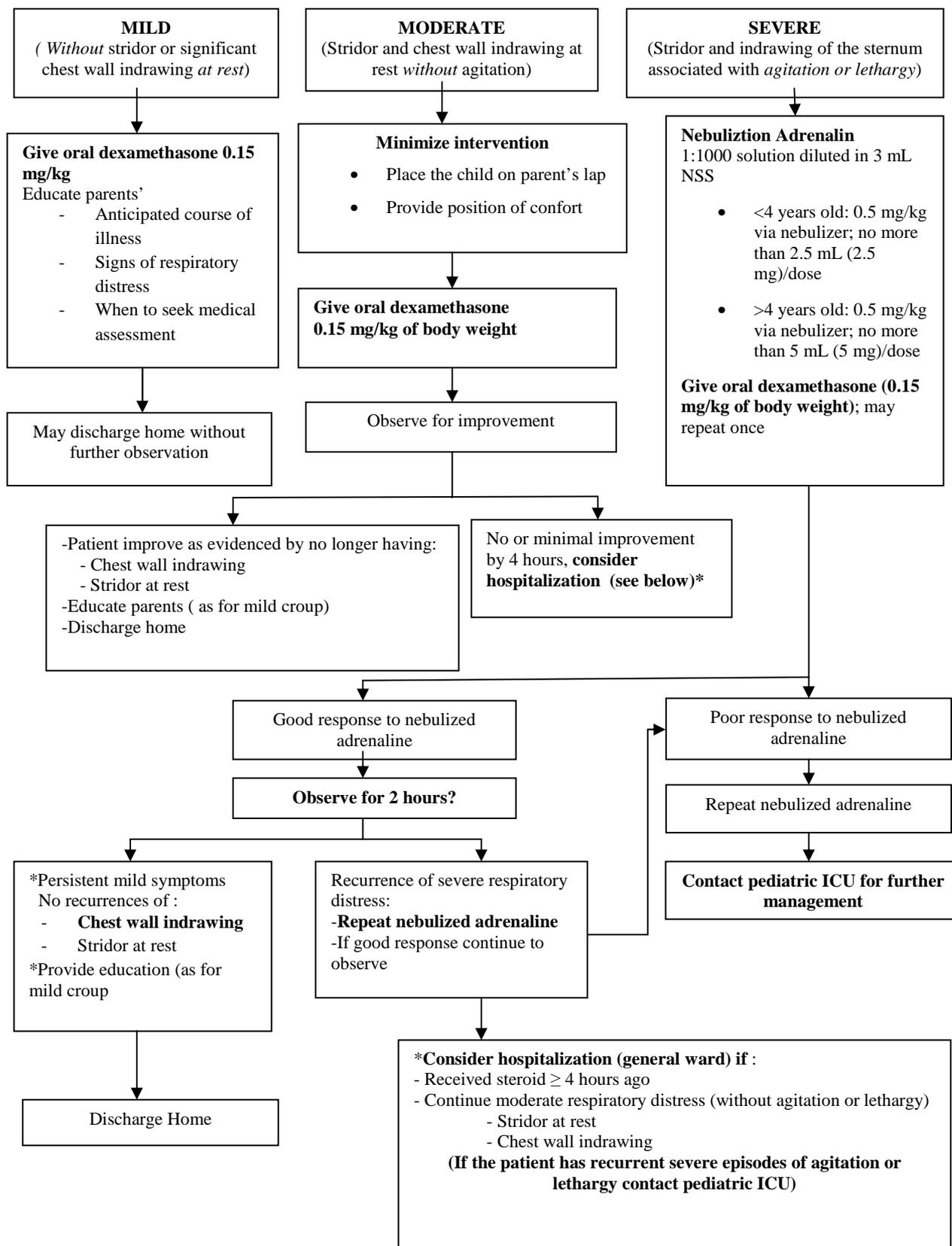
With the use of steroids + adrenaline in severe croup (the sustained action of steroids combined with quick action of adrenaline), the rate of intubation has been reduced from 3% to nil in many centres. The decision to intubate under controlled conditions (in Operation Theatre or Intensive Care Unit, with standby for tracheostomy) is made on clinical criteria, which suggests increasing respiratory distress.

- *The indications for oxygen therapy include:*
  - severe viral croup
  - percutaneous SaO<sub>2</sub> < 93%

*Caution: With oxygen therapy, the SaO<sub>2</sub> may be normal despite progressive respiratory failure and a high PaCO<sub>2</sub>. Hence clinical assessment is most important.*

- Antibiotics are not recommended unless bacterial super-infection is strongly suspected or the patient is very ill. IV fluids are not necessary except for those unable to drink.
- Humidified air: two randomized controlled trials investigated the effectiveness of mist, steam or humidification in the treatment of croup, neither of which showed any clinically significant difference with the use of humidified air.

### ALGORITHM: CROUP MANAGEMENT



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# ACUTE OTITIS MEDIA (AOM)

*By Dr. Lorntry Patrich*

## I. DEFINITION AND CAUSES

- AOM is the acute inflammation of the middle ear, due to viral or bacterial infection, very common in children under 3 years, but uncommon in adults.
- The principal causative organisms of bacterial otitis media are Streptococcus pneumoniae, Haemophilus Influenzae, Moraxella Catarrhalis and in older children Streptococcus pyogenes.

## II. EPIDEMIOLOGIE (7)

- Factors believed to affect the occurrence of OM include : age, gender, race, genetic background, socioeconomic status, type of milk or formula used in infant feeding, degree of exposure to tobacco smoke, degree of exposure to other children, presence or absence of respiratory allergy, season of the yr, and pneumococcal vaccination status. Children with certain types of congenital craniofacial anomalies are particularly prone to OM.
- The peak incidence and prevalence is from 6–20 month of age

## III. COMPLICATION

Particularly; in high risk children:

- Malnutrition
- Immunodeficiency
- Ear malformation
- Perforation of the TM results in purulent otorrhoea, and usually relief of pain
- Febrile convulsions are commonly related to AOM.
- Other potential complications include: facial nerve palsy, lateral sinus thrombosis, and benign intracranial hypertension

## IV. CLINICAL FEATURES

- Rapid onset of ear pain (in infant: crying, irritability, sleeplessness, reluctance to nurse) and ear discharge (otorrhoea) or fever.
- Other signs such as rhinorrhoea, cough, diarrhea or vomiting are frequently associated, and may confuse the diagnosis, hence the necessity of examining the tympanic membranes
- Otoscopy :
  - Bright red tympanic membrane (or yellowish if rupture is imminent) and presence of pus, either externalized ( drainage in ear canal if the tympanic membrane is ruptured) or internalized (opaque or bulging tympanic membrane). The combination of this signs with ear pain or fever confirms the diagnosis of AOM.
- Note: The following otoscopic finding are not sufficient to make the diagnosis of AOM:

- A red tympanic membrane alone, with no evidence of bulging or perforation, is suggestive of viral otitis in a context of upper respiratory tract infection, or may be due to prolonged crying in children or high fever.
- Presence of air bubbles or fluid behind an intact tympanic membrane, in the absence of signs and symptoms of acute infection, is suggestive of otitis media with effusion.

## V. MANAGEMENT

- Pain and fever : Paracetamol : 60 mg/kg/day in divided in 4 or 6 divided (4)
- Ear irrigation is contra-indicated if the tympanic membrane is ruptured or when the tympanic membrane cannot be fully visualised. Ear drop are not indicated
- Indications for antibiotic :
  - Children < 2 years
  - Severe infection( Vomiting Fever >39 0c severe pain)
  - Malnutrition
  - Immunodeficiency
  - Ear malformation
- For other children
  - If the child can be re-examined within 48-72 hours : it is preferable to delay antibiotic prescription . Spontaneous resolution is probable and a short symptomatic treatment of fever and pain may be sufficient. Antibiotics are prescribed if there is no improvement or worsening of symptoms after 48 to 72 hours.
  - If the child cannot be re-examined: antibiotic is prescribed.
- For children treated with antibiotics : advice the mother to bring the child back if fever and pain persist after 48 hours.
- Choice of antibiotic therapy
  - Amoxicillin(first line) PO : 80- 100 mg/kg/day in 2 or 3 divided doses for 5 days
  - Amoxicilline/clavulanic Acid (Second- line) , in case of treatment failure. Treatment failure is definite as persistence of fever and /or ear pain after 48 hours of antibiotic treatment. Dose Amoxicilline/Clavulanic acid PO 45mg/kg/day in 2 or 3 divided doses for 5 days.
  - Erythromycin should be reserved for every rare penicillin-allergic. Erythromycin PO 30-50 mg/kg/day in 2 to 3 divided doses for 10 days.
- Patients with persistent symptoms or recurrent AOM should be referred to an otorhinolaryngologist for evaluation.

## VI. PARENT EDUCATION

- Don't expose your child to secondhand smoke.
- Always hold your infant in an upright, seated position during bottle feeding.
- Breastfeeding for at least 6 months can make a child less prone to ear infections.
- Don't use a pacifier

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# **BRONCHITIS**

*By Dr. Lorntry Patrich*

## **ACUTE BRONCHITIS**

### **I. DEFINITION AND CAUSES**

- An acute inflammation of the bronchial mucosa, most commonly of viral origin(90%).[4]
- In older children it can be caused by Mycoplasma pneumonia.[2]
- Other causes include the following :[4]
  - Allergies
  - Chronic aspiration or gastro-esophageal reflux
  - Fungal infection
- In children over 2 years of age with repetitive acute bronchitis or wheezing bronchitis, consider asthma
- In children under 2 years of age, consider bronchiolitis

### **II. EPIDEMIOLOGY**

- Bronchitis, both acute and chronic, is prevalent throughout the world and is one of the top 5 reasons for childhood physician visits in countries that track such data. The incidence of bronchitis in British schoolchildren is reported to be 20.7%.
- Differences in population prevalences have been identified in patients with chronic bronchitis. For example, because of the association of chronic bronchitis with asthma and the concentration of asthma risk factors among inner-city populations, this population group is at higher risk.
- The incidence of acute bronchitis is equal in males and females. The incidence of chronic bronchitis is difficult to state precisely because of the lack of definitive diagnostic criteria and the considerable overlap with asthma. However, in recent years, the prevalence of chronic bronchitis has been reported to be consistently higher in females than in males.
- Acute (typically wheezy) bronchitis occurs most commonly in children younger than 2 years, with another peak seen in children aged 9-15 years. Chronic bronchitis affects people of all ages but is more prevalent in persons older than 45 years.

### III. COMPLICATIONS

may include the following:

- Bronchiectasis
- Bronchopneumonia
- Acute respiratory failure

### IV. CLINICAL FEATURE

- Often begins with a rhinopharyngitis that descends progressively : pharyngitis, laryngitis, tracheitis.
- Heavy cough, dry at the beginning then becoming productive
- Low-grade fever
- No tachypnoea, no dyspnea
- On pulmonary auscultation bronchial wheezing
- **Chest Radiography** : Chest films generally appear normal in patients with uncomplicated bronchitis . Abnormal findings are minimal and may include atelectasis, hyperinflation, and peribronchial thickening.

### V. TREATMENT

- Fever : Paracetamol : 60 mg/kg/day divided 4-6 time
- Keep the patient hydrated, warm drinks like hot tea (no alcohol)
- Children: nasal irrigation with 0.9% sodium chloride or Ringer Lactate, 4 to 6 times per day to clear airway.
- Antibiotic treatment is not useful for patients in good overall condition with rhinopharyngitis or influenza.
- **Antibiotic** treatment is indicated only if :
  - The patient is in poor general condition : malnutrition, measles, rickets, severe anaemia, cardiac disease.
  - If the patient has dyspnoea, fever greater than 38.5<sup>0</sup>c and purulent expectorations : a secondary infection with Haemophilus influenza or with pneumococcus is probable.
  - Choice of antibiotic treatment:
    - Amoxicillin PO for 6 days : 50 mg/Kg/day in 2or 3 divided doses, OR
    - Amoxicilline/Clavulanic acid PO 45mg/kg/day in 2 or 3 divided doses for 5 days, OR
    - Erythromycin PO for 10 days 30-50 mg/kg/day in 2 to 3 divided doses, OR
    - Azithromycin PO for 3 days : 10 to 20 mg/kg/day once daily.
- **Remark:** Referral to a pediatric pulmonologist may be helpful for patients experiencing persistent or recurrent symptoms (by 72 hours) and whose histories suggest the possibility of tracheobronchial foreign body aspiration, cystic fibrosis, immunodeficiency or persistent asthma for which appropriate first-line symptom or controller therapies have failed.

## **CHRONIC BRONCHITIS**

### **I. DEFINITION :**

A chronic inflammation of the bronchial mucosa due to irritation ( tobacco, pollution), allergy (asthma) or infection ( repetitive acute bronchitis).It may develop into chronic obstructive pulmonary disease.

### **II. CLINICAL FEATURE**

- Productive cough for 3 consecutive months per year for 2 successive years.
- No dyspnoea at onset. Dyspnoea develops after several years, first on exertion, then becoming persistent.
- On pulmonary auscultation : bronchial wheeze ( always exclude tuberculosis)
- A patient with an acute exacerbation of chronic bronchitis presents with :
  - Onset or increase of dyspnea
  - Increase volume of sputum
  - Purulent sputum

### **III. TREATMENT:**

- Antibiotic treatment is not useful in treating simple chronic bronchitis
- Antibiotic treating may be useful, for patients in poor general condition only, for acute exacerbations of chronic bronchitis (see acute bronchitis).

### **IV. PARENT EDUCATION**

- avoid passive environmental tobacco smoke; to avoid air pollutants, such as wood smoke, solvents, and cleaners; and to obtain medical attention for prolonged respiratory infections.
- Instruct parents that children may attend school or daycare without restrictions except during episodes of acute bronchitis with fever.
- Instruct parents that children may return to school or daycare when signs of infection have decreased, appetite returns, and alertness, strength, and a feeling of well-being allow.
- Immunization against pertussis, diphtheria, and influenza, which reduces the risk of bronchitis due to the causative organisms.

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# BRONCHIOLITIS

*By Prof. Kim Ang*

## I. DEFINITION

Bronchiolitis is an illness in children <2 years of age characterized by wheezing and airway obstruction due to primary infection or reinfection with a viral or bacterial pathogen, resulting in inflammation of the small airways/bronchioles.

## II. PATHOPHYSIOLOGY AND CAUSES

- Bronchiolitis is typically caused by a viral infection
- Respiratory syncytial virus (RSV) is the most common cause of this illness.
- Other causal agents:
  - Human parainfluenza viruses, Influenza virus, Adenovirus, Human metapneumovirus, Rhinovirus, Mycoplasma pneumoniae (in older children)
- RSV is transmitted by:
  - Close contact with infected secretions, large particle aerosols
  - Self-inoculation of conjunctivae or nose with infected hands
  - Secretions remain infectious on countertops and stethoscopes for up to 6 hours, rubber gloves for 90 minutes, and on hands or tissue for about 30 minutes.

## III. EPIDEMIOLOGY

- Bronchiolitis typically affects infants younger than two years and children less than one year are more likely to have more severe disease requiring hospital admission.
- In one prospective study of 1179 healthy infants, bronchiolitis accounted for 60 percent of the cases of LRTI during the first year of life. Bronchiolitis has a peak incidence between two and six months of age and remains a significant cause of respiratory disease during the first five years of life
- Patient groups at high risk of severe RSV disease:
  - Premature infants (<35 weeks' gestation)
  - Infants <12 weeks of age at time of RSV infection
  - Congenital heart disease, chronic lung disease, low birth weight, cystic fibrosis
  - Compromised immune function (from chemotherapy, transplant, congenital or acquired immunodeficiency)

## IV. DIAGNOSIS

### A. Diagnostic Characteristics:

- **Age:** Bronchiolitis mainly affects infants under two years of age. 90 % of cases requiring hospitalization occur in infants under 12 months. Incidence peaks at age 2 to 6 months.
- **Fever:** Infants with bronchiolitis may have fever or history of fever. High fever is uncommon in bronchiolitis. In the presence of high fever (axillary temperature  $\geq 39^{\circ}\text{C}$ ) careful evaluation for other causes (e.g. pneumonia) should be undertaken.
- **Rhinorrhea:** Nasal discharge often precedes the onset of other symptoms such as cough, tachypnoea, respiratory distress and feeding difficulties.
- **Cough:** A dry, wheezy cough is characteristic of bronchiolitis.
- **Respiratory rate:** Increased respiratory rate should arouse suspicion of lower respiratory tract infection, particularly bronchiolitis or pneumonia.
- **Poor feeding:** Many infants with bronchiolitis have feeding difficulties due to dyspnoea but poor feeding is not essential for the diagnosis of bronchiolitis. Feeding problems are often the reason for hospital admission.
- **Increased work of breathing** and recession: Dyspnoea and subcostal, intercostals and supraclavicular recessions are commonly seen in infants with acute bronchiolitis. The chest may be visibly hyperinflated in bronchiolitis. The presence of a hyperinflated chest may help to distinguish bronchiolitis from pneumonia.
- **Crackles/crepitations:** fine inspiratory crackles in all lung fields are a common (but not universal) finding in acute bronchiolitis.
- **Wheeze:** High pitched expiratory wheeze is a common examination finding.
- **Apnoea:** Apnoea can be the presenting feature of bronchiolitis, especially in the very young and in premature or low birthweight infants.

### B. Summary of Diagnostic Characteristic:

A diagnosis of acute bronchiolitis should be considered in an infant < 2 years of age with

- low grade fever
- nasal discharge
- wheezy cough
- the presence of fine inspiratory crackles and/or
- high pitched expiratory wheeze
- Apnoea may be a presenting feature.

### C. Investigations:

- **Oxygen saturation:** Pulse oximetry should be performed in every child who attends hospital with respiratory difficulties.
  - Infants with oxygen saturation  $\leq 95\%$  or signs of respiratory distress need oxygen therapy
- **Full blood cell count:** Full blood count is not indicated in assessment and management of infants with *typical* acute bronchiolitis however where other causes of respiratory illness are suspected, a FBC may help with the differential diagnosis.
- Other tests (if needed and/or available):
  - Blood gases: Blood gas analysis is not usually indicated in acute bronchiolitis. It may have a role in the assessment of infants with severe respiratory distress or in those who are tiring and may be entering respiratory failure.
  - Blood culture if pneumonia is suspected
  - RSV serology (acute and convalescent serum samples)
  - Rapid viral identification : best samples for testing
    - Nasopharyngeal aspirate

- Nasopharyngeal wash
- Viral culture of nasopharynx, may take up to 14 days for results

#### D. Chest X-ray:

- Chest X-ray should be considered in those infants where there is diagnostic uncertainty or in those with an atypical disease course. As with FBC, CXR may not be necessary in infants with *typical* acute bronchiolitis.
- Chest radiography findings include: hyperinflation, flattened diaphragms, peribronchial thickening, patchy or more extensive atelectasis, possible collapse of a segment or a lobe, diffuse interstitial infiltrates commonly seen

### V. DIFFERENTIAL DIAGNOSIS

- Pneumonia (viral or bacterial)
- Asthma (children over 2 years)
- Congestive heart failure
- Gastroesophageal reflux (GER)
- Foreign body aspiration

### VI. INDICATIONS FOR HOSPITALIZATION

Infants with symptoms of bronchiolitis and any of the following risk factors should be admitted to hospital:

- **Historical risk factors** for severe disease
  - < 12 weeks of age
  - Gestational age younger than 35 weeks
  - Underlying cardiopulmonary disease (e.g. heart disease, bronchopulmonary dysplasia)
  - Immunodeficiency or other high-risk group for developing severe disease
- **Clinical risk factors** for severe disease
  - Presence of apnea, tachypnea (according to age), retractions, poor feeding, pallor, lethargy or agitation (signs of impending respiratory failure), difficulty maintaining an airway
  - Pulse oximetry <95% in room air
  - Atelectasis on chest radiograph

### VII. MANAGEMENT

#### A. Outpatient Management:

Supportive care is the treatment for bronchiolitis not requiring admission.

- Adequate fluid intake, normal feeding (breast and other feeding)
- Nasal congestion — Saline nose drops may help to relieve partial nasal obstruction.
- Paracetamol for fever: 15 mg/kg/dose

#### **Return to doctor/hospital if child:**

- Increase in respiratory effort
- becomes toxic
- develops high fever
- has feeding difficulties

#### B. Supportive Inpatient Management:

⇒ same as home care plus

1) **Supplemental Oxygen:** Supplemental oxygen should be provided by nasal cannula (in preference to face mask), to maintain SpO<sub>2</sub> above 95%. For patient with severe respiratory distress, higher concentration oxygen delivery via face mask is needed (see CAP CPG)

⇒ Continuous Positive Airway Pressure (CPAP) should be considered in all patients with worsening severe respiratory distress despite oxygen therapy. Where hospitals do not have CPAP, referral is necessary when respiratory distress worsens

2) **Fluid administration:** The fluid intake and output of infants and children with bronchiolitis should be assessed regularly. Exclusive parenteral fluid administration may be necessary to ensure adequate hydration and avoid the risk of aspiration in infants and children who are hospitalized with bronchiolitis and have moderate to severe respiratory distress (nasal flaring; intercostal, subcostal, or suprasternal retractions; respiratory rate >70 breaths per minute; dyspnea; or cyanosis). For children who can tolerate enteral feedings, strategies to maintain hydration include small frequent feedings or orogastric or nasogastric feedings

### 3) **Drug Management:**

#### **Bronchodilators**

- Infants and children with bronchiolitis and moderate to severe respiratory distress (e.g. nasal flaring; retractions; grunting; respiratory rate >70 breaths per minute; dyspnea; or cyanosis) should receive a trial of nebulized salbutamol 2.5mg/dose, repeated twice at an interval of 30 minutes. If effective, continue 2.5mg/dose every 2-4 hrs in the acute phase and then reduction as recovery takes place.
- If ineffective, discontinue the treatment

#### **Antibiotics**

**Antibiotics are not required for bronchiolitis, however** if there is suspicion of bacterial pneumonia, choose an antibiotic according to guidelines for antibiotic use in childhood pneumonia.

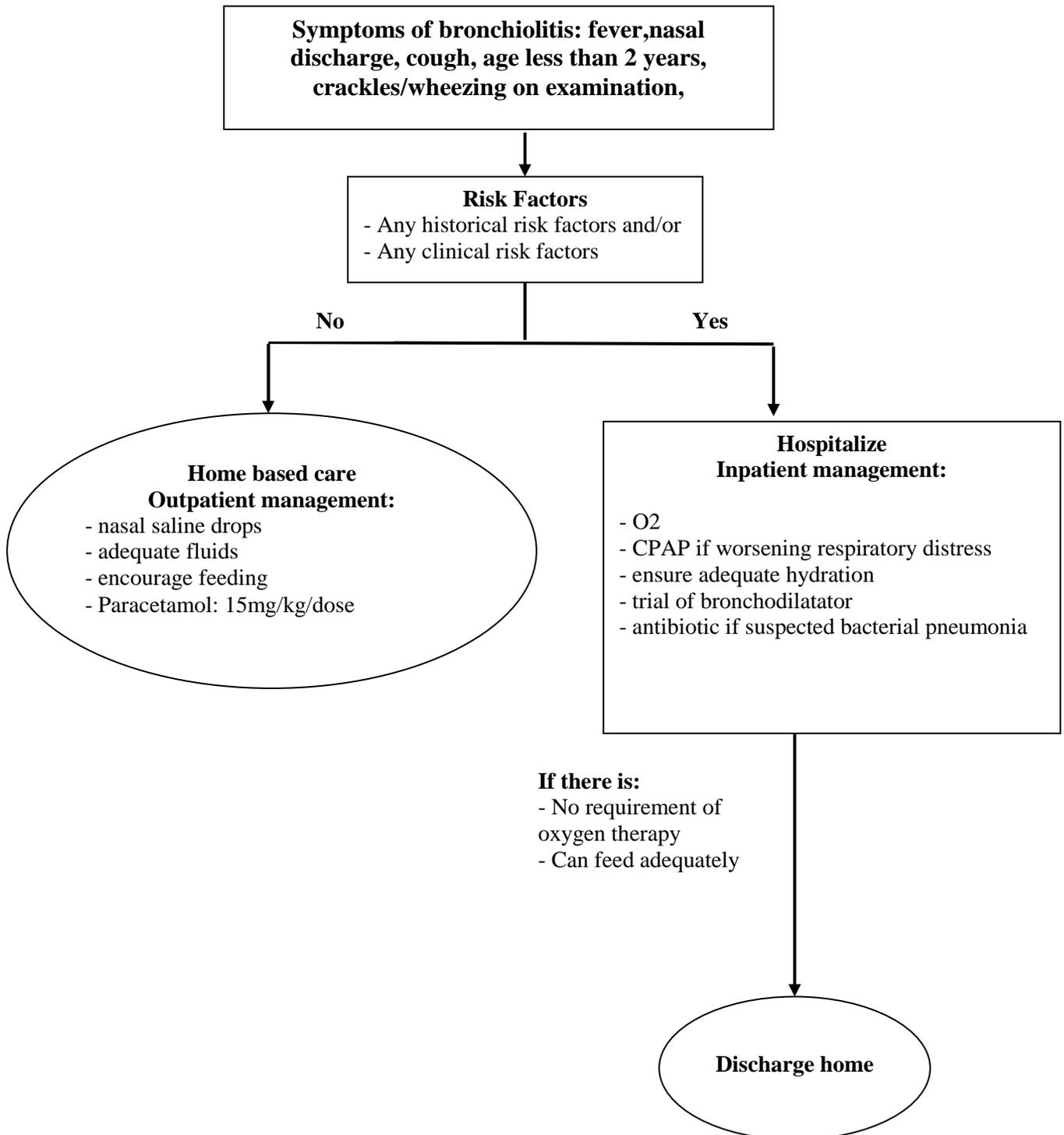
#### **Steroids**

Steroids are not recommended in children with bronchiolitis as there is no evidence that they are beneficial

#### 4) **Physiotherapy:**

Chest physiotherapy using vibration and percussion is only recommended for those admitted to intensive care.

## ALGORITHM



## VIII. DISCHARGE CRITERIA

- No requirement of oxygen therapy
- Can feed adequately
- Return of social smile

### \*\*\* Things to remember:

- Wheeze or mild chest indrawing is not a contraindication for discharging a patient.
- Most infants with no underlying disease improve within 3 to 5 days.
- In some patients, nasal congestion and cough may continue for 1 to 3 weeks.

## IX. PROGNOSIS

- For most previously healthy infants, prognosis is good.
- Premature infants 32 to 35 weeks gestation hospitalized for bronchiolitis have been shown to have an increased number of subsequent hospitalizations for respiratory problems, a greater number of outpatient visits, and an increased risk of sudden death compared with those who were not hospitalized for bronchiolitis.
- Mortality is increased in young infants (6 to 12 weeks), those with low birth weight, and those with underlying medical conditions (eg, underlying cardiopulmonary disease, immune deficiency)

## X. PREVENTION

- Breast feeding
- Hand washing: before and after handling the affected child by health care provider as well as by parents.
- Avoidance of known ill contacts and crowded places for infants at risk of severe disease.
- Avoidance of passive smoking
- Both service providers and staff should be aware of the risk that those with upper respiratory tract infections pose for high-risk infants.
- local policies should restrict hospital visiting by those with symptoms of respiratory infections.
- There should be ongoing surveillance by control of infection staff to monitor compliance with infection control procedures.

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# COMMUNITY ACQUIRED PNEUMONIA

By Prof. Eap Tek Chheng

## I. DEFINITION

Community acquired pneumonia (CAP) is an acute infection of the pulmonary parenchyma, acquired outside of a hospital setting. The diagnosis usually requires historical or physical evidence of an acute infectious process with fever and signs or symptoms of respiratory distress, or radiologic evidence of an acute pulmonary infiltrate.

## II. EPIDEMIOLOGY

Pneumonia is *the single biggest killer of children worldwide*, causing an estimated 2.4 million deaths in children under the age of five every year. Most of the deaths occur in resource-constrained countries (50% in sub-Saharan Africa and 20% in South-East Asia) where 151 million cases of childhood pneumonia are estimated to occur each year. Acute respiratory infection is still the major cause of mortality under five in Cambodia. In tropical regions, peaks of infection follow no common pattern and can occur during either the wet or dry seasons.

## III. PATHOGENESIS

Normally, the lungs are well protected. The infection is due to failure or defect in host defences, exposure to very virulent pathogens, exposure to an overwhelming load of pathogens. The failures of host defences are due to compromised immune response, viral infection, systemic sepsis, immunosuppressive drug use, cigarette exposure and change in mental status.

## IV. ETIOLOGY

The true prevalence of the various etiologic agents in CAP in children is uncertain because studies investigating the etiology of childhood pneumonia were performed in populations of various ages, in various settings, and using indirect methods: nasopharyngeal culture, blood culture, polymerase chain reaction, and serology. Systematic reviews have identified some consistent trends and conclusions regarding the etiology of CAP in children:

*Table 1: Pathogens for pneumonia*

Age	Pathogens
Neonates	Group B streptococcus, Gram negative bacilli, Listeria, <i>Streptococcus pneumoniae</i>

<b>Infants</b>	Viruses, <i>Streptococcus pneumoniae</i> , Haemophilus influenzae type b, Chlamydia trachomatis, cytomegalovirus, Mycoplasma hominis, and Bordetella pertussis
<b>children &lt; 5 years</b>	viruses, <i>Streptococcus pneumoniae</i> , Staphylococcus aureus, Streptococcus pyogenes,
<b>children &gt; 5 years</b>	<i>Streptococcus pneumoniae</i> , Mycoplasma pneumoniae, Chlamydia pneumoniae

Burkholderia pseudomallei (Meliodosis) should not be forgotten as one of the causes of very severe pneumonia with risk of septic shock in our endemic population. For patients who had a history of contact with poultry, influenza A (H5N1) should be considered as one of the cause of pneumonia.

## V. CLINICAL PRESENTATION

- **Symptoms:**
  - fever,
  - fast breathing,
  - difficult breathing,
  - cough (productive),
  - chest pain,
  - abdominal pain
- **Signs:**
  - respiratory distress (cyanosis, nasal flaring, head nodding, grunting, retractions...)
  - crackles
  - decreased breath sounds
  - bronchial breath sound
  - fast breathing:
    - $\geq 60$ /minute in child < 2 months
    - $\geq 50$ /minute in child 2 to 11 months
    - $\geq 40$ /minute in child 1 to 5 years

## VI DIAGNOSIS

<b>Signs or symptoms</b>	<b>Classification</b>
Cough or difficult breathing plus at least one of the following: <ul style="list-style-type: none"> <li>• Central cyanosis</li> <li>• Unable to breast feed or drink or vomiting everything</li> <li>• Convulsion, lethargy or unconsciousness</li> <li>• Severe respiratory distress (e.g. head nodding...)</li> </ul>	<b>Very severe pneumonia</b>
Cough or difficult breathing plus at least one of the following: <ul style="list-style-type: none"> <li>• Lower chest wall indrawing</li> <li>• Nasal flaring</li> <li>• Grunting (in neonate)</li> </ul>	<b>Severe pneumonia</b>
Cough or difficult breathing plus at least one of the following: <ul style="list-style-type: none"> <li>• Definite crackles on auscultation</li> <li>• Fast breathing: <ul style="list-style-type: none"> <li>▪ <math>\geq 60</math>/minute in child &lt; 2 months</li> <li>▪ <math>\geq 50</math>/minute in child 2 to 11 months</li> <li>▪ <math>\geq 40</math>/minute in child 1 to 5 years</li> </ul> </li> </ul>	<b>Pneumonia</b>

No signs of very severe pneumonia or severe pneumonia or pneumonia	<b>No pneumonia</b>
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**Table 2: Classification of severity of pneumonia (adapted from WHO)**

### Investigations:

- **WBC:** Increased white blood count with predominance of neutrophil may suggest bacterial cause. However, leucopenia can either suggests a viral cause or severe overwhelming infection.
- If available:
  - **Chest X-ray:** Children with signs and symptoms of pneumonia who are not admitted to hospital should not have a chest x-ray. Chest x-ray should be obtained if diagnosis is in doubt or concerned about other pathology such as heart disease, effusion, pneumothorax or tuberculosis. Pneumococcus and haemophilus influenza are most likely suspected in case of lobar or segmental infiltrate. The presence of pneumatoceles or abscesses suggests Staphylococcus Aureus etiology. Patchy, diffuse or perihilar alveolar syndrome suggests viral or mycoplasma causes.
  - **Blood culture:** Positive blood cultures are found only in 10% to 30% of patients with pneumonia. Blood culture should be performed in severe pneumonia or when there is poor response to the first line antibiotics.
  - **Pleural fluid:** If there is significant pleural effusion, diagnostic pleural tap will be helpful.
  - **CRP:** Serum CRP concentrations may be higher in patients with bacterial compared with viral pneumonia.
  - **Serology:** For Mycoplasma and Chlamydia if it will change the management.

## VI. MANAGEMENT

- **No pneumonia**
  - This child has cough or cold.
  - If coughing for more than 2 weeks, assess for cause of chronic cough e.g. asthma, tuberculosis.
  - Assess and treat ear problem or sore throat.
  - Advise mother to give a safe remedy for soothing a sore throat e.g. sugar syrup or honey and warm water solution. Advise mother to give home care.
  - Paracetamol 15mg/kg/dose every 6 hours for fever
  - Salbutamol nebulization (2.5mg/dose for child less than 5 years and 5mg/dose for child 5 years and above) in 2.5ml of NSS/dose if wheezing
- **Pneumonia**
  - Advise mother to give home care.
    - Oral Antibiotic (at home) for 3 to 5 days
    - **Amoxicillin (PO)** 40 mg/kg/dose twice daily.
  - Paracetamol 15mg/kg/dose every 6 hours for fever.
  - Salbutamol nebulization (2.5mg/dose for child less than 5 years and 5mg/dose for child 5 years and above) in 2.5ml of NSS/dose if wheezing.
  - Ask mother to return in 2 days for re-assessment - or earlier if the child is getting worse.
    - Add Clarithromycin 7.5 mg/kg/dose twice daily if concern about atypical pneumonia (Chlamydia or Mycoplasma...)

- Admit if the child gets worse
- **Severe pneumonia**
  - Admit patient to hospital
    - ABC management and stabilization
      - Position and clear airway by suctioning if secretion presented
      - Provide Oxygen via nasal prongs or nasal canula 1 to 2 l/min if the child has severe lower chest wall indrawing or breathing  $\geq 70$ /minute
      - Treat shock if present (see management of shock CPG). See more detail on fluid management in supportive care section.
    - Give Antibiotic for 7-10 days (both PO and injection)
      - **Ampicillin** (IM/IV) 100-200 mg/kg/day every 6 hours injections plus
      - **Gentamicin** (IM/IV) 7.5mg/kg/day once a day (at least 5 days)
      - As soon the child improves, switch to **Amoxicillin** (PO) 40 mg/kg/dose in 2 divided doses.
    - Supportive care (for fever, secretion)
    - Salbutamol nebulization (2.5mg/dose for child less than 5 years and 5mg/dose for child 5 years and above) in 2.5ml of NSS/dose if wheezing.
    - Reassess twice daily: If poor response to treatment in 48 hours or the child's condition deteriorates, switch to treatment for very severe pneumonia and look for complications such as pleural effusion, empyema or pneumothorax and treat if found.
- **Very Severe Pneumonia**
  - ADMIT the patient to hospital.
    - ABC management and stabilization
      - Position and clear airway by suctioning if secretion presented
      - Provide oxygen to all patients with very severe pneumonia. Higher concentration oxygen delivery via face mask (8 to 10 l/min) or via mask with reservoir (12-15l/min) maybe required in patients with severe respiratory distress. CPAP might be needed in patients who fail to response to high concentration oxygen therapy.
      - Treat shock if present (see management of shock CPG). See more detail on fluid management in supportive care section.
    - Give Antibiotic for 10 days
    - **First line antibiotic:**
      - **Ampicillin** (IM/IV) 200 mg/kg/day every 6 hours injections.  
Plus
      - **Gentamicin** (IM/IV) 7.5 mg/kg/day once a day (at least 5 days)
      - Change to oral **Amoxicilline** 40 mg/kg/dose 12 hourly and **Gentamycin** 7.5 mg/kg/day once daily IM to complete 10 days of treatment if the patient gets better in the first 5 days of iv antibiotics.
    - **Second line antibiotic:**
      - If there is no improvement after 48 hours with first line drugs switch to **Ceftriaxone** (IV / IM) 50-75 mg/kg/day given as a single infusion or twice a day for 7 days. Look for complications such as pleural effusion, empyema or pneumothorax and treat if found.

- If staphylococcal pneumonia is suspected switch to **Cloxacillin** (IM/IV) 200 mg/kg/day 6 hourly injections plus **gentamicin** (IM/IV) 7.5 mg/kg/day once a day (for 5 to 7 days)
  - Change to oral Cloxacillin 200mg/kg/day 6 hourly when the child has improved - continue for 3 weeks.
- **In case of melioidosis (*B. pseudomallei*): See Melioidosis CPG.**
  - Supportive care (for fever, secretion)
  - Salbutamol nebulization (2.5mg/dose for child less than 5 years and 5mg/dose for child 5 years and above) in 2.5ml of NSS/dose if wheezing.
  - Reassess at least twice daily: If poor response to treatment in 48 hours or the child's condition deteriorates, look for complications such as pleural effusion, empyema or pneumothorax and treat if found. Consider other causes of pneumonia such as *Staphylococcus aureus*, melioidosis or tuberculosis. If there are signs of impending respiratory failure or worsening condition despite high flow oxygen and antibiotic treatment, transfer the patient to higher level hospital. The patient might need intubation and ventilation support.
- **Supportive treatment**
    - **Fever:** Paracetamol 15mg/kg( po) every 6 hours for fever > 38.5C. Use tepid sponging and fanning.
    - **Wheezing:** Salbutamol nebulization (2.5mg/dose for child less than 5 years and 5mg/dose for child 5 years and above) in 2.5ml NSS
    - **Feeding:** Anorexia is common - children with severe pneumonia may have difficulty eating because of fast breathing or difficulty swallowing. Encourage continued breast-feeding - if the child is too ill to breast-feed, the mother can express milk into a cup and feed the child with a spoon slowly, or give the expressed breast milk via a naso-gastric tube. Encourage the child to eat small meals frequently.
    - **Fluids:** Increased fluid loss occurs during acute respiratory infections, especially when there is fast breathing or fever. The fluid loss from the lung consists mainly of water. Therefore, to replace fluid loss in children without diarrhoea, give breast milk or other age appropriate fluids, or ORS.

**Warning:**

Sometimes, children with severe pneumonia or bronchiolitis may be producing excess anti-diuretic Hormone (ADH) and are at **risk of fluid overload and pulmonary oedema**.

If the child is not in shock - give oral or nasogastric fluid very carefully; there is a **risk of aspiration**. Always use IV fluid (if needed) with extreme caution (avoid fluid overload).

In children with pneumonia and dehydration give fluid more slowly than when dehydration is caused by diarrhoea. If the child has diarrhoea and pneumonia - follow the guidelines for rehydration but monitor very carefully for signs of fluid overload.

- **Monitoring the patient**

A doctor should assess thoroughly at the patient least twice each day. A nurse should reassess the patient every 15-30 minutes during acute phase and later, after improvement, every 2-4 hourly.

▪ **Persistent Pneumonia**

Occasionally a child with a diagnosis of pneumonia remains ill despite 10-14 days of correct treatment with an adequate antibiotic. Low grade fever, chest indrawing and tachypnoea persist.

If possible do a chest x-ray. Causes of persistent pneumonia are:

- **Tuberculosis** - this is a very common cause of persistent pneumonia in Cambodia.
- **Foreign body** - look for history of sudden onset of symptoms while feeding or playing.
- **Chlamydial pneumonia** - consider in infants less than 6 months of age. Erythromycin (PO) is effective 30 to 50 mg/kg/day in 4 divided doses for 3 weeks. Check mother for STD and treat
- **Pneumocystis pneumonia** - may occur in malnourished children and children with AIDS

## VII. COMPLICATION

If the child responds poorly to treatment, examine for complications or other diagnoses:

- **Empyema** - consider if there is persistent fever, dullness to percussion and pleural fluid on x-ray.
- **Heart failure** - look for hepatomegaly, heart rate over 160/minute, large heart, cardiac murmur, distended jugular veins and cool extremities.
- **Bronchospasm** – (see bronchiolitis / asthma).
- **Pneumothorax** – consider if the patient develops more dyspnea, reduced breath sound and hyper resonance on percussion

## VIII. PATIENT EDUCATION

If child is treated at home, educate parents on importance of completing antibiotic treatment to avoid resistance, ensuring adequate fluid intake, providing paracetamol etc. If the patient does not improve despite treatment or worsens, the parents should be instructed to return for review.

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# EMPYEMA

*By Prof. Eap Tek Chheng*

## I/. DEFINITION

Empyema is the presence of pus in the pleural cavity.

## II/. EPIDEMIOLOGY

Parapneumonic effusion and empyema have an incidence of 3.3 per 100 000 children.

Parapneumonic effusions and empyema are more common in boys than girls and are more frequently encountered in infants and young children.

## III/. PHYSIOPATHOLOGY

The pleural space normally contains 0.3 ml/kg body weight of pleural fluid. There is a continuous circulation of this fluid and the lymphatic vessels can cope with several hundred millilitres of extra fluid per 24 hours. However, an imbalance between pleural fluid formation and drainage will result in a pleural effusion. These parameters are altered when disease processes such as infection affect the adjacent lung or vascular tissue and activate an immune response and pleural inflammation. Increased vascular permeability allows migration of inflammatory cells (neutrophils, lymphocytes, and eosinophils) into the pleural space. The process is mediated by a number of cytokines—such as interleukin (IL)-1, IL-6, IL-8, tumour necrosis factor (TNF)- $\alpha$ , and platelet activating factor—released by mesothelial cells lining the pleural space. The progression of pleural fluid collection evolves from stage 1-3.

In stage 1, **the exudative stage**, the pleural inflammation from a contiguous infection results in increased permeability and a small fluid collection. At this stage, the effusion is thin and amenable to thoracentesis alone, contains neutrophils, has normal pH and glucose levels, and is often sterile.

Stage 2, **the fibrinopurulent stage**, is characterized by invasion of the organism into the pleural space, progressive inflammation, and significant polymorphonuclear (PMN) leukocyte invasion. The increase in fibrin deposition also results in partitions or loculations within the pleural space. Inflammation is characterized by progressive decreases in the pleural fluid glucose and pH levels and increased protein and lactate dehydrogenase (LDH) levels.

The last stage, stage 3, is **the organizing stage**, in which a pleural peel is created by the resorption of fluid and is associated with fibroblast proliferation that can result in parenchymal entrapment.

**IV/. ETIOLOGY**

- Complication of pneumonia (this is the most common cause of empyema)
- Tuberculosis (with or without bacterial supra-infection)
- Following trauma to the chest
- More rarely, secondary to systemic infections (Septicaemia)

*S aureus* is the predominant pathogen in developing countries, especially during the hot and humid months when staphylococcal skin infections are more prevalent. There has been a decline in culture positive *S pneumoniae*, probably because of prior antibiotic use. Various Gram negative organisms—for example, Enterobacteriaceae such as *Klebsiella* spp and *Pseudomonas aeruginosa*—are also more common than in developed countries; they are not limited to infants and may be associated with protein energy malnutrition.

**V. DIAGNOSIS**

## 1. Infectious syndrome

- Prolonged fever
- Signs of general poor health or toxic condition in young infants (see staphylococcal pneumonia)
- Sometimes abdominal pain («pseudo-appendicitis» in children)

## 2. Respiratory syndrome

- cough and dyspnoea

## 3. Pleural effusion

- Chest pain
- dullness to percussion over effusion
- reduced breath sounds over effusion on auscultation
- Reduced vocal vibrations (auscultation and palpation)
- Chest asymmetry

Note: sometimes with associated pneumothorax (pyo-pneumothorax)

**Investigations**

## 1. CBC and CRP

2. Chest x-ray: Posteroanterior or anteroposterior radiographs should be taken; there is no role for a routine lateral radiograph.

2. Ultrasound: Ultrasound must be used to confirm the presence of a pleural fluid collection. Ultrasound should be used to guide thoracocentesis or drain placement.

3. Blood cultures should be performed in all patients with parapneumonic effusion or empyema

4. If you suspect a pleural effusion perform an exploratory pleural aspiration - ensure aseptic technique.

Pleural fluid (macroscopic)	Basic pleural fluid analysis		
Pus	It is an empyema: - GB > 10 000/ml, - LDH > 1 000 UI/l, - PH < 7,2, - Glucose < 2,2 micromol/l Do gram stain (bacteria seen in <20% cases)		
Yellow fluid Sero-fibrinous	Protein >30g/l Or Rivalta + WBC > 1000/ml	Exudate Inflammatory fluid	Early stage of empyema
			Tuberculosis
			Simple reactive pleurisy (not infected)

	Protein < 30g/l Or Rivalta - WBC < 1000/ml	Transudate non inflammatory fluid	? Cardiac ? Renal ? Hypoproteinemia (liver diseases) (severe malnutrition)
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## VII/. COMPLICATION

Complications are uncommon in children but may include bronchopleural fistula, lung abscess, pyopneumothorax, osteomyelitis of the ribs, pericarditis, septicemia or even perforation through the chest wall (empyema necessitatis).

## VIII/. TREATMENT

### 1. Indication for chest tube:

#### According to pleural fluid

##### *a/.Liquid aspirated is cloudy or purulent (empyema)*

- Insert a thoracic drain (ensure aseptic technique in operating theatre and after x-ray confirmation)

Where possible, any coagulopathy or platelet defect should be corrected before chest drain insertion.

##### *b/.Liquid aspirated from effusion is yellow-coloured (Protein > 30g/litre or Rivalta +, WBC >1000/ml)*

- Aspirate fluid if there is marked dyspnoea (ensure aseptic technique)
- Repeat aspiration if patient's condition worsens: if fluid aspirated becomes purulent, insert a thoracic drain. (ensure aseptic technique in operating theatre and after x-ray confirmation)
- Consider tuberculosis as a possible diagnosis.

##### *c/.Liquid aspirated from effusion is yellow-coloured (Protein < 30g/litre or Rivalta -, WBC <1000/ml)*

- Aspirate fluid if there is marked dyspnoea (ensure aseptic technique)
- Reassess patient. Clinical signs of cardiac, renal or liver diseases.
  - ⇒ Cardiomegaly on X-ray
  - ⇒ Peripheral oedema
  - ⇒ Proteinuria
  - ⇒ Ascites
  - ⇒ Severe malnutrition

- **Repeat** pleural tap if condition worsens. Check again fluid characteristics
- **According to X-RAY or clinical examination**

Presence of an associated pneumothorax, clinically evident or confirmed by x-ray (before pleural tap) is often an indication for chest drain.

### 2. Choose Antibiotic therapy

Bacteriological Analysis of pleural fluid is usually negative (no bacteria seen on gram stain, culture negative). All cases should be treated with intravenous antibiotics and must include cover for Staphylococcus Aureus and Streptococcus pneumonia. Broader spectrum cover is required for hospital acquired infections, as well as those secondary to surgery, trauma, and aspiration. Where possible, antibiotic choice should be guided by microbiology results.

**Remove the drain when there is less than 50 ml of clear fluid draining per day.**

### 1st choice

**Cloxacillin or oxacilline IV:** 200 mg/kg/day in 4 divided injections

+

**Gentamicin IM or slow IV:** 5 mg / kg/day divided in 2 injections

### 2nd choice

**Ceftriaxone IV** 100 mg/kg/day in 1 or 2 injections

+

**Gentamicin IM or slow IV:** 5 mg / kg/day divided in 2 injections

**Metronidazole** is added in case of anaerobic organism: 30 mg/kg/day divided in 2-3 perfusions

### 3. Duration of antibiotic therapy

Total duration is between 4 and 6 weeks

⇒ Parenteral route : 2-3 weeks

⇒ Oral route : 2-3 weeks

Switch to PO treatment as patient condition improves.

Note: Gentamicin use should not exceed 8-10 days because of the risk of toxicity.

### 4. Surgical management

- Video-assisted thoracic surgery (VATS)
  - Alternative to more invasive procedures (e.g., open thoracotomy/decortication)
  - Debridement through pleural visualization and lysis of adhesions/loculations
  - Useful when initial drainage is delayed, when loculations prevent adequate drainage, or patient is failing more conservative therapy
- Open thoracotomy with rib resection
  - Encapsulated empyema
- Decortication
  - Symptomatic chronic empyema
  - Relief of thick fibrous peel

### 5. Other management

- Antipyretics should be given.
- Analgesia is important to keep the child comfortable, particularly in the presence of a chest drain.
- Chest physiotherapy is not beneficial and should not be performed in children with empyema.
- Early mobilisation and exercise is recommended.
- Secondary thrombocytosis (platelet count  $>500 \times 10^9/l$ ) is common but benign; antiplatelet therapy is not necessary.
- Secondary scoliosis noted on the chest radiograph is common but transient; no specific treatment is required but resolution must be confirmed.

### 6. Monitoring the patient - follow-up

Note that a chest x-ray will not return to normal immediately (it will take 3 to 6 months), and therefore chest x-ray should not be used to decide when to remove the drain or stop antibiotics.

**Criteria for improvement are mostly clinical:**

- Patient is afebrile
- Respiratory Rate
- Recovery of appetite
- Weight curve
- Auscultation (better air entry on auscultation)

Everyday: Monitor chest tube output: how many ml per day and colour of fluid.

Everyday: Check and Ensure permeability of chest tube from patient to collect bag (no torsion)

Everyday: Change dressing and disinfect around the drain.

If you suspect that the drain is obstructed:

- NEVER push drain deeper into the thoracic cavity
- Do not inject anything into the drain
- You can try to remove drain a few centimetres
- And/or, using aseptic technique, perform gentle suction through the drain.

\* If no fluid starts to drain following these attempts - remove the drain.

Pleural lavage is not recommended as it may cause iatrogenic infection.

**Note if pus is leaking around the drain, it means it is obstructed.**

It is dangerous to let a chest tube for a too long period (risk of secondary infection). Generally, chest tube will be removed after an average period of 8-10 days. If air is coming from chest tube, it means associated pneumothorax (ruptured lung bullae or bronchus to pleural space fistula).

**VI. PROGNOSIS**

- The prognosis for most patients with parapneumonic effusions is quite good.
- Extended antibiotics may be needed in some patients with complicated parapneumonic effusions (CPE).
- Despite the variability in presentation, most patients recover without sequelae.
- Numerous studies have demonstrated resolution of the radiographic abnormalities by 3-6 months following therapy, with few to no symptoms reported at follow-up examination.
- Pulmonary function testing performed following hospitalization has not shown marked abnormalities, regardless of clinical course. The only abnormality observed may be slight expiratory flow limitation. Mild obstructive abnormalities were the only findings observed in patients evaluated 12 years ( $\pm 5$ ) following recovery from empyema.
- Some increased bronchial reactivity has been reported at later follow-up examinations; however, lung function and exercise response return to normal for most patients.
- Early recognition of pneumonia with parapneumonic effusion, effective intervention to identify the causative organism, and initiation of definitive therapy reduce morbidity and complications associated with this process.

**IX. PREVENTION**

[Vaccines](#) are available that prevent certain types of pneumonia. Yet there are many bacteria that cause pneumonia, children are not guaranteed to avoid it even with a complete immunization. If a child is suspected of having pneumonia based on the signs or symptoms, bring him to see a physician as soon as possible. There is no home treatment for pneumonia. Although cough suppressants, expectorants, or fever-lowering drugs may be helpful, they should not be started without discussing their use with physician.

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# **EMPYEMA**

*By Prof. Eap Tek Chheng*

## **I/. DEFINITION**

Empyema is the presence of pus in the pleural cavity.

## **II/. EPIDEMIOLOGY**

Parapneumonic effusion and empyema have an incidence of 3.3 per 100 000 children. Parapneumonic effusions and empyema are more common in boys than girls and are more frequently encountered in infants and young children.

## **III/. PHYSIOPATHOLOGY**

The pleural space normally contains 0.3 ml/kg body weight of pleural fluid. There is a continuous circulation of this fluid and the lymphatic vessels can cope with several hundred millilitres of extra fluid per 24 hours. However, an imbalance between pleural fluid formation and drainage will result in a pleural effusion. These parameters are altered when disease processes such as infection affect the adjacent lung or vascular tissue and activate an immune response and pleural inflammation. Increased vascular permeability allows migration of inflammatory cells (neutrophils, lymphocytes, and eosinophils) into the pleural space. The process is mediated by a number of cytokines—such as interleukin (IL)-1, IL-6, IL-8, tumour necrosis factor (TNF)- $\alpha$ , and platelet activating factor—released by mesothelial cells lining the pleural space. The progression of pleural fluid collection evolves from stage 1-3.

In stage 1, **the exudative stage**, the pleural inflammation from a contiguous infection results in increased permeability and a small fluid collection. At this stage, the effusion is thin and amenable to thoracentesis alone, contains neutrophils, has normal pH and glucose levels, and is often sterile.

Stage 2, **the fibrinopurulent stage**, is characterized by invasion of the organism into the pleural space, progressive inflammation, and significant polymorphonuclear (PMN) leukocyte invasion. The increase in fibrin deposition also results in partitions or loculations within the pleural space. Inflammation is characterized by progressive decreases in the pleural fluid glucose and pH levels and increased protein and lactate dehydrogenase (LDH) levels.

The last stage, stage 3, is **the organizing stage**, in which a pleural peel is created by the resorption of fluid and is associated with fibroblast proliferation that can result in parenchymal entrapment.

#### IV/. ETIOLOGY

- Complication of pneumonia (this is the most common cause of empyema)
- Tuberculosis (with or without bacterial supra-infection)
- Following trauma to the chest
- More rarely, secondary to systemic infections (Septicaemia)

*S aureus* is the predominant pathogen in developing countries, especially during the hot and humid months when staphylococcal skin infections are more prevalent. There has been a decline in culture positive *S pneumoniae*, probably because of prior antibiotic use. Various Gram negative organisms—for example, Enterobacteriaceae such as *Klebsiella* spp and *Pseudomonas aeruginosa*—are also more common than in developed countries; they are not limited to infants and may be associated with protein energy malnutrition.

#### V. DIAGNOSIS

##### 1. Infectious syndrome

- Prolonged fever
- Signs of general poor health or toxic condition in young infants (see staphylococcal pneumonia)
- Sometimes abdominal pain («pseudo-appendicitis» in children)

##### 2. Respiratory syndrome

- cough and dyspnoea

##### 3. Pleural effusion

- Chest pain
- dullness to percussion over effusion
- reduced breath sounds over effusion on auscultation
- Reduced vocal vibrations (auscultation and palpation)
- Chest asymmetry

Note: sometimes with associated pneumothorax (pyo-pneumothorax)

#### Investigations

##### 1. CBC and CRP

2. Chest x-ray: Posteroanterior or anteroposterior radiographs should be taken; there is no role for a routine lateral radiograph.

2. Ultrasound: Ultrasound must be used to confirm the presence of a pleural fluid collection. Ultrasound should be used to guide thoracocentesis or drain placement.

3. Blood cultures should be performed in all patients with parapneumonic effusion or empyema

4. If you suspect a pleural effusion perform an exploratory pleural aspiration - ensure aseptic technique.

Pleural fluid (macroscopic)	Basic pleural fluid analysis		
Pus	It is an empyema: - GB > 10 000/ml, - LDH > 1 000 UI/l, - PH < 7,2, - Glucose < 2,2 micromol/l Do gram stain (bacteria seen in <20% cases)		
Yellow fluid Sero-fibrinous	Protein >30g/l Or Rivalta + WBC > 1000/ml	Exudate Inflammatory fluid	Early stage of empyema Tuberculosis Simple reactive pleurisy (not infected)
	Protein < 30g/l Or Rivalta - WBC < 1000/ml	Transudate non inflammatory fluid	? Cardiac ? Renal ? Hypoproteinemia (liver diseases) (severe malnutrition)

## VII. COMPLICATION

Complications are uncommon in children but may include bronchopleural fistula, lung abscess, pyopneumothorax, osteomyelitis of the ribs, pericarditis, septicemia or even perforation through the chest wall (empyema necessitatis).

## VIII. TREATMENT

### 1. Indication for chest tube:

#### According to pleural fluid

##### *a/.Liquid aspirated is cloudy or purulent (empyema)*

- Insert a thoracic drain (ensure aseptic technique in operating theatre and after x-ray confirmation)

Where possible, any coagulopathy or platelet defect should be corrected before chest drain insertion.

##### *b/.Liquid aspirated from effusion is yellow-coloured (Protein > 30g/litre or Rivalta +, WBC >1000/ml)*

- Aspirate fluid if there is marked dyspnoea (ensure aseptic technique)
- Repeat aspiration if patient's condition worsens: if fluid aspirated becomes purulent, insert a thoracic drain. (ensure aseptic technique in operating theatre and after x-ray confirmation)
- Consider tuberculosis as a possible diagnosis.

##### *c/.Liquid aspirated from effusion is yellow-coloured (Protein < 30g/litre or Rivalta -, WBC <1000/ml)*

- Aspirate fluid if there is marked dyspnoea (ensure aseptic technique)
- Reassess patient. Clinical signs of cardiac, renal or liver diseases.
  - ⇒ Cardiomegaly on X-ray
  - ⇒ Peripheral oedema
  - ⇒ Proteinuria
  - ⇒ Ascites
  - ⇒ Severe malnutrition

- **Repeat** pleural tap if condition worsens. Check again fluid characteristics
- **According to X-RAY or clinical examination**

Presence of an associated pneumothorax, clinically evident or confirmed by x-ray (before pleural tap) is often an indication for chest drain.

## 2. Choose Antibiotic therapy

Bacteriological Analysis of pleural fluid is usually negative (no bacteria seen on gram stain, culture negative). All cases should be treated with intravenous antibiotics and must include cover for Staphylococcus Aureus and Streptococcus pneumonia. Broader spectrum cover is required for hospital acquired infections, as well as those secondary to surgery, trauma, and aspiration. Where possible, antibiotic choice should be guided by microbiology results.

**Remove the drain when there is less than 50 ml of clear fluid draining per day.**

### 1st choice

**Cloxacillin or oxacillin** IV: 200 mg/kg/day in 4 divided injections

+

**Gentamicin** IM or slow IV: 5 mg / kg/day divided in 2 injections

### 2nd choice

**Ceftriaxone** IV 100 mg/kg/day in 1 or 2 injections

+

**Gentamicin** IM or slow IV: 5 mg / kg/day divided in 2 injections

**Metronidazole** is added in case of anaerobic organism: 30 mg/kg/day divided in 2-3 perfusions

## 3. Duration of antibiotic therapy

Total duration is between 4 and 6 weeks

⇒ Parenteral route: 2-3 weeks

⇒ Oral route: 2-3 weeks

Switch to PO treatment as patient condition improves.

Note: Gentamicin use should not exceed 8-10 days because of the risk of toxicity.

## 4. Surgical management

- Video-assisted thoracic surgery (VATS)
  - Alternative to more invasive procedures (e.g., open thoracotomy/decortication)
  - Debridement through pleural visualization and lysis of adhesions/loculations
  - Useful when initial drainage is delayed, when loculations prevent adequate drainage, or patient is failing more conservative therapy
- Open thoracotomy with rib resection
  - Encapsulated empyema
- Decortication
  - Symptomatic chronic empyema
  - Relief of thick fibrous peel

## 5. Other management

- Antipyretics should be given.
- Analgesia is important to keep the child comfortable, particularly in the presence of a chest drain.

- Chest physiotherapy is not beneficial and should not be performed in children with empyema.
- Early mobilisation and exercise is recommended.
- Secondary thrombocytosis (platelet count  $.5006109/1$ ) is common but benign; antiplatelet therapy is not necessary.
- Secondary scoliosis noted on the chest radiograph is common but transient; no specific treatment is required but resolution must be confirmed.

## 6. Monitoring the patient - follow-up

Note that a chest x-ray will not return to normal immediately (it will take 3 to 6 months), and therefore chest x-ray should not be used to decide when to remove the drain or stop antibiotics.

### Criteria for improvement are mostly clinical:

- Patient is afebrile
- Respiratory Rate
- Recovery of appetite
- Weight curve
- Auscultation (better air entry on auscultation)

Everyday: Monitor chest tube output: how many ml per day and colour of fluid.

Everyday: Check and Ensure permeability of chest tube from patient to collect bag (no torsion)

Everyday: Change dressing and disinfect around the drain.

If you suspect that the drain is obstructed:

- NEVER push drain deeper into the thoracic cavity
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- Extended antibiotics may be needed in some patients with complicated parapneumonic effusions (CPE).
- Despite the variability in presentation, most patients recover without sequelae.
- Numerous studies have demonstrated resolution of the radiographic abnormalities by 3-6 months following therapy, with few to no symptoms reported at follow-up examination.
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# **PNEUMOTHORAX**

*By Prof. Eap Tek Chheng*

## **I. DEFINITION**

Pneumothorax refers to the presence of air or gas in the pleural cavity between the visceral and parietal pleura, which results in violation of the pleural space. This condition is uncommon during childhood but can be life threatening.

## **II. EPIDEMIOLOGY**

The annual incidence of primary spontaneous pneumothorax in the general population is estimated to be 5-10 per 100,000 populations. Although all age groups are affected, the peak incidence of pneumothorax occurs in persons aged 16-24 years.

The disorder is less common in children than in adults; the rate of pneumothorax is relatively higher in the newborn period, even in full-term newborns, but it declines during infancy.

Premature neonates on mechanical ventilation are at high risk, and limited data in young children suggest a strong male predominance of primary spontaneous pneumothorax.

The prevalence of pneumothorax depends on the underlying lung disease.

## **III. COMPLICATION**

- Pain
- Hypoxia
- Respiratory distress
- Tension pneumothorax
  - Hypoxia
  - Hypercarbia with acidosis
  - Respiratory failure
- Pneumomediastinum with subcutaneous emphysema
- Bronchopulmonary fistula

## **IV. PATHOPHYSIOLOGY**

- Air can enter the pleural space via:
  - Chest wall (e.g., penetrating trauma)
  - Intrapulmonary (e.g., ruptured alveoli)
- Usually collapse of the lung on the affected side seals the leak.

- If a ball valve mechanism ensues, however, air can accumulate in the thoracic cavity, causing a tension pneumothorax (a medical emergency).

## V. ETIOLOGY

- Spontaneous (secondary to rupture of apical blebs)
- Mechanical trauma
  - Penetrating injury (e.g., knife or bullet wound)
  - Blunt trauma
- Barotrauma
  - Mechanical ventilation
  - Cough (if severe enough)
- Iatrogenic
  - Central venous catheter placement
  - Bronchoscopy (especially with biopsy)
- Infection: most common organisms:
  - Staphylococcus aureus
  - Streptococcus pneumoniae
  - Mycobacterium tuberculosis
  - Bordetella pertussis
  - Pneumocystis carinii
- Airway occlusion
  - Mucus plugging (asthma)
  - Foreign body
  - Meconium aspiration
- Bleb formation (e.g., idiopathic, secondary to cystic fibrosis)
- Malignancy
- A study by Halliday et al examined the role of early postnatal corticosteroids in preventing chronic lung disease and found that some of these agents can result in pneumothorax as well as other potential or known adverse effects.

## VI. DIAGNOSIS

### 1. Clinical features:

- Patients with asthma, cystic fibrosis, pneumonia, or collagen vascular diseases have an increased risk for developing a pneumothorax
- Heavy lifting or increased coughing might have caused the pneumothorax
- Patient may be asymptomatic (pneumothorax discovered on chest film obtained for other reasons)
- Dry cough
- Shortness of breath
- Pleuritic chest pain that is usually sudden in onset and localized to apices (referred pain to shoulders)
- Respiratory distress
- physical examination:
  - May be normal
  - Decreased breath sounds on the affected side
  - Decreased vocal fremitus
  - Hyperresonance to percussion on the affected side
  - Tachypnea
  - Tachycardia
  - Shortness of breath
  - Respiratory distress

- Shifting of the cardiac point of maximal impulse away from the affected side
- Shifting of the trachea away from the affected side
- Subcutaneous emphysema
- cyanosis
- Scratch sign: listening through the stethoscope, a loud scratching sound is heard when a finger is gently stroked over the area of the pneumothorax

## 2. Investigations:

- Arterial blood gas
  - $PO_2$  can frequently be decreased
  - $PCO_2$ : elevated with respiratory compromise; decreased from hyperventilation
- Pulse oximetry
  - Useful for assessing oxygenation
- Electrocardiogram (ECG)
  - Diminished amplitude of the QRS voltage
  - Rightward shift of the QRS axis (if left-sided pneumothorax)
- **Pleural fluid:** If there is significant pleural effusion, diagnostic pleural tap will be helpful.
- **Serology:** For Mycoplasma and Chlamydia if it will change the management.
- **CRP:** Serum CRP concentrations may be higher in patients with bacterial compared with viral pneumonia.
- Chest radiograph
  - Radiolucency of the affected lung
  - Lack of lung markings in the periphery of the affected lung
  - Collapsed lung on the affected side
  - Possible pneumomediastinum with subcutaneous emphysema
- Chest CT
  - Useful for finding small pneumothoraces
  - Can help distinguish a pneumothorax from a bleb or cyst
  - Helpful for locating small apical blebs associated with spontaneous pneumothoraces

## VII. DIFFERENTIAL DIAGNOSIS

### 1. PULMONARY

- Congenital lung malformations
  - Cysts (e.g., bronchogenic cysts)
  - Cystic adenomatoid malformation
  - Congenital lobar emphysema
- Acquired emphysema
- Hyperinflation of the lung
- Postinfectious pneumatocele
- Bullae formation

### 2. MISCELLANEOUS

- Diaphragmatic hernia
- Infections (e.g., pulmonary abscess)
- Muscle strain
- Pleurisy
- Rib fracture

## VIII. PROGNOSIS

- Dependent on the underlying etiology of the pneumothorax
- If simple, spontaneous pneumothorax recovery is excellent

## IX. MANAGEMENT

- Stabilization of the patient
- Evacuation of the pleural air
  - Should be done urgently if tension pneumothorax is suspected
  - In small asymptomatic pneumothoraces, observation of the patient is indicated
- Treat the underlying condition predisposing for the pneumothorax:
  - Antibiotics for infection
  - Bronchodilators and anti-inflammatory agents for asthma attacks
- Oxygen
  - Used to keep  $\text{SaO}_2 \geq 95\%$

Breathing 100% O<sub>2</sub> (via a nonrebreathing face mask) can speed the intrapleural air's reabsorption into the bloodstream (useful for treating smaller pneumothoraces, especially in neonates) hastening lung reexpansion. However, the potential for oxygen toxicity should be considered, and this treatment should not be continued for long periods.

A small, simple pneumothorax in a patient who experienced trauma is best treated with a chest tube, because the condition may rapidly convert into a tension pneumothorax, especially if positive pressure ventilation is applied. Large or significantly symptomatic pneumothoraces require chest tube placement and surgical intervention. A tension pneumothorax requires immediate decompression with needle thoracostomy.

### A. SURGERY

- Needle thoracentesis
  - Useful for evacuation of the pleural air in simple, uncomplicated spontaneous pneumothorax
- Chest tube drainage
  - Used for evacuation of the pleural air in recurrent pneumothoraces, complicated pneumothoraces, and cases with significant underlying lung disease
  - Thoracotomy with video-assisted thoracoscopic surgery (VATS)
- Surgical removal of pulmonary blebs
  - Blebs have a high rate of rupturing with resultant pneumothorax.
  - In patients with established pneumothoraces, the blebs should be removed or oversewn to prevent reoccurrence of the pneumothorax (blebs have a high rate of reoccurrence if not repaired).
- Pleurodesis
- Used to attach the lung to the intrathoracic chest wall to prevent reoccurrence of a pneumothorax
- Useful in cases of recurrent pneumothorax or if the pneumothorax is unresponsive to chest tube drainage (e.g., cystic fibrosis, malignancy)
- Mechanism of action: the surface of the lung becomes inflamed and adheres to the chest wall via the formation of scar tissue.
- Two commonly used methods:
  - a. Surgical pleurodesis
    - Mechanical abrasion of part of the lung or pleurectomy
    - Advantages: very effective: low reoccurrence rate; site specific (limits affected area)
    - Disadvantages: requires surgery and general anesthesia; contraindicated if unstable
  - b. Chemical pleurodesis
    - Chemicals are used to cause inflammation
    - Chemicals commonly used: tetracycline, minocycline, doxycycline, quinacrine

- Advantages: requires no surgery or general anesthesia
- Disadvantages: less effective than surgery; generalized inflammation (rather than site-specific; makes future thoracic surgery more difficult; painful)

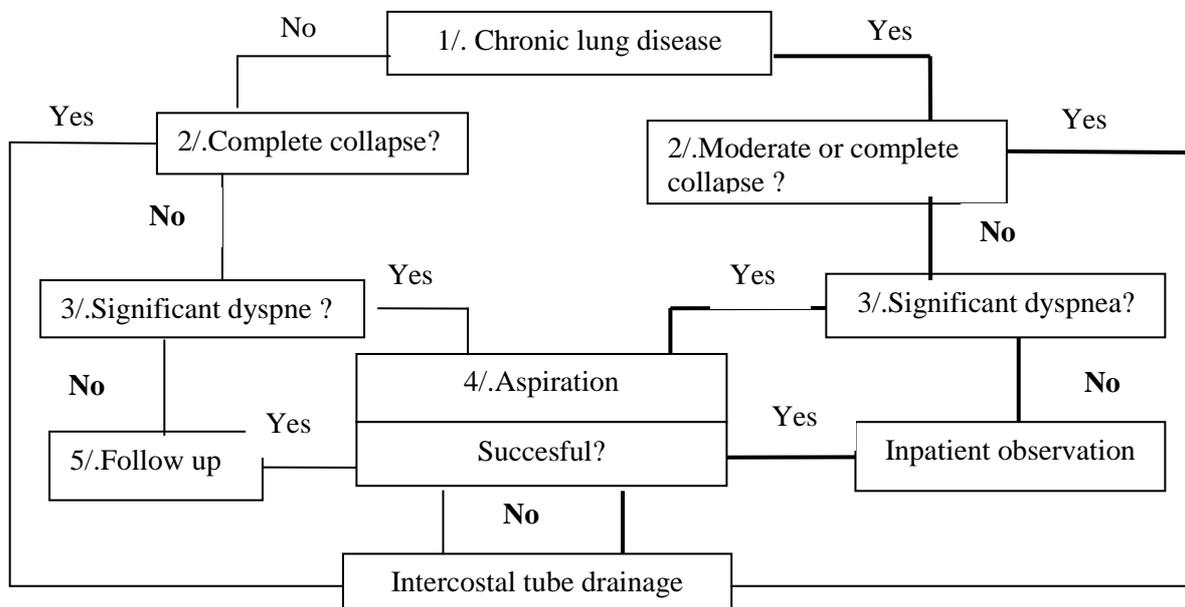
## B. DURATION

- Chest tube should be left in until:
  - Majority of the air is reabsorbed
  - No reaccumulation of air is seen on sealing of the chest tube
  - Usually 2 to 4 days

## C. LONG-TERM MONITORING

Instruct parents to return if the child has chest pain or shortness of breath; pain medication should be given on discharge. In addition, the chest tube wound site should be monitored for infection and to ensure proper healing.

### Initial management of pneumothorax



**1 Chronic lung disease:** In chronic lung disease- cystic, fibrotic, bullous, or emphysematous lung disease - respiratory compromise is commoner than with "simple" pneumothorax; drainage procedures are less successful and referral to a respiratory specialist is more likely.

**2 Degree of collapse:** Small=small rim of air around lung; Moderate=lung collapsed halfway towards heart border;

Complete=airless lung, separate from diaphragm -aspiration is necessary. Tension=any pneumothorax with cardiorespiratory collapse. It requires immediate cannulation. It is rare.

### 3 Significant dyspnoea

This means an obvious deterioration in usual exercise tolerance. Aspiration is necessary, whatever the size of pneumothorax.

### 4 Simple aspiration

Infiltrate local anaesthetic down to the pleura, in the second intercostal space in the mid-clavicular line (the axillary approach is an alternative). Using a cannula, enter the pleural cavity and withdraw the needle. Connect both the cannula and a 50 ml syringe (Luer lock) to a three way tap, so that aspirated air can be voided. Aspiration should be discontinued if resistance is felt. Repeat chest radiography in inspiration (an expiration film is unnecessary) in the x ray department. If pneumothorax is now only small, or resolved, the procedure has been successful.

**5 Follow up:** Arrange for a follow up in 7-10 days. The patient must be told to attend again immediately in the event of noticeable deterioration. Air travel should be avoided until changes seen on radiographs have resolved.

**6 Inpatient observation:** Observe overnight. If patient is stable both clinically and radiologically, discharge with respiratory physician appointment.

## X. PREVENTION

Strategies for the prevention of recurrent pneumothorax include observation, surgical and nonsurgical pleurodesis, and bleb resection. Prompt recognition and treatment of bronchopulmonary infections decreases the risk of progression to a pneumothorax. Pleurodesis decreases the risk of recurrence of spontaneous pneumothorax, as does thoracotomy or video-assisted thoracoscopy (VAT) to excise the bullae.

Observation is appropriate for iatrogenic pneumothorax in a patient with normal lungs who has responded to treatment with observation or simple aspiration. Simple aspiration or chest tube drainage of pneumothorax does not prevent recurrence. In fact, recurrences have been reported to occur in up to 32% of primary spontaneous pneumothorax (PSP).

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# CHILDHOOD ASTHMA

*By Prof. Eap Tek Chheng*

## I. INTRODUCTION

Asthma is one of the most common chronic diseases, with an estimated 300 million individuals affected worldwide. Its prevalence is increasing, especially among children.

## II. DEFINITION

Asthma is a chronic inflammatory disorder of the airways. Chronically inflamed airways are hyperresponsive; they become obstructed and airflow is limited (by bronchoconstriction, mucus plugs, and increased inflammation) when airways are exposed to various risk factors.

## III. PATHOPHYSIOLOGY AND ETIOLOGY

- Immune and inflammatory responses in the airways triggered by an array of environmental antigens, irritants, or infectious organisms
- Atopy and asthma are related
  - Eosinophilia and the ability to make excess IgE in response to antigen is associated with increased airway reactivity.
  - Asthma is more common in children who have allergic rhinitis and eczema.
- Viral infections, particularly respiratory syncytial virus (RSV), during infancy may play a role in the development of asthma or may modify the severity of asthma.
- Exposure to cigarette smoke and other airway irritants influences the development and severity of asthma.
- Airway stimulated and primary inflammatory mediators released.
- Airway is invaded by inflammatory cells (mast cells, basophils, eosinophils, macrophages, neutrophils, B and T lymphocytes).
- Inflammatory cells respond to and produce various mediators (cytokines, leukotrienes, lymphokines), augmenting the inflammatory response.
- Airway epithelium is inflamed and becomes disrupted, and basal membrane is thickened.
- Airway smooth muscle is hyperresponsive, and bronchoconstriction ensues.
- Airway smooth muscle hypertrophy and airway epithelial hyperplasia are characteristic chronic changes resulting from poorly controlled asthma.

## IV. GENETICS

- Children of asthmatics have higher incidence of asthma:
  - 6% to 7% risk if neither parent has asthma
  - 20% risk if one parent has asthma
  - 60% risk if both parents have asthma
- Several genes are known to be associated with the development of atopy and bronchial muscle responsiveness.

## V. DIAGNOSIS

### 1. Symptoms and medical history:

Presence of any of these signs and symptoms should increase the suspicion of asthma:

- Wheezing
- History of any the following:
  - Cough, worse particularly at night
  - Recurrent wheeze
  - Recurrent difficult breathing
  - Recurrent chest tightness
- Symptoms occur or worsen at night, awakening the patient.
- Symptoms occur or worsen in a seasonal pattern.
- The patient also has eczema, hay fever, or a family history of asthma or atopic diseases
- Symptoms occur or worsen in the presence of:
  - Animal with fur
  - Aerosol chemicals
  - Changes in temperature
  - Domestic dust mites
  - Drugs (aspirin, beta blockers)
  - Exercise
  - Pollen
  - Respiratory (viral) infections
  - Smoke
  - Strong emotional expression
- Symptoms respond to anti-asthma therapy.
- Patient's colds "go to the chest" or take more than 10 days to clear up.

### 2. Physical examination

#### A. signs of chronic illness

- Harrison sulci
- hyperinflated chest
- eczema / dry skin
- hypertrophied turbinates

#### B. Signs in acute exacerbation

- tachypnoea
- wheeze, rhonchi
- hyperinflated chest
- accessory muscles
- cyanosis
- drowsiness
- tachycardia

### 3. Diagnostic Challenges

- Cough-variant asthma. Some patients with asthma have chronic cough (frequently occurring at night) as their principal, if not only, symptom. For these patients,

documentation of lung function variability and airway hyperresponsiveness are particularly important

- Exercise-induced bronchoconstriction. Physical activity is an important cause of asthma symptoms for most asthma patients, and for some it is the only cause. Exercise testing with an 8-minute running protocol can establish a firm diagnosis of asthma.

- Children 5 Years and Younger. Not all young children who wheeze have asthma. In this age group, the diagnosis of asthma must be based largely on clinical judgment, and should be periodically reviewed as the child grows. Symptoms that may indicate a diagnosis of asthma include wheeze, cough, breathlessness (typically manifested by patterns of activity limitation), and nocturnal symptoms/awakenings. A history of recurrent respiratory symptoms; a strong family history of asthma in first degree relatives (especially the mother); and/or atopy presenting as atopic dermatitis, food allergy, and/or allergic rhinitis also make a diagnosis of asthma more likely.

- Laboratory Aids

- Pulmonary function tests: Spirometry measures the degree of airway obstruction and the response to bronchodilators. An increase in FEV1 of  $\geq 12\%$  after administration of a bronchodilator indicates reversible airflow limitation consistent with asthma.
- Provocational testing (exercise challenge, cold air challenge, methacholine challenge): useful in cases where history is equivocal and pulmonary function test is normal; measures the degree of airway hyperreactivity
- Allergy evaluation: Blood tests (eosinophil count, IgE level), Skin testing (best test for assessing allergen sensitivity), RAST testing (not as accurate as skin testing),

4. **Bronchoscopy** to rule out:

Anatomic malformations, Foreign bodies, Mucus plugging, Vocal cord dysfunction

5. **Imaging**

Chest radiograph should usually be obtained at least once for all children to rule out tuberculosis, congenital lung malformations or obvious vascular malformations. Findings can be normal. Common findings are peribronchial thickening, subsegmental atelectasis, and hyperinflation.

6. **Peak flow meter**

**Peak expiratory flow (PEF)** measurements can be an important aid in both diagnosis and monitoring of asthma.

## VI. DIFFERENTIAL DIAGNOSIS

### 1. Infectious

- Tuberculosis
- Pneumonia
- Bronchiolitis
- Chlamydia infection
- Laryngotracheobronchitis
- Chronic rhino-sinusitis

### 2. Mechanical

- Extrinsic airway compression
- Vascular ring
- Foreign body
- Vocal cord dysfunction
- Tracheobronchomalacia

### 3. Miscellaneous

- Cystic fibrosis
- Bronchopulmonary dysplasia
- Pulmonary edema

- Gastroesophageal reflux (GER)
- Recurrent aspiration
- Bronchiolitis obliterans

## VII. COMPLICATIONS

- Morbidity
  - Frequent hospitalizations and absence from school
  - Psychologic impact of having a chronic illness
  - Decline in lung function over time

## VIII. PROGNOSIS

- With proper therapy and good adherence with treatment regimen: excellent

## IX. MANAGEMENT

- **Assesment of Severity:** classification based on frequency, chronicity and severity of symptoms

*Table 1. Classification of severity of childhood asthma*

Category	Clinical presentation
Intermittent	daytime symptoms < once a week nocturnal symptoms < once a month no exercise induced symptoms brief exacerbations not affecting sleep and activity normal lung function
Persistent (Threshold for preventive treatment)	
<i>Mild persistent</i>	<b>daytime symptoms &gt; once a week</b> <b>nocturnal symptoms &gt; twice a month</b> exercise induced symptoms exacerbations once a month affecting sleep and activity PEFR / FEV <sub>1</sub> > 80%
<i>Moderate Persistent</i>	<b>daytime symptoms daily</b> <b>nocturnal symptoms &gt; once a week</b> exercise induced symptoms exacerbations > twice a month affecting sleep and activity PEFR / FEV <sub>1</sub> 60 – 80%
<i>Severe Persistent</i>	<b>daytime symptoms daily</b> <b>daily nocturnal symptoms</b> daily exercise induced symptoms frequent exacerbations > twice a month affecting sleep and activity PEFR / FEV <sub>1</sub> < 60%

PEFR = Peak Expiratory Flow Rate; FEV<sub>1</sub> = Forced Expiratory Volume in One Second

- **Management according to severity (GINA guidelines)**

In 2006, the Global Initiatives on Asthma (GINA) has proposed the management of asthma from severity based to control based. The change is due to the fact that asthma management based on severity is on expert opinion rather than evidence based, with limitation in deciding treatment and it does not predict treatment response. Asthma assessment based on levels of control is based on symptoms and the three levels of control are well controlled, partly control and uncontrolled.

**Table 2. Levels of Asthma Control (GINA 2006)**

Characteristics						
	daytime symptoms	limitation of activities	nocturnal symptoms or awakenings	need for reliever	lung function test	exacerbations
<b>Controlled</b> <b>All of the following</b>	none	none	none	none	normal	none
<b>Partly Controlled</b> <b>Any measure present in any week</b>	>2/week	any	any	2/week	<80% predicted or personal best	≥1 a year
<b>Uncontrolled</b>	≥3 features of partly controlled asthma present in any week					1/week

- **Drug Therapy**

- Asthma management based on levels of control is a step up and step down approach as shown in table 3.
- At each treatment step, **reliever medication** should be provided for quick relief of symptoms as needed. (However, be aware of how much reliever medication the patient is using – regular or increased use indicates that asthma is not well controlled.)
- At steps 2 through 5, patients also require one or more regular **controller medications**, which keep symptoms and attack from starting. Inhaled glucocorticosteroids are the most effective controller medications currently available.
- *For most patients newly diagnosed with asthma or not yet on medication, treatment should be started at step 2 (if the patient is very symptomatic, at Step 3).* If the asthma is not controlled on the current treatment regimen, treatment should be stepped up until control is achieved.
- See table 4, and 5 for drug delivery methods and dosages.

**Table 3. Management Approach Based on Control**

Reduce ← Treatment Steps → Increase			
Step 1	Step 2	Step 3	Step 4
<b>Asthma Education Environment Control</b>			
<b>As needed rapid-acting β2-agonist</b>			
	<b>Select One</b>	<b>Select One</b>	<b>Add One or More</b>
<b>Controller Options</b>	<b>Low-dose inhaled ICS*</b>	<b>Low-dose ICS plus long-acting β2-agonist (not recommended for &lt;5 years)</b>	<b>Medium or high dose ICS plus long-acting β2-agonist</b>
	<b>Leukotriene modifier</b>	<b>Medium or high dose ICS</b>	<b>Leukotrien modifier</b>
		<b>Low-dose ICS plus Leukotriene modifier</b>	
<b>NOTE:</b>			
1. Patients should commence treatment at the step most appropriate to the initial severity. A			

- short rescue course of prednisolone may help establish control promptly.
2. Explain to parents and patient about asthma and all therapy
  3. Ensure both compliance and inhaler technique optimal before progression to next step.
  4. **Step-up**; assess patient after 1 month of initiation of treatment and if control is not adequate, consider step-up after looking into factors as in 3.
  5. **Step-down**; *review treatment every 3 months and if control sustained for at least 4-6 months, consider gradual treatment reduction.*

**ICS\* : Inhaled Corticosteroids**

**Table 4. Delivery systems available & recommendation for the different ages**

Age (years)	MDI + Space + Mask	MDI + Spacer	Dry Powder Inhaler
<5	+	-	-
5 - 8	+	-	-
>8	+	+	+

*MDI : Metered Dose Inhaler*

**Table 5. Drug dosages for asthma**

Drug	Formulation	Dosage
<b>Relieving Drugs</b>		
Rapid acting $\beta_2$ -agonists		
salbutamol	oral metered dose inhaler dry powder inhaler	0.15 mg/kg/dose TDS- QID/PRN 100-200 mcg/dose QID/PRN 100-200 mcg/dose QID/PRN
terbutaline	oral metered dose inhaler dry powder inhaler	0.075 mg/kg/dose TDS- QID/PRN 250-500 mcg/dose QID/PRN 500-1000 mcg/dose QID/PRN (maximum 4000 mcg/daily)
fenoterol	metered dose inhaler	200 mcg/dose QID/PRN
Ipratropium bromide	metered dose inhaler	40-60mcg /dose TDS/QID/PRN
<b>Preventive Drugs</b>		
<b>Corticosteroids</b>		
beclomethasone dipropionate	metered dose inhaler dry powder inhaler	low dose: <400 mcg/day moderate dose: 400-800 mcg/day high dose: 800-1200 mcg/day
budesonide	metered dose inhaler dry powder inhaler	low dose: <400 mcg/day moderate dose: 400-800 mcg/day high dose: 800-1200 mcg/day
fluticasone propionate	metered dose inhaler dry powder inhaler	low dose: <200 mcg/day moderate dose: 200-400 mcg/day high dose: 400-600 mcg/day
ciclesonide	metered dose inhaler	low dose: 160 mcg/day high dose: 320 mcg day
<b>Combination: ICS + Long acting <math>\beta_2</math>-agonist</b>		

salmeterol /fluticasone	metered dose inhaler dry powder inhaler	25/50mcg, 25/125mcg, 25/250mcg 50/100mcg,50/250mcg, 50/500mcg
budesonide/Formoterol	dry powder	160/4.5mcg, 80/4.5mcg
<b><i>Antileukotrienes (Leukotriene modifier)</i></b>		
montelukast	oral	4 mg granules 5mg/tablet nocte <i>chewable</i> 10mg/tablet nocte

*Note: Dry powder inhaler devices available include rotahaler, diskhaler, turbohaler, accuhaler and easyhaler*

(p.r.n. = pro re nata= as needed, TDS: Ter die sumendum – 3 times a day, QID: Quater in die - 4 times a day)

- **Prevention**

Identifying and avoiding the following common triggers may be useful

- environmental allergens: These include house dust mites, animal dander, insects like cockroach, mould and pollen. Useful measures include damp dusting, frequent laundering of bedding with hot water, encasing pillow and mattresses with plastic/vinyl covers, removal of carpets from bed rooms, frequent vacuuming and removal of pets from the household.
- cigarette smoke
- c.respiratory tract infections - commonest trigger in children.
- food allergy - uncommon trigger, occurring in 1-2% of children
- exercise

Although it is a recognized trigger, activity should not be limited. Taking a  $\beta_2$ -agonist prior to strenuous exercise, as well as optimizing treatment, are usually helpful.

- **Monitoring**

Assessment during follow-up

- **Assess severity**

- **response to therapy**

- interval symptoms
- frequency and severity of acute exacerbation
- morbidity secondary to asthma
- quality of life
- PEF monitoring on each visit

- **compliance**

- frequency and technique, reason and excuses

- **education**

- technique factual information, written action plan, PEF monitoring may not be practical for all asthmatics but is essential especially for those have poor perception of symptoms and those with life threatening attacks.

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# GASTROINTESTINAL DISORDER

1. Dysentery .....	144
2. Gastroesophageal Reflux Diseases (GERD) .....	148
3. Peptic Ulcer Disease in Children .....	156
4. Gastro-intestinal Bleeding .....	162
5. Gastritis .....	170
6. Stomatitis .....	175
7. Pancreatitis .....	178
8. Acute Cholecystitis .....	183
9. Liver Abscess .....	187

# DYSENTERY

By Dr. Mey Moniborin

## I. INTRODUCTION

Dysentery is a major cause of childhood morbidity and mortality in developing countries. Most dysentery cases in the tropics are caused by *Shigella*, whereas dysentery in the developed countries is usually caused by *Salmonella*. Anti-microbial therapy is particularly important in developing countries, where prolonged diarrhea episodes, including dysentery, can significantly decrease the growth and nutritional status in the affected children. Amoebiasis is an *unusual* cause of bloody diarrhoea in young children, usually causing less than 3% of episodes. *Young children with bloody diarrhoea should not be treated routinely for amoebiasis*. Such treatment should be considered only when microscopic examination of fresh faeces done in a reliable laboratory reveals trophozoites of *E. histolytica* containing red blood cells, or two different antimicrobials usually effective for *Shigella* in the area have been given without clinical improvement.

## II. EPIDEMIOLOGY

Shigellosis is endemic throughout the world where it is held responsible for some 120 million cases of severe dysentery with blood and mucus in the stools, the overwhelming majority of which occur in developing countries and involve children less than five years of age. About 1.1 million people were estimated to die from *Shigella* infection each year, with 60% of the deaths occurring in children under 5 years of age.

The regional prevalence of amebic infections worldwide varies from 5-81%, with the highest frequency in the tropics. Humans are the major reservoir. It is estimated that 10%, approximately 480 million people, of the population worldwide is infected with *E. dispar* or *E. histolytica*.

## III. AETIOLOGY

There are two main types of dysentery. The first type, bacillary dysentery, is caused by invasive bacteria (*Shigella*, *Campylobacter*, *E. coli*, and *Salmonella species of bacteria*). The second type, amoebic dysentery or intestinal amoebiasis, is caused by a single-celled, microscopic parasite living in the large bowel. *Entamoeba histolytica*, the pathogenic species, can become invasive, causing symptomatic disease. *Entamoeba dispar*, the more prevalent species, is associated only with an asymptomatic carrier state. Both kinds of dysentery occur mostly in hot countries. Poor hygiene and sanitation increase the risk of dysentery by spreading the parasite or bacteria that cause it through food or water contaminated from infected human feces.

#### IV. COMPLICATION

##### *Bacillary dysentery*

- Dehydration is the most common complication.
- Sepsis and disseminated intravascular coagulation. The mortality rate is high (~20%) when sepsis occurs.
- Hemolytic-uremic syndrome
- Rectal prolapsed
- Toxic megacolon or pseudomembranous colitis

##### *Amoebic dysentery*

People with amoebic dysentery may experience other problems associated with amoebiasis:

- Amebic liver abscess is the most frequent complication.
- If the infection of the bowel is especially virulent, the intestinal ulcerations may lead to bowel perforation and death
- Extraintestinal manifestations of amebiasis are presumed to be a result of direct extension from liver abscesses. These include:
  - Amebic peritonitis
  - Pericarditis
  - Pleuropulmonary abscess or empyema
  - Bronchohepatic fistula
  - Genitourinary tract abscess

#### V. DIAGNOSIS

##### A. Clinical signs:

The main symptom of dysentery is frequent near-liquid diarrhea flecked with blood, mucus, or pus. Other symptoms include:

- abdominal pain
- fever
- convulsions
- lethargy
- dehydration
- rectal prolapse.

##### *Bacillary dysentery*

- Bacillary dysentery is clinically similar regardless of whether the disease is caused by any of the four species of *Shigella* or an enteroinvasive *E. coli*; however, there are some clinical differences, particularly relating to the greater severity and risk of complications with *S. dysenteriae* serotype 1 infection.
- Ingestion of shigellae is followed by an incubation period of 12 hr to several days before symptoms ensue
- Severe abdominal pain, high fever, emesis, anorexia, generalized toxicity, urgency, and painful defecation characteristically occur.
- Physical examination at this point may show abdominal distention and tenderness, hyperactive bowel sounds, and a tender rectum on digital examination.
- The diarrhea may be watery and of large volume initially, evolving into frequent small-volume, bloody mucoid stools; however, some children never progress to the stage of bloody diarrhea, whereas in others the first stools are bloody. Significant dehydration related to the fluid and electrolyte losses in both feces and emesis can occur.

##### *Amoebic dysentery*

- Intestinal amebiasis may occur within 2 wk of infection or be delayed for months.
- Stools are blood stained and contain a fair amount of mucus with few leukocytes.
- Abdominal pain and tenesmus

- No fever or moderate fever
- Possibly signs of dehydration

**Criteria for admission:**

Children with severe malnutrition and dysentery, and young infants (<2 months old) with dysentery should be admitted to hospital. In addition children who are toxic, lethargic, have abdominal distension and tenderness or convulsions are at high risk of sepsis and should be hospitalized. Others can be treated at home.

**B. Laboratory**

***Bacillary dysentery***

- Stool examination: fecal leukocytes, fecal blood,
- CBC: leukocytosis with a dramatic left shift.
- Culture of both stool and rectal swab specimens optimizes the chance of diagnosing *Shigella* infection
- In children who appear to be toxic, blood cultures should be obtained; this is particularly important in very young or malnourished infants because of their increased risk of bacteremia.

***Amoebic dysentery***

- **MICROSCOPIC DIAGNOSIS:** Identification of mobile trophozoites (*E.histolytica*) in the fresh stool samples
- Examination of three fresh stool samples by experienced laboratory personnel has a sensitivity of 90% for detecting *Entamoeba*.

**VI. TREATMENT:**

**Treatment of bacterial dysentery:**

- Ciprofloxacin – oral: Children 20 mg/kg/day in 2 divided doses for 5 days
- OR**
- Ceftriaxone (50 - 100 mg/kg/24 hr as a single daily dose IV or IM) for 5 days.

**Treatment of amoebic dysentery:**

- Metronidazole – oral: Children 30 to 50 mg/kg/day in 2-3 divided doses for 5 days (10 days for severe disease)
- OR**
- Tinidazole – oral: Children 50 mg/kg once daily for 3 days (without exceeding 2 g per day)

**Treatment of dehydration:** Oral rehydration salt (ORS) if there is risk of, or if there are signs of dehydration

**VII. PREVENTION**

- To encourage prolonged breast-feeding of infants. Breast-feeding decreases the risk of symptomatic shigellosis and lessens its severity in those infants who acquire infection despite breast-feeding.
- To educate families and child-care center personnel in hand washing techniques, especially after defecation and before food preparation and consumption.
- Treatment of drinking water
- Appropriate disposal of human fecal waste

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# GASTROESOPHAGEAL REFLUX DISEASES (GERD)

*By Dr. Te Vantha*

## I. DEFINITIONS

- GER is the passage of gastric contents into the esophagus with or without regurgitation and vomiting. GER is a normal physiologic process occurring several times per day in healthy infants, children, and adults. Most episodes of GER in healthy individuals last <3 minutes, occur in the postprandial period, and cause few or no symptoms. In contrast,
- GERD is present when the reflux of gastric contents causes troublesome symptoms and/or complications. Every effort was made to use these 2 terms strictly as defined
- Regurgitation in pediatrics is defined as the passage of refluxed gastric contents into the pharynx or mouth and sometimes expelled out of the mouth. Regurgitation is generally assigned as effortless and nonprojectile,
- Vomiting is defined as expulsion of the refluxed gastric contents from the mouth requiring the forceful contraction of diaphragm and abdominal muscles.

## II. EPYDEMOLOGY

- Approximately 85% of infants reflux and vomit during the first week of life and another 10% have symptoms by six weeks of age. Reflux is most common between one and four months old, but sometimes it persists in teenagers.

- Uncomplicated gastro-oesophageal reflux is common in infancy, with regurgitation of at least one episode a day found in half of all infants aged 0-3 months, in a cross-sectional study. Peak "problematic" regurgitation occurs at about six months and is reported in approximately a quarter of infants this age. This is due to the functional immaturity of the lower oesophageal sphincter.
- By 12-18 months, most symptomatic reflux will spontaneously resolve as the sphincter matures, the infant adopts an upright posture and begins having a more solid diet. Most children with GERD will present in the first year but there are some who present later with symptoms of heartburn, acid regurgitation or dysphagia.
- Other sources report the prevalence of pathological GERD in infants as being between 2-10%.

### **III. PATHOPHYSIOLOGY**

#### **1. GASTROINTESTINAL TRACT**

In the gastrointestinal (GI) tract, the lower esophageal sphincter is located at the distal end of the esophagus and is under tonic smooth muscle control. Transient lower esophageal sphincter relaxations unassociated with swallowing may be the major mechanism allowing the gastric refluxate to return into the esophagus. Delayed gastric emptying is another mechanism in infants and older children that predisposes them to gastric distension, increased acid secretion, and esophagitis. Gravitational and positional factors may exacerbate GER and increase the risk of GERD by allowing reflux to occur in a supine position.

#### **2. RESPIRATORY TRACT**

In the respiratory tract, complex reflex responses to the gastric refluxate occur in children by three mechanisms. First, the aspirated material may cause luminal mechanical obstruction. Second, neurally mediated impulses from the refluxate result in local airway or distal esophageal afferent signals stimulating mucous secretion, edema, and bronchial smooth muscle contraction. Third, aspiration stimulates the chemical release of inflammatory mediators that cause further respiratory luminal obstruction. These responses can result in signs of upper airway (apnea, stridor, laryngomalacia) and lower airway (chronic cough, wheezing) obstruction. In infants, activation of laryngeal chemoreflexes associated with regurgitation of gastric contents into the pharynx may be associated with episodic prolonged apnea.

### **IV. COMPLICATIONS OF GERD**

Complications of GERD are numerous and manifest as both esophageal and extraesophageal disorders.

#### **- Respiratory Complications**

Pulmonary complications of GERD include asthma, bronchitis, apnea, ALTE (Acute life Threatening Events), chronic cough, and recurrent aspiration pneumonia. Ear, nose, and throat complications include hoarseness, laryngitis, sinusitis, dental erosions, and recurrent otitis media. There is an increased association of such disorders in children who have GERD compared with other children.

#### **- Nonrespiratory Complications**

Chronic esophageal exposure to acid can result in inflammation and subsequent development of reflux esophagitis, esophageal strictures, Barrett esophagus, and adenocarcinoma. In severe chronic cases, UGI bleeding and anemia may develop. Children who are neurologically impaired are at greater risk for developing such complications. Barrett esophagus and esophageal adenocarcinoma rarely develop in the pediatric age group. In addition to neurologic impairment, other risk factors for long-term complications of GERD include lifestyle factors such as obesity, size and gestational age at birth, and repaired esophageal atresia. Adult studies correlate body mass index not only with severity of symptoms such as heartburn, erosive esophagitis, and hiatal hernia, but with severe complications such as Barrett esophagus and cancer.

## V. DIAGNOSIS OF GERD

Many of the symptoms and signs that may be associated in infants and children are non-specific. The diagnosis of GERD is often made clinically based upon troublesome symptoms (Table 1). Subjective symptoms are unreliable in children less than 8 to 12 years of age. GERD is diagnosed when tests show excessive frequency or duration of reflux events, esophagitis, or a clear association of symptoms and signs with reflux events in the absence of an alternative diagnosis.

### 1- History and Physical Examination

A history and examination are the first and most important steps in evaluating a child who has reflux. It is important to address questions directly to a child who is able to communicate.

In infants and toddlers, there is no symptom or symptom complex that is diagnostic of GERD or predicts response to therapy.

In older children and adolescents, as in adult patients, history and physical examination may be sufficient to diagnose GERD if the symptoms are typical.

The following are some of the common signs and symptoms of gastroesophageal reflux in infants and young children:

#### Table 1: Common Presenting Symptoms of GER/GERD

##### Infants and Young Children

- Recurrent vomiting
- Poor weight gain
- Irritability
- Dysphagia or feeding refusal
- Asthma
- Recurrent pneumonia
- Upper airway symptoms
- Apnea or apparent life-threatening event (ALTE)

##### Older Children and Adolescents

- Regurgitation
- Heartburn and retrosternal chest pain
- Dysphagia
- Asthma or chronic cough
- Recurrent pneumonia
- Anemia and hematemesis

### 2- Diagnostic Studies

For most infants and children who have GER, a history and physical examination are sufficient to diagnose nonpathologic GER reliably. Diagnostic testing should be saved for the child who has complications or when the diagnosis of GERD is in question. Investigations used to confirm the diagnosis of GERD include:

- **Upper Gastrointestinal Series**

The upper GI series is useful in the evaluation of vomiting to screen for possible anatomic abnormalities of the upper GI tract, including malrotation, hiatal hernia, esophageal stricture, atypical pyloric stenosis, duodenal web, or antral web.

- **Esophageal pH monitoring (not available):** Identification of acid reflux episodes over several hours can shed important information on the timing of the reflux and the adequacy of acid clearance.  
A thin wire is inserted through the nostril and the information is captured digitally in a portable recorder. Newer techniques include a sensor which is attached to the esophageal mucosa during the performance of an endoscopy and transmits the data wirelessly (The BRAVO system), and measurement of impedance in the esophagus. This allows identification of acid and nonacid reflux episodes but is not routinely available
- **Upper endoscopy with biopsies:** Helpful for assessing the severity of the inflammation and to exclude other conditions in the esophagus, stomach and duodenum.
- **Scintigraphy (not available):** It is most commonly used to evaluate gastric emptying. It will also show non-acid reflux, and it is also specific (but not sensitive) for the detection of aspiration of gastric contents.
- **Esophageal Manometry (not available):** May be useful to diagnose a motility disorder, i.e., achalasia or other esophageal motor abnormality that may mimic GERD

## VI. TREATMENT

Treatment is directed at suppressing acid exposure to the esophagus in order to allow healing and possibly to alter the natural history of GERD by preventing long-term complications of GERD such as strictures, Barrett's esophagus and esophageal cancer.

### 1- CONSERVATIVE TREATMENT

Conservative treatment for mild symptoms of GER involves:

- For Infants:

- Thickening feeding. Several thickening agents are available: Alginate ( Gasviscon ) and pectin, Prethickened milk feeds, Simple common household food (cereals ,bread ,fruit purée , corn starch and others starches )
- Upright and prone positioning
- Parents must be assured and should be informed that most infant with regurgitation and GER respond well to conservative treatment , the prevalence of functional GER in infancy, especially among one to four month-olds , observation of feeding behavior and the interaction between the parent and child, and revised instructions on feeding techniques
- Avoidance of environmental tobacco smoke

- For Children:

- Smaller, more frequent feedings
- Avoidance of foods and dietary items known to exacerbate reflux. Some of these incriminating foods include tomatoes, citrus products, fried/fatty/spicy foods, carbonated beverages, chocolates and even dairy products.
- Weight loss in overweight patient

### 2- MEDICATIONS

The goal of therapy is effective control of stomach acid: PPI and H2RAs (some studies show PPI is most effective)

**1-Prokinetics agents:**

Are used to promote gastric emptying, reduce episodes of GER, and improve symptoms. They may also act by increasing low oesophageal sphincter (LOS) tone:

- Domperidone: -Oral suspension 1 mg/ml  
-Dosage : 0.2 mg to 0.4 mg /kg tds or qds 15-30 minutes before meal . It can be used for maximum 12 weeks OR
- Metoclopramide: Dosage and Duration see table 2 and algorithm below  
(be cautious of side effects )

**2-Antacids:** Antacid may be used for symptomatic relief and don't use antacids for longer than two weeks

- Different types of antacids
  - Aluminum antacids : Aluminum hydroxide
  - Magnesium antacids : Magnesium hydroxide
  - Antacids containing aluminum and magnesium( Maalox, Mylanta)
- Dosage: see table 2 below

**3-Histamine-2 receptor antagonists (H2RAs):** Dosage and Duration: see table 2 and algorithm below

**4-Proton pump inhibitors (PPIs):** Dosage and Duration: see table 2 and algorithm below

**Table 2: Pediatric Doses of Drugs used in the Treatment of GERD**

Medication	Recommended dose	Adverse effects
<b>Prokinetic Agents</b>		
Metoclopramide (syrup)	0.1 mg/kg body weight per dose 4 times daily, before meals and bedtime*	Restlessness, Dystonia
<b>Acid neutralization/suppression agents</b>		
- Antacids	1 mL/kg body weight per dose , 3- 8 times daily*	Constipation, diarrhea
<b>- Histamine<sub>2</sub> receptor antagonists</b>		
Cimetidine	20-40mg/kg daily given as 4 divided dose	Headache, confusion, Pancytopenia, Gynecomastia
Ranitidine	5-10 mg/kg daily, usually given as 2 Divided doses	Headache, malaise
Famotidine	1.0 mg/kg daily in 2 divided doses, up to 40 mg twice daily	Headache, malaise

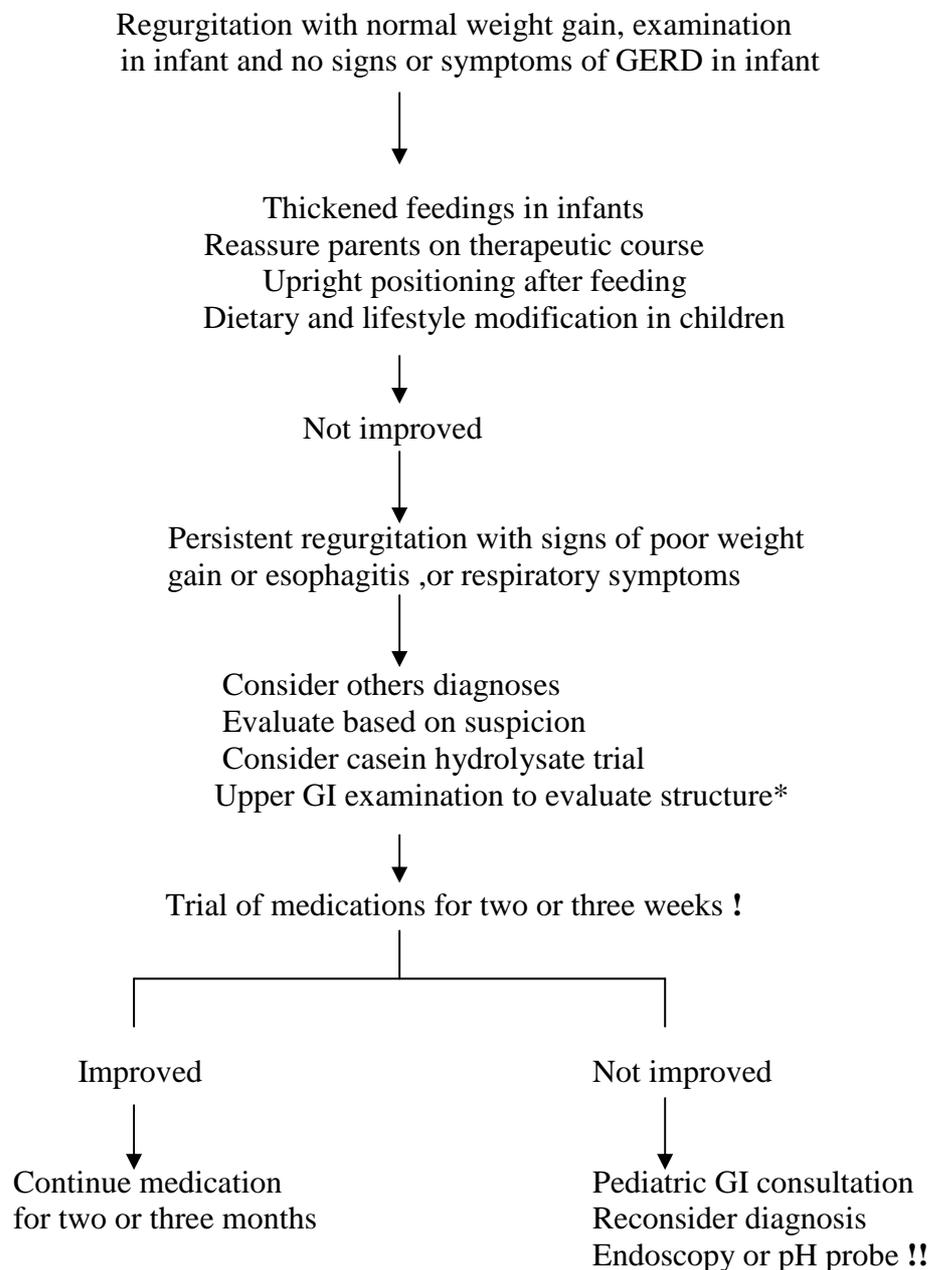
**- Proton pump inhibitors**

Omeprazole	0.7 – 3.3 mg/kg daily*	Headache, rash, diarrhea, hypergastrinemia, abdominal pain
Lansoprazole	For patients $\leq 30$ kg: 15mg daily For patient $> 30$ mg: 30 mg daily	Headache, rash, diarrhea Hypergastrinemia, abdominal pain

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**3- SURGERY**

Surgical treatment of severe GERD is an option in selected cases. Laparoscopic fundoplication is the preferred current technique. However, nearly two-thirds of children managed with fundoplication have recurrence of symptoms requiring reinstatement of medical treatment.

**Algorithms For Management of GER and GERD in Infant and Children**

**!\_Use of prokinetic agent and/or H<sub>2</sub>-receptor antagonist/proton pump inhibitor**  
**!!\_Requires pediatric GI consultation with choice of study case-dependent**

## VII. PARENTS EDUCATION

For infants with GERD ,the baby should be burped often during feeding. Also keep them upright for 30 minutes after every feeding. This can prevent acid from backing up into the esophagus.

Older children should eat smaller, more frequent meals to lessen the symptoms of GERD, Children with GERD should also avoid these foods:

- Chocolates
- Caffeinated drinks
- Carbonated drinks
- Fatty or spicy food
- Mint
- Citrus fruits
- Tomatoes and their by-products

Children with GERD should also be kept away from cigarette smoke. This includes second-hand smoke that is exhaled by a smoker and third-hand smoke, which is the toxic residue left behind by cigarette smoke, Third-hand smoke clings to wall , carpets clothes , cars, and others surfaces.

Sleeping with one or two pillows may also help since symptoms can get worse if the child is lying flat on his or her back. As an alternative, prop up the head of the bed where the child sleeps with wooden blocks.

Avoiding lying down after a meal will give the stomach enough time to empty and can decrease some symptoms of GERD, Avoiding tight clothing can also lessen GERD symptoms. make sure the child is no wearing clothing that is constrictive.

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# PEPTIC ULCER DISEASE IN CHILDREN

By Dr. Te Vantha

## I. INTRODUCTION

Peptic ulcer disease (PUD) results from a disruption in the mucosal lining of the stomach or duodenum, allowing penetration through the muscularis mucosa. Over the years, the causative role of *Helicobacter pylori* in the etiology of primary PUD has been proven. Despite increasing attention to PUD as a cause of abdominal pain in children, many cases of PUD in children are not recognized until they are complicated by haemorrhage, perforation, or gastric outlet obstruction. This is invariably associated with an increase in morbidity and mortality.

## II. EPIDEMIOLOGY

PUD is an uncommon disease of childhood, with an estimated frequency of 1 case in 2,500 hospital admissions in the United States. Data for developing countries, especially from Africa, are scarce, but peptic ulceration is being increasingly recognized in children in the developing world. A prevalence rate of 2% has been found among children presenting with abdominal pain. The majority of cases are duodenal ulcers. The male-to-female ratio for all childhood PUD is 1.5:1. However, no sex difference in the incidence of primary PUD has been noted in infants or young children.

Age of onset in population based studies:

- gastric ulcers - before age 6
- duodenal ulcers - after age 10 with mean age of diagnosis at 11.3 years (46% symptomatic before 10 years and 15% symptomatic before age 6 years)

## III. AETIOLOGY

Peptic ulcer diseases in children and adolescents can be classified into two aetiologies, primary and secondary.

Primary PUD is commonly associated with *H. pylori* infection. Primary ulcers are more likely to be chronic and more often duodenal, more common in blood group O and may be familial in 30–40% of PUD cases. It may be associated with elevated serum gastrin level, but this finding is inconsistent in children.

Secondary PUD which are usually more acute in onset and often gastric occurs as a result of accompanying stressful medical or surgical conditions. It may follow severe burns (Curling's ulcer), severe head injury (Cushing's ulcer), and ingestion of nonsteroidal anti-inflammatory drugs (NSAIDs). Mucosal ischaemia, in association with increased gastric acid and pepsin production, and with decreased prostaglandins and mucus production, has been implicated in the development of secondary PUD.

In general, PUD results from an interaction between protective forces that prevent a breach in the integrity of the gastric and duodenal mucosa and those that contribute to mucosal inflammation and ulceration.

### ***Helicobacter pylori* and Peptic Ulcer Disease**

*H. pylori*, a gram-negative microaerophilic spirochete, has been implicated in the development of gastritis and peptic ulcer disease in both adults and children in the presence of acid and pepsin. *H. pylori* infection is mainly acquired during childhood. In India, almost 80% of the population has been infected by the age of 10 years, compared to less than 10% of the population in developed countries. *H. pylori* infection is thought to be transmitted mainly through the faecal-oral route in developing countries. Most infected individuals are asymptomatic; approximately 15% develop peptic ulcer disease and 1% develop gastric cancer. The organism has a unique ability to survive in the harsh acidic environment of the stomach by producing the enzyme urease, which allows it to alkalize its microenvironment and survive for long periods of time. The organism also produces myriad other virulence factors such as catalase, vacuolating cytotoxin, and lipopolysaccharide. The organism has been classified as a class A carcinogen by the World Health Organization (WHO) because it has been causally associated with gastric carcinoma and lymphoproliferative disorders.

## **IV. DIAGNOSIS**

A detailed medical history, symptoms and physical examination are the mainstays of diagnosis, supplemented by diagnostic investigations where available.

### **1-Clinical Manifestations**

The presenting symptoms of peptic ulcer disease vary with the age of the patient. Hematemesis or melena is reported in up to half of the patients with peptic ulcer disease.

School-aged children and adolescents more commonly present with epigastric pain and nausea, presentations generally seen in adults. Dyspepsia, epigastric abdominal pain or fullness, is seen in older children.

Infants and younger children usually present with feeding difficulty, vomiting, crying episodes, hematemesis, or melena. In the neonatal period, gastric perforation can be the initial presentation. The classic symptom of peptic ulceration, epigastric pain alleviated by the ingestion of food, is present only in a minority of children. Many pediatric patients present with poorly localized abdominal pain, which may be periumbilical. The vast majority of patients with periumbilical or epigastric pain or discomfort do not have a peptic ulcer, but rather a functional GI disorder, such as irritable bowel syndrome or nonulcer (functional) dyspepsia.

Patients with peptic ulceration rarely present with acute abdominal pain from perforation or symptoms and signs of pancreatitis from a posterior penetrating ulcer. Occasionally, bright red blood per rectum may be seen if the rate of bleeding is brisk and the intestinal transit time is short. Vomiting can be a sign of gastric outlet obstruction.

The pain is often described as dull or aching, rather than sharp or burning, as in adults. It can last from minutes to hours; patients have frequent exacerbations and remissions lasting from weeks to months. Nocturnal pain waking the child is common in older children. A history of typical ulcer pain with prompt relief after taking antacids is found in <33% of children. Rarely, in patients with acute or chronic blood loss, penetration of the ulcer into the abdominal cavity or adjacent organs produces shock, anemia, peritonitis, or pancreatitis. If inflammation and edema are extensive, acute or chronic gastric outlet obstruction can occur.

### **2- Physical Examination**

A general physical examination in uncomplicated cases is usually not informative. Pallor may suggest blood loss. A combination of chronic epigastric or periumbilical pain and anaemia should raise a suspicion of PUD in a child. Careful inspection, auscultation, and palpation of

the abdomen, including rectal examination, are important, although findings may be normal. Haemorrhage accompanies PUD in 15–20% of patients and may be severe enough to require blood replacement. Shock may result from haemorrhage. Peritonitis resulting from perforation of the GIT occurs in about 5% of children with PUD.

### 3- Investigations

**I. The haemoglobin level is used to diagnose anaemia and determine its severity**

**II. Esophagogastroduodenoscopy (EGD or upper endoscopy)**

Esophagogastroduodenoscopy is the method of choice to establish the diagnosis of peptic Ulcer disease. It can be safely performed in all age.

- Diagnostic for peptic ulcer disease in 88% of children
- Endoscopic biopsy with culture or histology (Giemsa, Warthin-Starry stain, hematoxylineosin) is the gold standard for *H. pylori* infection

**III. Upper GI series**

Diagnostic

- in only 47% of cases
- high false-negative rate
  - will miss 33% of ulcers
- high false-positive rate
  - 67% of those with radiologically-diagnosed ulcer have normal endoscopy

Role

- to rule out other causes of abdominal pain, i.e., antral webs, hiatus hernia, malrotation, duodenal bands

**IV. Diagnostic Tests for *H. pylori* Infection**

- Serology for IgG antibodies to *H. pylori*: Several enzyme-linked immunosorbent assay-based commercial kits that measure anti-*H. pylori* serum immunoglobulin G (IgG) antibody titers are available for adults. The sensitivity and specificity of these tests in children are variable and seem to depend on the test used. Children younger than age 10 years seem to have more false-negative serology's. Therefore, a negative serology does not rule out infection in young children. Serology also is not useful for demonstrating successful eradication of *H. pylori* infection.
- The urea breath test offers some important advantages over the serologic tests. It is noninvasive, easy to perform, and easy to repeat to evaluate response to treatment. This test measures bacterial colonization in gastric mucosa.
- Stool antigen test- this test determines whether *H. pylori* is present in the feces (stools). This test is also useful in determining how effective treatment has been in getting rid of the bacteria.

### V. TREATMENT

The initial treatment of PUD in children is medical. Ulcer therapy has two goals : ulcer healing and elimination of the primary cause .Other considerations are relief the symptoms and prevention of complications.

The first line drugs for treatment of gastritis and PUD in children are:

**1- H<sub>2</sub> receptor antagonists** : Cimetidine ,Ranitidine ,Famotidine ,Nizatidine ( see table 1)

**2-Proton Pump Inhibitors** : Omeprazole, Lansoprazole , Pantoprazole , Esomeprazole and Rabeprazole ( see table 1)

**3-Cytoprotective Agents** : Sulcralfate ( see table 1)

**Table 1 -- ANTISECRETORY THERAPY WITH PEDIATRIC DOSAGES**

MEDICATION	PEDIATRIC DOSE	HOW SUPPLIED
H <sub>2</sub> RECEPTOR ANTAGONISTS		
Cimetidine	20-40 mg/kg/day	Syrup: 300 mg/mL

MEDICATION	PEDIATRIC DOSE	HOW SUPPLIED
	Divided 2 to 4 × a day	Tablets: 200, 300, 400, 800 mg
Ranitidine	4-10 mg/kg/day Divided 2 or 3 × a day	Syrup: 75 mg/5 mL Tablets: 75, 150, 300 mg
Famotidine	1-2 mg/kg/day Divided twice a day	Syrup: 40 mg/5 mL Tablets: 20, 40 mg
<b>PROTON PUMP INHIBITORS</b>		
Omeprazole	1.0-3.3 mg/kg/day <20 kg: 10 mg/day >20 kg: 20 mg/day Approved for use in those >2 yr old	Capsules: 10, 20, 40 mg
Lansoprazole	0.8-4 mg/kg/day <30 kg: 15 mg/day >30 kg: 30 mg/day Approved for use in those >1 yr old	Capsules: 15, 30 mg Powder packet: 15, 30 mg Solu-tab: 15, 30 mg
<b>CYTOPROTECTIVE AGENTS</b>		
Sucralfate	40-80 mg/kg/day	Suspension: 1,000 mg/5 mL Tablet: 1,000 mg

- 4-Antacids:**
- Antacid may be used for symptomatic relief
  - Different types of antacids
    - Aluminum antacids : Aluminum hydroxide
    - Magnesium antacids : Magnesium hydroxide
    - Antacids containing aluminum and magnesium( Maalox, Mylanta)
  - Dosage : 1mL/kg per dose( up to a maximum 30 mL) given one and three hours after meals and 2 mL/kg( up to a maximum of 60 mL) at bedtime. The regimen is continued for 6 to 8 weeks

**A- Treatment of H.Pylori-Related PUD**

**Recommended Eradication Therapies for *H. pylori* Disease in Children**

- First-line therapy is the use of one PPI and two antibiotics for 7 to 14 days. This can be either:
  - omeprazole + amoxicillin + clarithromycin; OR
  - omeprazole + amoxicillin + metronidazole; OR
  - omeprazole + clarithromycin + metronidazole.

**TABLE 2 . Recommended eradication therapies for *H. pylori* disease in children**

Options	Medications	Dosage	Duration of Treatments
1	amoxicillin	50 mg/kg/day up to 1 g bid	14 days
	clarithromycin	15 mg/kg/day up to 500 mg bid	14 days
	proton pump inhibitor:	1 mg/kg/day up to 20mg	
	omeprazole (or comparable acid inhibitory doses of another PPI)	bid	1 month
<i>OR</i>			
2	amoxicillin	50 mg/kg/day up to 1 g bid	14 days
	metronidazole	20 mg/kg/day–500 mg bid	14 days
	proton pump inhibitor:	1 mg/kg/day up to 20mg	

	omeprazole (or comparable acid inhibitory doses of another PPI)	bid	1 month
	<i>OR</i>		
3	clarithromycin	15 mg/kg/day up to 500 mg bid	14 days
	metronidazole	20 mg/kg/day up to 500 mg bid	14 days
	proton pump inhibitor: omeprazole (or comparable acid inhibitory doses of another PPI)	1 mg/kg/day up to 20 mg bid	1 month

*Adapted from Gold BD, Colletti RB, Abbott M, et al: Medical position statement: The North American Society for Pediatric Gastroenterology and Nutrition. Helicobacter pylori infection in children: recommendation for diagnosis and treatment, J Pediatr Gastroenterol Nutr 31:490-497,2000.*

- Second-line therapy is employed when there is no response to first-line therapy. It consists of either

- omeprazole + bismuth subsalicylate + metronidazole + amoxicillin or tetracycline for 14 days; OR
  - ranitidine + bismuth citrate + clarithromycin + metronidazole for 14 days.
- Other drug combinations and durations of treatment are currently being evaluated

Second-line Options	Medications	Dosage	Duration of Treatments
4	bismuth subsalicylate	1 tablet (262 mg) qid or 15 ml (17.6mg/mL qid)	
	metronidazole	20 mg/kg/day–500mg bid	
	proton pump inhibitor: omeprazole (or comparable acid inhibitory doses of another PPI)	1 mg/kg/day up to 20mg bid	
	antibiotic: amoxicillin or tetracycline <sup>a</sup> or clarithromycin	50 mg/kg/day up to 1 g bid 50 mg/kg/day up to 1 g bid 15 mg/kg/day–500mg bid	
5	ranitidine ,bismuth-citrate	1 tablet qid	
	clarithromycin	15 mg/kg/day–500mg bid	
	metronidazole	20 mg/kg/day–500mg bid	

*a.* Only for children 12 years of age or older.

bid : twice daily

qid : four times daily.

## **B. Treatment of NSAID related ulcer**

Active ulcers associated with NSAID use are treated :

- Appropriate course OF PPI therapy : For 4 weeks in Duodenal ulcer; For 8 weeks in gastric
- Appropriate course of PPI therapy: For 4 weeks in Duodenal ulcer ; For 8 weeks in Gastric ulcer
- and the cessation of NSAIDs.
- For patients with a known history of ulcer and in whom NSAID use is unavoidable, the lowest possible dose and duration of the NSAID and co-therapy with a PPI or misoprostol are recommended.

## VI. COMPLICATIONS

Without proper treatment, children with ulcers may experience serious complications. The most common problems include:

- Bleeding - As the lining of the stomach or duodenal wall is eroded, blood vessels may also be damaged, causing bleeding.
- Perforation - Sometimes a hole has worn through the wall of the stomach or duodenum, and bacteria and partially digested food can spill through the opening into the sterile abdominal cavity (peritoneum).
- Narrowing and obstruction - Ulcers located at the end of the stomach (where the duodenum is attached) can cause swelling and scarring, which can narrow or close the intestinal opening.

## VII. PREVENTION

Prevention involves the avoidance of predisposing factors, such as ingestion of NSAIDs, coffee, smoking, and alcohol in older children and adolescents. Secondary peptic ulceration in severely stressed and traumatized patients can be prevented by prophylactic antacids and H<sub>2</sub>-receptor blockers or PPIs. Early recognition and evaluation of abdominal pain will prevent the development of complications of PUD.

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# GASTRO-INTESTINAL BLEEDING

*By Dr. Heang Sothy*

## I. INTRODUCTION

Gastrointestinal (GI) bleeding in infants and children is a fairly common problem, accounting for 10%-20% of referrals to pediatric gastroenterologists. However, it is usually limited in volume, allowing time for diagnosis and treatment.

## II. DEFINITION

- Upper GI Bleeding: Vomiting of blood whether bright red or dark constitutes upper gastrointestinal (GI) bleeding or hematemesis. This usually represents bleeding from the GI tract proximal to the ligament of Treitz. One has to differentiate upper GI (UGI) bleeding from hemoptysis (coughing up of blood), nose bleeds, and bleeding from the mouth and pharynx. Sometimes UGI bleeding can present with melena or the passage of tarry stools.

- Lower GI bleeding refers to bleeding from the lower GI tract, distal to the Ligament of Treitz. It can be hematochezia (passage of bright red or dark blood per rectum) or melena (passage of dark, black, or tarry stools).

## III. EPIDEMIOLOGY

Severe GI bleeds are rare in the general pediatric population and are therefore not well documented. In the pediatric ICU population, 6-20% of the general pediatric population has upper GI bleeds. The incidence of lower GI bleeding has not been well established. In one report, rectal bleeding alone accounted for 0.3% of the chief complaints in more than 40,000 patients presenting to a major urban emergency department.

## IV. AETIOLOGY

Infectious causes are also often seen as dengue fever, typhoid fever and malaria, in tropical area. The causes of upper and lower gastrointestinal bleeding, according to age group, are summarized in the table below.

Table: Common Sources of Gastrointestinal Bleeding in Pediatrics

Age Group	Upper Gastrointestinal Bleeding	Lower Gastrointestinal Bleeding
Neonates	-Hemorrhagic disease of the newborn -Swallowed maternal blood -Stress gastritis -Coagulopathy	-Anal fissure -Necrotizing enterocolitis -Malrotation with volvulus
Infants aged 1 month to 1 year	-Esophagitis -Gastritis	-Anal fissure -Intussusception -Gangrenous bowel -Milk protein allergy
Infants aged 1-2 years	-Peptic ulcer disease -Gastritis	-Polyps -Meckel diverticulum
Children older than 2 years	-Esophageal varices -Gastric varices	-Polyps -Inflammatory bowel disease -Infectious diarrhea -Vascular lesions

## V. DIAGNOSIS

### 1-History

A complete history can often identify a presumptive GI bleeding source and direct an efficient workup. For example, NEC (Necrotizing enterocolitis) in most neonates is diagnosed based on history and clinical presentation.

Ask age- and etiology-specific questions. Ask about acuteness or chronicity of bleeding, color and quantity of the blood in stools or emesis, antecedent symptoms, history of straining, abdominal pain, and trauma.

Melena, rather than bright red blood per rectum, is usually a sign of bleeding that comes from a source proximal to the ligament of Treitz. However, massive upper GI bleeding can produce bright red blood per rectum if GI transit time is rapid.

Blood mixed in stool or dark red blood implies a proximal source with some degree of digestion of the blood.

For complaints of bloody stool, make sure to elicit a history of foods consumed or drugs used that may give a stool bloody appearance. This list includes certain antibiotics, iron supplements, red licorice, chocolate, Kool-Aid, flavored gelatin, or bismuth-containing products (eg, Pepto-Bismol).

A history of vomiting, diarrhea, fever, ill contacts, or travel suggests an infectious etiology. Bloody diarrhea and signs of obstruction suggest volvulus, intussusception, ornecrotizing enterocolitis, particularly in premature infants. Acute bloody diarrhea should be considered a medical emergency.

Familial history or NSAID use may suggest ulcer disease. Ingested substances, such as NSAIDs, tetracyclines, steroids, caustics, and foreign bodies, can irritate the gastric mucosa enough to cause blood to be mixed with the vomitus.

Ask questions that may reveal underlying, but as yet undiagnosed, organ dysfunction. Recent jaundice, easy bruising, and changes in stool color may signal liver disease. Other evidence of coagulation abnormalities elicited from the history may also point to disorders of the kidney or reticuloendothelial system.

## 2- Physical Examination

- Look for signs of shock, and document findings such as heart rate, blood pressure, capillary refill, and orthostatic changes.
- During examination of the head, ears, eyes, nose, and throat, look for causes such as epistaxis, nasal polyps, and oropharyngeal erosions from caustics and other ingestions.
- Examine abdominal surgical scars and elicit the reason for the surgery.
  - Specifically include bowel-sound frequency in the abdominal examination. Hyperactive bowel sounds are more common in upper GI bleeding.
  - Abdominal tenderness, with or without a mass, raises the suspicion of intussusception or ischemia.
  - Inspection of the perianal area may reveal fissures, fistulas, skin breakdown, or evidence of trauma. Gentle digital rectal examination may reveal polyps, masses, or occult blood.
- Looking for evidence of child abuse, such as perianal tearing, tags, or irregularities in anal tone and contour, is also important.
- Hepatomegaly, splenomegaly, jaundice, or caput medusa suggests liver disease and subsequent portal hypertension.
- Examination of the skin may reveal evidence of systemic disorders, such as IBD (inflammatory bowel disease), Henoch-Schönlein purpura, and Peutz-Jeghers polyposis.

## 3. Laboratory aids

- CBC: If there is leukopenia, anemia, and thrombocytopenia, think chronic liver disease and portal hypertension. If there is anemia with normal RBC indices, then there is truly an acute cause for bleeding. If RBC indices indicate iron-deficiency anemia, think of varices or a mucosal lesion, i.e., chronic blood loss.
- Coagulation profile: If PT/PTT are abnormal, then think of liver disease or disseminated intravascular coagulation (DIC) with sepsis. If DIC screen is negative, think liver disease. Make sure, however, that blood sample was not contaminated with heparin.
- Bleeding time: Abnormal in patients with previous history (or family history) of bleeding disorders.
- Liver function tests: Abnormal in chronic liver disease.

## 4- Nasogastric Tube

Children whose history and physical findings suggest significant bleeding from an upper GI source receive a nasogastric tube for diagnostic purposes. Return of coffee-ground-like material or Gastrocult-positive material confirms an upper GI bleed. Still, the false-negative rate is 16% if duodenopyloric regurgitation is absent. Therefore, a clear nasogastric aspirate alone cannot be used to rule out of a GI bleed.

## 5. Imaging

- Abdominal Radiography: *Patients with suspected obstruction should undergo plain abdominal radiography. Abdominal radiography may also be helpful in neonates in whom NEC is a possibility; the images may show free air, pneumatosis intestinalis (bubbles in the bowel wall), or portal air.*
- Barium Contrast Studies: *Imaging for nonemergency pediatric GI bleeding may begin with barium contrast studies (barium swallows, upper GI series, small bowel follow-throughs, or barium enemas) to point to foreign bodies, esophagitis, IBD, or polyps. For neonates with malrotation with midgut volvulus, it may reveal a corkscrew of small bowel or a bird's beak if*

complete obstruction is present. When intestinal malrotation is suspected, an immediate upper GI contrast study should be performed to confirm the diagnosis of malrotation with midgut volvulus.

- Doppler Ultrasonography: For suspected intussusception, color Doppler ultrasonography can be used. Its sensitivity is 98-100%, and its specificity is 89-100%; these rates are operator-dependent.
- Endoscopy: Patients with severe upper GI bleeding should receive endoscopy within the first 12 hours of the hemorrhagic episode if they are sufficiently stable, because early endoscopy improves the diagnostic index. The site of upper GI bleeding can be identified in 90% of cases when endoscopy is performed within 24 hours. This modality is also beneficial in predicting the likelihood of continued bleeding.
- Arteriography: Arteriography is used to localize lesions when endoscopy has failed or when the patient cannot cooperate. The modality can be helpful for bleeding that is distal to the ligament of Treitz.
- Colonoscopy: For lower GI bleeds, colonoscopy can reveal the source of bleeding more effectively than barium enema can, and it has 80% sensitivity. Colonoscopy should be performed only when the patient is stable and when blood and feces will not conceal proper visualization. Sigmoidoscopy alone has also been used in children who have had symptoms of chronic lower GI bleeding for 1 year or longer. The study reveals the most common etiologies, such as juvenile colorectal polyps and nonspecific proctitis.

## VI. DIAGNOSIS

### 1- Neonates

In most neonates with stress gastritis, the diagnosis is presumptive. If necessary, definitive diagnosis is made with upper endoscopy, demonstrating erythema, diffuse bleeding, erosions, or ulcerations of the gastric mucosa.

### 6.2- Children aged 1 month to 1 year

#### *a- Upper gastrointestinal bleeding*

Diagnostic workup for GER often begins with a barium swallow. Other diagnostic modalities include pH probes, esophagoscopy, esophageal manometry, and nuclear medicine studies.

Gastritis is primary or secondary in etiology. Primary gastritis is associated with *Helicobacter pylori* infection and is the most common cause of gastritis in children. *H pylori* is detected using serum immunoglobulin G (IgG) levels, rapid urease testing (CLO test), or mucosal biopsy.

#### *b- Lower gastrointestinal tract bleeding*

In cases of intussusception, ultrasonography may be used as the initial diagnostic study to avoid a more invasive barium or pneumatic enema. The ultrasonographic finding of a pseudokidney sign is pathognomonic for intussusception. Because ultrasonographic studies are only diagnostic, many clinicians choose to proceed directly to barium, saline, or pneumatic enema, which are diagnostic and potentially therapeutic. In patients with gangrenous bowel, upper and lower contrast studies aid in diagnosis.

### 6.3- Children aged 1-2 years

#### *a- Upper gastrointestinal bleeding*

When a peptic ulcer that is not associated with *H pylori* infection is diagnosed, a fasting plasma gastrin level is measured to exclude Zollinger-Ellison syndrome. Significant upper GI bleeding in patients with ulcer is evaluated and treated with immediate endoscopy. Biopsy samples are taken, if warranted.

### ***b- Lower gastrointestinal tract bleeding***

Most polyps in persons of this age group are the juvenile type and are located throughout the colon. These are benign hamartomas and usually require no treatment, because they autoamputate. In cases of polyps, colonoscopy is the diagnostic evaluation of choice, because it allows examination of the entire colon and the potential excision of bleeding polyps when they are identified. Colonoscopy is helpful in diagnosing other polyposis syndromes, such as familial polyposis syndromes and adenomatous polyps.

In patients with Meckel diverticulum, technetium-99m (<sup>99m</sup>Tc) pertechnetate scanning is used to identify this congenital anomaly, with 90% accuracy. This isotope has a high affinity for parietal cells of gastric mucosa and allows identification of normal and ectopic gastric mucosa. The use of H2 blockers and proton pump inhibitors (PPIs), pentagastrin, and glucagon may enhance the accuracy of this test, since H2 blockers inhibit excretion of the isotope, pentagastrin enhances gastric mucosal uptake, and glucagon inhibits peristalsis.

## **6.4- children older than age 2 years**

### ***a- Upper gastrointestinal bleeding***

After the initial stabilization of patients with upper GI bleeding, upper endoscopy is the preferred diagnostic and therapeutic tool. The esophagus and stomach are assessed for the presence of varices and in order to exclude gastritis or ulcer disease as the source of bleeding. Gastric varices are most commonly found in the fundus.

### ***b- Lower gastrointestinal tract bleeding***

Vascular lesions include a wide variety of malformations, including hemangiomas, arteriovenous malformations, and vasculitis. If these lesions are located in the colon, colonoscopy may be diagnostic and therapeutic. However, brisk bleeding may obscure the visual field, making localization the bleeding impossible. Arteriography assists in localizing the source and embolizing the feeding vessel.

## **VII. Differentials**

- Anal Fistulas and Fissures
- Diaper Rash
- Fever in the Neonate and Young Child
- Gastrointestinal Foreign Bodies
- Hemolytic Uremic Syndrome
- Inflammatory Bowel Disease
- Intussusception
- Pediatric Dehydration
- Pediatric Foreign Body Ingestion
- Pediatric Gastroenteritis

## **VIII. TREATMENT**

**1. General goals:** Determine the cause of the bleeding and begin treatment.

- Determine if the vomitus truly contains blood, as red food coloring, fruit flavored drinks and juices, vegetables, and medicines may appear like blood. A pH buffered Gastrocult test identifies blood in the vomitus or gastric aspirate.
- Assess severity of bleeding. Is there a change in vital signs, hematocrit, blood pressures, capillary filling, pulse?
- Determine the site of bleeding and begin treatment. Usually will require imaging or endoscopy.

**2. Considerations:**

- Provide hydration and volume support in patients with gastrointestinal (GI) bleeding.
- Transfusion may be required.
- If an acute bleed is suspected and there is hemodynamic instability, access with

2 large-bore intravenous (IV) catheters must be obtained.

- Patients with severe GI bleeds should be admitted to the pediatric ICU.
- For variceal bleeds, GI consultants may endoscopically control active hemorrhage with sclerotherapy, an elastic ligature (for esophageal varices or for hemorrhoids), or (in rare cases) a transjugular intrahepatic portosystemic shunt (TIPS).
- Failure to control bleeding may require the placement of a Sengstaken-Blakemore balloon for temporary tamponade if endoscopic treatment fails or is not possible at the time due to the massive bleeding.
- Significant GI bleeding that cannot be controlled (eg, due to duodenal ulcers or varices in the proximal GI tract, vascular malformations, nonreducible points of intussusception) by using the previously mentioned techniques may require surgical intervention, such as laparoscopy.
- Patients with first-time occurrences of nonsignificant amounts of bleeding who are discharged should be followed by their primary care pediatrician for further episodes. Again, most of these cases are benign and self-limiting.
- Children who present with upper or lower GI hemorrhage to hospitals without a pediatric ICU should be transferred to such a facility when sufficiently stable.
- Age-specific treatment and management strategies are discussed below.

## **IX. Particular cases:**

### **6.2.1- Neonates**

#### ***a- Upper gastrointestinal tract bleeding***

Treatment for stress gastritis in neonates is supportive and includes adequate resuscitation to reduce the underlying hypoxemia, nasogastric suction, and IV H<sub>2</sub> blockers or PPIs. Studies have advocated identifying high-risk neonates and treating them prophylactically with acid-reducing agents. Extremely rarely, continued or massive hematemesis despite medical therapy leads to operative interventions, such as gastric resection, vagotomy and pyloroplasty, or antrectomy and vagotomy.

Hemorrhagic disease of the newborn is a bleeding disorder resulting from a deficiency in vitamin K–dependent coagulation factors. Although it is normally self limited, in 0.25%-0.5% of neonates, severe hemorrhage may result.

Prophylactic vitamin K administration in the newborn period virtually eliminates hemorrhagic disease. If the disorder occurs, IV administration of 1 mg of vitamin K generally stops the hemorrhage within 2 hours. If the clinical condition warrants, fresh frozen plasma and packed red blood cells are administered in addition to the vitamin K.

#### ***b- Lower gastrointestinal tract bleeding***

For neonates with NEC, the standard treatment is aggressive medical resuscitation with bowel rest, antibiotics, total parenteral nutritional, and nasogastric decompression.

Nonoperative management of NEC yields a 70-80% recovery rate, but urgent laparotomy or drain placement is required in neonates in whom conservative therapy is unsuccessful owing to progressive sepsis, bowel perforation, or persistent bleeding. Recurrent bleeding in a baby who has recovered from NEC may indicate a second occurrence of the disease or an enterocolitis stricture.

### **6.2.2- Children aged 1 month to 1 year**

#### ***a- Upper gastrointestinal tract bleeding***

Peptic esophagitis caused by GER is the most common cause of bleeding in this age group. Treatment begins with acid-reducing agents, thickened feeds, upright positioning, and prokinetic agents.

Antireflux procedures are rarely performed to control bleeding but may be necessary to treat complications of GER (eg, apnea, esophageal stricture, lung disease) that are refractory to medical therapy.

Gastritis is primary or secondary in etiology. Primary gastritis is associated with *Helicobacter pylori* infection and is the most common cause of gastritis in children. Treatment is a combination of H<sub>2</sub> blockage, antibiotic therapy, and bismuth.

Secondary gastritis occurs in association with severe systemic illnesses that result in mucosal ischemia and produce diffuse erosive and hemorrhagic gastric mucosa. Correction of the underlying metabolic derangements and acid reduction are successful treatment measures in most patients.

***b- Lower gastrointestinal tract bleeding***

Treatment for anal fissures consists of the administration of stool softeners and the use of rectal dilation.

In patients with intussusception, barium, saline, and pneumatic enema, while diagnostic, are potentially therapeutic as well. Successful reduction in intussusception is achieved in up to 90% of cases. Unsuccessful enema necessitates laparotomy and manual reduction or resection of the intussusception.

In cases of gangrenous bowel, laparotomy is usually necessary for definitive treatment.

The symptoms of milk protein allergy generally resolve in 48 hours to 2 weeks after withdrawal of the offending milk product.

**6.2.3- Children aged 1-2 years**

***a- Upper gastrointestinal tract bleeding***

Significant upper GI bleeding caused by peptic ulcers is evaluated and treated with immediate endoscopy. Cautery, epinephrine therapy, fibrin sealants, and Endoclips are treatment options for ulcers, and biopsy samples are taken, if warranted.

Therapy for peptic ulcer disease in children mimics that in adults and centers around acid reduction and control of the underlying condition. Obstruction and/or persistent bleeding are indications for surgery.

***b- Lower gastrointestinal tract bleeding***

Most polyps in persons of this age group are the juvenile type and are located throughout the colon. These are benign hamartomas and usually require no treatment, because they autoamputate. Colonoscopy, the diagnostic evaluation of choice, can be used to excise bleeding polyps when they are identified.

In Meckel diverticulum, bleeding may be brisk, and transfusion is often required. However, the bleeding is usually self-limited and resolves spontaneously with episodic recurrences.

The treatment of ulceration in Meckel diverticulum is surgical resection after preoperative fluid resuscitation and adequate transfusion. A right lower quadrant incision is used, and the diverticulum is mobilized. (A bleeding, ulcerated Meckel diverticulum is seen below.)

Intraoperative view of the bleeding Meckel diverticulum. Note the ulceration at the base. Careful visual inspection and palpation locate the ectopic gastric mucosa and ulceration. If the ulcer is confined to the diverticulum, diverticulectomy alone is performed and closed in a transverse fashion with sutures or a stapling device.

If the diverticulum is broad based or the ulcer cannot be included in the diverticulum specimen, segmental bowel resection is necessary, with an end-to-end anastomosis. An appendectomy is often performed with the resection.

**6.2.4- Children older than 2 years**

***a- Upper gastrointestinal tract bleeding***

Esophageal varices result from portal hypertension, regardless of the age group. Once the diagnosis of gastric or esophageal varices has been confirmed, treatment is initiated. Most bleeding episodes stop spontaneously and respond to blood products and careful monitoring.

Pharmacologic therapy, administered as necessary, is directed at reducing portal venous blood flow. Vasopressin, octreotide, and beta blockers have been used systemically to control bleeding varices.

Balloon tamponade with a Sengstaken-Blakemore or Minnesota tube has yielded up to an 80% success rate in controlling bleeding varices, but rebleeding and serious complications, such as pressure necrosis or misplacement, make this technique less useful.

Endoscopic sclerotherapy with injection of sodium morrhuate controls bleeding with a success rate of 90%-95%. Generally, endoscopic sclerotherapy is repeated at 2- to 4-week intervals after the acute bleed to prevent recurrence.

Variceal banding offers results at least comparable to sclerotherapy but is more difficult to perform in children because of the smaller size of the esophagus.

In the approximately 20% of cases in which conservative management fails (defined by multiple transfusion requirements or an inability to maintain hemodynamic stability) with combined pharmacotherapy and endoscopic treatments, shunt and non-shunt surgeries are the definitive treatment.

For intrahepatic portal hypertension, TIPS provides temporary decompression of the intrahepatic portal vein into the hepatic veins. Surgical portosystemic or portoportal shunts are reserved for refractory cases and/or when liver transplantation is not an option.

Nonshunt operations include esophageal transaction and devascularization of the gastroesophageal varices (Sugiura procedure), but neither is commonly performed.

#### ***b- Lower gastrointestinal tract bleeding***

In patients with IBD, the occurrence of acute or persistent bleeding with resultant anemia, despite the use of maximal medical therapy, is considered to be an indication for surgery. Therapy for ulcerative colitis is a total proctocolectomy with an ileal pouch–anal pull-through. The goal of surgical treatment in Crohn disease is resection of all grossly diseased bowels with primary anastomosis, provided previous surgery (or the current resection) has not created a short-bowel situation.

Infectious diarrhea is suspected when lower GI bleeding occurs in association with profuse diarrhea. Recent antibiotic use raises suspicion for antibiotic-associated colitis and *Clostridium difficile* colitis. The former should be self-limited and should resolve after cessation of antibiotics, while *Clostridium difficile* colitis requires therapy with oral metronidazole or vancomycin. *Escherichia coli* and *Shigella* species are the two most common pathogens in infectious diarrhea. Treatment is supportive with antibiotic therapy, as indicated.

Vascular lesions include a wide variety of malformations, including hemangiomas, arteriovenous malformations, and vasculitis. If these lesions are located in the colon, colonoscopy may be diagnostic and therapeutic. However, brisk bleeding may obscure the visual field, making localization of the bleeding impossible. Arteriography assists in localizing the source and embolizing the feeding vessel.

Surgery is necessary when bleeding cannot be controlled using these techniques. Localization of hemorrhage in the small bowel is a challenge to surgeons and may require intraoperative endoscopy to find the lesion.

## **X. MEDICAL ADVICE**

Direct consultation toward the discipline appropriate to the diagnosis and treatment (eg, a radiologist for a barium enema study in intussusception, a pediatric ICU specialist and a pediatric surgeon for NEC, a gastroenterologist for presumed ulcer disease).

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# GASTRITIS

By Dr. Te Vantha

## I. DEFINITION

Gastritis is an inflammation of the stomach lining. In some cases, gastritis can lead to [ulcers](#) in the lining of the stomach. Gastritis can be:

- Acute—comes on suddenly and lasts briefly
- Chronic—either long lasting or recurrent

## II. EPIDEMIOLOGY

**Prevalence:** 8 out of every 1,000 people. >2% of ICU patients have heavy bleeding secondary to gastritis.

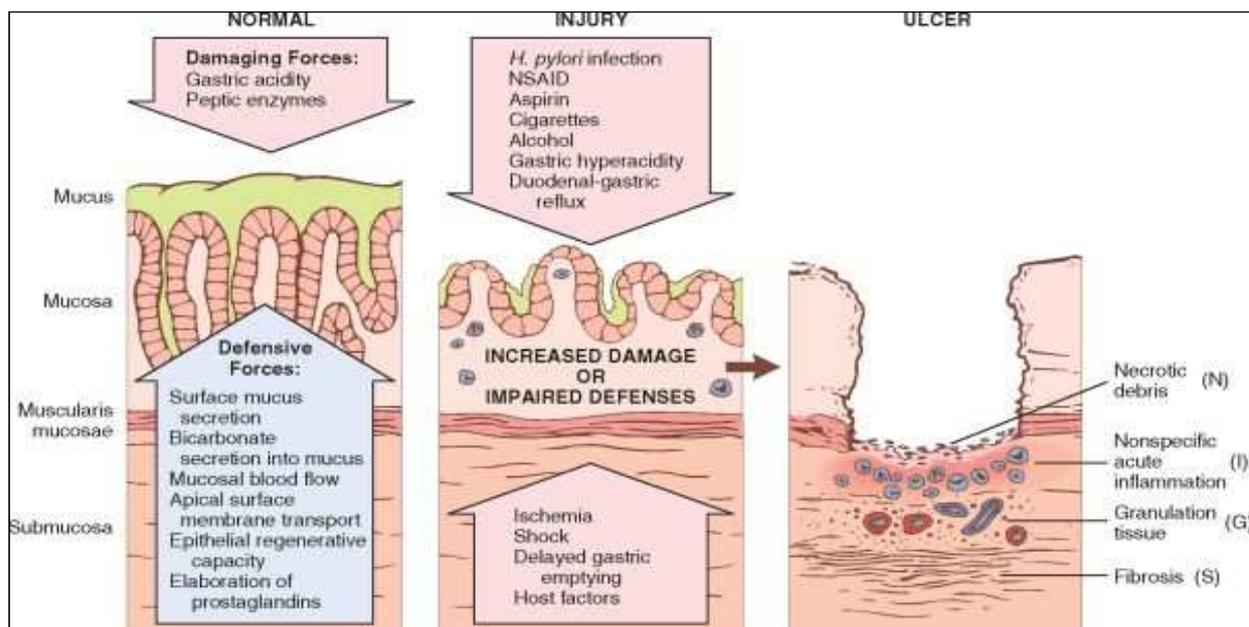
### **Mortality/Morbidity**

The mortality/morbidity is dependent on the etiology of the gastritis. Generally, most cases of gastritis are treatable once the etiology is determined. The exception to this is phlegmonous gastritis, which has a mortality rate of 65%, even with treatment.

**Sex:** No sexual predilection exists.

**Age:** Gastritis affects all age groups. The incidence of *H pylori* infection increases

## Pathophysiology



## III. AETIOLOGY

- *Helicobacter pylori* (children more likely to have more severe gastritis, specifically located in antrum of stomach). Classified by WHO as a class I carcinogen in 1994.
- Physiologic stress (e.g., in CNS disease, overwhelming sepsis, ICU patients)
- Major surgery; severe burns; renal, liver, respiratory failure; severe trauma
- Idiopathic
- Caustic ingestions (e.g., lye, strong acids, pine oil)
- Celiac disease: Lymphocytic gastritis
- Drug induced (e.g., NSAIDs, steroids, valproate; more rarely, iron, calcium salts, potassium chloride, antibiotics)
- Ethanol
- Protein sensitivity (e.g., cow's milk-protein allergy), allergic enteropathy
- Eosinophilic gastroenteritis
- Crohn disease:
  - Up to 40% of Crohn patients have gastroduodenal involvement.
  - Gastric Crohn may manifest itself as highly focal, non-*Helicobacter pylori*, non-granulomatous gastritis
- Infection (e.g., tuberculosis, cytomegalovirus, parasites)
- Less common causes:
  - Radiation
  - Hypertrophic gastritis (Ménétrier disease)
  - Autoimmune gastritis
  - Collagenous gastritis
  - Zollinger-Ellison syndrome
  - Vascular injury
  - Direct trauma (nasogastric tubes)

## IV. DIAGNOSIS

### 1. History

- Epigastric pain
- Abdominal indigestion
- Nausea
- Vomiting postprandially
- Vomiting blood or coffee ground–like material
- Diarrhea
- Dark or black stools (or bright red blood from rectum, if bleeding is brisk and intestinal transit time is short)
- Irritability
- Poor feeding and weight loss
- Less often: Chest pain, hematemesis, melena

### 2. Physical Exam

- Epigastric tenderness is physical finding that most closely correlates with gastritis on endoscopy.
- Normal bowel sounds

### 3. Laboratory Test

- Heme-test all stools.
- CBC for anemia with other signs of chronic blood loss (e.g., microcytosis, low reticulocyte count)
- *Helicobacter pylori* identification:
  - Noninvasive *H. pylori* tests, including antibody (from serum, whole blood, saliva, or urine), antigen (from stool), or urea breath testing (UBT). UBT (using <sup>13</sup>C) and stool antigen tests are more reliable and sensitive than antibody testing; serologic testing is not recommended. However, UBT is not widely available, and is used primarily in adults.
  - Rapid urease test from gastric biopsy specimen for *H. pylori*
  - Silver Warthin-Starry stain, Genta stain, modified Giemsa stain, or cresyl violet stain of gastric biopsy for *H. pylori*
  - Culture of homogenized gastric biopsy for *H. pylori* (difficult to perform outside of research setting)

### 4. Imaging

- Upper GI radiography when endoscopy not available
- Chest radiograph may detect free abdominal air secondary to perforation.
- Upper endoscopy with biopsies:
  - Sensitivity greatest
  - Possible findings:
    - Edema around small ulcers
    - Thickened hyperemic mucosa
    - Atrophic mucosa
    - Antral micronodules (represent lymphoid follicles) commonly seen in children with *Helicobacter pylori* infection
    - Antral and prepyloric edema with retained gastric secretions

## V. DIFFERENTIAL DIAGNOSIS

Of epigastric abdominal pain:

- Gastroesophageal reflux with esophagitis
- Peptic ulcer disease
- Biliary tract disorders
- Pancreatitis
- Inflammatory bowel disease
- Genitourinary pathology (renal stones, infection)
- Nonulcer dyspepsia
- Functional pain
- Allergic enteropathy

## VI. TREATMENT

### 1. General Measures

Diet

- Benefit of changes in diet is inconclusive.
- Eliminate alcohol, tobacco, and caffeine.

### 2. Medication (Drugs)

#### a. Antacids

aluminum hydroxide/magnesium hydroxide oral suspension (540mg/40mg)/5mL

- > 12 years old: 5-10 mL PO between meals & every bed time
- < 12 years old: Safety & efficacy not established

#### b. H<sub>2</sub> blockers to maintain gastric pH >4 to 5

- Ranitidine: 2–3 mg/kg/dose b.i.d. to t.i.d. in children
- Cimetidine: 10 mg/kg/dose q.i.d. (can be used prophylactically for hospitalized patients at risk for physiologic stress)
- Famotidine: 0.5–2 mg/kg/d divided twice

#### c. Proton pump inhibitors

Omeprazole, lansoprazole, rabeprazole, or esomeprazole 1 mg/kg/d

## Recommended Eradication Therapies for H.pylori-associated Disease in Children

MEDICATIONS	DOSE	DURATION
Amoxicillin	50 mg/kg/d + bid	14days
Clarithromycin	15 mg/kg/d + bid	14 days
Proton pump inhibitor	1 mg/kg/d + bid	1 month
Amoxicillin	50 mg/kg/d + bid	14days
Metronidazole	20 mg/kg/d + bid	14 days
Proton pump inhibitor	1 mg/kg/d + bid	1 month
Clarithromycin	15 mg/kg/d + bid	14days
Metronidazole	20 mg/kg/d + bid	14 days
Proton pump inhibitor	1 mg/kg/d + bid	1 month

- d. Triple therapy with proton pump inhibitor and antibiotics, e.g., omeprazole, amoxicillin, and clarithromycin
  - e. If eradication unsuccessful, quadruple therapy is recommended for 7–14 days, including:
    - Bismuth (of note, may need to avoid bismuth subsalicylate and choose instead bismuth subcitrate)
    - Metronidazole
    - A proton pump inhibitor
    - Another antibiotic (either amoxicillin, clarithromycin, or tetracycline).
  - f. Drug regimens change frequently, clarithromycin resistance becoming increasingly problematic.
- Precautions:
    - a. Antacids are not palatable to children and can lead to diarrhea or constipation. Prolonged use of large doses of aluminum hydroxide–containing antacids may lead to phosphate depletion and aluminum-related CNS toxicity (particularly in patients with renal disease).
    - b. If *Helicobacter pylori* eradication is attempted, important to use a tested regimen. Untested substitutions in the triple or quadruple regimens should be avoided.
  - Interactions: Ranitidine is less effective and can increase toxicity when given to patients receiving other medicines metabolized by cytochrome P-450 system (e.g., theophylline).

## VII. PROGNOSIS

Significant gastritis relapse rates for children who remain infected with *Helicobacter pylori*

## VIII. COMPLICATIONS

- Bleeding (from mild to hemorrhagic)
- When gastritis caused by acid/alkali ingestions, outlet obstruction may result from peyloric strictures (4–8 weeks after ingestion)

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# STOMATITIS

By Dr. Lorntry Patrich

## I. DEFINITION AND CAUSES

- Stomatitis is an inflammation of the mucous membranes of the mouth caused by a fungal viral or bacterial infection, a vitamin deficiency, an injury etc.
- recurrent aphthous stomatitis being the most common in children.
- Prolonged, painful stomatitis may contribute to malnutrition or dehydration or dehydration in children: always treat carefully and show the mother how to treat.

## II. EPIDEMIOLOGY

- HSV type 1: up to 90% of the adult population has serologic evidence of previous infection.
- Enteroviral infections occur commonly in summer.

## III. COMMON CLINICAL SIGNS

- Pain, difficulty eating, dysphagia, anorexia, sometimes nausea and vomiting. In a patient with these signs, examine the mucosa of mouth, particularly in children.
- In all cases maintain feeding and hydration (use a nasogastric tube for 3 days, only if pain is preventing the patient from eating) and keep the affected areas clean to prevent secondary infections or recurrence.
- Non specific symptoms: red mucosa, +/- aphthous ulcers, +/- ulcers, +/- vesicles, white plaques.

## IV. TREATMENT ACCORDING TO AETIOLOGY

- *Candida albicans (thrush)* :Very common in infants

### Causes :

- Malnourished children
- HIV infected patients
- Antibiotic treatment

**Clinical signs :** White patches on the tongue may spread to cover the whole mouth

### Treatment :

- Clean the mouth with salt water or NSS **frequently (every 1-2 hours)**.
- **Apply gentian** violet 2 times/day for 7 days or apply *nystatin* to the affected area between meals: lozenges of 100 000 IU/day in 4 divided doses for 7 days. For young children crush the tablets before applying to the affected area.

- Consider treating for intestinal candidiasis if oral thrush continues despite correct local treatment : **Nystatin** PO : 500.000 IU/day in 4 divided doses for 20 days
- In patients with extensive forms or with frequent recurrences, consider HIV infection. Do a thorough clinical examination and for treatment.
- **Herpes Simplex infection**
  - Very common in children
  - Primary infection : Very painful lesions, in the form of vesicles, erosions or yellowish ulcerations on the lips and buccal mucosa with general malaise, peripheral lymph swelling and fever.
  - Recurrence : clusters of vesicles in the nasolabial areaBoth forms of herpes are contagious. Recurrences may be provoked by an infectious disease such as malaria or pneumonia:  
**Treatment :**
  - Clean the affected area with salt water or NSS **frequently (every 1-2 hours)**.
  - Treatment pain with Paracetamol PO 60 mg/kg/day in 4-6 divided.
  - Spontaneous resolution usually occurs within 7 to 10 days. Secondary infections may develop
  - In patients with extensive forms or with frequent recurrences, consider HIV infection. Do a thorough clinical examination and for treatment.
- **Other infectious causes : Tonsillitis, Diptheria, Measle**
- **Stomatitis from vitamin deficiencies**
  - *Stomatitis from scavy*: Bleeding gums caused by vitamin C deficiency, In infants it is associated with lower limb pain caused by subperiosteal haemorrhage. It is common in contexts of poor food quality or in populations completely dependent on food aid (refugee camps).
    - Clean the mouth and apply **gentian violet** as for candidiasis
    - **Ascorbic acid (Vitamin C)** PO : 150 to 200 mg/day in 2 divided doses. The treatment is continued until symptoms improve ( 1 to 2 weeks), then a preventive treatment ( 25 to 50 mg/day) is given as long as the situation requires.
  - *Other stomatitis*
    - Other vitamin deficiencies may provoke mouth lesions : angular stomatitis of the lips and glossitis from Vitamin B2 (Riboflavin) or Vitamin B6 (Pyridoxine) deficiencies.
    - Multivitamins are insufficient to treat true vitamin deficiencies. Give the corresponding vitamins at curative dose.
    - Iron deficiencies may provoke angular stomatitis.

## V. PATIENT/PARENT EDUCATION

- Hand washing can prevent spread of viral infections.
- Contact isolation should be observed for children with viral stomatitis in the hospital setting.

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# PANCREATITIS

By Dr. Heang Sothy

## I. DEFINITION

Pancreatitis is inflammation of the pancreas characterized by variable local and systemic inflammatory responses. Pancreatitis can be classified into acute and chronic.

- Acute pancreatitis is characterized by abdominal pain, nausea and vomiting with elevation of pancreatic enzymes and is usually self-limiting. Recurrent episodes of pancreatitis may occur, but the pancreatic function and morphology is restored between episodes. Severe acute pancreatitis is rare in children, and has a high mortality.
- Chronic pancreatitis is characterized by recurrent or persistent abdominal pain with morphological changes in the pancreas leading to pancreatic enzymes or endocrine insufficiency in some patients.

## II. ETIOLOGY

- Idiopathic 22%.
- Trauma 20%: Bicycle's handle injuries, Motor vehicle accidents, Child abuse.
- Postoperative: ERCP, Scoliosis surgery, Posttransplant.
- Infections 15%
  - Bacterial (typhoid, mycoplasma)
  - Viral (measles, mumps, Epstein-Barr virus, Coxsackie B, rubella, influenza, echovirus, hepatitis A and B)
  - Parasites (Ascaris lumbricoides, Echinococcus granulosus, Cryptosporidium parvum, Plasmodium falciparum).
- Biliary tract disease 14%
- Gallstones Sclerosing cholangitis
- Congenital anomalies
  - Pancreatic divisum
  - Annular pancreas
  - Anomalous choledochopancreaticoduodenal junction
  - Biliary tract malformations
  - Duplication cyst of the duodenum/gastropancreatic/common bile duct
- Metabolic
  - Hyperlipidemia
  - Hypercalcemia
  - Uremia

- Inborn errors of metabolism
- Systemic disease
  - Shock/hypoxemia
  - Hemolytic uremic syndrome
  - Crohn disease
  - Celiac disease
  - Malnutrition (anorexia nervosa, bulimia and refeeding syndrome)
  - Diabetes mellitus
  - Mitochondropathy
  - Hemochromatosis
  - Vasculitis (SLE, Henoch-Schunlein purpura, Kawasaki disease)
- Drug (L-asparaginase, azathioprine/6-MP, mesalamine, sulfonamides, thiazides, furosemide, tetracyclines, valproic acid, corticosteroids, estrogens, procainamide, ethacrynic acid etc.)
- Toxins: Alcohol, organophosphates, Yellow scorpion sting
- Hereditary
  - Cystic fibrosis
  - Hereditary pancreatitis gene
  - SPINK 1 gene
  - Protease Serine 1 (PRSS 1)

### III. PATHOPHYSIOLOGY

- Mechanisms of acute pancreatitis are still obscure, but many mechanisms lead to stasis in the pancreatic duct.
- This leads to activation of pancreatic proenzymes by cathepsin, as well as cytokine release.
- Premature activation of trypsin sets off a cascade of zymogen activation of proteolytic enzymes leading to autodigestion of pancreas, necrosis, and hemorrhage.
- Autodigestion leads to local and systemic inflammatory response, which are characterized by cytokine release (TNF, IL1, IL2, IL6, platelet activating factor, etc.), neutrophil activation, and leucocyte recruitment.
- Systemic inflammatory response can lead to multi-organ failure and death.

### IV. COMPLICATIONS:

Pancreatitis can lead to local and systemic complications.

1. Local complications. Ascites, Pancreatic phlegmon, Pancreatic abscess, Pancreatic pseudocyst, Hemorrhagic pancreatitis, Necrotizing pancreatitis, Pancreatic calculi, Exocrine insufficiency, Diabetes mellitus, Pancreatic fistula, Pancreatic fibrosis, Pancreatic carcinoma.
2. Systemic complications
  - Gastrointestinal and Hepatobiliary: Paralytic ileus, Gastritis, Stress ulcer, Upper gastrointestinal bleeding, Portal vein thrombosis/splenic vein thrombosis/obstruction, Liver disease, Bile duct obstruction.
  - Pulmonary: Atelectasis, Pleural effusion, Pneumonitis, ARDS
  - Cardiovascular: Hypotension/circulatory collapse, Pericarditis/pericardial effusion, ECG changes, Sudden death.
  - Hematologic: Hemoconcentration, Disseminated intravascular coagulation
  - Renal: Oliguria, Azotemia and renal failure, Hepatorenal syndrome
  - Neurologic: Psychosis, Coma

- Metabolic: Acidosis, Hyperkalemia, Hyperglycemia, Hypertriglyceridemia, Hypocalcemia

## V. DIAGNOSIS

### 1. History

- Upper abdominal pain, usually epigastric with radiation to the back. There could be some relief of pain on stooping forward. Pain is aggravated by food intake.
- Low-grade fever could be part of the disease process and high-grade fever is usually as a result of infection.
- Nausea and vomiting are very common. Vomiting could be bilious.

### 2. Physical Examination

#### a. General examination

- Growth parameters (weight and height), vitals, capillary refill, pulse-oximetry, pallor, jaundice, edema, clubbing. Low-grade fever could be a manifestation of pancreatitis and high-grade fever could indicate infections.
- Shock is a complication of pancreatitis.
- Pallor could be the result of chronic systemic disease or a result of hemorrhage.
- Clubbing could be an indicator of Cystic fibrosis.

#### b. GI examination

- Mouth: presence of aphthous ulcers: possibility of Crohn disease.
- Inspection:
  - Abdominal distension or flank fullness (ascites or mass-like pseudopancreatitis cyst)
  - Bluish discoloration (Grey Turner's sign in the flanks and Cullen's sign around the umbilicus in hemorrhagic pancreatitis).
- Palpation:
  - Tenderness with guarding and rebound tenderness, especially in the epigastric or upper abdomen.
  - Palpable mass could be a pancreatic pseudocyst.
- Palpate for liver, gall bladder, spleen and for other masses.
- Percussion: Ascites.
- Auscultation:
  - Bowel sounds decreased or absent in paralytic ileus.
  - Perianal region:
    - Skin tags, fistulas, abscesses and healed scars, which could be indicative of IBD ( inflammatory bowel disease)
    - Per-rectal examination for mass and for melena/occult blood.
- Respiratory system
  - Pleural effusion and Acute respiratory distress syndrome
  - Diffuse respiratory findings could be indicative of Cystic fibrosis.
- CNS: Stupor or coma

### 3. Laboratory Aids

#### a. Test: CBC

- Hemoglobin may be decreased in hemorrhagic pancreatitis or in intestinal hemorrhage.
- Hemoconcentration occur in shock states.
- WBC count is elevated.

#### b. Test: Basic metabolic panel

- Electrolyte imbalance as a result of fluid shift and renal complications.
- Calcium is decreased.
- Glucose may be transiently elevated.

#### c. Test: Liver function tests

- Elevated transaminases.
- Elevated bilirubin.
- d. Test: Amylase level**
  - 3- to 6-fold increase in the level increases the specificity for the diagnosis of pancreatitis.
  - Starts rising 2 to 12 hours after the insult and remain elevated for 3 to 5 days
  - Persistent elevation could be a result of complication like pseudocyst.
  - Degree of elevation does not have any correlation to the severity or the course of the illness.
  - Necrotizing and hemorrhagic pancreatitis may develop with normal amylase levels.
- e. Lipase**
  - Start rising 4 to 8 hours after the insult and remain elevated for 8 to 14 days.
  - 3-fold increase in the level is very sensitive and specific for pancreatitis.
  - Levels do not correlate with severity or the clinical outcome.
- 4. Imaging**
  - a. Abdominal Radiographs
    - Sentinel loop: distended small intestinal loop near the pancreas.
    - Colon cut-off sign: absence of gas shadow in the colon distal to transverse colon.
    - Multiple fluid levels in paralytic ileus.
    - Calcification or stones in pancreas or gall bladder.
    - Diffuse haziness: ascites.
  - b. Chest Radiograph
    - Pleural effusion
    - Diaphragmatic involvement
    - ARDS
  - c. Ultrasound Abdomen
    - Pancreatic size, echogenicity, calcification or stones, abscess and pseudocysts.
    - Endoscopic ultrasound is more useful than the trans-abdominal ultrasound study.
  - d. CT Scan
    - In acute cases as in trauma, to look at extent of injury to pancreas and other intraabdominal structures.
    - Can identify complications like abscess, hemorrhage, pseudocyst etc.
    - Identify pathology in the hepatobiliary system.
  - e. Magnetic Resonance Cholangiopancreatography (MRCP)
  - f. Useful for delineation of the ductal pattern of the pancreas and also to identify pathology in the hepatobiliary system leading to pancreatitis in the older child. Note, still of limited use in small children and infants.
  - g. Endoscopic Retrograde Cholangiopancreatography (ERCP)
  - h. Persistent/chronic pancreatitis. Limited to therapeutic use in older children.

## VI. THERAPY:

Supportive care and pancreatic rest is still the main stay of therapy.

- Close monitoring of vitals and intake/output.
- Fluid management— maintenance initially as there is extreme third spacing.
- In moderate to severe cases, or vomiting, nasogastric decompression by placement of NG tube and NPO (nothing through the mouth) helps to decrease the pancreatic stimulation during the acute phase of the illness. Mild cases may be started on feeds after a few days.

- Pain management: narcotics may be used and Meperidine is preferable to Morphine as Meperidine (0.75 to 1.0 mg/kg SC or slow IV push every 3 hours as needed) has less effect on the sphincter of Oddi.
- H<sub>2</sub> blockage to prevents pancreatic stimulation in severe cases. Cimetidine (New born : 5 mg/kg/day, > 1month: 20 mg/kg/day)
- Nutritional feeds worth considering first. if oral feeding is not possible, an alternative is TPN (Total parenteral Nutrition).
- Antibiotic prophylaxes in severe cases in which necrotizing pancreatitis is suspected; note, few antimicrobials, such Ceftriaxone 100mg/kg/day, get adequate penetration.
- Therapeutic ERCP: For decompression of pancreatic or common bile duct obstruction/removal of ductal stones, and drainage of certain pseudocysts.
- Interventional radiology/surgery: For abscess and pseudocysts drainage.
- Surgery: Peritoneal lavage, and rarely for salvage in necrotizing/hemorrhagic pancreatitis.

## VII. PROGNOSIS

- The prognosis in children is mostly related to the associated medical condition, though inflammatory complications in other organs may be caused or exacerbated by the inflammatory response from acute pancreatitis.
- The adult criteria to predict outcome of acute pancreatitis (Ranson's criteria) and APACHE-11 are not very useful in children. CT scan changes in severe cases guide management.
- In children, acute pancreatitis may progress to recurrent pancreatitis, and eventually, chronic pancreatitis. These tend to occur in those with structural anomalies of the pancreatic or biliary tree, or hereditary. Many are idiopathic.

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# **ACUTE CHOLECYSTITIS**

*By Prof. Heng Sothy*

## **I- INTRODUCTION**

Cholecystitis is defined as inflammation of the gallbladder and is traditionally divided into acute and chronic subtypes. These subtypes are considered to be 2 separate disease states; however, evidence suggests that the 2 conditions are closely related, especially in the pediatric population. Cholecystitis may also be considered calculous or acalculous, but the inflammatory process remains the same.

## **II- EPIDEMIOLOGY**

Cholecystitis, which has long been considered an adult disease, is quickly gaining recognition in pediatric practice because of the significant documented increase in non-hemolytic cases over the last 20 years. Although gallbladder disease is much rarer in children with 1.3 pediatric cases occurring per every 1000 adult cases, pediatric patients undergo 4% of all cholecystectomies. In addition, acalculous cholecystitis, uncommon in adult, is not that unusual in children with cholecystitis. In adolescence, differences in the frequency of cholecystitis based on race, genetics, and sex become more evident. Adolescent girls are much more at risk of developing the disease than boys. The female-to-male ratio in white adults is 4:1; in adolescents, the ratio is estimated to be 14-22:1.

## **III- AETIOLOGY**

In 90% of cases, acute cholecystitis is caused by gallstones in the gallbladder. Other causes include severe illness and (rarely) tumors of the gallbladder.

Acute cholecystitis occurs when bile becomes trapped in the gallbladder. The buildup of bile causes irritation and pressure in the gallbladder. This can lead to infection and a perforation in the organ. Gallstones occur more often in women than men. Gallstones become more common with age in both sexes. Native Americans and Hispanics have a higher rate of gallstones than most other people.

## **IV- PATHOPHYSIOLOGY**

Gallstones may cause obstruction of the common bile duct, acute or chronic cholecystitis, cholangitis, gallbladder perforation, or pancreatitis. Choledocholithiasis occurs less often in children. Risk increases with age. Nevertheless, obstruction of the common bile duct may still accompany pediatric cholelithiasis, especially in the presence of congenital ductal narrowing or stenosis, and it may cause hepatocyte damage. Rule out common bile duct stones in the presence of any jaundice. Stones may also perforate the gallbladder, allowing bile leakage into the peritoneum, or create a cystoenteric fistula, possibly leading to a gallstone ileus.

The most common complication of gallstones in children is pancreatitis, reported to occur in 8% of cases. The course is usually mild and resolves spontaneously with passage of the stone, which occurs in several days.

Acute infection and inflammation of the gallbladder or ductal system may lead to sepsis or local spread of disease. Perforation, abscess, empyema, infarction, or gangrene may develop in acute cholecystitis, causing peritonitis and threatening the patient's life. Chronic cholecystitis may lead to acute hydrops, acute cholecystitis, or, more insidiously, porcelain gallbladder.

## V- DIAGNOSIS

### 1. Symptoms

The main symptom is **pain** in the upper right side or upper middle of the abdomen. The pain may be sharp, cramping, steady with possible radiation to the scapular region of the back, or pain may be diffuse or localized to the epigastrium.

Other symptoms that may occur include:

- Clay-colored stools
- Fever
- Nausea and vomiting
- Jaundice

### 2. Investigations

#### a. Laboratory finding

- Complete blood count (CBC): In acute cholecystitis, the white blood cell count is elevated, with a predominance of polymorphonuclear cells.
- Laboratory values may be notable for an elevated [alkaline phosphatase](#), amylase and lipase.
- **Bilirubin** is possibly elevated: direct-to-indirect ratio approaching 1:1.
- **CRP** (C-reactive protein) is often elevated.
- **Transaminases** may show mild elevation but not a significant increase, unless obstruction has been severe enough to cause hepatocyte damage.

The degree of elevation of these laboratory values may depend on the degree of inflammation of the gallbladder. Patients with acute cholecystitis are much more likely to manifest abnormal laboratory values, while in chronic cholecystitis the laboratory values are frequently normal.

#### b. Imageries: Imaging tests that can show gallstones or inflammation include:

- Plain Abdominal Radiography: Calcifications representing radiopaque gallstones may be observed in the gallbladder or ductal system.
- Abdominal Ultrasonography: Ultrasonographic findings in acute cholecystitis include a discrete echodensity representing the gallstone, the presence of sludge, and, possibly, ductal anomalies or dilation. The gallbladder may be dilated with thickened walls. Imhof et al. found gallbladder wall thickness of more than 3.5 mm to be a reliable independent diagnostic indicator of cholecystitis.
- MRI and CT scanning: can be used in the diagnosis of cholecystitis, especially in cases in which ultrasonography is not helpful. Ultrasonographic results may be compromised by ileus, surgical incisions, and coexisting diseases, especially those in patients who are critically ill. MRI and CT may be more sensitive than ultrasonography in detecting inflammation within and around the gallbladder. In addition, the presence of other sources of abdominal sepsis are more easily discovered and treated by means of MRI and CT scanning.

**VI- DIFFERENTIAL DIAGNOSIS****Acute cholecystitis**

This should be suspected whenever there is acute right upper quadrant or epigastric pain, other possible causes include:

- Perforated peptic ulcer
- Acute peptic ulcer exacerbation
- Liver abscess
- [Acute pancreatitis](#)
- Acute intestinal obstruction
- Renal colic
- Acute retro-colic appendicitis

**Chronic cholecystitis**

The symptoms of chronic cholecystitis are non-specific, thus chronic cholecystitis may be mistaken for other common disorders:

- Peptic ulcer
- [Hiatus hernia](#)
- [Colitis](#)
- [Irritable bowel syndrome](#)

**VII- TREATMENT****1. Nonsurgical treatment includes:**

- In the emergency room, patients with acute cholecystitis are given fluids through a vein.
- Antibiotics to fight infection: Antibiotics with biliary excretion covering enteric pathogens may be administered to control infection. The combination of ampicillin, gentamicin, and clindamycin is a common and well-accepted regimen.
  - Ampicillin:
    - . 100-400 mg/kg/day IV/IM divided q6hr
    - . 50-100 mg/kg/day PO divided q6hr
  - Gentamicin:
    - . >5 years old: 2-2.5 mg/kg/dose IV/IM q8hr
    - . <5 years old: 2.5 mg/kg/dose IV/IM q8hr
  - Clindamycin:
    - . <1 month old: 15-20 mg/kg/day divided q6-8hr
    - . >1 month old: 20-40 mg/kg/day divided q6-8hr
- Analgesics, such as oral: oxycodone/acetaminophen (Percocet<sup>®</sup>), based on oxycodone component: 0.05-0.15 mg/kg/dose q4-6h prn (as needed). Initial dose based on oxycodone component: 5 mg/dose.
- Low-fat diet (when food can be tolerated).

**2. You may need emergency surgery if you have gangrene, perforation, pancreatitis, or inflammation of the common bile duct.**

**VIII-COMPLICATIONS**

- Empyema (pus in the gallbladder)
- Gangrene (tissue death) of the gallbladder
- Injury to the bile ducts draining the liver (an occasional complication of cholecystectomy)
- Pancreatitis
- Peritonitis (inflammation of the lining of the abdomen)

**IX- PROGNOSIS:** Patients who have surgery to remove the gallbladder usually do very well.

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# LIVER ABSCESS

By Dr. Mey Moniborin

## I. INTRODUCTION

Hepatic abscess is not uncommon problem in children living in poor hygienic conditions in third world countries. The two most common varieties of liver abscess are pyogenic and amebic <sup>(2)</sup>. Pyogenic liver abscess is more common than amebic in children as compared to adults <sup>(3,4,6)</sup>. A review of the literature reveals that *Staphylococcus aureus* is the most common causative organism, followed by *Entamoeba histolytica* <sup>(6)</sup>. Children presenting with liver abscess have variable clinical features like fever, right upper quadrant pain or the features of associated disease and complications. Ultrasound is the main diagnostic tool and in some cases CT scan may be helpful. Treatment of patients is both medical and drainage of abscess, depending upon the size and localization of liver abscess <sup>(2)</sup>.

## II. EPIDEMIOLOGY

Overall, pyogenic liver abscess (PLA) constitutes the majority (80%) of hepatic abscesses in children. The incidence of PLA has been reported to be from 11 in 100 000 admissions to more than 79 per 100 000 pediatric admissions in many countries.. There is a paucity of the literatures regarding the exact incidence of amebic liver abscess (ALA) in children. Studies have suggested that it is rare in children. It has also been mentioned that ALA develops in less than 1% of patients infected with *Entamoeba histolytica*. This is not uncommon in Cambodia - predominantly seen in males <sup>(1,2,6)</sup>.

## III. AETIOLOGY

*Amoebic liver abscess* - *Entamoeba histolytica* is the most frequent cause <sup>(1,5)</sup>.

*Pyogenic liver abscess* - *Staphylococcus aureus*, *Streptococcus pyogenes*, *E. coli*, *Klebsiella*, anaerobic organisms <sup>(1,2,6)</sup>.

## IV. PREDISPOSING FACTORS

Liver abscess is seen often in children with:

- granulocyte dysfunction,
- congenital or acquired immunosuppression,
- congenital anomalies of biliary tract,
- abdominal and skin infection

- helminthic infection,
- protein calorie malnutrition <sup>(6,7)</sup>.

## V. CLINICAL PRESENTATION

- Fever, often with chill,
- right upper quadrant pain(2)
- tender hepatomegaly
- non specific symptoms: weight loss, fatigue, nausea, vomitings, anorexia, unexplained anemia and cough
- A single abscess is often insidious in its presentation while multiple abscesses usually present in a more acute fashion
- Clinical presentations do not distinguish amoebic from a bacterial etiology unless there is an obvious precipitating source for eg. abdominal infections.
- It is uncommon to get a positive history of colitis diarrhea from patients of amebic liver abscesses (2,5,6,7).

## VI. DIFFERENTIAL DIAGNOSIS

- Cholecystitis
- Cholangitis
- Hepatitis
- Right lower lobe pneumonia, or empyema
- Hydatid cyst
- Acute gastritis (2).

## VII. INVESTIGATIONS

- Full blood count - leucocytosis present in both amoebic and pyogenic abscess.
- raised sedimentation rate
- Low hemoglobin most often
- Blood culture, pus culture
- altered liver enzymes
- increased alkaline phosphatase
- prolonged prothrombin time
- indirect hemagglutination antibody titres in blood is sensitive in detecting systemic amoebic infection. Negative amoebic serology points strongly to a pyogenic source of infection.
- Ultrasounds scan and CT scan are highly diagnostic for liver abscess
- Abdominal and chest X-ray: elevated diaphragm +/- right pleural effusion (1,2,7)

## VIII. TREATMENT

### 1- Medication:

A combination of anti-staphylococcal drug like cloxacilline, an anti-anaerobic and anti-amoebic drug like metronidazole and an aminoglycoside or cephalosporin provide a good coverage for liver abscess in children<sup>(7,13)</sup>. Ciprofloxacin is used as an alternative to cephalosporin in case of penicillin anaphylaxis<sup>(12)</sup>.

- 1<sup>st</sup> choice:
  - **Cloxacilline** Children 100 mg/kg/day (IV then oral) in 3-4 divided doses for 10-14 days  
PLUS
  - **Gentamicin** Children 5mg/kg/day IV/IM once daily 5-7 days  
PLUS
  - **Metronidazole** Children 30-50 mg/kg/day in 2-3 divided doses IV (1week

only)

- 2<sup>nd</sup> choice:
  - Ceftriaxone 50-75 mg/kg/day IV for 10-14 days  
PLUS
  - **Cloxacilline** Children 100 mg/kg/day (IV then oral) in 3-4 divided doses for 10-14 days  
PLUS
  - Metronidazole Children 30-50 mg/kg/day in 2-3 divided doses IV (1 week only)

**Then oral treatment should be continued at least for 4 weeks with cloxacilline.**

## 2- Aspiration / percutaneous drainage of abscess:

- *first*, the volume of the abscess is large and there is risk of spontaneous rupture (specially in cases of left lobe LA or abscess > 5cm);
- *second*, after 48-72 hours of medical therapy, there is lack of clinical response along with signs of persistent sepsis;
- *third*, there are clinical or ultrasound features suggestive of enlarged abscess with impending rupture;
- *fourth*, there is evidence of liver failure;
- *fifth*, there is uncorrected primary pathology in critically ill patient as a temporal measure to improve their conditions before surgery (6).

## IX. COMPLICATIONS

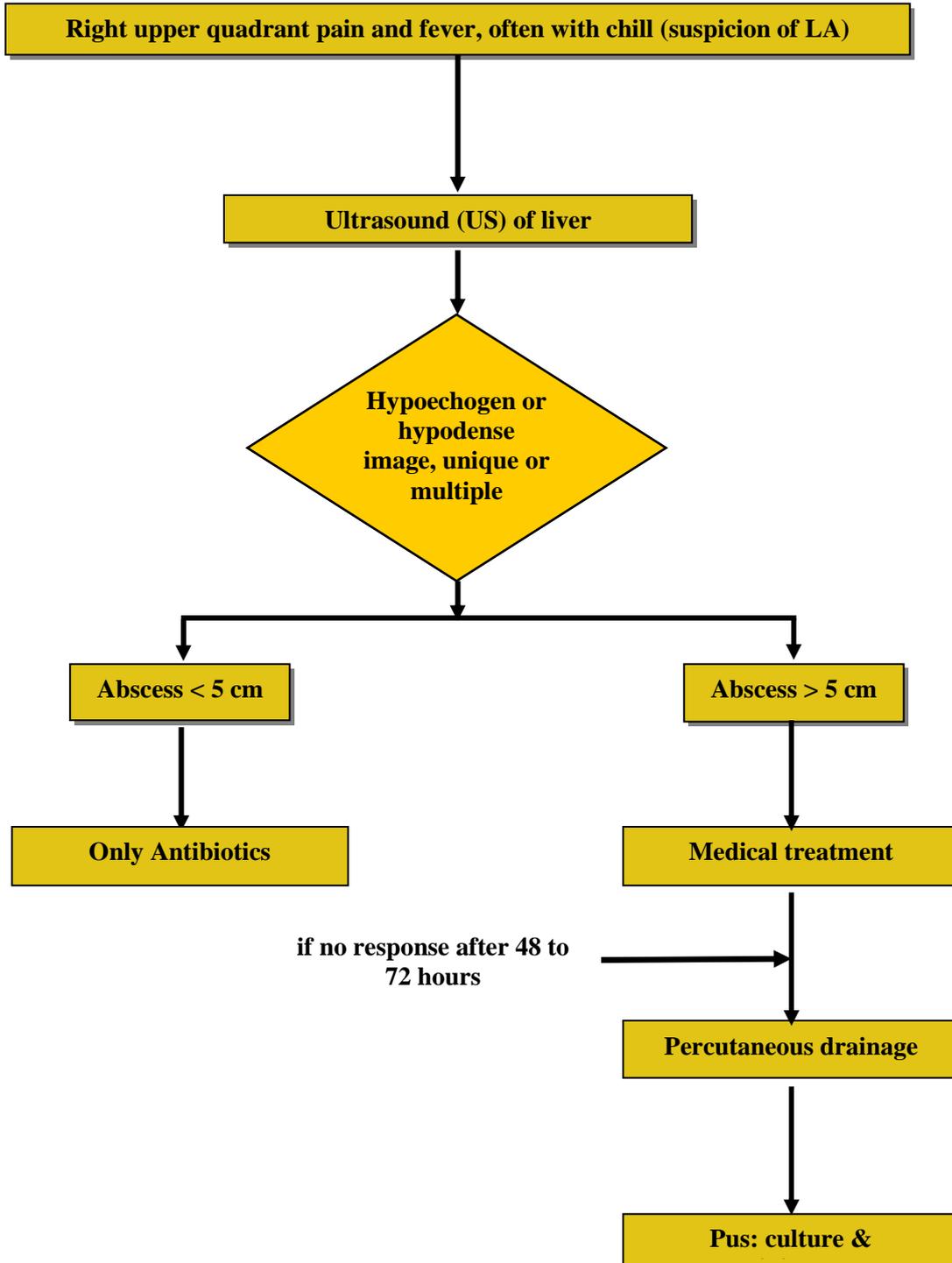
Rupture into peritoneum: signs of peritonitis +/- Shock - refer to surgeons.

- Rupture into pleural space - causes empyema - this needs antibiotic treatment and drainage.
- Rupture into biliary tract (rare)
- Rupture into gastrointestinal tract (stomach, duodenum, intestine and colon) (rare, but more often in children than in adults)
- Rupture pericardium (left lobe abscess): tamponade, urgent drainage.
- Subphrenic abscess
- Septicemia (1, 9,11).

## X. PROGNOSIS

If liver abscess is untreated, the prognosis is fatal because of complications including sepsis, empyema or peritonitis from rupture into the pleural or peritoneal spaces and retroperitoneal extension. The mortality rate of liver abscess cases was as high as 40% until the 1980s. Since then, more potent antibiotics, improvement in imaging techniques with image-guided percutaneous drainage, and appropriate use of surgical intervention have reduced the mortality rate to less than 15%. Jaundice, liver failure, acute abdomen and sepsis, bilirubin levels > 3.5mg/dl, encephalopathy, large volume of abscess, multiple abscesses, and hypoalbuminemia (< 2mg/dl) are indicators of poor prognosis <sup>(6)</sup>.

### Liver Abscess (LA) Algorithm



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# CARDIOVASCULAR DISEASES

1. Hypertention in Children.....	193
2. Valvular Heart Disease.....	198
3. Overview on Congenital Heart Diseases in Infant and Children .....	205
4. Congestive Heart Failure in Children.....	216
5. Pediatric Arrhythmia .....	220

# HYPERTENTION IN CHILDREN

*By Dr. Nget Pises*

## I. INTRODUCTION

Hypertension in children is not so common but becoming more widely recognized as pediatric problem. Blood pressure should be determined at every pediatric visit beginning at age 3 years. <sup>(1)</sup>

## II. DEFINITION

Hypertension is blood pressure exceeding the 90<sup>th</sup> percentile for age, height and weight of the patient (Chart 1) <sup>(2)</sup>. Blood pressure in children must be taken when the child is relaxed and an appropriate –size cuff must always be used. The bladder should be wide enough to equal or exceed two thirds of the length of the upper arm and should be completely encircle the arm. Blood pressure should be obtained at least 3 measurements in separate occasion before diagnose as hypertension <sup>(3)</sup>.

## III. CAUSES

Hypertension can be primary (essential) or secondary. Common secondary causes are:

- 1-Renal cause: Acute glomerulonephritis (AGN), Chronic Renal Failure
- 2-Cardiac cause: Coartation of the aorta
- 3-Renovascular: vasculitis, Neurofibromatosis, Renal artery stenosis
- 4-Endocrine: Cushing disease, Pheochromocytoma, neuroblastoma.
- 5-Neurologic: Increased intracranial pressure, Guillain-Barre syndrome
- 6-Drugs: corticosteroids, illicit drugs (cocaine, phencyclidine), oral contraceptive drugs
- 7-Other: Obesity, burns, traction

## IV. EPIDEMIOLOGY

Primary hypertension is the most common cause hypertension in adolescents and adults. The differences rates of children with hypertension have been reported from 1.2 to 13%, but less than 1% need medication. African American adult have a greater incidence of hypertension. But Secondary hypertension is the most common in infants and younger children represent almost 98%. The most common were renal disease (68%) and endocrine 11% and renovascular diseases 10%.

## V. DIFFERENTIAL DIAGNOSIS

After diagnosis hypertension, the initial objective is to distinguishing primary from the secondary causes. Generally, the younger the child and more elevated the blood pressure measurements are the more likely the cause of hypertension is secondary.

## VI. SIGNS AND SYMPTOMS

### a. History

- Family history: hypertension, heart disease, stroke
- Past medical history: UTI, Umbilical artery line in the newborn
- Medications: Corticosteroids, illicit drugs, Oral contraceptive drugs
- Symptoms: headache, blurry vision, epistaxis, chest pain, weight loss or gain, flushing, rashes
- Trauma: traction

### b. Physical examination

- Blood pressure and pulse should be taken in arm and leg
- Body habitus: thin, Obese, growth failure, turner or Williams syndrome
- Skin: café-au-lait spots, neurofibroma, rashes
- Eyes: fundoscopic changes: papilledema, hemorrhage
- Head: moon facies
- Abdomen: mass, hepatomegaly, bruit

### c. Assess the severity of hypertension

- Severely hypertension: child may have signs of congestive heart failure or hypertensive encephalopathy plus systolic blood pressure >95<sup>th</sup> percentile
- Moderate hypertension: Asymptomatic child with systolic blood pressure >95<sup>th</sup> percentile
- Mild hypertension: Asymptomatic child with systolic blood pressure >90-95<sup>th</sup> percentile

## VII. LABORATORY TEST

- CBC and differences, Serum electrolytes, Urea and creatinine, cholesterol
- Urinalysis, urine culture (if possible)
- Echocardiogram
- Renal ultrasound

## VIII. MANAGEMENT

- Nonpharmacologic treatment: for severe, moderate and mild hypertension
  - Sodium reduction, weight loss, exercise, avoid stimulant medications, diet
- Pharmacologic therapy: For mild- moderate who failed nonpharmacologic treatment and for severe hypertension

**For sever hypertension:** Should send to pediatric hospital for further investigation and management

- First line: - Diuretic
  - Hydrochlorothiazide 1mg/kg/dose PO, bid **or**
  - Furosemide 1-2mg/kg dose IV/PO bid or tid **or**
  - Spironolactone 1-2mg/kg/dose PO, bid- Beta blocker:
  - Propranolol 0.01mg/kg/dose IV slow or 0.5-1mg/kg/day PO q6h-q12h **or**
  - Atenolol 1-2mg/kg/dose PO qd(Contraindicate: Asthma, Heart block and diabetes)
- Second line drugs: one or combine the following
  - Calcium Channel blocker:
    - Nifedipine 0.25-0.5mg/kg/dose PO tid or qid **or**
    - Amlodipine 0.1-.06mg/kg/dose PO qd or bid
  - Angiotensin-converting enzyme (ACE) inhibitors

- Captopril: child 0.15mg/kg/dose bid or tid, adolescent: 25mg (max: 150mg) bid or tid **or**
- Enalapril maleate: child 0.05-0.15mg/kg/dose PO qd or bid (max 40mg/day), adolescent: 2.5-5mg (max 40mg/day) qd or bid
- Angiotensin-receptor antagonist: Losartan 0.75mg/kg/dose qd PO
- Vasodilator: Hydralazine 0.1-0.2mg/kg/dose IM/IV q4h-6h; 0.75mg-3mg/kg/day PO q6h-12h

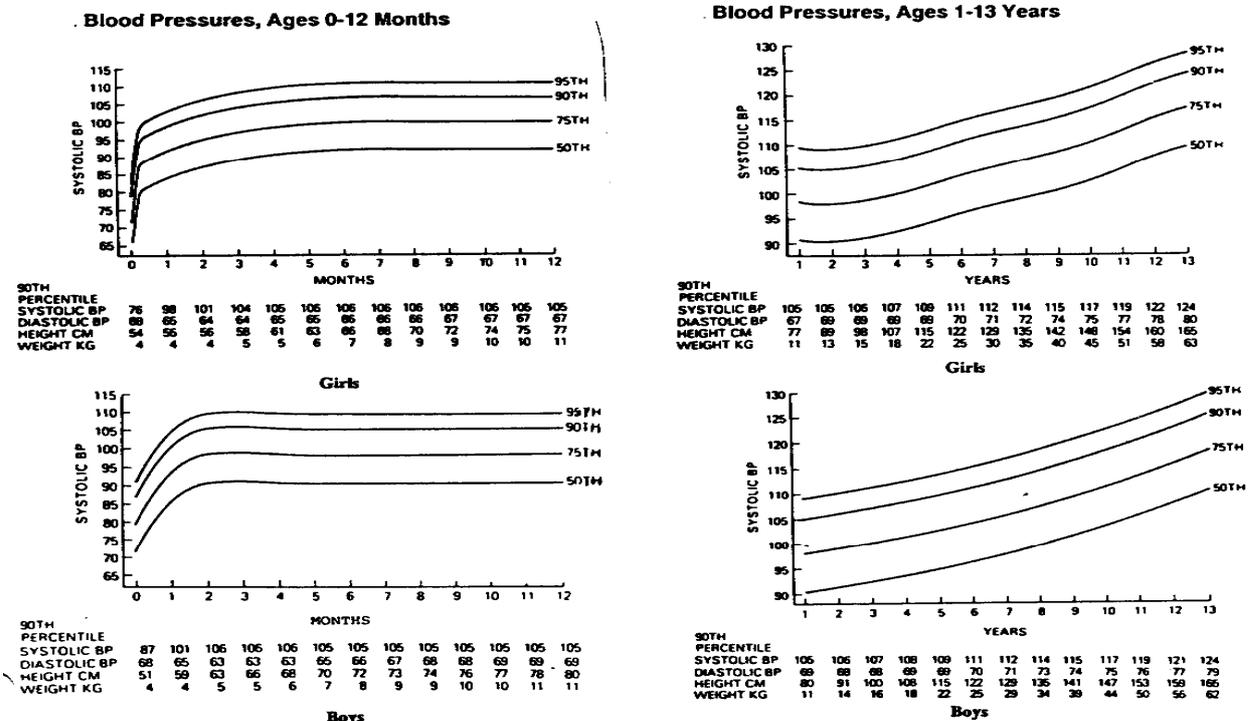
**For moderate hypertension:** Diuretics or Calcium channel blockers or ACE inhibitors, Beta blockers

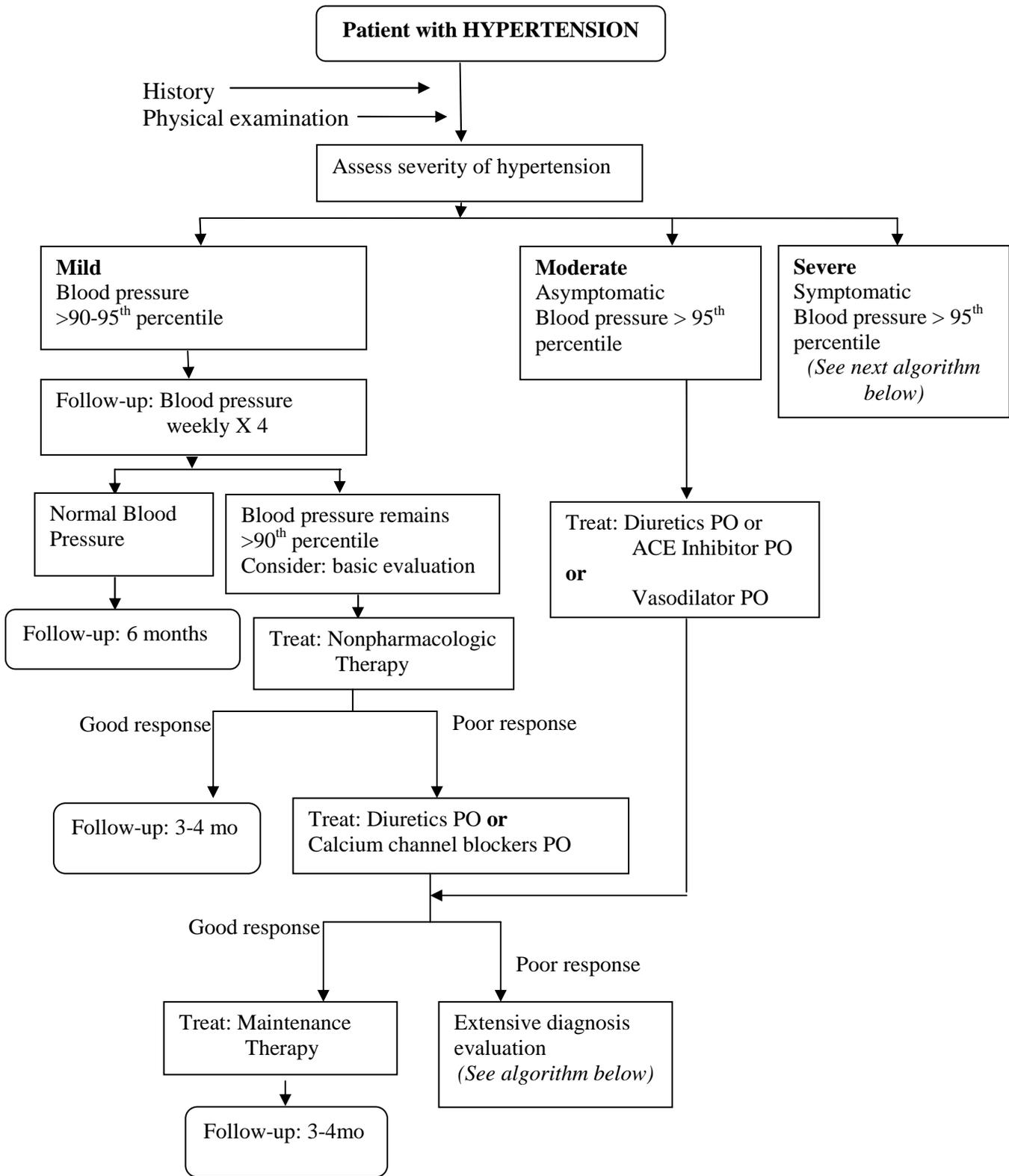
- c. Other specific therapies include surgery: coartation of the aorta, chronic renal failure, dialysis
- d. Monitor Blood Pressure closely during giving medication

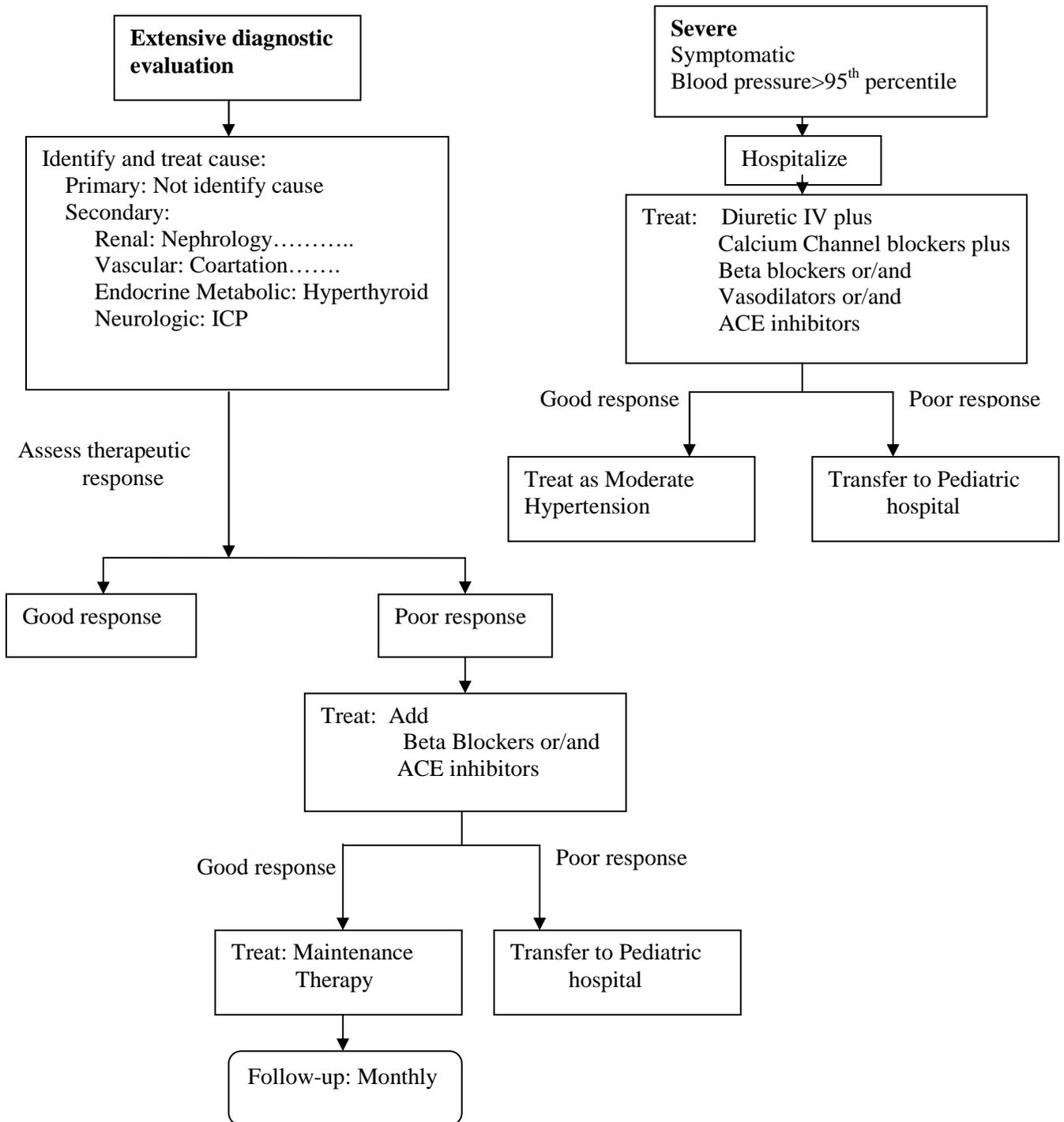
## IX. PATIENT EDUCATION:

Take medication regular can prevent cardiovascular risk in adult

**Chart 1: Blood Pressures Indicating Hypertension**







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# VALVULAR HEART DISEASE

*By Dr. Hav Rathneary*

Valvular Heart Disease (VHD) can be congenital or acquired. The pathophysiology and clinical manifestation are similar for both entities. Almost acquired valvular heart diseases are rheumatic in origin. Mitral stenosis (MS), Mitral regurgitation (MR), and aortic regurgitation (AR) of rheumatic origin are discussed in this chapter.

Diagnosis and evaluation of the severity of VHD should be based on the combined analysis of clinical findings and the results of investigation. Clinical examination plays a major role in the detection of VHD in asymptomatic patients. It is the first step in the diagnosis of VHD and assessment of its severity.

In addition to clinical findings, echocardiography is the key technique to confirm the diagnosis of VHD, as well as to assess its severity and prognosis.

## MITRAL STENOSIS

### I. PREVALENCE

MS of rheumatic origin is rare in children (because it requires 5 to 10 years from the initial attack to develop), it is the most common valvular involvement in adult rheumatic patients. In certain parts of the world where rheumatic fever is prevalent, severe MS occurs in children younger than 15 years of age.

### II. PATHOLOGY

1. In patient with MS due to rheumatic fever, the pathological process causes leaflet thickening and Calcification, fusion of the commissures, chordal fusion, or a combination of these processes. The results a funnel-shaped mitral apparatus in which the orifice of the mitral opening is decreased in size. Interchordal fusion obliterates the secondary orifices, and commissural fusion narrows the principle orifice.
2. The left atrium (LA) and right-sided heart chambers: dilated and hypertrophied.
3. In patients with severe pulmonary venous hypertension, pulmonary congestion and edema, fibrosis of the alveolar walls, hypertrophie of the pulmonary arterioles, and loss of lung compliance result.

### III. CLINICAL MANIFESTATIONS

#### A. History

1. Mild MS are asymptomatic
2. Dyspnea with or without exertion is the most common symptom. Orthopnea, nocturnal dyspnea, or palpitation, cough, hemoptysis

#### B. Physical Examination

1. An increased right ventricular impulse is palpable along the sternal border. Peripheral pulses may be weak, with narrow pulse pressure. Neck veins are distended if right-sided heart supervenes.
2. A loud S1 at the apex and narrowly split S2 with accentuated P2 (pulmonary regurgitation) are audible if pulmonary hypertension is present. An opening snap (a short snapping sound accompanying the opening of the mitral valve) is followed by low-frequency mitral diastolic rumble at the apex. A crescendo presystolic murmur may be audible at the apex. Occasionally, a high-frequency diastolic murmur of pulmonary regurgitation is present at the upper left sternal border.

#### C. Electrocardiography

Right axis deviation, left atrial hypertrophy (LAH), and right ventricular hypertrophy (RVH), cause by pulmonary hypertension, are common. Atrial fibrillation is rare in children.

#### D. X-ray Studies

1. The left atrium and right ventricle are usually enlarged, and the main pulmonary artery segment is usually prominent.
2. Pulmonary venous congestion, interstitial edema shown as Kerley's B line, and redistribution blood flow (with increased pulmonary vascularity) to the upper lobes

**E. Echocardiography.** Echo is the most accurate noninvasive tool for the detection of MS

### IV. NATURAL HISTORY

- Most children with MS are asymptomatic but become symptomatic with exertion. Recurrence of rheumatic fever worsens the stenosis.
- Atrial flutter or fibrillation and thromboembolism are rare in children.
- Subacute bacterial endocarditis (SBE) can occur, but rare.
- Hemoptysis (rupture of small vessels in the bronchi  $\leq$  long-standing pulmonary venous hypertension).
- Symptomatic patients have poor prognosis.

### V. MANAGEMENT

#### A. Medical

- Good dental hygiene and antibiotic prophylaxis against SBE.
- Penicillin prevents recurrence of rheumatic fever.
- Varying degrees of restriction of activity.
- Atrial fibrillation (chronic AF): anticoagulant therapy with a target INR in the upper half of the range 2-3 is indicated in patients with either permanent or paroxysmal AF (warfarin) to reduce the incidence of thromboembolism..

**Percutaneous Mitral balloon valvotomy** is effective for symptomatic patients (NY HA functional class II, III, or IV), with moderate or severe MS.

**B. Surgical: is only alternative when percutaneous mitral balloon valvotomy is contraindicated.**

**a. Indication :**

- Symptomatic patient (dyspnea on exertion, pulmonary edema, paroxysmal dyspnea).
- Recurrence atrial fibrillation, thromboembolic phenomenon, hemoptysis.
- Procedure and mortality
- Close mitral valve commissurotomy has been replaced by open-heart mitral commissurotomy using cardiopulmonary bypass.
- Valve replacement (Prothetic valve or bioprostheses) may be indicated in patient with calcified valves and those with MR. Operative mortality ranges between 3 and 10%.

**b. Complications**

- Postoperative congestive heart failure (CHF) is the most common cause of early postoperative death.
- Atrial embolization is a rare complication.
- Bleeding diathesis is possible with anticoagulation therapy for an implanted prosthetic valve.

**c. Post operative Follow-up**

- Regular checkup (every 6 to 12 month) for the repaired or replaced valve=> echo and Doppler studies.
- For prothetic valve: anticoagulated with warfarin (Coumadin, po: initial:1-3 mg/day for 2-4 days in evening, daily PT determination, maintenance: 1-5 mg/day one a day(tab: 2, 5mg )), the patient prothrombin time should be maintaint at 2.5 to 3.5 international normalized ratio (INR).
- Dental hygiene instituting prophylaxy.

**Regiments for a Dental Procedure**

		Regiments: Single dose 30 to 60 min Before procedure	
Situation	Agents	Adults	Children
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Amoxicillin	2 g IM or IV	50 mg/kg IM or IV
	OR		
Allergic to penicillins or ampicillin-oral	Cefazolin or ceftriaxone	1 g IM or IV	50 mg/kg IM or IV
	Cefalexin	2 g	50 mg/kg
	OR		
	Clindamycin	600 mg	20 mg/kg
Allergic to penicillin or ampicillin and unable to take oral medication	OR		
	Azithromycin or clarithromycin	500 mg	15 mg/kg
	Clindamycin	600 mg IM or IV	20 mg/kg IM or IV

This table corresponds to table 7 in the ACC/AHA VHD Guidelines: 2008 Focused Update Incorporated on Valvular Heart Disease.

## MITRAL REGURGITATION

### I. PREVALENCE

MR is the most common valvular involvement in children with rheumatic heart disease.

### II. PATHOLOGY

- Mitral valve leaflets are shortened because of fibrosis.
- When the degree of MR increases, dilatation of the left atrium (LA) and the left ventricle (LV) results, and the mitral valve ring may become dilated.

### III. CLINICAL MANIFESTATIONS

#### A. History

- Patients are usually asymptomatic during childhood.
- Rarely, fatigue ( $\leq$  reduced forward cardiac output), palpitation ( $\leq$  atrial fibrillation).

#### B. Physical Examination

- Severe MR: hyperdynamic apical impulse is palpable.
- A regurgitant systolic murmur starting with S1, grade 2-4/6 at the apex, transmission to the left axilla.

#### C. Electrocardiography

- ECG is normal in mild cases.
- Left ventricular hypertrophy (LVH) or LV dominance, with or without LAH, is usually present.
- Atrial fibrillation is rare in children but often develops in adults.

#### D. X-ray studies

- The LA and LV are enlarged to varying degrees.
- Pulmonary vascularity usually is within normal limits, but pulmonary venous congestion pattern may develop if CHF supervenes.

#### E. Echocardiography

- Two-dimensional echo : dilated LA and LV, and the degree of dilatation is related to the severity of MR.
- Color flow mapping of the regurgitant jet into the LA and Doppler studies can assess the severity of the regurgitation.

### IV. NATURAL HISTORY

- Patients are relatively stable for a long time.
- Infective endocarditis is rare complication.
- LV failure and consequent pulmonary hypertension may occur in adult life.

### V. MANAGEMENT

#### A. Medical

- Preventive measures against SBE and prophylaxis against recurrence of rheumatic fever are important.
- Activity need not be restricted in most mild cases.
- Afterload-reducing agents are useful in maintaining the forward cardiac output, Vasodilator: Captopril (Lopril,<sup>R</sup> tab: 25mg), infant-0.5-0.6 mg/kg/day in 1-4 doses; child-12.5 mg/dose 1-2 times/day .

- Anticongestive therapy is provided if CHF develops (management of CHF) : Diuretic (Furosemide iv: 0.5-2 mg/kg/dose 2-4 times/day, po: 1-2 mg/kg/dose 1-3 times/day (Lasix<sup>R</sup>, tab: 20,40 mg, inj: 10 mg/ml (2ml)) and/or Spironolactone, po: 1-3 mg/kg/day in 1-3 doses (Aldactone<sup>R</sup>, tab: 25,50 mg) and.
- Atrial fibrillation (management of atrial fibrillation)

## B. Surgical

- Indication.** CHF, progressive cardiomegaly with symptom, and pulmonary hypertension may be indication. In adults, an LV diastolic dimension of 60 mm => mitral valve replacement.
- Procedure and mortality.** Mitral valve repair or valve replacement is performed under cardiopulmonary bypass.
- Complications** are similar to those list for MS.
- Postoperative follow-up.**
  - o Valve function, check by echo and Doppler studies every 6 to 12 months.
  - o Prosthetic valve: anticoagulant with warfarin (Coumadin),po: initial:1-3 mg/day for 2-4 days in evening, daily PT determination, maintenance: 1-5 mg/day one a day(tab: 2, 5mg). The patient's prothrombin time should be maintained at 2.5 to 3.5 INR.
  - o Dental hygiene and SBE prophylaxis.

## AORTIC REGURGITATION

### I. PREVALENCE

AR is less common than MR. Most patients with AR have associated mitral valve disease.

### II. PATHOLOGY

Semilunar cusps are deformed and shortened, and the valve ring is dilated so that cusps fail to appose tightly. The commissures usually are fused to a varying degree.

### III. CLINICAL MANIFESTATIONS

#### 1. History

- Mild regurgitation: asymptomatic.
- Exercise tolerance is reduced with more severe AR or CHF.

#### 2. Physical Examination

- The precordium may be hyperdynamic with a laterally displaced apical impulse. A diastolic thrill occasionally is present at the third left intercostal space. A wide pulse pressure and a bounding water-hammer pulse may be present with severe AR.
- Auscultation: the S1 is decreased in intensity. The S2 may be normal or single. A high-pitch diastolic decrescendo murmur, best audible at the third or fourth left intercostal space. The longer the murmur, the more severe the regurgitation.

#### 3. Electrocardiography

- The ECG may be normal in mild cases.
- Severe cases, LVH, LAH may be present in long-standing cases.

#### 4. X-ray studies

Cardiomegaly involving the LV is present. A dilated ascending aorta and a prominent aortic knob frequently are present. Pulmonary venous congestion develops if LV failure supervenes.

#### 5. Echocardiography

The LV dimension is increased, LA remains normal in size. The LV diastolic dimension is proportional to the severity of AR. Color flow and Doppler examination can aid estimating the severity of the regurgitation.

#### IV. NATURAL HISTORY

- Patients remain asymptomatic for a long time, but once symptoms begin to develop, many patients deteriorate rapidly.
- Anginal pain, CHF, and multiple premature ventricular contractions are unfavorable signs.
- Infective endocarditis is rare.

#### V. MANAGEMENT

##### A. Medical

- Oral hygiene and antibiotic prophylaxis against SBE.
- Prophylaxis should be continued against the recurrence of rheumatic fever with penicillin.
- Activity need not be restricted in mild cases, but varying degrees of restriction are indicated in more severe cases.
- When used on a long-term basis, the angiotensin-converting enzyme inhibitor captopril has been shown to reduce (or even reverse) the dilatation and hypertrophy of the LV in children with AR but without CHF.
- Treatment CHF.

##### B. Surgical

- a. **Indications.** A major clinical decision in AR is the timing of aortic valve replacement.
  - Symptoms: angina pain or dyspnea on exertion.
  - Even in asymptomatic patients, cardiomegaly, ejection fraction <40%, or stress-test-induced symptoms may be an indication.
- b. **Procedure and Mortality:** Aortic valve replacement is performed under cardiopulmonary bypass. The mortality rate is about 2% to 5%.
  - The antibiotic-sterilized aortic homograft has been widely used.
  - The porcine heterograft has the risk of accelerated degeneration.
  - The St. Jude prostheses (prosthetic mechanical) require anticoagulation therapy and are less suitable for young patients.
  - A pulmonary root autograft (Ross procedure) may be an attractive in selected adolescents and young adults.
- a. **Complications**
  - Postoperative acute cardiac failure is the most common cause of death.
  - Thromboembolism, chronic hemolysis, and anticoagulant-induced hemorrhage may occur with prosthetic valve.
  - Porcine valves tend to develop early calcification in children.
  - Prosthetic valve endocarditis is rare.
- b. **Postoperative Follow-up**
  - Regular follow-up of valve function should be done every 6 to 12 months by echo and Doppler studies.
  - Patients with prosthetic valve: warfarin (INR should be maintained at 2.5 to 3.5).
  - Good oral hygiene and antibiotic prophylaxis against SBE.

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# OVERVIEW ON CONGENITAL HEART DISEASES IN INFANT AND CHILDREN

By Dr. Nget Pises

## I. INTRODUCTION

Congenital heart disease (CHD) in children is not uncommon in paediatric population. CHD accounts for 0.5-0.8% of live birth and the incident is higher in premature infants but this does not include PDA in premature baby, mitral valve prolapse and bicuspid aortic valves<sup>(1)</sup>. All most 33% to 55% of these defects are critical and need intervention in the first year of life<sup>(3)</sup>.

## II. DEFINITION

Congenital heart disease is defined as the structural, functional or positional defect of the heart in isolation or in combination, present from birth, but may be manifest at any time after birth and may not manifest at all.<sup>(2)</sup>

Congenital heart disease remains a major problem for doctor to make diagnosis and counseling the patients and family as we do not have enough facility to deal with this problem.

## III. CAUSES

The most common cause of CHD is unknown. The most cases of CHD are from multifactorial and the result of combination of genetic disposition and environmental factors such as trisomy 21, 13 and 18 and turner syndrome<sup>(1,2)</sup>.

Inheritance: a few family reports on ASD, Supra valvular aortic stenosis, cardiomyopathy.

Chromosome abnormalities: present 5% of CHD. (Table 1)

Environmental factors: maternal viral infection, maternal drugs consumption (Table2)

## IV. CLINICAL PRESENTATION AND DIAGNOSIS

Due to variety of CHD, clinical presentations are depended on types of CHD, age of the patients. Some patients present with cyanosis or heart failure or combination of both, heart murmur, stridor, circulatory shock, hypercyanotic spells, respiratory tract infections and failure to thrive.

The diagnosis is based on several clinical findings, ECG, chest x-ray, echocardiography, cardiac catheterization, cineangiography and cardiac MRI.

### Classifications of common structural congenital heart disease: 2 types

1-Cyanotic Heart Disease

2-Acyanotic Heart Disease

## 1. CYANOTIC HEART DISEASE

Some defect related to increase pulmonary blood flow (PBF) and some decrease pulmonary blood flow.

- Tetralogy of Fallot (TOF)
- Transposition of Great Arteries (TGA)
- Total Anomalous Pulmonary Venous Return (TAPVR)
- Tricuspid Atresia (TA)

### **A-Tetralogy of Fallot (TOF)**

- 10% of all CHD
- Large VSD, Right Ventricular outflow tract obstruction, Right ventricular Hypertrophy (RVH), and Overriding aorta

### **Clinical manifestations:**

- Most patients with cyanosis, hypoxic spells
- Some infant with acyanotic, asymptomatic
- Cyanosis gets worse as the child grows and exercise
- Degree of cyanosis depend on the degree of right ventricular outflow tract (RVOT) obstruction
- If mild Pulmonary stenosis, there will be acyanosis
- Increase Pulmonary obstruction, there will be cyanosis
- Loud systolic ejection murmur at left mid sternal border and left lower sternal border
- Single S2 with/without thrill at the left mid sternal border and left lower sternal border
- Cyanotic spells occurs in young infants as RVOT obstruction increase or systemic resistance decrease, so right to left shunt increase across the VSD. Child may present with tachypnea, increase cyanosis and decreasing murmur.

### **Electrocardiography (ECG):**

- Right axis deviation (RAD)
- Right ventricular Hypertrophy (RVH)

### **Chest X-ray:**

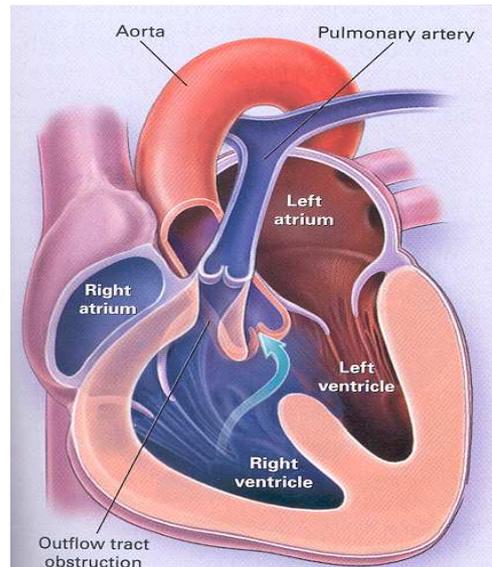
- Boot-shaped heart with normal heart size with/without decreased pulmonary vascular marking

### **Echocardiography:**

- Large VSD and overriding of the aorta
- Anatomy of pulmonary obstruction and right ventricular hypertrophy

### **Treatment:**

- Medical treatment:
  - Treat hypoxic spells:
    - The infant should be picked up and held in a knee chest position.
    - Oxygen supply
    - Morphine 0.1-0.2mg/kg/dose IV, IM or SC
    - Propranolol 0.01 to 0.25mg/kg IV or PO q6h to treat and prevent hypoxic spell.
    - NaHCO<sub>3</sub> 1mEq/kg IV If acidosis. Can repeat every 10-15mn
  - Prophylaxis treatment: Subacute Bacterial Endocarditis (SBE) is strongly needed
- Surgical treatment: Arrange for surgery at heart center.



### **B-Transposition of Great Arteries (TGA)**

- 5% of all CHD, Male more common than Female.
- Aorta arise from Right Ventricle, Pulmonary artery rise from Left Ventricle
- Associated lesions: ASD or VSD or PDA

#### **Clinical manifestations:**

- History of cyanosis from birth
- Signs of congestive heart failure with dyspnea and feeding difficulties.
- Nonspecific finding
- Extreme cyanosis does not response to oxygen therapy
- No murmur unless associated VSD or PS
- Loud, Single S2

#### **Electrocardiography:**

- Right Ventricular Hypertrophy (RVH)
- Combine Ventricular Hypertrophy (CVH)
- Right Axis Deviation (RAD)(+90 to +200degree)

#### **Chest X-ray:**

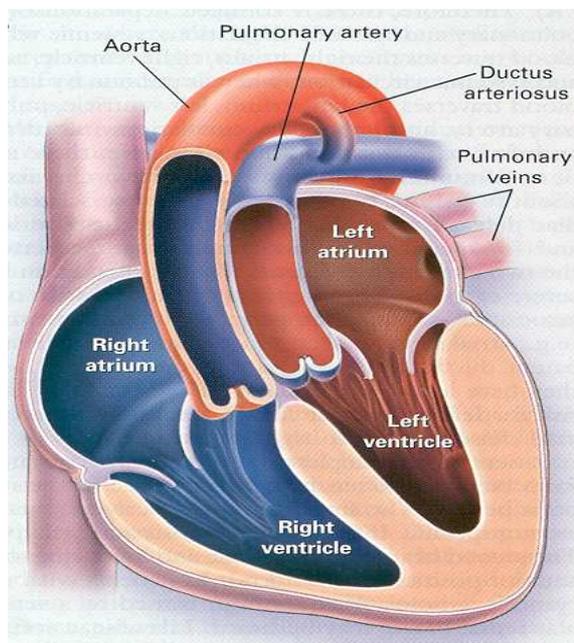
- Classic finding: Egg-shaped
- Cardiomegaly with increased pulmonary vascular marking

#### **Echocardiography:**

- Pulmonary artery (PA) is posterior and more aorta is anterior
- Aorta arise from the right ventricle and PA arise from left ventricle
- Associated lesions

#### **Treatments:**

- Medical management:
  - Anti-heart failure should be given
  - Prostaglandin E1 infusion 0.05-0.1mcg/kg/mn temporary help waiting for surgery
  - Oxygen supply
  - Prophylaxis treatment: SBE is strongly needed
- Surgical treatment is an option but palliative care is suggested.



### **C-Total Anomalous Pulmonary Venous Return (TAPVR)**

-1% of all CHD

-All Pulmonary veins connect anomalously to the right atrium directly or indirectly

-Patient must have ASD or PFO to survive

-There are 4 basic types:

1-Supracardiac: Pulmonary veins connected to Superior vena cava is the most common

2-Cardiac: pulmonary veins connected to Coronary sinus or Right Atrium

3-Subdiaphragmatic/infracardiac: Pulmonary veins connected to inferior vena cava or Portal vein, hepatic vein

4-Mixed: Pulmonary veins connect to 2 or more above the connection.

#### **Clinical manifestations:**

-Clinical presentation depend on obstruction or un-obstruction of pulmonary venous return

-Unobstructed form: similar large ASD, growth retardation, recurrent chest infections, mild cyanosis from birth, mild signs of CHF in the first year of life, mild cyanosis, precordial bulge with hyperactive RV Impulse, S2 widely split and fixe at upper left sternal border and mid diastolic murmur at lower left sternal border.

-Obstructed form: severe heart failure and/or cyanosis, respiratory distress, tachypnea (usually present in the first year of life), Loud and single S2 and gallop rhythm, no heart murmur.

#### **Electrocardiography:**

-Right axis deviation (RAD).

-Right atrial hypertrophy (RAH) and Right ventricular hypertrophy (RVH).

#### **Chest X-ray:**

-Unobstructed form: mild cardiomegaly with increased PVM.

-Obstructed form: no cardiomegaly but pulmonary edema, snowman sign.

#### **Echocardiography:**

-Right ventricular overload, small Left atrium, pulmonary artery dilatation.

-Present ASD or PFO (Patent Foramen Ovale).

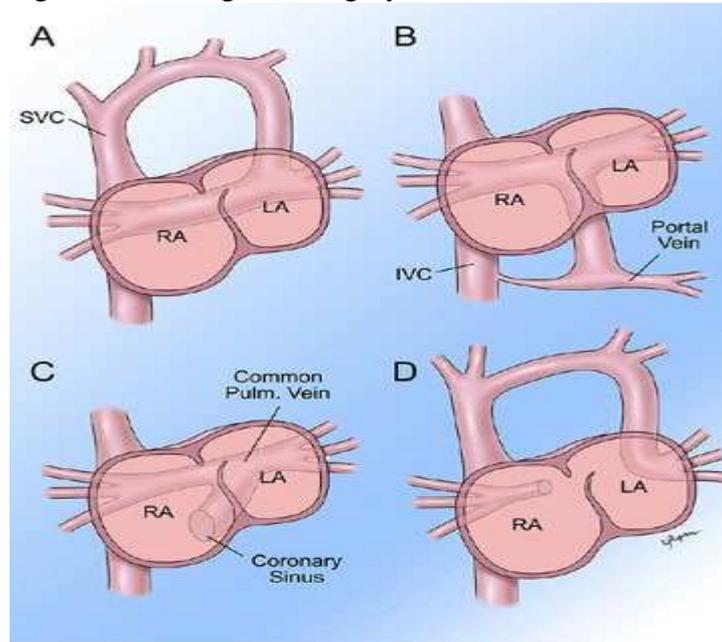
-Color flow shows pulmonary veins connection anomalously and increase flow velocity in the Pulmonary artery.

#### **Treatment:**

-Medical:

- Anti-heart failure medication is temporary helpful.
- Prophylaxis treatment: SBE is strongly needed.

-Surgical management: Arrange for surgery at heart center



#### **D-Tricuspid Atresia (TA)**

-1%-3% of all CHD

- Absent of tricuspid valve and hypoplastic of the Right Ventricle and Pulmonary Atresia.
- ASD or VSD or PDA must present to survive.

#### **Clinical manifestations:**

- Severe Cyanosis from birth, tachycardia, poor feeding.
- Cyanotic spell may be present in infant.
- Cyanotic with/without clubbing.
- Single S2, systolic murmur grade 2-3/6 at Left Lower Sternal border (LLSB) if VSD present or PDA continuous murmur.

#### **Electrocardiography:**

- Superior QRS axis
- Right atrial enlargement (RAE) or Combine atrial enlargement (CAE) and Left ventricular enlargement (LVE).

#### **Chest X-ray:**

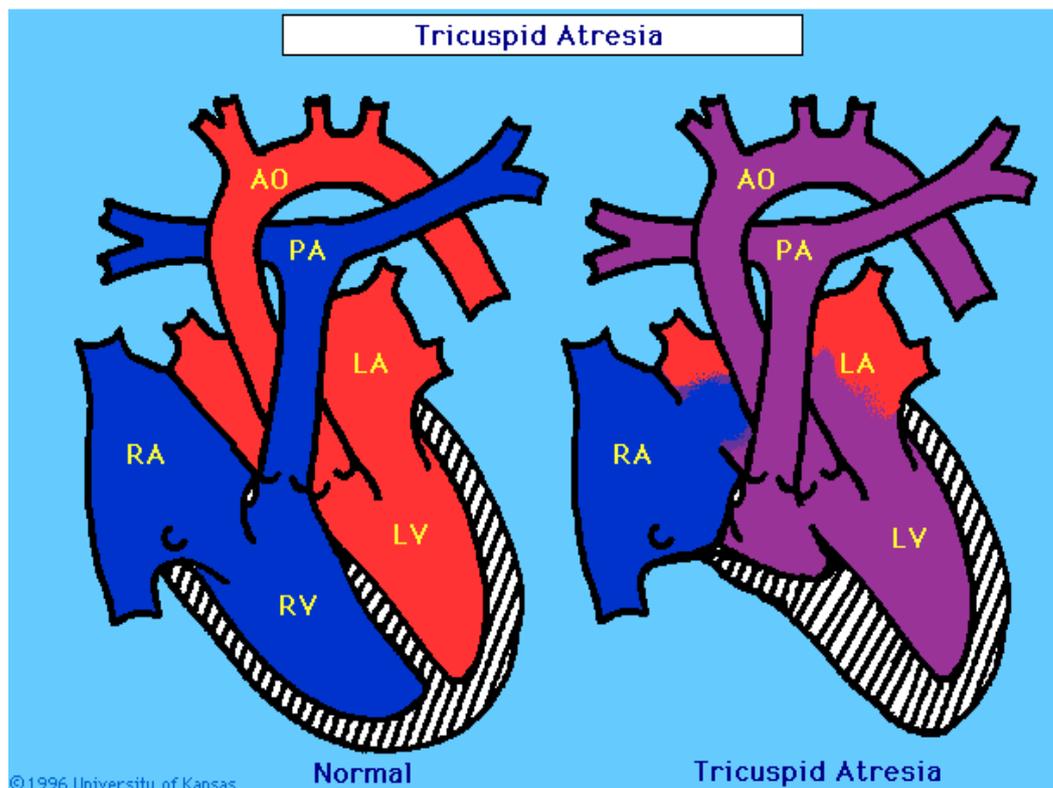
- Normal or slightly cardiomegaly.
- May be have boot-shape or decrease pulmonary vascularity.

#### **Echocardiography:**

- Absence of the tricuspid orifice, marked hypoplastic of the right ventricle and large left ventricle.
- Bulging of the atrial septum toward the left.

#### **Treatment:**

- Medical treatment:
  - Anti-heart failure treatment is not help.
  - Prophylaxis treatment: SBE is strongly needed
- Surgical management: Palliative care is an option in our situation.



## 2. ACYANOTIC HEART DISEASES

- Ventricular Septal Defect (VSD)
- Atrial Septal Defect (ASD)
- Patent Ductus Arteriosus (PDA)
- Coarctation of the Aorta (CoA)
- Atrioventricular septal defect (AVSD)

### A-Ventricular Septal Defect (VSD):

- 15%-25% of all CHD.
- Following pathology, divided as 4 types:
  - 1-Membranous VSD
  - 2-Inlet VSD
  - 3-Outlet (infundibular) VSD
  - 4-Muscular (trabecular) VSD

### Clinical manifestations:

- Small VSD (<5mm or 1/3 aortic diameters): asymptomatic child-spontaneous closure occurs 40-50% by 3 years of age. Holosystolic murmur grade 3/6-6/6 at Left Lower Sternal border (LLSB) and thrill at LLSB and sound S2 and P2 are normal.
- Moderate VSD (5-10mm or 1/3-3/4 of aortic diameter): asymptomatic, mild symptomatic, rarely congestive heart failure and/or recurrent pulmonary infection.
- Large VSD (>10mm or 3/4 of aortic diameter): signs of congestive heart failure at age of 2-3 months with failure to grow and repeated pulmonary infections. Classic holosystolic murmur grade 3/6-6/6 at LLSB and thrill at LLSB. Diastolic rumble may be heard at apex. Sound S2 split is narrowing; increased P2 and ejection click at ULSB as signs of pulmonary hypertension.

### Electrocardiography (ECG):

- Small VSD: Normal.
- Moderate VSD: Left ventricular hypertrophy with/without left atrial hypertrophy
- Large VSD: Left atrial enlargement and biventricular enlargement.

-Right ventricular enlargement- pulmonary vascular obstructive disease.

**Chest X-ray:**

- Small: normal.
- Moderate to Large: mild to severe Cardiomegaly with increased pulmonary vascular marking to pulmonary congestion.

**Echocardiography:**

- Subcostal view: just below the aortic root- Membranous VSD.
- Short axis view: showing Muscular VSD.
- Short axis view: at 12 to 3 a clock-Outlet VSD.
- Apical or subcostal four chamber view beneath the Atrio-ventricular valves- Inlet VSD.

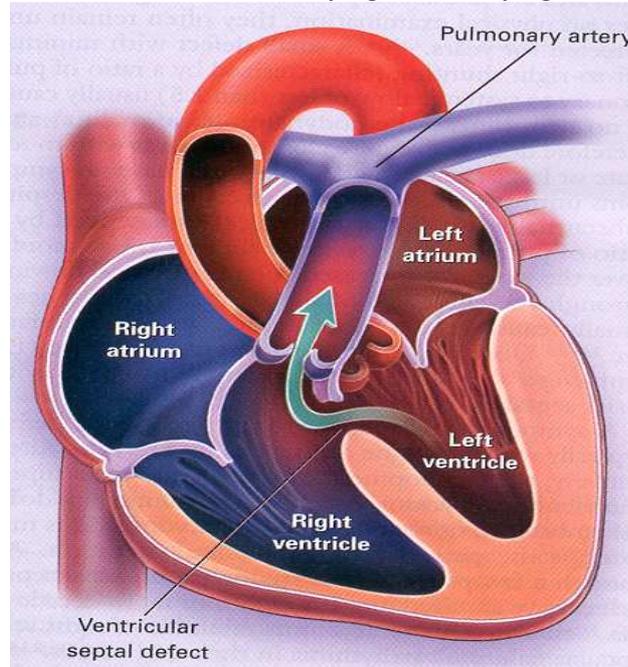
**Treatment:**

- Medical:

- Anti-heart failure is helpful temporary.
- Prophylaxis treatment: for isolated VSD no SBE needed.

-Surgery:

- Small VSD: no surgery if not associated with Aortic regurgitation.
- Moderate to severe: indicate at any age but early age is better.



**B-Atrial Septal Defect (ASD):**

-5%-10% of all CHD

-Following pathology, divided as 3 common types:

- 1-Secundum ASD (most common type)
- 2-Primum ASD
- 3-Sinus Venosus ASD

**Clinical manifestations:**

- Small ASD: <5mm
- Moderate ASD: 5-8mm
- Large ASD: >8mm
- Usually asymptomatic
- Well growth

-Wide, fixed split S2 with systolic ejection murmur grade 2/6-3/6 at Left Upper sternal border (LUSB). This murmur may be absent in infant, even infant who have a large defect.

**Electrocardiography:**

-Small ASD: Normal.  
-Large ASD: right axis deviation and mild right ventricular hypertrophy or with right bundle branch block (RBBB) with rsR' pattern in V1.

**Chest X-ray:**

-May show cardiomegaly with enlargement of Right ventricle (RV) and right atrium (RA).  
-A prominent pulmonary artery (PA) with increased pulmonary vascular marking.

**Echocardiography:**

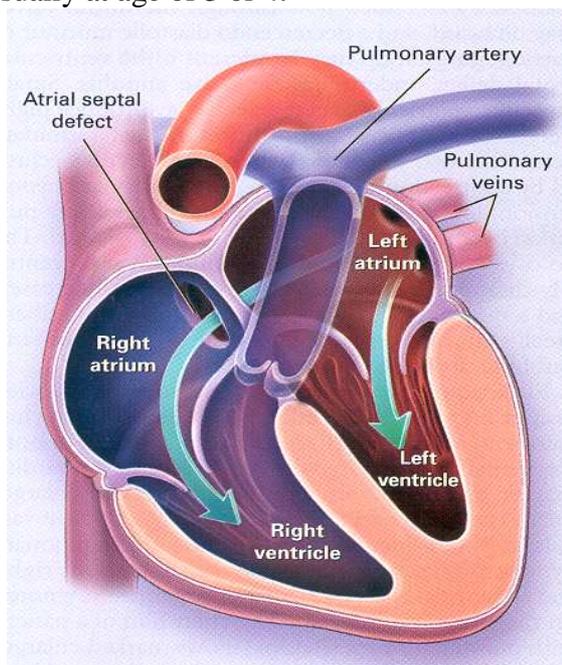
-Subcostal four-chamber view: can see all types.  
-Apical four-chamber view: can see dilatation of RV, RA.

**Treatment:**

-Medical treatment:

- Anti-heart failure is helpful temporary.
- Prophylaxis: no SBE needed.

-Nonsurgical closure: device closure for secundum ASD.  
-Surgical closure: usually at age of 3 or 4.



**C-Patent Ductus Arteriosus (PDA)**

-5-10% of all CHD, 40-60% in very low birth weights infants.  
-Persistent patency of a normal fetal structure between the left Pulmonary artery and the descending aorta, about 5-10mm distal to the origin of the left subclavian artery.

**Clinical manifestations:**

-Small PDA usually asymptomatic.  
-Large PDA: recurrent lung infection, lungs atelectasis and CHF including failure to growth.  
-Tachycardia and dyspnea on exertion in children with large PDA.  
-Continuous "machinery" murmur grade 1-4/6 loudest at LLSB. Bounding pulses with Wide pulse pressure.

**Electrocardiography (ECG):** similar to those of VSD

- Small –moderate PDA: Normal or LVH
- Large PDA: Biventricular Hypertrophy (BVH)

**Chest X-ray:** similar to those of VSD

- Small PDA: normal
  - Moderate-Large PDA: varying degree of cardiomegaly LVH, LAH and ascending aorta.
- Increased Pulmonary Vascular Markings

**Echocardiography:**

- Can be seen in high parasternal view or a suprasternal notch.

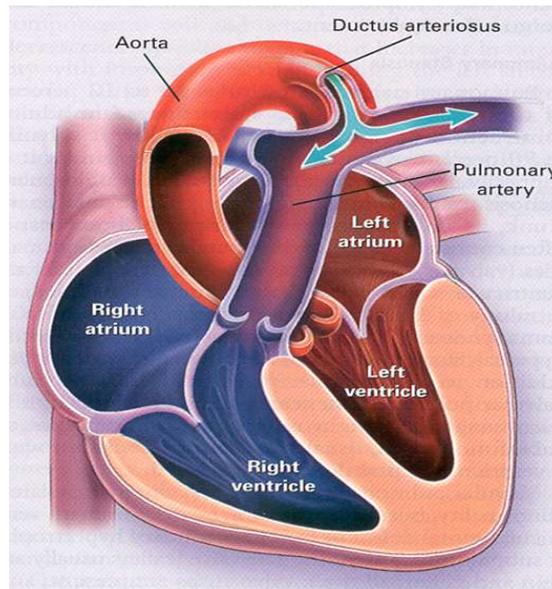
**Treatment:**

-Medical treatment:

- Ibuprofen 10mg/kg/dose IV or PO X1 then 5mg/kg/dose x2 doses after 24 and 48hr for total 3 doses.
- Prophylaxis treatment: SBE is indicated if associated.
- No exercise restriction if no pulmonary hypertension.

-Nonsurgical closure: Catheter closure with differences devices has been used.

-Surgical Closure: can perform any time at any age unless there is severe pulmonary hypertension.



**D-Coarctation of the Aorta (CoA):**

- 8%-10% of all CHD, Male>Female
- Narrowing of aorta almost in juxtaductal position.
- May present as infant in CHF, as child with hypertension, as murmur.
- vary from no murmur to Systolic ejection murmur at the LUSB radiating to the left interscapular area depend on the severity of coarctation and association lesion.
- Associated with Bicuspid aortic valve: systolic ejection click at apex and RUSB.
- BP in lower extremities will be lower than in upper extremities
- Neonate: severe CHF, poor peripheral perfusion, metabolic acidosis, oliguria.
- Children: frequently asymptomatic, weak or absent femoral pulses.

**Electrocardiography:**

- In infancy: RVH
- in older children: LVH

**Chest X-ray:**

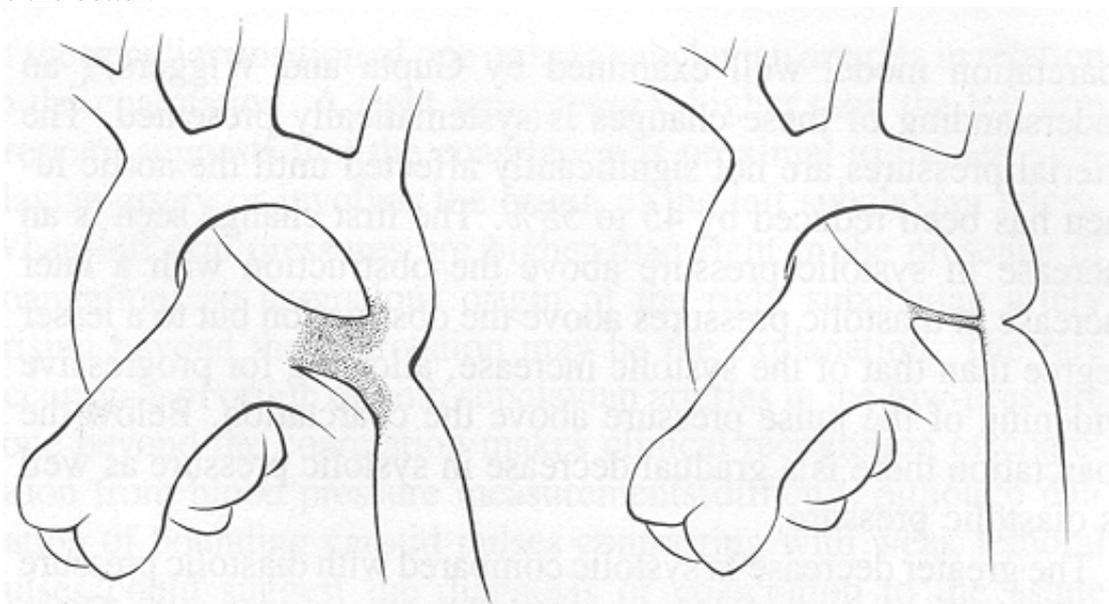
- Neonate: cardiomegaly, lung congestion and pulmonary edema.
- Children > 5 years: cardiomegaly and rib notching due collateral circulation.

**Echocardiography:**

- In the parasternal notch view, a shelf shaped of tissue is seen. Other associated can be seen such VSD.
- Doppler studies above and below the coartation site can assessing the severity of the narrowing.

**Treatment:**

- Medical treatment: temporary helpful to wait for surgery
  - Prostaglandin E1 infusion 0.05-0.1mcg/kg/mn temporary help waiting for surgery.
  - Anti-heart failure: dopamine/dobutamine, diuretics and oxygen (See congestive heart failure).
  - Balloon angioplasty.
- Surgical treatment: Procedures vary greatly from heart center to heart center. The early it is done the better.



**E-Atrioventricular Septal Defects (AVSD):**

- 2% Of all CHD, 30-60% in Down syndrome
- Compose of Primum ASD, Inlet VSD and clefts of mitral valve and tricuspid valve.
- Hyperactive precordium with systolic thrill grade 3-4/6 of systolic murmur at the LLSB and loud S2.
- With/without systolic murmur of MR at apex
- Signs of congestive heart failure

**Electrocardiography:**

- Superior QRS axis
- RVH and LVH may be present

**Chest X-ray:**

- Cardiomegaly with increased pulmonary vascular markings.
- Prominent Pulmonary artery segment.

**Echocardiography:**

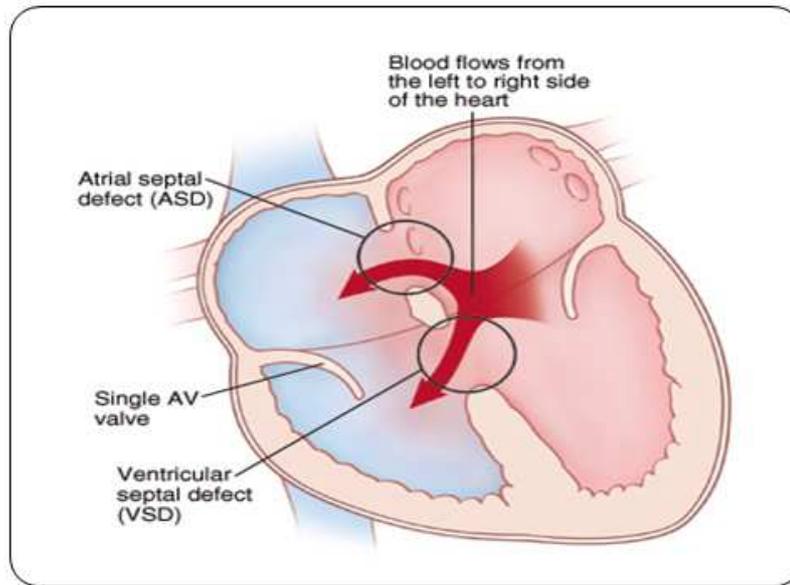
- Two-dimensional and Doppler echo studies allow to images all of the component of AVSD.

**Treatment:**

-Medical treatment:

- Anti-heart failure (see congestive heart failure)
- Prophylaxis: SBE is needed

-Surgical treatment: indicate for all AVSD.



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**Table 1: Incidence of congenital heart disease with chromosomal abnormalities**

Chromosome abnormality	Name of syndrome	Incidence of CHD (%)	Type of defect
21 Trisomy	Downs Syndrome	60	AV canal defect, VSD
18 Trisomy		90	VSD, PDA, DORV
13 Trisomy		90	Dextrocardia, VSD, PDA
XO	Tuner's Syndrome	15	Coartation of aorta, Aortic stenosis

**Table 2: Incidence of congenital heart disease with environmental factors**

Maternal infections	Rubella Mumps	PDA, Pulmonary stenosis, VSD, ASD Endocardial Fibroelastosis
Maternal drugs	Phenytoin Vitamin D	Variable Supravalvular aortic stenosis
Maternal diseases	Diabetes Systemic lupus erythematosus	Transposition of great artery Congenital heart block

# CONGESTIVE HEART FAILURE IN CHILDREN

*By Dr. Nget Pises*

## I. INTRODUCTION

Pediatric congestive heart failure (CHF) is a diverse etiology manifesting, a variety of clinical presentations. In all CHF syndromes, whether adult or pediatric, a unifying pathophysiologic mechanism is involved. Chronic or acute CHF progress death if left untreated. Indeed, pediatric congestive heart failure is most common reason presenting in children with heart disease <sup>(1)</sup>.

## II. DEFINITION

Congest Heart Failure (CHF) is the state that heart cannot deliver adequate blood to meet the metabolic needs of the body. In the early stage of CHF, the heart can compensate to maintain normal metabolic function. When the compensate mechanisms become ineffective, severe clinical manifestations present <sup>(2)</sup>.

## III. EPIDEMIOLOGY

The overall prevalence and incidence of pediatric heart failure is unknown, generally because of no acceptable universal classification apply to its many forms. The largest CHF burden comes from children born with congenital malformations. It has been estimated that 15% to 25% of children who have structural heart disease develop CHF. Although cardiomyopathy is relatively rare, approximately 40% who experience cardiomyopathy develop heart failure of such severity that it leads to transplantation or death.

#### IV. AETIOLOGY <sup>(1)</sup>

<p><b>3-1: Cardiac Malformations</b></p> <ul style="list-style-type: none"> <li>• Shunt lesion             <ul style="list-style-type: none"> <li>-Ventricular septal defect (VSD)</li> <li>-Patent ductus arteriosus (PDA)</li> <li>-Atrioventricular septal defect (AVSD)</li> <li>-Atrial septal defect (ASD)</li> </ul> </li> <li>• Total/ Partial anomalous pulmonary venous connection</li> <li>• Complex congenital heart disease             <ul style="list-style-type: none"> <li>-Single ventricle</li> <li>-Transposition of the great arteries</li> </ul> </li> <li>• Valvular lesion             <ul style="list-style-type: none"> <li>-Mitral regurgitation (MR)</li> <li>-Aortic regurgitation (AR)</li> </ul> </li> <li>• Inflow obstruction             <ul style="list-style-type: none"> <li>-Mitral stenosis</li> <li>-Pulmonary vein stenosis</li> </ul> </li> <li>• Outflow Obstruction             <ul style="list-style-type: none"> <li>-Aortic stenosis</li> <li>-Coartation Aorta</li> </ul> </li> </ul>	<p><b>3-2: Structurally Normal Heart</b></p> <ul style="list-style-type: none"> <li>• Primary cardiac             <ul style="list-style-type: none"> <li>-Cardiomyopathy</li> <li>-Myocarditis</li> <li>-Myocardial infarction</li> <li>-Acquired valve disorders</li> </ul> </li> <li>• Secondary             <ul style="list-style-type: none"> <li>-Sepsis</li> <li>-Anemia</li> <li>- B1 deficiency</li> <li>-Renal failure</li> <li>-Arrhythmogenic</li> <li>- Hypoglycemia</li> </ul> </li> </ul>
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#### V. DIAGNOSIS

##### a. Signs and symptoms <sup>(2-3)</sup>

Due to CHF have many causes, variety of clinical presentations depending on age of the patients and degree of heart failure. There is no single test for specific heart failure; the diagnosis is based on several clinical findings.

##### b. History:

1-Infant: poor feeding of recent onset, tachypnea worse during feeding, poor weight gain and cold sweat on the forehead.

2-Older children: complaint of shortness of breath, especially with activities, easy fatigability, puffy eyelids, or swelling feet.

##### c. Physical examination:

1-Compensatory sings

- a- Tachycardia, gallop rhythm and weak and thread pulse are common
- b- Cardiomegaly
- c- Growth failure, sweating, and cold, wet skin

2-Signs of left heart failure

- a- Tachypnea with mild to severe chest retraction
- b- Dyspnea with grunting (poor feeding in small infants)
- c- Wheezing and Crackle
- d- Orthopnea may be seen in older children

3-Signs of right heart failure

- a-Hepatomegaly
- b-Puffy eyelids
- c-Distend neck veins and ankle edema more common in big child and adult

**Severity of heart failure based on Modified Ross Heart Failure Classification in Children <sup>(4)</sup>**

Class I	Asymptomatic
Class II	Mild tachypnea or diaphoresis with feeding in infants Dyspnea on exertion in older children
Class III	Marked tachypnea or diaphoresis with feeding in infants Marked dyspnea on exertion Prolonged feeding times with growth failure
Class IV	Symptoms such as tachypnea, retractions, grunting, or diaphoresis at rest

**d. Laboratory:**

- 1-Chest X-ray: Cardiomegaly, increased pulmonary blood flow or pulmonary edema
- 2-Electrocardiography (ECG): not help to define CHF
- 3-Echocardiography:
  - Confirm an enlargement of chamber
  - Confirm impaired left ventricular function
  - To determine the cause of CHF
  - Effusion (pericardial and pleural)
- 4-Brain Natriuretic Peptide (BNP) increased (not available)

**VI. DIFFERENTIAL DIAGNOSIS**

- Acute respiratory distress syndrome
- Respiratory failure
- Asthma
- Cardiogenic Shock
- Chronic Bronchitis
- Pneumonia
- Pulmonary edema

**VII. TREATMENT<sup>(1,3,4)</sup>**

**1. General measure**

- a-A infant seat or (half sitting position) is used to relieve respiratory distress
- b-Humidify O<sub>2</sub> (40%-50%) supply
- c-Sedation with morphine sulfate 0.1-0.2mg/kg/dose IV,IM or SC if needed
- e-Daily weight-necessary for hospitalized patients
- f-Salt restriction in children(<0.5g/day) and avoid salty food
- g-Fluid restriction 2/3 maintenance (D5% 1/3NS, D5% 1/2NS depend on electrolyte)
- h-Increased calorie intake
- i-In anemia patient-raise hematocrit to  $\geq 35\%$  (See blood transfusion national guideline)
- j-Treat other underlying causes

**2. Drugs Therapy**

There are 3 majors classes of drugs are used in the treatment of CHF in children: 1- Inotropic agents, 2-Diuretics (Preload reduction) agents, 3- Afterload reduction agents. And other drugs: Sympathetic inhibitions.

**Diuretics Agents (preload reduction):**

- Furosemide 1-2mg/kg/dose PO,IV, IM divided in bid or tid **AND/OR**
- Spironolactone 1-3mg/kg/day PO divided in bid or tid **OR**
- Hydrochlorothiazide 2-4mg/kg/day PO divided in bid or tid

**Afterload reduction:**

- Captopril 0.5-6mg/kg/day PO divided in qd to qid (for infant) and 12.5mg/dose (for Children) **OR**
- Enalapril 0.1mg/kg/dose qd or bid **OR**
- Hydralazine 0.1-0.2mg/kg/dose IV q4-6h or 0.75-3mg/kg/day PO bid to qid **OR**
- Nitroprusside 0.5-8µg/kg/min IV Infusion **OR**
- Metoprolol 0.1-0.9mg/kg/dose PO bid

**Inotropic agents:**

- Digoxin dose

Age	Total Digitalizing Dose (TDD)* (µg/kg)	Maintenance Dose** µg/kg/day
Prematures	20	5
Newborns	30	8
<2yr	40-50	10-12
>2yr	30-40	8-10

\*TDD: divided in 3 doses, 50% first dose then 25% in subsequence 8hours

\*\* Maintenance Dose: 25% of TDD divided in 2 doses/day in <10yr and 1 dose/day in >10yr

- Epinephrine 0.1-1µg/kg/min IV infusion **OR**
- Dobutamine 2-20µg/kg/min IV Infusion **OR**
- Dopamine 5-10µg/kg/min IV Infusion **OR**
- Milrinone 0.25-1µg/kg/min IV Infusion

**3. Patient Education**

It is necessary to take regular medications to help prevent recurrence heart failure. Counsel and educate patients with heart failure following the cause, such as dietary factors or medication noncompliance with regard to the importance of proper diet.

**VIII. COMPLICATION:**

- Renal failure: in chronic heart failure
- Pump failure with cardiovascular collapse
- Ventricular tachyarrhythmias or bradyarrhythmias
- Death

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# PEDIATRIC ARRHYTHMIA

By Dr. Hav Rathneary

## I. INTRODUCTION

Most infants and children with arrhythmias present to primary care physicians and intensivists before being referred to a pediatric cardiologist for assessment and management. Thus, the physician has to be able to recognize and manage basic arrhythmias and some cases to provide the acute treatment.

In normal cardiac conduction, depolarization occurs in following sequence: sinoatrial node (depolarization can not seen on ECG), atrial (P wave), atrioventricular node (PR)), and bundles and ventricles (QRS). Repolarization (T wave) then occurs.

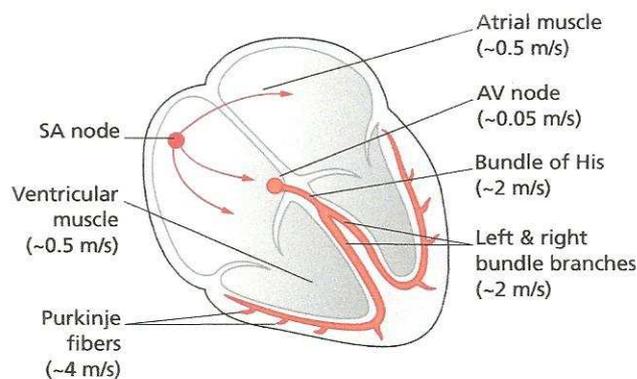


Figure: (From Christopher Wren 2012. *Concise Guide to Pediatric Arrhythmias*, John Wiley & Sons, UK.)

Sinus rhythm on ECG:

- P wave, normal shape, duration (80 ms), and axis,
- Normal PR interval: 80-120 ms for infants and 100-180 ms for adult,
- QRS complex: < 80 ms for infants and 100 ms for adult. Every P wave is followed by a QRS and every QRS is preceded by a P wave.
- Measured QT by using Bazett's formula: a corrected QT interval < 440 ms ( $QTc \text{ interval} = QT \text{ interval} / \sqrt{RR \text{ interval}}$ ).

We can measure the heart rate, PR interval, QRS duration, and QT interval.

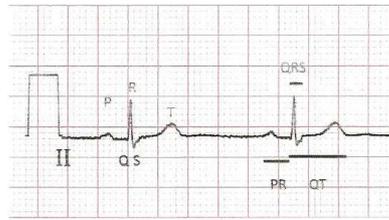


Image normal ECG

The normal heart rate varies with age. Tachycardia is defined as a heart rate beyond the upper limit of normal.

The frequency and clinical significance of arrhythmia are different in children and in adults.

### ***Normal Ranges of Resting Heart rate***

Age	Beats/Minute
Newborn	110-150
2 yr	85-125
4 yr	75-115
Over 6 yr	60-100

## **II. RHYTHMS ORIGINATING IN THE SINUS NODE**

All rhythms that originate in the sinoatrial (SA) node (sinus rhythm)

### **1. REGULAR SINUS RHYTHM**

The rhythm is regular, and the rate is normal for age.

No treatment is required.

### **2. SINUS TACHYCARDIA**

Characteristics of sinus rhythm are present.

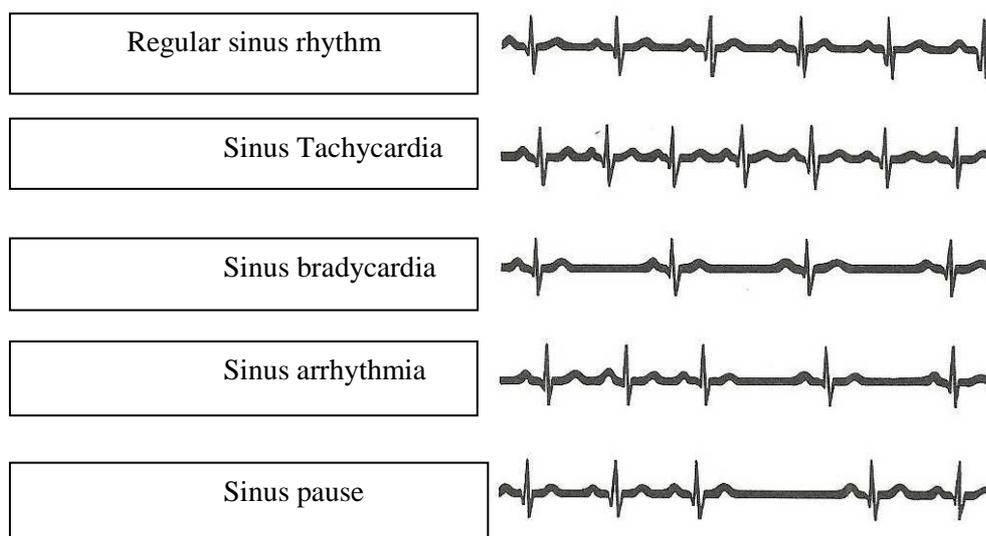
The rate is faster than the upper limit of normal for age.

A rate > 140 beats/minute in children and > 160 beats/minute in infants.

**a. Causes.** Anxiety, fever, hypovolemia or circulatory shock, anemia, congestive heart failure (CHF), administration of catecholamines, thyrotoxicosis, and myocardial disease are possible causes.

**b. Management.** The underlying cause is treated.

### 3. SINUS NODE DYSFUNCTION



**Figure: Normal and abnormal rhythms originating in the sinoatrial node.** (From Park MK, *Cardiac Arrhythmias. In Mosby editor. Pediatric Cardiology for Practitioners 2002.*)

#### 4. SINUS BRADYCARDIA

The characteristics of sinus rhythm are present, the heart rate is lower limit of normal for the age. A rate slower than 80 beats/minute in newborn infants and slower than 60 beats/minute in older children.

**a. Causes.** Sinus bradycardia may occur in normal individuals and trained athletes, with vagal stimulation, increased intracranial pressure, hypothyroidism, hypothermia, hypoxia, hyperkalemia, administration of drugs such as digitalis and  $\beta$ -adrenergic blockers.

**b. Management.** The underlying cause is treated.

#### 5. SINUS ARRHYTHMIA

No treatment is indicated.

#### 6. SINUS PAUSE

Absence of the P wave and QRS complex for a relatively short time.

**a. Cause:** Increased vagal tone, hypoxia, digitalis toxicity, and sick sinus syndrome.  
Significance. Sinus pause usually has no hemodynamic significance but may reduce cardiac output.

**b. Treatment** is rarely indicated except in sick sinus syndrome and digitalis toxicity.

#### 7. SICK SINUS SYNDROME

The sinus node fails to function as the dominant pacemaker of the heart or performs abnormally slowly.

**a. Causes**

- Extensive cardiac surgery, particularly involving the atria.
- Rarely, arteritis or focal myocarditis is a cause.
- Idiopathic.

**b. Management**

- Severe bradycardia: intravenous atropine (0.04 mg/Kg) or isoproterenol (IsuprelR, IV: 0.1 to 0.5  $\mu\text{g}/\text{kg}/\text{min}$ , titrated to desired effect, inj: 0.2 mg/ml) or both.
- Chronic medical treatment has not been uniformly successful and is not accepted as standard of sinus node dysfunction.
- Antiarrhythmic drug, propranolol or quinidine, may be given to suppress tachycardia, but not they are often unsuccessful.
- Permanent Pacemaker implantation in symptomatic patients.

**III. RHYTHM ORIGINATING IN THE ATRIUM**

Rhythm that originate in the atrium (ectopic atrial rhythm):

- P waves have an unusual contour, an abnormal P axis, and/or there is an abnormal number of P waves per QRS complex.
- QRS complexes are usually of normal configuration.

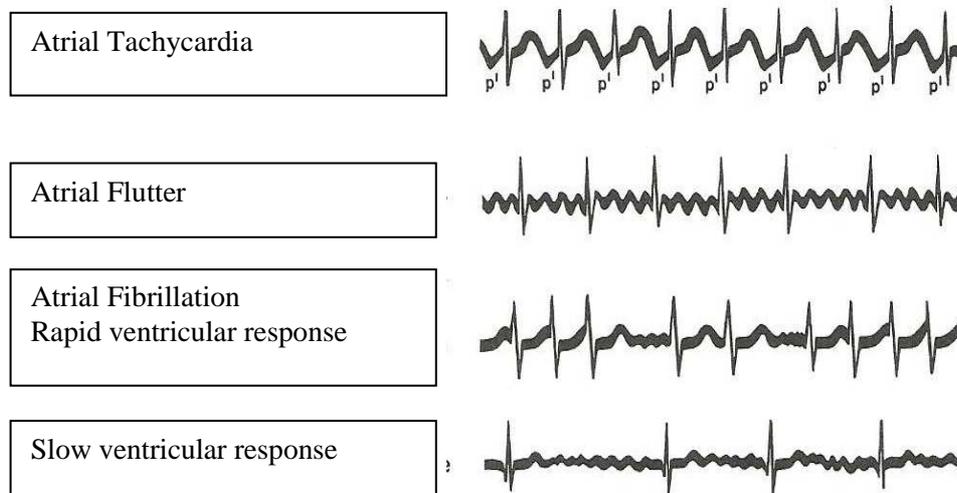
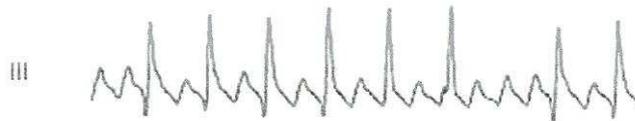


Figure. Arrhythmias originating in the atrium. (From Park MK, Cardiac Arrhythmias. In Mosby editor. Pediatric Cardiology for Practitioners 2002.)

**1. ATRIAL FLUTTER**

Atrial flutter is a single reentry loop contained within the atrium.

Atrial flutter is most commonly seen in children in the newborn period. Atrial rate of about 300 beats/minute, a ventricular response with varying degrees of block (e.g., 2:1, 3:1, 4:1), and normal QRS complexes.



**Figure:** Atrial Flutter. (From Christopher Wren. 2012. *Concise Guide to Pediatric Arrhythmias*, John Wiley & Sons, UK.)

- a. Causes.** Possible causes are structural heart disease with dilated atria, myocarditis, previous surgery involving atria (the Mustard or Senning procedure, Fontan operation or atrial septal defect repair), and digitalis toxicity.

Significance: a too-rapid ventricular rate may decrease cardiac output.

**b. Management**

- Digitalization. Propranolol (1 to 4 mg/kg per day orally in three or four doses) may be added to digoxin.
- Or Amiodarone with digoxin.

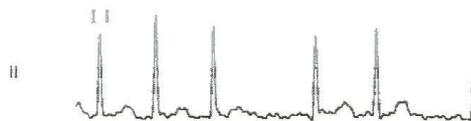
- Electric external cardioversion may be required. Digitalis should be discontinued for at least 48 hours before cardioversion. Anticoagulation with warfarin is recommended before external cardioversion to prevent embolization.
- Rapid atrial pacing with a catheter in the esophagus or the right atrium can be effective when cardioversion is contraindicated.

## 2. ATRIAL FIBRILLATION

Atrial fibrillation is a rare arrhythmia in childhood. It has mostly been reported in association with rheumatic or congenital heart disease or cardiomyopathy.

### a. ECG diagnosis

The 12 lead ECG demonstrates: absence of P wave and the presence of a chaotic irregular baseline. Atrioventricular (AV) conduction is erratic, producing irregularly QRS complexes. The ventricular rate is usually significantly higher than normal but depends on the



**Figure:** Atrial Fibrillation. (From Christopher Wren. 2012. *Concise Guide to Pediatric Arrhythmias*, John Wiley & Sons, UK.)

characteristics of the AV node.

Atrial fibrillation is characterized by an extremely fast atrial rate (f wave at a rate of 350 to 600 beats/minutes ).

**b. Causes.** Atrial fibrillation usually is associated with structural heart disease, including dilated atria; myocarditis; digitalis toxicity; or previous intra-atrial surgery.

### c. Management

- If Atrial fibrillation > 48 h: anticoagulation with warfarin (PO: initial:1-3mg/day for 2-4 days in evening) for 3 weeks to prevent systemic embolization of atrial thrombus, if the conversion can be delayed. Anticoagulation is continued for 4 weeks after restoration of sinus rhythm. Heparin With subsequent oral anticoagulation.
- Digoxin is provided to slow the ventricular rate. Propranolol (1 to 4 mg/kg per day orally in three or four doses) may be added.
- Class I Antiarrhythmias agents (e.g., quinidine, procainamide, flecainide) and the class III agent amiodarone may be used.
- Quinidin may prevent recurrence.

## 3. SUPRAVENTRICULAR TACHYCARDIA

Supraventricular tachycardia (SVT) refers to a sustained tachyarrhythmia that originates above the bundle of His.

SVT is the most common abnormal tachyarrhythmia of childhood, often presents in infancy. It is often secondary to bypass tracts (accessory pathways between the atrial and ventricles who conduction times differ from those of the atrioventricular node).

Three groups of tachycardia are included in SVTs:

- Atrial tachycardia (ectopic or nonreciprocating atrial tachycardia),
- Nodal (or AV junctional) tachycardia,
- And AV reentrant (reciprocating) tachycardia.

The majority of SVTs are due to reentry AV tachycardia rather than rapid firing of a single focus in the atria (nonreciprocating atria tachycardia) or in the AV node (nodal tachycardia)

The heart rate is extremely rapid and regular (usually  $240 \pm 40$  beats/minute). The P wave usually is invisible. The QRS duration is usually normal.

**a. Causes**

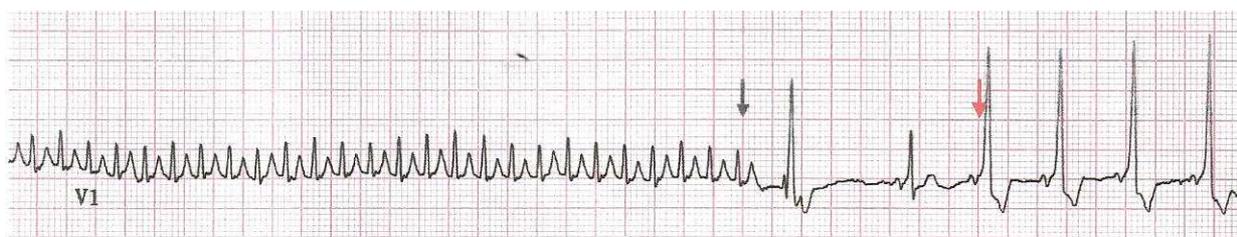
- 50% patients: no heart disease. This idiopathic of SVT occurs more commonly in young infants than older children.
- WPW syndrome is present in 10% to 20% of cases and is evident only after conversion to sinus rhythm.
- Some congenital heart defect (e.g., Ebstein's anomaly, single ventricle, congenitally corrected transposition of the great arteries).
- SVT may occur following cardiac surgery.

**b. Significance**

- SVT may decrease cardiac output and result in CHF.
- Many infants tolerate STV well for 12 to 24 hours
- Infant with SVT tent to present with nonspecific symptoms: irritability, lethargy, poor feeding. Clinical manifestations of CHF include irritability, tachypnea, and pallor. When CHF develops, the infant's condition can deteriorate rapidly.  
The older child describe palpitations, or dizziness, syncope or cardiac arrest may ensue (rare)

**c. Management**

- Vagal stimulatory maneuver (carotid sinus massage, gagging, pressure on an eyeball) may be effective in older children but are rarely effective in infants.
- Placing an ice bag on the face (for up to 10 seconds) is often effective in infants.
- Adenosine is giving by rapid intravenous bolus followed by a saline flush ( $50 \mu\text{g}/\text{kg}$ ) and increasing in increment of  $50 \mu\text{g}/\text{kg}$  every 1 to 2 minutes (maximum  $250 \mu\text{g}/\text{kg}$ ). When tachycardia is converted to sinus rhythm, either digitalization or  $\beta$ -adrenergic blocker are started to prevent recurrence.
- Shok or cardiovascular collapse: External cardioversion with 0,5 to 1 joule/kg. this followed by digitalization.
- Digitalization may be used in infants without CHF and those with mild CHF.
- If the patient is not in CHF: intravenous infusion of phenylephrine, 10 mg added to 200 ml of intravenous solution.
- In patient with postoperative atrial tachycardia: intravenous administration of amiodarone.
- The recurrence of STV should be prevented with a maintenance dose of digoxin for 3 to 6 months. In children older than 8 years of age with WPW syndrome, propranolol or atenolol.
- Radiofrequency catheter ablation or surgical interruption of accessory pathways should be considered if medical management fail.



**Figure:** Diagnostic use of adenosine: Tachycardia stops with AV block, the most common response, show by non-conducted P wave (black arrow). The obvious ventricular pre-excitation in sinus rhythm (red arrow), confirming the presence of an accessory pathway. (From Christopher Wren. 2012. *Concise Guide to Pediatric Arrhythmias*, John Wiley & Sons, UK.)

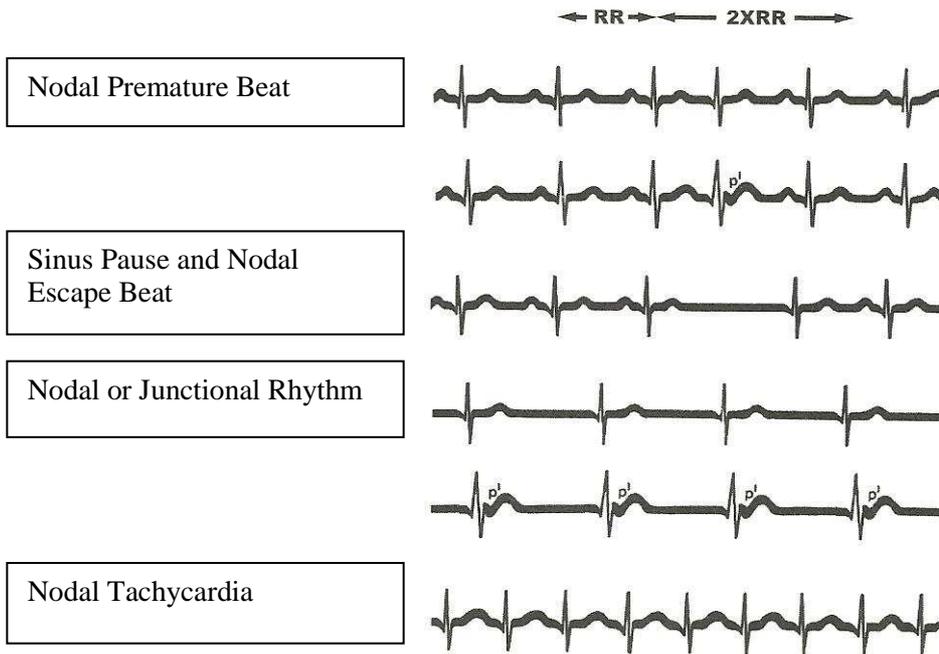
#### 4. RHYTHMS ORIGINATING IN THE ATRIOVENTRICULAR NODE

Rhythms that originate in the AV node are characterized by the following:

- The P wave may be absent, or inverted P waves may follow the QRS complex.
- The QRS complex usually is normal in duration and configuration.

##### NODAL TACHYCARDIA

- The ventricular rate : 120-200 beats/minute
- P waves : absent or inverted P waves follow QRS complexes
- QRS complex: normal
- Rate < 130 beates/minue: no treatment.
- Treatment : quinidine, amiodarone (in postoperative juntional tachycardia)

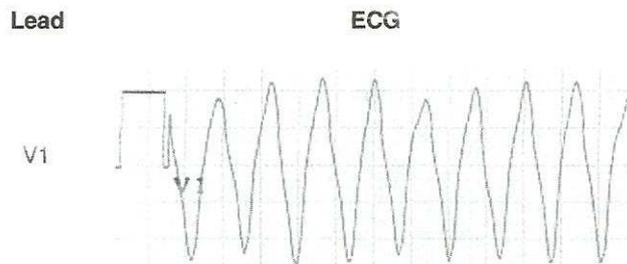


**Figure:** Arrhythmias originating in the atrioventricular node. (From Park MK, Cardiac Arrhythmias. In Mosby editor. Pediatric Cardiology for Practitioners 2002)

#### 5. RHYTHMS ORIGINATING IN THE VENTRICLE

Rhythms that originated in the ventricle (ventricular arrhythmia) are characterized by the following:

- Bizarre and wide QRS complexes.
- T wave pointing in directions opposite of QRS complexes.
- QRS complexes randomly related to P waves, if visible.



**Figure:** Ventricular Tachycardia. (From Christopher Wren. 2012. Concise Guide to Pediatric Arrhythmias, John Wiley & Sons, UK.)

**a. PREMATURE VENTRICULAR CONTRACTION:**

PVCs that cause no symptoms and have no hemodynamic consequences in patients with normal hearts do not require treatment.

**b. VENTRICULAR ARRHYTHMIA**

Ventricular tachycardia, an uncommon dysrhythmia in children, is often associated with organic heart disease or myocardial tumor.

VT is defined as an abnormal accelerated rhythm arising from below the bundle of His. The mechanisms of VT include reentry (the most common), abnormal automaticity or triggered automaticity.

The ECG features: a wide complex QRS greater than the upper limits than normal for age, the heart rate is usually 120-180 beats/minute.

The P wave may occur at the end of the QRS complex in a retrograde fashion or may be completely dissociated from the tachycardia. QRS morphology: monomorphic or polymorphic.

Torsade de pointe: a specific type of polymorphic VT that has a sinusoidal pattern of QRS variation. Torsade de pointe is the typical form of VT in patient with long QT syndrome.

Intermittent runs of ventricular tachycardia frequently precede sustained tachycardia, which can develop into ventricular fibrillation.

- **Significance**

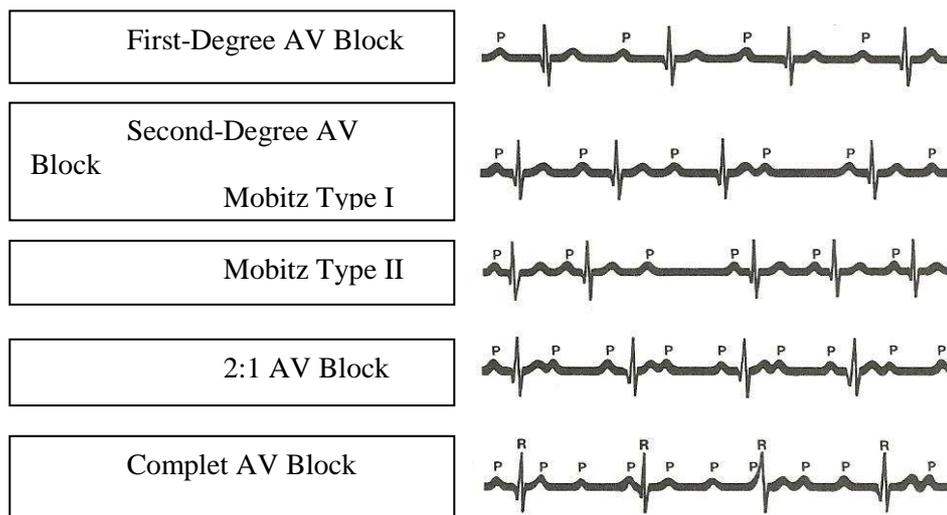
- Ventricular tachycardia usually signifies a serious myocardial pathology or dysfunction.
- With a fast heart rate, cardiac output may decrease, and rhythm may deteriorate to ventricular fibrillation, in which cardiac output does not occur.

- **Symptoms:** lethargic, tachypneic, pale, and feed poorly. Mottling or cyanosis may be present as well. Older children report palpitations, chest discomfort, dizziness, nausea, or syncope, sudden cardiac death.

- **Treatment for Ventricular Tachycardia**

- Patient is unconscious or has cardiovascular instability: electrical external cardioversion using energies of 0,5 to 1 joule/kg.
- Lidocaine 0,5- 1mg/kg per dose by injection over 1 to 2 minutes, (followed if necessary by 0,6-3mg/kg/h by infusion) may be used.
- Amiodarone: intravenous 5 mg/kg over 30 mn (use only in Heart center), oral loading doses are preferred, 15 mg/kg 10 days then 5-10 mg/kg per day (Cordarone<sup>R</sup>, Ap3<sup>ml</sup>=150mg, Cp= 200 mg).
- Search for reversible conditions contributing to initiation and maintenance of VT (e.g., hypokalemia, hypoxemia) and correct the condition.
- Torsade de pointe : Magnesium sulfate 25-50 mg/kg over 5 to 15 minutes (in adult: 2 g IV bolus), lidocaine  
Torsade de pointe that occurs in the long QT syndrome: intravenous  $\beta$ -blocker (esmolol).  
An implantable pacemaker(Heart Center)/cardioverter-defibrillator (ICD) device is indicated for: patient cardiomyopathy, long QT syndrome, life-threatening VT, and resuscitated sudden cardiac death.
- Recurrence may be prevented with: propranolol, atenolol, phenytoin sodium, or quinidine.
- Longer- term management depends on the specific type of VT and its cause.

## 6. ATRIOVENTRICULAR BLOCK



**Figure:** Atrioventricular block. (From Park MK, Cardiac Arrhythmias. In Mosby editor. Pediatric Cardiology for Practitioners 2002.)

Atrioventricular (AV) block describes delayed or incomplete conduction of impulses through the AV node. There are three degrees of AV block:

1. First-degree AV block: prolonged conduction through the AV node, prolonged PR interval on the ECG, but there is consistent 1:1 AV conduction.
2. Second-degree AV block has two forms;
  - Mobitz type I AV block, also known as a Wenckebach: a gradually lengthening PR interval followed by a nonconducted P-wave (dropped beat).
  - Mobitz type II AV block: intermittent failure of the P-wave to be conducted, measurable PR intervals occur, they are consistent and do not lengthen. Fixed ratio of P-wave to QRS complexes (2:1 or 3:1), but occasionally the AV block is variable.
3. Third-degree AV block: complete failure of the atrial impulses to be conducted to the ventricles. ECG: AV dissociation is seen in which the atrial rate is faster than the ventricular rate.

AV block may be congenital or acquired: associated congenital heart disease (transposition of the great arteries with ventricular inversion), association between SS-A/R or SS-B/La autoantibodies in the mother (present in collagen vascular diseases: lupus erythematosus) and the development of congenital AV block. Surgical AV block: heart surgery  $\leq$  injury to the AV node or His bundle. Inflammation: myocarditis, rheumatic fever, or Lyme disease, is another cause for acquired AV block.

### a. Symptoms

Children with first-degree or second-degree Mobitz I AV block are asymptomatic.

Older children: fatigue, exercise intolerance, dizziness, or, in some cases, syncope. Sudden death has been reported.

Chest Radiograph: cardiomegaly in patient with long-standing AV block.

### b. Management

No treatment is required for children with asymptomatic congenital complete heart block. Atropine or isoproterenol is indicated in symptomatic children and adults until temporary ventricular pacing is secured.

Symptomatic children with second-degree Mobitz II and third-degree complete AV block: an endogenous nucleoside, has negative chronotropic, dromotropic, and inotropic action of very short duration (half-life  $< 1.5$  second), with minimal hemodynamic consequence. Pacemaker.

In postoperative patient, the AV block may be transient: temporary pacing is employed for the first 10 to 14 days.

\***Adenosine Triphosphate (Striadyne<sup>R</sup>)** 2<sup>ml</sup>=20 mg, an endogenous nucleoside, has negative chronotropic, dromotropic, and inotropic action of very short duration (half-life < 1.5 second), with minimal hemodynamic consequence. It transiently blocks the AV conduction and sinus node pacemaking activity.

Intravenous adenosine is the first-line treatment for any sustained regular tachycardia in infancy or childhood, with either a normal or wide QRS. Adenosine is not recommended for sustained irregular tachycardia.

Adenosine may be the drug of choice in the treatment of SVT because almost all SVT in which the AV node forms part of the reentry circuit.

Adenosine has a differential diagnosis ability with both narrow and wide-complex regular tachycardia because the absence of adverse hemodynamic effects.

It is not recommended for the management of irregular tachycardias. It terminates STV with aberration but is not effective for nonreciprocating atrial tachycardia, atrial flutter or fibrillation, and ventricular tachycardia. Although adenosine has no important hemodynamic side effect, severe bronchospasm has been reported in several asthmatic patients following adenosine infusion.

### Drugs

Denomination	Dose/day	Divide/day	Side effects
Digoxine	Tab: 0.125, 0.25 mg < 3 kg : 15µg/kg 3-6 kg : 20 µg/kg 6-12 kg : 15µg/kg	3 times	ECG (PR)
Class IC Flecainide	2-5mg/kg	2	Dosage Flecainemia ECG : risk VT Wide QRS
Propafénone	300-500 mg/m <sup>2</sup>	3	Glycemia,ECG
Bêta-bloquant (Avlocardyl <sup>R</sup> )	3 mg/kg	3	
Nadolol (Corgard <sup>R</sup> ) Sotalol (Sotalex <sup>R</sup> )	1 mg/kg one daily 2 mg/kg per day in two doses	1 2	
Amiodarone (Cordarone <sup>R</sup> )	500 mg/ m <sup>2</sup> × 15 days (oral) 250 mg/ m <sup>2</sup> (entretien)	1	ECG (QT) Photosensitivity Dysthyroïde (T3.T4.TSH) Cornal microdeposits
Calcium channel blocker Verapamil (Isoptine <sup>R</sup> )	100-200 mg/ m <sup>2</sup>	3	Myocardial dysfunction

Calcium channel blocker and amiodarone: intravenous contre indication

Risk cardiovascular collapse: amiodarone, isoptine.

Risk severe proarrhythmia: Flecainide, propafenone.

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ECG (\*Vitess du papier 25 mm/s, 1 grand careau = 5 mm = 0,25 s (200 ms), 1 petit carreau = 0,04 s= 40 ms)

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# INFECTIOUS DISEASES

1. Bacterial Meningitis .....	232
2. Poliomyelitis.....	236
3. Cellulitis.....	240
4. Osteomyelitis .....	244
5. Septic Arthritis.....	248
6. Typhoid Fever.....	254
7. Tetanus.....	259
8. Measles .....	266
9. Varicella.....	269
10. Pertussis.....	273
11. Mumps/Parotitis.....	277
12. Antibiotic Guidelines 2012.....	280
13. Rickettsial Diseases .....	302
14. Melioidosis .....	307
15. Parasitic Infections .....	313

# BACTERIAL MENINGITIS

By Prof. Srour Yina

## I. INTRODUCTION AND CAUSES

Bacterial meningitis is an infection of the meninges by bacteria that have usually travelled there from mucosal surfaces via the bloodstream. In children and young people aged 3 months or older, the most frequent causes of bacterial meningitis include *Neisseria meningitidis* (meningococcus), *Streptococcus pneumoniae* (pneumococcus) and *Haemophilus influenzae* type b (Hib). These organisms occur normally in the upper respiratory tract and can cause invasive disease when acquired by a susceptible person. In neonates (children younger than 28 days), the most common causative organisms are *Streptococcus agalactiae* (Group B streptococcus), *Escherichia coli*, *S pneumoniae* and *Listeria monocytogenes*.

## II. SYMPTOMS AND SIGNS

- Fever
- Headache
- Photophobia
- Vomiting
- Neck stiffness
- Back pain
- Myalgia
- Rash
- Confusion and disorientation
- Lethargy
- Seizures
- Kernig's and Brudzinski's signs
- Sixth nerve palsy (suggesting raised ICP)
- Papilloedema (uncommon)
- Coma

## III. INVESTIGATIONS

### 1- Lumbar Puncture (LP): CSF for cell count, gram stain and culture.

- Cells: Predominantly polymorphs (normal CSF in children > two months old contains < 5Wbc/mm<sup>3</sup> and no polymorphs; CSF Wbc counts in the neonatal period should not exceed 11–22 x 10<sup>6</sup>/L)
- Protein : Elevated (normal CSF protein in children < ten years old should be < 0.35g/L; CSF protein in neonates should be < 1.0g/L)

- Glucose : Reduced (normal CSF glucose concentration should be approximately two-thirds of serum levels)
- Pressure : Accepted upper limit during LP with patient in the left lateral decubitus position is 150mm of water in older children and 85–110mm of water in younger children. A normal range between 0–60mm of water has been reported in neonates
- Latex agglutination tests for detection of polysaccharide antigen is most reliable for Hib (85–95%), followed by *S. pneumoniae* (50–75%) and *N. meningitidis* (33–50%)
- PCR for detection of Hib, *S. pneumoniae* and *N. meningitidis*

#### Contraindications to LP:

1. Signs of raised ICP
2. Cardiorespiratory instability
3. Infection in the area through which the LP needle will pass
4. Evidence of coagulopathy

**NB:** Traumatic LP's occur in up to 20% of cases. Simple calculations to correct for blood contamination are based on the assumption that the ratio of white to red cells in the CSF attributable to blood contamination is approximately 1:500.

#### 2- Full Blood Count (FBC)

**3- C Reactive Protein (CRP) :** Useful in distinguishing bacterial from viral meningitis but has the limitation of low specificity.

**4- Blood culture :** Positive in most children with bacterial meningitis especially that caused by Hib or *S. pneumoniae*

#### 5- Serum glucose

### IV. MANAGEMENT

#### 1. Antibiotics

##### a. For Suspected Bacterial Meningitis

AGE	History of prolonged or multiple exposure to antibiotics (3m)	ANTIBIOTICS
≥ 3 months	-	Ceftriaxone
	+	Ceftriaxone + Vancomycine
< 3 months	-	Cefotaxime OR Ceftriaxone + { Amoxicilline <b>OR</b> Ampicilline }
	+	Cefotaxime OR Ceftriaxone + { Amoxicilline <b>OR</b> Vancomy } + Ampicilline

- If tuberculous meningitis is part of the differential diagnosis, use antibiotic treatment appropriate for tuberculous meningitis.

**b. For Specific Infections in Confirmed Bacterial Meningitis**

- Children and Young People Aged  $\geq$  3 Months**

<b>AGE <math>\geq</math> 3 MONTHS</b>	<b>ANTIBIOTICS</b>	<b>DIURATION</b>
<i>Haemophilus influenzae type b</i>	Ceftriaxone	10 days
<i>S. pneumoniae</i>	Ceftriaxone	14 days

- Children < 3 Months**

<b>AGE &lt; 3 MONTHS</b>	<b>ANTIBIOTICS</b>	<b>DIURATION</b>
<i>Group B streptococcal</i>	Cefotaxime	$\geq$ 14 days
<i>Listeria monocytogenes</i>	Ampicilline OR Amoxicilline + Gentamycine	21 days First 7 days
<i>Gram-negative bacilli</i>	Cefotaxime	$\geq$ 21 days

- Dose Guidelines of Intravenous Antimicrobials in Infants and Children With Bacterial Meningitis (Medscape)**

<b>Antibiotic</b>	<b>Dose (mg/kg/d) IV</b>	<b>Maximum Daily Dose</b>	<b>Dosing Interval</b>
<b>Ampicillin</b>	400	6-12 g	q6h
<b>Vancomycin</b>	60	2-4 g	q6h
<b>Ceftriaxone</b>	100	4 g	q12h
<b>Cefotaxime</b>	200-300	8-10 g	q6h
<b>Gentamycin*</b>	<b>3-7.5</b>		<b>q8h</b>

\*[www.drugs.com/dosage/gentamicin](http://www.drugs.com/dosage/gentamicin)

- Other Aspects of Management in Bacterial Meningitis**

- *Metabolic Disturbances*
- *Seizures*
- *Raised Intracranial Pressure*
- *Fluid Management*
- *Respiratory Support*

**2. Corticosteroids****Bacterial Meningitis**

- Do not use corticosteroids in children younger than 3 months with suspected or confirmed bacterial meningitis.
- Give dexamethasone (0.15 mg/kg to a maximum dose of 10 mg, four times daily for 4 days) for confirmed bacterial meningitis as soon as possible.
- If tuberculous meningitis is in the differential diagnosis, refer to the National guideline before administering steroids.
- If dexamethasone was not given before or with the first dose of antibiotics, but was indicated, try to administer the first dose within 4 hours of starting antibiotics, but do not start dexamethasone more than 12 hours after starting antibiotics.

## V. PROGNOSIS AND SEQUELAE

- The mortality rate is less than 5–10% for the three most common pathogens. Case fatality rate and neurological sequelae are greatest with *pneumococcal meningitis*.
- Sensorineural hearing loss is the most common sequelae. It occurs in 20–30% of patients after *S. pneumoniae* meningitis and in 5–10% of cases after meningitis due to Hib or *N. meningitidis*. Hearing should be tested within one month of discharge to detect hearing loss as early as possible.

## VI. PREVENTION

- Hib conjugate vaccine has had a dramatic impact on reducing the incidence of invasive Hib disease.
- Pneumococcal (7-11-13 valent) conjugate vaccine is effective against invasive infections caused by the pneumococcal serotypes contained in the vaccine. Children older than two years who are at risk of developing invasive pneumococcal disease should also receive the 23-valent polysaccharide vaccine in addition to the conjugate vaccine.
- Quadrivalent meningococcal polysaccharide vaccine against A, C, Y and W-135 strains is recommended for high-risk children (e.g. asplenia) older than two years. Meningococcal sero-group C conjugate vaccine is routinely administered in some countries
- Chemoprophylaxis:
  - Meningococcal disease (see “Meningococcal Infections”)
  - Hib : Rifampicin prophylaxis is recommended for all household contacts
  - Dose:
    - 0 – 3 months: 10mg/kg once daily for four days
    - 3 months - 12 years: 20mg/kg once daily for four days
    - 12 years and adults: 600mg once daily for four days

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# POLIOMYELITIS

By Prof. Yay Chantana, Dr. Iv Malene

## I. DEFINITION

Poliomyelitis, often called polio or infantile paralysis, is an acute viral infectious disease spread from person to person, primarily via the fecal-oral route.

## II. PUBLIC HEALTH MEASURE

Epidemiological surveillance:

- Consider every case of acute flaccid paralysis as a suspected poliomyelitis (clinical diagnosis).
- Encourage communities to report all children age less than 15 years who have acute flaccid paralysis to health center or referral hospital nearby.
- All health centers, hospitals, private clinics have to report all acute flaccid paralysis to OD, PHD.
- Confirmation of the diagnosis implies isolation of the virus by a laboratory: two stool samples are taken at 48 hours interval.
  - 1st specimen taken 24 hours after case reported.
  - 2nd specimen taken 48 hours after case reported.
  - While waiting for confirmation of diagnosis, immunize all children in the community without considering their former immunization status. Immediately after confirmation, organize an immunization campaign according to results of the epidemiological investigations.
  - OD, PHD has to do another investigation 60 days after case reported.
- All suspected acute flaccid paralysis reported OD, PHD has to go immediately to find the case and take specimens for investigation.

## III. ETIOLOGY AND EPIDEMIOLOGY

Poliovirus is a member of genus *Enterovirus*, family Picornaviridae. There are three types: Type 1, 2, and 3. The virus is extremely stable and can remain viable in the environment for a long period of time. It is rapidly inactivated by heat, formaldehyde, chlorine and ultraviolet light.

- **Reservoir** is humans.
- **Transmission:** Wild-type polio is predominately transmitted through the fecal-oral route. In many developing countries transmission is through direct contact with oral

secretions.

- **Period of Communicability:** Poliomyelitis is communicable for as long as the virus is shed in the throat (36 hours to 12 days after exposure) or in the stool (72 hours to six weeks after exposure or until feces are culture negative). The disease is most communicable in the few days before and after the onset of symptoms.
- **Host Susceptibility:** Immunodeficiency increases the risk for acquiring polio. Viral type specific immunity follows an infection.

#### IV. COMPLICATION

Poliomyelitis mortality in children is about 2 to 5% and in adults it is 15 to 30%.

- **Polio affecting the breathing muscles:** This will lead to a difficulty in breathing. The patient is also likely to suffer from congestion of the chest and chest infections. The heart will also be affected as it tries to pump blood into the lungs. Polio affecting the swallowing muscles. This makes it difficult to feed the patient. There is also a risk of choking on food, drinks, saliva, etc. This can cause a type of chest problem that is difficult to treat and which requires the patient to be admitted to hospital for a period of time.
- **Polio affecting the digestive system:** This will make it difficult for the patient to open their bowels normally. They may suffer from constipation a lot of the time.
- **Polio affecting the urinary system:** If the bladder is affected, the patient suffers from infection of the urinary system (urinary tract infections). The urine may become very concentrated and this forms stones in the urinary system. These are a big problem when they block the flow of urine from the kidney and they may damage the kidney extensively.
- **Polio affecting the arms / legs:** This will result in paralysis of the affected arm/leg. The arm/leg (limb) has no muscle strength and it cannot be used at all. However, the patient is able to feel if the affected limb is touched. With time, due to the paralysis, the muscles of the affected limb shrink and in the end the paralysed limb is very small compared to a normal one.
- **Polio affecting the nerves in the head:** This is not very common.
- **Polio can affect the nerves:** That control the muscles of the face, the eye, the tongue, etc. The paralysis makes it difficult for the patient to use their mouth properly, it may affect their speech and it also affects their vision.

#### V. CLINICAL PRESENTATION

The time between first exposure and first symptoms, known as the incubation period, is usually 6 to 20 days, with a maximum range of 3 to 35 days.

- Asymptomatic 90 to 95%
- Abortive poliomyelitis 4 to 8%:
  - Clinically indistinct from many other viral infections (fever, myalgia, malaise)
  - Only suspected to be polio during an epidemic
- Non-paralytic poliomyelitis 1 to 2%:
  - Differs from abortive poliomyelitis by the presence of meningeal irritation
  - Course similar to any aseptic meningitis
- Paralytic poliomyelitis 0.1 to 0.5 % which is further subdivided:
  - Spinal paralytic poliomyelitis (frank polio 79%)
  - Bulbar paralytic poliomyelitis: paralysis of muscle groups innervated by cranial nerves; involves the circulatory and respiratory centers of the medulla with high mortality (19%)
  - Mixed bulbospinal poliomyelitis (2%)

**Outcomes of poliovirus infection**

<b>Outcome</b>	<b>Proportion of cases</b>
Asymptomatic	90%-95%
Minor illness	4%-8%
Non-paralytic aseptic meningitis	1%-2%
Paralytic Poliomyelitis	0.1%-0.5%
Spinal Polio	79% of paralytic cases
Bulbospinal Polio	19% of paralytic cases
Bulbar polio	2% of paralytic cases

**VI. DIAGNOSIS**

The following are considerations to confirm polio:

- All suspected cases of polio should have a throat swab and CSF for viral isolation.
- Collection of one stool sample within two weeks (up to six weeks) after the onset of paralysis for viral studies. A rectal swab is acceptable in the absence of a stool sample.
- Serum specimen should be collected immediately for polio serology.
- In the absence of a positive culture, acute and convalescent neutralizing antibody titres can be examined to detect a fourfold rise indicative of infection. In some cases these antibodies may already be present at the time of paralysis and no rise is demonstrated.
- A second serum specimen should be collected two weeks later if the patient presents in the acute phase of the illness or one month later if the patient presents in the convalescent phase. Samples should be tested in parallel for poliovirus antibody titres and polio-specific IgG and IgM evaluations.

**VII. DIFFERENTIAL DIAGNOSIS**

- Enteroviral Meningitis – Coxsackie virus, myocarditis, hand-foot-and-mouth disease; difference is made serologically.
- Acute Flaccid Paralysis (AFP) – a variety of neurologic illnesses including and mimicking poliomyelitis; distinguished by increased frequency of fevers and asymmetric neurologic signs in poliomyelitis AFP.
- Guillain-Barre Syndrome – weakness is more symmetric and ascending and CSF often is normal in the first week of the illness and then shows elevated protein levels without pleocytosis.

**VIII. TREATMENT**

- No specific treatment is available.
- Only supportive care for non-paralytic forms: rest and analgesics (paracetamol: oral, rectal: Children: 60mg/kg/day divided in 4-6 time as needed ).
- The paralytic forms must be hospitalized as they often need respiratory assistance (respiratory muscle paralysis). The main component for the management of AFP is early physiotherapy to prevent deformities.

**IX. PREVENTION:**

- In Cambodia, oral polio vaccine composed of live attenuated viruses is used within EPI program
- Eradication program (National Immunization Day)
- Immunization schedule: at 6, 10 and 14 weeks.

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-

# CELLULITIS

*By Prof. Kim Ang*

## I- DEFINITION

- Inflammation/infection of the skin/subcutaneous tissues
- Often classified by body area involved:
  - Periorbital
  - Orbital
  - Buccal
  - Peritonsillar
  - Extremity
  - Breast
  - Perianal
  - Adenitis

## II- CAUSES

- Staphylococcus aureus
- Group A beta-hemolytic streptococci (Streptococcus pyogenes)
- S. pneumoniae: less common since advent of childhood vaccination with heptavalent pneumococcal conjugate vaccine (Prevnar)
- Group B streptococci, gram-negative bacilli: neonates
- Haemophilus influenzae type b: very rare now as a result of childhood immunization
- Pseudomonas aeruginosa, anaerobic bacteria: immunocompromised children
- Pasteurella species: from cat and dog bites
- Eikenella corrodens: from human bites

## III- PATHOPHYSIOLOGY

- Most commonly secondary to local trauma
  - Abrasions
  - Lacerations
  - Bite wounds
  - Excoriated dermatitis, varicella
  - Other breaches in the integument
- May develop secondary to local invasion or infection (e.g., sinusitis leading to orbital cellulitis).
- Hematogenous dissemination

## IV-EPIDEMIOLOGY

- The most common cause of cellulitis in children is *S. aureus* or *S. pyogenes* infection, which develops secondary to local trauma of the integument.
- Bacteremic disease, previously seen commonly when *H. influenzae* type b was prevalent, has now been surpassed by *S. pneumoniae*.
- Clinical failures with penicillin-resistant *S. pneumoniae* have not yet become a significant problem in cases of uncomplicated cellulitis.
- Methicillin-resistant *S. aureus* (MRSA) infections have risen dramatically in the past few years.

## V- ASSOCIATED ILLNESSES

- Periorbital
  - Usually secondary to local trauma
  - Impetigo
  - Varicella
  - Eczema
  - Hematogenous is very uncommon
  - Rarely associated with infectious conjunctivitis
- Orbital
  - Most commonly associated with severe sinusitis
  - Much less commonly: dental abscess, trauma, hematogenous
- Buccal
  - Same pathophysiology and epidemiology as periorbital cellulitis (excluding conjunctivitis)
- Peritonsillar
  - Commonly secondary to severe group A  $\beta$ -hemolytic streptococcal pharyngitis
  - Cellulitis may progress to a peritonsillar abscess
- Extremity
  - Almost always secondary to local trauma
- Breast
  - Usually with mastitis (most often in neonates)
- Perianal
  - Seen in infants and young children
  - Etiology: Group A Streptococcus
  - Perianal pain, pruritus, and erythema; sometimes associated with bloody stools.
- Cellulitis-Adenitis Syndrome
  - Uncommon infection seen in neonates and young infants
  - Etiology: Group B Streptococcus, *S. aureus*, gram-negative bacilli
  - Bacteremia and/or meningitis commonly associated

## VI-DIAGNOSIS

### 1. HISTORY

- The most common presentation: an expanding, red, painful area of swelling.
- Associated, mild constitutional symptoms (with or without fever): commonly associated with cellulitis.
- A history of local trauma to the integument: the clue to the portal of bacterial entry.
- Worrisome for orbital cellulites if there are visual changes, or pain with (or limitation of) eye movements.
- Classic presenting symptoms of peritonsillar cellulitis/abscess: painful swallowing, pain with opening the mouth (trismus).

## 2. Physical Examination

- The classic clinical findings of cellulitis: erythema, edema, tenderness, and warmth.
- The classic description of erysipelas, a superficial cellulitis usually associated with *S. pyogenes*: distinct demarcation of raised erythema.
- Lymphangitis, which usually implies more serious involvement: a red streak extending proximally from the extremity.
- Regional adenopathy: commonly associated with minor cellulitis. Occasionally complicated by lymphadenitis.

## 3. Laboratory Aids

- WBC count: may be normal or elevated.
- Blood culture: blood cultures are rarely positive in most routine cases of cellulitis. Ill-appearing children, and children with extensive cases of cellulitis, however, should probably have a culture obtained.
- Wound culture: as resistance continues to rise, cultures should be sent from any site in which *S. aureus* is a suspected pathogen.
- X-ray studies: sometimes helpful to rule out complications such as arthritis or osteomyelitis. Also useful in cases of suspected foreign bodies.
- Head CT scan: important in orbital cellulitis to delineate extent of disease, and also in some cases when distinction from periorbital cellulitis is clinically difficult.

## VII- DIFFERENTIAL DIAGNOSIS

- Allergic angioedema is the most common entity; it can usually be excluded by its lack of tenderness and the absence of fever.
- Contact dermatitis, similarly, is distinguished by its painlessness, pruritus, and the Koebner phenomenon (appearance of isomorphic lesions in the lines of scratching).
- A traumatic contusion may be mistaken for cellulitis, but the history should be confirmatory.
- Severe conjunctivitis may mimic periorbital cellulitis; conjunctival injection, chemosis, and discharge usually implicate conjunctivitis.
- A primary eye malignancy (retinoblastoma), locally invasive tumor (rhabdomyosarcoma), or metastatic disease (neuroblastoma, leukemia, lymphoma), may simulate periorbital or orbital cellulitis.

## VIII- COMPLICATIONS

- Local as well as distant spread of infection is possible.
- Suppuration and abscess formation may occur (e.g., peritonsillar abscess).
- Extremity cellulitis may extend into the deep tissues to produce an arthritis or osteomyelitis, or it may extend proximally as a lymphangitis.
- Orbital cellulitis may be complicated by visual loss and/or cavernous sinus thrombosis.
- Prior to widespread immunization against *H. influenzae* type b, the bacteremia associated with facial cellulitis was commonly associated with pneumonia, meningitis, pericarditis, epiglottitis, as well as arthritis and osteomyelitis.

## IX-PROGNOSIS

- The prognosis for complete recovery is good as long as appropriate antimicrobials are administered in a timely fashion.

## X- THERAPY

- Most cases of uncomplicated, superficial cellulitis can be treated with oral antibiotics active against *Staphylococcus* and *Streptococcus* (e.g., amoxicillin-clavulanate, cephalexin, and erythromycin).
- For more severe infections, in which *S. aureus* is a suspected pathogen, clindamycin should be considered as empiric therapy; allergic patients should receive trimethoprim-sulfamethoxazole.
- Ill-appearing children or those with extensive cellulitic lesions require intravenous antibiotics.
- Initial intravenous therapy should be directed against *S. aureus* and *Streptococcus* (e.g., oxacillin, nafcillin, cefazolin, or ampicillin/sulbactam).
- As MRSA infections continue to rise, many experts now recommend clindamycin as initial parenteral therapy.
- Vancomycin should be used as empiric therapy for severe or rapidly progressive infections.
- If hematogenous dissemination is a strong possibility, an agent active against *H. influenzae* type b also should be added (e.g., ceftriaxone, cefotaxime).
- Infants  $\leq$  6 weeks of age should have gram-positive and gram-negative coverage (e.g., oxacillin/nafcillin and gentamicin, or oxacillin/nafcillin and cefotaxime) to cover the enterics as well.
- The duration of antibiotics (intravenous and oral) should generally be 7 to 10 days.
- Abscesses should be surgically drained.
- Bite wounds should have tetanus and rabies prophylaxis issues addressed.
- Do not forget to consider the possibility of MRSA in all deep, invasive, or persistent infections (Clindamycin is recommended).
- Penicillin and amoxicillin are never good empiric choices for even superficial cellulitis (poor *S. aureus* coverage).

## XI-FOLLOW UP

- Rapid, steady improvement should be expected.
- If daily improvement is not noted, inappropriate antimicrobial coverage, a deeper infection or abscess, or some other complication should be suspected (e.g., foreign body).

## XII- PREVENTION

- Good wound care can prevent most cases of cellulitis.
- Parents should be instructed to cleanse all wounds thoroughly with soap and water, then cover with a clean, dry cloth.
- Topical antibiotic ointment is optional.

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# OSTEOMYELITIS

*By Prof. Kim Ang*

## I- DEFINITION

Osteomyelitis is infection of the bone.

## II- CAUSES

- Staphylococcus aureus: causes 90% of osteomyelitis in otherwise healthy children of all ages
- Streptococcus pyogenes or Haemophilus influenzae can also be the etiologic agent.
- Group B streptococci and Escherichia coli are often isolated in children under 1 month of age.
- Salmonella can be the cause in children with sickle cell anemia.
- Pseudomonas aeruginosa can be found in puncture wounds to the foot.

## III- PATHOLOGY

- Usually, osteomyelitis begins as bacteremia with hematogenous spread to the bone, but direct inoculation of bacteria into the bone by trauma is also possible.
- Most bacteria that enter the bone are phagocytized, so that no infection develops. When bacteria enter areas of the bone with low blood flow, however, such as the metaphysis directly beneath the physal plate, they may not be phagocytized, and an infection may develop.
- The first changes noted in osteomyelitis are the death of the osteoblasts in the infected area and resorption of trabeculae. Inflammation develops, which further compromises blood flow, and microabscesses are formed within the bone. Pus can spread through the bone and between the bone and the periosteum. This pus can lift the periosteum, causing point tenderness.

## IV-EPIDEMIOLOGY

- Increased incidence in patients with sickle cell disease and other immunodeficiencies.
- The frequency of skeletal infection is greater in infants and toddlers than in older children.
- Incidence of 0.016% per year. The femur and tibia are most often affected.

### Distribution of Affected Bones in Acute Hematogenous Osteomyelitis

Bone No.	Per Cent
Tibia	10724.3
Femur	10523.8
Humerus	5813.2
Fibula	265.9
Radius	173.9
Ulna	102.3
Vertebra	92.0
Foot bones	337.5
Pelvic bones	306.8
Hand bones	276.1
Chest bones	132.9
Head bones	61.4

*Based on unpublished series of 372 patients with 441 infected bones.*

#### V- DIAGNOSIS:

##### 1. History

The signs and symptoms of skeletal infection are highly dependent on the age of the patient. A child with osteomyelitis usually complains of sudden onset of bone or joint pain and fever. A younger child may refuse to bear weight on or move the extremity that is involved.

##### 2. Physical Examination

- Physical examination usually reveals a febrile child with point tenderness over the area of infected bone. The child is often unwilling to move the involved extremity.
- As the infection progresses, swelling, warmth, and erythema of the skin overlying the infection may be noted.
- An infant with osteomyelitis may appear septic.

### 3. Laboratory Aids

- Patients usually have an elevated white blood cell count and a high sedimentation rate.
- C-reactive protein levels are usually elevated and are useful for monitoring response to therapy.
- Blood cultures are positive in over 50% of patients.
- Aspiration of the infected bone, even in the absence of debridement, is useful to determine the etiologic organism.

### 4. Imaging

- Plain films begin to show the changes of osteomyelitis 10 to 14 days into the infection, with periosteal elevation and bone destruction.
- **Ultrasonography.** Ultrasound is helpful in detecting joint effusion and fluid collection in the soft tissue and subperiosteal regions and may guide localization for aspiration or drainage. Ultrasound is highly sensitive in the detection of joint effusion, particularly for the hip joint, where plain radiographs may be normal in more than 50% of cases of suppurative arthritis of the hip.
- <sup>99</sup>Tc bone scans are 80% accurate, and gallium scans are thought to be 91% accurate in diagnosing osteomyelitis.
- MRI can be useful in defining abscesses and extent and anatomy of bone sequestra; it is also the most useful imaging study to delineate chronic osteomyelitis.

## VI-COMPLICATIONS

Permanent damage to the growth plate, septic arthritis, fracture in a weakened bone

## VII- DIFFERENTIAL DIAGNOSIS

- Cellulitis
- Osteitis
- Septic arthritis
- Inflammatory arthritis or JRA
- Malignancy
- Trauma
- Sick cell crisis
- Toxic synovitis

## VIII- THERAPY

- The initial empirical antibiotic therapy is based on knowledge of likely bacterial pathogens at various ages, the results of the Gram stain of aspirated material, and additional considerations.
  - In neonates, an antistaphylococcal penicillin, such as nafcillin or oxacillin (150-200 mg/kg/24 hr divided q6h IV), and a broad-spectrum cephalosporin, such as cefotaxime (150-200 mg/kg/24 hr divided q8h IV), provide coverage for the *S. aureus*, group B *Streptococcus*, and gram-negative bacilli. An aminoglycoside may be used in place of the cephalosporin, but aminoglycoside antibiotics have reduced antibacterial activity in sites with decreased oxygen tension and low pH, conditions that are present in tissue infections. If the neonate is a small premature infant or has a central vascular catheter, the possibility of nosocomial bacteria (*Pseudomonas aeruginosa* or coagulase-negative staphylococci) or fungi (*Candida*) should be considered.
- Special situations dictate deviations from the usual empirical antibiotic selection.

- In patients with sickle cell disease with osteomyelitis, gram-negative enteric bacteria are common pathogens; a broad-spectrum cephalosporin such as cefotaxime or ceftriaxone is used in addition to an antistaphylococcal drug. Clindamycin (30-40 mg/kg/24 hr divided q6h IV) is a useful alternative drug for patients allergic to  $\beta$ -lactam drugs. In addition to good antistaphylococcal activity, clindamycin has broad activity against anaerobes and is useful for the treatment of infections secondary to penetrating injuries or compound fractures. Clindamycin and vancomycin (40 mg/kg/24 hr divided q6h IV) are alternatives when treating methicillin-resistant *S. aureus* infections.
- For immunocompromised patients, combination therapy is usually initiated, such as with vancomycin and ceftazidime, or with piperacillin-clavulanate and an aminoglycoside.
- When the pathogen is identified, appropriate adjustments in antibiotics are made, if necessary. If a pathogen is not identified and a patient's condition is improving, therapy is continued with the antibiotic selected initially. If a pathogen is not identified and a patient's condition is not improving, re-aspiration or biopsy and the possibility of a noninfectious condition should be considered
- Duration of antibiotic therapy is individualized depending on organism isolated and clinical course.
  - For infections caused by *S. aureus* or gram-negative bacillary infections, the minimum duration of **antibiotics is 21 days**, provided that (1) the patient shows prompt resolution of signs and symptoms (within 5-7 days) and (2) the ESR has normalized; a total of **4-6 wk of therapy may be required**.
  - For group A streptococcus, *S. pneumoniae*, or *H. influenzae* type b, antibiotics are given for a minimum of 10-14 days, using the same criteria. A total of 7 postoperative days of treatment is adequate for *Pseudomonas* osteochondritis when thorough curettage of infected tissue has been performed.
  - Immunocompromised patients generally require prolonged courses of therapy, as do patients with mycobacterial or fungal infection.
- Changing antibiotics from the intravenous route to oral administration when a patient's condition has stabilized, generally after 1 wk of intravenous therapy, may be considered.
  - For the oral antibiotic regimen with  $\beta$ -lactam drugs for staphylococcal or streptococcal infection, a dosage two to three times that used for other infections is prescribed.
  - The oral regimen decreases the risk of nosocomial infections related to prolonged intravenous therapy, is more comfortable for patients, and permits treatment outside the hospital if adherence to treatment can be assured.
- If an abscess is present in the bone, surgical debridement may also be necessary.

## IX-FOLLOW UP

Patients should be followed to ensure adequate treatment of infection and continued growth of the extremity involved.

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# SEPTIC ARTHRITIS

By Prof. KIM ANG

## I- DEFINITION

Septic arthritis is an inflammatory response to the presence of infectious organisms within the joint space.

## II- CAUSES

### Types of Organisms

AGE	MOST COMMON ORGANISM	OTHER ORGANISMS
Newborn	<i>S. aureus</i> (Klebsiella, Salmonella)	Candida albicans Group B streptococcus Gram-negative organisms
Infants and children ≤5 years	<i>S. aureus</i>	<i>Haemophilus influenzae</i> * <i>Streptococcus pneumoniae</i>
Children >5 years	<i>S. aureus</i>	<i>S. pneumoniae</i> , <i>Neisseria meningitidis</i>
Adolescents	<i>N. gonorrhoeae</i>	<i>S. aureus</i> , <i>S. pneumoniae</i> , <i>N. Meningitidis</i>
* Less likely in fully immunized children.		

## III- EPIDEMIOLOGY

- Predominant age: 2 to 6 years, adolescent (N. gonorrhea)
- Sex predominance: male/female 2:1
- Predominantly affected joints: knee, hip, elbow, ankle

## IV-PATHOLOGY/PATHOPHYSIOLOGY

- Entry of bacteria into joint space
  - Hematogenous spread
  - Direct inoculation (penetrating trauma) or extension from bone infection
  - Influx of inflammatory cells within the joint capsule
  - Destruction of cartilaginous structures within the joint by bacterial and lysosomal enzymes
  - If left untreated, can progress to necrosis of the intraarticular epiphysis

## V- DIAGNOSIS

### 1- History

- History of recent trauma does not rule out septic arthritis.
- Pain of bacterial arthritis worsens over 1 to 3 days and does not wax and wane.
- Septic arthritis is rarely polyarticular.

### 2- Physical Examination

- Fever occurs within the first few days of illness in 75% of patients, but less commonly in infants. Only 50% of children with gonococcal arthritis will have fever.
- Children with septic arthritis usually appear ill.
- The joint appears warm and swollen.
- Pseudoparalysis: decreased range of motion
- Hip effusion causes the leg to be held flexed and externally rotated.
- The child with septic arthritis will usually have pain through any range of motion. In contrast, most traumatic injuries will allow some painless range of motion of that joint.
- There are usually no external findings when the hip or shoulder joints are infected.
- Consider hip involvement when the patient complains of knee or thigh pain.
- In the frightened or uncooperative child, it is possible to have the parent perform an examination for tenderness and range of motion while the physician observes from a distance.

### 3- Laboratory investigations

#### a. Joint fluid in septic arthritis

- The WBC is often greater than 100,000/mm<sup>3</sup>, but can be as low as 50,000/mm<sup>3</sup> in early infections.
- The glucose level in the synovial fluid is less than 50% that of the serum.
- Culture of the joint reveals an organism in 70% to 80% of cases (except for gonorrhea).
- A Gram stain of synovial fluid reveals pathogens in 50% of cases.

#### b. Other Supportive Tests

- The ESR is elevated (>30 mm/hr) in 95% of cases. Retain suspicion if >20 mm/hr.
- The C-reactive protein is increased. In one study, a CRP less than 1.0 mg/dL had a negative predictive value of 87% in a population in which the prevalence of septic arthritis in tested patients was 29%.
- Blood cultures are positive in 30% to 40% of cases.
- A high peripheral WBC count is neither sensitive nor specific for septic arthritis.

#### c. Imaging

- Radiography is rarely helpful in diagnosis, can show widening of joint space and/or displacement of the normal fat pads in the knee or elbow, and is less often positive in the shoulder or hip.
- Ultrasonography  
Ultrasonography is a simple and relatively inexpensive technique for detecting a hip effusion. This test has a greater sensitivity than plain radiography and is becoming the modality of choice to reveal hip effusions. Ultrasonography is also used to guide the aspiration needle if an effusion is detected.

In a study of 96 children suspected of having septic arthritis of the hip, 40 had normal ultrasonographic findings and no septic arthritis.

## VI-DIFFERENTIAL DIAGNOSIS

- Juvenile Rheumatoid Arthritis
- Kawasaki Disease
- Lyme Disease
- Rheumatic Fever
- Serum Sickness
- Transient Synovitis

## VII- COMPLICATIONS AND PROGNOSIS

- Permanent limitation of range of motion as a result of tissue destruction and scarring
- Growth disturbance if the epiphysis is involved

Time to diagnosis is the most important prognostic factor in septic arthritis. Early institution of therapy helps to prevent degenerative arthritis. Diagnosis may be delayed in young infants, which leads to a poorer outcome.

Other poor prognostic factors include infection of the hip joint, which may lead to aseptic necrosis of the femoral head; infection with *S aureus*; and a prolonged passage of time before the synovial fluid is sterilized.

Meningitis (10-30%), osteomyelitis (5-10%), cellulitis (10-30%), and pneumonia (5%) are potential complications in young children with septic arthritis resulting from hematogenous spread of *H influenzae* type B. Osteonecrosis, growth arrest, and sepsis are potential complications from SA of any etiology.

Because of the availability of antibiotics, children rarely die from septic arthritis or its complications. Although chronic arthritis is uncommon, the short-term morbidity and costs, in terms of prolonged antibiotic therapy and hospitalizations, may be substantial.

## VIII- TREATMENT

### 1- Emergency Care

- Drainage of infection: should occur as soon as possible if bacterial cause is suspected
- Indications for open surgical drainage/irrigation:
  - Hip involvement
  - Shoulder involvement (controversial)
  - Thick, purulent, or fibrinous exudate unable to pass through 18-gauge needle
  - All other joints not undergoing open drainage should undergo needle aspiration.
- Antibiotic administration as soon as possible after joint aspiration is performed
- Immobilization of extremity
- Pain management

### 2- Drugs

Choice of antibiotics depends on age of child as outlined in the tables. In communities in which the prevalence of methicillin-resistant *S. aureus* is high, vancomycin should be considered. Once an organism is identified, an appropriate antibiotic is selected, and the child is demonstrating a good clinical response, continue outpatient therapy with either high-dose oral antibiotics or parenteral antibiotics. Antibiotics readily enter the joint fluid in high concentrations

after oral administration. Frequent revisits to the physician to ensure compliance and good clinical response are essential.

<b>Empiric Therapy Prior to Identification of Organism</b>			
<b>AGE</b>	<b>FIRST CHOICE*</b>	<b>SECOND CHOICE</b>	<b>DURATION</b>
Neonatal	Cefotaxime	Ampicillin and Gentamicin	IV for 14 days PO for 14 days
≤5 years	Cefuroxime	O/N/M	IV + PO = 28 days
>5 years	O/N/M, Cefazolin	Clindamycin	IV + PO = 28 days
<b>Adolescent</b>			
Gonococcal	Ceftriaxone	Penicillin	IV + PO = 7 to10 days
Nongonococcal	O/N/M	Cefazolin	IV + PO = 28 days
O/N/M = oxacillin or nafcillin or methicillin.			
* In communities in which the prevalence of methicillin-resistant <i>S. aureus</i> is high, vancomycin should be considered.			

### **Oxacillin:**

#### **Susceptible Staph Infections in Infants & Children**

- 100-200 mg/kg/day divided q6hr IV/IM
- Maximum 4gm/day for mild to moderate infections
- Maximum 12gm/day for severe infections

#### **Susceptible Staph Infections in Neonates**

- (<7 days old, <2 kg) OR (>7 days old, <1.2 kg): 50 mg/kg/day divided q12hr IV/IM
- (<7 days old, >2 kg) OR (>7 days old, 1.2-2 kg): 75 mg/kg/day divided q8hr IV/IM
- >7 days old, >2 kg: 100 mg/kg/day divided q6hr IV/IM

### **Gentamicin**

#### **Susceptible Infections**

- >5 years old: 2-2.5 mg/kg/dose IV/IM q8hr
- <5 years old: 2.5 mg/kg/dose IV/IM q8hr
- <30 week gestation
  - 0-28 days old: 2.5 mg/kg IV/IM qDay
  - >28 days old: 3 mg/kg IV/IM qDay
- 30-36 week gestation
  - 0-14 days old: 3 mg/kg IV/IM qDay
  - >14 days old: 5 mg/kg/d IV/IM divided q12hr
- >37 week gestation
  - 0-7days old: 5 mg/kg/d IV/IM divided q12hr
  - >7days old: 7.5 mg/kg/d IV/IM divided q8hr

### **Ceftriaxone**

<12 years old: 50-75 mg/kg IV/IM divided q12hr

## Clindamycin

8-20 mg/kg/day PO as hydrochloride; 8-25 mg/kg/day as palmitate divided q6-8hr; 37.5 mg q8hr minimum palmitate dose

- <1 month old: 15-20 mg/kg/day divided q6-8hr
- >1 month old: 20-40 mg/kg/day divided q6-8hr

### Neonates (<28 days old)

- <7 days old, <2 kg OR (>7 days old, <1.2 kg): 10 mg/kg/day IV/IM divided q12hr
- <7 days old, >2 kg OR >7 days old, 1.2-2kg: 15 mg/kg/day IV/IM divided q8hr
- >7 days old, >2 kg: 20 mg/kg/day IV/IM divided q6hr

## Vancomycin

40 mg/kg/day divided q6hours IV

### Neonatal Dosing

- <7 days old, <1.2 kg: 15 mg/kg IV qDay
- <7 days old, 1.2-2 kg: 10-15 mg/kg q12-18hours IV
- (<7 days old, >2 kg) OR (>7 days old, 1.2-2 kg): 10-15 mg/kg q8-12hours IV
- >7 days old, >2 kg: 45-60 mg/kg/day divided q8hours IV

## Penicillin:

### Neonatal Bacterial Infection General Dosing Guidelines

- <7 days & <2000 g: 50,000 units/kg/day IV divided q12hr
- <7 days & >2000 g: 75,000 units/kg/day IV divided q8hr
- >7 days & <1200 g: 50,000 units/kg/day IV divided q12hr
- >7 days & 1200-2000 g: 75,000 units/kg/day IV divided q8hr
- >7 days & >2000 g: 100,000 units/kg/day IV divided q6hr

### Infant & Children Bacterial Infection General Dosing Guidelines

- Moderate Infection: 25,000-50,000 units/kg/day IV/IM divided q6hr
- Severe Infection: 250,000-400,000 units/kg/day IV/IM divided q4-6hr
- Not to exceed 24 million units/day

### 3- Duration of therapy (IV and PO) for various organisms

- Treat for at least 2 weeks after resolution of fever and joint effusion.
- 28 days: *S. aureus*, gram-negative organisms, group B streptococcus
- 14 days: *H. influenzae*, *N. meningitidis*, streptococci
- 7 days: *N. gonorrhoeae*

### 4- Follow-Up

- Involve orthopaedic surgery and physical therapy services in follow-up.

### 5- When to expect improvement

With appropriate antibacterial therapy, one should see improvement of symptoms with 2 days of initial administration.

**6- Signs to watch for**

- Continued pain, fever, or lack of improvement of range of motion after 3 to 4 days of appropriate antibiotic treatment.
- Rising ESR or CRP in the face of antibiotic treatment.

**IX-PATIENT EDUCATION**

Nontraumatic joint pain with evidence of arthritis, such as swelling, warmth, or redness, requires emergency medical attention.

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# TYPHOID FEVER

By Prof. Kdan Yuvatha

## I- INTRODUCTION <sup>[8] [9]</sup>

Typhoid fever continues to be a major health problem due to poor hygienic and sanitary conditions prevalent in developing countries. Cambodia reported 5,399 children (age less than 15 y.o) of enteric fever in 2010 resulting in 4 deaths. The emergence of *Salmonella* More Details typhi strains resistant to multiple antibiotics have been causing enormous childhood morbidity and increasing the cost of therapy.

## II- DEFINITION

Infection caused by *Salmonella typhi* or *paratyphi*, starting in the lymphatic system.

## III- EPIDEMIOLOGY

Typhoid fever is a major health problem in Cambodia. All age groups are at risk but it occurs most commonly in older children and the incidence is highest in the hot and wet seasons. Transmission is either directly (dirty hand) or indirectly (through water or food contaminated with the faecal or urine of a patient or carrier).

## IV- AETIOLOGY

Typhoid fever is caused by the gram-negative organism *Salmonella typhi* or *paratyphi* that causes a prolonged febrile illness with bacteria passing into the bloodstream (septicaemia).

## V- PATHOGENESIS

The organisms penetrate the mucosa of the small intestine and travel through the reticulo-endothelial cell system, where they multiply before entering the bloodstream in large numbers - this is the start of the fever. The Peyer's patches of the ileum are also infected at this time - they become inflamed and in the second or third week of the illness may ulcerate - causing haemorrhage and perforation of the small bowel. The liver and gall bladder are also involved. After recovery, symptomless biliary infection may persist indefinitely, leading to chronic faecal or urinary carriage.

## VI- CLINICAL SIGNS <sup>[3]</sup>

**Incubation period** is 10-21 days.

**Symptoms and signs:**

The onset of symptoms is insidious.

Initial symptoms develop over 2-3 days:

- fever,
- malaise,
- anorexia,
- myalgia,
- headache,
- abdominal pain,
- hepatomegaly,
- diarrhea / constipation,
- epistaxis,

Severe lethargy may develop in some children.

Temperature, which increases in a stepwise fashion and high fever within 1 week, often reaching 40°C (sometime with chill)

**During the 2nd week of illness:**

High fever is sustained, and fatigue, anorexia, cough, and abdominal symptoms increase in severity. Patients appear acutely ill, disoriented, and lethargic. Delirium and stupor may be observed. Physical findings include a relative bradycardia, which is disproportionate to the high fever. Hepatomegaly, splenomegaly, and distended abdomen with diffuse tenderness are very common. Classical signs: rose spots are rare in Asian children but are a very specific sign of typhoid. They appear on about the 7th–10th day. Lesions are usually discrete, erythematous, and 1–5 mm in diameter; the lesions are slightly raised and blanch on pressure. They appear in crops of 10–15 lesions on the lower chest and abdomen and last 2–3 days. They leave a slight brownish discoloration of the skin on healing.

Rhonchi and scattered rales may be heard on auscultation of the chest.

Nausea and vomiting if occurring in the 2nd or 3rd week suggest a complication.

If no complications occur, the symptoms and physical findings gradually resolve within 2–4 weeks, but malaise and lethargy may persist for an additional 1–2 months.

**VII- LABORATORY TESTS**

- 1- Full blood count : often shows leucopenia (except in complicated cases)
- 2- Malaria smear : to exclude malaria
- 3- Lumbar puncture : if necessary to exclude meningitis

**Diagnosis confirmation:**

- 1- **Blood culture** : 80% positive in first week (less if prior antibiotic use).  
Less frequently positive after first week.
- 2- **Stool culture / urine culture** : positive after second week.

**Widal test** : note this is non-specific and unreliable and only useful if test can be re-performed after 2 weeks to show a rising antibody titre. If only a single test can be done use 1/320 as a cut-off for positive results. This test becomes positive around day 8 and is of very little diagnosis value.

**VIII-COMPLICATIONS**

*May appear during illness and during convalescence even under therapy :*

- Encephalitis : Drowsiness, Confusion, Delirium, Coma and Meningeal signs
- Intestinal hemorrhage : Melaena, hematemesis
- Abdominal distension : abdominal tenderness, peritonitis (intestinal perforation)
- Septicemia : with or without shock
- Myocarditis

- Jaundice (febrile hepatitis)
- Joint pains
- Malnutrition and pallor

**Note:** Cough is quite common but it is quite rare to observe bronchitis or pneumonia associated with typhoid fever.

### IX- DIFFERENTIAL DIAGNOSIS

- Malaria
- Gastro-enteritis and dysentery
- Septicemia or septic shock
- Meningitis
- Acute abdomen
- Dengue Hemorrhagic Fever

### X- CLASSIFICATION OF DISEASE SEVERITY <sup>[1]</sup>

	Mild	Moderate	Severe	Very Severe
<b>General</b>	fever +/- chills	Typhoid facies	Pre-Shock	Septic Shock
<b>Neuro</b>	headaches	Drowsiness +/- Neck stiffness	delirium confusion +/- Meningeal reaction	Coma +/- Meningitis
<b>Liver</b>	hepatomegaly	Tender hepatomegaly	with jaundice	with abscess
<b>Intestine</b>	soft abdomen cramps	Tenderness Constipation or diarrhea (+/- blood)	Abdominal distension melaena	signs of Ileus or perforation
<b>Spleen</b>	none	Palpable	Tenderness	Abscess
<b>Renal</b>	normal	Proteinuria	pyuria Pyelonephritis	haematuria Glomerulo- nephritis
<b>Lungs</b>	Dry cough	Bronchitis	Pneumonia	Severe pneumonia +/- emphysema

Note that the diagnosis must be based on the clinical history and examination. At RH level, laboratory tests are sometimes useful to rule out other diseases.

### XI- TREATMENT

#### 1. Antimicrobial <sup>[3]</sup> <sup>[10]</sup>

Uncomplicated typhoid fever	Antibiotic	Daily dose mg/kg	Days	Severe typhoid fever	Antibiotic	Daily dose mg/kg	Days
<b>First line</b>	Ciprofloxacin PO	20 - 30	5 - 7	<b>First line</b>	Ciprofloxacin PO	20 - 30	10 - 14
	<b>or</b> Ofloxacin PO	15			<b>or</b> Ofloxacin IV	15	
<b>Second line</b>	Cefixime PO	15 - 20	7 - 14	<b>Second line</b>	Ceftriaxone IV	75-100	10 - 14
	Ceftriaxone IV	75	7				

## 2. Supportive treatment <sup>[1]</sup>

- **Fluid:** ensure adequate hydration PO (ORS, water, coconut, or soy milk) or IV (Ringer Lactate /dextrose 10%) for severe complicated cases
- **Fever:** - Paracetamol (60mg/kg/day, divided in 4 times per day).
  - Tepid sponging and fanning.
  - Do not use salicylates which can cause bleeding.
- **Food:** Ensure very early and appropriate nutrition. There is no indication for special diet (just avoid spicy foods and uncooked vegetables). Start with soft semi-liquid food.

## 3. Good nursing care <sup>[1]</sup>

- Chart temperature every 6 hours
- Check hydration status (give extra fluids by mouth)
- Check nutrition (start early with soft, nutritious food -high-energy borbor)
- Prevent bedsores, especially in unconscious or malnourished patients.

## 4. Daily examination <sup>[1]</sup>

- Hemodynamic state (BP, pulse, urine output, heart & lungs, extremities)
- Neurological status (use Glasgow coma scale)
- Anemia (check for melaena - blood may be red or black)
- Abdomen (signs of intestinal perforation - acute abdomen - refer to surgeons)

## XII- RECURRENCE OF TYPHOID FEVER <sup>[3]</sup>

- Relapse after the initial clinical response occurs in 4–8% of the patients who are not treated with antibiotics.
- In patients who have received appropriate antimicrobial therapy, the clinical manifestations of relapse become apparent about 2 wk after stopping antibiotics and resemble the acute illness.
- The relapse, however, is usually milder and of shorter duration.
- Numerous relapses may occur.
- Individuals who excrete *S. ser. Typhi* for =3 mo after infection usually become chronic carriers. The risk of becoming a carrier is low in children and increases with age; of all patients with typhoid fever, 1–5% becomes chronic carriers.
- The incidence of biliary tract diseases is higher in chronic carriers than in the general population. Although chronic urinary carriage may also occur, it is rare and found mainly in individuals with schistosomiasis.

## XIII-PREVENTION <sup>[1]</sup>

- Isolation
- Disinfection of excreta with chlorine solution 2%
- Health education: Individual and collective hygiene (Hand washing, water and sanitation)
- Oral or Parenteral vaccines are effective.

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# TETANUS

By Prof. Kdan Yuvatha

## I- DEFINITION <sup>[1]</sup> <sup>[5]</sup>

**Tetanus** is acquired through exposure to the spores of the bacterium *Clostridium tetani* which are universally present in the soil. The disease is caused by the action of a potent neurotoxin produced during the growth of the bacteria in dead tissues, e.g. in dirty wounds or in the umbilicus following non-sterile delivery. Tetanus is not transmitted from person to person. A person usually becomes infected with tetanus when dirt enters a wound or cut. Tetanus germs are likely to grow in deep puncture wounds caused by dirty nails, knives, tools, wood splinters, and animal bites.

**Tetanus** develops in persons who have not been correctly vaccinated before exposure, or have not received adequate prophylactic treatment immediately after exposure.

## II- EPIDEMIOLOGY <sup>[2]</sup> <sup>[4]</sup>

Tetanus occurs worldwide and is endemic in 90 developing countries, but its incidence varies considerably. The most common form, neonatal (umbilical) tetanus, kills approximately 500,000 infants each year because the mother was not immunized; about 80% of these deaths occur in just 12 tropical Asian and African countries. In addition, an estimated 15,000–30,000 unimmunized women worldwide die each year of maternal tetanus that results from postpartum, postabortal, or postsurgical wound infection with *C. tetani*. Cambodia reported 105 children (age less than 15 y.o) of tetanus in 2011 resulting in 14 deaths:

- Neonate tetanus : 24 alive and 6 deaths
- Other tetanus : 67 alive and 8 deaths

## III- AETIOLOGY <sup>[2]</sup>

**Tetanus**, historically called **lockjaw**, is an acute, spastic paralytic illness caused by tetanus toxin, the neurotoxin produced by *Clostridium tetani*, a motile, gram-positive, spore-forming obligate anaerobe whose natural habitat worldwide is soil, dust, and the alimentary tracts of various animals.

## IV- CLINICAL FEATURES <sup>[1]</sup>

Generalized tetanus is the most frequent and severe form of the infection. It presents as muscular rigidity, which progresses rapidly to involve the entire body, and paroxysmal muscle spasms, which are very painful. Level of consciousness is not altered.

### 1. Children and adults <sup>[1]</sup>

- Average period from exposure to onset of symptoms is 7 days (3 to 21 days)
- Muscular rigidity is first seen in the jaw muscles (*difficulty, then inability, in opening the mouth [trismus], preventing the patient from speaking, eating) then, extends to*

those of the face (fixed smile [*risus sardonicus*]), the neck (difficulty in swallowing), trunk (restriction of respiratory muscles, hyperextension [*opisthotonos*]), abdomen (guarding) and limbs (extension of the lower limbs and flexion of the upper limbs).

- Muscle spasms appear at the onset or when muscular rigidity becomes generalized. They are triggered by stimuli or arise spontaneously. Spasms of the thoracic and laryngeal muscles may cause respiratory distress or aspiration.

## 2. Newborns <sup>[1]</sup>

- In 90% of cases, initial symptoms appear within 3 to 14 days of birth.
- The first signs are significant irritability and sucking difficulties (*rigidity of the lips, trismus*), then rigidity becomes generalized, as in adults. An infant qualifies as a **case of neonatal tetanus** if it has sucked and cried normally for the first 2 days of life, then becomes irritable and stops sucking 3 to 28 days after birth, and demonstrates rigidity and muscle spasms.
- Although the umbilicus is almost always the portal of entry, clinical infection of the cord site (*omphalitis*) is evident in only one half of cases.
- Check for septicemia, which is frequently associated.

## 3. Prognostic Scoring Systems in Tetanus Dakar Score <sup>[3] [13]</sup>

Prognostic Factor	Score 1	Score 0
Incubation period	< 7 days	≥ 7 days or unknown
Period of onset	< 2 days	≥ 2 days
Entry site	Umbilicus, burn, uterine, open fracture, surgical wound, IM injection	All others plus unknown
Spasms	Present	Absent
Fever	> 38.4°C	< 38.4°C
Tachycardia	Adult > 120 beats/min Neonate > 150 beats/min	Adult < 120 beats/min Neonate < 150 beats/min
Total Score		

- Maximum = 6    Minimum = 0

Total score	Disease severity	Mortality
0 – 1	No severe	< 10%
2 – 3	Mild	10-20%
4	Severe	20-40%
5 – 6	Very severe	> 50%

## V- DIFFERENTIAL DIAGNOSIS <sup>[3]</sup>

### 1. Hyper tonicity / hyper-excitability:

- Neuroleptic intoxication (*Haloperidol, chlorpromazine, metoclopramide*)
- Strychnine intoxication

### 2. Trismus can be observed in other diseases:

- ENT infection (*maxillary arthritis, abscess...*)
- Dental infection (wisdom tooth)
- Meningitis and encephalitis

- Cerebral malaria (with convulsions)

## VI- DIAGNOSIS AND LABORATORY TESTS <sup>[2][6]</sup>

Tetanus is diagnosed based on a physical exam, medical and immunization history, and the signs and symptoms of muscle spasms, stiffness and pain.

Laboratory tests generally aren't helpful for diagnosing tetanus.

Routine laboratory studies are usually normal. A peripheral leukocytosis may result from a secondary bacterial infection of the wound. The cerebrospinal fluid (CSF) is normal, although the intense muscle contractions may raise intracranial pressure.

*C. tetani* is not always visible on Gram stain of wound material, and it is isolated in only about one third of cases.

## VII- COMPLICATION <sup>[9][12]</sup>

1. Respiratory: apnea, atelectasis, aspiration pneumonia, laryngospasm, pulmonary embolism.
2. Cardiovascular: tachy / bradycardia, hypo / hypertension, myocard ischemia, abnormal heart rate (arrhythmias, asystole), cardiac failure.
3. Acute kidney failure.
4. Nosocomial infections.
5. Gastrointestinal: ileus, gastric stasis, diarrhea, hemorrhage.
6. Fractures of the spine or long bones as a result of sustained contractions and convulsions.
7. Malnutrition.
8. Thromboembolism.
9. Bedsore
10. Syndrome multiple organ failure.

## VIII-TREATMENT <sup>[1][7][10][11]</sup>

Hospitalization is necessary and requires 3 to 4 weeks on average. Correct management can reduce mortality by 50%, even in hospitals with limited resources.

### a. General measures

- The patient should be the sole occupant of a dark, quiet room: all stimulation (*noise, light, touch*) may trigger painful spasms that may cause critical respiratory distress.
- Establish IV access: *hydration, access for IV injections*.
- Insert a nasogastric tube: *hydration and feeding, administration of oral medications*.
- Gentle aspiration of secretions (*nose, oropharynx*).
- Provide hydration and nutrition in feeds divided over 24 hours. In newborns, give expressed breast milk every hour (*risk of hypoglycemia*).
- All wounds should be cleaned and debrided as indicated.
- Give oxygen if needed.

**Note <sup>[7]</sup>:** The total daily fluid requirement of a child is calculated with the following formula: 100ml/kg for the first 10 kg, then 50ml/kg for the next 10 kg, thereafter 25ml/kg for each subsequent kg.

### b. Neonatal Tetanus

- **Anticonvulsants:**
  - + *Diazepam* (PO, Rectal, or IV): variable dose depending on the severity and progression of the disease: 0.5 to 2mg/kg/dose (maximum 20-40 mg /kg/ day).

## PLUS

- + Phenobarbital: 20mg/kg/day PO, a single dose at the first day and then 5mg/kg/day for the following days.
- **Antibiotics**
  - + Ceftriaxone: 200mg/kg/day (PIV), divided into 2 times at the first day and then 100mg/kg/day for the following days.
- **TIG** (human immunoglobulin) = Tétuman 1,000 IU (i.m).  
Or **SAT**: 10,000UI en IVL
- Completed by vaccination (National Immunization Program).
- **Adequate fluids and nutrition** should be provided, as tetanus spasms result in high metabolic demands and a catabolic state. Nutritional support will enhance chances of survival.
- **Antipyretic (if fever)**: Paracetamol 10-15mg/kg/dose, not to exceed 60mg/day.
- **Vitamin K1** = 1mg (i.m)
- **Airway / respiratory control**: drugs used to control spasm and provide sedation can result in respiratory depression. Patients must be carefully monitored and medication doses adjusted to provide maximal spasm and autonomic dysfunction control while avoiding respiratory failure. Nasotracheal intubation with assisted ventilation (if apnea).

### c. Tetanus Infant and Child

- **Anticonvulsants:**

- + Diazepam (PO, Rectal, IV):

- 1 to 3mg/kg/dose, depending on the severity of

- contracture,

- maintenance dose in 5 to 6mg/kg/day (maximum

- 10mg/kg/day) for 2

- weeks and 1 week followed by gradual decrease.

- + Phenobarbital: 10mg/kg/ dose (PO) at first dose, then 5mg/kg/day in single dose for the following days.

- **Antibiotics:**

- + Ceftriaxone 200mg/kg/day ( PIV) divided in 2 times at the first day, then 100mg/kg/day for 7 days

- + With Metronidazole 30mg/kg/day divided in 2-3 times for 7 days (PO, PIV)

- **TIG** (human immunoglobulin: 100 IU/kg, single dose i.m (maximum 3,000 IU) Or **SAT**: 10,000UI en IVL

- Completed by vaccination (National Immunization Program)

- **Cimetidine**: 20mg/kg/day, divided in 2 times (PO, i.v, i.m)

- **Antipyretic** (if fever): Paracetamol 10-15mg/kg/dose, not to exceed 60mg/day

- **Adequate fluids and nutrition** should be provided, as tetanus spasms result in high metabolic demands and a catabolic state. Nutritional support will enhance chances of survival.

- **Airway / respiratory control**: drugs used to control spasm and provide sedation can result in respiratory depression. Patients must be carefully monitored and medication doses adjusted to provide maximal spasm and autonomic dysfunction control while avoiding respiratory failure. Nasotracheal intubation with assisted ventilation (if apnea).

- 10-15mg/kg/dose, not to exceed 60mg/day

## IX- PREVENTION <sup>[1]</sup>

### 1. Post-exposure prophylaxis

- In all cases:
  - Cleansing and disinfection of the wound, and elimination of foreign material.
  - Antibiotics are not prescribed routinely for prophylaxis. The decision to administer an antibiotic is made on a case-by-case basis, according to the patient's clinical status.
- Depending on pre-exposure vaccination status:
  - Tetanus vaccine (TV) and immunoglobulin (*see indications below*)

Risk	Complete vaccination (3 or more doses) Time since administration of latest dose:			Incomplete vaccination (less than 3 doses) or no vaccination or unknown status
	< 5 years	5-10 years	> 10 years	
Minor clean wound	None	None	TV One booster dose	Initiate or complete TV
All other wound	None	TV One booster dose	TV One booster dose	Initiate or complete TV and Administer tetanus immunoglobulin

- **Tetanus vaccine IM**

**Children and adults** : 0.5 ml/injection

- With no vaccination or unknown vaccination status: *administer at least 2 doses at an interval of 4 weeks.*
- With incomplete vaccination: *administer one dose.*

Then, to ensure long-lasting protection, administer additional doses as indicated in the table below.

- **Human anti-tetanus immunoglobulin IM**

**Children and adults:** 250 IU as a single dose; 500 IU for wounds more than 24 hours. Inject the **vaccine** and the **immunoglobulin** in 2 different sites, using a separate syringe for each. Or **SAT:** 1,500UI en IM

### 2. Routine vaccination (pre-exposure prophylaxis)

- **Children:** a first series of 3 doses of DTP or DTP + HepB or DTP + Hib +HepB before the age of 1 year, administered at an interval of 1 month (e.g. at the age of 6,10 and 14 weeks), then a 4<sup>th</sup> dose between 12 and 15 years.
- **Women of childbearing age:** 5 doses during the reproductive years: a series of 3 doses (*dT or TT*) with an interval of at least one month between the 1<sup>st</sup> and 2<sup>nd</sup> dose and an interval of at least 6 months between the 2<sup>nd</sup> and 3<sup>rd</sup> dose, then two other doses, each at minimum interval of one year, e.g. during pregnancies.
- **Pregnant women:** if a woman has never been vaccinated or if her vaccination status is unknown: 2 doses of dT or TT during the pregnancy to reduce the risk of tetanus in at least 4 weeks later and at least 2 weeks before delivery. The vaccination regime protects more than 80% of newborns from *neonatal tetanus*. A single dose offers no protection. Continue vaccination after delivery to complete 5 doses, as for women of childbearing age.

**3. Other measures**

Appropriate hygiene during delivery, including home birth.

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# MEASLES

By Dr. Yay Chantana

## I. DEFINITION

Measles is a very contagious viral infection, characterized by fever, coryza, conjunctivitis, cough and a specific enanthem (Koplik's spots) followed by a generalized maculopapular eruption.

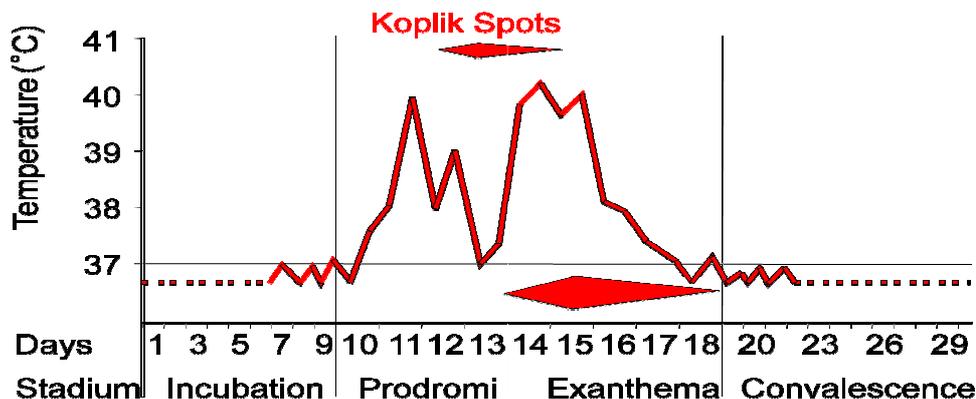
## II. ETIOLOGY

Measles is caused by a paramyxovirus in the morbillivirus genus and family Paramyxoviridae.

## III. CLINICAL MANIFESTATION

Measles is a serious infection characterized by high fever, an enanthem, cough, coryza, conjunctivitis, and a prominent exanthem. After an incubation period of 8–12 days, the prodromal phase begins with a mild fever followed by the onset of conjunctivitis with photophobia, coryza, a prominent cough and increasing fever. The enanthem, **Koplik spots**, is the pathognomonic sign of measles and appears 1 to 4 days prior to the onset of the rash. The rash begins around the forehead (around the hairline), behind the ears, and on the upper neck as a red maculopapular eruption. It then spreads downward to the torso and extremities, reaching the palms and soles in up to 50% of cases. The exanthem frequently becomes confluent on the face and upper trunk.

**Droplet infection; contagious:  
1-2 days before symptoms  
till 4 days after start of rash**





Facial exanthema



Koplik Spots

#### IV. DIAGNOSIS

- The diagnosis of measles is almost always based on clinical and epidemiologic findings
- In the acute phase include reduction in the total white blood cell count, with lymphocytes decreased more than neutrophils.
- Serologic confirmation is most conveniently made by identification of immunoglobulin (IgM, IgG) antibody in serum.

#### V. COMPLICATIONS

- Pneumonia is the most common cause of death in measles. It may manifest as **giant cell pneumonia** caused directly by the viral infection or as superimposed bacterial infection. The most common bacterial pathogens are *S. pneumoniae*, *H. influenzae*, and *S. aureus*
- Worsening of the nutritional state of the child: because of anorexia, stomatitis, vomiting, diarrhoea, fever and other complications
- Obstructive laryngitis and laryngotracheitis
- Acute encephalomyelitis, subacute measles encephalitis and subacute sclerosing panencephalitis.
- Measles infection is known to suppress skin test responsiveness to purified tuberculin antigen. There may be an increased rate of activation of pulmonary tuberculosis in populations of individuals infected with *Mycobacterium tuberculosis*.
- Xerophthalmia and keratomalacia.

#### VI. DIFFERENTIAL DIAGNOSIS

Rubella, parvovirus B19 infection, roseola infantum, enterovirus infection, scarlet fever, Kawasaki disease, meningococemia, toxic erythema, and drugs eruptions

#### VII. TREATMENT

There is currently no specific anti viral therapy for measles infection.

##### 1. Vitamin A supplementation

Vitamin A supplementation is recommended to all children with acute measles or within 3 months after measles infection

- Infant < 6 months of age: Vitamin A 50,000 IU on 1<sup>st</sup> and 2<sup>nd</sup> day.
- Infant 6 to 11 months of age (< 8 kg): Vitamin A 100,000 IU on 1<sup>st</sup> and 2<sup>nd</sup> day.
- Children over 12 months of age: Vitamin A 200,000 IU on 1<sup>st</sup> and 2<sup>nd</sup> day.

If there are signs of xerophthalmia, another dose (3<sup>rd</sup> dose) of vitamin A is given on 14<sup>th</sup> day.

##### 2. Supportive care

- Nursing care of eyes and mouths
- Adequate fluid intake: oral rehydration solution, serum perfusion for diarrhea.
- Adequate nutrition, encourage the continuation of breast-feeding if possible.
- Control of temperature: Paracetamol, Ibuprofen or tepid sponging for fever.
- Oxygen therapy, airway humidification in respiratory tract involvement and intubation ventilation for respiratory failure.

- Antibiotics for bacterial complications.
- Advise the mother against harmful dietary practices such as fasting, drinking toad's blood

### VIII. PREVENTION

Immunization 1<sup>st</sup> dose is given at 9 months of age and 1 additional dose should be given at second year of age.

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# VARICELLA

*By Dr. Heng Sothy*

## I. DEFINITION

**Varicella or Chickenpox** is a highly [contagious](#) illness caused by primary [infection](#) with [varicella zoster virus](#) (VZV). It usually starts with [vesicular](#) skin [rash](#) mainly on the body and head rather than at the periphery and becomes itchy, raw [pockmarks](#), which mostly heal without scarring. On examination, the observer typically finds lesions at various stages of healing.

## II. ETIOLOGY

VZV is a neurotropic human herpesvirus with similarities to herpes simplex virus, which is also  $\alpha$ -herpesvirus. These viruses are enveloped with double-stranded DNA genomes that encode more than 70 proteins, including proteins that are targets of cellular and humoral immunity.

## III. EPIDEMIOLOGY

Primary varicella is a disease that is [endemic](#) to all countries worldwide. Varicella has a prevalence that is stable from generation to generation. In the tropics, varicella often occurs in older people and may cause more serious disease. In adults the pock marks are darker and the scars more prominent than in children.

90% cases of varicella occur in the child between 1 year and 14 years, 50 to 60% cases occur between 5 and 9 years, only 2% cases with beyond 20 years.

Varicella is an [airborne disease](#) spread easily through coughing or sneezing of ill individuals or through direct contact with secretions from the rash. A person with chickenpox is infectious one to two days before the rash appears. The contagious period continues for 4 to 5 days after the appearance of the rash, or until all lesions have crusted over. Crusted lesions are not contagious. It takes from 10 to 21 days after contact with an infected person for someone to develop chickenpox.

## IV. CLINICAL MANIFESTATION

### a. Immunocompetent form:

- Incubation period: the illness usually begins 14–16 days after exposure
- The onset of illness is often characterized by symptoms including [myalgia](#), [nausea](#), fever (38° to 41°C), malaise, anorexia, headache, sore throat. Fever and other systemic symptoms may occur 24–48 hr before the rash appears and persist during the 1st 2–4 days after the onset of the rash.
- Varicella lesions often appear first on the scalp, face, or trunk. The initial exanthem consists of intensely pruritic erythematous macules that evolve through the papular stage to form clear, fluid-filled vesicles. Clouding and umbilication of the lesions begin in 24–48 hr. While the initial lesions are crusting, new crops form on the trunk

and then the extremities; the simultaneous presence of lesions in various stages of evolution is characteristic of varicella. Ulcerative lesions involving the mucosa of oropharynx and vagina are also common; many children have vesicular lesions on the eyelids and conjunctivae, but corneal involvement and serious ocular disease is rare. The average number of varicella lesions is about 300, but healthy children may have fewer than 10 to more than 1,500 lesions. The exanthem may be much more extensive in children with skin disorders, such as eczema or recent sunburn. Hypopigmentation or hyperpigmentation of lesion sites persists for days to weeks in some children, but severe scarring is unusual unless the lesions were secondarily infected.

**b. Immunocompromised form:** (HIV, Leukemia, lymphoma, corticotherapy, Transplantation, ...)

- Severe infectious Status, eruption often necrotic and hemorrhagic.
- visceral organ involvement especially lungs, liver, brain.

The mortality rate for children who acquired varicella while undergoing treatment for malignancy and who were not treated with antiviral therapy approaches 7%

**c. Neonatal form:**

Infection late in gestation or immediately following birth is referred to as "*neonatal varicella*". Infants whose mothers develop varicella in the period from 5 days prior to delivery to 2 days afterward are at high risk for severe varicella. Newborns who develop symptoms are at a high risk of [pneumonia](#) and other serious complications of the disease. The baby may also be exposed to the virus via infectious siblings or other contacts, but this is of less concern if the mother is immune. Newborns have particularly high mortality (30%) in the circumstances of a susceptible mother contracting varicella around the time of delivery. Because perinatally acquired varicella may be life threatening, the infant should be treated with acyclovir (10 mg/kg every 8 hr IV) when lesions develop.

**d. Congenital form:**

Varicella infection in pregnant women could lead to [viraltransmission](#) via the placenta and infection of the fetus. If infection occurs during the first 28 weeks of [gestation](#), this can lead to fetal varicella syndrome (also known as *congenital varicella syndrome*).

## V. DIAGNOSIS

The diagnosis of varicella is primarily clinical, with typical early "[prodromal](#)" symptoms, and then the characteristic [rash](#). Confirmation of the diagnosis can be sought through either examination of the fluid within the vesicles of the rash, or by testing blood for evidence of an acute immunologic response.

\*\*\***The differential diagnosis** of varicella includes vesicular rashes caused by other infectious agents, such as Herpes simplex virus, Zona, Coxsackie infection, rickettsial, S. aureus, drug reaction, contact dermatitis and insect bites.

## VI. LABORATORY FINDINGS

- Laboratory evaluation has not been considered necessary for the diagnosis or management of healthy children with varicella.
- Leukopenia is typical during the 1st 72 hr; it is followed by a relative and absolute lymphocytosis.
- Results of liver function tests are also usually (75%) mildly elevated.
- Patients with neurologic complications of varicella or uncomplicated herpes zoster have a mild lymphocytic pleocytosis and a slight to moderate increase in protein in the cerebrospinal fluid; the glucose concentration is usually normal

## VII. COMPLICATIONS

The complications of VZV infection occur with varicella, or with reactivation of infection, more commonly in immunocompromised patients. Purpura, hemorrhagic vesicles, hematuria, gastrointestinal bleeding and Cerebellar ataxia are rare complications that may have serious consequences. Other complications of varicella, some of them rare, include encephalitis, pneumonia, nephritis, nephrotic syndrome, hemolytic-uremic syndrome, arthritis, myocarditis, pericarditis, pancreatitis, and orchitis.

- *Bacterial Infections*: Secondary bacterial infections of the skin, usually caused by group A streptococci and *S. aureus*.
- *Encephalitis and Cerebellar Ataxia*: morbidity from CNS complications is highest among patients younger than 5 yr or older than 20 yr.
- *Pneumonia*: Varicella pneumonia is a severe complication that accounts for most of the increased morbidity and mortality in adults and other high-risk populations, but pneumonia may also complicate varicella in young children.

## VIII. TREATMENT

### 1. **Uncomplicated form**: symptomatic therapy.

- Antipyretic: Paracetamol.
- Antihistaminic H1: Promethazine.
- Apply antiseptic on itchy lesion : Chlorhexidine (not absolutely recommended).
- The use of NSAID is associated with an elevated risk of severe skin and soft tissue complication of varicella zoster.
- But [Aspirin](#) is highly contraindicated in children younger than 16 years as it has been related with a potentially fatal condition known as [Reye's syndrome](#).

### 2. **Complicated form**:

- Bacterial suppra-infection: Antibiotic against Staphylococcus, and streptococcus (Amoxilline+acide clavulanique, pristinamycine).
- Acyclovir:
  - *Oral therapy*: is not recommended routinely for treatment of uncomplicated varicella in the otherwise healthy child because of the marginal benefit, the cost of the drug, and the low risk for complications of varicella.
  - *Intravenous therapy* with acyclovir (500 mg/m<sup>2</sup> every 8 hr IV for 7 days.) is indicated for severe disease and for varicella in immunocompromised patients.

## IX. PREVENTION

### 1. **Vaccine**

Varicella is a vaccine-preventable disease. The chickenpox vaccine is not yet included in national immunization program of Cambodia.

### 2. **Hygiene Measures**:

- Patients are usually required to stay at home while they are infectious to avoid spreading the disease to others (about 1 week).
- Asked to cut their [nails](#) short or to wear [gloves](#) to prevent scratching and to minimize the risk of secondary [infections](#).
- It is important to maintain good hygiene and daily cleaning of [skin](#) with warm water one to two time per day (avoid frequent bathing) to avoid secondary [bacterial infection](#).
- Avoid frequent bathing or using the traditional method to patient as water bath mixing with leaf, snail-shell or other substances. It can cause severe bacterial infection or sepsis.

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# PERTUSIS

*By Dr. Yay Chantana*

## I. DEFINITION

Pertussis is a classic "whooping cough" syndrome of prolonged paroxysmal coughing spells with a characteristic inspiratory whoop, caused by *Bordetella pertussis* infection.

## II. EPIDEMIOLOGY

- Pertussis is one of the most highly communicable diseases with attack rates close to 80–90% in susceptible individuals.
- Humans are the only hosts of *B. pertussis*.
- Route of spread is primarily via large aerosolized respiratory droplets generated by coughing or sneezing.
- Pertussis occurs with seasonal peaks and 3–5 year cycles of increased incidence of disease.

## III. PATHOPHYSIOLOGY

- Replicates only in association with ciliated epithelium, causing congestion and inflammation of the bronchi; peribronchial lymphoid hyperplasia followed by a necrotizing process occurs and results in a bronchopneumonia; atelectasis can also occur owing to bronchiolar obstruction from accumulated secretions.
- The long incubation period (7–21 days) reflects the time necessary for *B. pertussis* to increase in numbers needed for progressive spread of infection in the respiratory tract and to produce enough toxin for eliciting damage and dysfunction of the respiratory epithelium.

## IV. ETIOLOGY

Infection with *B. pertussis*, a small, nonmotile, fastidious, Gram-negative rod

## V. DIAGNOSIS

### 1. Signs and Symptoms

- The most likely source of pertussis in young infants is from the adolescent or adult with mild symptoms of pertussis. Therefore, a thorough history, including presence of

cough in adult family members, must be taken and a high index of suspicion for pertussis must be maintained when evaluating infants and children for cough.

- 3 clinical stages:
  - Catarrhal stage (1–2 weeks) with symptoms of an upper respiratory infection
  - Paroxysmal stage (2–4 weeks or longer) characterized by paroxysmal cough with increased severity and frequency producing the characteristic whoop during the sudden forceful inspiratory phase; posttussive vomiting is also observed during this stage.
  - The convalescent stage begins and lasts 1–2 weeks, but cough can persist for several months. In the adolescent or adult, long-standing cough of 2–3 weeks is the hallmark symptom.
- Apnea is a common manifestation in infants younger than 6 months. The characteristic whoop is typically absent.

## 2. Physical Exam

- Rhinorrhea, lacrimation, conjunctival hyperemia, and fever can be seen in the early stage of disease.
- Cyanosis can be observed during the paroxysmal stage.
- Lung auscultatory examination is usually normal unless significant atelectasis or pneumonia has occurred.

## 3. Laboratory

- CBC (completed blood count): Leukocytosis with predominant lymphocytosis (77%) is commonly observed at the end of the catarrhal stage and throughout the paroxysmal stage of illness, although this phenomenon is more common in infants and children than adolescents.
- Serology (if possible): excellent sensitivity and specificity when the acute serum is collected early in the course of illness (2 weeks after cough onset) and compared with the convalescent serum specimen (collected 4 weeks after cough onset)
- Culture of *B. pertussis* (if possible):
  - Achieved using calcium alginate or Dacron swabs of the nasopharynx and plated onto selective media such as Regan-Lowe or Bordet-Gengou and incubated for 10 days
  - Most frequently successful during the catarrhal or early paroxysmal stages and is rarely found beyond the third week of illness
  - Specificity 100%; overall sensitivity is 60–70% but can be lower in previously vaccinated individuals, if antibiotics have already been given, or if beyond the third week of illness.

## 4. Chest radiograph:

May reveal perihilar infiltrates or a shaggy right-sided heart border, although these findings are neither sensitive nor specific

## VI. DIFFERENTIAL DIAGNOSIS

- *B. parapertussis* and adenoviruses
- Bronchiolitis
- Bacterial pneumonia
- Cystic fibrosis
- Tuberculosis

- Foreign body aspiration
- Reactive airway disease

## VII. TREATMENT

### 1. General Measures:

- Patients with more severe disease manifestations (apnea, cyanosis, feeding difficulties) or other complications require hospitalization for supportive care: > Infants <6 months may develop apnea from fatigue secondary to excessive coughing. They need close observation, preferably in the hospital.
- If antibiotic treatment is initiated during the catarrhal stage, it can prevent disease from progressing. Antibiotics have not been shown to shorten the course of illness if begun during **the paroxysmal stage, although they will eliminate the organism from the nasopharynx within 3–4 days**, thus shortening the potential for contagion.
- **Admission Criteria:**
  - Young infant (<6 months of age) with concern for apnea or fatigue with coughing
  - Patients with severe disease manifestations or complications
- **Discharge Criteria:**
  - No evidence of cardiorespiratory instability
  - Able to self-recover from coughing spells

### 2. Medication:

- **Erythromycin** (40 mg/kg/day twice per day for 14 days OR
- **Azithromycine**
  - < 6 months of age: 10 mg/kg/day single dose for 5 days
  - > 6 months of age: 10 mg/kg/day as a single dose on day 1, then 5 mg/kg/day as a single dose on days 2–5
  - Adolescents and adults: 500 mg/day as a single dose on day 1, then 250 mg/day as a single dose on days 2–5. OR
- **Clarithromycin:** 15 mg/kg/day twice per day for 7 days. It has similar effectiveness to erythromycin, and can be used in children 1 month of age or older

## VIII. PRONOSIS

The paroxysmal stage can last up to 4 weeks, and the convalescent stage up to several months. The prognosis is directly related to patient age:

- Highest mortality is observed in infants <6 months of age, with a 0.5–1% risk of death.
- In the older child, prognosis is good.

## IX. COMPLICATIONS

The complications of pertussis are more likely to occur in infants <6 months of age and therefore tend to have a more serious, protracted course:

- Pneumonia, which occurs in 22% of these infants, is responsible for >90% of deaths in young children with pertussis and is usually from secondary bacterial disease rather than *B. pertussis*.
- Superinfections owing to viruses (adenovirus, respiratory syncytial virus, cytomegalovirus), bacteria (*Streptococcus pneumoniae*, *Staphylococcus aureus*), and Gram-negative iatrogenic infections can complicate pneumonias.
- Other pulmonary complications include atelectasis, pneumothorax, pneumomediastinum, and subcutaneous emphysema.

- Seizures (2%) and encephalopathy (0.5%) have also been observed in infants with pertussis.

## **X. PREVENTION**

Immunization: Combination DTP schedule at 6, 10 and 14 weeks old.

### **REFERENCES**

The 5-Minute Pediatric Consult 5th Edition © 2009 by Lippincott Williams & Wilkins, a Wolters Kluwer business 530 Walnut Street Philadelphia, PA 19106 LWW.com

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# MUMPS/PAROTITIS

*By Yay Chantana*

## I. DEFINITION

Mumps is an acute viral disease characterized by painful enlargement of the parotids and other salivary glands.

## II. EPIDEMIOLOGY

- Humans are the only known host for mumps.
- Spread is via the respiratory route.
- Incidence of this once very common disease has declined dramatically since the advent of universal childhood immunization. Outbreaks, however, continue to occur.
- Period of communicability: 7 days before to 5 days after onset of parotid swelling
- Most communicable period: 1 to 2 days before the parotid swelling
- Incubation period: 12 to 25 days after exposure
- One attack of mumps (clinical or subclinical) confers lifelong immunity.

## III. ETIOLOGY

- Parotitis is usually caused by mumps, a Rubulavirus in the paramyxovirus family.
- Other viral causes of parotitis include cytomegaloviruses, influenza, parainfluenza, and enteroviruses.
- Bacterial cases are usually secondary to *Staphylococcus aureus* (suppurative parotitis).
- Recurrent parotitis is an idiopathic, rare, recurrent swelling of the parotids, without suppuration or external inflammatory changes.

## IV. PATHOPHYSIOLOGY

- The mumps virus enters via the respiratory tract, and a viremia ultimately ensues.
- The viremia spreads to many organs, including the salivary glands, gonads, pancreas, and meninges.

## V. DIAGNOSIS

### 1. Signs and Symptoms

- Prodromal symptoms uncommon, but may include the following: fever, anorexia, myalgia, headache
- Onset usually pain and swelling in front of and below ear
- Parotid gland swelling: Usually starts on one side of the face, and then progresses to the other.

- Mild fever: Usually accompanies parotid gland swelling
- Dysphagia and dysphonia are common
- Testicular pain and swelling, along with constitutional symptoms, usually begin ~1 week after the parotid swelling of mumps.
- Epigastric pain and constitutional symptoms with pancreatic involvement
- Fever, headache, and stiff neck with meningitis
- Behavioral changes, seizures, and other neurologic abnormalities are rare.
- Other symptoms are analogous to the particular organ involved.
- Parotid enlargement can be an initial sign in HIV-infected children.

## 2. Physical Exam

- Nonerythematous, tender parotid swelling (erythema seen with suppurative parotitis)
- Swelling ultimately obscures the mandibular ramus.
- The ear is often displaced upward and outward.
- Submaxillary and sublingual glands also may be swollen.
- Inflammation may be noted intraorally at the orifice of Stensen duct.
- Presternal edema is occasionally noted.
- Mumps are infrequently associated with truncal rash.
- Tender, edematous testicle in mumps orchitis (usually unilateral)
- Ask the patient if the pain (at the parotid) intensifies with the tasting of sour liquids: ask the patient suck on a lemon drop or lemon juice, and note any discharge from Stensen duct.

## 3. Laboratory

- Uncomplicated parotitis: Mild leukopenia with lymphocytosis
- Suppurative parotitis and mumps orchitis: Leukocytosis
- Pancreatic involvement: Hyperamylasemia and elevated serum lipase
- Salivary adenitis without pancreatic involvement: Isolated hyperamylasemia
- Gram stain and **culture** of pus expressed from Stensen duct is diagnostic in suppurative parotitis.
- Positive serologic test for mumps IgM
- **Lumbar puncture** if meningitis is suspected: CSF pleocytosis (predominately mononuclear)

## 4. Imaging

Sialography is useful to evaluate for stones or strictures, but is contraindicated in acute infection.

## VI. DIFFERENTIAL DIAGNOSIS

- Mumps parotitis can be distinguished from the other viral causes by clinical presentation along with specialized laboratory studies.
- Cases of tuberculous and nontuberculous (atypical) mycobacterial parotitis are rare, but have been reported.
- Salivary calculus can be diagnosed by sialogram.
- Recurrent childhood parotitis is a rare disorder in which symptoms initially manifest in children 3–6 years of age: > Largely a diagnosis of exclusion.
- Cervical or preauricular adenitis may simulate parotitis: > Close anatomic localization should be diagnostic.
- Infectious mononucleosis and cat scratch disease are other considerations.
- Drug-induced parotid enlargement occasionally occurs.
- Malignancies of the parotid are extremely rare.
- Pneumoparotitis is seen in those with a history of playing a wind instrument, glass blowing, scuba diving, and even general anesthesia.

## **VII. COMPLICATIONS**

- Meningitis: more than 50% of patients have a CSF pleocytosis; this aseptic meningitis is usually benign.
- Encephalitis: rarely causes permanent sequelae
- Cerebellitis
- Facial nerve palsy
- Oophoritis, nephritis, thyroiditis, myocarditis, mastitis, arthritis, transient ocular involvement, deafness, and sterility (all rare)

## **VIII. TREATMENT**

- Supportive therapy is all that is required in mumps parotitis.
- Antibiotics directed against bacteria should be used in cases of suppurative parotitis.

## **IX. PROGNOSIS**

Complete recovery in 1 to 2 weeks is the rule.

## **X. PREVENTION**

- A single 0.5-mL subcutaneous injection of live mumps vaccine (usually given together with measles and rubella, the MMR) at 12 to 15 months usually confers long-lasting immunity. But this MMR not yet available in our National Program.
- Primary vaccine failure and waning vaccine-induced immunity have been reported.
- A second vaccination is recommended between 4 and 6 years of age.
- The first dose of MMR vaccine sometimes causes fever and rash, usually 7 to 10 days after immunization.
- Vaccine should not be administered to children who are immunocompromised by disease or pharmacotherapy, or to pregnant women.
- Children with HIV infection who are not severely immunocompromised should be immunized with the MMR vaccine.

## **REFERENCES**

*The 5-Minute Pediatric Consult* 5th Edition © 2009 by Lippincott Williams & Wilkins, a Wolters Kluwer business 530 Walnut Street Philadelphia, PA 19106 LWW.com

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## ANTIBIOTIC GUIDELINES 2012

*By Dr. Ngoun Chanpheaktra*

### **PRINCIPLES OF GOOD ANTIBIOTIC USE**

- Only prescribe antibiotics with a clear clinical justification where a bacterial infection is suspected or proven.
- Document in the chart why the antibiotic is being ordered
- An antibiotic is not an anti-pyretic – don't use antibiotics simply because a patient has fever
- Collect specimens for microbiology **before** giving antibiotics unless the situation is life-threatening
- Prescribe antibiotics according to the local guidelines and at the correct dose (see Appendix A)
- Surgical prophylaxis should be given for a maximum of 24 hours
- Choose the narrowest spectrum antibiotic possible for the required indication
- **Narrow** the antibiotic as soon as possible - e.g. when appropriate culture results are available
- **Switch** IV antibiotics to oral antibiotics as soon as possible and **stop** antibiotics as soon as possible – can do both these while patient is still admitted

**Follow the guidelines below to help choose empirical antibiotics (i.e. causative organism NOT known) for the various clinical syndromes, BUT remember to use frequent patient re-assessment and laboratory/culture results in order to adjust antibiotic treatment as appropriate.**

## SEPSIS SYNDROME

Age	Likely causative Organism	Choice of Antibiotic	Route	Duration of therapy	Oral step-down choice (if no specific pathogen identified)	Notes
< 1 month	<p>Early onset (&lt; 48 hours): Group B streptococcus, <i>E. coli</i>, <i>Listeria monocytogenes</i>, <i>Haemophilus influenzae</i></p> <p>Late onset (&gt; 48 hours old): Same as above,+ <i>Staph aureus</i>, <i>S. pneumoniae</i>, <i>Klebsiella</i> spp., <i>Salmonella</i> spp, <i>Pseudomonas aeruginosa</i>, <i>Enterococcus</i> spp.</p>	Ampicillin PLUS Gentamicin	IV	5-10 days	Co-amoxiclav for empiric step-down	<p>This is choice of antibiotics for <u>empirical therapy</u> – i.e. causative organism not known. Should revise according to culture results.</p> <p>If not better and 48 hour culture is negative, consider Imipenem</p>
≥1 month <i>Unknown source Community acquired</i>	<i>E. coli</i> , <i>H. influenzae</i> , <i>S. pneumoniae</i> , <i>Klebsiella</i> spp., <i>Salmonella</i> Typhi, <i>Salmonella</i> spp., <i>Staphylococcus aureus</i> , <i>N. meningitides</i> , Group A streptococcus, <i>Burkholderia pseudomallei</i>	Ceftriaxone	IV	5-10 days	Co-amoxiclav for empiric step-down	<p>This is choice of antibiotics for <u>empirical therapy</u> – i.e. causative organism not known. Should revise according to culture results.</p> <p>If blood culture negative and no evidence of infection stop antibiotics at 48 hours</p> <p>If blood culture negative but clinical evidence of infection and improving treat for 5 days</p>
≥1 month <i>Unknown source Hospital acquired</i>	<i>Klebsiella</i> spp., <i>E. coli</i> , <i>Staphylococcus aureus</i> (MRSA), <i>Acinetobacter</i> , <i>Pseudomonas aeruginosa</i> , other Gram negative bacilli	<p><i>If no shock:</i> Ceftriaxone (or consider diagnosis of viral illness and don't give any antibiotic)</p> <p><i>If shock or critically ill:</i> Imipenem</p>	IV  IV	5-10 days  5-10 days	Co-amoxiclav for empiric step-down	<p>If blood culture positive treat specific pathogen</p> <p>If not better and 48 hour culture is negative, consider Imipenem</p> <p>If ICU patient and suspect staphylococcal sepsis, use Ceftriaxone + Cloxacillin until culture results</p>

**MENINGITIS** (see also AHC Meningitis protocol)

Age	Likely causative Organism	Choice of Antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
<1 month	Group B streptococcus, <i>E. coli</i> , <i>L. monocytogenes</i> , <i>N. meningitidis</i> , <i>H. influenzae</i> , <i>S. pneumoniae</i> , <i>Salmonella</i> spp.	Ceftriaxone PLUS Ampicillin	IV	Minimum of 14 days	Whole course should be intravenous	Choice of antibiotics listed is for empirical therapy (i.e. causative organism not known). Ceftriaxone should be high dose given Q12hours Stop ampicillin if 48hour cultures negative for Listeria Can increase duration depending on clinical progress and repeat CSF results Monitor bilirubin for any neonate on Ceftriaxone
≥1 month	<i>N. meningitidis</i> , <i>H. influenzae</i> , <i>S. pneumoniae</i>	Ceftriaxone	IV	Minimum of 10 days	Whole course should be intravenous	Ceftriaxone should be high dose given Q12hours Can increase duration depending on clinical progress and repeat CSF results

## LOWER RESPIRATORY TRACT INFECTIONS

### Severity definitions for pneumonia (WHO)

- **MILD/MODERATE (OPD case)** – Cough/difficulty breathing + fast breathing:  $\geq 60$ /min if < 2 months;  $\geq 50$ /min if 2-11 months;  $\geq 40$ /min if aged 1-5 years
- **SEVERE (IPD case)** - Cough and difficulty breathing + one of: chest indrawing; nasal flaring; grunting (young infants)
- **VERY SEVERE (ICU case)** - Cough or difficulty breathing + one of : central cyanosis; severe respiratory distress; unable to drink or feed

Age	Likely causative Organism	Choice of Antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
<b>PNEUMONIA (NEONATAL COMMUNITY ACQUIRED)</b>						
< 1 month	As with neonatal sepsis	Ampicillin PLUS Gentamicin	IV	5-10 days	Co-amoxiclav for empiric step-down	Revise treatment according to isolated organism
<b>PNEUMONIA (COMMUNITY ACQUIRED) – standard in OPD: MILD/MODERATE</b>						
$\geq 1$ month to <5 years	<i>S. pneumoniae</i> , <i>H. influenzae</i>	Amoxicillin	Oral	5-7 days		
$\geq 5$ years	<i>M. pneumoniae</i> , <i>S. pneumoniae</i> , <i>C. pneumoniae</i> , <i>H. influenzae</i>	Amoxicillin OR Macrolide	Oral	5 days		Acceptable macrolides: Clarithromycin or Azithromycin
<b>PNEUMONIA (COMMUNITY ACQUIRED) – standard in IPD: SEVERE</b>						
$\geq 1$ month	<i>S. pneumoniae</i> , <i>H. influenzae</i>  (Also <i>M. pneumoniae</i> & <i>C. pneumoniae</i> in >5y)	Ceftriaxone (Q24) OR Co-amoxiclav	IV  Oral	7-10 days	Amoxicillin OR Co-amoxiclav OR Cefixime OR Macrolide if >5y	If >5y, consider adding macrolide to initial treatment and also consider macrolide as oral step-down
<b>PNEUMONIA (COMMUNITY ACQUIRED) – standard in ICU: VERY SEVERE</b>						
$\geq 1$ month	<i>S. pneumoniae</i> , <i>H. influenzae</i>	Ceftriaxone	IV	7-10 days	Co-amoxiclav OR Cefixime	If not better and 48 hour culture is negative, consider Imipenem
	If considering	Ceftazidime PLUS Cloxacillin	IV	Minimum	Co-amoxiclav	If suspect either Staph or Melioidosis, should

	<i>Staphylococcus aureus</i> , <i>Burkholderia pseudomallei</i>			of 14 days		treat both until culture results For melioidosis see organism-specific section below
<b>PNEUMONIA (HOSPITAL ACQUIRED&gt; 48 hours after admission to healthcare facility) – MILD (not VAP)</b>						
All ages	<i>S. aureus</i> , Enterobacteriaceae, <i>P. aeruginosa</i> , <i>S. pneumoniae</i> , <i>H. influenzae</i>	Co-amoxiclav	Oral	7-10 days		
<b>PNEUMONIA (HOSPITAL ACQUIRED&gt; 48 hours after admission to healthcare facility) – MODERATE (not VAP)</b>						
All ages	As with MILD Hospital-acquired pneumonia above	Ceftriaxone	IV	7-10 days	Co-amoxiclav /cefexime	
<b>PNEUMONIA (HOSPITAL ACQUIRED&gt; 48 hours after admission to healthcare facility) – SEVERE or VENTILATOR-ASSOCIATED (VAP)</b>						
All ages	As above, plus ESBL gram-negatives	Imipenem	IV	7-10 days	Whole course should be IV	
<b>PERTUSSIS (WHOOPIING COUGH)</b>						
All ages	<i>Bordetella pertussis</i>	Erythromycin OR Azithromycin OR Clarithromycin	Oral  Oral  Oral	14 days  5 days  7 days		
<b>MELIOIDOSIS</b>						
All ages	<i>B. pseudomallei</i>					See organism-specific section below

## ENDOCARDITIS

Age	Likely causative Organism	Choice of Antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
All ages	<i>S. aureus</i> , <i>S. viridans</i> , coagulase-negative staphylococci, Group A & Group B streptococcus, Enterococci, <i>S. pneumoniae</i> , <i>E. coli</i> , HACEK organisms ( <i>Haemophilus</i> , <i>Actinobacillus</i> , <i>Cardiobacterium</i> , <i>Eikenella</i> , and <i>Kingella</i> )	Ceftriaxone	IV	Minimum of 4 weeks	Whole course should be IV	<p>Ceftriaxone should be 100mg/kg divided Q12-24 hours</p> <p>Can add Gentamicin for up to 2 weeks if severe.</p> <p>If first culture is negative, should repeat 2-4 times</p> <p>4 weeks is <u>minimum empiric</u> duration. Total duration and choice of antibiotics should be adjusted based on any specific organism isolated.</p>

## UPPER RESPIRATORY TRACT INFECTIONS

Age	Likely causative Organism	Choice of Antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
<b>TONSILLOPHARYNGITIS</b>						
All ages: <i>If well</i>	<b><i>Streptococcus pyogenes</i> (Group A strep), other Beta haemolytic streptococci</b>	Penicillin V OR Amoxicillin 50mg/kg <b>QD</b> (Amox may be more palatable)	Oral  Oral	10 days  10 days		Most cases of pharyngitis in children are viral. To decide whether or not to treat with antibiotics, use the following scoring system: temperature > 38° C =1 point no cough or no runny nose =1 point tender anterior cervical adenopathy =1 point tonsillar swelling or exudates =1 point age 3-14 years =1 point Score 0-1: no antibiotics , no further testing, symptomatic treatment Score 2-3: do throat swab culture to confirm Group A streptococcal pharyngitis before giving antibiotics Score 4-5: do throat swab AND give antibiotics
All ages: <i>Systemically unwell</i>	<b><i>Streptococcus pyogenes</i>, other Beta haemolytic streptococci</b>	Penicillin G (Benzylpenicillin)	IV	10 days		
<b>SINUSITIS</b>						
All ages: <i>Mild acute</i>	<i>S. pneumoniae</i> , <i>H. influenzae</i> , <i>Moraxella catarrhalis</i>	Amoxicillin	Oral	7-10 days		
<i>Severe acute</i>	Same as mild acute	Ceftriaxone	IV	10-14 days	Co-amoxicla or cefexime	
<i>Chronic</i>	Same as acute + oral anaerobes	Co-amoxiclav	Oral	See note		Duration dependant on severity and clinical response

OTITIS EXTERNA						
All ages	<i>Pseudomonas</i> spp. Enterobacteriaceae <i>S. aureus</i>	Ear drops – ciprofloxacin OR gentamicin	Topical	5-7 days		If no improvement, send ear swab for culture and treat according to results  Add Cloxacillin PO for severe & refractory cases
OTITIS MEDIA (ACUTE)						
Child > 2 years, non-recurrence	<i>S. pneumoniae, H. influenzae</i>	Amoxicillin	Oral	7 days		If no improvement, send ear swab for culture and treat according to results
Child <2 years or recurrent episode	<i>S. pneumoniae, H. influenzae</i>	Amoxicillin	Oral	10 days		If no improvement, send ear swab for culture and treat according to results
All ages: <i>Treatment failure</i>		Co-amoxiclav OR Cefixime OR Ceftriaxone	Oral  Oral  IV	10 days  10 days  3 days		Send ear swab for culture
MASTOIDITIS						
All ages: <i>Acute</i>	<i>S. pneumoniae</i> , Group A streptococci, <i>H. influenzae, M. catarrhalis, S.aureus</i>	Ceftriaxone	IV	2 weeks	Co-amoxiclav (should give IV antibiotics for at least 7-10 days)	Metronidazole should be included if acute mastoiditis is complication of a chronic infection
All ages: <i>Chronic</i>	<i>P. aeruginosa</i> , Enterobacteriaceae, <i>S. aureus</i> (including MRSA), anaerobic bacteria; consider MTB	Attempt to get appropriate specimens to guide choice before use of antibiotics				If no pathogen found, then give Co-amoxiclav empirically for 14 days and then reassess. If still not better, then strongly consider TB treatment or Melioidosis.
EPIGLOTTITIS						
All ages	<i>H. influenzae</i> (99%), <i>S.</i>	Ceftriaxone	IV	7-10 days	Co-amoxiclav OR	

	<i>aureus</i> , <i>S. pneumoniae</i>				Cefixime	
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## SKIN AND SOFT TISSUE INFECTIONS

Remember to consider tetanus boosters for certain scenarios e.g. bites, puncture wounds to feet

Age	Likely causative Organism	Choice of antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
<b>BITES</b>						
All ages	ANIMAL BITES <i>Pasteurella canis</i> , <i>Pasteurella multocida</i> , <i>Staph aureus</i> , <i>Staphylococcus</i> spp., <i>Streptococcus</i> spp., Anaerobes  HUMAN BITES <i>Staphylococcus</i> spp., <i>Streptococcus</i> spp., Anaerobes, <i>Eikenella</i> <i>corrodens</i>	Co-amoxiclav	Oral	5 days		Strongly consider tetanus booster  For animal bites – see Rabies guideline
<b>PUNCTURE WOUNDS</b>						
All ages	Streptococci, <i>S. aureus</i>	Cloxacillin	Oral	5 days		Strongly consider tetanus booster
<b>FOLLICULITIS</b>						
All ages	<i>S. aureus</i>	Cloxacillin	Oral	5 days		
<b>FURUNCLES, CARBUNCLES AND ABSCESSES</b>						
All ages	<i>S. aureus</i>	Cloxacillin	Oral	5-7 days		Abscesses may require incision & drainage (I&D) in consultation with surgeon
<b>IMPETIGO</b>						
All ages	<i>S. aureus</i>	Cloxacillin	Oral	5 days		

**CELLULITIS AND ERYSIPELAS**

All ages	<i>S. pyogenes</i> , <i>S. aureus</i> , Group C or G beta- haemolytic strep <i>H. influenzae</i> also a cause in young infants	Cloxacillin	Oral	5-7 days	Co-amoxiclav/ Cefexime	
		OR				
		Co-amoxiclav	Oral	5-7 days		
		OR				
		Ceftriaxone (if severe)	IV	5-7 days		

**GASTROINTESTINAL, RENAL AND GENITOURINARY**

Age	Likely causative Organism	Choice of antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
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**GASTROENTERITIS (acute watery diarrhea)**

All ages	Acute watery diarrhea is usually a viral infection and antibiotics are not necessary  Cholera ( <i>Vibrio cholerae</i> ) is a possibility, especially if an outbreak is known to be occurring	Avoid antibiotic unless suspect cholera				Rehydration. Send stool for culture if bloody, mucoid positive for WBC, febrile, or severe disease. For antibiotic treatment of proven specific gastroenteritides – see “Dysentery” section
		If suspect cholera: Erythromycin	Oral	3 days		
		OR Azithromycin	Oral	single dose (20mg/kg)		
		OR Ciprofloxacin	Oral	3 days		

**DYSENTERY**

All ages	<i>Shigella</i> spp., <i>Salmonella</i> spp.	Ceftriaxone	IV	5 days	Ciprofloxacin OR Azithromycin	Rehydration. Send stool for culture.
		OR				
		Ciprofloxacin	Oral/IV	5 days		
		OR				
		Azithromycin	Oral	5 days		

**INTESTINAL PARASITES (this section is for all ages – 1<sup>st</sup> column is parasite-syndrome instead of age)**

Ascariasis	<i>Ascaris lumbricoides</i>	Mebendazole OR Albendazole	Oral  Oral	3 days or single dose  Single dose		
Hookworm	<i>Ancylostoma duodenale</i> <i>Necator americanus</i>	Mebendazole OR Albendazole	Oral  Oral	3 days  Single dose		
Trichuriasis	<i>Trichuris trichiura</i>	Mebendazole OR Albendazole	Oral  Oral	3 days  Single dose		
Strongyloidiasis	<i>Strongyloides stercoralis</i>	Children > 2 years: Albendazole  Children > 5 years: Ivermectin	Oral  Oral	7 days  2 days		400mg twice daily (BID); consider repeating after 3 weeks  200microg/kg per day
Threadworm/pinworm	<i>Enterobius vermicularis</i>	Mebendazole	Oral	Single dose		Suggest treatment of household at the same time to prevent re-infection; re-treat at 2 weeks
Tapeworm infection	<i>Taenia</i> spp. <i>Diphyllobothrium latum</i>	Praziquantel	Oral	Single dose		5-10mg/kg
Dwarf tapeworm infection	<i>Hymenolepis</i> spp.	Praziquantel	Oral	Single dose		15-25mg/kg
Giardiasis	<i>Giardia lamblia</i>	Metronidazole	Oral	5 days		15-30mg/kg/day divided TID
Amoebiasis	<i>Entamoeba histolytica</i>	Metronidazole	Oral	7-10 days		35-50mg/kg/day divided TID  Following Metronidazole treatment course: should give diloxanide furoate or iodoquinol or

						paromomycin, if available, in order to eliminate the amoeba cysts.
Blastocystosis	<i>Blastocystis hominis</i>	Metronidazole	Oral			Treat <b>ONLY</b> if symptomatic (e.g. abdominal pain, abnormal stool) <b>AND</b> if no other cause found.
Schistosomiasis	<i>Schistosoma japonicum</i> <i>Schistosoma mekongi</i>	Praziquantel	Oral	One day of treatment (3 doses)		20mg/kg/dose three times daily
Clonorchiasis/Opisthorchiasis	<i>Clonorchis sinensis</i> <i>Opisthorchis viverrini</i>	Praziquantel	Oral	2 days of treatment (6 doses)		25mg/kg/dose three times daily

#### NECROTISING ENTEROCOLITIS

< 1 month	Gastrointestinal bacteria	Ampicillin PLUS Gentamicin PLUS Metronidazole	IV	10-14 days		
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#### URINARY TRACT INFECTIONS (UTIs) - SIMPLE UTIs

All ages	<i>E. coli</i> (90%), <i>Enterococcus</i> spp  <i>Staphylococcus</i> spp., <i>Streptococcus</i> spp., <i>Pseudomonas</i> spp., <i>Klebsiella</i> spp.	First line: Ciprofloxacin	Oral	7 days		Send urine for microscopy and culture (collect urine as described in the urine collection guidelines)  Can give 5 days duration if <u>afebrile</u> simple UTI
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#### URINARY TRACT INFECTIONS (UTIs) – PYELOPNEPHRITIS

All ages	<i>E. coli</i> (90%), <i>Enterococcus</i> spp., <i>Staphylococcus</i> spp., <i>Streptococcus</i> spp., <i>Pseudomonas</i> , <i>Klebsiella</i> spp.	Ceftriaxone	IV	7-14 days		Fever + back/flank/loin pain OR systemically unwell OR <12 months  Send urine for microscopy and culture
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#### VAGINAL DISCHARGE

All ages	<i>Candida</i> spp., <i>N. gonorrhoeae</i> , Group A streptococcus/ <i>H. influenzae</i> / <i>Moraxella catarrhalis</i> / <i>S. pneumoniae</i> ,	Ciprofloxacin AND Azithromycin	Oral  Oral	Single dose  Single dose		Consider foreign bodies/possibility of sexual abuse.  Culture for gonorrhoea needs to be requested specifically (request this for all vaginal DC)
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	<i>Shigella</i> spp. (if bloody), anaerobes					
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## OPHTHALMIC INFECTIONS

Age	Likely causative Organism	Choice of antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
<b>CONJUNCTIVITIS</b>						
All ages	<i>H. influenzae</i> , <i>S. pneumoniae</i> , <i>Staphylococcus</i> spp., <i>M. catarrhalis</i>	Chloramphenicol OR Gentamicin	Topical  Topical	5 days  5 days		Irrigate gently with sterile 0.9% saline.
Conjunctivitis of the newborn (Ophthalmia neonatorum)	<i>Neisseria gonorrhoeae</i> <i>Chlamydia trachomatis</i>	Ceftriaxone 25-50mg/kg  PLUS Erythromycin 12.5mg/kg four times a day	IV  Oral	Single dose  14 days		If chlamydia or gonococcal infection is suspected, then request gonococcal culture and start empiric treatment Consider advising mother +/- sexual partners to get treated
<b>ORBITAL CELLULITIS</b>						
All ages	<i>S. pneumoniae</i> , <i>H. influenzae</i> , <i>S. aureus</i> , Group A streptococci	Ceftriaxone	IV	10-14 days	Co-amoxiclav	
<b>ENDOPHTHALMITIS</b>						
All ages	Consult ophthalmologist					

## SURGICAL INFECTIONS

Age	Likely causative Organism	Choice of antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
<b>SEPTIC ARTHRITIS</b>						
Birth to < 3 months	<i>S. aureus</i> , Group B Streptococci, Enterobacteriaceae, <i>N. gonorrhoeae</i>	Ceftriaxone PLUS Cloxacillin	IV	21-42 days	Give whole course IV	Adjust choice according to isolated organism Change to monotherapy within 48-72 hours Remember adjacent bony involvement in 2/3 of cases
≥ 3 months	<i>S. aureus</i> , Group A streptococci, <i>S. pneumoniae</i> , Gram negative bacilli, <i>H. influenzae</i> , <i>N. meningitidis</i> , ( <i>N. gonorrhoeae</i> if sexual exposure)	Ceftriaxone (add Cloxacillin if very severe illness or in ICU)	IV	21-42 days depending on clinical response and normalisation of CRP/ESR	Consider switch to oral antibiotics if CRP is normal at ≥ 7-10 days. Choice should be guided by culture.	Adjust choice according to isolated organism Change to monotherapy within 48-72 hours Maximum oral doses are required
<b>ACUTE OSTEOMYELITIS</b>						
Birth to < 3 months	<i>S. aureus</i> , Group B streptococci, Gram negative bacilli	Ceftriaxone PLUS Cloxacillin	IV	Minimum of 4 weeks		Adjust choice according to isolated organism Change to monotherapy within 48-72 hours
≥ 3 months	<i>S. aureus</i> , Group A streptococci, Gram negative bacilli (rare), Salmonella (rare)	Cloxacillin	IV	3-6 weeks depending on clinical response	Consider oral antibiotics if CRP is normal at ≥ 7-10 days. Choice should be guided by culture.	Adjust choice according to isolated organism
<b>PYOMYOSITIS</b>						
All ages	<i>S. aureus</i>	Cloxacillin	IV		Depends on culture results	Adjust choice according to isolated organism

<b>SUPPURATIVE PAROTITIS</b>						
All ages	<i>S. aureus</i> and <i>B. pseudomallei</i>	Ceftazidime PLUS Cloxacillin	IV		Depends on culture results	Surgical drainage and samples for culture Narrow therapy when culture results available
<b>PERITONITIS</b>						
≥ 1 month	Gastrointestinal bacteria	Ceftriaxone PLUS Metronidazole	IV	7-10 days	Co-amoxiclav OR Amoxicillin PLUS Metronidazole	For < 1 month: Ampicillin PLUS Gentamicin PLUS Metronidazole
<b>POST-OPERATIVE WOUND INFECTION</b>						
≥ 1 month	<i>S. aureus</i> , Beta hemolytic streptococci, anaerobes, Gram negative bacilli (depends on site of operation – latter mainly if urinary/gastrointestinal)	Ceftriaxone PLUS Metronidazole  OR  Co-amoxiclav OR clindamycin (if mild)	IV   Oral	5-10 days depending on severity of infection; status of host	Co-amoxiclav OR Amoxicillin (if mild)	For < 1 month: Ampicillin PLUS Gentamicin PLUS Metronidazole
<b>OPEN FRACTURES</b>						
All ages		Co-amoxiclav  OR  If severe or very contaminated: Ceftriaxone PLUS Metronidazole OR Cloxacillin PLUS Metronidazole	Oral   IV	5 days   5-7 days		Consider tetanus booster

## SPECIFIC INFECTIONS

Age	Causative Organism	Choice of antibiotic	Route	Duration of therapy	Oral step-down choice	Notes
<b>MELIOIDOSIS</b>						
All ages	<i>Burkholderia pseudomallei</i>	Initial intensive therapy with maximum doses of: Ceftazidime OR Imipenem	IV	Minimum of two weeks	Follow-on oral eradication therapy: Co-amoxiclav (all ages)  OR Co-trimoxazole PLUS doxycycline (only if child >8 years of age)	Oral follow-on to be given for a minimum of three months; 6 months if neurologic melioidosis or osteomyelitis.  For co-amoxiclav use 20/5 mg/kg TID
<b>ENTERIC FEVER/TYPHOID</b>						
All ages	Salmonella Typhi/Paratyphi A	Ceftriaxone  Azithromycin	IV  Oral	Total duration should be 7 days for out-patient treatment OR 10-14 days if child admitted	Azithromycin	Step down to azithromycin when afebrile for 24hours  Ciprofloxacin may be used ONLY if isolate is susceptible
<b>LISTERIOSIS</b>						
All ages	<i>Listeria monocytogenes</i>	Ampicillin +/- Gentamicin	IV	14 - 21 days	Whole course should be IV	If sepsis without CNS disease: 14 days If CNS disease: 21 days and add Gentamicin for 7 days
<b>CULTURE-CONFIRMED MENINGITIS (see also AHC Meningitis protocol)</b>						
All ages	Confirmed <i>N.meningitidis</i> meningitis	Benzympenicillin (or narrowest)	IV	7 days	Whole course should be IV	Consider single dose ciprofloxacin as prophylaxis for close contacts.

		susceptible antibiotic)				
All ages	Confirmed <i>H. influenzae</i> or <i>S. pneumoniae</i> meningitis	Ceftriaxone  OR Benzylpenicillin in penicillin-sensitive <i>S. pneumoniae</i>	IV	10-14 days	Whole course should be IV	If Haemophilus in CSF add Dexamethasone 0.8 mg/kg BID for 2 days  For <i>H. influenzae</i> , consider prophylaxis for close contacts – CDC guidance suggests if 1 household contact <48 months or immunocompromised, all household should get prophylaxis – single dose ciprofloxacin
All ages	Confirmed Group B streptococcus meningitis	Benzylpenicillin	IV	14 days	Whole course should be IV	
All ages	Confirmed Gram negative bacillus (except <i>H. influenzae</i> ) meningitis	Start with Imipenem	IV	21 days	Whole course should be IV	Change to Ceftazidime (melioid dosage) or Ceftriaxone (meningitis dose) if appropriate when culture result available
All ages	Confirmed <i>Staphylococcus aureus</i> meningitis	Cloxacillin (if MSSA)  Vancomycin (if MRSA)	IV  IV	21 days  21 days	Whole course should be IV	
<b>METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA)</b>						
All ages	<i>Staphylococcus aureus</i>  Invasive disease (sepsis, meningitis, pneumonia, endocarditis, osteomyelitis, pyomyositis, septic arthritis)  Non-invasive (skin, soft tissue)	Vancomycin  Based on sensitivity	IV  Oral	As per syndrome  As per syndrome	As per syndrome	Duration of treatment should be according to the clinical syndrome, as detailed in these guidelines. If a range of duration is given, the higher end of the range is recommended for MRSA infections.  If severe infection (e.g. sepsis, meningitis) then consider adding Gentamicin for 48-72 hours.

## APPENDIX - DRUG DOSAGES

Note: QD=Once daily    BID=Twice daily    TID=Three times daily    QID=Four times daily    IV=Intravenous    CGA=Corrected gestational age

Antibiotic	Age	Route	Dose (mg/kg/dose)	Number of doses per day	Notes
Acyclovir	< 2 months (<30 weeks gestation)	IV	20	Q12 hours	Maximum: 3200mg per 24hours
	< 2 months (≥30 weeks gestation)	IV	20	Q8 hours	
	≥ 2 months	IV	10	Q8 hours	
Acyclovir	≥ 2 months	Oral	10-20	QID	Neonatal oral dosing same as neonatal IV dosing Maximum: 3200mg per 24hours
Albendazole	≥ 2 months	Oral	400	Single dose	BID for 7 days for Strongyloidiasis
Amoxicillin	< 3 months	Oral	10-20	BID	Double dose in severe infections (all ages)
	≥ 3 months	Oral	10-20	TID	Maximum: 2000mg (2g) per 24hours
Ampicillin	< 7 days	IV	25-50	Q12 hours	Double dose in severe infections (all ages) Maximum: 12000mg (12g) per 24hours
	≥ 7 days but < 2kg	IV	25-50	Q8 hours	
	≥ 7 days (> 2kg)	IV	25-50	Q6 hours	
Co-amoxiclav (Augmentin®)	< 3 months	Oral	15	BID	Maximum: 4000mg (4g) per 24hours
	≥ 3 months	Oral	10-15	TID	
Azithromycin	≥ 2 months	Oral	10	Once daily (QD)	
Cefixime	≥ 1 month	Oral	4	Q12hours	Maximum: 400mg per 24hours
Ceftazidime	< 7 days	IV	50	Q12 hours	Maximum: 6000mg (6g) per 24hours
	≥ 7 days	IV	40-50	Q8 hours	
Ceftriaxone	<i>Non-meningitis</i>	IV	50-80	Q24 hours	Maximum: 2000mg (2g) per <u>dose</u>
	<i>Meningitis</i>	IV	50	Q12 hours	Monitor bilirubin for any neonate on Ceftriaxone
Ciprofloxacin	< 28 days	IV	6-10	Q12 hours	Maximum: 800mg per 24hours

	≥ 28 days	IV	9-15	Q12 hours	For severe infection age >2m: give same daily dose but ÷ Q8 hrs
Ciprofloxacin	< 28 days	Oral	10-15	BID	Maximum: 1500mg per 24hours
	≥ 28 days	Oral	10-15	BID	
Clindamycin	< 7 days	Oral	5	BID	Maximum: 1800 mg per 24hours
	7-28 days	Oral	5	TID	
	≥ 28 days	Oral	5-10	TID	
Cloxacillin	< 7days	IV	25	Q12 hours	Double the dose in osteomyelitis, cerebral abscess, meningitis  Maximum: 6000mg (6g) per 24hours
	7-28 days	IV	25	Q8 hours	
	≥ 28 days	IV	25	Q6 hours	
Cloxacillin	All	Oral	20-30	TID	Avoid if hepatic disease. Follow LFTs if long-term use.  Maximum: 2000mg (2g) per 24 hours
Co-trimoxazole	≥ 6 weeks	IV	4-6 (trimethoprim) 20-30 (sulfameth)	Q12 hours	Increase to 5mg/kg/dose <u>Q6 hours</u> in Pneumocystis or other severe infection
Co-trimoxazole	≥ 6 weeks	Oral	4-6 (trimethoprim) 20-30 (sulfameth)	BID	Avoid under 6 weeks old
Doxycycline	Use ≥ 8 years old only ≤45 kg >45 kg	Oral	2 100 mg	BID or QD BID or QD	Avoid under 8 years  Maximum: 200 mg per 24 hours
Erythromycin	≥ 28 days	IV	5-12.5	Q6 hours	Maximum: 4000mg (4g) per 24hours
Erythromycin	< 7 days	Oral	10	BID	Maximum: 2000mg (2g) per 24hours
	7-28 days	Oral	10	TID	
		Oral	10-15	TID	

	≥ 28 days				
Gentamicin	< 28 days: < 30 weeks CGA 30-36 wks CGA ≥ 37 weeks CGA	IV	4 4 4-5	Q48 hours Q36 hours Q24 hours	
	≥ 28 days	IV	5-7.5	Q24 hours	
Imipenem	<7 days old	IV	20-25	Q12 hours	Maximum: 4000mg (4g) per 24hours
	7-28 days	IV	20-25	Q8 hours	
	28 days - 3 months	IV	25	Q6 hours	
	≥ 3 months	IV	15-25	Q6 hours	
Mebendazole	1-2 years	Oral	100 mg total dose	BID	3 days
	2-18 years	Oral	100 mg total dose OR 500mg total dose	BID  Single dose	3 days
Metronidazole	< 7 days	IV	7.5	Q24 hours (<2kg)	Maximum: 4000mg (4g) per 24 hours  For all ages: consider first giving 15 mg/kg loading dose before starting the maintenance doses  For amebiasis: Increase to 15-20mg/kg/dose Q8hr
	7-28 days	IV	7.5 (<2kg), 15 (>2kg)	Q12 hours (>2kg)	
	≥ 28 days	IV	10	Q12 hours Q8 hours	
Metronidazole	< 7 days	Oral	7.5	QD	Maximum: 4000mg (4g) per 24 hours  For amebiasis: Increase to 15-20mg/kg/dose Q8hr
	7-28 days	Oral	7.5 (<2kg), 15 (>2kg)	BID	
	≥ 28 days	Oral	10	TID	
Penicillin G (Benzyl	< 7days	IV	25,000 - 50,000 IU	Q12 hours	Double dose in severe infection for age >28 days

penicillin)	7- 28 days	IV	25,000 - 50,000 IU	Q8 hours	Maximum: 24 million IU per 24hours
	≥ 28 days	IV	25,000 - 50,000 IU	Q6 hours	
Penicillin V	≥ 28 days	Oral	10-15	TID	Maximum: 1500mg (1.5g) per 24hours
Vancomycin	< 7days	IV	10-15	Q12 hours	Maximum: 4000mg (4g) per 24hours
	7- 28 days	IV	10-15	Q8 hours	
	≥ 28 days	IV	10-15	Q6 hours	

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# RICKETTSIAL DISEASES

By Prof. Eap Tek Chheng

## I. DEFINITION

A group of diseases caused by intracellular bacteria (Rickettsiae) and transmitted to humans by arthropods (ticks, lice and fleas). Despite some minor differences in epidemiologic, clinical, and laboratory characteristics, the illnesses caused by these organisms have similar manifestations and treatment.

Rickettsial illnesses, caused by organisms within the genus of rickettsiae, are recognized and can be divided into the following 3 biogroups:

### Spotted fever biogroup (15 rickettsioses)

- Rocky Mountain spotted fever (RMSF), caused by *Rickettsia rickettsii*
- Rickettsialpox, caused by *Rickettsia akari*
- Boutonneuse fever (ie, Kenya tick-bite fever, African tick typhus, Mediterranean spotted fever, Israeli spotted fever, Indian tick typhus, Marseilles fever)

### Typhus group

These are similar diseases that differ epidemiologically. The causative organisms (*Rickettsia prowazekii* and *Rickettsia typhi*) are similar to those of the spotted fever group but are antigenically distinct.

- Louse-borne (epidemic) typhus
- Brill-Zinsser disease (ie, relapsing louse-borne typhus)
- Murine (endemic or flea-borne) typhus

### Scrub typhus biogroup (Tsutsugamushi disease)

The rickettsial agents of scrub typhus have a single taxonomic name: *Orientia tsutsugamushi*. However, these organisms represent a heterogeneous group that strikingly differs from Rickettsial species of the spotted fever and typhus groups. The 3 major serotypes are Karp, Gilliam, and Kato.

## II. PHYSIOPATHOLOGY

Rickettsiae microorganisms appear to exert their pathologic effects by adhering to and then invading the endothelial lining of the vasculature within the various organs affected. The adhesins appear to be outer membrane proteins that allow the rickettsia to be phagocytosed into the host cell. Once inside, the rickettsial organisms either multiply and accumulate in large numbers before

lysing the host cell (typhus group) or they escape from the cell, damaging its membrane and causing the influx of water (spotted fever group).

Rickettsiae rely on the cytosol of the host cells for growth. To avoid phagocytosis within the cells, they secrete phospholipase D and hemolysin C, which disrupt the phagosomal membrane, allowing for rapid escape.

The most important pathophysiologic effect is increased vascular permeability with consequent edema, loss of blood volume, hypoalbuminemia, decreased osmotic pressure, and hypotension. On the other hand, disseminated intravascular coagulation is rare and does not seem to contribute to the pathophysiology of rickettsiae.

- Louse-borne (epidemic) typhus: The pathology is similar to that described for the spotted fever group of rickettsial diseases. However, typhus group rickettsiae do not stimulate actin-based mobility and rather extensively multiply and accumulate intracellularly until they burst the endothelial cell and disseminate into the bloodstream.
- Murine (endemic or flea-borne) typhus: Pathology is similar to that described for epidemic typhus.
- Tsutsugamushi disease (ie, scrub typhus): After invading the host cell and replicating in its cytoplasm, the *Orientia tsutsugamushi* exits by budding enveloped by part of the host cell membrane as it invades adjacent cells. Perivasculitis of small blood vessels occurs similarly to other rickettsial diseases. Usually, a necrotic inflammatory skin lesion occurs at the mite-bite site, and regional and generalized lymphadenopathy is associated with this infection.

### III. ETIOLOGY AND EPIDEMIOLOGY

Transmission depends on a reservoir of bacteria (in humans or animals depending on the form), an arthropod vector such as body lice in typhus, often associated with poor hygiene and overcrowding which is often the case in refugee camps.

Rickettsial diseases occur in patients of all ages. Rocky Mountain spotted fever (RMSF) has a predilection for children. Two thirds of patients with RMSF are aged 15 years or younger.

Rickettsialpox, boutonneuse fever, epidemic and endemic typhus, and Tsutsugamushi disease affect all ages.

The epidemiology of human diseases caused by rickettsiae is intimately related to the biology of the vector that transmits it. Rickettsial diseases widely vary in severity from self-limited mild illnesses to fulminating life-threatening infections.

The spotted fever rickettsiae have been found in every continent except Antarctica.

- **Louse-borne (epidemic) typhus:** Epidemics have occurred in Europe, Asia, and Africa.
- **Murine (endemic or flea-borne) typhus:** This is prevalent in large cities around the world where rats abound. It has been reported in travelers returning from ports and beach resorts in Asia, Africa and Europe. Human infections with rickettsia contracted after exposure to cat fleas was recently described in Australia.
- **Tsutsugamushi disease (ie, scrub typhus):** Cases are usually seen in rural south and southeast Asia, limited to the geographical area bound by Japan, the Solomon Islands, and Pakistan. It is estimated that 1 million cases occur each year.

The two commonest forms of rickettsiosis

	Louse borne typhus	Flea borne typhus or murine typhus
Pathogenic agent	<i>R. prowazeki</i>	<i>R. typhi</i>
Reservoir	humans, squirrels, cattle	rats
Vector	body lice	rat fleas
Transmission pattern	epidemic	endemic
Geographical distribution	world-wide	world-wide (Asia, Africa, South America)

*R. rickettsii* and *R. prowazekii*, which kill a significant portion of infected persons unless the diseases are sufficiently treated early with an effective antimicrobial agent.

## IV. DIAGNOSIS

### Clinical features:

Early signs and symptoms of these infections are notoriously nonspecific and may mimic benign viral illnesses, making the diagnosis more difficult. Certain features that aid in making the early diagnosis of rickettsial diseases include (1) a history of tick bite or exposure, (2) recent travel to endemic areas, and (3) similar illness in family members, coworkers, or family pets (especially dogs).

The different forms have a common core of clinical features:

- High fever of sudden onset
- Macular rash
- Severe headache, body pains
- Altered conscious level and coma

The clinical course of the disease is cyclical; after 14 days there is a terminal crisis, when signs become more severe then disappear.

Without treatment complications may be serious and even fatal (encephalitis, myocarditis, haemorrhage).

### Investigations:

Test: Polymerase chain reaction (PCR) from blood or tissue

- Allows the identification of rickettsial-specific DNA sequences
- *R. rickettsii*, *R. typhi*, and *R. prowazekii*

Test: Immunofluorescent (IgM) tests

- Sensitive, specific, and simple
- Can differentiate acute from past infection
- This technique is only useful early in the course of *R. tsutsugamushi* (scrub typhus) infection.
- Biopsy of the tache noir may reveal rickettsial organisms of the spotted fever group by direct immunofluorescent staining. Similar testing of the generalized rash is not useful for rickettsial illnesses other than RMSF.

Test: Serologic tests

- Complement fixation tests
- Enzyme-linked immunosorbent assay (ELISA)
- Latex agglutination test
- The Weil-Felix reaction assays the patients' serologic response to rickettsiae; the highest titers occur during the second and third weeks of illness; this test will be negative in patients with rickettsialpox.
- PCR tests in blood and tissue are available for many rickettsial diseases.

## V. DIFFERENTIAL DIAGNOSIS

Before the appearance of the rash, the constitutional symptoms associated with the spotted fevers result in a very wide differential diagnosis. After the appearance of the rash, the diagnoses are more limited: measles, meningococemia, secondary syphilis, viral infections, coxsackievirus (hand-foot-and-mouth disease), infectious mononucleosis, enteroviral infection.

- Environmental (poisons): drug hypersensitivity reaction (toxicodermatosis)
- Tumors: leukemia with thrombocytopenia
- Immunologic: idiopathic thrombocytopenia purpura (ITP)
- Miscellaneous: leukocytoclastic angitis, erythema multiforme/Stevens-Johnson syndrome

## VI. COMPLICATION

- Venous thrombosis
- Pneumonitis
- Pericarditis, myocarditis, heart failure
- Severe disease occurs more commonly in patients with G6PD deficiency, cardiac insufficiency, or immunocompromise.

## VII. MANAGEMENT

### 1. Emergency

- Fluid resuscitation for patients who appear moderately to severely ill.
- Antimicrobial therapy should be instituted as soon as the diagnosis is suspected and should not be delayed while awaiting serological confirmation.
- Therapy is most effective if instituted within the first week of illness.
- Control fever. Do not use aspirin.

### 2. Antibiotics

- Doxycycline (usual medication of choice in all patients, except those who are pregnant)
  - Dosage: child: 2.2 mg/kg PO b.i.d. for 1 day, then 2.2 mg/kg per day PO in single dose; adult: 100 mg PO b.i.d. (IV route if indicated)
  - Also treats ehrlichiosis (similar presentation) if diagnosis uncertain
  - Side effects: less likely to stain teeth than tetracycline, contraindicated during pregnancy. Studies have shown that there is little risk of tooth staining in children under 8 years old who receive less than 14 days of doxycycline.
- Tetracycline
  - Dosage: child: 25 to 50 mg/kg per day PO divided q.i.d. or 20 to 30 mg/kg per day IV; adult: 500 mg q.i.d. PO or IV
  - Side effects: tooth discoloration if child younger than 8 years of age (dose and duration related); pseudotumor cerebri, photosensitivity reaction, contraindicated during pregnancy
- Erythromycin (30-50 mg/kg/day PO divided t.i.d or q.i.d), trimethoprim-sulfamethoxazole (8-12 mg TMP/kg/day PO divided b.i.d) and fluoroquinolones (Ciprofloxacin 20-40 mg/kg/day PO divided b.i.d, not to exceed 750 mg/dose even in patients weighing >51 kg) have been used with variable success against rickettsial infections.
- The optimum duration of treatment for rickettsial infections has not been determined. In general, the more severe infections warrant 7 to 14 days of antimicrobial therapy.
- Corticosteroids
  - May be helpful in severe cases, though no controlled studies
  - Not recommended for mild or moderately ill patients

## VIII. PREVENTION

- Control of rats, ticks, mites and fleas: individual and collective protection with insecticides.
- Clothing to cover the entire body should be worn in tick-infested areas.
- In areas in which louse-borne typhus is epidemic, periodic delousing and dusting of insecticide into clothes is recommended.
- No vaccines are currently available.

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# MELIOIDOSIS

By Dr. IV Malene and Dr. YAY Chantana

## I. DEFINITION

**Melioidosis** is an infectious disease caused by a Gram-negative bacterium, *Burkholderia pseudomallei*, found in soil and water. It exists in acute and chronic forms.

## II. ETIOLOGY

Melioidosis results from infection by *Burkholderia pseudomallei*, a Gram negative bacillus in the family Burkholderiaceae. This organism was formerly known as *Pseudomonas pseudomallei*. It is closely related to *Burkholderia mallei*, the agent of glanders, as well as to *B. thailandensis* and *B. oklahomensis*.

## III. EPIDEMIOLOGY

### 1- Endemic Melioidosis

- Melioidosis cases have been increasingly reported from countries located between 20°N and 20°S in latitude, with the greatest concentration in Vietnam, Cambodia, Laos, Thailand, Malaysia, Singapore, and northern Australia. It has also been observed in the South Pacific, Africa, India, and the Middle East.
- In addition, sporadic melioidosis cases have occurred in the Western Hemisphere in Aruba, Brazil, Mexico, Panama, Ecuador, Haiti, Peru, and Guyana.
- In endemic regions, the disease occurs in humans, sheep, goats, horses, swine, cattle, dogs, cats, and other animals. Melioidosis cases that occur in temperate regions often result from recent travel to endemic areas.
- In Cambodia, few microbiologically confirmed cases have been described based on first national Melioidosis in Cambodia at Pasteur, National Paediatric Hospital, Kantha Bopha Hospital, Jayavarman VII Children Hospital, Angkor Hospital for Children, Kg. Cham and Takeo Referral Hospitals.
- A retrospective study during 20 months from January 2010 to August 2011 in Jayavarman VII Children Hospital there were 74 hospitalized children confirmed with Melioidosis of which 30% was bacteremia melioidosis and 70% was localized melioidosis.

### 2- Risk Factor

- The single most important risk factor for developing severe melioidosis is **diabetes mellitus**.
- Other risk factors include thalassaemia, kidney disease, occupation (rice paddy farmers), cystic fibrosis, Cirrhosis, Excessive alcohol ingestion and chronic lung disease or patients with an immune deficiency of any kind.

### 3- Transmission

- Animals and humans usually acquire melioidosis from organisms in the environment. *B. pseudomallei* is a saprophytic bacterium that is widespread in soil and muddy water in endemic areas. It is particularly common in moist clay soils.
- Infections can occur by ingestion, by inhalation, or through wounds and abrasions. All three routes are thought to occur in animals. Infected animals can shed the organism in wound exudates and, depending on the site of the infection, from other sources including nasal secretions, milk, feces and urine.
- Transplacental transmission has been reported in goats, a pig and a spider monkey.
- Nosocomial transmission was reported in four cats at a veterinary hospital, possibly via contamination of a multidose injectable solution.
- Vector-borne transmission by mosquitoes (*Aedes aegypti*) and rat fleas (*Xenopsylla cheopis*) has been reported, but the role of insect bites remains uncertain.
- There have been a few reports of zoonotic transmission, often after contamination of skin lesions by exposure to infected animals, tissues including meat, or milk. However, most people become infected directly from the environment. Inoculation through skin wounds is thought to be the major route of transmission to humans. Inhalation, which usually leads to the pneumonic form of the disease, may be particularly important during periods of heavy rainfall and strong winds. The importance of ingestion is controversial.
- Person-to-person transmission has been described rarely, generally to family members in close contact (e.g. family members who nursed patients).
- Sexual transmission has also been suggested in some cases. Vertical transmission has rarely been proven, but a few cases have been described in newborns. One infant may have been infected by nursing culture-positive breast milk.
- In non-endemic areas, contamination of the environment from infected animals or humans is a concern. Shed organisms can survive for months or years in soil and water. In one report, *B pseudomallei* remained viable in triple distilled water for more than three years. This experiment is ongoing, and unpublished reports suggest that the organism is still present fourteen years later.
- Other laboratories have reported that *B pseudomallei* can survive in room temperature water for as long as eight weeks, in muddy water for up to seven months, and in soil for up to 30 months.
- This organism can also survive in some antiseptic and detergent solutions, and resists pH 4.5 for up to 70 days.

## IV. PHYSIOPATHOLOGY

- Melioidosis is an infectious disease caused by *B pseudomallei* (formerly *Pseudomonas pseudomallei*). The organism is distributed widely in the soil and water of the tropics.
- It is spread to humans through direct contact with a contaminated source, especially during the rainy season.
- The disease usually occurs in the fourth and fifth decades of life, especially among those who have chronic comorbidities such as diabetes, alcoholism, immunosuppression, and renal failure. *B pseudomallei* is considered a good candidate as a bioweapon because it is easily available in the tropics, it is fairly easy to cultivate, it is sturdy, and it has a high potential to become bacteremic, thereby increasing morbidity and mortality.
- The incubation period in naturally acquired infections can vary from days to months to years. The incubation period after an aerosol attack is expected to be from 10-14 days.

### 1- Localized form

- Bacteria enter the skin through a laceration or abrasion, and a local infection with ulceration develops. The incubation period is 1-5 days. Swollen lymph glands may develop.

- Bacteria that enter the host through mucous membranes can cause increased mucus production in the affected areas.

## 2- Pulmonary form

- When bacteria are aerosolized and enter the respiratory tract via inhalation or hematogenous spread, pulmonary infections may develop. Pneumonia, pulmonary abscesses, and pleural effusions can occur.
- The incubation period is 10-14 days. With inhalational melioidosis, cutaneous abscesses may develop and take months to appear.

## 3- Septicemia

- When bacteria are disseminated in the bloodstream in glanders, it is usually fatal within 7-10 days. The septicemia that develops affects multiple systems, and cutaneous, hepatic, and splenic involvement may occur.
- With melioidosis, bacteremia is observed with chronically ill patients (eg, patients with HIV, patients with diabetes).
- They develop respiratory distress, headaches, fever, diarrhea, pus-filled lesions on the skin, and abscesses throughout the body. Septicemia may be overwhelming, with a 90% fatality rate and death occurring within 24-48 hours.

## 4- Chronic form

- The chronic form involves multiple abscesses, which may affect the liver, spleen, skin, or muscles.
- This form also is known as farcy in glanders disease.
- It can become reactive many years after the primary infection.

## V. CLINICAL MANIFESTATIONS

- Most infections are asymptomatic.
- Acute disease, lasting for **less than two months**, is most common.
- Chronic disease is symptoms persisting **longer than two months**.

### 1- Incubation period: 1-21 days in acute cases

- Short incubation: < 24 hours. Rapid onset within 24 hours of inoculation has been seen in presumed aspiration following near drowning.
- Long incubation: > 30 years.

### 2- Acute melioidosis

### 3- Acute pulmonary infection

Most commonly affected organ (55%):

- Fever, headache.
- Cough,
- Dull aching chest pain.
- Tachypnea,
- Respiratory distress,
- Crackle rales,
- Sputum production, purulent sputum,
- Hemoptysis,
- With or without shock (fulminant septic shock (mortality 84% in the Darwin study),
- Pleural effusions have generally been uncommon in acute melioidosis but effusions and empyema can still occur, especially with lower lobe disease.
- Mild undifferentiated pneumonia, which can be acute or subacute with little mortality.
- There may also be multiple abscesses in abdominal organs.

**Chest radiography:** often have diffuse nodular infiltrates throughout both lungs, which coalesce, cavitate and progress rapidly, consistent with the caseous necrosis and multiple metastatic abscess formation seen at autopsy.

#### 4- Focal infection

- Hematogenous seeding and abscess formation can occur in any organ. However, **liver, spleen, skeletal muscle, prostate, and kidney** are the most common abscess sites.
- Less common presentations of melioidosis include uncomplicated infections of the skin, subcutaneous tissues, or the eye. Corneal ulcerations resulting from trauma, which become secondarily infected with *B. pseudomallei*, are rapidly destructive.
- Septic arthritis and osteomyelitis have also been described, but cellulitis appears to be rare. In a prospective study of more than 2 000 patients in Thailand, primary meningitis or endocarditis was not observed, but meningitis secondary to cerebral abscess rupture and mycotic aneurysms was seen.
- Other unusual melioidosis presentations include mediastinal masses, pericardial fluid collections, and adrenal abscesses.
- In Thailand 30% of the melioidosis cases in children present as acute suppurative parotitis.
- In Australia, approximately 4% of the melioidosis cases in northern Australia present as brain stem **encephalitis** or **encephalomyelitis** with peripheral motor weakness or flaccid paralysis or flaccid paraparesis. Features of this presentation include limb weakness, cerebellar signs, and cranial nerve palsies. Patients with this syndrome usually have an initial normal state of consciousness. Multiple focal *B. pseudomallei* microabscesses in the brain stem and spinal cord probably cause this syndrome.

#### 5- Septicemic melioidosis

- Patients with the acute septic form of melioidosis present characteristically with a short history of fever and no clinical evidence of focal infection. Most patients are profoundly ill with signs of sepsis. Septic shock may appear on presentation.
- Acute onset, high fever, tachypnea, dyspnea, myalgia, hepatosplenomegaly,
- Markers of organ dysfunction, including **leukopenia** (particularly lymphopenia), **hepatic dysfunction** (raised aspartate aminotransferase, alanine aminotransferase, and bilirubin levels), **renal dysfunction** (raised urea and creatinine levels), and **metabolic derangements** (hypoglycemia and acidosis).
- Mortality:
  - 90% without treatment.
  - 50% with treatment.

#### 6- Chronic melioidosis

- Chronic melioidosis is usually defined by duration of symptoms greater than 2 months and occurs in approximately 10% of patients.
- The clinical presentation of chronic melioidosis is protean and includes such presentations as chronic skin infection, skin ulcers and lung nodules or chronic pneumonia, closely mimicking tuberculosis, sometimes being called "Vietnamese tuberculosis.
- Chronic melioidosis can mimic tuberculous pericarditis.

## VI. DIAGNOSIS

- Clinical signs.
- It is diagnosed by growing *Burkholderia pseudomallei* from **the blood, urine, sputum, or skin lesions**.
- Detecting and measuring antibodies to the bacteria in the blood is another means of diagnosis.

- Other diagnostic tools that may be useful in melioidosis are radiological tests such as **chest x-rays** for the diagnosis of pulmonary melioidosis, and **computerized tomography (CT) scans** used to diagnose abscesses in the liver and spleen.
- There is also a serological test for melioidosis (indirect haemagglutination), but this is not commercially available in most countries.

## VII. DIFFERENTIAL DIAGNOSIS

- Anthrax Infection
- Plague
- Smallpox
- Pneumonia Bacterial
- Pneumonia, Mycoplasma,
- Pneumonia, Viral.

## VIII. TREATMENT

### 1- Current treatment

#### a. Initial intensive phase

1. Ceftazidime: 2-3 g or 40 mg/kg/dose every 8 hours, IV for 2-4 weeks, OR
2. Meropenem: 1 g or 25 mg/kg every 8 hours, IV for 2-4 weeks, OR
3. Augmentin (amoxicillin/clavulanic acid): 25mg/kg every 4 hours, IV for 2-4 weeks

#### b. Eradication phase:

1. Trimethoprim-Sulphamethoxazole: 8/40 mg/kg every 12 hours, PO, for 12-20 weeks, OR
2. Augmentin (amoxicillin/clavulanic acid): 75mg/kg/day, PO, divided into 3-4 doses, for 12-20 weeks.

### 2- Surgical treatment

Surgical drainage is usually indicated for prostatic abscesses and septic arthritis, may be indicated for parotid abscesses and not usually indicated for hepatosplenic abscesses. In bacteraemic melioidosis unresponsive to intravenous antibiotic therapy, splenectomy has been attempted, but there is only anecdotal evidence to support this practice.

## IX. COMPLICATIONS

Melioidosis can present in a variety of ways. Some of the more unusual types of infections it can cause include:

- Pericarditis
- Septic arthritis
- Necrotizing fasciitis
- Osteomyelitis
- Skin ulcers
- Body organ abscesses
- Bacterial pneumonia
- Septicemia
- Meningitis

## X. PREVENTION

- *B. pseudomallei* is widely distributed in soil and standing water in endemic regions.
- People with diabetes or other predisposing conditions should take special precautions to avoid skin contact with these sources.
- In addition, gloves and rubber boots are recommended for anyone doing agricultural work.
- Skin wounds including abrasions or burns should be promptly and thoroughly cleansed.
- A few outbreaks have been linked to contaminated drinking water supplies. Although small numbers of organisms may survive, chlorination of the water supply decreases the risk of infection. Because *B. pseudomallei* can be found in milk from infected ruminants, only pasteurized dairy products should be consumed.
- Veterinarians should take precautions to avoid exposure, including the use of gloves and protective clothing, when working with infected animals or collecting diagnostic samples. People who process meat should also wear gloves and disinfect knives regularly.
- In endemic areas, infected carcasses intended for human consumption are condemned and destroyed.
- Laboratory workers may be exposed in clinical samples from patients, even where melioidosis is not endemic.
- Practices such as sniffing opened culture plates should be discouraged. Postexposure prophylaxis may be given after laboratory exposure to aerosols or contact with skin wounds, or to people with risk factors for septicemia.
- In hospitals, ordinary precautions to prevent transmission in blood and body fluids should be taken. **No vaccine is available.**

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# PARASITIC INFECTIONS

By Dr. Mey Moniborin

## I. INTRODUCTION

Soil-transmitted helminth infection and schistosomiasis are significant health problems in Cambodia. Within the last decade, however, Cambodia has instituted several helminth control programs that have made significant progress in reducing the burden of these diseases.

Only three forms of parasite infection are on consideration:

### 1. Nematodes

Nematodes commonly parasitic on humans include ascarids (*Ascaris*), hookworms, pinworms (*Enterobius*), threadworms (*Strongyloides stercoralis*) and whipworms (*Trichuris trichiura*).

### 2. Cestodes

Cestoda (Cestoidea) is the name given to a class of parasitic flatworms, commonly called tapeworms, of the phylum Platyhelminthes.

Several species parasitise humans after being consumed in underprepared meat such as pork (*Taenia solium*), beef (*T. saginata*), and fish (*Diphyllobothrium spp.*), or in food prepared in conditions of poor hygiene (*Hymenolepis spp.* or *Echinococcus spp.*).

### 3. Trematodes (intestinal flukes)

trematodes (Intestinal flukes) are flat, hermaphroditic worms that range in size from a few millimeters to several centimeters. The geographic distribution is worldwide; the highest prevalences are in East and Southeast Asia.

## II. EPIDEMIOLOGY

Approximately 1,300,000 preschool children and 2,775,000 school children are infected with soil-transmitted helminthes.

A survey of intestinal parasite infection, including food-borne trematodes, in 251 primary school was conducted in Kampong Cham in 2002. The infection rate was approximately 57% in males and 51% in females. *Ascaris* was present in 26% of the cases, *Echinostoma sp.* 16%, hookworm 6% and *Opisthorchis sp.* 4%, with nearly 17% of the samples exhibiting two different kinds of parasites. Another survey of 623 school children was conducted in Batdambang in 2004. The overall infection rate was 25.7% (roughly equal between boys and girls), with *Echinostoma sp.* (4.8%) and hookworm (3.4%) the most common. No positive cases of *Ascaris* or *Trichuris* were identified.

In 2002, Cambodia's Ministry of Health began a campaign to deliver antihelminthic drugs and health education to 75% of its population of 2.8% million school children twice a year.

**III. DIAGNOSIS AND MANAGEMENT/TREATMENT** (*see tables of nematodes, cestodes and trematodes as below*)

**Nematode infections**

<b>Infection/Epidemiology</b>	<b>Clinical features/Diagnosis</b>	<b>Treatment</b>
<p><b>Ascariasis</b> (round worms) <i>Ascaris lumbricoides</i> <i>Distribution:</i> world wide, mainly in tropical and subtropical <i>Transmission:</i> ingestion of ascaris eggs</p>	<ul style="list-style-type: none"> <li>- <i>During larval migration</i> Loeffler's syndrome: transient pulmonary symptoms (dry cough, dyspnoea, wheezing) and mild fever.</li> <li>- <i>Once adult worms present in the intestine</i> Abdominal pain and distension. In general, the diagnosis is made when adult worms are expelled from the anus (or occasionally from the mouth). Ascaris are large (15-30cm), cylindrical worms, pinkish-white, with slightly ends.</li> <li>- <i>Complications</i> Ascariasis is usually benign, but massive infestation may cause intestinal obstruction (abdominal pain, vomiting, constipation), especially in children &lt;5 years. Worms may accidentally migrate to gall bladder, liver or peritoneum, causing jaundice, liver abscess, or peritonitis.</li> <li>- Ascaris eggs may be detected through parasitological examination of stools.</li> </ul>	<p><b>albendazole</b> PO as a single dose Children &gt;6 months and adult: 400 mg (200 mg in children &gt; 6 months by &lt; 10 kg, or <b>mebendazole</b> PO for 3 days Children &gt; 6 months and adults: 200 mg/day in 2 divided doses or 500 mg once ( 100mg/day in 2 divided doses in children &gt; 6 months but &lt; 10 kg, or <b>pyrantel pamoate</b> (11 mg/kg; maximum, 1 g) a single dose, or <b>Piperazine citrate</b> (75 mg/kg/d for 2 days; maximum, 3.5 g) is suggested in cases of obstruction due to large worm bezoars to aid passage</p>
<p><b>Trichuriasis</b> (whipworms) <i>Trichuris trichiura</i> <i>Distribution and transmission:</i> As for <i>A. lumbricoides</i></p>	<ul style="list-style-type: none"> <li>- In heavy infection: abdominal pain and diarrhea</li> <li>- In massive infection: chronic bloody diarrhea, tenesmus, rectal prolapsed due to frequent attempts to defecate, especially in children. Worms may sometimes be seen on the rectal mucosa when prolapsed: these are grayish-white, 3-5 cm in length, in the shape of a whip, with a thickened body and a long, threadlike extremity.</li> <li>- Trichuris eggs may be detected through parasitological examination of stools.</li> </ul>	<p><b>albendazole</b> PO for 3 days Children &gt;6 months and adult: 400 mg once daily (200 mg once daily in children &gt; 6 months by &lt; 10 kg) or <b>mebendazole</b> PO for 3 days as for ascariasis. A single dose of <b>albendazole</b> or <b>mebendazole</b> is often insufficient.</p>
<p><b>Hookworm infection</b> <i>Ancylostoma duodenale</i> <i>Necator americanus</i> <i>Distribution:</i> tropical and subtropical regions <i>Transmission:</i> larval skin penetration following contact (feet, hands) with contaminated soil</p>	<ul style="list-style-type: none"> <li>- <i>During larval penetration/migration:</i> cutaneous signs (pruritic papulo-vesicular rash at the site of penetration, usually the feet) and pulmonary symptoms (similar to ascariasis).</li> <li>- <i>Once adult worms are present in the intestine:</i> mild abdominal pain. Attachment of the parasite to the mucosa leads to chronic blood loss and anaemia (in endemic areas, antihelminthic treatment is recommended for patients with iron-deficiency anaemia)</li> <li>- Hookworm eggs may be detected through parasitological examination of stools.</li> </ul>	<p><b>albendazole</b> PO as a single dose is much more effective than <b>mebendazole</b> as a single dose. When using <b>mebendazole</b>, a 3-day treatment (as for ascariasis is recommended, or <b>Pyrantel pamoate</b> (11 mg/kg PO once daily for 3 days; maximum dose: 1 g)</p>

		Treatment of anaemia
<p><b>Strongyloidiasis</b>  <i>Strongyloides stercoralis</i>  <i>Distribution:</i> humid tropical regions  <i>Transmission:</i> larval skin penetration and auto-infection</p>	<ul style="list-style-type: none"> <li>- <i>Acute strongyloidiasis</i> <ul style="list-style-type: none"> <li>• During larval penetration/migration: cutaneous signs (erythema and pruritus at the site of penetration, which may persist several weeks) and pulmonary symptoms (similar to ascariasis).</li> <li>• Once larvae are present in the intestine: gastrointestinal symptoms (bloating, abdominal and epigastric pain, vomiting, diarrhea).</li> </ul> </li> <li>- <i>Chronic strongyloidiasis</i>            Intestinal larvae may re-infect their host (auto-infection) by penetrating through the intestinal wall or by migrating transcutaneously from perianal skin. Chronic infections result in prolonged or recurrent pulmonary and gastrointestinal symptoms. Transcutaneous migration of intestinal larvae gives rise to a typical rash (<i>larva currens</i>), mainly in the anal region and on the trunk: sinuous, raised, linear, migrating lesion, intensely pruritic, moving rapidly ( 5 to 10 cm/hour) and lasting several hours or days<sup>2</sup>.</li> <li>- <i>Complications:</i> Hyperinfection (massive infestation) results in exacerbation of pulmonary and gastrointestinal symptoms, and possible dissemination of larvae to atypical locations, (CNS, heart, etc.). This form occurs mainly in patients receiving immunosuppressive therapy ( e.g. corticosteroids).</li> <li>- <i>Strongyloides</i> larvae may be detected through parasitological examination of stools.</li> </ul>	<p>First line treatment is ivermectine (200 µg/kg/24 hr once daily PO for 1-2 days), on an empty stomach. While less effective, a 3-day treatment with <b>albendazole</b> PO (as for trichuriasis) may be alternative.</p> <p>Hyperinfections are refractory to conventional therapy. Prolonged or intermittent multiple-dose regimens are required.</p>
<p><b>Entorobiasis</b> (pinworms)  <i>Enterobius vermicularis</i>  <i>Distribution:</i> worldwide  <i>Transmission:</i> faecal-oral route or auto-infection</p>	<ul style="list-style-type: none"> <li>- Anal pruritus, more intense at night, vulvovaginitis in girls (rare). In practice, the diagnosis is more often made when worms are seen on the perianal skin (or in the stool in heavy infestation). Pinworms are small (1 cm), mobile, white, cylindrical worms with slightly tapered ends.</li> <li>- Pinworm eggs may be collected from the anal area (scotch tape method) and detected under the microscope.</li> </ul>	<p><b>albendazole</b> PO as a single dose (as for ascariasis)  or  <b>mebendazole</b> 100 mg (available as a chewable tablet) PO once, may repeat in 2 weeks if symptoms still present, or  <b>Pyrantel Pamoate</b>, 11 mg/kg (maximum 1 g) once, may repeat in 2 weeks.</p>
<p><b>Trichinellosis</b>  <i>Trichinella</i> sp  <i>Distribution:</i> worldwide, particularly frequent in Asia</p>	<ul style="list-style-type: none"> <li>- <i>Enteric phase</i> (1 to 2 days after ingestion of infected meat) self-limited episode of diarrhea and abdominal pain lasting several days.</li> <li>- <i>Muscular phase</i> (about 1 week after ingestion): high fever, muscular pain (ocular [pain on eye movement], masseters [limitation of mouth opening],</li> </ul>	<p><b>albendazole</b> PO for 10 to 15 days  Children &gt;2 years: 10 mg/kg/day in 2 divided doses, or  <b>mebendazole</b> PO for 10 to 15 days</p>

(Thailand, Laos, China, etc.) <i>Transmission:</i> consumption of raw or undercooked meat containing trichinella larvae (pork, wart-hog, bear, dog, etc.)	throat and neck [pain with swallowing and speech], trunk and limbs); facial or bilateral peri-orbital oedema; conjunctival haemorrhage, subungual haemorrhage; headach. Typical features are not always present and the patient may present with a non-specific flu-like syndrome. Other features, such as dietary habits (consuming pork/raw meat), suggestive symptoms (fever >39 °C and myalgia and facial oedema) in several individuals who reinforce the clinical suspicion. <ul style="list-style-type: none"> <li>Definitive diagnosis: muscle biopsy; serology (ELISA, Western Blot)</li> </ul>	Children >2 years: 5mg/kg/day in 2 divided doses
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### Cestodes

Parasites	Clinical features/Laboratory	Treatment	Transmission/Prevention
<b>Taeniasis</b> <i>Taenia saginata</i> <i>Taenia solium</i> (worldwide)	Often asymptomatic or segments expelled in the stools. Sometimes gastrointestinal disturbances (epigastric or abdominal pain, nausea, diarrhea) Laboratory: eggs in stools or collected from perianal skin (scotch tape method), segments in stools	<b>Praziquantel PO</b> Children over 4 years and adults: 5 to 10 mg/kg as a single dose, or <b>niclosamide PO</b> Children: 50 mg/kg as a single dose Thoroughly chew the tablets before swallowing and wash down with as little water as possible	<i>Transmission</i> by eating raw or undercooked meat: <ul style="list-style-type: none"> <li>beef for <i>T. saginata</i></li> <li>pork for <i>T. solium</i></li> </ul> <i>Prevention:</i> <ul style="list-style-type: none"> <li>individual: cook meat thoroughly</li> <li>collective: slaughterhouse monitoring</li> </ul>
<b>Diphyllobothriasis</b> <i>Diphyllobothrium latum</i> (temperate or cold lake areas)	Often asymptomatic In the event of heavy infection: mild gastrointestinal disturbances, anaemia due to vitamin B12 deficiency associated with (rare) neurological sequelae Laboratory: eggs in stools	<b>Praziquantel PO</b> Children over 4 years and adults: 10 to 25 mg/kg as a single dose, or <b>niclosamide PO</b> Children: 50 mg/kg as a single dose Thoroughly chew the tablets before swallowing and wash down with as little water as possible If anaemia: <b>vitamin B12 +folic acid</b>	<i>Transmission</i> by eating raw or undercooked fresh water fish <i>Individual prevention:</i> cook fish thoroughly
<b>Hymenolepiasis</b> <i>Hymenolepis nana</i> (worldwide)	Often asymptomatic In the event of heavy infection: gastrointestinal disturbances (epigastric pain) Laboratory: eggs in stools	<b>Praziquantel PO</b> Children over 4 years and adults: 15 to 25 mg/kg as a single dose, or <b>niclosamide PO</b> 1 g PO for children 5-15 kg, 1.5 g PO for ≥16 kg for 6 days)	<i>Transmission</i> by faecal-oral route or auto-infection <i>Prevention:</i> <ul style="list-style-type: none"> <li>Individual: hand washing, nail cutting</li> <li>Collective: hygiene and sanitation (water, latrines,</li> </ul>

			etc.)
<b>Cysticercosis</b> <i>Taenia solium</i> (worldwide)	<ul style="list-style-type: none"> <li>- Muscular: asymptomatic or myalgia</li> <li>- Subcutaneous: nodules</li> <li>- Neurological (neurocysticercosis) headache, convulsion, coma, etc.</li> <li>- Ocular: exophthalmia, strabismus, iritis, etc.</li> </ul> Laboratory: hypereosinophilia in blood and cerebrospinal fluid	<b>albendazole</b> PO Children over 2 years: 15mg/kg/day in divided dose (without exceeding 800 mg/day) for 8 to 30 days, or <b>Praziquantel</b> PO Children over 4 years and adults: 50 mg-100 mg/kg/day in 3 divided doses for 14 to 30 days In the event of <i>neurocysticercosis</i> : hospitalize, treat convulsions and combine with <b>prednisolone</b> PO for the entire duration of treatment, starting 2 or 3 days before.  Several studies indicate that <b>albendazole</b> produces a somewhat better outcome than <b>praziquantel</b>	<i>Transmission</i> by eating food contaminated with <i>T. solium</i> eggs or auto-infection  Individual <i>prevention</i> : <ul style="list-style-type: none"> <li>• treat <i>T.solium</i> carriers</li> <li>• hygiene</li> <li>• cook meat thoroughly</li> </ul>

### Trematodes (intestinal flukes)

Infection/Epidemiology	Clinical features/Diagnosis	Treatment
<i>Opisthorchis felineus</i> (Asia, Eastern Europe) <i>Opisthorchis viverrini</i> (Cambodia, Laos, Vietnam, Thailand) <i>Clonorchis sinensis</i> (China, Korea, Vietnam) <i>Transmission</i> : eating raw/undercooked freshwater fish	<ul style="list-style-type: none"> <li>- Abdominal pain and diarrhea. With heavy infection, hepatobiliary symptoms: hepatomegaly, right upper quadrant pain, jaundice or episodes of febrile cholangitis. The diagnosis is confirmed when parasite eggs are detected in stools.</li> </ul>	<b>Praziquantel</b> PO Children > 2 years and adults: 75 mg/kg/day in 3 divided doses for 1 or 2 days.
<b>Echinostomiasis</b> <i>Echinostoma</i> sp. <i>Trichuris trichiura</i> <i>Distribution</i> : Far East and Southeast Asia (Indonesia, Philippines, China, Malaysia, Singapore, Korea, Japan, Thailand, and India ) <i>transmission</i> : eating raw fish/ mollusks	<ul style="list-style-type: none"> <li>- In general asymptomatic</li> <li>- In massive infection: abdominal pain and diarrhea,</li> <li>- in general echinostomiasis is not life threatening</li> </ul> The diagnosis is established by finding characteristic eggs in the stool.	<b>Praziquantel</b> PO Children over 4 years and adults: 15 to 25 mg/kg as a single dose <b>or</b> <b>albendazole</b> PO for 3 days Children >6 months and adult: 400 mg once daily (200 mg once daily in children > 6 months by < 10 kg)

#### **IV. PREVENTION**

- Decontaminate the environment by washing underclothes, bedclothes, bed sheets, and towels.
- Maintain good hand hygiene, including hand washing and proper toileting. avoiding contamination of food and drink with human or animal feces.
- Proper cooking of meat and fish.
- Keep fingernails short and avoid nail biting.
- Treat family members and close contacts.

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# ENDOCRINE DISEASES

1. Type 1 Diabetes Mellitus in Children (Insulin Dependent Diabetes Mellitus, Juvenile diabetes) .....	321
2. Goitre .....	326
3. Adrenocortical Insufficiency (Adrenal Crisis, Addison's Disease) .....	336
4. Diabetes Insipidus .....	340
5. Pediatric Hypoglycemia.....	346
6. Obesity .....	350

# TYPE 1 DIABETES MELLITUS IN CHILDREN

(INSULIN DEPENDENT DIABETES MELLITUS, JUVENILE DIABETES)

*By Dr. Iv Malene*

## I. INTRODUCTION

- It accounts for 10% of all cases of diabetes mellitus.
- It may present at any age but it is the most common type of diabetes affecting children and adolescents under 18 years old.
- Diagnosis of type 1 diabetes is **definitive**. The only possible therapy is **insulin**.
- Diabetic ketoacidosis (**DKA**) can occur very quickly in children, especially in young children. Therefore, **do not delay treatment after diagnosis**.
- It is important that education be delivered to patients and the whole family. The children with type 1 diabetes need to adjust their insulin dosage on a day-to-day basis in order to achieve optimal control.

## II. DEFINITION

Type 1 diabetes mellitus (DM1) is a chronic autoimmune disease caused by destruction of pancreatic beta cells.

## III. EPIDEMIOLOGY

- DM1 is the most common pediatric endocrine disorder, affecting approximately 1 in 300-500 children under 18 years of age.
- The variation in incidence showed that the lowest incidence were found in Asia and the highest incidence were found in Europe (0.1- 36.8/100,000/y)
- The EURODIAB collaborative study, a registry involving 44 countries in Europe, indicates an annual rate of increase in incidence of type 1 diabetes of 3 - 4%, with a largest rate of increase is seen in children aged 0-4 years.
- WHO (1995) estimated that there are 19.4 million people with type 1 diabetes and that the number will rise to 57.2 million by 2025.

## IV. COMPLICATIONS

### 1. Acute Complications of Type 1 Diabetes

- Hypoglycemia: (see chapter hypoglycemia)
- Diabetic ketoacidosis
  - DKA is a life-threatening and the most common cause of deaths **immediate hospitalization.**
  - Often as a result of inadequate insulin therapy during intercurrent illness and insulin omission.
  - Cerebral edema occurs 1-5% of cases of DKA.

### 2. Chronic complications

- Microvascular complications: retinopathy, nephropathy, and neuropathy,
- Macrovascular complications include circulatory and cardiovascular events such as stroke and myocardial infarction, which are rare in children and adolescents.
- Chronic complications have been linked to poor glycemic control and the duration of the disease.

## V. SYMPTOMS AND DIAGNOSES

1. Classical diabetes: —> See Algorithm
2. Diabetic ketoacidosis (DKA): —> See Algorithm
3. Diagnosis:
  - Clinical features,
  - Laboratory finding:
    - Glucose testing —> hyperglycemia ( normal glycemia preprandial 70 -110mg/dl “3.8-6.1mmol/l” and postprandial 126 – 140 mg/dl”7-7.7mmol/l”)
    - Urine testing —> glycosuria, ± Ketonuria

If you meet the patients that have the symptoms like above you should tell the family and transfer the patients to the specialized center (currently at Kantha Bopha Hospital).

## VI. TREATMENT

### 1. Aims of Diabetes Management

- Have optimal glycaemic control.
- Have normal growth and development.
- reduce the risk of long-term complications: retinopathy, nephropathy, neuropathy

### 2. Insulin therapy: We have two methods:

#### A. Subcutaneous Insulin: it is used in a classical form.

- **Two injections daily (Using with insulin syringe)** Short-acting insulin (Actrapid®) + Intermediate-acting insulin (Insulatard®) →in the same syringe given 20-30 minutes before breakfast and dinner.
- **Four injections daily (using with insulin pen)**
  - ✓ Short-acting insulin (**Novorapid**®): before breakfast, lunch, dinner, and
  - ✓ long-acting insulin (**Levemir**®) at bedtime.
  - ✓ The patients can eat immediately after insulin injection.
- **Insulin dose:** —> See Algorithm

- **Recommended Injection Sites**
  - ✓ Lateral aspect of arm
  - ✓ Front of thigh /lateral thigh,
  - ✓ Abdomen,
  - ✓ Buttocks,

B. **Intravenous insulin:** Use in DKA with regular insulin (**Atrapid<sup>®</sup>**) See Algorithm

### 3. Monitoring

- Portable glucose meters (Medisafe Reader)
- Glucose test: usually the patients must be measured four times per day and can reduce two times per day when glycemia result is stable.
- Urine testing (Ketodiabur) should be test for ketonuria.
- The HbA1c test (N= 6 - 8%) is another test to see the evolution of diabetes in long term management. This test should be measured four times per year, at least twice a year if the glycemia is stable.

### 4. Diet

- The diet for people with diabetes is no different from that considered healthy for everyone. The child or adolescent with diabetes can eat a normal food plan as recommended for the general population without the need for special foods.
- The overweight or obese should be encouraged to lose weight by a combination of changes in food intake and physical activity.

### 5. Exercises

- Exercise increases insulin absorption, again predominantly related to increased subcutaneous blood flow.
- A major complication of exercise in diabetic patients is the presence of a hypoglycemic reaction during or within hours after exercise.

## VII. EDUCATION

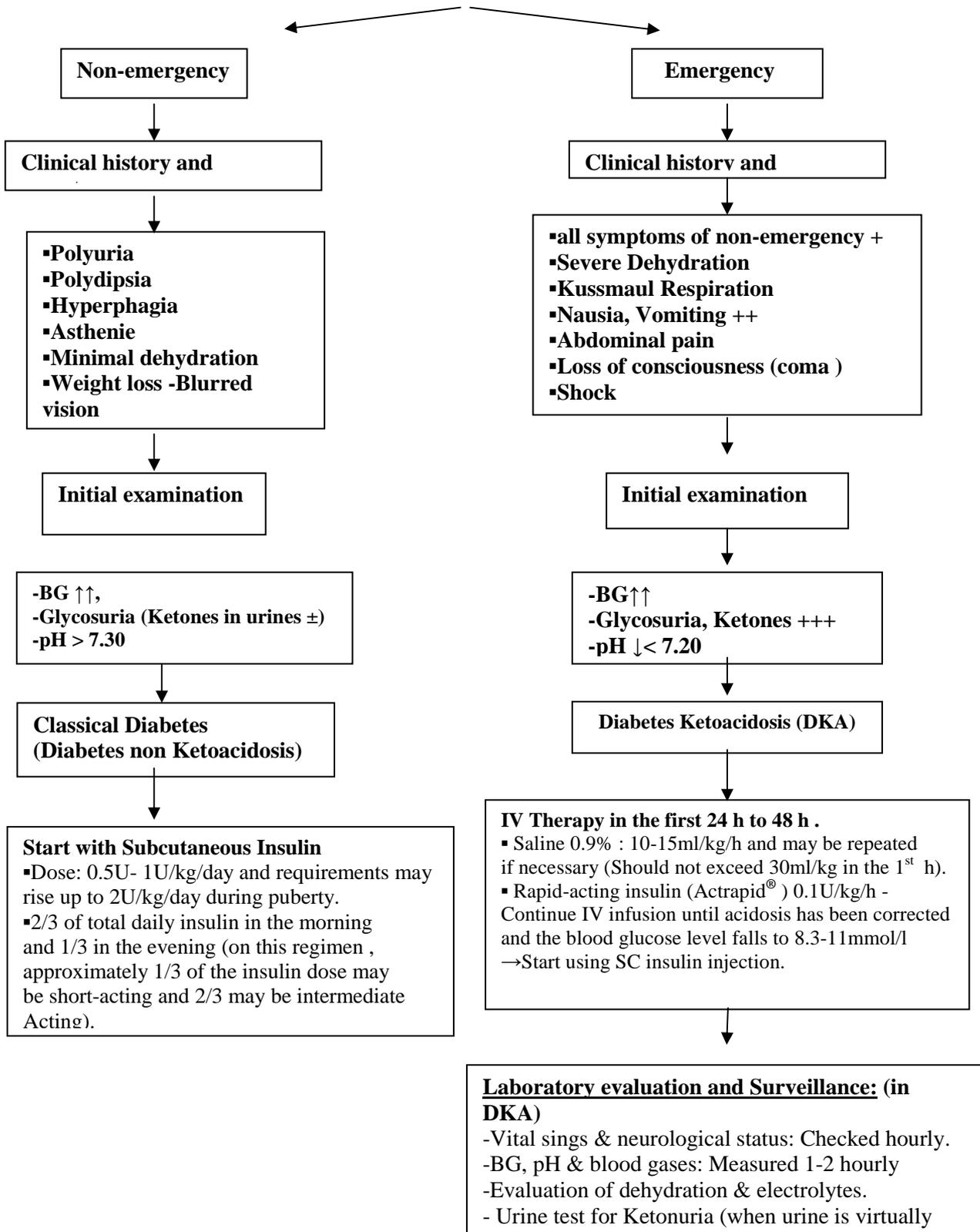
- Education is the keystone of diabetes care
- Diabetic lesson is given to patients to teach them to understand about some of diabetic fields to make it easier to practice at home.
- Structured self-management education is the key to a successful outcome.
- Empower them and their families to take control of their diabetes.
- All patients and family need careful training for life with insulin. This is best achieved outside hospital.

## VIII. RECOMMENDATIONS

- Every child with type 1 diabetes, including those from rural and remote areas after suspecting or confirm diagnosis should transfer to the specialized center to get proper treatment (currently at Kantha Bopha Hospital).
- Do not delay the treatment after diagnosis.
- Self-blood glucose monitoring (SBGM) is essential in the long term management of diabetes.
- In general, postprandial glucose values should be kept below 10 mmol/l (180 mg /dl) and postprandial glucose values should vary between 5 and 7 mmol/l (90-126 mg/dl) to avoid acute and long term complications.

- Providing diabetes education is very important to encourage the patients to be independent in doing injections and blood testing. It also gives the children the opportunity to be responsible and to live a healthy lifestyle.

**Presentation and management of type 1 Diabetes**



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# GOITRE

By Dr. Heng Sothy

## I- INTRODUCTION

Goitre is enlargement of the thyroid gland. Children with thyroid disorders usually present with an enlargement of the thyroid gland (goitre), with or without symptoms of thyroid hormone deficiency or excess.

## II- EPIDEMIOLOGY

- Prevalence of goitre in the US is 3-7%, although the incidence is much higher in regions of iodine deficiency. The most common cause of pediatric goitre in the US is chronic lymphocytic thyroiditis.
- Thyroid cancer comprises 0,5-1,5%<sup>(10)</sup> of all malignancies in children and adolescents.
- Thyroid tumors and autoimmune thyroid disease are both more common in females than in males.
- Prevalence: World Health Organization (WHO) Global Database on Iodine Deficiency (1993-2003)<sup>(2)</sup>.
  - Global goitre prevalence is 15,8% of the general population.
  - Insufficient iodine intake ranged from 10,1% in the Americas to 59,9% in Europe.

## III- AETIOLOGY

- Because goitre is often the first sign of thyroid disease, the diagnostic considerations can be approached from the perspective of the goitre.
- Immunologic:
  - Chronic lymphocytic thyroiditis (often referred to as Hashimoto thyroiditis)
  - Graves disease
- Infectious:
  - Acute suppurative thyroiditis (most often *Streptococcus pyogenes*, *Staphylococcus aureus*, and *Streptococcus pneumoniae*)
  - Subacute thyroiditis (often viral)
- Environmental:
  - Goitrogens: Iodide, lithium, amiodarone, oral contraceptives, perchlorate, cabbage, soybeans, cassava, thiocyanate in tobacco smoke (smoking is especially goitrogenic in iodine-deficient areas)

- Iodine deficiency, an endemic goitre. Iodine deficiency is uncommon in North America. However, iodine deficiency associated with goitre is the most common cause of hypothyroidism globally.
- Neoplastic:
  - Thyroid adenoma/carcinoma
  - Follicular adenoma: Benign
  - Follicular, papillary, or mixed carcinoma
  - Medullary carcinoma
  - TSH-secreting adenoma
  - Lymphoma
- Nodular goitre
  - Solitary nodule (adenoma, carcinoma, cyst)
  - Multinodular goitre secondary to autoimmune thyroid disease
- Stimulation of TSH receptors by TSH from pituitary tumors, pituitary thyroid hormone resistance, gonadotropins, and/or thyroid-stimulating immunoglobulins
- Thyroid peroxidase mutations lead to iodide organification defects and goitrous congenital hypothyroidism.
- Dyshormonogenesis
- Anatomic abnormalities
  - Thyroglossal duct cyst
  - Hemiagenesis of the thyroid
- The multinodular goitre 1 (MNG1) locus has been identified on chromosome 14q and on chromosome Xp22<sup>(5)</sup>.

#### IV- DIAGNOSIS

##### 1. Signs and Symptoms

- Careful dietary and medication history
- History of head, neck, or chest irradiation is associated with increased risk of carcinoma
- Family history of thyroid carcinoma or MEN syndrome.

<ul style="list-style-type: none"> <li>▪ <b><u>Symptoms and signs of hypothyroidism:</u></b> <ul style="list-style-type: none"> <li>○ Lethargy,</li> <li>○ Hypotonia,</li> <li>○ Hoarse cry,</li> <li>○ Feeding problems,</li> <li>○ Constipation,</li> <li>○ Macroglossia,</li> <li>○ Umbilical hernia,</li> <li>○ Dry skin,</li> <li>○ Hypothermia,</li> <li>○ Prolonged jaundice.</li> <li>○ Overweight for height</li> <li>○ Proximal muscle weakness</li> <li>○ Delayed growth</li> <li>○ Pallor</li> <li>○ Irregular menstrual cycles</li> <li>○ Delayed puberty (occasionally precocious puberty)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ <b><u>Symptoms of hyperthyroidism of the child by Zimmerman et al<sup>(27)</sup>:</u></b> <ul style="list-style-type: none"> <li>○ Nervousness 64 %</li> <li>○ Sleep non-reparateur 27 %</li> <li>○ Intolerance to heat 45 %</li> <li>○ Attention decreased 13 %</li> <li>○ Weight loss 37%</li> <li>○ Diarrhea 10 %</li> <li>○ Irritability 34 %</li> <li>○ Insomnia 7 %</li> <li>○ Tire 27 %</li> <li>○ Menstrual irregularities 6 %</li> <li>○ Exophthalmos 40 %</li> <li>○ Paresis upper eyelid 25 %</li> <li>○ Upper eyelid retraction 20%</li> <li>○ Tachycardia 64 %</li> <li>○ Tremor 50 %</li> <li>○ Hot and clammy skin 36 %</li> <li>○ Deep tendon reflexes 12%</li> <li>○ Muscle weakness 25 %</li> </ul> </li> </ul>
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## 2. **Physical Exam**

Inspect, palpate, and auscultate the neck:

- Neck extension aids inspection.
- Have patient drink water during inspection of gland.
- Palpation is best performed standing behind the child.
  - Determine if the thyroid is diffusely enlarged or asymmetric, evaluate gland firmness, and assess for any nodularity.
  - Check for cervical lymphadenopathy
  - Pain on palpation suggests acute inflammation.
- Auscultate with the stethoscope diaphragm (while patient holds his or her breath) for a bruit, which indicates the hyperthyroidism-associated hypervascularity.
- Careful examination for signs of hypothyroidism or hyperthyroidism:
  - Pulse
  - Linear growth and weight pattern
  - Sexual development
  - Deep tendon reflexes
  - Skin

## 3. **Laboratory**

- Thyroid function tests: Total T<sub>4</sub>, Free T<sub>4</sub> and TSH are the best screens for hypothyroidism or hyperthyroidism.
- Free T<sub>4</sub> measurement is preferred to the total T<sub>4</sub> level because the former is not influenced by thyroid binding globulin levels and, therefore, better reflects the active thyroid hormone level.
- An increased TSH level (>4.12 mIU/L) suggests a diagnosis of primary hypothyroidism; this diagnosis is confirmed if the patient has a low free thyroxine (FT<sub>4</sub>) level<sup>(9,16,18,24,26)</sup>. Because TSH is a more sensitive test than FT<sub>4</sub>, patients with subclinical hypothyroidism (mild thyroid failure) will have a normal FT<sub>4</sub> with an elevated TSH level<sup>(9,18,24)</sup>.
- In the presence of an increased TSH with a normal FT<sub>4</sub>, a thyroid peroxidase antibody (TPOab) test is useful for establishing thyroid autoimmunity as the cause of subclinical hypothyroidism (mild thyroid failure).
- A normal TSH level in a patient with low FT<sub>4</sub> suggests secondary hypothyroidism or a hypothalamic-pituitary disorder<sup>(22,24,26)</sup>.
- If the FT<sub>4</sub> is high in an individual with a normal or elevated TSH level, possible TSH-secreting pituitary tumor or thyroid hormone resistance<sup>(26)</sup>.
- A decreased TSH level (<0.45 mIU/L) and an increased FT<sub>4</sub> generally confirm a diagnosis of hyperthyroidism<sup>(6,9,18,16,22,24)</sup>.
- In case of suspected Grave disease: Thyroid-stimulating immunoglobulins (or TSH-receptor antibodies)
- Fine-needle aspiration biopsy in children should be considered only for evaluation of low risk or purely cystic thyroid nodules. (A higher percentage of solitary thyroid nodules are malignant in children compared with adults).
- Calcitonin levels: Elevated in 75% of patient with medullary carcinoma
- Urinary iodine (UI) concentration is the best measure of the adequacy of iodine intake.

## 4. **Imaging**

- Ultrasound to determine the number, size, and nature (cystic, solid, or mixed) of nodules.
- Some authors recommend regular sonographic follow-up<sup>(25,23)</sup>, although the growth rate does not seem useful in distinguishing malignant from benign nodules<sup>(3)</sup>.

<b><u>Benign</u></b>	<b><u>Malignant</u></b>
Normal echogenicity or hyperechogenicity	Hypoechogenicity
Coarse calcifications	Microcalcifications
Thin, well defined halo	Thick, irregular, or absent halo
Regular margin	Irregular margin
No regional lymphadenopathy	Regional lymphadenopathy
Low intranodular flow by Doppler	High intranodular flow by Doppler

- $^{123}\text{I}$  thyroid scans in cases of solitary nodules to establish whether the nodule concentrates iodide.
  - “Cold” nodules (no I uptake) suggest neoplasia and require immediate evaluation by a pediatric endocrinologist and surgeon.
- Barium swallow studies can reveal a fistulous tract between the left piriform sinus and the left thyroid lobe in children with recurrent acute suppurative thyroiditis. Such fistulas are amenable to surgical resection.

## V- DIFFERENTIAL DIAGNOSIS

- Thyroglossal duct cysts
- Nonthyroidal neoplasms: lymphoma, teratoma, hygroma, ganglioneuroma
- Fat neck: adipose tissue, large sternocleidomastoid muscles

## VI- TREATMENT

### 1. **General measures (Diet)**

- Depends on the cause of the goitre
- Incidence of iodine deficiency (endemic) goitre has greatly declined since the addition of potassium iodide to table salt.
- Iodide can also be added to communal drinking water or administered as iodized oil in isolated rural areas.

### 2. **Medication (Drugs)**

#### a. **Goitres with hypothyroidism:**

- The drug of choice is levothyroxine, which allows measuring serum FT4 levels to assess the efficacy of treatment and adjusting doses.
- Treatment should be individualized because the absorption of T4 and metabolism vary among individuals.
- Serum FT4 and TSH concentrations should be monitored periodically. The goal is to keep the serum FT4 concentration at the mid-normal range and the TSH concentration in the normal range. Once the patient is euthyroid, many of the symptoms disappear.
- It is administered once a day in the morning. *Algorithm Hypothyroidism Management* shows the recommended doses for different age groups.
- Approximately 20% of children with CLT recover to the euthyroid state and do not require lifelong thyroid hormone replacement. CLT, Treatment is usually expectant, and up to one-third of adolescents has spontaneous resolution, with the gland becoming normal and the antibodies disappearing. Exogenous thyroid hormone should be reserved for patients who are hypothyroid.

#### b. **Goitres with hyperthyroidism:** Treatment is palliative and is designed to decrease the production of thyroid hormone.

- Current treatments include Antithyroid medications, Radioactive  $^{131}\text{I}$ , and Subtotal thyroidectomy<sup>(11)</sup>.

- In the majority of the cases a treatment by the Carbimazole associated with the Propranolol is considered in first<sup>(20)</sup>. They are quite difficult to specify because they didn't exist protocol standardized for the ATS (dose, duration, criteria to stop). Two ways are possible:

First possibility	Second possibility
<ul style="list-style-type: none"> <li>• A high dose (1 mg/kg/day) maintained until the appearance of a hypothyroidism possibly compensated by a prescription of LT4 or gradually decreased according to biological evolution, the minimum duration of this treatment is from 18 to 24 months.</li> <li>• The criteria of stop are not very precise: clinical euthyroidie, biological: standardization of the TSH.</li> <li>• This method is considered to be more satisfactory than the following one because it generates less annual consultations.</li> </ul>	<ul style="list-style-type: none"> <li>• The other possibility is a low dosage of attack (0.5 to 0.7 mg/kg/d) gradually decreased to treatment of maintenance prolonged very long extended from 5 to 10 mg/d for years.</li> <li>• The risk of relapse to the stop is very large at the teenager and takes a significant risk, given the low compliance, to prescribe such a treatment this age.</li> <li>• Relapse harder responding to medical treatment, a second cure is sometimes attempted, but fails the only remaining possibility is surgical treatment, Radioactive Iodine therapy.</li> </ul>

Toxic Reactions Produced by Antithyroid Drugs	
-Erythematous rash	-Disseminated intravascular coagulation
-Urticaria	-Peripheral neuritis
-Granulocytopenia	-Sensorineural hearing impairment
-Arthralgia	-Toxic psychosis
-Arthritis	-Loss of taste sensation
-Lymphadenopathy	-Hepatitis
-Edema	-Thrombocytopenia
-Fever	-Hypoprothrombinemia
-Conjunctivitis	
-Lupus-like syndrome	

- **Drug additives**

The  $\beta$ -blockers, propranolol, are useful in the initial period of treatment 80 mg/m<sup>2</sup>/day in 2-4 divided dose. This treatment continue approximately 2 weeks.

- **Surgery:**

- Subtotal and total thyroidectomy are the two surgical options for patients who fail initial medical therapy, relapse after cessation of antithyroid drugs, have significant drug reactions, or have large goitres (80 g) or the nodule is malignant.
- Thyroidectomy has a cure rate of 90% and reverses the hyperthyroid state rapidly, but it entails a complex surgical procedure that has a potential for complications, especially hypoparathyroidism and recurrent laryngeal nerve damage.

- **Radioactive Iodine (RI) therapy:**

- With RI therapy, orally administered iodine-131 concentrates in the thyroid gland, where it induces cell death. With a cure rate of 90% or greater, RI is a simple and relatively inexpensive treatment option for patients who fail to follow a drug regimen, who experience major adverse effects from drug treatment, or who do not achieve disease remission with drug treatment after several years.

- The risk of thyroid cancer, leukemia, genetic damage and reproduction problems in children treated with radioactive iodine are still uncertain.
- However, several epidemiological studies have failed to demonstrate an increased incidence of thyroid cancer or other malignancies following I<sup>131</sup> therapy in adults <sup>(7,17,21)</sup>. Several studies of long-term follow-up in children with Graves' disease have not shown an increased risk of thyroid neoplasia or other malignancies <sup>(12,14,15)</sup>.
- However, it has been suggested that radioactive iodine should be avoided in children less than 5 years of age <sup>(4)</sup>.
- Permanent hypothyroidism after radioiodine treatment has been reported to be 60-90% <sup>(1,8,13,19,20,28)</sup>, requiring thyroxine replacement therapy.

The author's practice is not to treat euthyroid goitres unless they are cosmetically significant. Even then, the use of thyroxine is controversial.

## VII- FOLLOW UP

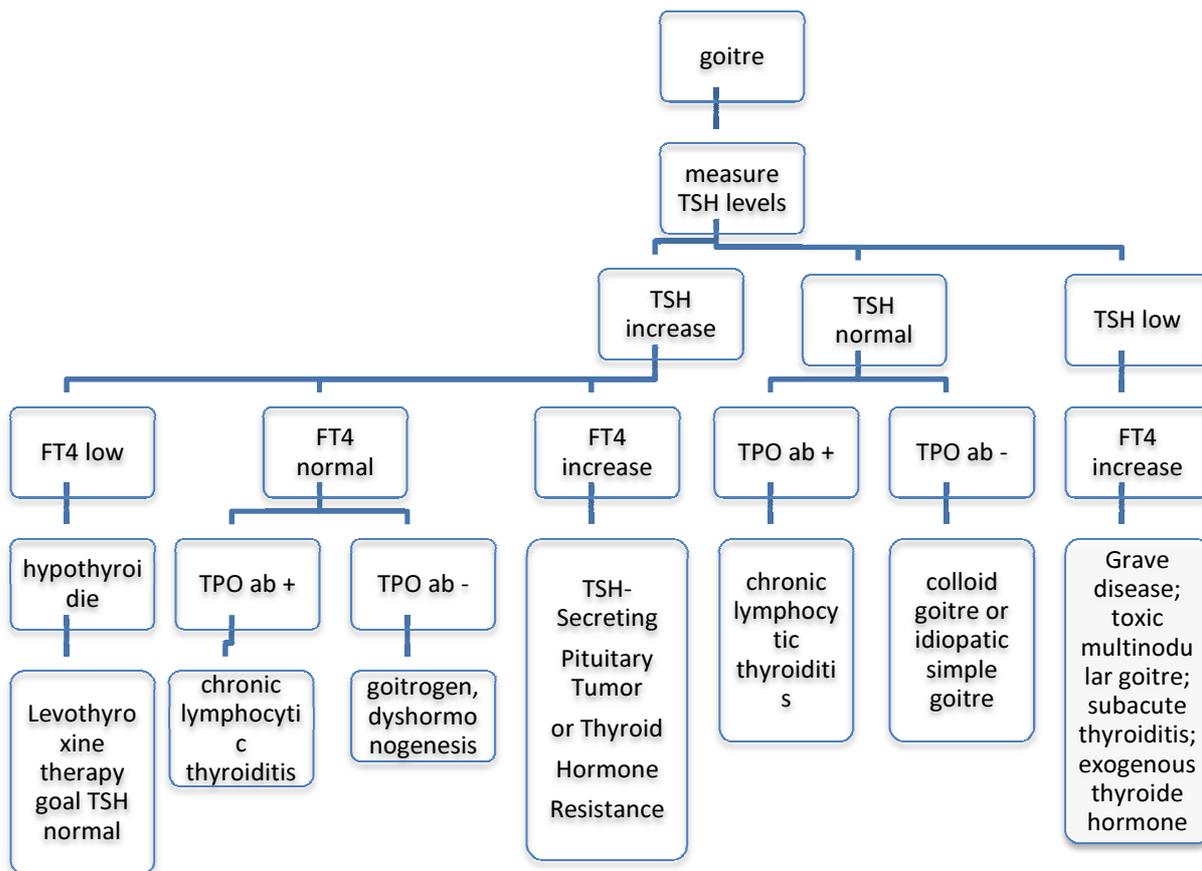
- Potential for goitre regression depends on its cause.
- A goitre patient who is clinically and biochemically euthyroid still requires careful follow-up for the detection of the early signs of developing thyroid dysfunction.
- Workup solitary thyroid nodules aggressively; remember, incidence of malignancy in these nodules in children is 15-40% (less in adults).

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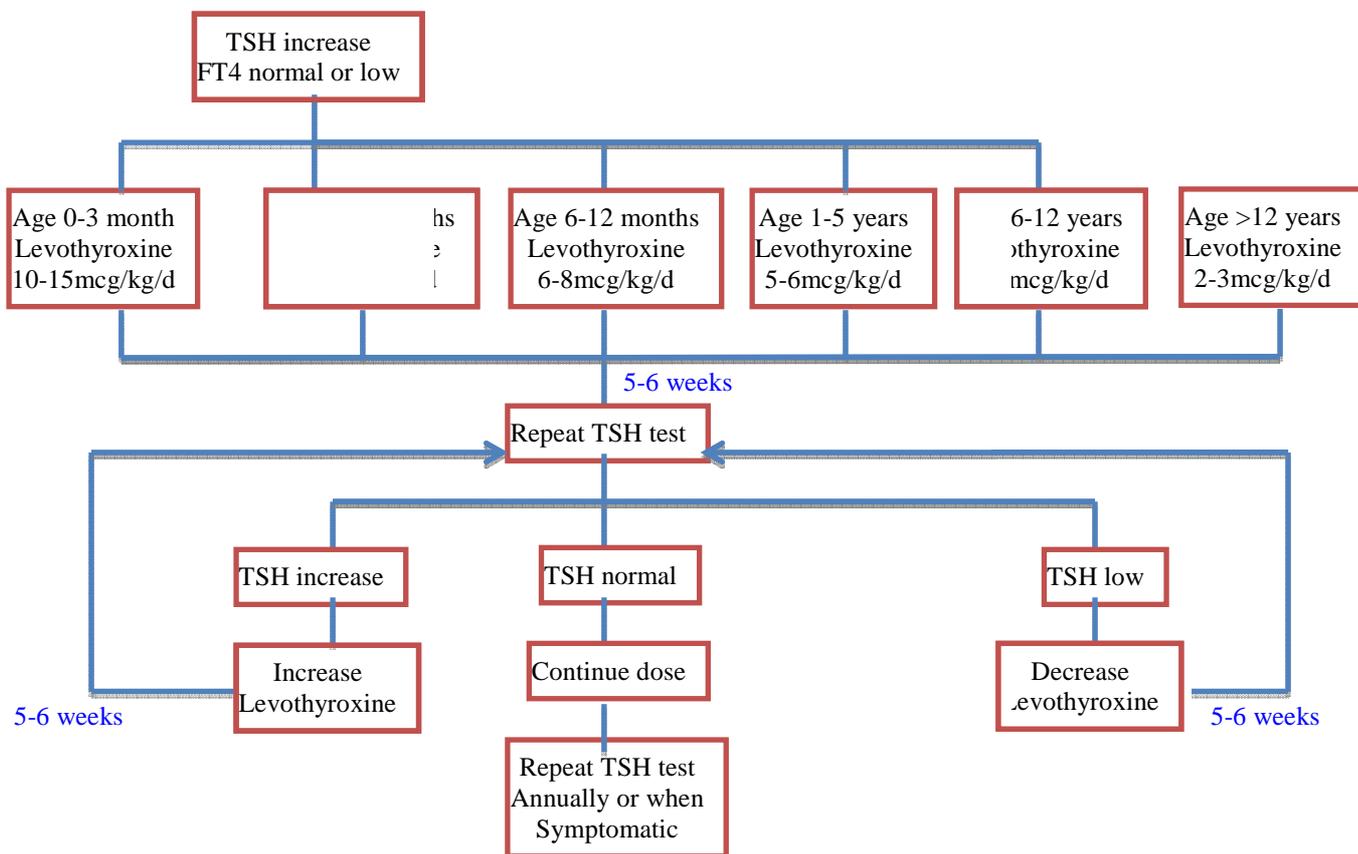
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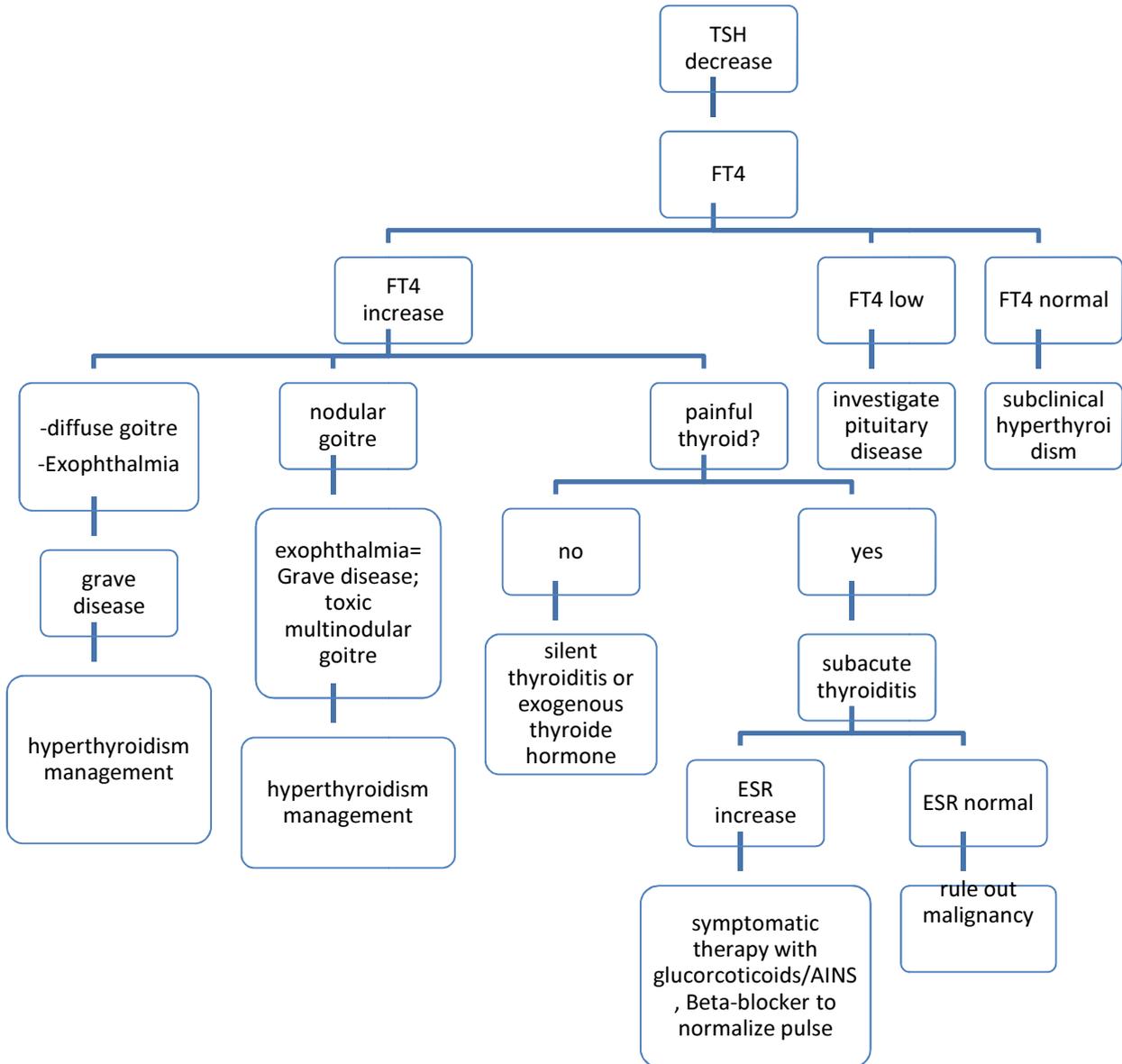
**GOITRE ALGORITHM**



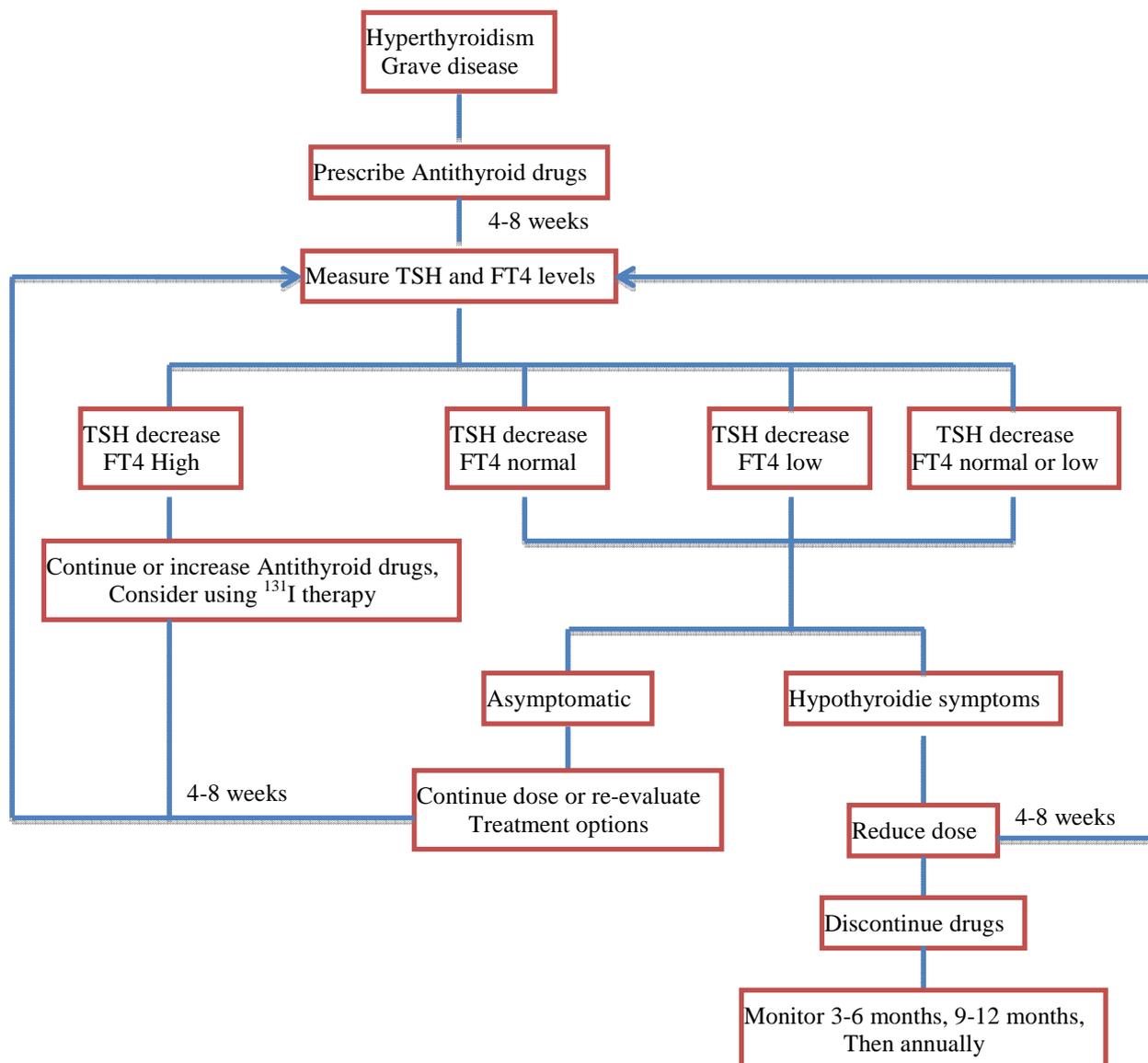
**ALGORITHM HYPOTHYROIDISM MANAGEMENT**



### HYPERTHYROIDISM DIFFERENTIAL DIAGNOSIS ALGORITHM



**HYPERTHYROIDISM MANAGEMENT:  
ANTITHYROID DRUGS ALGORITHM**



# ADRENOCORTICAL INSUFFICIENCY (ADRENAL CRISIS, ADDISON'S DISEASE)

By Dr. Phay Narith

## I. DEFINITION

Adrenal insufficiency is an endocrine or hormonal disorder that occurs when the adrenal glands do not produce enough of certain hormones (1).

## II. EPIDEMIOLOGY

- In children, boys constitute approximately 75% of patients in contrast to adults, where the majority (70%) are women.
- Overall, **Addison disease** in the paediatric population is most commonly attributed to primary adrenal insufficiency, which occurs in approximately 1 in 15 000 births and usually presents in the neonatal period or early childhood. 95% of cases are due to deficiency of an enzyme (21 hydroxylase) involved in the steroidogenesis pathway, which also results in impaired aldosterone synthesis (1, 2).

## III. ETIOLOGY (3)

- The **leading causes** of adrenal insufficiency are :
  - hereditary enzyme defects (congenital adrenal hyperplasia),
  - autoimmune destruction of the glands (Addison disease),
  - central adrenal insufficiency caused by intracranial neoplasm or its treatment.
- Addison disease may be familial. Less commonly, the gland is destroyed by tumor, calcification, or hemorrhage (Waterhouse-Friderichsen syndrome).

## IV. SYMPTOMS AND SIGNS

### A. Acute Form (Adrenal Crisis) (3)

Manifestations include: nausea, vomiting, diarrhea, abdominal pain, dehydration, fever (sometimes followed by hypothermia), weakness, hypotension, circulatory collapse, confusion and coma.

### B. Chronic Form (2, 3)

Manifestations include: weakness (99%), weight loss (97%), flank or abdominal pain (34%), diarrhoea (20%), constipation (19%), fatigue, hypotension, failure to gain weight, , salt craving (primary insufficiency), vomiting, and dehydration. Diffuse tanning with increased pigmentation over pressure points, scars, and mucous membranes (Fig.1) may be present in primary adrenal insufficiency. A small heart may be seen on chest radiograph.



Figure 1: Hyperpigmentation of the buccal mucosa

## V. LABORATORY FINDINGS (3)

### A. Suggestive of Adrenocortical Insufficiency:

#### Primary adrenal insufficiency

- Natriuremia, serum bicarbonate, blood pH, blood volume : ↓
- Arterial partial pressure of carbon dioxide : ↓
- Serum potassium and urea nitrogen : ↑
- Urinary sodium level : ↑

#### Central adrenal insufficiency

- Serum sodium levels : mildly ↓

- Eosinophilia and moderate lymphopenia occur in both forms of insufficiency.

### B. Confirmatory Tests

- ACTH (Cosyntropin) Stimulation Test
  - In primary adrenal insufficiency (originating in the gland itself), plasma cortisol and aldosterone concentrations do not increase significantly over baseline 60 minutes after an intravenous dose of ACTH (250 mcg). To diagnose central adrenal insufficiency, a low dose of ACTH is given (1 mcg).
  - Baseline Serum ACTH Concentration: (↑ in primary adrenal failure and ↓ in central adrenal insufficiency)
- Urinary Free Cortisol and 17-Hydroxycorticosteroid Excretion : ↓
- CRH Test (if available)

## VI. IMAGING (1)

- For Addison's Disease: an X-ray or an ultrasound of the abdomen may be taken to see if the adrenals have any signs of calcium deposits. Calcium deposits may indicate bleeding in the adrenal gland or TB, for which a tuberculin skin test also may be used.
- If secondary adrenal insufficiency is diagnosed: CT scan and MRI may be used.

## VII. DIFFERENTIAL DIAGNOSIS (3)

### A. Acute adrenal insufficiency must be differentiated from:

- Severe acute infections, diabetic coma, various disturbances of the CNS, and acute poisoning.
- In the neonatal period: respiratory distress, intracranial hemorrhage, or sepsis.

### B. Chronic adrenocortical insufficiency must be differentiated from:

- anorexia nervosa, certain muscular disorders (myasthenia gravis), salt-losing nephritis, and chronic debilitating infections, and must be considered in cases of recurrent spontaneous hypoglycemia.

## VIII. TREATMENT (3)

### A. Acute Insufficiency (Adrenal Crisis)

- Hydrocortisone Sodium Succinate: Hydrocortisone sodium succinate is given initially at a dose of 50 mg/m<sup>2</sup> intravenously over 2–5 minutes or intramuscularly; thereafter, it is given intravenously, 12.5 mg/m<sup>2</sup>, every 4–6 hours until stabilization is achieved and oral therapy can be tolerated.
- Fluids and Electrolytes:
  - In primary adrenal insufficiency, 5–10% glucose in normal saline, 10–20 mL/kg intravenously, is given over the first hour and repeated if necessary to reestablish vascular volume. Normal saline is continued thereafter at 1.5–2 times the maintenance

fluid requirements. Intravenous boluses of glucose (10% glucose, 2 mL/kg) may be needed every 4–6 hours to treat hypoglycemia.

- In central adrenal insufficiency, routine fluid management is generally adequate after restoration of vascular volume and institution of cortisol replacement.
- Fludrocortisone: When oral intake is tolerated, fludrocortisone, 0.05–0.15 mg daily, is started and continued as necessary every 12–24 hours for primary adrenal insufficiency.
- Waterhouse-Friderichsen Syndrome with Fulminant Infections: Corticosteroids should be considered if there is possible adrenal insufficiency (if hypotension and circulatory collapse).

#### **B. Maintenance Therapy**

- Following initial stabilization, the most effective substitution therapy is hydrocortisone, combined with fludrocortisone in primary adrenal insufficiency.
- Overtreatment should be avoided as it causes obesity, growth retardation, and other cushingoid features.
  - Glucocorticoids: A maintenance dosage of 6–10 mg/m<sup>2</sup>/d of hydrocortisone (or equivalent) is given orally in two or three divided doses. The dosage of all glucocorticoids is increased to 30–50 mg/m<sup>2</sup>/d during intercurrent illnesses or other times of stress.
  - Mineralocorticoids: In primary adrenal insufficiency, fludrocortisone is given, 0.05–0.15 mg orally daily as a single dose or in two divided doses. Periodic monitoring of blood pressure is recommended to avoid overdosing.
  - Salt: The child should be given ready access to table salt. Frequent blood pressure determinations in the recumbent position should be made to check for hypertension. In the infant, supplementation of 3–5 mEq Na<sup>+</sup>/kg/d by adding the injectable solution (4 mg/mL) to formula or breast milk is generally required until table foods are introduced.

### **IX. COURSE & PROGNOSIS (3)**

- The course of acute adrenal insufficiency is rapid, and death may occur within a few hours, particularly in infants, unless adequate treatment is given. Spontaneous recovery is unlikely. Patients who have received long-term treatment with adrenocorticosteroids may exhibit adrenal collapse if they undergo surgery or other acute stress. Pharmacologic doses of glucocorticoids during these episodes may be needed throughout life.
- Patients with chronic adrenocortical insufficiency who receive adequate therapy can lead normal lives.

### **X. EDUCATION (1)**

- People with adrenal insufficiency should always carry identification stating their condition in case of an emergency. A card or medical alert tag should also include the name and telephone number of the person's doctor and the name and telephone number of a family member to be notified.
- The dose of hydrocortisone needed may vary with a person's age. For example, a child younger than 2 years of age can receive 25 milligrams (mg), a child between 2 and 8 years of age can receive 50 mg, and a child older than 8 years should receive the adult dose of 100 mg. When traveling, people with adrenal insufficiency should carry a needle, syringe, and an injectable form of cortisol for emergencies.

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# DIABETES INSIPIDUS

*By IV Malene*

## I. INTRODUCTION

- Diabetes insipidus (also called *pituitary diabetes insipidus*) is a disorder of water metabolism resulting from a deficiency of circulating vasopressin (also called *antidiuretic hormone* [ADH]).
- It's characterized by excessive fluid intake and hypotonic polyuria. The disorder may start in childhood or early adulthood (the median age of onset is 21) and is more common in males than in females.
- Incidence is slightly higher today than in the past.
- In uncomplicated diabetes insipidus, the prognosis is good with adequate water replacement and replacement of ADH by tablet or nasal spray, and patients usually lead normal lives.

## II. DEFINITION

Polyuria and polydipsia caused by inability to produce or respond to antidiuretic hormone (ADH) also called arginine vasopressin.

## III. TYPES OF DIABETES INSIPIDUS

There are two types of diabetes insipidus:

### 1. Central diabetes insipidus:

This is caused by a deficiency of the hormone vasopressin. These results in the kidneys not being given the signal to retain fluid and so large quantities of fluid are lost as very dilute urine. Because fluid is being lost from the body in this way, the blood becomes too concentrated. Normally, this concentration of the blood would be detected by the thirst centre in the hypothalamus and it would send a message to the pituitary to secrete vasopressin. In people with diabetes insipidus, there is a deficiency of vasopressin which means that the only way they can make up for the loss of fluid in the urine is to drink more fluids. Thus, the hypothalamus detects the concentrated blood and this stimulates a feeling of thirst.

### 2. Nephrogenic diabetes insipidus:

This is due to an abnormality of the kidneys such that they are not able to respond to the vasopressin stimulus. This too means that large quantities of fluid are passed out of the body in the form of urine.

## IV. ETIOLOGY

### 1. Central diabetes insipidus

Can result from multiple etiologies:

- Genetic mutations in the vasopressin gene;
- Congenital malformations of the hypothalamus or pituitary;
- Neoplasms;
- Infiltrative, autoimmune, and infectious diseases affecting vasopressin neurons.
- Trauma (to the base of the brain) and neurosurgical intervention (in the region of the hypothalamus or pituitary)
- Tumors located near the base of the hypothalamus (Germinomas, Pinealomas, Craniopharyngiomas and optic gliomas).
- Langerhans cell histiocytosis and lymphocytic hypophysitis are common types of infiltrative disorders causing central DI, with hypophysitis as the cause in 50% of cases of “idiopathic” central DI.
- Infections involving the base of the brain, including meningitis (meningococcal, cryptococcal, listerial, toxoplasmal), congenital cytomegalovirus infection, tuberculosis and nonspecific inflammatory diseases of the brain may give rise to central DI that is often transient.
- Drugs associated with the inhibition of vasopressin release include ethanol, phenytoin, opiate antagonists, halothane, and  $\alpha$ -adrenergic agents.

### 2. Nephrogenic diabetes insipidus (NDI)

Vasopressin-insensitive can result from genetic or acquired causes.

- **Genetic NDI** causes are less common but more severe than acquired forms of NDI.
  - Genetic NDI usually presents within the first several weeks of life but may only become apparent after weaning or with longer periods of night time sleep.
  - Congenital X-linked NDI results from inactivating mutations of the vasopressin V2 receptor.
  - Congenital autosomal recessive NDI results from defects in the aquaporin-2 gene.
  - An autosomal dominant form of NDI is associated with processing mutations of the aquaporin-2 gene.
- **Acquired NDI**
  - Urinary tract obstruction.
  - Renal medullary cystic disease.
  - Electrolyte disturbances: hypokalemia, hypercalcemia (hypercalciuria).
  - Drugs: usually reversible: Diuretics, Diphenylhydantoin, Reserpine, Amphotericin, Methicillin, Rifampin, Lithium

## V. PATHOPHYSIOLOGY

- ADH stimulates the formation of cyclic adenosine monophosphate (cAMP) in the renal collecting ducts, thereby increasing water permeability and increasing reabsorption of free water.
- Lack of ADH effect results in urinary loss of free water.
- Patients with an intact thirst mechanism drink copiously (polydipsia) to compensate for free water loss.
- If the thirst mechanism is not present or if access to free water is limited (e.g., infants or vomiting), severe dehydration can occur.

## VI. COMPLICATIONS

- Without treatment and without access to water:
  - Hyponatremia
  - Dehydration
  - Coma
- When overdosed with water:
  - Hyponatremia
  - Seizures
  - Cerebral edema

## VII. SYMPTOMS

The symptoms of nephrogenic diabetes insipidus are similar to central diabetes insipidus.

- Polydipsia
- Polyuria
- Colourless urine instead of pale yellow
- Waking frequently through the night to urinate
- Dry skin
- Constipation
- Weak muscles
- Bedwetting.

## VIII. DIAGNOSIS

Diabetes insipidus is diagnosed by:

- Clinical examination
- Laboratory investigations

The tests used to diagnose diabetes insipidus are the following:

- Water deprivation test/vasopressin test to see how much urine is passed:
    - > *See annex*
  - Hypertonic saline infusion test.
  - Urine specific gravity of 1.005 or less and urine osmolality less than 200mOsm/kg are the hallmark of diabetes insipidus.
  - Serum osmolality is raised (>295mOsm/kg)
  - Plasma sodium concentration >142 meq/L, due to water loss
- 
- Magnetic resonance imaging (MRI) scans of the brain. For Germinomas can be very small and undetectable by MRI for several years following the onset of polyuria.
  - Computed tomography (CT) scans.

## IX. DIFFERENTIAL DIAGNOSIS

- Psychogenic polydipsia
- Abnormal thirst mechanism (dipsogenic DI)
- Hypernatremic dehydration
- Diabetes mellitus
- Polyuric renal failure (e.g., renal tubulopathy)
- Hypercalcemia
- Adrenal insufficiency
- Cerebral salt wasting

## X. MANAGEMENT

### 1. Central diabetes insipidus

- **Fluid Therapy:**
  - Drink enough fluid to replace their urine losses. Free access to oral fluids, usually 2 - 2.5 liters per day) to ensure proper hydration.
  - Intravenous (IV) fluid that is hypo-osmolar with respect to the patient's serum. Avoid hyperglycemia, volume overload, and overly rapid correction of hypernatremia.
- **Desmopressin (DDAVP): "Vasopressin Analogs"**
  - nasal spray: 5-10 µg (0.1mg/mL=10 µg/ml) per spray, 1-2 times/day.
  - tablets by mouth: the optimal dosage range is 0.1 mg to 0.8 mg daily divided in 2 to 3 times.
  - Injections:
    - for children > 1year: 0.4-1µg(0.10-0.25ml).
    - for children < 1year: 0.2-0.4 µg(0.05-0.10ml)

### OR

- **Pitressin "Aqueous Vasopressin":**
  - Titrate dose based on serum Na, serum osmolality, fluid balance and urine output  
5-10 U IM/SC or intranasal q6-12hr.
  - Continuous IV infusion: initial dose 0.0005 U/kg/hr IV infusion then double dose q30min to reach desired effect; max dose 0.01 U/kg/hr.

### 2. Nephrogenic diabetes insipidus: Acquired nephrogenic diabetes insipidus, congenital diabetes insipidus

- Nephrogenic DI may be treated with diuretics and solute restriction as these patients are resistant to Vasopressin drugs.
- The goal of treatment is to control the body's fluid levels. Patients will be given a large amount of fluids. The amount of fluids given should be about equal to the amount of urine produced.
- If the condition is due to a certain medication, stopping the medicine may improve symptoms. Hydrochlorothiazide (1-2 mg/kg/day in 1-2 divided dose; < 6mth: up to 3 mg/kg/day) may improve symptoms. This may be used alone or in combination with other medications, including Indomethacin.
- Although this medication is a diuretic (these medications are usually used to increase urine output), in certain cases hydrochlorothiazide can actually reduce urine output for people with nephrogenic diabetes insipidus.

## XI. PROGNOSIS

Generally good, but depends on the primary cause.

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## Annex

A recommended protocol includes the following steps:

- \* The test is performed after breakfast. It is started after the child voids or, in infants, after the first spontaneous void after the morning feed. Body weight and plasma sodium and osmolality are measured after the patient voids. No further fluid is given until the test is terminated.
- \* Record each urine void and measure the urine volume, specific gravity, and osmolality.
- \* Weight and vital signs are obtained every two hours for the first four hours and then hourly. The plasma sodium and osmolality are measured at four hours and then every two hours until the conclusion of the test.

The test is terminated when one of the following end points are attained:

- \* Urine specific gravity  $\geq 1.020$
- \* Urine osmolality is  $\geq 600$  mosmol/kg
- \* Plasma osmolality exceeds 295 or 300 mosmol/kg or plasma sodium is 145 meq/L or higher
- \* The patient has lost 5 percent of body weight or exhibits signs of volume depletion
- \* If the period of water restriction reaches six hours in infants less than six months of age, eight hours in children from six months to two years of age, or 12 hours in children older than two years of age

At the end of the test, weight, vital signs, plasma sodium, plasma and urine osmolality, and urine specific gravity should be measured. A specimen should also be obtained for measurement of plasma ADH, which is always elevated during short dehydration tests in patients with hereditary nephrogenic DI.

Children who continue to have impaired urinary concentration despite reaching a plasma osmolality of 295 mosmol/kg or a plasma sodium of 150 meq/L can be given desmopressin (5 to 10 microg by nasal insufflation or 2 to 4  $\mu\text{g}$  intravenously or subcutaneously). The urine volume and osmolality are measured to detect any antidiuretic response. We no longer use aqueous vasopressin which, due to its vasoconstrictive effect mediated by the V1a receptor, produces sudden and noticeable pallor that raises concerns with the mother.

### **Interpretation:**

Accurate interpretation of the water restriction test usually requires that desmopressin not be given before the urine osmolality has stabilized or the plasma osmolality has reached 295 mosmol/kg. Below this level, maximum endogenous ADH effect may not be present and an antidiuretic response to desmopressin is of no diagnostic benefit, since it will raise the urine osmolality even in normal subjects.

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# PEDIATRIC HYPOGLYCEMIA

*By Dr. IV Malene*

## I. INTRODUCTION

Glucose has a central role in fuel economy and is a source of energy storage in the form of glycogen, fat, and protein. It is essential for cerebral energy metabolism because it is usually the preferred substrate and its utilization accounts for nearly all the oxygen consumption in the brain. Cerebral glucose uptake occurs through a glucose transporter molecule or molecules that are not regulated by insulin. Cerebral transport of glucose is a carrier-mediated, facilitated diffusion process that is dependent on blood glucose concentration. Deficiency of brain glucose transporters can result in seizures because of low cerebral and cerebrospinal fluid (CSF) glucose concentrations (hypoglycorrhachia) despite normal blood glucose levels. To maintain the blood glucose concentration and prevent it from falling precipitously to levels that impair brain function, an elaborate regulatory system has evolved.

## II. DEFINITION

Hypoglycemia is a blood glucose values below 3.3–3.9 mmol/L (60–70 mg/dL) even in the absence of obvious signs and symptoms.

- In neonates, there is not always an obvious correlation between blood glucose concentration and the classic clinical manifestations of hypoglycemia.
- The absence of symptoms does not indicate that glucose concentration is normal and has not fallen to less than some optimal level for maintaining brain metabolism.
- There is evidence that hypoxemia and ischemia may potentiate the role of hypoglycemia in causing permanent brain damage.

## III. ETIOLOGY

- Not enough food or delayed food.
- Too much insulin.
- Unscheduled exercise.
- Genetics:
  - Almost all IEMs causing hypoglycemia are autosomal recessive. One form of hyperinsulinism is autosomal dominant.

## IV. PATHOPHYSIOLOGY

- Through glycolysis and oxidative phosphorylation, glucose is a major source of cellular energy (ATP). Failure to produce ATP is probably the main source of hypoglycemia associated tissue dysfunction.

- The brain preferentially utilizes glucose metabolism to produce energy, and is particularly sensitive to hypoglycemia.  
    **ATP:** Adenosine Triphosphate, **IEMs :** Inborn errors of metabolism
- A long list of metabolic disturbances in a variety of pathways can result in hypoglycemia.
- Neonates are at particular risk for hypoglycemia because they use glucose more rapidly than adults and have immature ability to obtain energy from other sources (glycogen, muscle protein, adipose tissue).

## **V. COMPLICATIONS**

- Hypoglycemic episodes must be recognized and treated promptly otherwise permanent CNS injury may occur.
- For many IEMs, recurrent episodes of hypoglycemia may occur. These are avoided by specific dietary measures during times of stress.

## **VI. SYMPTOMS AND DIAGNOSIS**

- Shaky, Sweaty
- Dizzy, Tired
- Pale, Hungry,
- Weakness,
- Nausea,
- Vomiting,
- Headache,
- Mental confusion,
- Somnolence,
- Personality change (mood changes),
- Disoriented, Irritable, Sleepy
- Uncoordinated,
- Convulsion,
- Coma,

\*\* \* Severity of Hypoglycemia

### **1. Mild/moderate hypoglycemia**

Hypoglycemia has often been described as mild, moderate, or severe based on the individual's ability to treat him/herself. However, there are no clinically important reasons to distinguish between mild and moderate hypoglycemia, and younger children will almost always need to be treated by a parent or caregiver. Therefore, mild and moderate hypoglycemias are considered together.

### **2. Severe hypoglycemia**

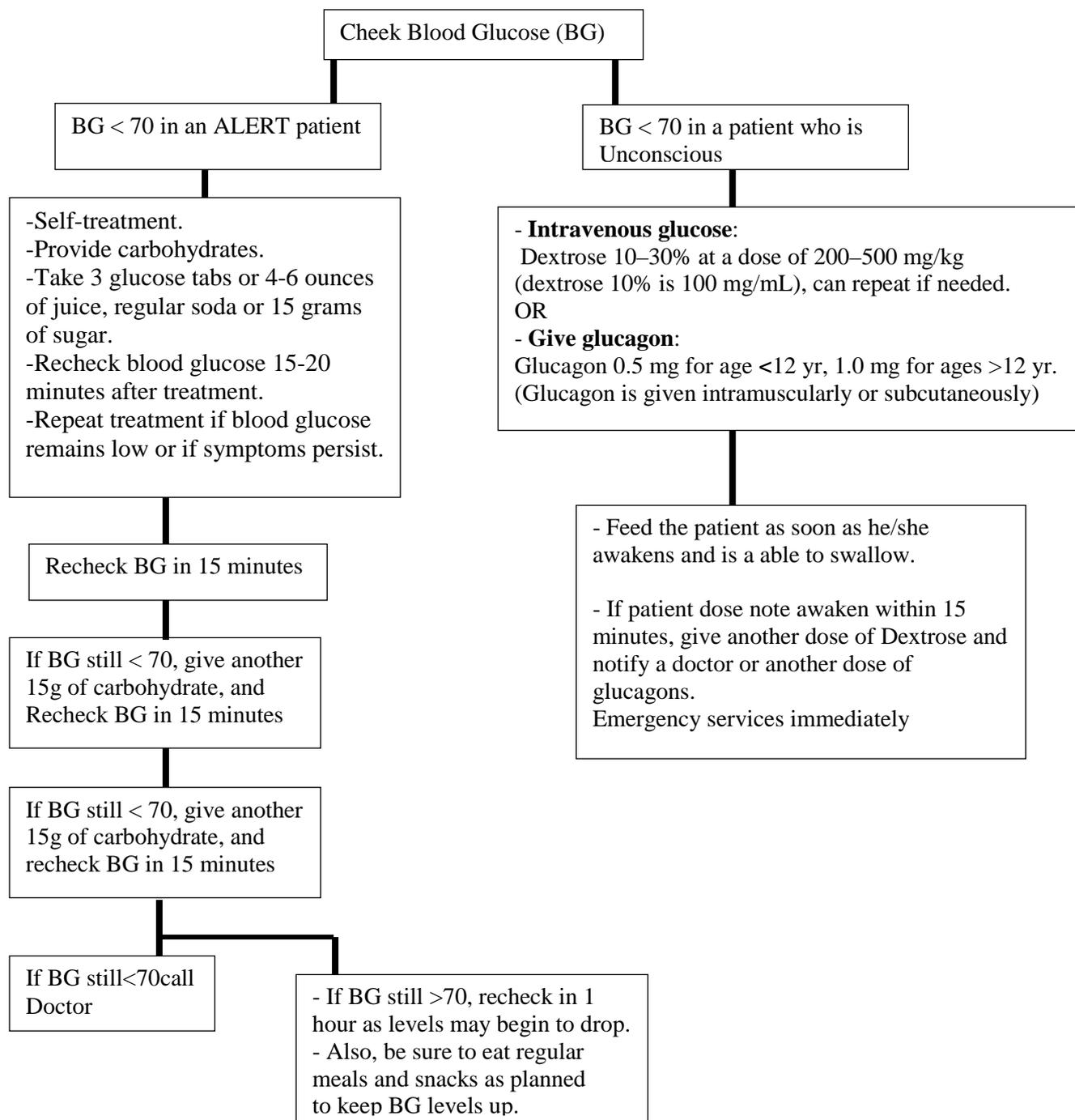
The child is having altered mental status and cannot assist in their care, is semiconscious or unconscious, or in coma convulsions and may require parenteral therapy (glucagon or i.v. glucose).

The diagnosis of hypoglycemia should be made on the basis of symptoms compatible with hypoglycemia, resolution of the symptoms after administration of glucose and a low serum glucose concentration.

## VII. TREATMENT

-> See algorithm

### Hypoglycemia Protocol



## VIII. PROGNOSIS

The prognosis is good in asymptomatic neonates with hypoglycemia of short duration. Hypoglycemia recurs in 10–15% of infants after adequate treatment. Recurrence is more common if intravenous fluids are extravasated or discontinued too rapidly before oral feedings are well tolerated. Children in whom ketotic hypoglycemia later develops have an increased incidence of neonatal hypoglycemia.

The prognosis for normal intellectual function must be guarded because prolonged, recurrent, and severe symptomatic hypoglycemia is associated with neurologic sequelae. Symptomatic infants

with hypoglycemia, particularly low-birthweight infants, those with persistent hyperinsulinemic hypoglycemia, and infants of diabetic mothers, have a poorer prognosis for subsequent normal intellectual development than asymptomatic infants do.

## **IX. MONITORING**

- All patients experiencing hypoglycemia should be closely monitored for the next 24 hours with blood glucose checks ordered by the physician.
- Record in the nursing notes the signs and symptoms displayed treatment administered, initial and subsequent glucose reading and notifications to the attending physician.

## **X. PARENT EDUCATION**

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# OBESITY

By PHAY Narith

## I- INTRODUCTION

Obesity is an important pediatric public health problem associated with risk of complications in childhood and increased morbidity and mortality throughout adult life. The prevalence of childhood obesity has increased, and the prevention and treatment of obesity has emerged as an important focus of pediatric research and clinical care.

## II- DEFINITION

Overweight and Obesity are defined by using **BMI** (Body Mass Index) ;

- Overweight if  $BMI \geq 25$  and Obesity if  $BMI \geq 30$

**BMI or IMC (Index de masse corporelle or *Indice de Quetelet*) = weight in kg/(height in meters)<sup>2</sup>**, developed in 1869 (Table 1).

**Table 1 : Classification of Obesity**

	<b>BMI or IMC (Kg/m<sup>2</sup>)</b>
Normal Weight	18,5-24,9
<b>Overweight</b>	25-29,9
<b>Obesity</b>	
-moderate	30-34,9
-severe	35-39,9
-morbid	$\geq 40$

Eg<sub>1</sub> : one child (weight 15 kg, height 0.72 cm)

His BMI is  $15 / (0.72)^2 \Rightarrow BMI = 15 / 0.51 = 29.41$  (so this child is overweight)

Eg<sub>2</sub> : one child (weight 16 kg, height 0.72 cm)

His BMI is  $16 / (0.72)^2 \Rightarrow BMI = 16 / 0.51 = 31.37$  (so this child is moderate obesity).

## III- EPIDEMIOLOGY

Obesity is a global public health problem. As of 2005, more than 1.6 billion persons  $\geq 15$  yr old are overweight or obese (WHO).

In the USA, in children, the prevalence of obesity increased 300% over approximately 40 years. The National Health and Nutrition Examination Survey (NHANES) IV, 1999-2002, found 31% of children older than 2 yr to be overweight or obese, and 16% of children and adolescents 6-19 years were in the obese range. Children's risk varies by socioeconomic status, race, maternal education level, and gender. Parental obesity correlates with a higher risk for obesity in their

children. Prenatal factors including weight gain during pregnancy, high birth weight, and gestational diabetes are associated with increased risk for later obesity.

#### **IV- AETIOLOGY**

Simplistically, obesity results from an imbalance of caloric intake and energy expenditure. Environmental factors determine levels of available food, preferences for types of foods, levels of physical activity, and preferences for types of activities.

- **Environmental Changes**

Over the last 4 decades, the food environment has changed dramatically. Foods are increasingly prepared by a “food industry,” with high levels of calories, simple carbohydrates, and fat. The snacking is increased between meals. The consumption of high-carbohydrate beverages (sodas, sport drinks, fruit punch, and juice) is also increased.

Sweetened beverages have been linked to increased risk for obesity because children who drink high amounts of sugar do not consume less food. Since World War II, levels of physical activity in children and adults have declined. Work is increasingly sedentary, and many sectors of society do not engage in physical activity during leisure time. Perception of poor neighborhood safety is another factor that can lead to lower levels of physical activity when children are required to stay indoors. The advent of television, computers, and video games has resulted in opportunities for sedentary activities that do not burn calories or exercise muscles.

Changes in another health behavior, sleep, might also contribute. Over the last 4 decades, children and adults have decreased the amount of time spent sleeping. Reasons for these changes may relate to increased time at work, increased time watching television. Chronic partial sleep loss can increase risk for weight gain and obesity, with the impact possibly greater in children than in adults.

- **Genetics**

More than 600 genes, markers, and chromosomal regions have been associated with human obesity. (Table 2)

- **Endocrine and Neural Physiology**

Monitoring of “stored fuels” and short-term control of food intake (appetite and satiety) occurs through neuroendocrine feedback loops linking adipose tissue, the gastrointestinal (GI) tract, and the central nervous system. GI hormones, including cholecystokinin, glucagon-like peptide-1, peptide YY, and vagal neuronal feedback promote satiety. Ghrelin stimulates appetite.

Clinical clues that suggest a hormonal etiology for childhood obesity include the following:

- Weight gain out of character for the family
- Obesity in a short child
- Progressive weight gain without a comparable increase in linear growth
- Dry skin, constipation, intolerance to cold, and fatigability
- History of central nervous system (CNS) damage (eg, trauma, hemorrhage, infection, radiation, seizures)
- Accumulation of fat in the neck and trunk but not in the arms or legs
- Purple striae (stretch marks)
- Hypertension
- Inappropriate sexual development at an early age
- Excess facial hair, acne, and/or irregular menses in a teenage girl
- Headaches, vomiting, visual disturbances, or excessive urination and drinking
- Treatment with certain drugs or medications

**Table 2: ENDOCRINE AND GENETIC CAUSES OF OBESITY**

DISEASE	SYMPTOMS	LABORATORY
<b>ENDOCRINE</b>		
Cushing syndrome	Central obesity, hirsutism, moon face, hypertension	Dexamethasone suppression test
Growth hormone deficiency	Short stature, slow linear growth	Evoked GH response, IGF-1
Hyperinsulinism	Nesidioblastosis, pancreatic adenoma, hypoglycemia, Mauriac syndrome	Insulin level
Hypothyroidism	Short stature, weight gain, fatigue, constipation, cold intolerance, myxedema	TSH, FT4
<b>GENETIC</b>		
Down syndrome	Short stature, dysmorphic facies, mental retardation	Trisomy 21
Prader-Willi Syndrome	Neonatal hypotonia, slow infant growth, small hands and feet, mental retardation, hypogonadism, hyperphagia leading to severe obesity, paradoxically elevated ghrelin	Partial deletion of chromosome 15 or loss of paternally expressed genes
Turner syndrome	Ovarian dysgenesis, lymphedema, web neck, short stature, cognitive impairment	XO chromosome
Frohlich syndrome	Hypothalamic tumor	?

## V- COMORBIDITIES

Complications of pediatric obesity occur during childhood and adolescence and persist into adulthood.

-Surmortality (x 2) by cardiovascular disease for boys who were overweight during adolescence.

-Type 2 diabetes, hypertension, hyperlipidemia, and nonalcoholic fatty liver disease (10-25% of obese adolescents and can progress to cirrhosis), chronic inflammation, obstructive sleep apnea and orthopedic complications (Blount disease and slipped femoral capital epiphysis), adolescent depression.

## VI- DIAGNOSIS

### 6.1-Method:

-Examination of the growth chart reveals the severity, duration, and timing of obesity onset. Children who are overweight (BMI in the 85th-95th percentile) ; and who are obese (BMI  $\geq$  95th percentile).

-Or Calculation of BMI (See Table 1) .

### 6.2-Consideration of possible medical causes of obesity is essential:

- In some children with congenital disorders such as myelodysplasia or muscular dystrophy, lower levels of physical activity can lead to secondary obesity.

-Some medications can cause excessive appetite and hyperphagia, resulting in obesity. A typical antipsychotic medications most commonly have this dramatic side effect.

**6.3-Exploration of family eating and nutritional and activity patterns :**

-description of regular meal and snack times and family habits for walking, bicycle riding, active recreation, television, computer, and video-game time.

**6.4-Initial assessment of the overweight or obese child : the possibility of comorbid conditions ?**

-Developmental delay and visual and hearing impairment can be associated with genetic disorders.

-Difficulty sleeping, snoring, or daytime sleepiness suggests the possibility of sleep apnea.

-Abdominal pain might suggest nonalcoholic fatty liver disease.

-Symptoms of polyuria, nocturia, or polydipsia may be the result of type 2 diabetes.

-Hip or knee pain can be caused by secondary orthopedic problems, including Blount disease and slipped capital femoral epiphysis.

-Irregular menses may be associated with polycystic ovary syndrome.

**6.5-Family histories:**

-parental obesity, type 2 diabetes, hypertension, cardiovascular disease, or metabolic syndrome ?

**6.6-Physical examination (possible comorbid conditions ?)**

-Careful screening for hypertension using an appropriately sized blood pressure cuff is important. -Systematic examination of the skin can reveal acanthosis nigricans, suggesting insulin resistance, or hirsutism, suggesting polycystic ovary syndrome.

**6.7-Laboratory testing:**

- fasting plasma glucose, triglycerides, low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol, and liver function tests (Table 3). Overweight children (BMI 85th-95th percentile or BMI > 25) who have a family history of diabetes mellitus or signs of insulin resistance should also be evaluated with a fasting plasma glucose test.
- Other laboratory testing should be guided by history or physical examination findings.

**Table 3: NORMAL LABORATORY VALUES FOR RECOMMENDED TESTS**

LABORATORY TEST	NORMAL VALUE
Glucose	<110 mg/dL
Insulin	<15 mU/L
Hemoglobin A <sub>1c</sub>	<5.7%
AST 2-8 yr	<58 U/L
AST 9-15 yr	<46 U/L
AST 15-18 yr	<35 U/L
ALT	<35 U/L
Total cholesterol	<170 mg/dL
LDL	<110 mg/dL
HDL	<35 mg/dL
Triglycerides 2-15 yr	<100 mg/dL
Triglycerides 15-19 yr	<125 mg/dL

NB: AST, aspartate aminotransferase; ALT, alanine aminotransferase; LDL, low-density lipoprotein; HDL, high-density lipoprotein.

## VII- TREATMENT

### 7.1-Foods

#### **-High protein diets is not recommended.**

-Meals : fruits, vegetables, whole grains, lean meat, fish, and poultry.

-Psychological strategies are helpful. The “traffic light” diet groups foods into those that can be consumed without any limitations (low caloric foods), in moderation (medium caloric foods), or reserved for infrequent treats (high caloric foods) (Table 5).

**Table 5: DIFFERENT CATEGORY OF FOODS**

FEATURE	Low caloric FOOD	Medium caloric FOODS	High caloric FOODS
Quality	Low-calorie, high-fiber, low-fat, nutrient-dense	Nutrient-dense, but higher in calories and fat	High in calories, sugar, and fat
Types of food	Fruits, vegetables	Lean meats, dairy, starches, grains	Fatty meats, sugar, fried foods
Quantity	Unlimited	Limited	Infrequent or avoided

### 7.2-physical activity

-Increasing physical activity (walking to school, engaging in physical activity during leisure time with family and friends, sports) can decrease risk for cardiovascular disease, improve well-being, and contribute to weight loss.

-The American Academy of Pediatrics recommends that screen time be restricted to no more than 2 hr/day for children >2 yr old and that children < 2 yr old not watch television.

### 7.3-Medications :

-adolescents may receive adjunctive pharmacologic therapy. In adults, the addition of antiobesity drugs to comprehensive lifestyle modification can produce more weight loss than lifestyle modification alone, with a BMI-lowering effect of 4%.

-The pediatric provider also makes referrals to specialists to treat comorbid conditions, including type 2 diabetes, hypertension, nonalcoholic fatty liver disease, and orthopedic disorders.

## VIII-PREVENTION

- promotion of breast-feeding,
- access to fruits and vegetables,
- walkable communities, and 60 min/day of activity for children.
- improved food choices,
- increased physical activity, and
- reduced screen time (television, computer, and video-game time). Discourage the snacking during television watching (see Table 6).
- all families should be counseled about healthy nutrition for their children. Those who have an obese parent are at increased risk.
- Promotion of exclusive breast-feeding for 6 mo and total breast-feeding for 12 mo.
- Introduction of infant foods at 6 months should focus on cereals, fruits, and vegetables. Lean meats, poultry, and fish may be introduced later in the 1st year of life.
- Parents should be specifically counseled to avoid introducing highly sugared beverages and foods in the 1st year of life.
- Instead, they should expose their infants and young children to a rich variety of fruits, vegetables, grains, lean meats, poultry, and fish to facilitate acceptance of a diverse and healthy diet.

**Table 6: PROPOSED SUGGESTIONS FOR PREVENTING OBESITY**

<b>PREGNANCY</b>
<p>Normalize body mass index before pregnancy.</p> <p>Do not smoke.</p> <p>Maintain moderate exercise as tolerated.</p> <p>In gestational diabetics, provide meticulous glucose control.</p>
<b>POSTPARTUM AND INFANCY</b>
<p>Breast-feeding is preferred for a minimum of 3 mo.</p> <p>Postpone the introduction of solid foods and sweet liquids.</p>
<b>FAMILIES</b>
<p>Eat meals as a family in a fixed place and time.</p> <p>Do not skip meals, especially breakfast.</p> <p>No television during meals.</p> <p>Use small plates, and keep serving dishes away from the table.</p> <p>Avoid unnecessary sweet or fatty foods and soft drinks.</p> <p>Remove televisions from children's bedrooms; restrict times for television viewing and video games.</p>

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# RENAL DISEASE

1. Kidney Stone in Children.....	357
2. Urinary Tracts Infection.....	361
3. Acute Renal Failure in Children .....	365
4. Syndrome Nephrotique Idiopathique De L'enfant (SNI) .....	372
5. Acute Poststreptococcal Glomerulonephritis (AGN) .....	382

# **KIDNEY STONE IN CHILDREN**

*By Prof. OUM Sokhom*

## **I- INTRODUCTION**

- Kidney stones (also called nephrolithiasis or urolithiasis) develop when a collection of minerals or other material form a small "stone."
- The stone can cause pain, block the flow of urine, and cause long-term kidney problems if it is not recognized and treated promptly. Fortunately, most children who develop kidney stones recover without any long-term complications.
- Stones are less common in children than in adults.
- Most children who develop kidney stones have an underlying condition that increases their risk of stones, although some children develop a stone for unknown reasons.

## **II- EPIDEMIOLOGY**

Nephrolithiasis occurs in all parts of the world.

- The annual incidence of urinary tract stones in the industrialized world is estimated to be 0.2%.
- In developing countries, bladder calculi are more common than upper urinary tract calculi;
- stone disease in children are equally prevalent between the sexes..

## **III- CAUSES**

Kidney stones form when the components of urine :

- fluid and various minerals and acids — are out of balance.
- When this happens, the urine contains more crystal-forming substances, such as calcium, oxalate and uric acid, than the available fluid can dilute.
- At the same time, the urine may be short of substances that keep crystals from sticking together and becoming stones.
- This creates an environment in which kidney stones are more likely to form.

## **IV-RISK FACTORS**

Certain factors can increase a child's risk of developing kidney stones.

- History of kidney stones — Children who have had a kidney stone in the past have the highest risk of developing a stone in the future.

- Not drinking enough — The amount of fluids a child drinks directly affects the amount of urine the body makes. Drinking a small amount of fluids means that the kidneys make a small amount urine, which increases the concentration of stone-forming substances in the urine.
- Ketogenic diet — Diets that include a very small amount of carbohydrates, called ketogenic diets, can increase the risk of developing kidney stones. Ketogenic diets are sometimes used to treat seizure disorders.
- Cystic fibrosis — Children with cystic fibrosis are at higher risk of developing kidney stones.
- Urinary tract abnormalities — Having congenital (from birth) abnormalities in the kidneys, ureters, or bladder can increase the risk of developing a kidney stone.
- Medicines — Some medicines increase the risk of forming crystals in the urine. These include furosemide (Lasix), acetazolamide (Diamox), and allopurinol (Aloprim, Zyloprim).
- Inherited disorders — Several uncommon inherited disorders can increase a child's risk of developing kidney stones. Testing for these disorders might be recommended.

## V- DIAGNOSIS

### A. SYMPTOMS

The most common symptoms of kidney stones include:

- Pain in the belly or back
- Blood in the urine (hematuria)
- Nausea or vomiting
- Needing to rush to the bathroom to urinate
- However, some children, particularly young children, do not have any symptoms, and the kidney stone is found when an imaging test (like an X-ray, ultrasonography) is done for another reason.
- Some kidney stone symptoms are similar to those of a bladder infection (also called a urinary tract infection).

### B. INVESTIGATIONS

may undergo tests and procedures to diagnose , such as:

- **Blood tests.** Blood tests may reveal excess calcium or uric acid in the blood. **Urine tests.** Tests of the urine, such as the 24-hour urine collection, may show the excreting too many stone-forming minerals or too few stone-inhibiting substances.
- **Imaging tests.** Imaging tests may show kidney stones in the urinary tract. Imaging tests may include ultrasonography , computerized tomography (CT) or, less commonly, X-ray.

## VI-TREATMENT

- Treatment depends on the size and type of stone, the underlying cause, the presence of urinary infection and whether the condition recurs.
- Stones 4 mm and smaller (less than 1/4 inch in diameter) pass without intervention in 90 percent of cases. The child should drink more fluids than usual to help flush the stone out
  - Infants — 750 mL or more ( 3 cups)
  - Children younger than five years of age — 1000 mL or more ( 4 cups)
  - Children between five and ten years of age — 1500 mL or more ( 6 cups)
  - Children greater than 10 years of age — 2000 mL or more ( 8 cups)
- Those 5-7 mm pass without intervention in 50 percent of cases. Those larger than 7 mm rarely pass without intervention.
- If possible, the kidney stone is allowed to pass naturally and is collected for analysis.
- the child is instructed to strain his urine to obtain the stone(s) for analysis.

- If a kidney stone does not move through the ureter within 15 days, if fever develops or if the pain doesn't improve, surgery is considered.
- Use several procedures to break up, remove or bypass kidney stones. These procedures include:
  - **Lithotripsy** – This procedure is effective for stones in the kidney or upper ureter. It uses an instrument, machine or probe to break the stone into tiny particles that can pass naturally. Lithotripsy is not appropriate for patients with very large stones or other medical conditions. This is performed in an outpatient setting.
  - **Ureteroscopy** – This is a long, thin fiberoptic telescope (ureteroscope) inserted through the urethra and passed through the bladder to the stone. It is used to remove or break up (fragment) stones with a laser. A small tube (or stent) may be left in the ureter for a few days after treatment to promote healing and prevent blockage from swelling or spasm. This is performed in an outpatient setting.
  - **Percutaneous nephrostolithotomy (PCNL)** – Percutaneous (through needle-puncture of the skin) removal of kidney stones (lithotomy) is accomplished by the surgeon threading various catheters over the guidewires into the kidney and manipulating surgical instruments through the catheters to fragment and remove kidney stones.
- **Pain relievers.** Passing a small stone can cause some discomfort. To relieve mild pain may recommend pain relievers such as ibuprofen- given at 10 mg/kg/dose PO (Advil, Motrin, others), acetaminophen 15mg/kg/dose (Tylenol, others) or naproxen sodium (Aleve)

## VII- COMPLICATIONS

1. urinary tract obstruction: General parts can cause obstruction above water, upper ureter and in the following ureteral calculi can cause hydronephrosis.
2. local damage: summary of rock, local damage light. Large, fixed stone, can make kidneys, epithelial cells of renal pelvis expulsion, ulcers, fibrous tissue hyperplasia, resulting in interstitial fibrosis.
3. infection: Calculus with infection, before the stones discharged or removed, it is difficult to cure. This infection may occur around pyelonephritis, pyonephrosis, kidney inflammation and renal abscess and cystitis
4. adipose tissue of renal tissue to replace: kidney stones occur when pyelonephritis, renal tissue damage can be replaced by fatty tissue. Thus leading to decline in renal function, can develop renal failure and uremia.

## VIII- PREVENTIONS

- The child may need to make lifestyle modifications such as increased fluid intake and changes in diet.
- Proper hydration helps prevent the urine from becoming concentrated with crystals, which can lead to stone formation.
- Reduces the risk for [urinary tract infections](#), which may lessen the risk for struvite stones (stones associated with a urinary tract infection)
- Lemonade with real lemon juice is a good source of citrate and may be recommended as an alternative to water.
- Recommend limiting meat, salt and foods high in oxalate (e.g., green leafy vegetables, chocolate, nuts) in the child's diet.

**Calcium** — Children with increased levels of calcium in the urine should drink more fluids and make some changes in their diet:

- Eat a low-sodium diet

- Get the right amount of calcium from foods and drinks. The "right" amount of calcium depends on the child's age:
  - 500 mg/day for children one to three years
  - 800 mg/day for children four to eight years
  - 1300 mg/day for children nine years and older
  - Avoid calcium and vitamin D supplements
  - Eat potassium-rich foods (fresh fruits and vegetables)

**Oxalate** — Children who have high levels of oxalate in the urine should:

- Drink more fluids
- Avoid vitamin C supplements
- Avoid foods that contain large amounts of oxalate, strawberries, star fruit, sweet potatoes, wheat bran, tea, cocoa, pepper, chocolate, nuts, and citrus juices

**Urate** — Children with increased levels of urate in the urine should drink more fluids.

**Cystine** — Children with high levels of cystine in the urine should drink more fluids.

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# URINARY TRACTS INFECTION

By Prof. Oum Sokhom

## I. DEFINITION

Infection of any component of the urinary tract including:

- Urethritis
- Cystitis
- Pyelonephritis

## II. PREVALENCE AND ETIOLOGY

- Urinary tract infections (UTIs) occur in 3–5% of girls and 1% of boys.
- In girls, the first UTI usually occurs by the age of 5 yr, with peaks during infancy and toilet training.
- After the first UTI, 60–80% of girls will develop a second UTI within 18 mo.
- In boys, most UTIs occur during the 1st yr of life.

UTIs are caused mainly by colonic bacteria. In females, 75–90% of all infections are caused by *Escherichia coli*, followed by *Klebsiella* spp. and *Proteus* spp.

- Some series report that in males older than 1 yr of age. *Proteus* is as common a cause as *E. coli*;
- Others report a preponderance of gram-positive organisms in males.
- *Staphylococcus saprophyticus* and enterococcus are pathogens in both sexes.
- Viral infections, particularly adenovirus, also may occur, especially as a cause of cystitis

## III. CLINICAL PRESENTATION

Age and gender dependent:

- 0 - 2 months:
  - Fever
- 2 mo – 2 years:
  - Fever (>38 C)
  - Irritability
  - Vomiting and Diarrhea
  - Decrease appetite
  - Between 1-2 y/o = crying on urination, foul smelling odor
- 2 – 6 years:
  - Systemic symptoms
  - Fever

- Flank or back pain
- Urgency, urinary incontinence, dysuria
- Suprapubic or abdominal pain
- Foul smelling odor
- > 6 years and adolescents:
  - Same as above

#### **Symptoms of urethritis**

- Dysuria
- Reluctance to void
- Perineal discomfort, erythema
- May be associated with vaginal irritation and erythema in girls
- In older boys, urethral discharge
- In adolescent girls associated with PID symptoms

#### **Cystitis**

- Afebrile usually
- Frequency
- Enuresis
- Dysuria
- Reluctance to void

#### **Pyelonephritis**

- Usually associated with fever and systemic signs 2° renal parenchymal inflammation
  - Older children: Flank pain or abdominal pain
  - Younger children: Fever, irritability, vomiting, poor feeding

### **IV. DIAGNOSIS**

- A UTI may be suspected based on:
  - Symptoms OR
  - findings on urinalysis OR
  - Both, but a urine culture is necessary for confirmation and appropriate therapy.
- The correct diagnosis of UTI depends on having the proper sample of urine.
- There are several ways to obtain a urine sample. Some are more accurate than others.
  - In toilet-trained children, a midstream urine sample usually is satisfactory
    - If the culture shows >100,000 colonies of a single pathogen, or if there are 10,000 colonies and the child is symptomatic,
    - Nitrites and leukocyte esterase usually are positive in infected urine.
  - Blood test: leukocytosis, neutrophilia, and elevated erythrocyte sedimentation rate and C-reactive protein are common

### **V. IMAGING STUDIES**

**The use of imaging will depend on the age of the child and on whether the UTI is recurrent or atypical.**

- **Recurrent UTI is defined as:**
  - Two or more episodes of UTI with acute pyelonephritis/upper urinary tract infection, or
  - One episode of UTI with acute pyelonephritis/upper urinary tract infection plus one or more episodes of UTI with cystitis/lower urinary tract infection, or
  - Three or more episodes of UTI with cystitis/lower urinary tract infection
- **Atypical UTI is defined as any of the following:**
  - Seriously ill
  - Poor urine flow

- Abdominal or bladder mass
- Raised creatinine
- Septicaemia
- Failure to respond to treatment with suitable antibiotics within 48 hours
- Infection with non-E. coli organisms.

**Ultrasound (if available)**

- Voiding Cystourography (if available)

**VI. TREATMENT****1. Antibiotic treatment:****a. < 3 months**

- Refer immediately to paediatric specialist when UTI suspected
- The treatment is parenteral antibiotics

In acute febrile infections suggestive of **pyelonephritis**, a 10- to 14-day course of broad-spectrum antibiotics capable of reaching significant tissue levels is preferable.

- Ceftriaxone (50–75 mg/kg/24 hr, not to exceed 2 g) **OR**
- Ampicillin (100 mg/kg/24 hr) + Gentamicin (3–5 mg/kg/24 hr in 1 to 3 divided doses)

**b. ≥ 3 months**

- **Acute pyelonephritis/upper urinary tract infection**

- Consider referral to a paediatric specialist (CPA3)
- Treat with oral antibiotic for 7-10 days, such as:
  - Cephalosporin: cefaclor (20 mg/kg/day, divided in 3 times) **OR**
  - Co-amoxiclav (80mg/kg/day)
- If oral antibiotics cannot be used, give parenteral antibiotic such as Ceftriaxone (50–75 mg/kg/24 hr), for 7-10 days

- **Cystitis/lower urinary tract infection (CPA2)**

- Treat with oral antibiotics for 5 days:
  - Cefixim (8mg/kg/day divided in 2 times) **OR**
  - Ciprofloxacin (20-30 mg/kg/day)
- Re-assess if infant or child remains unwell after 24-48 hours. If no alternative diagnosis is made, send urine sample for culture to identify presence of bacteria and determine antibiotic sensitivity (if this has not already been done)

**2. Antibiotic prophylaxis:** indicated in case of vesico-uretero reflux**VII. COMPLICATIONS**

- High blood pressure
- Kidney abscess
- Kidney infection (pyelonephritis)
- Renal insufficiency or kidney failure
- Swelling of the kidneys (hydronephrosis)

**VIII. PREVENTION**

Have the child wear loose-fitting underpants and clothing

- Increase the child's intake of fluids
- Keep the child's genital area clean to prevent bacteria from entering through the urethra
- Teach the child to go to the bathroom several times every day
- Teach the child to wipe the genital area from front to back to reduce the chance of spreading bacteria from the anus to the urethra

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# ACUTE RENAL FAILURE IN CHILDREN

by Prof. Oum Sokhom

## I. INTRODUCTION

### a. DEFINITION:

Acute renal failure (ARF) is defined as an acute decline in renal function characterized by an increase in blood urea nitrogen (BUN) and serum creatinine values, often accompanied by hyperkalemia, metabolic acidosis, and hypertension.

### b. The RIFLE classification of ARF is as follows<sup>[1]</sup>:

- Risk (R) - Increase in serum creatinine level X 1.5 or decrease in GFR by 25%, or UO < 0.5 mL/kg/h for 6 hours
- Injury (I) - Increase in serum creatinine level X 2.0 or decrease in GFR by 50%, or UO < 0.5 mL/kg/h for 12 hours
- Failure (F) - Increase in serum creatinine level X 3.0, decrease in GFR by 75%, or serum creatinine level  $\geq$  4 mg/dL with acute increase of >0.5 mg/dL; UO < 0.3 mL/kg/h for 24 hours, or anuria for 12 hours
- Loss (L) - Persistent ARF, complete loss of kidney function >4 weeks
- End-stage kidney disease (E) - Loss of kidney function >3 months

### c. ARF is divided into three forms:

- Pre renal failure (most common)
- Intrinsic renal failure
- And post renal failure.

## II. ETIOLOGY

### A. Prerenal failure

#### a. Extracellular Fluid Volume Deficits

- Gastrointestinal losses: vomiting, diarrhea, decreased oral intake of fluids, nasogastric loss of fluids
- Diuretic use, adrenal insufficiency, blood loss, liver disease, sepsis, anaphylaxis, excessive sweating
- Inflammatory skin disease, burn, peritonitis, pancreatitis

#### b. Cardiac Dysfunction

Congenital heart disease, cardiomyopathy, arrhythmia, acquired valvular disease

### **B. Intrinsic Renal Disease**

- Renal or intrinsic renal failure describes parenchymal injury due to vascular spasm, intravascular coagulation, and microvascular injury.
- The most common causes of intrinsic renal failure include acute tubular necrosis, interstitial nephritis, hemolytic-uremic syndrome, glomerulonephritis, and nephrotoxic drugs ,
- Acute Glomerulonephritis , Goodpasture syndrome , Systemic lupus erythematosus
- Hemolytic-uremic syndrome, Henoch-Schönlein purpura, Renal venous thrombosis
- Acute Interstitial Nephritis , Acute tubular necrosis , Intratubular obstruction

### **C. Post renal Failure**

- Postrenal failure results from obstruction to urinary flow. Causes of obstruction include renal calculi, bladder outlet obstruction, and internal or external ureteral compression.

## **III. DIAGNOSIS**

### **A. Pre renal Failure**

- In prerenal failure, clinical history should reveal causes of volume depletion, such as dehydration due to vomiting or gastroenteritis, hemorrhage, cardiac failure, or third-space fluid losses.
- Renal ultrasonography and renal scan findings should be normal.
- Laboratory findings:
  - Urine specific gravity  $>1.018$
  - Urine osmolality (mOsm/kg water)  $>500$
  - Urine sodium (mEq/L)  $<15-20$
  - Plasma BUN-creatinine ratio  $>20$
  - Urine-plasma creatinine ratio  $>40$

### **B. Intrinsic Renal Disease**

- Clinical history may reveal dehydration, hypoxic-ischemic events, toxic ingestion, NSAID or other nephrotoxic medication use, signs and symptoms of sepsis, gross hematuria, or trauma.
- Urine output can be: oliguria ( $<0.5$  mL/kg per hour in a child or  $<1$  mL/kg per hour in an infant) or anuria (no urine output).
- Laboratory examination:
  - Urine sediment may demonstrate red blood cell casts, granular casts, and red blood cells, findings seen in glomerulonephritis.
  - Decreased complement C3 value may indicate an underlying diagnosis of systemic lupus erythematosus or membranoproliferative or poststreptococcal glomerulonephritis.
  - Increased Streptococcal antibodies, including the antistreptolysin O titer (ASLO).
  - Biopsy may be indicated if the patient has gross hematuria and proteinuria, rapidly rising BUN and creatinine serum values.
- Renal scans can be helpful in diagnosis because they can demonstrate the extent of kidney function.
- Urine indices that suggest ATN include the following:

- Urine specific gravity < 1.012
- Urine osmolality (mOsm/kg water) < 500
- Urine sodium (mEq/L) >40
- Plasma BUN/creatinine ratio < 10-15
- Urine-plasma creatinine ratio < 20

### C. Post renal Failure

- Clinical history may reveal signs or symptoms of an obstruction, such as gross hematuria and colicky pain, as seen in a patient who has renal stones.
- A history of prenatal ultrasonography demonstrating bilateral hydronephrosis and hydroureters suggests the presence of posterior urethral valves.
- The physical examination may reveal a palpable flank mass, as seen in a patient who has ureteropelvic obstruction. Urine output and urinary sediment findings may be variable.
- In obstruction, a radioisotope scan shows isotope collection within the kidney or at any level of the ureter or bladder, with delayed or absent excretion of the isotope.

## IV. MANAGEMENT

**A.** Medical management of ARF includes maintaining renal perfusion and fluid and electrolyte balance, controlling blood pressure, treating anemia, providing adequate nutrition, adjusting medications for the degree of renal impairment, and initiating renal replacement therapy (dialysis) when indicated.

**B.** The patient who clearly has cardiopulmonary collapse, who requires close monitoring of vital signs, or who requires dialysis should be admitted to the intensive care unit.

### a. Vasoactive Agents

- Vasoactive agents frequently are administered to improve a patient's blood pressure and ensure adequate perfusion of the kidneys.
- Maintaining adequate perfusion
- Low-dose dopamine (0.5 to 3.0  $\mu\text{g}/\text{kg}$  per minute)

### b. Fluids

- Fluid management depends on the patient's hemodynamic status and urinary output. The patient who presents with oliguria and hemodynamic instability should be given a fluid bolus of 20 mL/kg of an isotonic solution such as normal saline, packed red blood cells, or even albumin
- Repeat boluses may be given if the child remains hemodynamically unstable, as indicated by persistent low blood pressure or increased heart rate, decreased capillary refill, or no urinary output.
- A repeat bolus can be administered within minutes if the patient is in shock or until clinical improvement is evidenced.
- Furosemide:
  - Initial dose of oral furosemide in pediatric patients is 2 mg/kg body weight, given as a single dose.
  - If the diuretic response is not satisfactory after the initial dose, dosage may be increased by 1 or 2 mg/kg no sooner than 6 to 8 hours after the previous dose.
  - Doses greater than 6 mg/kg body weight are not recommended.

- Once intravascular volume is re-established, fluid intake should be restricted to  $400 \text{ mL/m}^2[(4 P + 7)/(P+90)]$  per day (5% dextrose in water) plus urinary output and extrarenal losses,
- Final fluid adjustments depend on daily weights and close monitoring of the patient's intake and output.

### c. Electrolytes

- Frequent electrolyte abnormalities seen in ARF that must be corrected include hyponatremia, hyperkalemia, acidosis, and hypocalcemia
- **Metabolic Acidosis:**
  - Sodium bicarbonate if  $\text{pH} < 7.2$  or  $\text{HCO}_3^- < 12.0 \text{ mEq/L}$  ( $12.0 \text{ mmol/L}$ )  
 $[0.6 \times \text{BW}(\text{body weight}) \times \text{HCO}_3^- \text{ desired} - \text{HCO}_3^- \text{ observed}] \div 2$  OR 0.5 to 1.0 mEq/kg IV over 1 h ( sodium bicarbonate 8.4% 1mEq=1ml)
  - Hyponatremia (sodium concentrations  $< 130.0 \text{ mEq/L}$ )
  - If the patient is symptomatic and having seizures, 3% sodium chloride should be used:  
10 to 12 mL/kg of 3% NaCl infused over 1 hour
- Hyperkalemia is defined as mild-to-moderate when the potassium concentration is between 6.0 and 7.0 mEq/L (6.0 and 7.0 mmol/L) and severe when the concentration is greater than 7.0 mEq/L (7.0 mmol/L) with any electrocardiographic changes.
  - Treatment of hyperkalemia includes infusion of 10% calcium gluconate (1.0 to 1.5 mL/kg) or insulin 0.1u/kg IV + dextrose 50% 1-2ml/kg IV, or administration of sodium polystyrene sulfonate (kayexalate) (1 g/kg rectally or orally)
  - If these attempts do not correct the patient's hyperkalemia, dialysis should be initiated, especially if anuria is present.
- Hypocalcemia can be treated with intravenous calcium gluconate (10%) 0.5 to 1 mL/kg IV (up to 10 mL) or calcium carbonate po 45-65mg/kg/day

### C. Anemia

- Children who have ARF do not need transfusions unless there is active bleeding, hemodynamic instability, or a hematocrit value below 25% (0.25).

### D. Nutrition

- Proper nutrition is a major issue in patients who have ARF.
- . Infants who have ARF can be given a formula low in phosphorus.
- Older children can be fed formulas that provide proteins of high biologic value.
- If the patient cannot be fed enterally, supplemental intravenous alimentation should begin.
- Caloric intake should be aimed at providing greater than 70% of calories as carbohydrates (as dextrose up to 25%) and less than 20% as lipids, with biologic value proteins up to 0.5 to 2 g/kg per day.

### E. Hypertension (see chapter hypertension)

### F. Renal Replacement Therapy

- When conservative medical management is unsuccessful in restoring renal function, dialysis is the therapy of choice.
- Indications for initiating dialysis include congestive heart failure, anemia, hyperkalemia, severe acidosis, pericarditis, and inadequate nutrition.

## V. POSSIBLE COMPLICATIONS

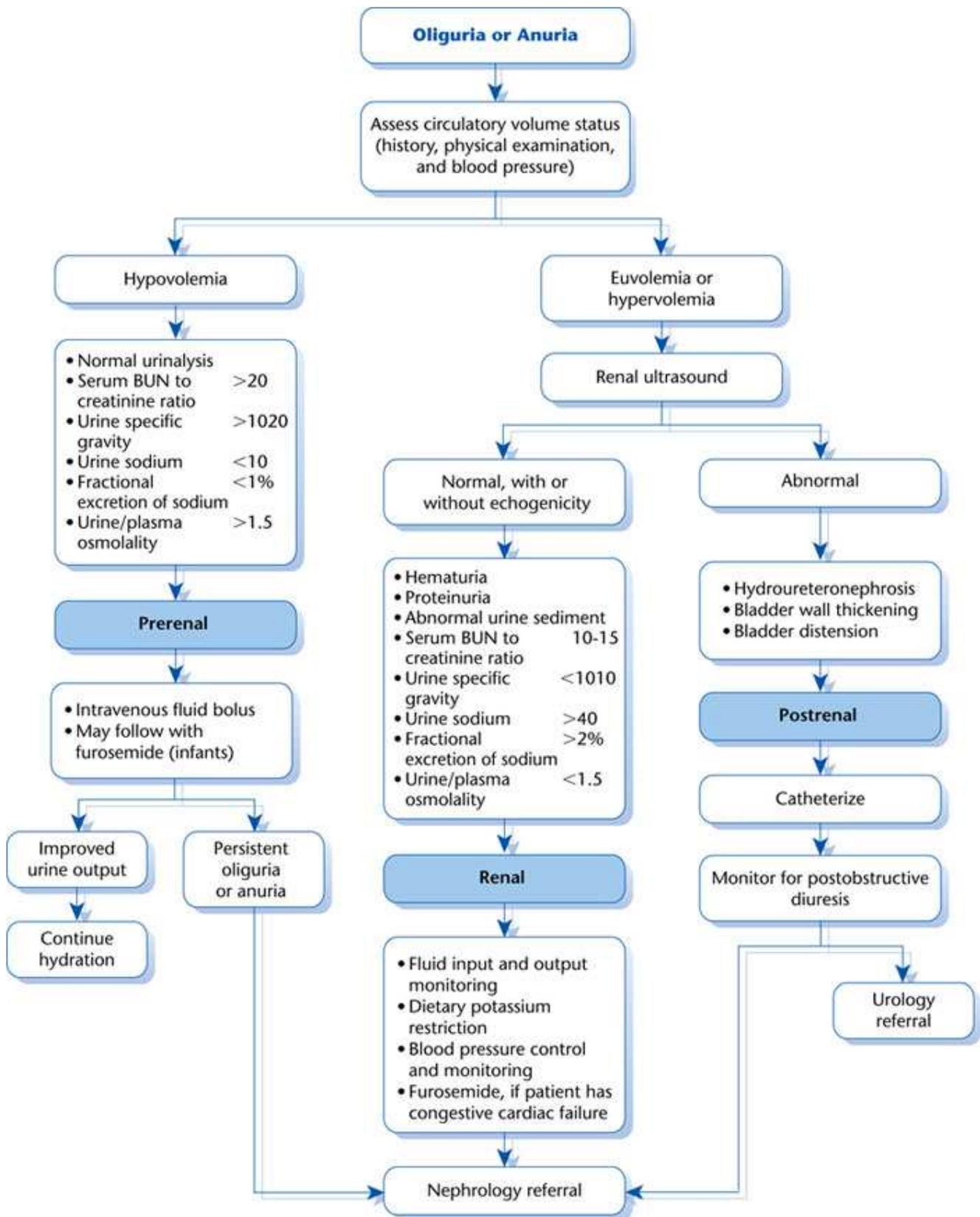
- Chronic (long-term) kidney failure ,damage to the heart or nervous system ,end-stage kidney disease
- High blood pressure ,loss of blood in the intestines,pulmonary edema.
- Potential complications of acute kidney failure include:
  - **Permanent kidney damage.** Occasionally, acute kidney failure causes permanent loss of kidney function, or end-stage renal disease. People with end-stage renal disease require either permanent dialysis
  - **Death.** Acute kidney failure can lead to loss of kidney function and, ultimately, death. The risk of death is highest in people who had kidney problems before experiencing acute kidney failure.

## VI. PROGNOSIS

- Prognosis depends on several factors, including the need for dialysis, the time between onset of illness and presentation to medical care, and the underlying disease.
- Patients who present at a younger age and have multisystem organ failure appear to have worse prognoses.
- Therefore, early identification of patients who have ARF and early intervention are necessary to improve the current 10% to 60% mortality rates associated with these risk factors.

## VII. PREVENTION

- Follow instructions on over-the-counter medications. Follow the instructions on over-the-counter pain medications such as aspirin, acetaminophen and ibuprofen. Taking doses that are too high may increase the risk of acute kidney failure.
- Follow and manage kidney problems.



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# SYNDROME NEPHROTIQUE IDIOPATHIQUE DE L'ENFANT (SNI)

By Prof. Heng Sothy

## I- INTRODUCTION

Chez l'enfant, le syndrome néphrotique est en rapport avec un syndrome néphrotique idiopathique dans 90% des cas, au moins entre les âges de 2 et 10 ans.

Le syndrome néphrotique idiopathique répond habituellement rapidement à la corticothérapie avec une disparition de la protéinurie dans 90 % des cas. Environ 70 % de ces enfants auront une ou plusieurs rechutes conduisant à poursuivre la corticothérapie. Cette corticothérapie peut être responsable d'effets secondaires sérieux obligeant à recourir à d'autres traitements. Les rechutes peuvent s'accompagner de complications, en particulier infectieuses ou thrombo-emboliques. Tant que les traitements sont efficaces pour maintenir une rémission, le risque d'évolution vers l'insuffisance rénale terminale est très faible. Environ 10 % des enfants ne répondent pas à la corticothérapie. Dans ce cas la maladie évolue dans la moitié des cas vers l'insuffisance rénale terminale.

## II- DEFINITION

Le syndrome néphrotique est caractérisé par:

1. **Un Œdème** est constant mais l'intensité variable, souvent anasarque ;
2. **Une protéinurie** > 50 mg/kg/24 hrs chez l'enfant;
3. **Une protidémie** < 60 g/L ou **albuminémie** < 30 g/L
4. **Une hypercholestérolémie** (sérum cholestérol) > 200mg/dL

## III- BILAN INITIAL

### 1. Objectif

- Confirmer le diagnostic de syndrome néphrotique;
- Rechercher d'éventuelles complications du syndrome néphrotique: thrombose vasculaire, embolie pulmonaire, insuffisance rénale, infection ;
- Mettre en route le traitement approprié ;
- Définir une stratégie de suivi.

## 2. Examen initial

### a. Anamnèse

- Antécédents personnels ;
- Terrain atopique ;
- Infection : virale, bactérienne et parasitaire ;
- Vaccination récente ;
- Antécédents familiaux de syndrome néphrotique ou d'autres néphropathies.

### b. Examen clinique

- Poids, taille, température ;
- Mesure de la pression artérielle ;
- Evaluation des oedèmes ;
- Recherche de signes cliniques extra rénaux tel une éruption cutanée, un purpura ou des signes articulaires ;
- Recherche de signes cliniques orientant vers une complication : dyspnée, fièvre, douleurs abdominale, tachycardie ;
- Recherche de foyers infectieux (ORL, dentaire, broncho pulmonaire, digestif, urinaire).

### c. Examens complémentaires

- NFS-plaquettes ;
- CRP en cas de suspicion de complication infectieuse ;
- Protidémie et albuminémie ;
- Urée sanguine, créatininémie ;
- Bandelettes urinaires (recherche de protéinurie) ;
- Protéinurie des 24 h ou,
- ECBU en cas de positivité pour les leucocytes et /ou les nitrites à la bandelette.

## IV-PRISE EN CHARGE THÉRAPEUTIQUE

### 1. Objectifs

- Traiter les complications aiguës du syndrome néphrotique ;
- Obtenir une rémission complète du syndrome néphrotique ;
- Prévenir les rechutes ;
- Prévenir et traiter les complications à long terme liées aux effets secondaires des médicaments.

### 2. Éducation des malades

#### a. Éducation thérapeutique

L'objectif est de permettre au patient de bien comprendre sa maladie en particulier sur certains aspects liés à la prise en charge thérapeutique tels que :

- la longue durée de traitement.
- la place capitale de la diététique
- les traitements (corticoïdes, immunosuppresseurs, anticoagulants, diurétiques) ;
- le risque de complications du syndrome néphrotique et de complications liées au traitement.

#### b. Éducation diététique pendant le période de traitement

- Aliments très salés interdits : les viandes et poissons fumés ou salés, les crustacés, toutes les conserves, les pain, les biscuits variés, les pâtisseries du commerce, tous les légumes en boîte, les pâtisseries du commerce, les sauces, le lard, ...
- Aliments permis dans le régime pauvre en sel : Tous les aliments « nature » non cuisinés de façon industrielle.

### c. Mesures hygiéno-diététiques

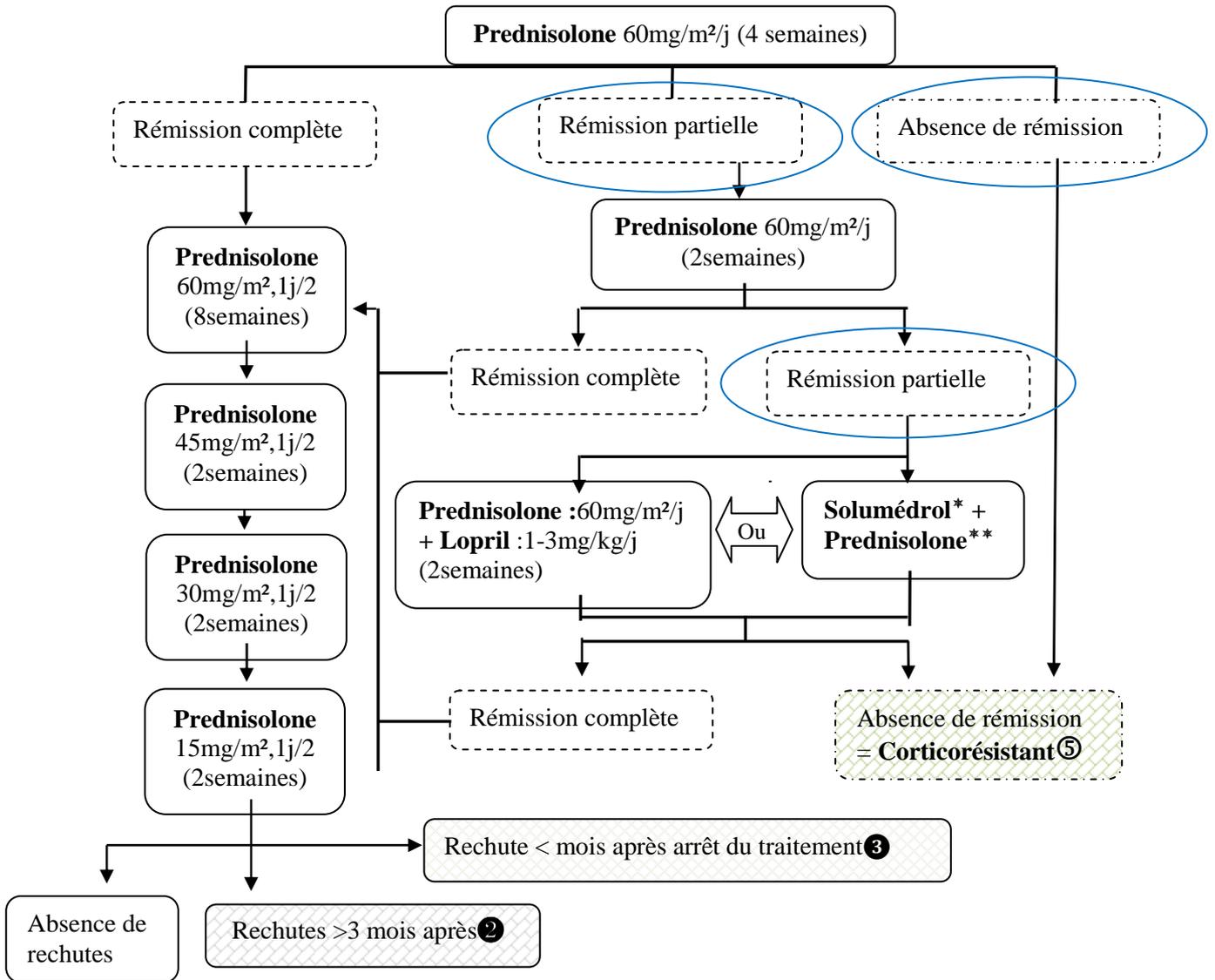
L'alimentation doit apporter une ration protidique de 1 à 2 g/kg. Elle doit être pauvre en sel et une restriction hydrique n'est indiquée que si la natrémie corrigée est inférieure à < 130 mmol/l. Le régime pauvre en sel (<1 mmol/kg/j soit 35 mg/kg/j) doit être maintenu jusqu'à la rémission et en cas de corticothérapie à fortes doses (0,5 mg/kg/ tous les 2 jours).

### 3. Traitement symptomatique

- Diurétiques : le furosémide (1 à 2 mg/kg), l'aldactone (5 mg/kg) .
- Perfusions de plasma sanguin : 10 à 20 ml/kg de poids, il y a hypoprotidémie importante.
- Inhibiteurs de l'enzyme de conversion (IEC) : Ils sont utilisés pour diminuer le débit de la protéinurie en cas d'échec des traitements spécifiques : Lopril 1 à 3 mg/kg/j en IV
- Antihypertenseurs : Lopril 1 à 3 mg/kg/j en IV ou Adalat 1 à 2 mg/kg/j en PO
- Prévention et traitement des thromboses :
  - Mesures générales : mobilisation et éviter le repos au lit ; éviter les perfusions inutiles.
  - Traitements anticoagulants : Aspirine 5mg/kg/j en PO, seule prise.
- Infection
  - Infection bactérienne :
  - Prescrire une antibiothérapie uniquement en cas d'infection déclarée.
  - Obliger de faire le bilan tuberculeux au cours de traitement de fond.
  - Infections virales : Varicelle ou Herpès : aciclovir per os, 30 mg/kg PO pendant 5 jours.

### 4. Traitements spécifiques : Les schémas synthétiques du traitement spécifique du SNI de l'enfant :

**a. Traitement épisode initial :**

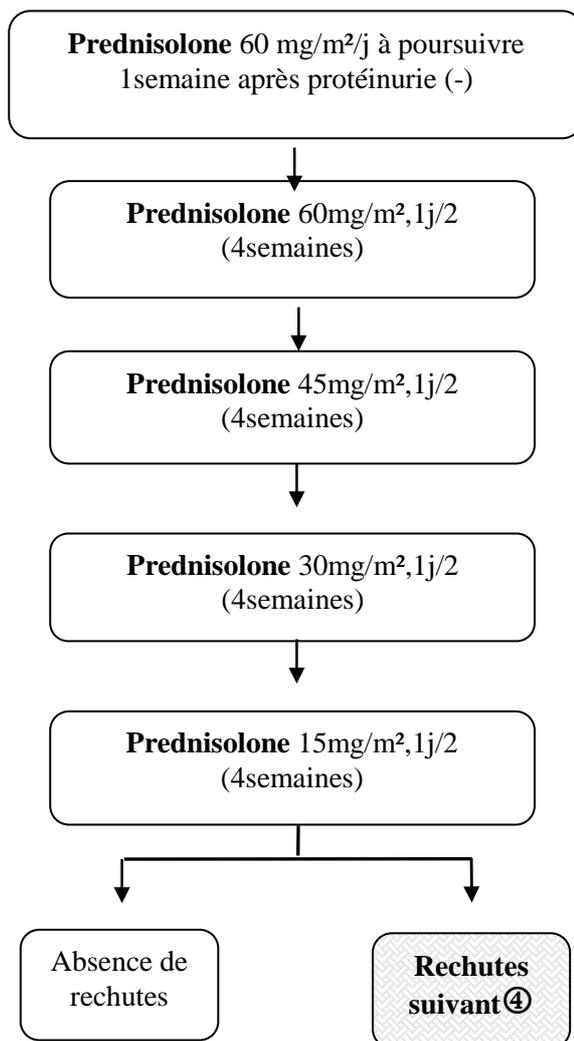


\* **Prednisolone** dose maximum 80mg/j

\*\* **Solumédrol** : PIV : 1g/1,73m<sup>2</sup>, en 4-6h, 3 doses à 48h intervalle ; Evaluer 8jours après perfusions de Solumedrol.

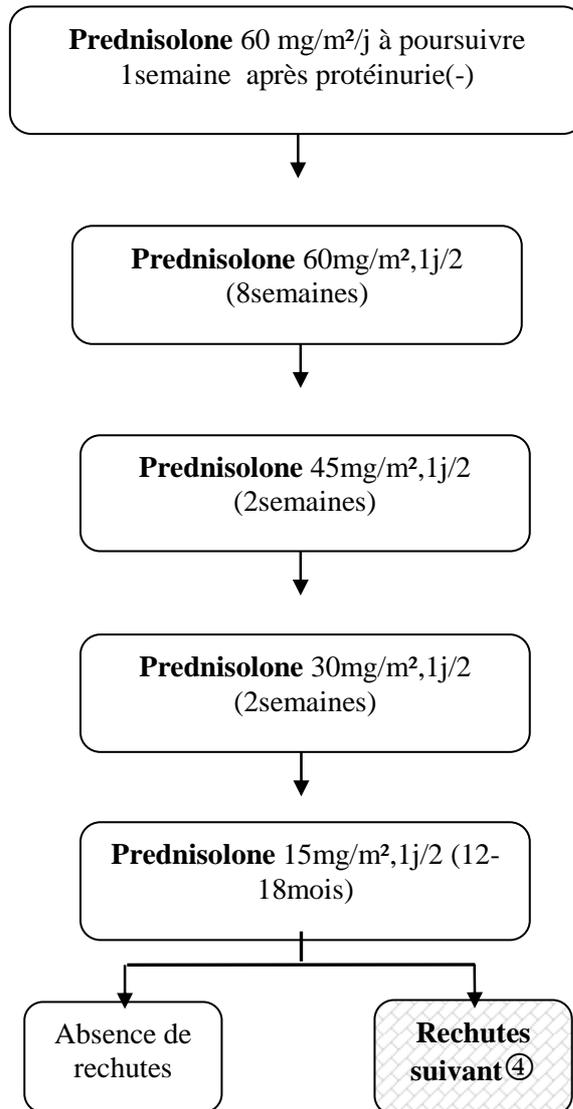
\*\*\* **Prednisolone** : à interrompre le jour de perfusions de Solumédrol.

**b. Traitements des rechutes espacés (>3 mois après arrêt du traitement)**

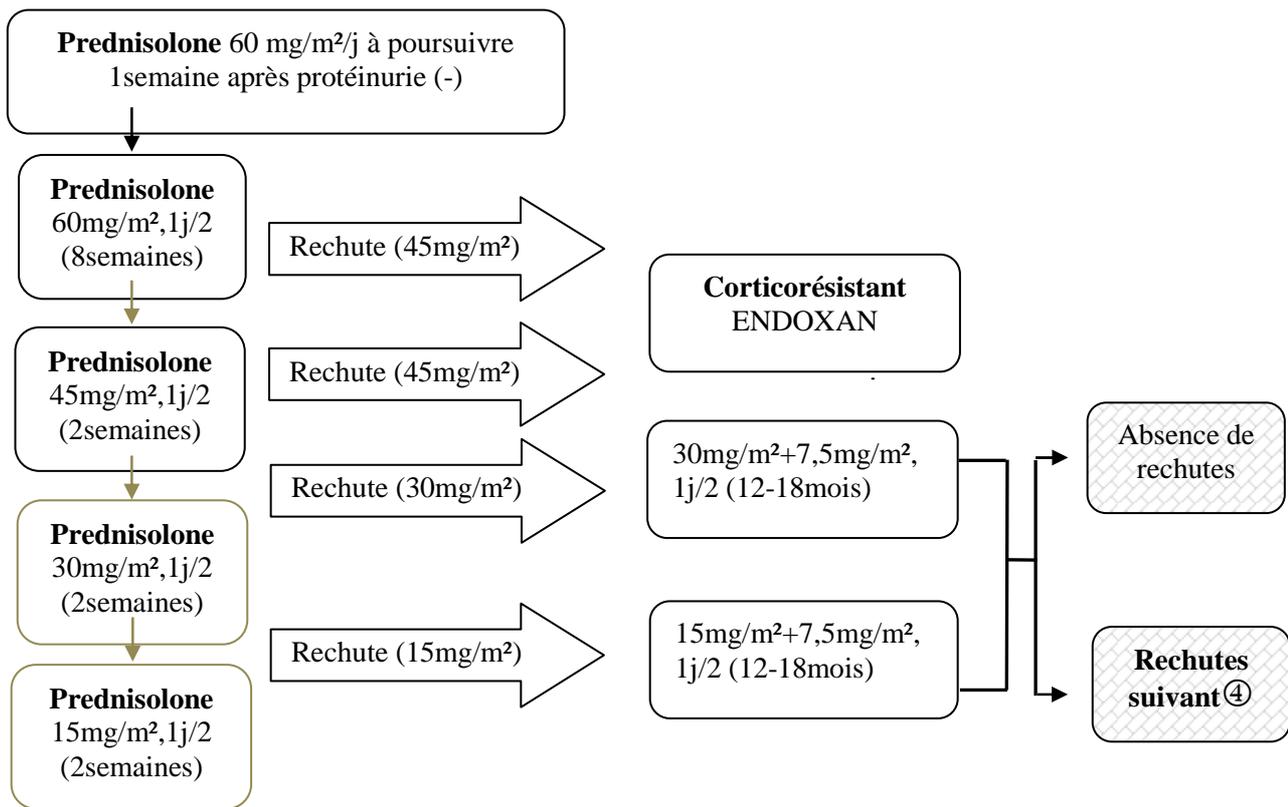


**c. Traitement de corticodépendance**

**\* Rechute < 3 mois après arrêt du traitement**



\* **Rechute sous corticothérapie discontinuée**



\* **Traitement des rechutes suivantes (> 3 fois de rechutes)**

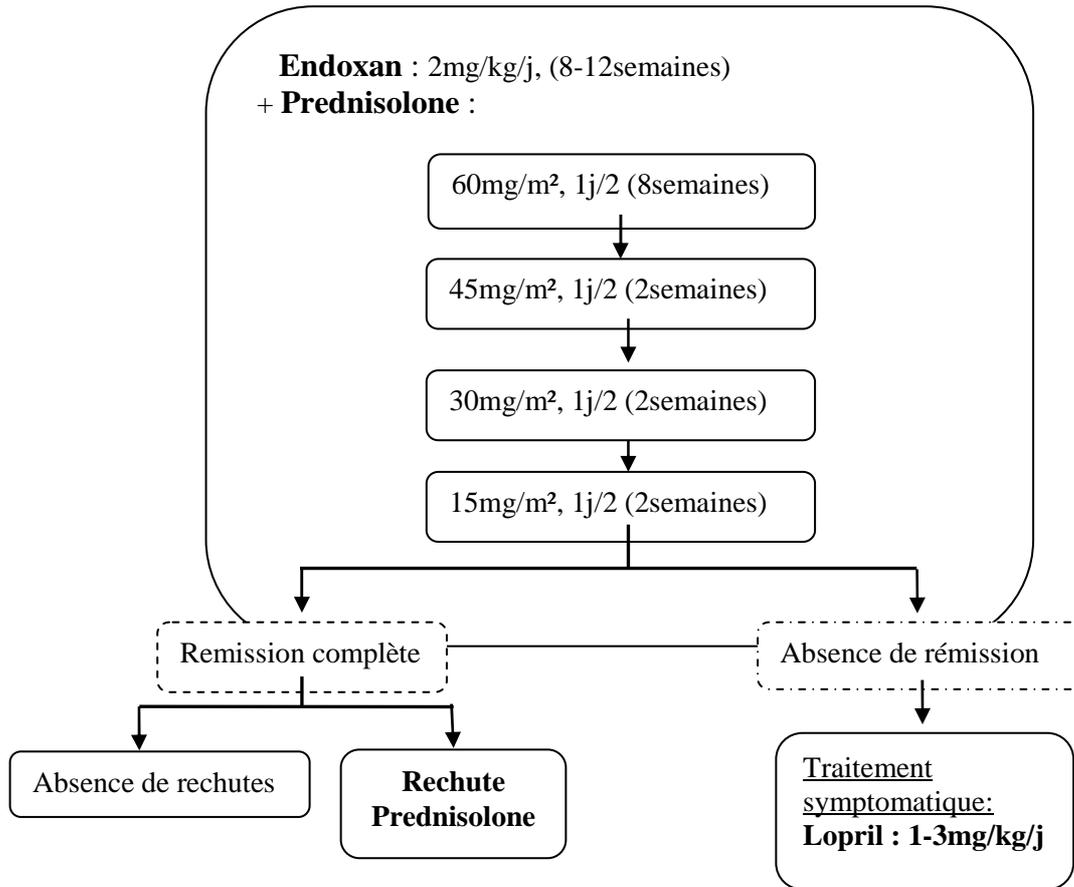
**Selon le niveau de corticothérapie (Corticosensible ou Corticodédance)** pour lequel la rechute est survenue, la durée d'attaque peut être moindre et la décroissance de la corticoïdes plus rapide pour arriver plus vite au dessus du seuil de la dernière rechute et continue jusqu'au 12- 18 mois.

**Remarque :**

- *S'il y a des complications de la corticothérapie (diabète sucré, troubles psychiques, HTA, cataracte, ostéoporose, ...) Il faut changer à d'autres traitements (**Endoxan ou Cyclosporine**).*
- *Durant l'utilisation de l'ENDOXAN ou du CYCLOSPORINE, Il faut conserver la dose minimale de corticoïdes permettant de maintenir la rémission pendant la durée du traitement puis amorcer une décroissance progressive des corticoïdes*

**5. Traitement de Corticorésistant :**

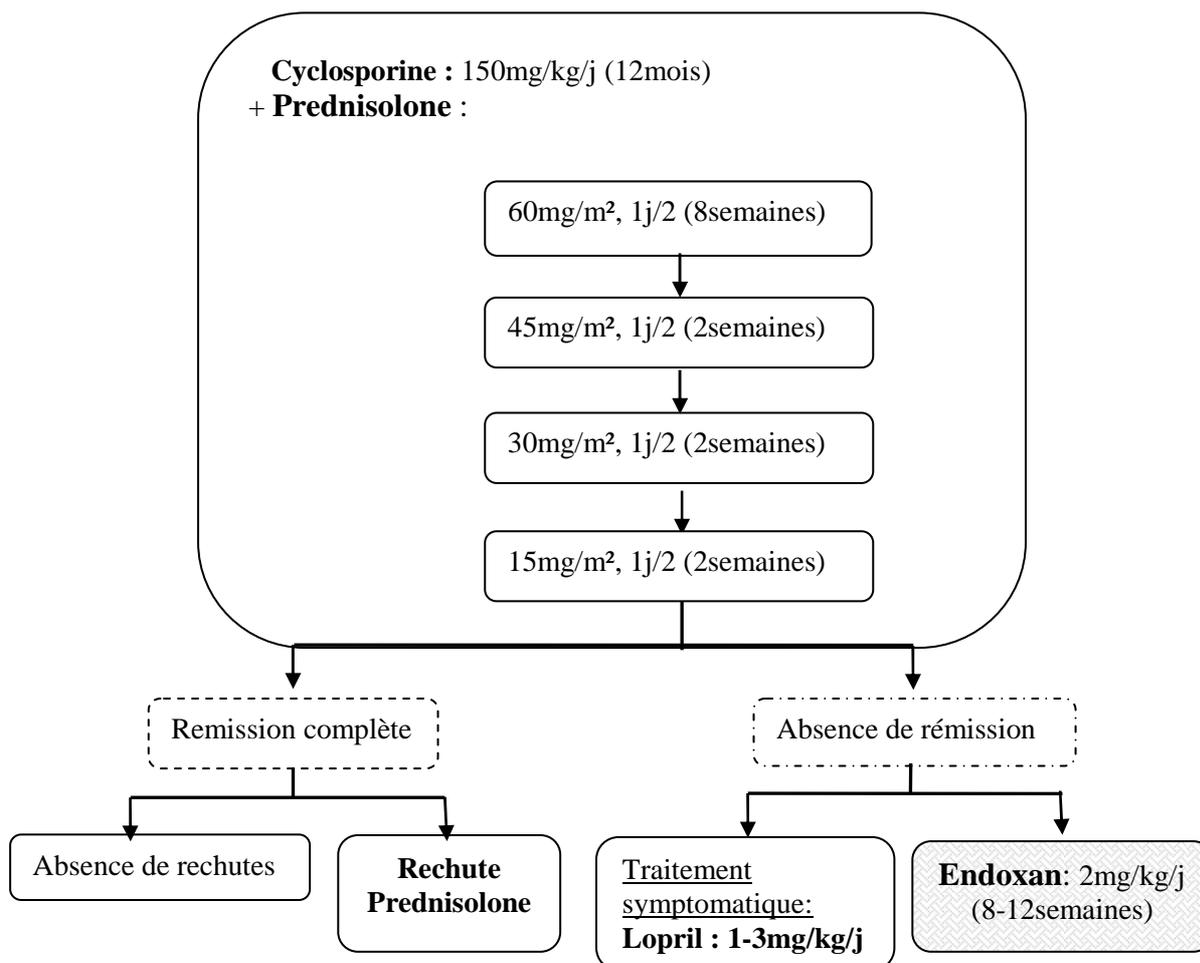
\* **Endoxan** : ( 1<sup>è</sup> choix)



**ENDOXAN** : maximum dose 2,5mg/kg/j,

Il faut arrêter provisoirement si polynucléaires < 2000/mm<sup>3</sup> ou lymphocyte < 800/mm<sup>3</sup> ou plaquettes < 100 000/mm<sup>3</sup>.

\* **Cyclosporine** : (2<sup>er</sup> choix)



## V- SUIVI

Pour la surveillance clinique et paraclinique et continuer le traitement.

### 1. Objectifs

- S'assurer de l'observance au traitement ;
- Vérifier la tolérance au traitement ;
- Dépister la survenue des complications liées au traitement ;
- Surveiller la survenue des rechutes ;
- Dépister la survenue des complications du syndrome néphrotique.

### 2. Examens de suivi

- Surveillance clinique : évolution de la courbe pondérale et staturale, de la tension artérielle.
- Surveillance paraclinique : Surveillance régulière des urines par bandelettes au domicile : pendant la poussée 2 à 3 fois par semaine, au moins une fois par semaine ensuite, pendant toute la durée du traitement.
- En cas de bandelettes urinaires négatives et en l'absence de circonstances particulières (surveillance de traitements médicamenteux, ou complications), les examens biologiques sanguins ne sont pas justifiés.
- En cas de protéinurie persistante, surveillance biologique (au moins tous les 3 mois) : créatininémie, ionogramme sanguin, albuminémie, protéinurie des 24 h, créatininurie, ECBU.

## DEFINITIONS

- **Une rémission complète (RC)** est définie par une protéinurie inférieure à 3 à 5mg/kg/j ou un rapport protéinurie/créatininurie inférieur à 0,2 en g/g ou à 0,02 en g/mmol et une albuminémie supérieure à 30gr/l.
- **Une rémission partielle** est définie par une diminution du débit de protéinurie par rapport au niveau initial avec une augmentation de l'albuminémie supérieure à 25 g/l.
- **La rechute** est définie par une protéinurie supérieure à 50 mg/kg/j ou un rapport protéinurie/ créatininurie supérieur à 0,3 g/mmol s'accompagnant d'une hypoalbuminémie inférieure à 30g/l ou d'une protéinurie isolée (rapport protéinurie/créatinine supérieur à 0,11 en g/mmol) pendant plus de 3 semaines.
- **La corticodépendance** est définie par la survenue d'une rechute durant la diminution des doses de corticoïdes ou dans les trois mois suivant l'arrêt des corticoïdes.

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# ACUTE POSTSTREPTOCOCCAL GLOMERULONEPHRITIS (AGN)

*By Dr. Heng Sothy*

## I. DEFINITION:

AGN is a classic example of the **acute nephritic syndrome** characterized by the sudden onset of gross hematuria, edema, hypertension, and renal insufficiency. AGN is an autoimmune inflammation of the renal glomerule. This is most commonly following a streptococcal infection (usually tonsillitis or a skin infection in the previous 5 weeks). It affects children > 3 years of age and young adults.

## II. ETIOLOGY AND EPIDEMIOLOGY

AGN follows infection of the throat or skin by certain “nephritogenic” strains of group A  $\beta$ -hemolytic streptococci. The factors that allow only certain strains of streptococci to be nephritogenic remain unclear. Poststreptococcal glomerulonephritis commonly follows streptococcal pharyngitis during cold weather months and streptococcal skin infections or pyoderma during warm weather months. Although epidemics of nephritis have been described in association with both throat (serotype 12) and skin (serotype 49) infections, this disease is most commonly sporadic.

## III. PATHOGENESIS

There is an immunological process with deposits of Ag-Ac complexes on basal membrane of glomerules. The streptococcal antigens create with antibodies of the complexes circulating in blood (complexes immuns) which settle in the walls of the glomerules. Certain sources of streptococci are specifically nephritogenic (serotypes 12, 49). Although morphologic studies and a depression in the serum complement (C3) level strongly suggest that poststreptococcal glomerulonephritis is mediated by immune complexes, the precise mechanisms by which nephritogenic streptococci induce complex formation remain to be determined. Despite clinical and histologic similarities to acute serum sickness in rabbits, the finding of circulating immune complexes in poststreptococcal glomerulonephritis is not uniform and complement activation is primarily through the alternative rather than the classic (immune complex-activated) pathway.

## IV. DIAGNOSIS

**Confirmation of the diagnosis** requires clear evidence of invasive streptococcal infection. A positive throat culture report may support the diagnosis or may simply represent the carrier state. On the other hand, a rising antibody titer to streptococcal antigen(s) confirms a recent streptococcal infection. Importantly, the antistreptolysin O titer is commonly elevated after a pharyngeal infection but rarely increases after streptococcal skin infections. The clinical diagnosis

of poststreptococcal glomerulonephritis is quite likely in a child presenting with acute nephritic syndrome, evidence of recent streptococcal infection, and a low C3 level.

### **1. Symptoms:**

AGN is most common in children aged 5–12 yr and uncommon before the age of 3 year. The typical patient develops an acute nephritic syndrome 1–2 weeks after an antecedent streptococcal pharyngitis or 3–6 weeks after a streptococcal pyoderma.

The severity of renal involvement varies from asymptomatic microscopic **hematuria** with normal renal function to acute renal failure. Depending on the severity of renal involvement, patients may develop various degrees of **edema**, **hypertension**, and **oliguria**. Patients may develop encephalopathy and/or heart failure owing to hypertension or hypervolemia. Encephalopathy may also possibly result from the direct toxic effects of the streptococcal bacteria on the central nervous system.

Nonspecific symptoms such as malaise, lethargy, abdominal or flank pain, and fever are common. Acute subglottic edema and airway compromise have been reported. The acute phase generally resolves within 6–8 wk. Although urinary protein excretion and hypertension usually normalize by 4–6 wk after onset, persistent microscopic hematuria may persist for 1–2 yr after the initial presentation.

### **2. Laboratory finding**

#### **• Urine analysis:**

- Macroscopic or microscopic hematuria present in all patients.
- Proteinuria (trace to 2+, but may be in the nephrotic range, usually associated with more severe disease.)
- Red blood cell casts (pathognomonic of acute glomerulonephritis).

#### **2. Blood analysis:**

- Renal function test: variable increase a blood urea, creatinine and electrolytes.
- Protide and lipide are normal.
- Bacteriological and serological evidence of an antecedent streptococcal infection
  - raised ASLO ( > 200 IU/ml )
  - throat swab or skin swab.
- Complement levels
  - C3 level – low at onset of symptoms, normalize by 6 weeks.
  - C4 is usually within normal limits in post-streptococcal AGN.
- Full blood count
  - anaemia (mainly dilutional)
  - leucocytosis may be present .

3. **Ultrasound of the kidney** - not necessary if patient has clear cut acute nephritic syndrome.

**V. DIFFERENTIAL DIAGNOSIS:** includes many of the causes of hematuria listed in annex 1.

## **VI. MANAGEMENT**

### **1. Strict monitoring:**

- fluid intake, urine output, daily weight, blood pressure
- Bed rest
- **Fluid restriction** to control oedema and circulatory overload during oliguric phase until child diureses and blood pressure is controlled
  - Day 1 : up to 400 mls/m<sup>2</sup>/day. Do not administer intravenous or oral fluids

- if child has pulmonary oedema.
- Day 2 : till patient diureses – 400 mls/m<sup>2</sup>/day (*as long as patient remains in circulatory overload*)
- When child is in diuresis – free fluid is allowed
- Diuretic (e.g. furosemide) should be given in children with pulmonary oedema. It is also usually needed for treatment of hypertension.
- **Diet** – no added salt to diet. Protein restriction is unnecessary
- **Look** out for **complications** of post-streptococcal AGN:
  - Hypertensive encephalopathy usually presenting with seizures
  - Pulmonary oedema (acute left ventricular failure)
  - Acute renal failure

## 2. Management of severe complications of post-streptococcal AGN:

- **Hypertension**
  - significant hypertension but asymptomatic
    - bed rest and recheck BP ½ hour later
    - If BP still high, give oral **Nifedipine** 0.25 - 0.5 mg/kg. Recheck BP ½ hour later.
    - monitor BP hourly on 4 hours then 4 hourly if stable.
    - oral Nifedipine can be repeated if necessary on 4 hourly basis.
    - may consider regular oral nifedipine (6-8 hourly) if BP persistently high.
    - add furosemide 1 mg/kg/dose if BP still not well controlled.
    - other anti-hypertensives if BP still not under control:
    - **Captopril** (0.1-0.5 mg/kg q8 hourly), **Metoprolol** 1-4 mg/kg 12 hourly
  - symptomatic, severe hypertension or hypertensive emergency / encephalopathy
    - Symptom/signs: headache, vomiting, loss of vision, convulsions, papilloedema
    - Target of BP control: reduce BP by 25% of target BP over 3 – 12 hours the next 75% reduction is achieved over 48 hours.  
(*see CPG on hypertension in children for more information*)
- **Pulmonary oedema**
  - Give oxygen, prop patient up; ventilatory support if necessary.
  - IV furosemide 2 mg/kg/dose, double this dose 4 hours later if poor response.
  - Fluid restriction – withhold fluids for 24 hours if possible.
  - Consider dialysis if no response to diuretics.
- **Acute renal failure**
  - Mild renal impairment is common;
  - Severe persistent oliguria or anuria with azotaemia is uncommon.
  - Management of severe acute renal failure  
(*see CPG on acute renal failure*)

## 3. Antibiotiques

- **Penicillin V** for 10 days to eliminate  $\beta$  - haemolytic streptococcal infection
- **Erythromycin** if penicillin is contraindicated.

## VII. COMPLICATIONS

Acute complications of this disease result from hypertension and acute renal dysfunction. Hypertension is seen in 60% of patients and may be associated with hypertensive encephalopathy in 10% of cases. Other potential complications include heart failure, hyperkalemia, hyperphosphatemia, hypocalcemia, acidosis, seizures, and uremia.

**VIII. FOLLOW UP:** for at least 1 year.

- Monitor BP at every visit.
- Urinalysis and renal function to evaluate recovery.
- Repeat C3 levels 6 weeks later if not already normalized by time of discharge.

**IX. PROGNOSIS**

Complete recovery occurs in more than 95% of children with poststreptococcal AGN. Mortality in the acute stage can be avoided by appropriate management of acute renal failure, cardiac failure, and hypertension.

**X. PREVENTION AND MEDICAL ADVICES**

- There's no way to prevent most forms of poststreptococcal AGN. However, here must seek prompt treatment of a strep infection causing a sore throat or impetigo. Family members of patients with AGN should be cultured for group A  $\beta$ -hemolytic streptococci and treated if culture positive.
- Any vaccination should be done at least one year after cured.

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DISEASES	POSTSTREPTOCOCCAL GLOMERULONEPHRITIS	IGA NEPHROPATHY	GOODPASTURE SYNDROME	IDIOPATHIC RAPIDLY PROGRESSIVE GLOMERULONEPHRITIS (RPGN)
Clinical manifestations				
Age and sex	All ages, mean 7 yr, 2 : 1 male	10–35 yr, 2 : 1 male	15–30 yr, 6 : 1 male	Adults, 2 : 1 male
Acute nephritic syndrome	90%	50%	90%	90%
Asymptomatic hematuria	Occasionally	50%	Rare	Rare
Nephrotic syndrome	10–20%	Rare	Rare	10–20%
Hypertension	70%	30–50%	Rare	25%
Acute renal failure	50% (transient)	Very rare	50%	60%
Other	Latent period of 1–3 wk	Follows viral syndromes	Pulmonary hemorrhage; iron deficiency anemia	None
Laboratory findings	↑ ASO titers (70%) Positive streptozyme (95%) ↓C3–C9;normal C1, C4	↑ Serum IgA (50%) IgA in dermal capillaries	Positive anti-GBM antibody	Positive ANCA in some
Immunogenetics	HLA-B12, D “EN” (9) <sup>[2]</sup>	HLA-Bw 35, DR4 (4) <sup>[2]</sup>	HLA-DR2 (16) <sup>[2]</sup>	None established
Renal pathology				
Light microscopy	Diffuse proliferation	Focal proliferation	Focal → diffuse proliferation with crescents	Crescentic GN
Immunofluorescence	Granular IgG, C3	Diffuse mesangial IgA	Linear IgG, C3	No immune deposits

Electron microscopy	Subepithelial humps	Mesangial deposits	No deposits	No deposits
Prognosis	95% resolve spontaneously	Slow progression in 25–50%	75% stabilize or improve if treated early	75% stabilize or improve if treated early
	5% RPGN or slowly progressive			
Treatment	Supportive	Uncertain (options include steroids, fish oil, and ACE inhibitors)	Plasma exchange, steroids, cyclophosphamide	Steroid pulse therapy

**Annex 1: Table: Summary of primary renal diseases that manifest as Acute Glomerulonephritis**  
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# HEMATOLOGY

1. Anemia .....	388
2. Immune Thrombocytopenic Purpura .....	398
3. Aplatic Anemia .....	402
4. Acute Lymphoblastic Leukemia .....	405
5. Approach to a Bleeding Child.....	410

## ANEMIA

By Prof. Ty Kieng Hy

### I- DEFINITION

Anemia is defined as a hemoglobin level below reference value. The threshold for defining anemia is a hemoglobin (Hb) or hematocrit (Ht) that is more than two standard deviations below the mean for the reference population. Normal ranges for Hb and Ht vary substantially with age; thus, it is particularly important to use age and sex adjusted norms when evaluating a pediatric patient for anemia

	NB	3-6m	6m-2y	2-6y	6-12Y	12-18Y(G)	12-18Y(F)
Hb mean (g/100ml)	16,5	11,5	12,5	12	13,5	14,5	14
-2SD(g/100ml)	13,5	9,5	10,5	11,5	11,5	13	12
MCV	90-120	72-82	75-85	78-88	80-90	88	90
Reticulocytes	200-400	40-80	40-80	40-80	40-80	40-80	40-80

Table 1- Hemoglobin level for boys and girls of all race/ethnic groups according to ages

### II- EPIDEMIOLOGY

The WHO estimates that worldwide 47% of pre-school children and 42% of pregnant women suffer from anemia, 60% of which is estimated to be due to iron deficiency. Alarming high rates of anemia were found among preschool-aged children in rural Cambodia; prevalence was highest among children less than 24 months of age (nearly 70%).

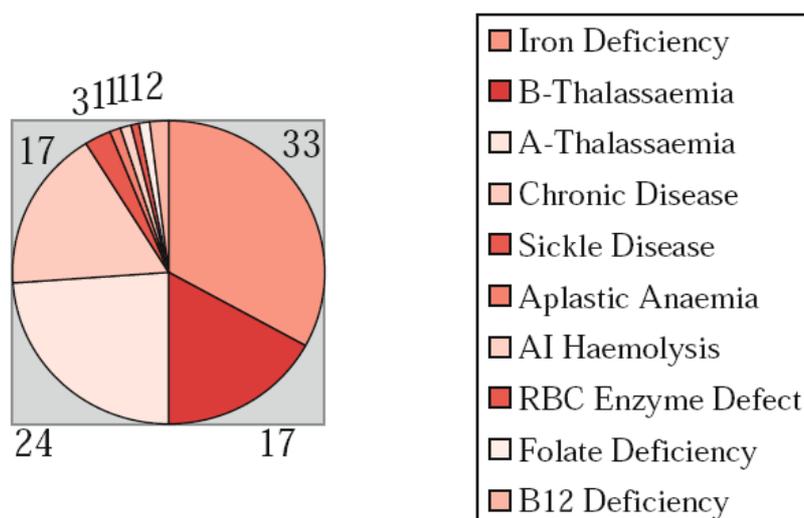


Figure 1 Epidemiology Anemia (globally)

### III- ETIOLOGY

Anemia is caused by:

- Decrease production of red blood cells: nutritional iron and or folic acid deficiency, depress bone marrow function, some infection.
- Loss of red blood cells: acute or chronic hemorrhage (ancylostomiasis ect.)
- Increase destruction of red blood cells (hemolysis): malaria, infections or the intolerance of certain drugs by patients with G6PD deficiency (primaquine, dapsone, cotromoxazole, nalidix acid, nitrofurantoin derivatives ect.) hemoglobinopathies (sickle disease, thalassemias), certain bacterial and viral infections.

In the tropical settings, the causes are often interlinked; the two most common causes are nutritional deficiency and malaria. The groups most at risk are children and young women particularly during pregnancy.

Anemia in itself is not indication of transfusion. Most anemia are well tolerated and can be corrected with simple etiological treatment.

### IV- DIAGNOSIS

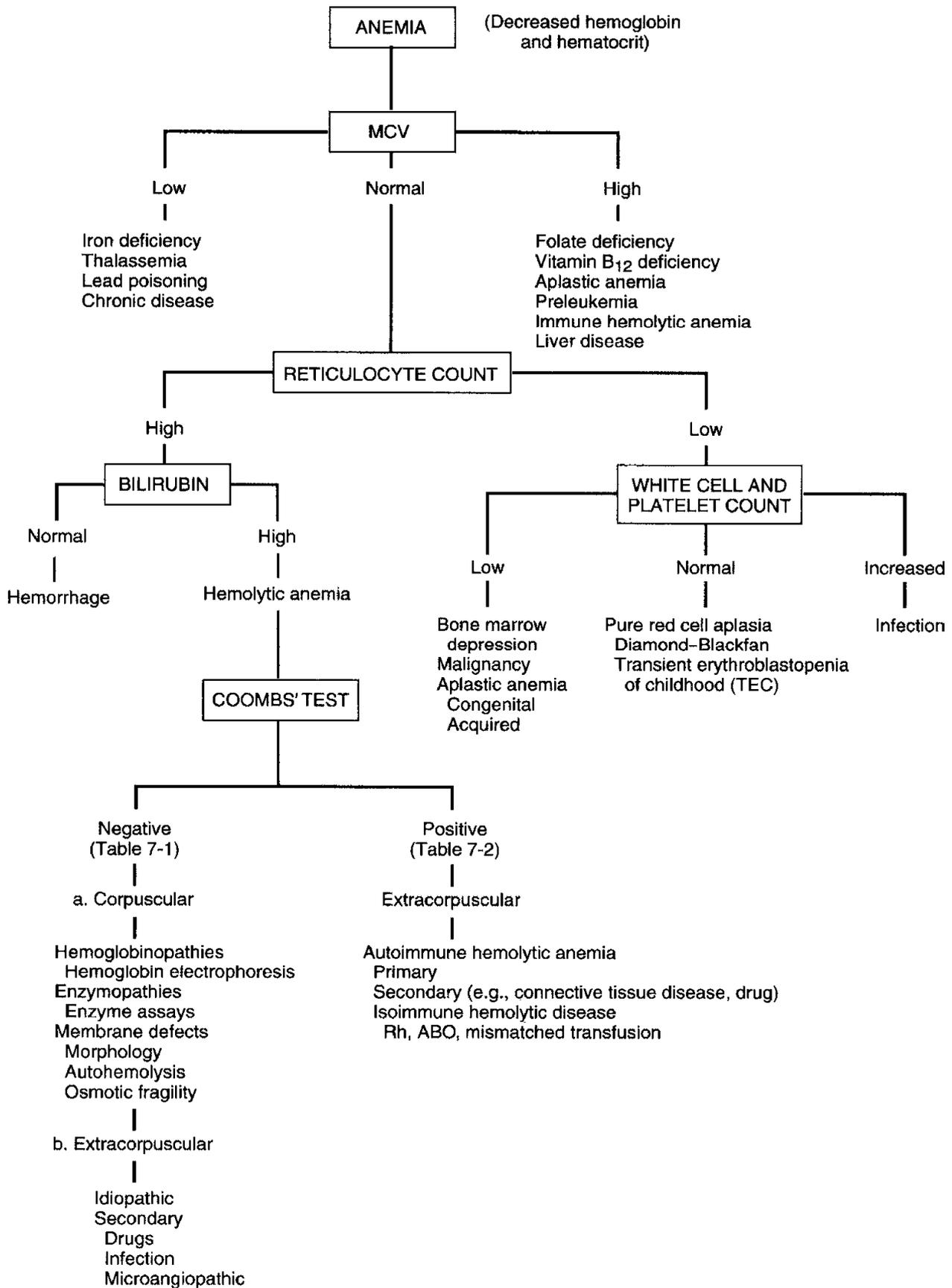
#### 1. Clinical features

- Common signs of anemia: pallor of the conjunctiva, mucous membranes, palms of hand and soles of feet, fatigue, dizziness, edema in the lower limbs, dyspnea, tachycardia, heart murmur.
- Signs that anemia may be immediately life threatening: sweating, thirst, cold extremities, tachycardia, respiratory distress and shock.
- Look for signs of a specific pathology: cheilosis, nutritional deficiency glossitis, hemolytic jaundice, signs of malaria.

#### 2. Laboratory

- Complete blood count
- Peripheral blood smear
- Reticulocytes

### Approach to patient with anemia



## V- TREATMENT

### 1. Immediate life threatening anemia

- i. Oxygen
- ii. Transfusion after determination of blood group and type.
- iii. Blood volume required and rate of transfusion
  1. Newborn and children under 1 year: 15ml/kg over 3-4 hours
  2. Children over 1 year: 20ml/kg over 3-4 hours
  3. Malnourished children: 10ml/kg over 3 hours

Monitor vital signs and watch for clinical signs of transfusion reactions.

### 2. Anemia during the Neonatal Period

- i. Severely affected
  1. Administer 10–20 mL/kg packed red blood cells (hematocrit usually 50–60%) via an umbilical catheter.
  2. Cross-match blood with the mother. If unavailable, use group O Rh-negative blood or saline boluses (temporarily for shock).
  3. Use partial exchange transfusion with packed red cells for infants in incipient heart failure.
- ii. Mild anemia due to chronic blood loss
- iii. Ferrous sulfate (2 mg elemental iron/kg body weight 3 times a day) for 3 months.

### 3. Iron Deficiency Anemia

- i. Maintain breast-feeding for at least 6 months, if possible until 3 years.
- ii. Use an iron-fortified (6–12 mg/L) infant formula until 1 year of age (formula is preferred to whole cow's milk). Restrict milk to 1 pint/day.
- iii. Use iron-fortified cereal from 6 months to 1 year.
- iv. Use evaporated milk or soy-based formula when iron deficiency is due to hypersensitivity to cow's milk.
- v. Elemental Iron (e.g tablet of 200mg ferrous sulphate such as those of ferrous sulphate + folic acid contain 65 mg of elemental iron) po:
  1. Children < 2 years: 30mg/day in 2 divided doses = ½ tablet/day
  2. Children 2-12 years: 120mg/day in divided doses – 2 tablets/day
  3. Adults: 120-180mg/day in divided doses = 2-3 tablets/day

#### Combine with anthelmintic:

- **Albendazole po**
  - Children 1-2 years: 200mg as a single dose
  - Children over 2 years and adults: 400mg as a single dose
- Or**
- **Mebendazole po** children over one year and adults: 500mg as a single dose

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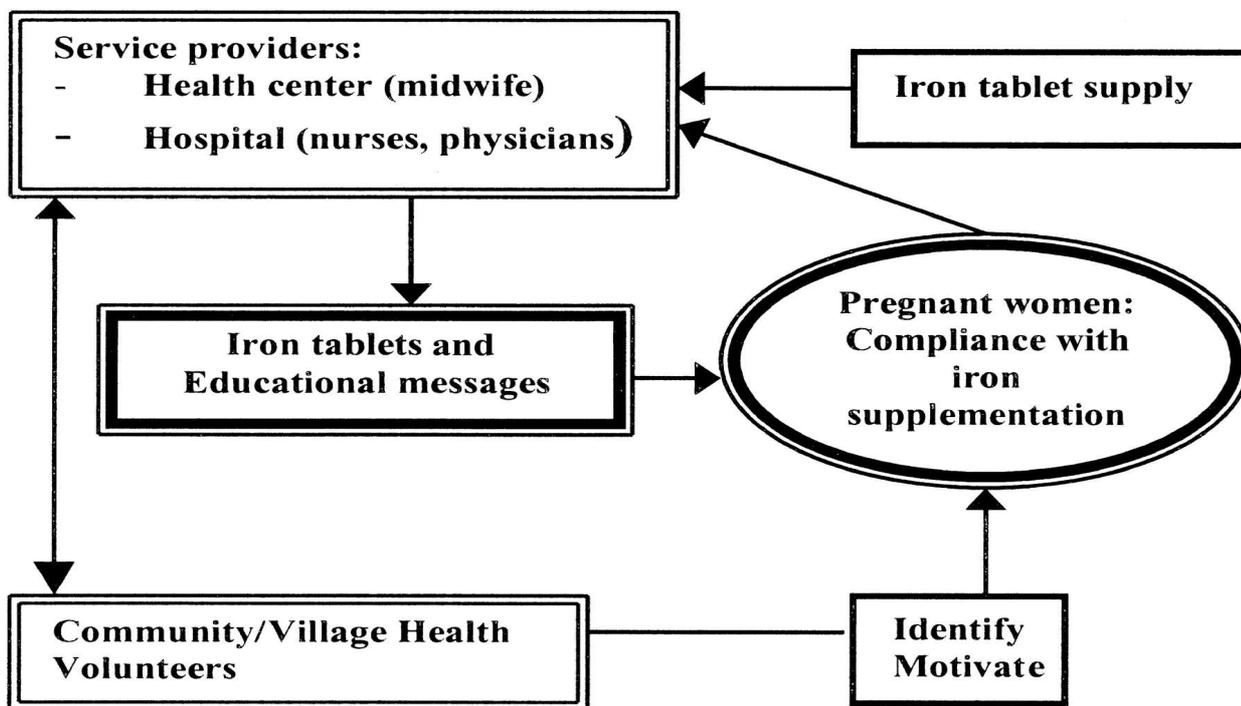
- vi. Provide supplemental iron for low-birth-weight infants:
  1. Infants 1.5–2.0 kg: 2 mg/kg/day supplemental iron
  2. Infants 1.0–1.5 kg: 3 mg/kg/day supplemental iron
  3. Infants <1 kg: 4 mg/kg/day supplemental iron.
- vii. Facilitators of iron absorption such as vitamin C-rich foods (citrus, tomatoes, and potatoes), meat, fish, and poultry should be included in the diet; inhibitors of iron absorption such as tea, phosphate, and phytates common in vegetarian diets should be eliminated.

### 4. Hemolytic Anemia

- i. Folic acid supplementation
- ii. Transfusions as required
- iii. Splenectomy (if transfusion requirements increase); splenectomy does not arrest hemolysis, but decreases transfusion requirements.

## VI- PREVENTION

- Iron or folic acid deficiency
  - Drug supplements: elemental iron (65mg) + folic acid (0.40mg) PO
  - Nutritional supplements if the basic diet is insufficient
- Early treatment of malaria, helminthic infection



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## HEMOPHILIA

By Prof. CHEAN Sophal

### I- DEFINITION

Hemophilia is an X-linked recessive inherited disorder in which there is a defect in the clotting mechanism, but in 30% there is no family history as it is a spontaneous gene mutation. The most common hemophilias are:

Hemophilia A – Deficiency of factor VIII (85% cases)

Hemophilia B – Deficiency of factor IX (15% cases)

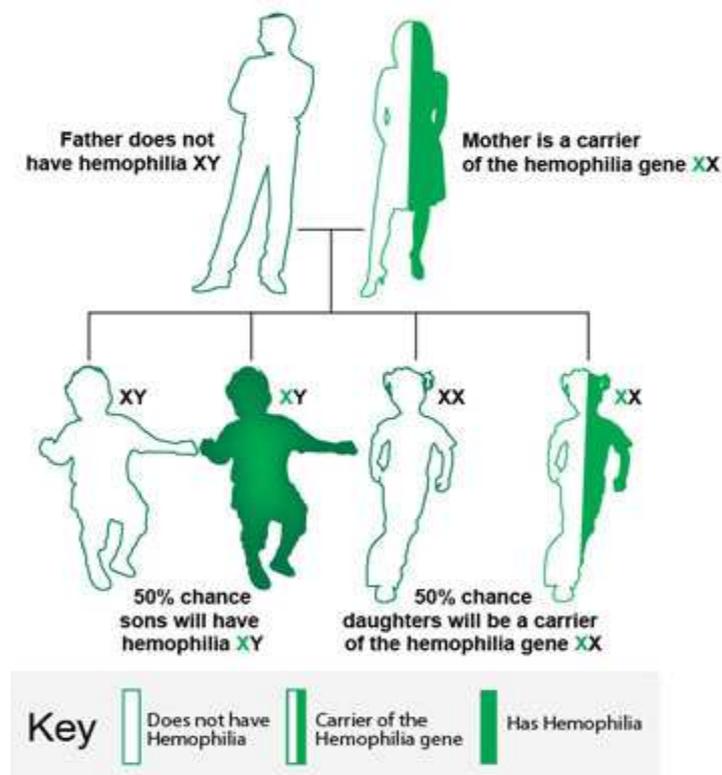
### II- EPIDEMIOLOGY

- Hemophilia is a congenital bleeding disorder, occurring in 20 of every 100,000 of the male population worldwide.
- Current estimates of incidence indicate that 1 in 10,000 males are affected by severe Hemophilia A and 1 in 50,000 males by severe Hemophilia B.
- In Cambodia, the estimated prevalence is about 1,500 cases, and they are currently undiagnosed or misdiagnosed and have, therefore, no adequate management. Based on birth rate (2.4%) in Cambodia, there are 40 new cases born with hemophilia.

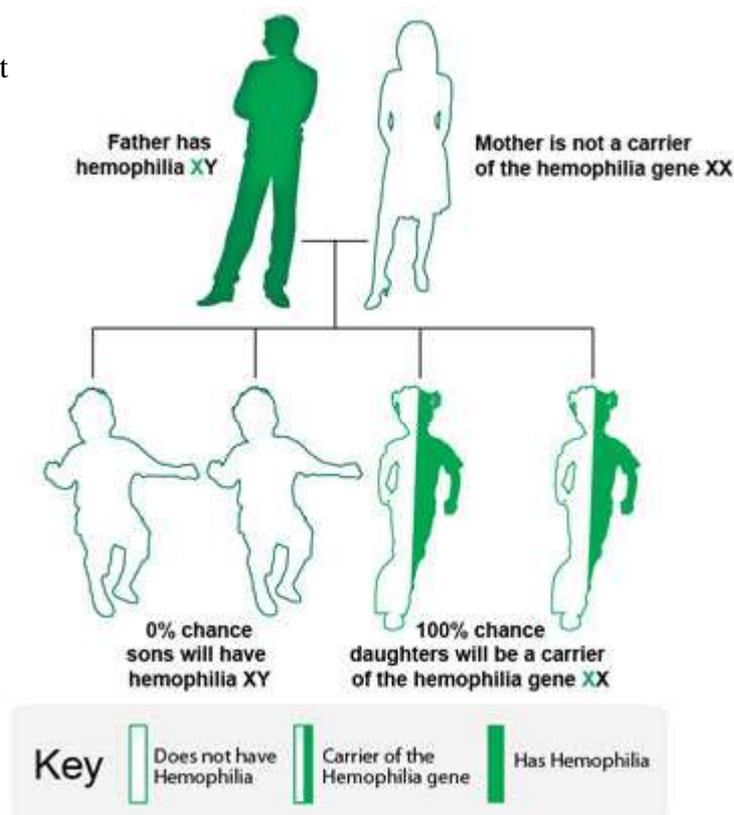
### III- HOW HEMOPHILIA IS INHERITED

The following examples show how the hemophilia gene can be inherited.

1. In this example, the mother is a carrier of the hemophilia gene, and the father does not have hemophilia.
  - There is a 50% chance that each son will have hemophilia.
  - There is a 50% chance that each daughter will be a carrier of the hemophilia gene.



2. In this example, the father has hemophilia, and the mother does not carry the hemophilia gene.
  - All daughters will carry the hemophilia gene.
  - No sons will have hemophilia.



#### IV-DIAGNOSIS

##### 1. Clinical Manifestation

- Bleeding in the neonatal period is unusual
- Usually present with easy bruising when crawling and walking (9-12 months age)
- Hemarthrosis is characteristic of hemophilia.
- Large joints are usually affected (knee, ankle, elbow); swollen, painful joints are common.
- Epistaxis, gum bleeding, hematuria also occur
- Life-threatening intracranial hemorrhages can be life threatening
- Bleeding may also occur spontaneously or after trauma or operation.

##### 2. Diagnostic Investigations

- Full blood count
- Coagulation screen: PT, APTT (*in hemophilia: the APTT is prolonged, PT normal*)
- Specific factor assay: FVIII level (low in Hemophilia A), FIX level (low in Hemophilia B)

Table 1. Classification of hemophilia and clinical presentation

Factor level % activity (IU/ml)	Classification	Clinical presentation
< 1% (0.01)	Severe	Spontaneous bleeding, predominantly in joints and muscles, risk of intracranial hemorrhage
1% - 5% (0.01 – 0.05)	Moderate	Occasional spontaneous bleeding. Severe bleeding with trauma, surgery
5% - 40% (0.05 – 0.40)	Mild	Severe bleeding with major trauma or surgery

##### 3. Further Investigations

- Hepatitis B surface antigen, anti-HBs antibody
- Hepatitis C antibody

- HIV serology
- Diagnosis of carrier status for genetic counseling.
  - mother of a newly diagnosed son with hemophilia
  - female siblings of boys with hemophilia
  - daughter of a man with hemophilia

Once a child is diagnosed to have hemophilia, check the viral status at diagnosis and then yearly. This is because treatment carries the risk of acquiring viruses. All hemophiliacs should be immunized against Hepatitis B.

## V- TREATMENT

Treatment consists of replacing the missing factor :

- FVIII concentrates for hemophilia A; FIX concentrates in Hemophilia B
- Fresh Frozen Plasma (FFP) (if factor concentrates are not available) but high risk for viral transmission. One ml of FFP contains 1 unit of FVIII activity; less than 1 unit of FIX activity. Starting dose is 15-20 ml/kg.
- Formula for calculating dose:
  - units of Factor VIII : (% level desired) x (weight in kg) x 0.5
  - units of Factor IX : (% level desired) x (weight in kg) x 1.4
- The percentage of factor desired depends on the type of bleed.
  - For hemarthroses, 30-40% is adequate.
  - For soft tissue or muscle bleed, desired 40- 50% level.  
(*there is potential to track and cause compression/compartement syndrome*)
  - For intracranial bleeds or patients going for surgery, desired 80-100%
- Factor VIII is given every 8 – 12 hours. Factor IX is given every 12 – 24 hours.
- Duration of treatment depends on type of bleed:
  - Hemarthroses 2-3 days
  - Soft tissue bleeds 4-5 days
  - Intracranial bleeds or surgery 7-10 days.

### ***Intracranial hemorrhage (ICH)***

- Give factor replacement before suspected bleed is confirmed by CT scan
- Initial dose is 80%
- Urgent CT scan:
  - if scan confirms ICH : maintain factor level above 50% , give factor concentrates 6-8 hourly for at least 3-5 days depending on the clinical response, then reduce dose to maintain at 30%, initially 12 hourly and then daily up to a total of 10 -14 days replacement therapy
  - if CT scan show no evidence of ICH, admit 1 day for observation
- follow up CT scan after 2 weeks

### ***Surgery***

- Calculate dose
  - ½ hour before operation, infuse patient with appropriate factors.
  - Initial dose is 80%
- Check post infusion specific factor level ½ hour later if necessary or after surgery to ensure correct factor level is achieved
- Clotting factor level should be maintained above 50% during the operation and 24 hours after surgery.
  - day 3 till day 7 – maintain at 50%
  - day 8 till day 14 – reduce the dose gradually
- Replacement therapy is recommended post operatively for at least 10 -14 days

- Replacement therapy should be given as long as there is bleeding plus another 5 –10 days after the bleeding stops, until the wound heals

### ***Iliopsoas bleed***

- Complete bed rest
- Give factor replacement early - aim for level > 50% for hemophilia A & B
- Maintain level > 50% with factor concentrates given 8 hourly for hemophilia A and 12 hourly for hemophilia B for at least 3-5 days. Reduce dose accordingly.
- A minimum of 10 – 14 days replacement therapy is recommended
- Physiotherapy – when pain subsides

### ***Hematuria***

- Bed rest
- Drink plenty of water
- Monitor for first 24 hours: Urine Full Examination - Microscopic Examination
- If bleeding persists for > 24 hours, start factor concentrate infusion. Perform an x-ray of the kidneys, ureter, and bladder & ultrasound of the kidneys
- *DO NOT give antifibrinolytic drugs (tranexamic acid) because this may cause formation of clots in the tubules which may not re-canalize.*

### ***Hemarthroses (Joint hemorrhages)***

- Episodic replacement therapy is the main stay of treatment
- Most spontaneous hemarthroses respond to a single infusion of factor concentrate. Aim for a level of 30 % to 40%.
- If swelling or spasm is present, treatment to level of 50% is required and infusion may have to be repeated at 12-24 hours interval, until pain subsides
- Minor hemarthroses may not require immobilization
- Elastic bandage or slings and ice may help in pain relief
- In severe hemarthroses:
  - Rest, splint in position of comfort, give analgesics if required
  - Factor replacement
  - Joint rehabilitation to be started as soon as possible

### ***Supportive Treatment***

#### ***Analgesia***

There is rapid pain relief in hemarthroses once missing factor concentrate is infused. If analgesia is required, avoid intramuscular injections. Also do not use aspirin or the non-steroidal anti-inflammatory drugs (NSAIDS) as risk of bleeding.

#### ***Dental care***

Good dental hygiene is important as dental caries are a regular source of bleeding. Dental clearance with factor replacement will be required in severe cases.

## **VI-IMMUNIZATION**

These are important and must be given: in this case intramuscular injections are allowed: use the smallest gauge needle to minimize trauma. If a baby has had a hematoma after immunization, give the next injection under factor cover.

## VII- COMPLICATIONS

### *Joint destruction*

Recurrent hemarthroses into the same joint will destroy the joint causing osteoarthritis and deformity. This can be prevented by prompt and adequate factor replacement.

### *Acquisition of viruses*

Hepatitis B, C or HIV: immunization and regular screening is recommended.

### *Inhibitors*

In 15-25% cases of hemophilia A, patients may develop antibodies to the missing factors. This is suspected when factor replacement does not result in clinical improvement. If a patient is suspected to have inhibitors, the case should be discussed with a hematologist.

## VIII- EDUCATION

When your child is diagnosed with a bleeding disorder, there will be challenges, both physically and emotionally. Most children want to play and socialize, and this means engaging in physical activities that could be dangerous to a child with a bleeding disorder.

### *Be prepared*

Find out all you can about treatments, bleeding prevention and what to do in emergencies. Know the signs of bleeding to look for in your child, and keep cold packs in the freezer for bumps and bruises.

### *Inform others*

Be sure to inform anyone who will be taking care of your child about your child's condition — signs to look for and what to do in case of a bleeding episode, whether it's minor or major. Such individuals include babysitters, teachers and day care staff, coaches and other school staff members.

### *Play it safe*

Most physical activities and sports are safe for children with bleeding disorders, though this will depend on the severity of your child's condition. Talk to the doctor or physical therapist about what's safe for your child. It is advisable for children to wear protective gear (such as helmets and knee and elbow pads) during activities that bring a high risk of injury.

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# IMMUNE THROMBOCYTOPENIC PURPURA

*By Prof. CHEAN Sophal*

## I- DEFINITION

Immune thrombocytopenic purpura (ITP) is an isolated thrombocytopenia which is secondary to increased destruction of platelets by the macrophages in the reticulo-endothelial system, particularly the spleen, and no associated conditions.

*Table 1 : Features of Acute and Chronic ITP*

<b>FEATURES</b>	<b>ACUTE</b>	<b>CHRONIC</b>
Presentation	Abrupt	Insidious
Age	Usually young (2 – 10 years)	Adolescents and Adults
Sex	Equal in boys and girls	More common in female patients
Associated conditions	Antecedent viral infections	Autoimmune disorders
Duration of thrombocytopenia	< 6 months	> 6 months

## II- EPIDMIOLOGY

- It is the most common acquired bleeding disorders in children with prevalence 5/100,000.
- Peak age 2 – 10 yr
- Sex : Boys = Girls

## III- PATHOGENESIS

- Etiology is still unknown. It is an autoimmune disorder affecting platelets, usually self-limiting disorder that resolves spontaneously.
- Most pediatric cases, the thrombocytopenia is consequent to antibodies formed against platelets in response to a viral infection (70% of cases, usually occurring 1 – 4 weeks before the onset of ITP) or underlying defects of immune regulation.

Table 2 : Other causes of thrombocytopenia

- Neonatal alloimmune/ isoimmune thrombocytopenia if < 6 months old
- Sepsis and infections including HIV infection
- Drug-induced thrombocytopenia
- Hematological malignancy e.g. acute leukemia
- Congenital marrow failure syndromes e.g. Fanconi anemia, thrombocytopenia with absent radius
- Autoimmune disorders e.g. Systemic lupus erythematosus, Evan syndrome
- Primary immunodeficiency syndromes e.g. Wiskott -Aldrich syndrome

#### IV-DIAGNOSIS

The diagnosis is based on history, physical examination, blood counts, and examination of the peripheral blood smear, which should exclude other causes of thrombocytopenia.

##### 1. Clinical Presentation

- Onset is usually acute with history of viral illness in the several weeks preceding onset in a previously healthy 2 – 10 yr old child, presented by generalized petechiae, ecchymosis, and easy bruising – especially over the legs.
- Hemorrhages of the mucous membranes, hemorrhagic bullae of the gums and lips, subconjunctival hemorrhage.
- Epistaxis, gingival bleeding, GI bleeding, hematuria and menorrhagia are common with profound thrombocytopenia (platelet count < 10,000/mm<sup>3</sup>).

Otherwise normal physical examination

- Non-Toxic appearance
- Usually there is an absence of lymphadenopathy and hepato-splenomegaly

##### 2. Laboratory finding

- The role of laboratory data is to exclude other causes of thrombocytopenia.
- Typically, the CBC is normal except for the **low platelet count** (usually < 20, 000) and anemia if there is a history of significant bleeding.
- Large platelets on the blood smear (increased MPV).
- Bone marrow aspiration shows normal or increased megakaryocytes, normal myeloid and erythroid elements and the absence of abnormal cell populations.

Bone marrow examination is rarely performed and is indicated if :

- Atypical features : organomegaly, significant lymphadenopathy, abnormal blood counts suspicious peripheral blood picture.
- Failure to respond to steroid therapy
- Persistent thrombocytopenia > 6 months
- Thrombocytopenia recurs after initial response to treatment

#### V- TREATMENT

*Not all children with diagnosis of acute ITP need hospitalization. ITP in many children – certainly those without hemorrhage – is managed on an outpatient basis with minimal investigation, short-term therapy in select cases.*

Hospitalization is indicated if :

- Severe life-threatening bleeding (e.g. intracranial hemorrhage [ICH]) regardless of platelet count
- Platelet count  $< 20,000/\text{mm}^3$  with evidence of bleeding
- Platelet count  $< 20,000/\text{mm}^3$  without bleeding but inaccessible to health care
- Parents request for admission

Most children remit spontaneously : 70% achieve a platelet count  $> 50,000/\text{mm}^3$  by the end of the 3<sup>rd</sup> week, normalized platelet count within 6 months.

Careful observation and monitoring of platelet count, without specific treatment, is appropriate for patients with :

- Platelet count  $> 20,000/\text{mm}^3$  without bleeding
- Platelet count  $> 30,000/\text{mm}^3$  with only cutaneous purpura

Treatment is indicated if there is :

- Life threatening bleeding episode (e.g. ICH) regardless of platelet count
- Platelet count  $< 20,000/\text{mm}^3$  with mucosal bleeding
- Platelet count  $< 10,000$  with little or no purpura

Choice of treatment includes :

- Oral Prednisolone 2-4 mg/kg/day for 7 days, then taper and discontinue at 21 days
- IV Methylprednisolone 30 mg/kg/day for 3 days
- IVIG 0.8 g/kg/dose over 3 hrs for 1 day or 250 mg/kg for 2 days
- IV anti-D immunoglobulin 50  $\mu\text{g}/\text{kg}$  single dose over 5 mn in Rhesus positive patients
- Platelet transfusion : antiplatelet antibodies will bind to transfused platelets as well as they do to autologous platelets. Thus, platelet transfusion in ITP is usually not recommended unless life-threatening bleeding is present, dose 0.2 unit/kg

*Notes regarding treatment :*

- *There is no evidence that these treatments reduce bleeding complications or mortality or influence progression to chronic ITP.*
- *Steroids should not be continued if there is no response or if there is a rapid relapse after withdrawal.*
- *Treatment should not be directed at increasing the platelet count above a preset level but rather on the clinical status of the patient.*

### **Treatment of chronic ITP**

- Asymptomatic children can be left without therapy and kept under observation.
- Symptomatic children may need short course of treatment to tide them over the relapse which includes :
  - intermittent pulses of steroids (care must be taken to avoid treatment-related steroid side-effects)
  - intermittent anti-D antibody
  - intermittent pulses of IVIG

### **Splenectomy**

- Is indicated when :
  - Persistence of disease after 12 months with bleeding symptoms and platelet count  $< 10,000/\text{mm}^3$ , mostly in patients over 5 years of age
  - No response or only transient success with intermittent pulsed steroids, anti-D or IVIG.
  - No contra-indications to surgery

- Over 70% rate of complete remission post-splenectomy
- Pre-splenectomy immunization against pneumococci, *haemophilus influenzae* type b and meningococci infection mandatory 2 weeks before surgery
- Post-splenectomy sepsis – *Bacterial sepsis* (~ 3%)
- Post-splenectomy : penicillin prophylaxis for a number of years

## VI-COMPLICATIONS

- Serious bleeding in ITP : 2 – 4%
  - Epistaxis, GI bleeding, hematuria, menorrhagia
  - Risk of ICH in newly diagnosed ITP child within 1<sup>st</sup> year is < 1% of cases with mortality rate 50%. Risk factors : Platelet < 10,000, antiplatelet drugs (Aspirin, NSAIDs ...), head trauma.

## VII- EDUCATION

To prevent bleeding, the parents of a child with the disorder need to be aware of how to prevent injuries and bleeding. Consider the following :

- For the young child, make the environment as safe as possible. Padding a crib, wearing helmets, and providing protective clothing are necessary when platelet counts are low.
- Avoidance of activities that predispose your child to trauma such as contact sports, riding bicycles, and rough play
- Avoid medications that impair platelet function (aspirin, non-steroidal anti-inflammatory drugs, and antihistamines) as they may interfere with the body's ability to control bleeding.

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# APLATIC ANEMIA

By Prof. Ty Keang Hy

## I. DEFINITION

The aplastic anemia is characterized by peripheral blood pancytopenia, bone marrow hypocellularity, and absence of a clonal hematological process.

- The International Agranulocytosis and Aplastic Anemia Study has defined aplastic anemia as hemoglobin  $\leq 10$  g/dl, platelet count  $\leq 50 \times 10^9/L$ , granulocytes  $\leq 1.5 \times 10^9/L$ , and a bone marrow biopsy demonstrating a decrease in cellularity and the absence of significant fibrosis or neoplastic infiltration.
- Severe aplastic anemia (SAA) is diagnosed when there is less than 25% of normal bone marrow cellularity, determined by bone marrow biopsy, and at least two of the following peripheral blood findings: granulocytes  $< 0.5 \times 10^9/L$ , platelets  $< 20 \times 10^9/L$ , or absolute reticulocytes  $\leq 40 \times 10^9/L$  ( $< 1\%$  when corrected for hematocrit).
- Very severe AA is defined when the above criteria for SAA are met and the granulocyte count  $< 0.2 \times 10^9/L$ .
- Moderate AA is defined when the criteria for SAA are not met.

## II. EPIDEMIOLOGY

They have an incidence of approximately two patients per million population in the West and four per million in Asia.

- The incidence of AA in childhood ( $< 15$  years) is reported as 1–3 per million children per year.
- The age of presentation peaks at 15–25 years and older than 60 years.
- A high proportion of children ( $> 70\%$ ) have severe disease at the time of presentation.
- There is a slightly higher proportion of males.

## III. ETIOLOGY

### a. Inherited

- Fanconi anemia
- Diamond-Blackfan anemia
- Dyskeratosis congenital
- Shwachman-Diamond syndrome

### b. Direct Toxicity

- Iatrogenic: Radiotherapy, Chemotherapy
- Chemicals: Benzene, Pesticides
- Drugs (Chloramphenicol?)

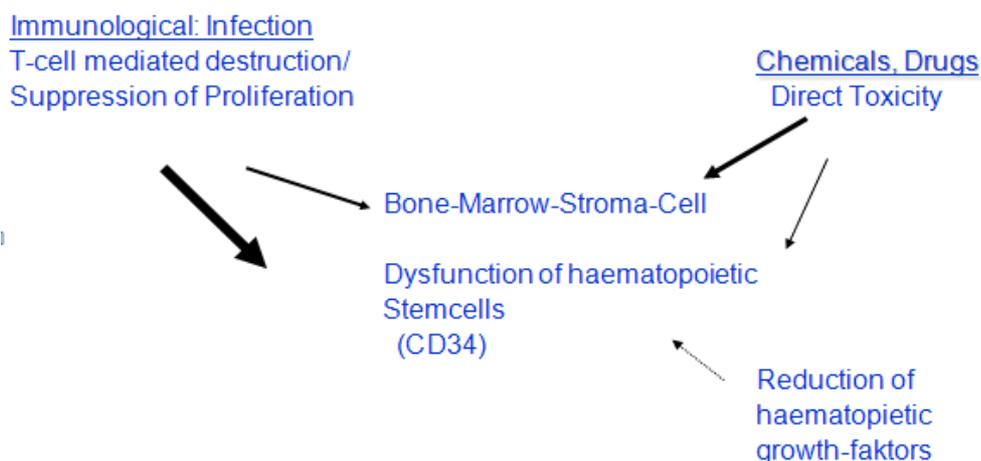
### c. Immunological mediated

- Idiopathic (70-80%)
- Virus infection
  - Parvo B19, EBV, HIV
  - Posthepatic aplastic anemia (mostly HV neg, HCV)
  - Tuberculosis
- Iatrogenic: Transfusion associated GVHD
- Benzene [evidence based on large industrial studies (Yin et al, 1987, 1996; Smith, 1996)]
- Pesticides: DDT Organochlorines, e.g. Lindane, Organophosphates,
- Pentachlorophenol [Fleming & Timmeny, 1993; Roberts, 1997 (literature reviews of case reports), Muir et al, 2003
- Cutting oils and lubricating agents (Muir et al, 2003)
- Recreational drugs: methylenedioxy-methamphetamine (MDMA)
- Antibiotics Chloramphenicol\*, Sulphonamides
- Anti-rheumatics Gold, Penicillamine
- Anti-inflammatory Phenylbutazone, Indomethacin,
- Diclofenac, Naproxen, Piroxicam
- Anti-convulsions Phenytoin, Carbamazepine
- Anti-thyroids Carbimazole, Thiouracil
- Anti-depressants Dothiepin, Phenothiazines
- Anti-diabetics Chlorpropamide
- Anti-malarial Chloroquine

## IV. PHYSIOPATHOLOGY

Three main mechanisms have been implicated in the pathophysiology of acquired AA:

- an “autoimmune attack” on hematopoietic progenitor cells +++
- inherent stem cell defects
- defects of the bone marrow stroma.



## V. CLINICAL PRESENTATION

Symptoms are related to the pancytopenia:

- Thrombocytopenia: Bleeding (Petechia, mucosal bleeding)
- Anemia: Paleness, weakness, tachycardia
- Leuco-/Neutropenia: Infections (bacterial > fungal > viral)
- Usually no splenomegaly, no lymphadenopathy

## VI. DIAGNOSIS AND LABORATORY FINDINGS

- Detail history, developmental histories, careful physical examination
- Screen for potential etiologies such as inherited bone marrow failure syndrome;
- History of any previous hematologic derangements, drugs exposures...
- Complete blood count: pancytopenia and absolute reticulopenia.
- Peripheral blood smear commonly shows red blood cell macrocytosis.
- Hemoglobin F and MCV (mean corpuscular volume) can be high in acquired AA, but less frequently and lesser degree compared with inherited bone marrow failure.
- Bone marrow examination is essential for confirmation of hypoplasia and to rule out others causes of pancytopenia.
- Viral serology, including cytomegalovirus, Epstein–Barr virus, parvovirus B19, hepatitis A, B, and C, human immunodeficiency virus, and herpes simplex virus type 6, is of value in diagnosis and for later management.

## VII. TREATMENT

### 1- Supportive Therapy

- Blood transfusion:
- Prophylaxis for bacterial infections
  - Granulocytes  $< 0.5 \times 10^9/L$ : **Bactrim**<sup>®</sup> 25mg/kg/day
- Acute Infection: Treat as fever and neutropenia :
  - Give gram negative coverage (Ampicilline<sup>®</sup> /Gentamycin<sup>®</sup>)
  - Use antifungal drugs (Amphotericin B<sup>®</sup>) after 4-5d of fever.
- Draw blood culture, treat according to antibiogramme

### 2- Therapy strategy

- Allogenic Stemcelltransplantation (SCT)
- Immunosuppressive Therapy (IST)

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# **ACUTE LYMPHOBLASTIC LEUKEMIA**

*By Dr. Heng Sothy*

## **I- INTRODUCTION**

The leukemias are the most common malignant neoplasms in childhood, accounting for about 41% of all malignancies that occur in children <15 yr of age.

Acute lymphoblastic leukemia (ALL) accounts for about 77% of cases of childhood leukemia, acute myelogenous leukemia (AML) for about 11%, chronic myelogenous leukemia (CML) for 2–3%, and juvenile chronic myelogenous leukemia (JCML) for 1–2%. The remaining cases consist of a variety of acute and chronic leukemias that do not fit classic definitions for ALL, AML, CML, or JCML.

The leukemias may be defined as a group of malignant diseases in which genetic abnormalities in a hematopoietic cell give rise to an unregulated clonal proliferation of cells. The progeny of these cells have a growth advantage over normal cellular elements, because of their increased rate of proliferation, and a decreased rate of spontaneous apoptosis. The result is a disruption of normal marrow function and, ultimately, marrow failure. The clinical features, laboratory findings, and responses to therapy vary depending on the type of leukemia.

## **II- DEFINITION**

Acute lymphoblastic leukemia (ALL) is a malignant disorder of lymphoblasts occurring as a result of indefinite clonal proliferation of a single lymphoblast that has undergone malignant transformation. This lymphoblastic clonal proliferation leads to overgrowth and the crowding out of normal bone marrow precursors, invasion of nonhematopoietic tissues, and suppression of differentiation of normal cells causing ineffective hematopoiesis.

## **III- EPIDEMIOLOGY**

- Incidence of ALL is 1/1700 in children under the age of 15 years age. Peak incidence occurs between 2 and 5 years of age
- Predominant sex: Male > Female (slightly)
- Acute leukemia is the most common cancer of childhood
- 75% to 80% of acute leukemia in childhood is ALL

## IV-AETIOLOGY

- In virtually all cases, the etiology of ALL is unknown,
- Although several genetic and environmental factors are associated with childhood leukemia, exposure to medical diagnostic radiation both in utero and in childhood has been associated with an increased incidence of ALL.
- Epstein-Barr virus is implicated in Burkitt leukemia/lymphoma.

### Genetic predisposition

- Identical twins
- Trisomy 21 (Down syndrome)
- Ataxia telangectasia
- Bloom syndrome
- Wiscott-Aldrich syndrome
- Congenital hypogammaglobulinemia

### Immunodeficiencies

- Prolonged immunosuppressive therapy is related to lymphoid malignancies
- Exposure to ionizing radiation (not diagnostic x-rays)
- Chemical exposure

Other risk factors include in utero x-ray exposure and therapeutic postnatal radiation.

## V- PATHOGENESIS

In general, cancer is caused by damage to [DNA](#) that leads to uncontrolled cellular growth and spread throughout the body, either by increasing chemical signals that cause growth or by interrupting chemical signals that control growth. Damage can be caused through the formation of [fusion genes](#), as well as the dys-regulation of a [proto-oncogene](#) via juxtaposition of it to the promoter of another gene, e.g. the [T-cell receptor](#) gene. This damage may be caused by environmental factors such as chemicals, drugs or radiation.

## VI-CLASSIFICATION

**The FAB classification** Subtyping of the various forms of ALL used to be done according to the French-American-British (FAB) classification, which was used for all acute leukemias (including acute myelogenous leukemia, AML).

- ALL-L1: small uniform cells
- ALL-L2: large varied cells
- ALL-L3: large varied cells with vacuoles (bubble-like features)

Each subtype is then further classified by determining the surface markers of the abnormal lymphocytes, called immunophenotyping. There are 2 main immunologic types: pre-B cell and pre-T cell. The mature B-cell ALL (L3) is now classified as Burkitt's lymphoma/leukemia. Subtyping helps determine the prognosis and most appropriate treatment in treating ALL.

## VII- DIAGNOSIS

### 1- History: ask about:

- Bleeding (cutaneous and mucosal); easy bruising; petichiae,
- Bone pains; arthralgia, limp,
- Fatigue and pallor,

**2- Physical Examination**

- Petechiae and purpura, subconjunctival and retinal hemorrhages
- Anemia
- Lymphadenopathy (generalized)
- Hepatosplenomegaly
- Fever, infection

**3- LAB:**

- CBC
  - Significance: Increased white blood count
    - $>10,000/\text{mm}^3$  in 50% of cases
    - $>50,000/\text{mm}^3$  in 20% of cases
    - Neutropenia ( $<500/\text{mm}^3$ ) common
    - Hb  $<10$  g/dL in 80% of cases
    - Thrombocytopenia ( $<100,000/\text{mm}^3$ ) in 75% of cases
  - Peripheral blood lymphoblasts: the leukemic cells are often initially reported to be atypical lymphocytes.
- Test: Bone marrow aspirate:  $>25\%$  leukemic lymphoblasts is diagnostic.
- Test: CSF examination with lymphoblast: CNS leukemia (5% at diagnosis)
- **Medical imaging** (such as **ultrasound** or **CT scanning**) can find invasion of other **organs** commonly the **lung**, liver, spleen, lymph nodes, brain, kidneys, and reproductive organs.

**VIII- DIFFERENTIAL DIAGNOSIS****Nonmalignant conditions:**

- Aplastic anemia
- Infectious mononucleosis
- Acute infectious lymphocytosis
- Idiopathic thrombocytopenic purpura
- Juvenile rheumatoid arthritis

**Malignant conditions:**

- Acute myeloid leukemia
- Neuroblastoma with bone marrow involvement
- Lymphoma with bone marrow involvement
- Rhabdomyosarcoma
- Retinoblastoma

**IX- TREATMENT**

The earlier acute lymphocytic leukemia is detected, the more effective the treatment. The aim is to induce a lasting **remission**, defined as the absence of detectable cancer cells in the body (usually less than 5% blast cells on the bone marrow).

Treatment for acute leukemia can include **chemotherapy**, **steroids**, **radiation therapy**, intensive combined treatments (including **bone marrow** or **stem cell** transplants), and growth factors.

**Chemotherapy:** (follow Treatment protocol for acute lymphoblastic leukemia of childhood in Kantha Bopha Children's Hospital, Cambodia)

Chemotherapy is the initial treatment of choice. Most ALL patients will receive a combination of different treatments. In general, cytotoxic chemotherapy for ALL combines multiple antileukemic drugs in various combinations.

Chemotherapy for ALL consists of three phases: induction, consolidation, and maintenance therapy.

- Induction: 6weeks. Vincristne, Daunorubicine, L-Asparaginase, Dexamethasone and IT (Intrathecaltherapy [IT]: Methotrexate, Cytosar and Prednisolone).
- Consolidation: 26weeks. Vincristne, Daunorubicine, L-Asparaginase, Dexamethasone, 6-mercaptopurine, Methotrexate and IT.
- Maintenance: continue until 2 years. 6-mercaptopurine, Methotrexate, Dexamethasone, Vincristne and IT.

## X- COMPLICATIONS

Due to disease:

- Hyperleukocytosis (WBC >400,000): can lead to stroke
- Mediastinal mass (usually T-cell lineage): can lead to cardiorespiratory arrest
- Tumor lysis syndrome: can lead to renal failure, cardiac arrhythmias
- Coagulopathy: can lead to stroke and hemorrhage
- Severe anemia: can lead to congestive heart failure
- Hypercalcemia: can lead to renal failure, cardiorespiratory arrest
- Febrile neutropenia can lead to infections, shock, sepsis

Due to therapy:

- Vincristine (VCR)
  - Syndrome of inappropriate antidiuretic hormonal
  - Hair loss
- L-asparaginase
  - Pancreatitis
  - Coagulopathy leading to cerebral infarcts or thrombosis
- Adriamycin/Doxorubicin/Daunorubicin
  - Cardiac toxicity
- Cyclophosphamide
  - Hemorrhagic cystitis
  - Sterility
- Methotrexate (MTX): Hepatotoxicity

## XI-PROGNOSIS

- Remission induction in all risk categories with presently available therapy is 95%.
- Long-term survival overall approaches 80%
- Long-term survival in standard risk group is about 85% (>5 years after completion of therapy) and slightly higher for girls than for boys.
- Long-term survival in high-risk group is about 60% to 65%.

### Prognostic Factors

A) Definition of Standard Risk (SR) patients: Patients belong to this group if they have:

1. Initial WBC less than 50,000/ $\mu$ l;
2. Age over 1 year;
3. No initial CNS-involvement;
4. No pre T/T-immunology or mediastinal involvement; (if available)

5. Complete Remission by day 36 of therapy
6. No initial signs of high risk (see below)

**B) Definition of High Risk (HR) patients:** To this group belong the patients for whom **at least one** of the following criteria is true:

1. Initial WBC is more than 50,000/ $\mu$ l;
2. Age < 1 year or > 10 years
3. Initial CNS-involvement;
4. Mediastinal mass (on X-ray) and/or T-cell phenotype (Immunophenotyping currently not available!)
5. Absence of remission on day 36 of therapy
6. More than 1000 blasts/mm<sup>3</sup> at day 8 in the peripheral blood after the first week of monotherapy (steroid poor responder).

## **XII- MEDICAL ADVICES**

- Risks of infection, transfusion, chemotherapy.
- In suspect case of ALL please transfer a patient to reference hospitals where the diagnosis and treatment can be done such as Kantha Bopha Children's Hospital.

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# APPROACH TO A BLEEDING CHILD

By Prof. CHEAN Sophal

## I- INTRODUCTION

The presentation of an infant or child with symptoms of bruising and/or bleeding commonly causes considerable anxiety to both pediatricians and hematologists.

When evaluating a child with a potential bleeding disorder, it is extremely crucial to ascertain whether the patient's symptoms are appropriate to a bleeding disorder and whether further investigation of an underlying bleeding disorder is required. To understand approach to a bleeding child, it is essential to know the steps in hemostasis.

## II- PHYSIOLOGY OF HEMOSTASIS

Hemostasis is a delicate balance between clot formation, anticoagulation and fibrinolysis and it occurs in the following phases:

- Vascular response
- Platelet adhesion
- Platelet aggregation
- Clot formation
- Clot stabilization
- Limitation of clot by anticoagulation
- Fibrinolysis to reestablish vascular patency

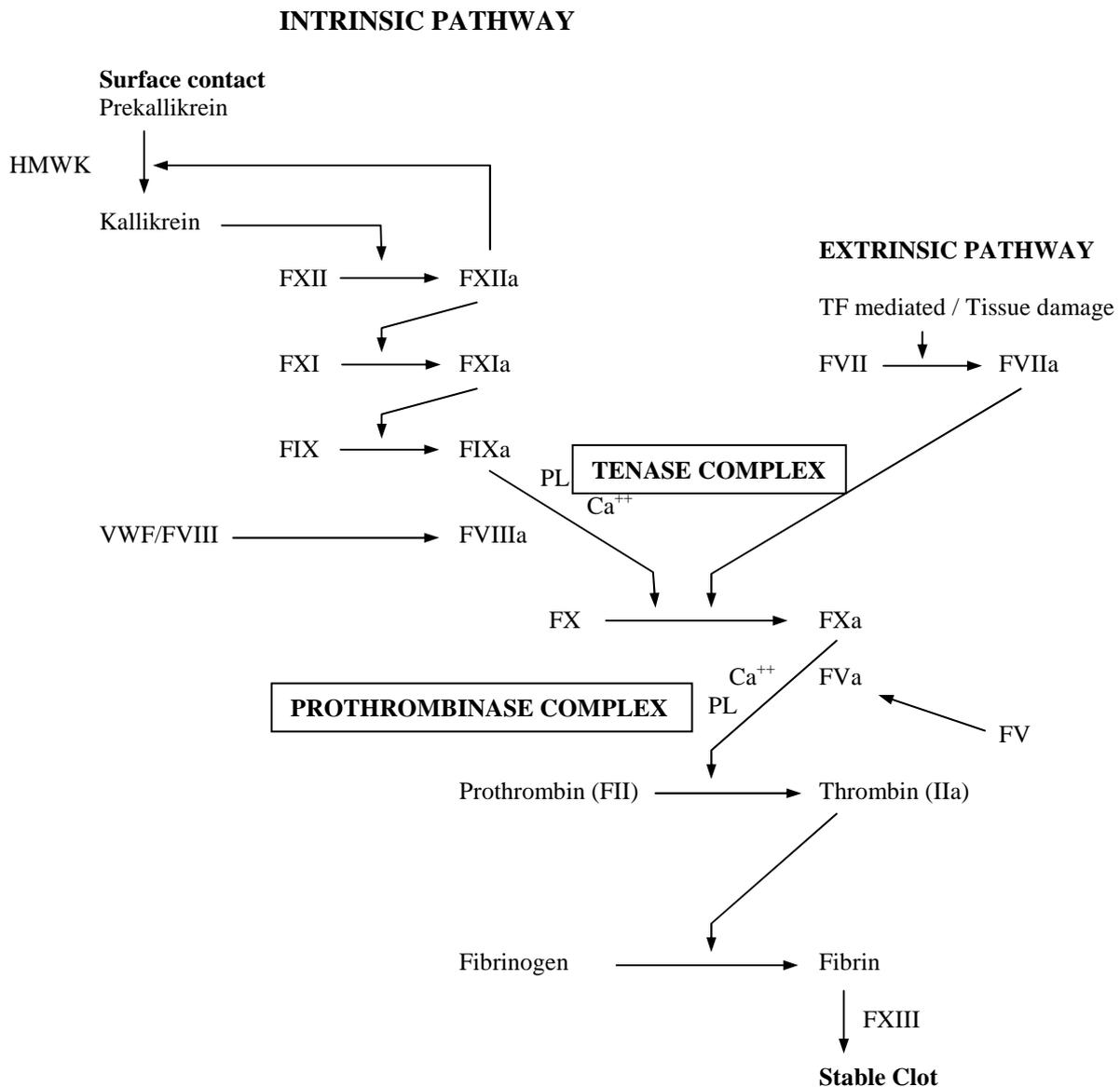
The primary phase of hemostasis is the production of the platelet plug. This process begins immediately after vascular injury as subendothelial tissues are exposed to circulating blood. Platelet binding to subendothelial tissue i.e. adhesion is followed by platelet activation with release of platelet contents, leading to platelet aggregation. The platelet plug not only offers the first line of defense against hemorrhage but also provides the phospholipid surface required for coagulant protein's interactions necessary for the formation of a fibrin clot.

The secondary phase of hemostasis results in the formation of a fibrin clot. The coagulation proteins circulate in inactive precursor forms; however, with the initiation of coagulation, these are converted to active forms. These activated proteins then further activate other factors in chain reaction (coagulation cascade) (figure 1), ultimately leading to the formation of the blood clot. Although the clotting cascade model has undergone significant modification since its introduction in 1964, it is still very useful for the interpretation of abnormal coagulation test results such as the prothrombin time (PT) and activated partial thromboplastin time (APTT).

The interactions of activated platelets and the clotting cascade give rise to hemostatic response that is potentially explosive and unchecked, may lead to thrombosis and tissue damage. Fortunately, coagulation is modulated by a number of mechanisms including the removal of activated factors through the reticuloendothelial system and the control of activated procoagulants by natural antithrombotic pathways

(antithrombin III, protein C, protein S). In addition to these limiting reactions, there exists the fibrinolytic pathway, which restores vessel patency following hemostasis.

**Figure 1 : Coagulation cascade**



### III-DIAGNOSIS

#### 1. HISTORY AND CLINICAL EXAMINATION

To begin with, it is important to address the following questions in any child who is referred for bleeding. These include:

- Is it bleeding?
- If it is bleeding, then is it localized or generalized?
- If generalized, is it platelet type or coagulation type of bleeding?
- Is it congenital/hereditary or acquired disorder?
- What are the factors affected?

#### 2. SCREENING TESTS

These are the tests for the initial assessment for bleeding tendency and include:

- **CBC and peripheral smear examination**
- **PT**
- **APTT**
- Bleeding Time (BT)
- Clotting Time (CT)

- Clot retraction

**CBC and peripheral smear examination** is required for hematological evaluation:

- To know the extent of anemia and involvement of other cell lines in cases suspected to have leukemia, aplastic anemia etc.
- Proper smear examination also helps in evaluating extent of thrombocytopenia if present.
- Presence of clumps of platelets rules out platelet deficiency and absence of platelets indicates severe thrombocytopenia usually less than 10,000 - 20,000/cumm.
- Presence of platelets but not in clumps - indicates absence of aggregation, suggesting platelet functional disorder.
- Large platelets simulating size of the lymphocytes suggest possibility of Bernard Soulier syndrome.
- Large platelets also indicate younger platelets as seen in regenerative type of thrombocytopenia where there is peripheral destruction of platelets.

#### **IV- IS THE DEFECT INHERITED OR ACQUIRED?**

##### **Inherited disorders:**

- Inherited disorders usually present in infancy and early childhood. History of bleeding from the umbilical cord, without evidence of sepsis or slipped ligature, Cephalhematoma during early neonatal period, without history of prolonged and difficult lab our, Bleeding during the eruption or fall of deciduous tooth etc should be enquired. However, acquired hemorrhagic disorders like ITP are often seen during childhood i.e., 3-5 years of age.
- Family history of bleeding may be present. Proper pedigree chart will help in recognizing type of inheritance.
- Hemarthrosis (spontaneous), bleeding in the muscles without significant trauma points towards inherited bleeding disorders.

##### **Conversely patients with acquired disorders:**

- Usually present later in life
- Have a negative family history,
- There may be underlying systemic disorders like kidney diseases, liver disorders, infections etc.

However, inherited disorders in milder forms may not be seen in early infancy and may present later in life with:

- Bleeding following injury or during surgery like in mild hemophilia. Previous history of operations like circumcision, dental extraction, tonsillectomy or major operation practically rules out the possibility of a moderate to severe inherited bleeding disorder.
- Subject with normal hemostasis or mild bleeding disorder may also have bleeding from non-hematological causes as seen in females with menorrhagia or of molar tooth extraction.
- History of ingestion of drugs like aspirin, in the recent past should lead to the suspicion of a transient drug related hemostatic defect.

#### **V- CONCLUSION**

Children are likely to experience bruising and bleeding as normal events. The pediatrician must be able to distinguish such normal events from defective hemostasis. A thorough medical history and physical examination should enable the clinician to identify those children who deserve to undergo further evaluation. With this approach in mind, pediatricians should be capable of performing the initial laboratory evaluation and making the correct diagnosis in majority of cases.

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# RHEUMATOLOGICAL DISEASES

1. Acute Rheumatic Fever .....414
2. Juvenile Idiopathic Arthritis .....420
3. Systemic Lupus Erythematosus.....428

# ACUTE RHEUMATIC FEVER

By Dr. Nget Pises

## I- INTRODUCTION

Acute Rheumatic Fever (ARF) is a non-suppurative complication of group A beta hemolytic streptococcal sore throat infection. ARF is uncommon in developed countries, but is still a major problem in developing countries. A prevalence of ARF in Cambodia has not been study yet but there is recent study on rheumatic heart disease (RHD) in Cambodia showed that echocardiography finding much higher than clinical findings by specifically murmur. The prevalence of RHD is 2.2 cases per 1000 by clinical finding and by echocardiography screening 21.5 cases per 1000<sup>(1)</sup>.

## II- DEFINITION

ARF is a post-infectious immune-mediated response to a group A  $\beta$ -hemolytic streptococcal infection with *streptococcus pyogenes* leading to an inflammation process involving multiple organ systems.

## III- CAUSES/EPIDEMIOLOGY

- Untreated or inappropriately treated group A strep tonsillopharyngitis precedes ARF by approximately 1-5 weeks
- ARF does not occur after strep skin infection such as impetigo
- 2-3% patients with untreated or inappropriately treated strep tonsillopharyngitis develop ARF
- It is more common in children between 6 to 15 years of age
- 11.2% to 34% of group A strep carriage in India is asymptomatic<sup>(4)</sup>

## IV-DIAGNOSIS

ARF is diagnosed by clinical history and use of the revised Jones Criteria (1993).

### 1- History

- Streptococcal tonsillopharyngitis 1-5 weeks before the onset of symptoms
- Pallor, malaise, easy fatigability, epistaxis and abdominal pain
- Family history of rheumatic fever

**2- Diagnosis**

- The diagnosis of acute rheumatic fever can be made when **two** majors or **one** major plus two minor criteria, are present along with **one** of the supportive evidence of streptococcal infection.

**3- Supportive Evidence of antecedent group A streptococcal infection**

- Positive rapid strep A antigen test
- Positive throat cultures
- Elevated or rising antistreptolysin O titer (ASOT)

**4- Revised Jones Criteria**

MAJOR MANIFESTATIONS	MINOR MANIFESTATIONS
Carditis	Arthralgia
Polyarthrititis	Fever
Chorea	Elevated acute-phase reactants (ESR, CRP)
Erythema Marginatum	Prolonged PR interval
Subcutaneous Nodules	

**5- Major manifestations**

- Arthritis (70%): Often large joints and more than one joint, and migratory with swelling, warmth, redness, severe pain, tenderness and limited motion.
- Carditis (50%): Signs of carditis include some or all of the following:
  - Tachycardia: out of proportion to the degree of fever
  - Heart Murmur: systolic or diastolic
  - Pericarditis: Friction rub, pericardial effusion, chest pain and ECG changes
  - Cardiomegaly: on chest x-ray
  - Signs of Congestive Heart Failure: gallop, distant heart sounds, cardiomegaly
    - *Moderate carditis*: mitral or aortic valve diseases without cardiomegaly
    - *Severe carditis*: combined mitral and aortic disease with marked cardiomegaly
    - *Very severe carditis*: congestive heart failure
- Erythema Marginatum: nonpurulent, macular rash with an erythematous border
- Subcutaneous Nodules: painless nodules located on extensor surfaces of joints, scalp and spine
- Sydenham's Chorea: random, rapid, involuntary, purposeless, non-rhythmic movements often of the face and extremities

**6- Minor manifestations**

- Arthralgia
- Fever
- Elevated CRP or ESR (acute-phase reactants)
- Prolonged PR interval on ECG

**V- DIFFERENTIAL DIAGNOSIS**

- Juvenile Rheumatoid Arthritis (JRA)
- Collagen Vascular Disease: Systemic Lupus Erythematosus, reactive arthritis
- Hematologic disorders: leukemia, sickle cell disease
- Virus acute arthritis: rubella, Hepatitis B virus, herpes viruses
- Septic arthritis
- Kawasaki disease

- Huntington chorea

## VI-RECOMMENDED TREATMENT

1. Treat all patient with antibiotic to eradicate group A streptococcus
  - Benzathine penicillin G 600.000 IU (<27kg), 1.2M IU(>27kg) IM one single dose **OR**
  - Penicillin V 250mg/dose (<27kg), 500mg/dose (>27kg) bid or tid PO for 10 days
 If penicillin allergy:
  - Erythromycin 250mg/dose (<27kg), 500mg/does (>27kg) PO bid for 10 days **OR**
  - Azithromycin 12mg/kg (max 500mg) qd PO for 5 days
2. Anti-inflammatory therapy for confirmed ARF
  - For Arthritis: Aspirin 100mg/kg/day qid PO for 2 weeks then taper down over 2-3 weeks
  - For severe carditis: Prednisone 2mg/kg/day PO qid for 1-2weeks then taper down over 2-3 weeks
3. Treat congestive heart failure: some or all of the following
  - Bed rest and provide oxygen
  - Morphine sulfate 0.2mg/kg every 4hours PRN
  - Prednisolone for severe carditis of recent onset
  - Fluid restriction
  - Furosemide 1mg/kg/dose every 6-12 hours
  - Digoxin dosage for congestive heart failure

Age	Total Digitalizing Dose (TDD)* (µg/kg)	Maintenance Dose** µg/kg/day
Prematures	20	5
Newborns	30	8
<2yr	40-50	10-12
>2yr	30-40	8-10

\*TDD: divided in 3 doses, 50% first dose then 25% in subsequence 8hours

\*\* Maintenance Dose: 25% of TDD divided in 2 doses/day in <10yr and 1 dose/day in >10yr

4. Hospitalize for severe carditis or transfer to specialized center
5. Treatment of Sydenham's chorea:
  - Reduce physical and emotional stress
  - Give Benzathine penicillin G for eradication and prophylaxis
  - Give
    - Phenobarbital 15mg-20mg/kg loading dose then 12h later 4-8mg/kg/day qd or bid, PO
    - Haloperidol 0.25mg-0.5mg/day bid or tid, increased 0.15mg/kg/day (for child 15-40kg)
    - Diazepam 0.05-0.3mg/kg/dose IV, then 0.2mg-0.3mg/kg , q6h or q8h, PO

## VII- COMPLICATIONS

- Rheumatic heart disease
- Rheumatic carditis can be resolved in approximately 70-80% of cases if proper prophylaxis guidelines are followed

- Recurrence of rheumatic fever
- Congestive heart failure

### VIII- PREVENTION

- *Primary prophylaxis*: Treat all group A streptococcal tonsillopharyngitis with 10 days of penicillin
- *Secondary prophylaxis*: Patients with a history of ARF must receive secondary prophylaxis.
  - Medication:
    - Benzathine Penicillin G 600.000 IU (<27kg), 1.2M IU (>27kg), IM every 28 days **OR**
    - Penicillin V 250mg/dose (<27kg), 500mg/dose (>27kg) PO bid **OR**
    - Erythromycin 250mg/dose (<27kg), 500mg/dose (>27kg) PO bid
  - Duration:
    - ARF without carditis: at least 5 years or until age 21 years
    - ARF with carditis but no residual rheumatic heart disease: 10 years or up to age 21 years
    - ARF with carditis and residual rheumatic heart disease: up to age 40 years or life long

### IX-PATIENT EDUCATION

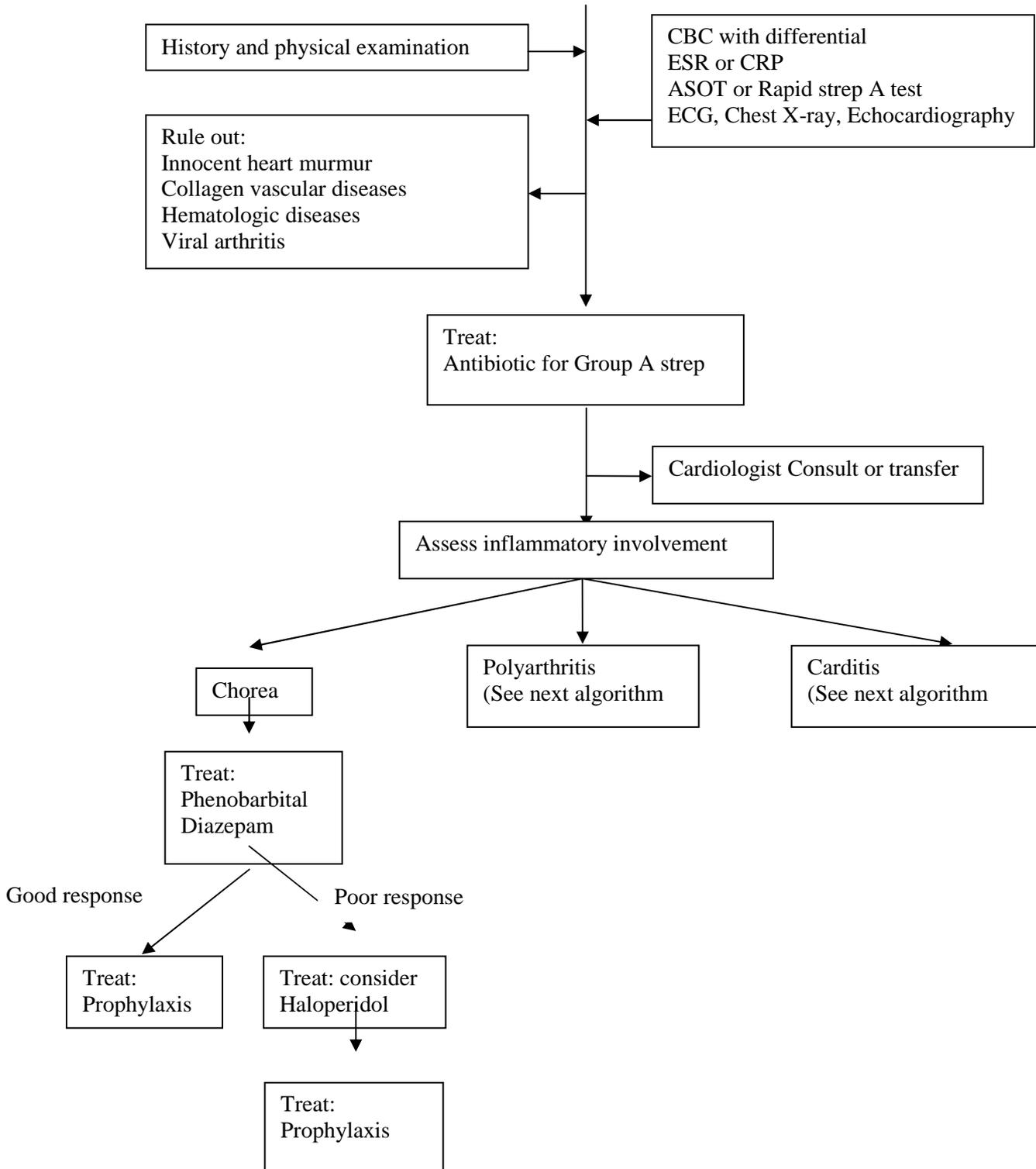
- Must go to the hospital or seek medical care when a child has a sore throat
- Must follow the doctor advice strictly to prevent lifelong complications

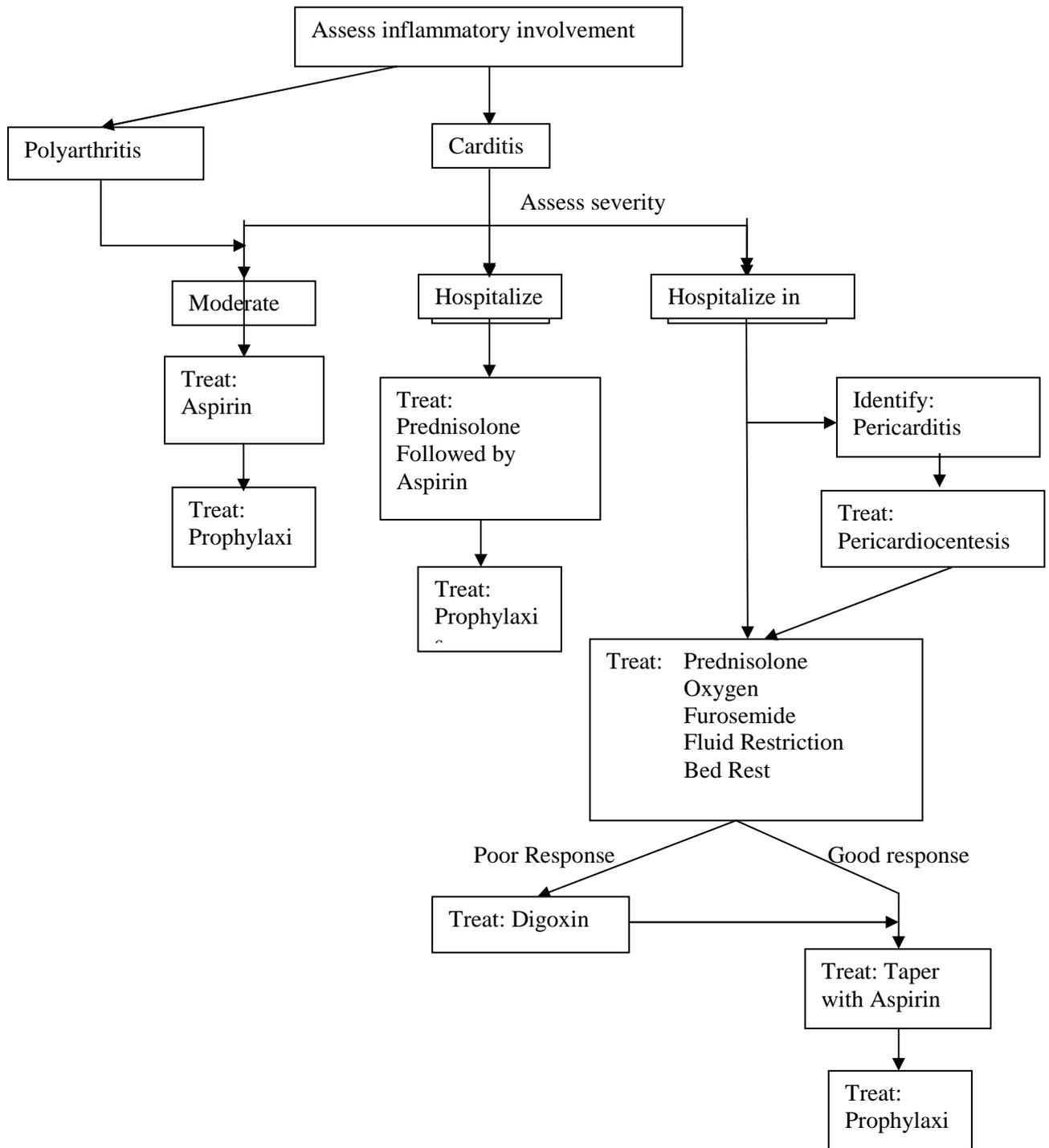
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### TREATMENT ALGORITHM

#### Patient with Acute Rheumatic Fever





# JUVENILE IDIOPATHIC ARTHRITIS

By Prof. IV Malene

## I- DEFINITION

- Juvenile idiopathic arthritis (JIA)/ Juvenile rheumatoid arthritis (JRA)/ Juvenile chronic arthritis (JCA) is a common rheumatic disease of children and a major cause of chronic disability. It is characterized by a synovitis of the peripheral joints manifesting in soft tissue swelling and effusion.
- Arthritis (swelling or effusion, presence of 2 or more of the following signs: limitation of range of motion, tenderness or pain on motion, increased heat in  $\geq 1$  joints).
- Age at onset:  $< 16$  years.
- Duration of disease:  $\geq 6$  weeks.

## II- EPIDEMIOLOGY

- The incidence of JRA is  $\approx 13.9/100,000$  children/year among white children  $\leq 15$  years of age, with a prevalence of  $\approx 113/100,000$  children.
- A report from Western Australia, estimates a much higher prevalence of  $400/100,000$  based on sequential examinations of schoolchildren by a pediatric rheumatologist.
- Different racial and ethnic groups have varying frequencies of the subtypes of JRA.
- Females predominate 2:1

## III- ETIOLOGY

- Unknown
- Combination of factors:
  - environment (infection, trauma, stress),
  - autoimmunity,
  - immunogenetic,

## IV- PATHOGENESIS

Characterized by:

- Chronic inflammation of the synovium;
- Presence of articular cartilage damage;
- Accompanied by extra-articular systemic manifestations.

## V- CLASSIFICATION OF JUVENILE RHEUMATIS ARTHRITIS

- Oligoarthritis:  $\leq 4$  inflamed joints  $\approx 50\%$
- Polyarthritis :  $> 4$  inflamed joints  $\approx 20\%$
- Systemic disease: arthritis with fever and rash  $\approx 20\%$

- Enthesitis related arthritis  $\approx$  10%

**VI- VI. CLINICAL MANIFESTATIONS AND DIAGNOSIS**

<b>Articular signs:</b> <ul style="list-style-type: none"><li>• joint swelling</li><li>• joint pain</li><li>• joint stiffness / gelling</li><li>• after periods of inactivity</li><li>• joint warmth</li><li>• restricted joint movements</li></ul>	<b>Extra- articular manifestations</b> <ul style="list-style-type: none"><li>• generalized or local growth disturbances</li><li>• delayed puberty</li><li>• pericarditis, myocarditis, rarely endocarditis</li><li>• pleural effusion, rarely</li><li>• pneumonitis, pulmonary fibrosis</li><li>• hepatitis</li><li>• hematuria</li></ul>
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The diagnosis is essentially clinical; laboratory investigations are only supportive.  
No laboratory test or combination of tests can confirm the diagnosis of JIA.

<b>Clinical and investigation</b>	<b>Oligoarthritis (pauciarticular disease) (50%)</b>	<b>Polyarticular (20%)</b>	<b>Systemic (20%)</b>
Morning irritability/stiffness	<ul style="list-style-type: none"> <li>• Subtle</li> <li>• Asymmetric involvement (large joints rarely hip)</li> </ul>	<ul style="list-style-type: none"> <li>• more prominent</li> <li>• symmetric involvement (Large and small joints including cervical spine)</li> </ul>	Arthritis may be absent for months to years.
Systemic symptoms	usually absent	mild to moderate	Prominent systemic symptoms: <ul style="list-style-type: none"> <li>• fever,</li> <li>• skin rash,</li> <li>• lymphadenopathy</li> <li>• hepatosplenomegaly</li> <li>• pericarditis</li> <li>• pleuritis</li> </ul>
uveitis	20%	5%	uncommon
<ul style="list-style-type: none"> <li>• WBC</li> <li>• ESR</li> <li>• Hb</li> <li>• Platelete</li> </ul>	<ul style="list-style-type: none"> <li>• Normal</li> <li>• Usually normal</li> </ul>	<ul style="list-style-type: none"> <li>- ↑</li> <li>- ↑ to ↑↑</li> <li>- ↓</li> <li>- N or ↑</li> </ul>	<ul style="list-style-type: none"> <li>- ↑</li> <li>- ↑</li> <li>- ↓</li> <li>- ↑</li> </ul>
ANA	frequently positive (risk for uveitis)	Positive ~20% (risk for uveitis)	usually negative
RF	usually negative	May be positive	usually negative
Synovial fluid	inflammatory	inflammatory	
X-Ray findings:	<ul style="list-style-type: none"> <li>• Soft tissue swelling,</li> <li>• periarticular osteoporosis,</li> <li>• growth disturbance,</li> <li>• loss of joint space</li> </ul>	<ul style="list-style-type: none"> <li>• soft tissue swelling,</li> <li>• periarticular osteoporosis,</li> <li>• joint space narrowing,</li> <li>• erosions</li> </ul>	soft tissue swelling

## VII- DIFFERENTIAL DIAGNOSIS

- Rheumatic fever
- Septic arthritis
- Transient arthritis following infection
- Tuberculosis
- Leucemia/ bone tumor

## VIII-TREATMENT

### 1. Medical treatment (*See algorithm*)

**2. Physiotherapy**

- avoid prolonged immobilization.
- strengthens muscles, improves and maintains range of movement.
- improves balance and cardiovascular fitness.

**3. Ophthalmologist**

- All patients must be referred to the ophthalmologist for uveitis screening (as uveitis can be asymptomatic) and have regular follow-up even if initial screening normal.

**4. Others**

- ensure well balanced diet, high calcium intake.
- encourage regular exercise and participation in sports and physical education.
- family support and counseling when required.
- referral to other disciplines as required: Orthopedic surgeons.

**IX- IX. PROGNOSIS**

The prognosis of JRA in an individual child is unpredictable.

- Chronic disease which cannot be cured.
- Characterized by flares and remissions.
- After 10 years or more:
  - 31%-55% persistent active disease.
  - 31% (9% - 48%) Steinbrocker Class III and IV.

**X- EDUCATION AND SUPPORTIVE COUNSELING**

Understand disease process, treatment and prognosis.

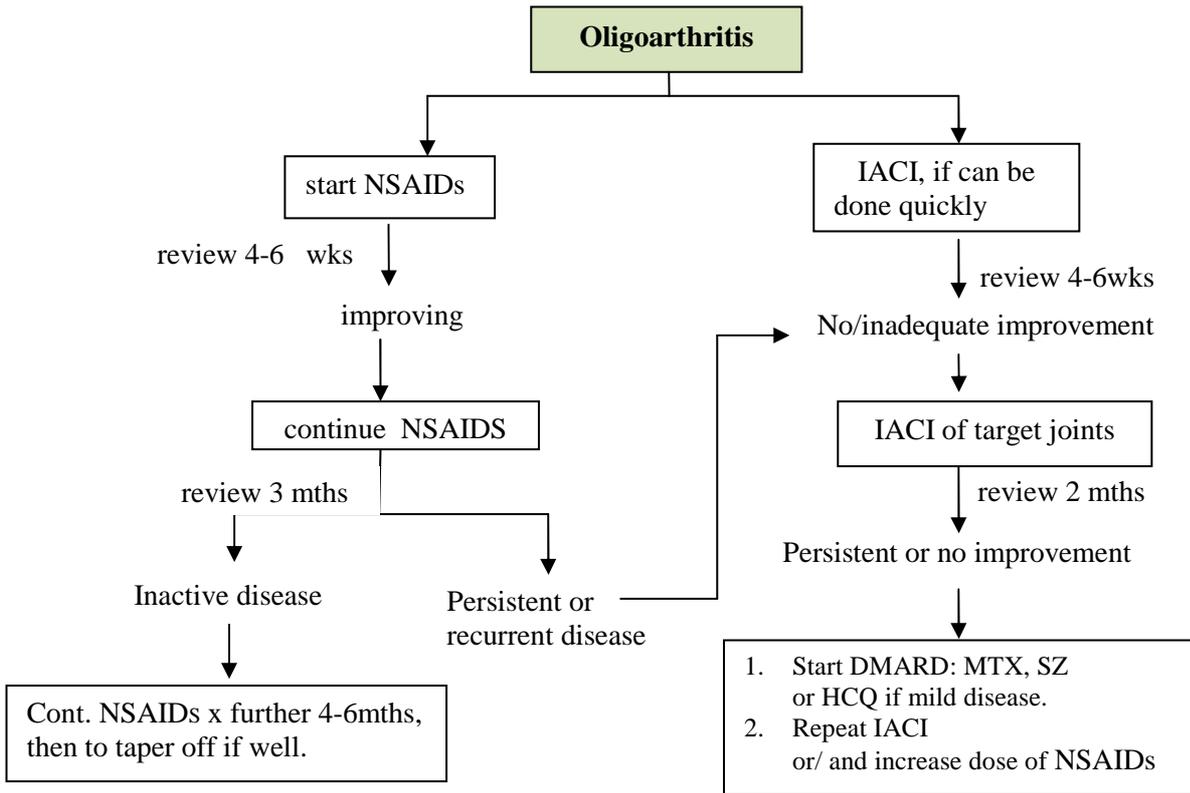
- Understand roles in care.
- As normal possible:
  - discipline/family life
  - school
  - peer relationships
- Counseling
 

At this moment JIA remains a chronic disease with considerable psychosocial impact that often extends into adulthood.

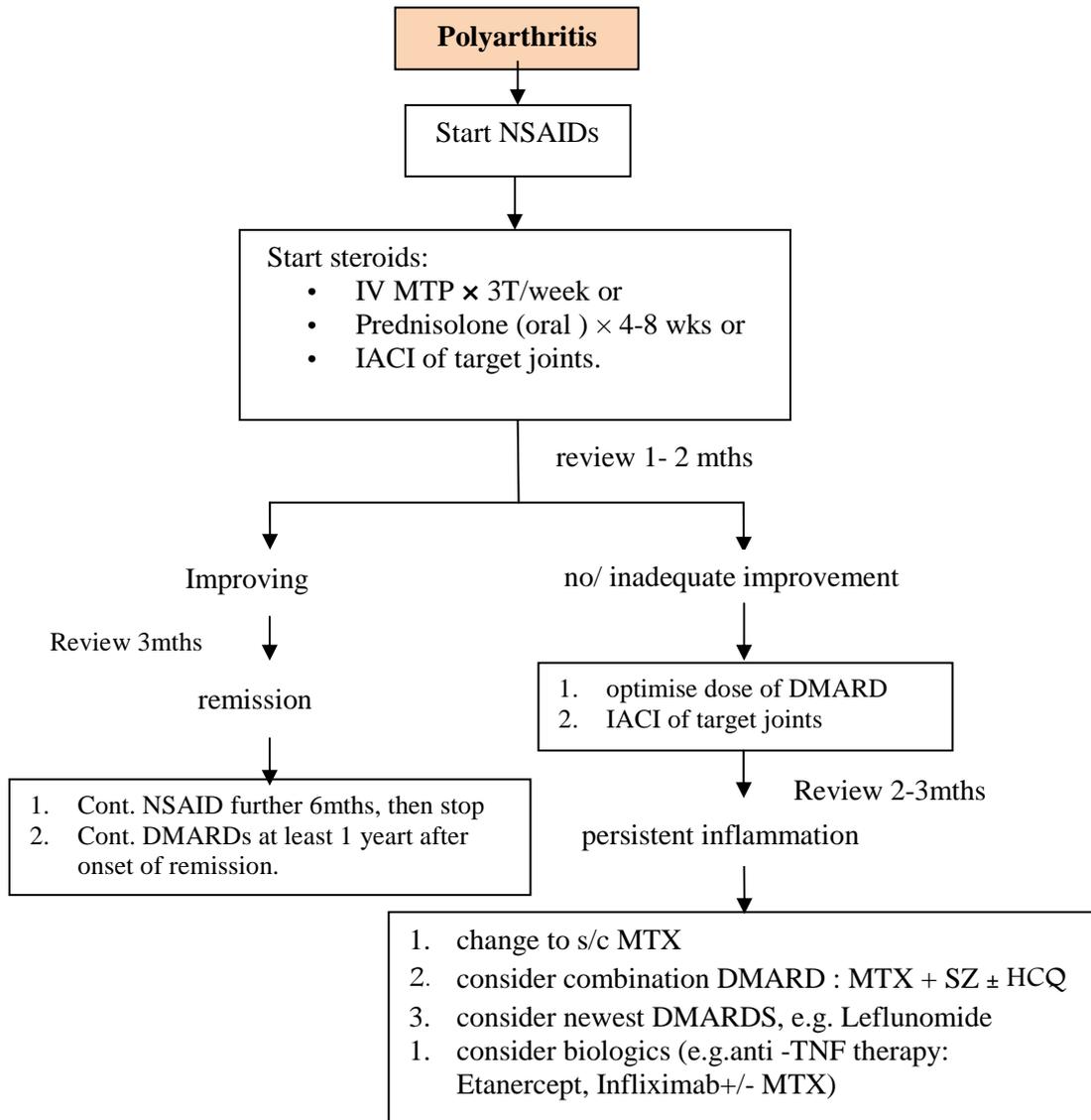
**Dosages of drugs commonly used in JIA**

Group	Name	Dose	Frequency
AINS	Ibuprofen	5 - 10 mg/kg/dose	3 - 4/day
	Naproxen	5 - 10 mg/kg/dose	2/day
	Indomethacin	0.5 - 1 mg/kg/dose	2-3/day
	Diclofenac	0.5 - 1 mg/kg/dose	3/day
Corticosteroid	prednisolone	0.1 - 2 mg/kg/dose	1-3/day
	Methylprednisolone	30 mg/kg/dose(max 1Gm/dose)	1/day × 3 days
DMARDS	Hydroxychloroquine	5 mg/kg/dose	1/day
	Methotrexate	10 - 15 mg/m <sup>2</sup> /dose (max 25mg/dose)	1/week
	Cyclosporine	2-3 mg/kg/day	2/day
	Sulphasalazine	15 - 25 mg/kg/dose(start 2.5mg/kg/dose & double weekly; max 2Gm/day)	2/day

### TREATMENT OF OLIGOARTRITIS JIA

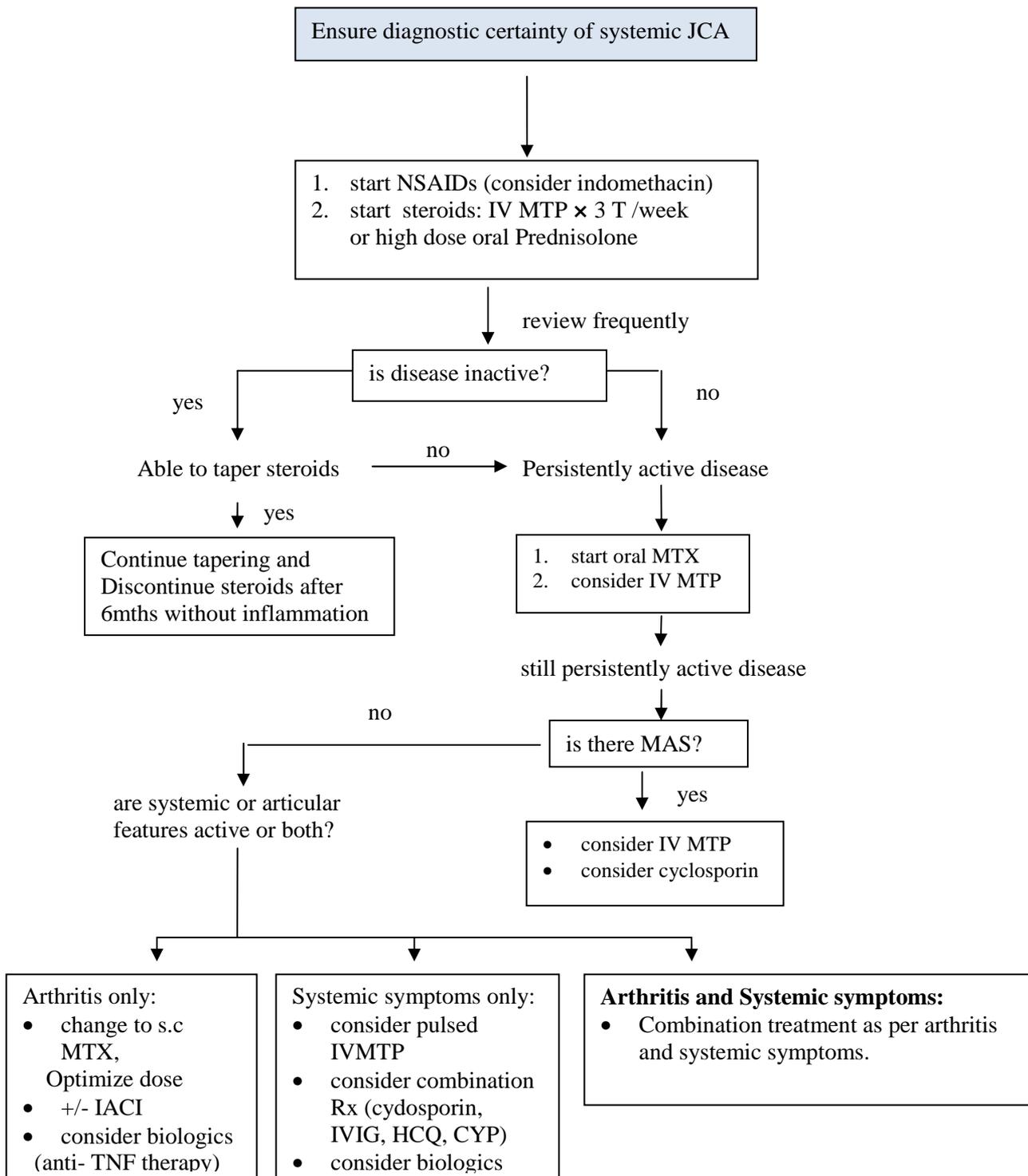


**TREATMENT OF POLYGOARTRITIS JIA**



**RF:** Rheumatoid factor, **IACI:** Intra-Articular Corticosteroid Injection, **MTX:** Methotrexate, **MTP:** Methylprednisolone **SZ:** Sulphasalazine, **HCQ:** Hydroxychloroquine, **DMARD:** Disease Modifying Anti-Rheumatic Drugs, **ERA:** Enthesitis Related Arthritis, **CYP:** Cyclophosphamide, **IVIG:** Intravenous Immunoglobulins, **MAS:** Macrophage Activation Syndrome, **TNF:** Tumor necrosis factors.

## TREATMENT OF SYSTEMIC JIA



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# SYSTEMIC LUPUS ERYTHEMATOSUS

*By Dr. Iv Malene*

## I. DEFINITION

Systemic lupus erythematosus (SLE) is characterized by auto-antibodies directed against self antigens, leading to inflammatory damage of many target organs including the joints, kidneys, blood-forming cells, and the central nervous system.

## II. EPIDEMIOLOGY

- Prevalence influenced by age, gender, race, and genetics.
- An overall prevalence has been estimated of 10 to 20 cases per 100,000 people less than 18 years of age.
- The annual incidence in children in the US is estimated at 0.53–0.60/100,000/year.
- Peak incidence between 19 and 29 years of age.
- Black > White (1:250 vs. 1:1000)
- Female predominance 4-8:1
- Severity is equal in male and female.

## III. ETIOLOGY

- Etiology is unknown.
- Most probable causes:
  - Genetic influence: Certain HLA types (HLA-B8, HLA-DR2, and HLA-DR3) occur with increased frequency among patients with lupus.
  - Environmental factors:
    - Ultraviolet light (UV)
    - Viruses: parvovirus, CMV, HCV
    - Hormones (Estrogen)
    - Chemicals (hydrazines) ?
    - Drugs (Trimethoprim + sulphamethoxazole)
    - Smoking

#### IV. CLINICAL FEATURES

TARGET ORGAN	MANIFESTATIONS
Constitutional	Fatigue, anorexia, weight loss, prolonged fever, lymphadenopathy, abdominal pain
Musculoskeletal	Arthralgias, Arthritis, Synovitis, Osteoporosis, Osteonecrosis
Skin	Malar rash (butterfly erythema), discoid lesions, Photosensitive rash, Livedo reticularis, Vasculitis, Oral ulceration, Alopecia
Ocular	Conjunctivitis, Photophobia, Monocular blindness-transient or permanent, Blurred vision.
Renal (Lupus Nephritis)	Glomerulonephritis, hypertension, nephrotic syndrome, renal failure
Cardiovascular	Pericarditis, Endocarditis, Cardiac failure, Cardiac Arrhythmias,
Neurologic	Seizures, psychosis, stroke, cerebral venous thrombosis, pseudotumor cerebri, aseptic meningitis, chorea, global cognitive deficits, mood disorders, transverse myelitis, peripheral neuritis (mononeuritis multiplex)
Pulmonary	Pleuritis/Pleural effusion, Acute lupus pneumonitis, pulmonary hemorrhage
Hematologic	Coombs-positive hemolytic anemia, anemia of chronic with reticulocytosis, thrombocytopenia, leucopenia, elevated ESR and CRP; decreased C3 or C4
Urine Analysis	Hematuria, Proteinuria
Immunologic disorder	positive ANA and anti-double-stranded DNA antibodies

ANA, antinuclear antibody; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate

#### V. DIAGNOSIS

The diagnosis of lupus is confirmed by the combination of clinical and laboratory manifestations revealing multisystem disease.

The presence of 4 of 11 criteria (ACE classification) serially or simultaneously strongly suggests the diagnosis.

##### **ACR Classification criteria for SLE (1997 update)** (ACE: American College of Rheumatology)

1. Malar rash (butterfly erythema).
2. Discoid lesions: Erythematous raised patches with adherent keratotic scaling and follicular plugging; atrophic scarring may result in older lesions.
3. Photosensitivity: Skin rash as a result of unusual reaction to sunlight, by patient history or physician observation.
4. Oral ulcers Oral or nasopharyngeal ulceration, usually painless
5. Arthritis: Non-erosive arthritis involving two or more peripheral joints, characterized by tenderness, swelling, or effusion.
6. Serositis: Pleural effusion, Pericarditis.
7. Renal disorder: Persistent proteinuria >0.5 g/day (or >3+ if quantitation not performed).
8. Neurologic disorder: Seizures/ Psychosis in the absence of offending drugs or known metabolic derangements.

9. Hematologic disorder:
  - Hemolytic anemia with reticulocytosis disorder Or
  - Leukopenia <4,000/mm<sup>3</sup> total, on two or more occasions Or
  - Lymphopenia <1,500/mm<sup>3</sup> total, on two or more occasions Or
  - Thrombocytopenia <100,000/mm<sup>3</sup> total, in the absence of offending drugs
10. Immunologic disorder:
  - Positive lupus erythematosus cell preparation disorder Or
  - Anti-DNA antibody to native DNA in normal titer Or
  - Presence of anti-Sm nuclear antigen Or
  - False-positive serologic test for syphilis known to be positive for at least 6 months and confirmed by *Treponema pallidum* immobilization or fluorescent treponemal antibody absorption test.
11. Antinuclear antibody by immunofluorescence or an equivalent assay at any point antibody in time and in the absence of drugs known to be associated with drug-induced lupus syndromes.

## VI. CLINICAL FORMS

Mild SLE	Moderate SLE	Severe SLE
<ul style="list-style-type: none"> <li>• arthritis, arthralgia, myalgia,</li> <li>• fatigue,</li> <li>• mild mucocutaneous involvement,</li> <li>• low grade fever,</li> <li>• mild serositis</li> <li>• lupus headache</li> </ul>	<ul style="list-style-type: none"> <li>• High grade fever, toxemia,</li> <li>• severe mucocutaneous manifestations,</li> <li>• marked photosensitivity,</li> <li>• moderate to severe serositis,</li> <li>• lupus pneumonitis, myocarditis,</li> <li>• minimal change lupus nephritis</li> </ul>	Characterized by organ/life-threatening features: <ul style="list-style-type: none"> <li>• Focal/diffuse proliferative glomerulonephritis with or without HTA</li> <li>• Lupus cerebritis: Seizures, acute confusional state, coma,</li> </ul>

## VII. DIFFERENTIAL DIAGNOSIS

- Dermatomyositis
- Nonrheumatic: HIV, endocarditis, viral infections, hematologic malignancies, vasculitis, other causes of nephritis
- Systemic-onset juvenile rheumatoid arthritis,
- Acute poststreptococcal glomerulonephritis,
- Acute rheumatic fever, infective endocarditis,
- Leukemia, immune thrombocytopenic purpura,
- Idiopathic hemolytic anemia.
- Idiopathic thrombocytopenic purpura.

## VIII. TREATMENT

No cure currently exists for SLE.

The treatment regimen depends on the affected target organs and disease severity.

\* **Sun exposure** should be minimized and include use of a sunscreen.

\* **Mild SLE:**

- **Nonsteroidal anti-inflammatory drugs (NSAIDs)** used to treat arthralgia and arthritis (used with caution because patients with lupus are more susceptible to hepatotoxicity).
  - **Aspirin : 75-100mg/kg/day in 4-6 divided or**
  - **Diclofenac : 2-3 mg/kg/day in 2-3 divided or**
  - **Ibuprofen : 30-40 mg/kg/day in 3-4 divided or**

- **Naproxene : 20-30mg/kg/day in 2 divided**
  - **Chloroquine/ Hydroxychloroquine (Antimalarials)** are often used to treat mild manifestations including skin lesions, fatigue, arthritis, and arthralgia when symptoms cannot be controlled with NSAIDs. It may also reduce the risk of thromboembolic disease and lowers lipid levels.
    - **Chloroquine : 100-200mg/day (5mg/kg/day)**, in case of non response : **400mg/day** , then followed by slow tapering **100 mg/day** pendant plusieurs mois après obtention de la remission.
    - **Hydroxychloroquine : 3-5 mg/kg/day in 1-2 doses.**
  - **Corticosteroids in low dose** may be treated with patients not responding to the above measures: Prednisolone **0.3-0.5mg/kg/day** for **4-6 weeks** followed by slow tapering.
- \* Moderate and severe SLE:**
- **Corticosteroids:**
    - Prednisone: 1–2 mg/kg/24 h, take up to 6 weeks and should be tapered off slowly over 6 to 12 months. OR
    - Methylprednisolone ( in a toxic appearing patients) : 15 mg/ kg over an hour for 3-5 consecutive days, to gain control of severe disease, and then maintain improvement with 1 to 2 mg/kg/day oral prednisolone.
- Corticosteroids have serious side effects when given in high doses over prolonged periods.
- **Immunosuppressives:** immunosuppressive medications are used for treating people with more severe manifestations of SLE (renal or cerebral disease), such as damage to internal organ.
    - Cyclophosphamide (Endoxan): 2mg/kg/day (see the treatment of nephrotic syndrome in cyclophosphamide part).
    - Azathioprine (Imurel<sup>R</sup>) : 2-2.5mg/kg/day for about 2 years.

## IX. COMPLICATIONS

- The major causes of death in patients with lupus currently include infection, nephritis, central nervous system disease, pulmonary hemorrhage, and myocardial infarction, which may be a result of chronic but not suppressive corticosteroid administration in the setting of immune complex disease.
- Lupus nephritis is present in most children with lupus; those children with clinically significant nephritis show evidence of progression within 2 yr after onset of symptoms. Persistent leukopenia, anemia, or thrombocytopenia may develop.
- Osteopenia and osteoporosis are known complications of longterm corticosteroid use.

## X. PROGNOSIS

- Untreated lupus may be followed by spontaneous remission, years of smoldering disease, or rapid death.
- The natural history of lupus is highly variable, ranging from acute, life-threatening disease to many years of symptoms.
- Childhood lupus was initially viewed as a uniformly fatal disease. Early diagnosis and treatment tailored to the particular problems of each individual patient greatly improves the course of the disease and, currently, the 5-yr survival rate is >90%.

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# NUTRITIONAL DISORDER

1. Severe Acute Malnutrition.....	434
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# SEVERE ACUTE MALNUTRITION

By Dr. Han Sokhan

## I- DEFINITION

Severe Acute Malnutrition (SAM) is defined as:

- the presence of severe wasting (weight for height  $< -3SD$ ) and/or bilateral pitting oedema, OR
- infant  $< 6$  months with visible wasting or bilateral pitting oedema, OR
- infant  $\geq 6$  months with weight  $< 4$  kg

A child with SAM is cured when s/he:

- Has reached target weight gain (15%)
- Has good appetite, is eating well
- No oedema
- Clinically well
- If  $< 2$  years old, breastfeeding well

## II- EPIDEMIOLOGY

Malnutrition is responsible for 35% of child deaths globally, 2.2 million deaths per year. In Cambodia, childhood malnutrition improved through the 1990's and early 2000's, but the 2008 Cambodian Anthropometric Survey (CAS) and the 2010 Cambodia Demographic and Health Survey (CDHS) both found no improvement in childhood malnutrition between 2005 and 2010. CDHS 2010 reported that 40% of children less than five years of age suffered from chronic malnutrition (stunted or height for age  $< -2SD$ ), 28% were underweight (weight for age  $< -2SD$ ), 11% were acutely malnourished (wasted or weight for height  $< -2SD$ ), and 2.5% were severely wasted (SAM or weight for height  $< -3SD$ ). This translates to about 80,000 cases of SAM in children under five requiring treatment in Cambodia each year. Active case finding is needed as only 1,050 cases of SAM in children were treated in the 21 hospitals offering SAM treatment in 2010 and only 1,266 cases treated in 29 hospitals with SAM services in 2011.

## III- COMPLICATION

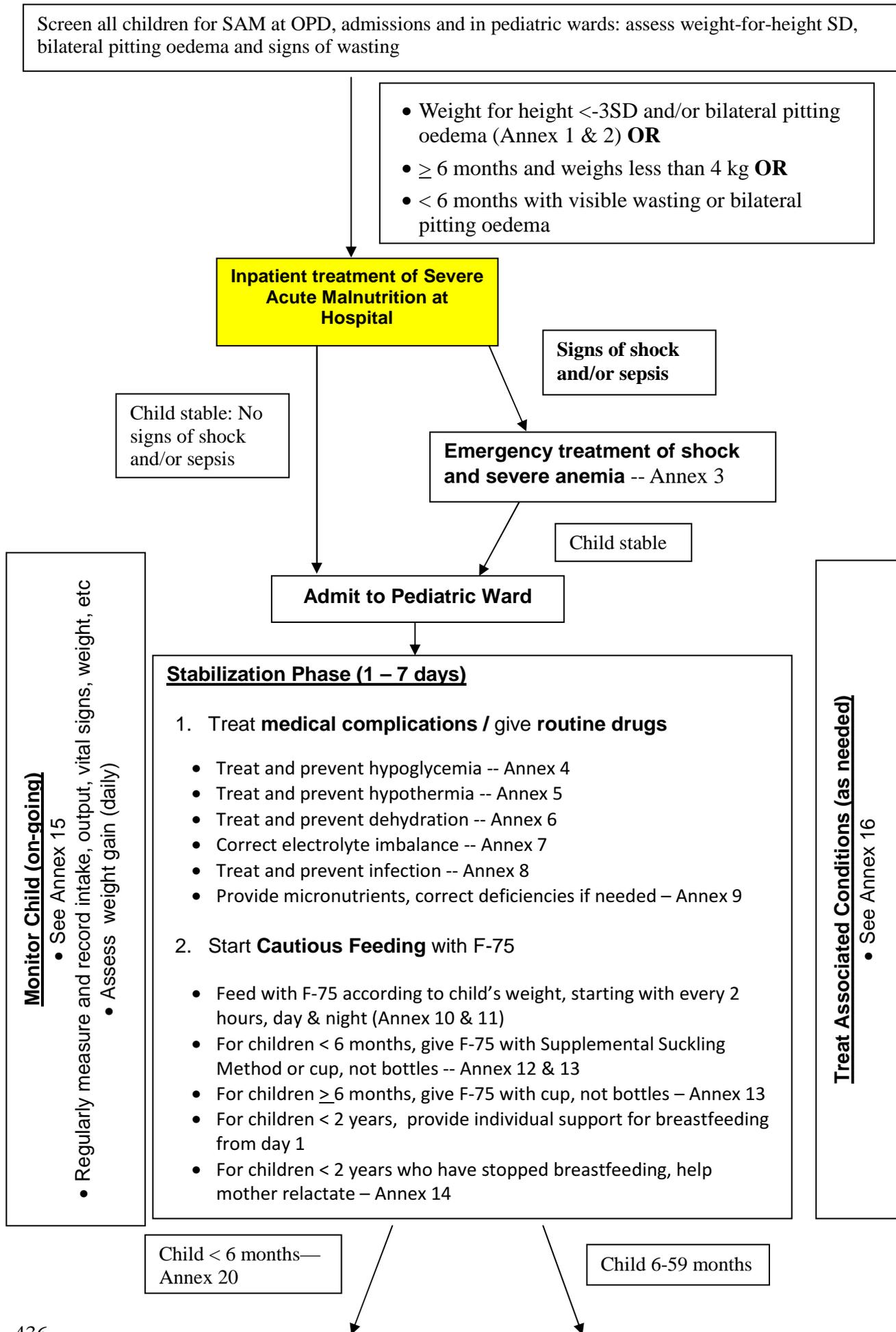
- SAM children are at very high risk of death and need immediate treatment
- SAM children with medical complications need to be treated for their medical complication and for SAM

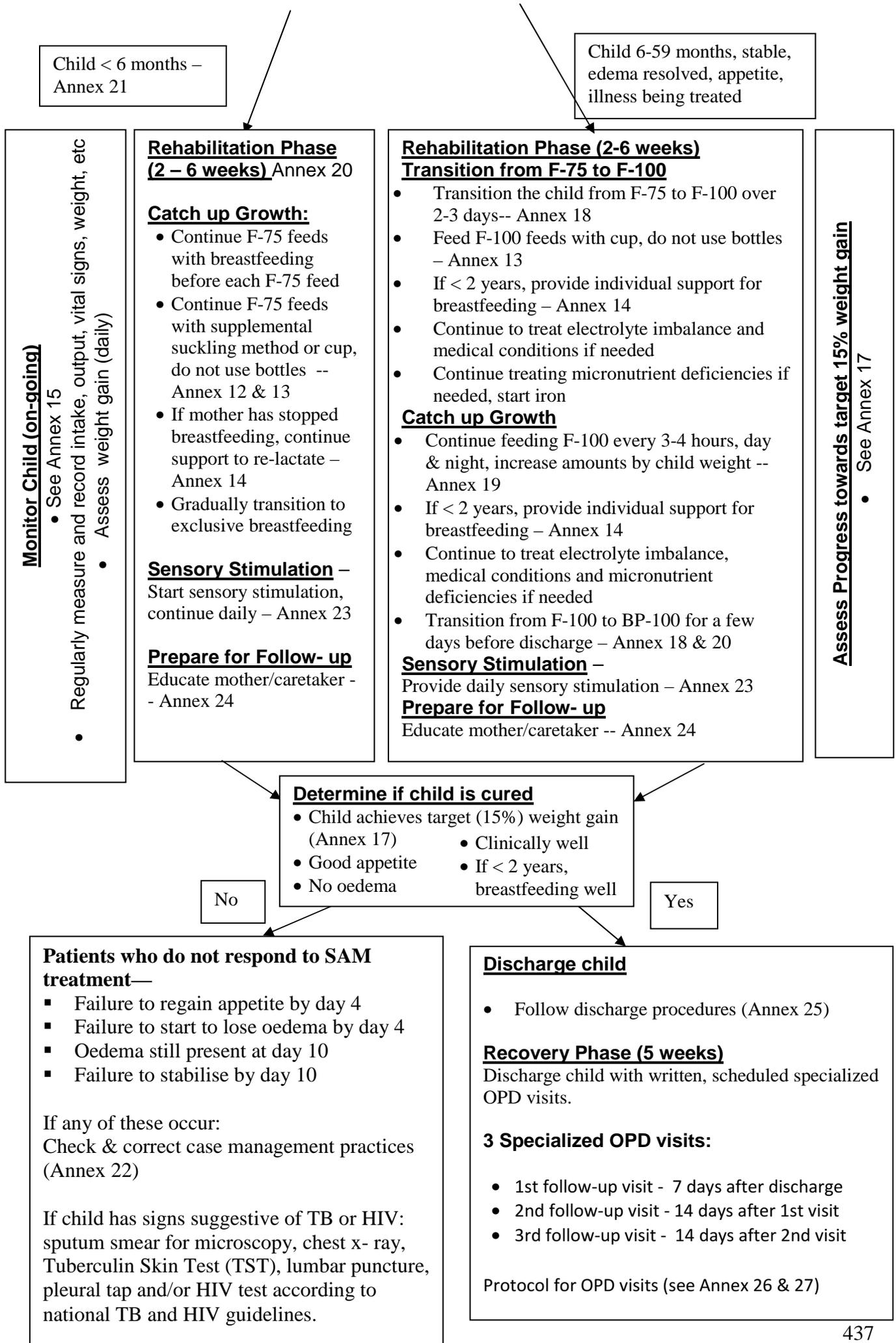
- SAM patients require 24-hour inpatient care until their condition stabilises (at least 4-7 days)
- Hospitals offering SAM services should have health care providers on 24 hour duty who have been trained in the 6 day training course on the Management of Severe Acute Malnutrition
- Children with SAM who do not respond to treatment by day 4 after admission require additional investigation (of case management practices, for suspect TB and HIV, etc.)

#### **IV-DIAGNOSIS**

- All pediatric patients at OPD and on the wards should be weighed and have their height measured at admission, regardless of diagnosis. Check for oedema, even in children who do not seem to be thin. All pediatric inpatients should be reweighed daily. The SAM Stamp should be completed on every pediatric patient file at admission or within the first 24 hours.
- Any infant < 6 months of age with signs of wasting or bilateral pitting oedema should be referred to the pediatric ward.
- Any infant  $\geq$  6 months of age who weighs less than 4 kg should be admitted.
- For children 6-59 months, if weight for height is < -3SD and/or bilateral pitting oedema is present, they should be classified as SAM and referred to the pediatric ward.

## V- MANAGEMENT/TREATMENT OF SEVERE ACUTE MALNUTRITION IN CHILDREN





## 10-Step Treatment of Children with SAM

STEP	STABILISATION PHASE		REHABILITATION PHASE
	Days 1-2	Days 3-7	Weeks 2-6
1. Hypoglycaemia	→		
2. Hypothermia	→		
3. Dehydration	→		
4. Electrolytes			→
5. Infection	→	→	
6. Micronutrients		no iron	with iron →
7. Cautious feeding		→	
8. Catch-up growth			→
9. Sensory stimulation			→
10. Prepare for follow-up			→

\*\*Start #8 Catch-up growth and #10 Prepare for follow-up sooner (starting on Days 3-7) if patient will be moved to outpatient treatment after stabilization & initial rehabilitation phases; then complete rehabilitation phase as outpatient

### **Remember:**

- DO NOT give IV fluid routinely to malnourished children. (It is only given for shock)
- DO NOT give a diuretic for oedema
- DO NOT give iron during stabilization phase (days 1 – 7)
- DO NOT give F-100 during stabilization phase, use F-75 instead
- DO NOT give F-100 to a child < 6 months old, use F-75 instead
- DO NOT refer to F-75 or F-100 as “formula”
- DO NOT feed F-75 or F-100 from a bottle, only from a cup

Specific inpatient charts, called the Critical Care Pathway – Severe Malnutrition (5 pages) are used for SAM. Copies are found in Annex 28.

### **Patients who leave the hospital before being “cured”:**

If a child leaves the hospital without reaching the target 15% weight gain, but other issues are resolved (i.e. medical complications are treated, oedema is resolved, appetite has returned, if <2 years breastfeeding well), the child should be successfully transitioned to BP-100 before s/he leaves the hospital. The child should not be discharged until s/he is consuming at least 75% of the prescribed BP-100 ration for a few days.

The mother/caretaker should also be educated about caring for the child’s continuing rehabilitation and home, and 3 specialized OPD visits should be scheduled:

- 1st follow-up visit - 7 days after leaving the hospital
- 2nd follow-up visit - 14 days after 1st visit
- 3rd follow-up visit - 14 days after 2nd visit

**Patients with access to health center management of severe acute malnutrition:**

The patient should be treated as an inpatient at the hospital through the transition phase until:

- Medical complications are treated
- Appetite has returned (i.e. child has transitioned to F-100, then BP-100 over a few days and has taken at least 75% of the prescribed BP-100 ration for a few days)
- Oedema is resolved
- If < 2 years, breastfeeding well

Then, the child can be transferred to complete treatment and recovery phases at a specific health center with capabilities in outpatient management of SAM.

**Adjusted 10-Step Treatment of Children with SAM where outpatient management is available**

Step	Stabilization Phase		Rehabilitation Phase
	Days 1-2	Days 3-7	Weeks 2-6
1. Hypoglycaemia	→		
2. Hypothermia	→		
3. Dehydration	→		
4. Electrolytes	→		→ - - - - - →
5. Infection	→		
6. Micronutrients	→		
7. Cautious feeding	→		
8. Catch-up growth		Start with F-100, then transition to BP-100	BP-100 at home during outpatient phase →
9. Sensory stimulation	→		→ - - - - - →
10. Prepare for follow up		For follow up as outpatient →	For follow up at home after outpatient phase →

**VI-PATIENT/PARENT EDUCATION OR DOCTOR’S ADVICE**

Hospitals should organize cooking demonstrations on at least a weekly basis, daily or every other day if resources allow. Caretakers of each patient should participate in at least one of these cooking demonstrations before the child is discharged to ensure that they are capable of following feeding advice for continuing rehabilitation or recovery at home.

Individual breastfeeding support should be provided to mothers/families of every child under 2 years of age as described above (see Annex 14). Relactation support should be provided where indicated. General patient education on these issues is not sufficient to ensure rehabilitation and recovery.

All caretakers should also be provided with education on how to care for their child once the child is discharged, as the child’s recovery and growth depend on continuing good care at home. This education should include appropriate feeding and breastfeeding, danger sign counseling, how to continue any needed medications, good home and food hygiene, and follow up routines. This education should be started while the child is an inpatient and reviewed again at discharge (Annex 24 & 25).

## REFERENCES

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2. National Institute of Statistics, Ministry of Planning, *Cambodia Anthropometrics Survey 2008*. (CAS 2008)
3. National Institute of Statistics, Directorate General for Health, and ICF Macro, 2011. *Cambodia Demographic and Health Survey 2010*. Phnom Penh, Cambodia and Calverton, Maryland, USA: National Institute of Statistics, Directorate General for Health, and ICF Macro.
4. National Nutrition Program, *National Interim Guidelines for the Management of Acute Malnutrition*, December 2011.

**ANNEX 1: WEIGHT FOR HEIGHT STANDARDS (IN SDs)**  
**These are available laminated, in Khmer, 2 pages double sided**  
**(one for children 6-24 mo; another for children > 24 months)**

WHO Child Growth Standards 2006								
Weight for Length (children 6-24 months, length should be measured lying down)								
GIRLS				(recumbent)	BOYS			
weight (kg)	weight (kg)	weight (kg)	weight (kg)	length (cm)	weight (kg)	weight (kg)	weight (kg)	weight (kg)
"-3 SD"	"-2 SD"	"-1 SD"	median		median	"-1 SD"	"-2 SD"	"-3 SD"
3.0	3.3	3.6	3.9	52.5	3.9	3.6	3.3	3.0
3.1	3.4	3.7	4.0	53.0	4.0	3.7	3.4	3.1
3.2	3.5	3.8	4.2	53.5	4.1	3.8	3.5	3.2
3.3	3.6	3.9	4.3	54.0	4.3	3.9	3.6	3.3
3.4	3.7	4.0	4.4	54.5	4.4	4.0	3.7	3.4
3.5	3.8	4.2	4.5	55.0	4.5	4.2	3.8	3.6
3.6	3.9	4.3	4.7	55.5	4.7	4.3	4.0	3.7
3.7	4.0	4.4	4.8	56.0	4.8	4.4	4.1	3.8
3.8	4.1	4.5	5.0	56.5	5.0	4.6	4.2	3.9
3.9	4.3	4.6	5.1	57.0	5.1	4.7	4.3	4.0
4.0	4.4	4.8	5.2	57.5	5.3	4.9	4.5	4.1
4.1	4.5	4.9	5.4	58.0	5.4	5.0	4.6	4.3
4.2	4.0	5.0	5.5	58.5	5.6	5.1	4.7	4.4
4.3	4.7	5.1	5.6	59.0	5.7	5.3	4.8	4.5
4.4	4.8	5.3	5.7	59.5	5.9	5.4	5.0	4.6
4.5	4.9	5.4	5.9	60.0	6.0	5.5	5.1	4.7
4.6	5.0	5.5	6.0	60.5	6.1	5.6	5.2	4.8
4.7	5.1	5.6	6.1	61.0	6.3	5.8	5.3	4.9
4.8	5.2	5.7	6.3	61.5	6.4	5.9	5.4	5.0
4.9	5.3	5.8	6.4	62.0	6.5	6.0	5.6	5.1
5.0	5.4	5.9	6.5	62.5	6.7	6.1	5.7	5.2
5.1	5.5	6.0	6.6	63.0	6.8	6.2	5.8	5.3
5.2	5.6	6.2	6.7	63.5	6.9	6.4	5.9	5.4
5.3	5.7	6.3	6.9	64.0	7.0	6.5	6.0	5.5
5.4	5.8	6.4	7.0	64.5	7.1	6.6	6.1	5.6
5.5	5.9	6.5	7.1	65.0	7.3	6.7	6.2	5.7
5.5	6.0	6.6	7.2	65.5	7.4	6.8	6.3	5.8
5.6	6.1	6.7	7.3	66.0	7.5	6.9	6.4	5.9
5.7	6.2	6.8	7.4	66.5	7.6	7.0	6.5	6.0
5.8	6.3	6.9	7.5	67.0	7.7	7.1	6.6	6.1
5.9	6.4	7.0	7.6	67.5	7.9	7.2	6.7	6.2
6.0	6.5	7.1	7.7	68.0	8.0	7.3	6.8	6.3
6.1	6.6	7.2	7.9	68.5	8.1	7.5	6.9	6.4
6.1	6.7	7.3	8.0	69.0	8.2	7.6	7.0	6.5
6.2	6.8	7.4	8.1	69.5	8.3	7.7	7.1	6.6
6.3	6.9	7.5	8.2	70.0	8.4	7.8	7.2	6.6
6.4	6.9	7.6	8.3	70.5	8.5	7.9	7.3	6.7
6.5	7.0	7.7	8.4	71.0	8.6	8.0	7.4	6.8
6.5	7.1	7.7	8.5	71.5	8.8	8.1	7.5	6.9
6.6	7.2	7.8	8.6	72.0	8.9	8.2	7.6	7.0
6.7	7.3	7.9	8.7	72.5	9.0	8.3	7.6	7.1
6.8	7.4	8.0	8.8	73.0	9.1	8.4	7.7	7.2
6.9	7.4	8.1	8.9	73.5	9.2	8.5	7.8	7.2
6.9	7.5	8.2	9.0	74.0	9.3	8.6	7.9	7.3

GIRLS				(recumbent)	BOYS			
weight (kg)	weight (kg)	weight (kg)	weight (kg)	length (cm)	weight (kg)	weight (kg)	weight (kg)	weight (kg)
"-3 SD"	"-2 SD"	"-1 SD"	median		median	"-1 SD"	"-2 SD"	"-3 SD"
7.0	7.6	8.3	9.1	74.5	9.4	8.7	8.0	7.4
7.1	7.7	8.4	9.1	75.0	9.5	8.8	8.1	7.5
7.1	7.8	8.5	9.2	75.5	9.6	8.8	8.2	7.6
7.2	7.8	8.5	9.3	76.0	9.7	8.9	8.3	7.6
7.3	7.9	8.6	9.4	76.5	9.8	9.0	8.3	7.7
7.4	8.0	8.7	9.5	77.0	9.9	9.1	8.4	7.8
7.4	8.1	8.8	9.6	77.5	10.0	9.2	8.5	7.9
7.5	8.2	8.9	9.7	78.0	10.1	9.3	8.6	7.9
7.6	8.2	9.0	9.8	78.5	10.2	9.4	8.7	8.0
7.7	8.3	9.1	9.9	79.0	10.3	9.5	8.7	8.1
7.7	8.4	9.1	10.0	79.5	10.4	9.5	8.8	8.2
7.8	8.5	9.2	10.1	80.0	10.4	9.6	8.9	8.2
7.9	8.6	9.3	10.2	80.5	10.5	9.7	9.0	8.3
8.0	8.7	9.4	10.3	81.0	10.6	9.8	9.1	8.4
8.1	8.8	9.5	10.4	81.5	10.7	9.9	9.1	8.5
8.1	8.8	9.6	10.5	82.0	10.8	10.0	9.2	8.5
8.2	8.9	9.7	10.6	82.5	10.9	10.1	9.3	8.6
8.3	9.0	9.8	10.7	83.0	11.0	10.2	9.4	8.7
8.4	9.1	9.9	10.9	83.5	11.2	10.3	9.5	8.8
8.5	9.2	10.1	11.0	84.0	11.3	10.4	9.6	8.9
8.6	9.3	10.2	11.1	84.5	11.4	10.5	9.7	9.0
8.7	9.4	10.3	11.2	85.0	11.5	10.6	9.8	9.1
8.8	9.5	10.4	11.3	85.5	11.6	10.7	9.9	9.2
8.9	9.7	10.5	11.5	86.0	11.7	10.8	10.0	9.3
9.0	9.8	10.6	11.6	86.5	11.9	11.0	10.1	9.4
9.1	9.9	10.7	11.7	87.0	12.0	11.1	10.2	9.5
9.2	10.0	10.9	11.8	87.5	12.1	11.2	10.4	9.6
9.3	10.1	11.0	12.0	88.0	12.2	11.3	10.5	9.7
9.4	10.2	11.1	12.1	88.5	12.4	11.4	10.6	9.8
9.5	10.3	11.2	12.2	89.0	12.5	11.5	10.7	9.9
9.6	10.4	11.3	12.3	89.5	12.6	11.6	10.8	10.0
9.7	10.5	11.4	12.5	90.0	12.7	11.8	10.9	10.1
9.8	10.6	11.5	12.6	90.5	12.8	11.9	11.0	10.2
9.9	10.7	11.7	12.7	91.0	13.0	12.0	11.1	10.3
10.0	10.8	11.8	12.8	91.5	13.1	12.1	11.2	10.4
10.1	10.9	11.9	13.0	92.0	13.2	12.2	11.3	10.5
10.1	11.0	12.0	13.1	92.5	13.3	12.3	11.4	10.6
10.2	11.1	12.1	13.2	93.0	13.4	12.4	11.5	10.7
10.3	11.2	12.2	13.3	93.5	13.5	12.5	11.6	10.7
10.4	11.3	12.3	13.5	94.0	13.7	12.6	11.7	10.8
10.5	11.4	12.4	13.6	94.5	13.8	12.7	11.8	10.9
10.6	11.5	12.6	13.7	95.0	13.9	12.8	11.9	11.0
10.7	11.6	12.7	13.8	95.5	14.0	12.9	12.0	11.1
10.8	11.7	12.8	14.0	96.0	14.1	13.1	12.1	11.2
10.9	11.8	12.9	0.6	96.5	14.3	13.2	12.2	11.3
11.0	12.0	13.0	14.2	97.0	14.4	13.3	12.3	11.4

WHO Child Growth Standards 2006								
Weight for Height (children over 24 months, height should be measured standing up)								
GIRLS				Height (cm)	BOYS			
weight (kg)	weight (kg)	weight (kg)	weight (kg)		weight (kg)	weight (kg)	weight (kg)	weight (kg)
"-3 SD"	"-2 SD"	"-1 SD"	median		median	"-1 SD"	"-2 SD"	"-3 SD"
9.2	10.0	10.9	11.9	87.0	12.2	11.2	10.4	9.6
9.3	10.1	11.0	12.0	87.5	12.3	11.3	10.5	9.7
9.4	10.2	11.1	12.1	88.0	12.4	11.5	10.6	9.8
9.5	10.3	11.2	12.3	88.5	12.5	11.6	10.7	9.9
9.6	10.4	11.4	12.4	89.0	12.6	11.7	10.8	10.0
9.7	10.5	11.5	12.5	89.5	12.8	11.8	10.9	10.1
9.8	10.6	11.6	12.6	90.0	12.9	11.9	11.0	10.2
9.9	10.7	11.7	12.8	90.5	13.0	12.0	11.1	10.3
10.0	10.9	11.8	12.9	91.0	13.1	12.1	11.2	10.4
10.1	11.0	11.9	13.0	91.5	13.2	12.2	11.3	10.5
10.2	11.1	12.0	13.1	92.0	13.4	12.3	11.4	10.6
10.3	11.2	12.1	13.3	92.5	13.5	12.4	11.5	10.7
10.4	11.3	12.3	13.4	93.0	13.6	12.6	11.6	10.8
10.5	11.4	12.4	13.5	93.5	13.7	12.7	11.7	10.9
10.6	11.5	12.5	13.6	94.0	13.8	12.8	11.8	11.0
10.7	11.6	12.6	13.8	94.5	13.9	12.9	11.9	11.1
10.8	11.7	12.7	13.9	95.0	14.1	13.0	12.0	11.1
10.8	11.8	12.8	14.0	95.5	14.2	13.1	12.1	11.2
10.9	11.9	12.9	14.1	96.0	14.3	13.2	12.2	11.3
11.0	12.0	13.1	14.3	96.5	14.4	13.3	12.3	11.4
11.1	12.1	13.2	14.4	97.0	14.6	13.4	12.4	11.5
11.2	12.2	13.3	14.5	97.5	14.7	13.6	12.5	11.6
11.3	12.3	13.4	14.7	98.0	14.8	13.7	12.6	11.7
11.4	12.4	13.5	14.8	98.5	14.9	13.8	12.8	11.8
11.5	12.5	13.7	14.9	99.0	15.1	13.9	12.9	11.9
11.6	12.7	13.8	15.1	99.5	15.2	14.0	13.0	12.0
11.7	12.8	13.9	15.2	100.0	15.4	14.2	13.1	12.1
11.9	12.9	14.1	15.4	100.5	15.5	14.3	13.2	12.2
12.0	13.0	14.2	15.5	101.0	15.6	14.4	13.3	12.3
12.1	13.1	14.3	15.7	101.5	15.8	14.5	13.4	12.4
12.2	13.3	14.5	15.8	102.0	15.9	14.7	13.6	12.5
12.3	13.4	14.6	16.0	102.5	16.1	14.8	13.7	12.6
12.4	13.5	14.7	16.1	103.0	16.2	14.9	13.8	12.8
12.5	13.6	14.9	16.3	103.5	16.4	15.1	13.9	12.9
12.6	13.8	15.0	16.4	104.0	16.5	15.2	14.0	13.0
12.8	13.9	15.2	16.6	104.5	16.7	15.4	14.2	13.1
12.9	14.0	15.3	16.8	105.0	16.8	15.5	14.3	13.2
13.0	14.2	15.5	16.9	105.5	17.0	15.6	14.4	13.3
13.1	14.3	15.6	17.1	106.0	17.2	15.8	14.5	13.4
13.3	14.5	15.8	17.3	106.5	17.3	15.9	14.7	13.5
13.4	14.6	15.9	17.5	107.0	17.5	16.1	14.8	13.7
13.5	14.7	16.1	17.7	107.5	17.7	16.2	14.9	13.8
13.7	14.9	16.3	17.8	108.0	17.8	16.4	15.1	13.9
13.8	15.0	16.4	18.0	108.5	18.0	16.5	15.2	14.0
13.9	15.2	16.6	18.2	109.0	18.2	16.7	15.3	14.1

GIRLS				Height (cm)	BOYS			
weight (kg)	weight (kg)	weight (kg)	weight (kg)		weight (kg)	weight (kg)	weight (kg)	weight (kg)
"-3 SD"	"-2 SD"	"-1 SD"	median		median	"-1 SD"	"-2 SD"	"-3 SD"
14.1	15.4	16.8	18.4	109.5	18.3	16.8	15.5	14.3
14.2	15.5	17.0	18.6	110.0	18.5	17.0	15.6	14.4
14.4	15.7	17.1	18.8	110.5	18.7	17.1	15.8	14.5
14.5	15.8	17.3	19.0	111.0	18.9	17.3	15.9	14.6
14.7	16.0	17.5	19.2	111.5	19.1	17.5	16.0	14.8
14.8	16.2	17.7	19.4	112.0	19.2	17.6	16.2	14.9
15.0	16.3	17.9	19.6	112.5	19.4	17.8	16.3	15.0
15.1	16.5	18.0	19.8	113.0	19.6	18.0	16.5	15.2
15.3	16.7	18.2	20.0	113.5	19.8	18.1	16.6	15.3
15.4	16.8	18.4	20.2	114.0	20.0	18.3	16.8	15.4
15.6	17.0	18.6	20.5	114.5	20.2	18.5	16.9	15.6
15.7	17.2	18.8	20.7	115.0	20.4	18.6	17.1	15.7
15.9	17.3	19.0	20.9	115.5	20.6	18.8	17.2	15.8
16.0	17.5	19.2	21.1	116.0	20.8	19.0	17.4	16.0
16.2	17.7	19.4	21.3	116.5	21.0	19.2	17.5	16.1
16.3	17.8	19.6	21.5	117.0	21.2	19.3	17.7	16.2
16.5	18.0	19.8	21.7	117.5	21.4	19.5	17.9	16.4
16.6	18.2	19.9	22.0	118.0	21.6	19.7	18.0	16.5
16.8	18.4	20.1	22.2	118.5	21.8	19.9	18.2	16.7
16.9	18.5	20.3	22.4	119.0	22.0	20.0	18.3	16.8
17.1	18.7	20.5	22.6	119.5	22.2	20.2	18.5	16.9
17.3	18.9	20.7	22.8	120.0	22.4	20.4	18.6	17.1

## ANNEX 2: OEDEMA

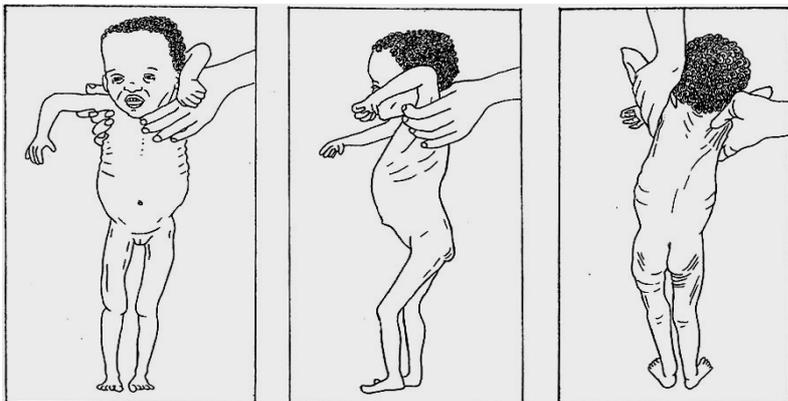
### Clinical Signs of Oedema

- Bilateral Pitting Oedema (oedema on both feet) is a clinical manifestation of SAM caused by an excess accumulation of fluid in the body.
- Oedema may also be presented due to other medical complications. However, if the oedema is bilateral and pitting, it is nutritional.
- Diagnose as + (bilateral pitting oedema of both feet), ++ (moderate: oedema of feet, legs and arms), +++ (severe: oedema of feet, legs, arms, face and body)



#### To identify Oedema:

- Apply gentle thumb pressure on the top of both feet for three seconds (COUNT 101, 102, 103). See top photo at left.
- Next, remove your thumbs.
- If a depression (print or pit) persists on both feet, this indicates that the child has oedema. See second photo at



This is a child that is severely wasted without oedema: front, side and back view.

## ANNEX 3: EMERGENCY TREATMENT OF SHOCK AND SEVERE ANEMIA

### SHOCK

- Dehydration and sepsis
  - Dehydration **will** respond to IV fluid
  - Sepsis **will** not respond to IV fluid
- **Start treatment**
- Give oxygen
  - Give D10% (5ml/kg) by IV, if BG < 3mmol/l
  - Give IV fluid D5% Ringer's lactate or half normal saline with 5% glucose, if either of these is used, add sterile potassium chloride (20 mmd/l) if possible.
  - Monitor VS every 10 mins for first 2 hours
  - Give IV AB
- **Improvement:**
- Pulse and RR fall
  - Repeat IV 15ml/kg over 1 hour, then change to oral nasogastric rehydration with ReSoMal 5-10ml/kg/h alternate with F-75 for up to 10 hours
  - Continue feeding with starter F-75
- **No improvement** after first hour of treatment (15ml/kg), assume that the child has septic shock. Then:
- Give maintenance IV fluid (4ml/kg/h) waiting for blood
  - FWB available give 10ml/kg over 3 hours
  - Feed with starter F-75.

For additional information, refer to Pediatric Shock CPG.

### SEVERE ANEMIA

Treat severe anemia as per Micronutrient Policy.

Blood transfusion required if:

- Hb < 40g/l or PCV < 12%, OR
- If there is respiratory distress and Hb is 50-70g/l

For blood transfusion:

- Give whole blood 10ml/kg over 3hours
- Furosemide 1mg/kg IV at the start of transfusion
- If child has signs of heart failure give Pack cell 5-7ml/kg over 3hours

## ANNEX 4: TREAT AND PREVENT HYPOGLYCEMIA

Check the blood glucose (BG) of all children with SAM

If **BG < 3 mmol/l** OR **< 54 mg/dl** treat with

- If conscious and no seizure: 50ml of D10% or (1 tsp of 5 cc sugar mixed with 50 ml water) oral or NG-tube OR
- If unconscious or seizure: 5ml/kg IV of D10% followed by 50 ml of 10% glucose or sucrose by NGT
- Feed F-75 (1/4 of feeding amount) every 30 min for the first 2 hours

### Monitor

After initial treatment, check BG after 2 hours:

- If BG still low, make sure antibiotics and F-75 already given. Repeat dose of D10% and continue F-75 (1/4 of feeding amount) every 30 minutes.
- If BG is normal, check it q 12 hours for 1 – 2 days and move to F-75 (full feeding amount) every 2 hours.

Always check BG if child is hypothermic

Always check BG if there is deterioration or loss of consciousness (LOC)

### Prevention

- Feed q2h with F-75
- Always feed throughout the night

## ANNEX 5: TREAT AND PREVENT HYPOTHERMIA

If axillary T < 35°C or RT < 35.5°C:

- Feed immediately with F-75
- Warm the child (using Kangaroo Mother Care (skin-to-skin, detailed on next page), a blanket and hat, or lamp).

### Monitor

- Body temperature while warming the child q30min until this rises to 36.5°C.
- Feel for warmth
- Check BG

### Prevention

- Feed q2h with F-75
- Keep room between 25° - 30°C to the extent possible
- Keep child covered and away from draughts
- Keep child dry
- Avoid exposure (for bathing or a prolonged medical examination)
- Have the child sleep with the mother at night for warmth

## Kangaroo Mother Care (KMC)

Kangaroo Mother Care (KMC) involves skin-to-skin contact between the child and the mother or caregiver. It is very important for malnourished children - studies have shown that KMC reduces hypothermia and infection, improves breathing and weight gain, provides psycho-social support to both caretaker and infant, and strengthens the bond between them. Hospitals in the developed and developing world rely on KMC based on its proven effectiveness.

### Kangaroo Mother Care

- Explain to the mother and her family how KMC works
- Remove the baby's clothing, except a diaper, hat, and socks
- Have the mother/caregiver sit up or rest on a big pillow
- Place the baby upright in skin-to-skin contact on the mother/caregiver's chest
- Turn the child's head to one side so that the child can breathe comfortably
- Make sure the child's hips and elbows are flexed into a frog-like position and the child's head and chest are on the mother/caregiver's chest
- Keep the child in place with a piece of cloth or kromah tied around the mother/caregiver and child to prevent the child from slipping out when the mother/caretaker stands up and moves around
- Explain to the mother/caregiver that s/he can keep the baby in this position day and night, if possible, with breaks for feeding
- Tell her/him that shorter periods are also helpful, with maximum benefit at about 22 hours
- Two caregivers can share KMC, taking turns to hold the child



### Breastfeeding

- Have the mother attempt to breastfeed either when the baby/child is waking from sleep or when awake and alert
- Have the mother sit comfortably, and help her with correct positioning and attachment, if necessary

### Educating the Caregiver

- Emphasize to the caregiver that s/he should wash hands frequently and keep the baby clean
- For babies < 6 months, emphasize that the baby should not be given any other food or fluids besides breastmilk
- Teach the caregiver to observe the baby's breathing pattern
- Teach the caregiver to recognize danger signs such as apnea, decreased movement, lethargy, or poor feeding

### Before discharge

- Make sure that the caregiver feels comfortable with her/his ability to continue KMC at home

- Advise her/him to return to the health facility if the baby is not feeding well, if her/his skin feels hot or cooler than normal, if she/he has breathing difficulty, or if she/he has a skin rash

## ANNEX 6: TREAT AND PREVENT DEHYDRATION

**Do not use the IV route for dehydration except in cases of shock.**

Diagnosis of Dehydration It is difficult to estimate dehydration status accurately in severely malnourished (SAM) children using clinical signs alone. *Assume that all SAM children with watery diarrhea have some dehydration.*

Treatment: Because SAM children are deficient in potassium and have abnormally high levels of sodium, standard ORS which is high in sodium and low potassium content is not suitable for them. Instead give special **Rehydration Solution for Malnutrition (ReSoMal)**. It contains less sodium, but more potassium and sugar than ORS.

ReSoMal is delivered in sachets containing 84 g of powder. ***One sachet should be dissolved in two litres of water.***

For any SAM child with watery stools, give:

- ReSoMal 5ml/kg every 30 min for first 2 hours orally or by nasogastric tube (not IVs), then:
  - 5–10ml/kg every 2 hours, alternate with F-75 every other hour for up to 10 hours. This means they get ReSoMal 5 times in 10 hours and F-75 5 times in 10 hours. This rate is slower than for children who are not SAM. Reassess the child at least every hour. The exact amount of ReSoMal to give should be determined by how much the child will drink, stool loss, vomiting, or signs of overhydration, especially signs of heart failure.
- Breastfeeding should not be interrupted during rehydration.

Monitor: During treatment, rapid respiration and pulse rates should slow down and the child should begin to pass urine. Return of tears, moist mouth, eyes and fontanelle appearing less sunken, and improved skin tone, are also signs that rehydration is proceeding. It should be noted that many severely malnourished children will not show these changes even when fully rehydrated.

Observe half hourly for 2 hours, then 1 hour for next 10 hours:

- Respiratory rate and pulse rate
- Urine frequency
- Stool/vomiting frequency
- Signs of jugular vein engorgement or increasing oedema (e.g. puffy eyelids)

**ReSoMal should be stopped immediately if:**

- respiratory or pulse rates increase;
- the jugular veins become engorged; or
- there is increasing oedema (e.g. puffy eyelids).

Prevention: To prevent dehydration in a child with continuing watery diarrhea:

- Continue to feed with F-75
- Replace volume of stool loss with ReSoMal. 50–100ml after each loose stool for children <2 years, 100–200 ml after each loose stool for older children. Continue until diarrhea stops.

- If child is breastfeeding, encourage to mother to continue. Support re-lactation in non-breastfed children under 2 years of age.
- In case of profuse diarrhea such as cholera, use ORS instead of ReSoMal in same amount and frequency.

### **ANNEX 7: CORRECT ELECTROLYTE IMBALANCE**

- Use of ReSoMal should correct electrolyte imbalance. It is not necessary and could be dangerous to give additional potassium.
- In case of abdominal distension with poor bowel movement, give MgSo4 50% 2 ml IM
- Prepare food without salt

### **ANNEX 8: TREAT AND PREVENT INFECTION**

#### **Give antibiotics to all children with SAM**

##### Child with infection

- Ampiciline 100-200mg/kg/d IV qid x 2 days, then Oral Amoxicillin 25 mg/kg/d every 12 hours for 5-7days
- AND
- Gentamycin IV or IM 7.5mg/kg qd for 7 days

If child fails to improve after for 48 hours

- Ceftriaxone 50-75mg/kg/d IV qd for 5-7 days or Cephalosporin third generation depending on course and disease

##### Child without infection

- Amoxicillin PO 25 mg/kg/d bid for 5-7days

##### Laboratory tests

- CBC, malaria smear, BG, Electrolyte, RFTs, LFTs, Protein & Albumin, HIV
- Urine analysis
- Stool examination
- Chest X-ray where indicated

Take action as needed based on lab test results.

## ANNEX 9: PROVIDE MICRONUTRIENTS & CORRECT MICRONUTRIENT DEFICIENCIES IF NEEDED

Provide systematic micronutrients to all SAM children:

Provide Vitamin A (1 dose) only at discharge, for discharge cured only

Give daily for 14 days:

- Folic acid 1 mg/d (5mg on D1)
- In case of diarrhea, zinc – 10 mg/d (1/2 tablet) for age <6 months, 20 mg/d (1 tablet) for age > 6 months (National Policy for ARI and Diarrhea Diseases)
- Once F-100 has started, not before, also give:
  - Iron/folic acid 3mg/kg

**In cases of identified Vitamin A deficiencies (Bitot's spots, pus/inflammation. Corneal clouding, corneal ulceration), eye signs or measles:**

D1 1<sup>st</sup> dose, D2 2<sup>nd</sup> dose, D14 3<sup>rd</sup> dose:

- 200 000 UI for age  $\geq$ 12 months
- 100 000 UI for age 6-11 months
- 50 000 UI for age < 6 months

**For Severe Anemia:**

- See Annex 3

## **ANNEX 10: START CAUTIOUS FEEDING WITH F-75**

### Stabilization Phase (1 – 7 days)

Feed with F-75 (for amount of F-75, see reference card, Annex 11)

- Feed F-75 starting with every 2 hours, day & night
- Feed every 30 min for 2 hours if child has hypoglycemia
- Gradually increase feed size and reduce frequency to q3h, q4h

F-75 should be fed by cup (or cup & spoon), not a bottle (for more information, see Annex 13)

- BF children should be BF every 2-3 hours, day & night. BF every time before F-75 is given
- If child is < 2 years and has stopped BF, help mother relactate (for more information, see Annex 14)

**During stabilization phase, diarrhea should gradually diminish and children with oedema should lose weight**

# ANNEX 11: VOLUME OF F-75 FEED BY CHILD WEIGHT

## F-75 Reference Card



### Volume of F-75 to give for children of different weights

*See reverse for adjusted amounts for children with severe (+++) oedema.*

Weight of child (kg)	Volume of F-75 per feed (ml) <sup>a</sup>			Daily total (130 ml/kg)	80% of daily total <sup>a</sup> (minimum)
	Every 2 hours <sup>b</sup> (12 feeds)	Every 3 hours <sup>c</sup> (8 feeds)	Every 4 hours (6 feeds)		
2.0	20	30	45	260	210
2.2	25	35	50	286	230
2.4	25	40	55	312	250
2.6	30	45	55	338	265
2.8	30	45	60	364	290
3.0	35	50	65	390	310
3.2	35	55	70	416	335
3.4	35	55	75	442	355
3.6	40	60	80	468	375
3.8	40	60	85	494	395
4.0	45	65	90	520	415
4.2	45	70	90	546	435
4.4	50	70	95	572	460
4.6	50	75	100	598	480
4.8	55	80	105	624	500
5.0	55	80	110	650	520
5.2	55	85	115	676	540
5.4	60	90	120	702	560
5.6	60	90	125	728	580
5.8	65	95	130	754	605
6.0	65	100	130	780	625
6.2	70	100	135	806	645
6.4	70	105	140	832	665
6.6	75	110	145	858	685
6.8	75	110	150	884	705
7.0	75	115	155	910	730
7.2	80	120	160	936	750
7.4	80	120	160	962	770
7.6	85	125	165	988	790
7.8	85	130	170	1014	810
8.0	90	130	175	1040	830
8.2	90	135	180	1066	855
8.4	90	140	185	1092	875
8.6	95	140	190	1118	895
8.8	95	145	195	1144	915
9.0	100	145	200	1170	935
9.2	100	150	200	1196	960
9.4	105	155	205	1222	980
9.6	105	155	210	1248	1000
9.8	110	160	215	1274	1020
10.0	110	160	220	1300	1040

<sup>a</sup>Volumes in these columns are rounded to the nearest 5 ml.

<sup>b</sup>Feed 2-hourly for at least the first day. Then, when little or no vomiting, modest diarrhoea (<5 watery stools per day), and finishing most feeds, change to 3-hourly feeds.

<sup>c</sup>After a day on 3-hourly feeds: if no vomiting, less diarrhoea, and finishing most feeds, change to 4-hourly feeds.

### Volume of F-75 for Children with Severe (+++) Oedema

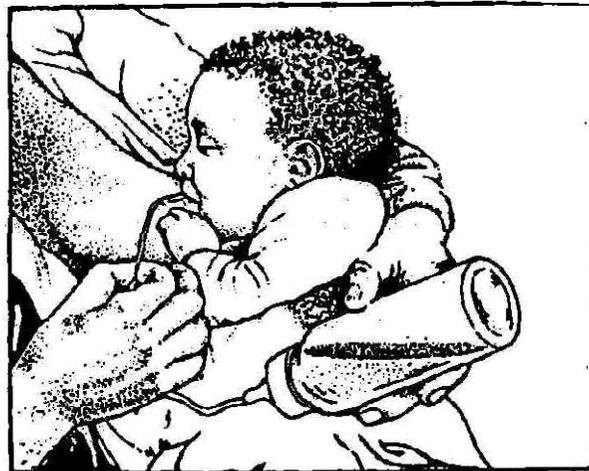
Weight with +++ oedema (kg)	Volume of F-75 per feed (ml) <sup>a</sup>			Daily total (100 ml/kg)	80% of daily total <sup>a</sup> (minimum)
	Every 2 hours <sup>b</sup> (12 feeds)	Every 3 hours <sup>c</sup> (8 feeds)	Every 4 hours (6 feeds)		
3.0	25	40	50	300	240
3.2	25	40	55	320	255
3.4	30	45	60	340	270
3.6	30	45	60	360	290
3.8	30	50	65	380	305
4.0	35	50	65	400	320
4.2	35	55	70	420	335
4.4	35	55	75	440	350
4.6	40	60	75	460	370
4.8	40	60	80	480	385
5.0	40	65	85	500	400
5.2	45	65	85	520	415
5.4	45	70	90	540	430
5.6	45	70	95	560	450
5.8	50	75	95	580	465
6.0	50	75	100	600	480
6.2	50	80	105	620	495
6.4	55	80	105	640	510
6.6	55	85	110	660	530
6.8	55	85	115	680	545
7.0	60	90	115	700	560
7.2	60	90	120	720	575
7.4	60	95	125	740	590
7.6	65	95	125	760	610
7.8	65	100	130	780	625
8.0	65	100	135	800	640
8.2	70	105	135	820	655
8.4	70	105	140	840	670
8.6	70	110	145	860	690
8.8	75	110	145	880	705
9.0	75	115	150	900	720
9.2	75	115	155	920	735
9.4	80	120	155	940	750
9.6	80	120	160	960	770
9.8	80	125	165	980	785
10.0	85	125	165	1000	800
10.2	85	130	170	1020	815
10.4	85	130	175	1040	830
10.6	90	135	175	1060	850
10.8	90	135	180	1080	865
11.0	90	140	185	1100	880
11.2	95	140	185	1120	895
11.4	95	145	190	1140	910
11.6	95	145	195	1160	930
11.8	100	150	195	1180	945
12.0	100	150	200	1200	960

<sup>a</sup>Volumes in these columns are rounded to the nearest 5 ml.

<sup>b</sup>Feed 2-hourly for at least the first day. Then, when little or no vomiting, modest diarrhoea (<5 watery stools per day), and finishing most feeds, change to 3-hourly feeds.

<sup>c</sup>After a day on 3-hourly feeds: if no vomiting, less diarrhoea, and finishing most feeds, change to 4-hourly feeds.

## Annex 12: Supplemental Suckling Method for feeding F-75 to infants < 6 months



### How to use the supplemental suckling method:

- ❑ A nursing supplemter is used for feeding infants and helping mothers to re-lactate if they have stopped breastfeeding.
- ❑ A nursing supplemter is a tube that is placed on the mother's breast and works like a drinking straw to draw milk from a cup, bottle or syringe while the baby sucks on the mother's breast.
- ❑ The end of the tube should be placed on the mother's breast so that the baby can suck and get milk from the tube and breast at the same time.
- ❑ The tube should be thin enough so that the baby sucks vigorously at the mother's breast to stimulate breastmilk production, while at the same time receiving milk from the tube itself.
- ❑ If the tube is too thick, have the mother pinch the tube (as shown in the picture) to slow down the flow of milk from the cup or bottle. This will encourage the baby to suck harder.

## Annex 13: How to Feed with a Cup (Not a bottle)



### Advantages of cup feeding over bottle feeding:

- ✓ Cups are easy to clean with soap and water if boiling is not possible.  
Cups are less likely than bottles to be carried around for a long time, which gives bacteria time to breed.  
Cup feeding is associated with lower risk of diarrhea, ear infections, and tooth decay.
- ✓ A cup does not interfere with suckling at the breast.
- ✓ A cup cannot be left beside a baby for the baby to feed himself. The person who feeds a baby by cup has to hold the baby and look at him and give him some of the contact that he needs.
- ✓ Using a cup respects Joint Prakas No 133

### How to cup feed:

- Wash your hands with clean water and soap.
- Wash the cup with boiling water and soap before putting the liquid feed (F-75 or other) in it.
- Place the estimated amount of 1 feed into the cup.
- Hold the baby sitting upright or semi-upright on your lap. Put a clean cloth or bib under the baby's chin to keep the baby clean or hold a saucer under the cup to catch any spills.
- Hold the cup of liquid feed to the baby's lips:
  - Tip the cup so that the liquid just reaches the baby's lips.
  - The cup should rest lightly on the baby's lower lip, and the edge of the cup should touch the outer part of the baby's upper lip.
  - Hold the cup to the baby's lips at a slight incline, so the baby can drink in little sips. *Do not pour* the feed into the baby's mouth to help the baby or to have the baby drink more quickly.
- Talk to the baby and look into the baby's eyes while feeding to show all your love.
- When the baby has had enough to drink, the baby will close his/her mouth and not take any more. If the baby has not taken enough, move up the time of the next feeding.
- After an hour, throw away any liquid feed the baby did not consume.

## Annex 14: How to Help a Mother to Relactate or Increase her Breastmilk Supply

### FACTS:

- Relactation usually takes 3-5 days.
- It is accomplished by putting the baby to the mother's breast every 2-3 hours, day and night. Frequent suckling stimulates the mother's breast milk production.
- If the baby is still BF, the baby is still young, or the mother only recently stopped BF, the mother will be able to re-lactate more quickly.
- However, re-lactation can be done at any time, even in a woman who has not BF for months or even years. Even a woman who has never BF can produce milk if she suckles a child, but this takes longer.

Re-lactation is easier to support while the mother is in the hospital with her infant or young child since health workers can help the mother and monitor progress 24 hours a day.

Remind the mother and other family members not use bottles or pacifiers while the child is in the hospital & not to use them once they return home.

### HOW TO PROVIDE SUPPORT TO A MOTHER:

- Discuss with the mother when and why she stopped BF and reassure her that with your help she can produce breast milk again.
- Make sure that the mother has enough to eat & drink so that she feels that she has strength & energy, and is more confident.
- Encourage the mother to rest and to relax when she feeds the baby.
- Encourage the mother to keep her child near her as much as possible, day & night.
- **The most important thing is to let the infant or young child suckle often at the mother's breast.** The mother should try to BF **every 2 hours** – so that the baby suckles at least 10 times every 24 hours. She should also let her infant or young child suckle whenever s/he seems interested. The mother should keep her infant or young child with her and **BF day & night**. She should let her infant or young child **suckle longer than before at each breast**, each time that the child breastfeeds.
- Make sure that the baby suckles in a good position. (Baby's body faces its mother and is close to her, baby's mouth is wide open, baby's chin touches mother's breast, baby's mouth covers areola and you can see baby's lower lip, baby takes long and deep sucks, mother doesn't feel any nipple pain)
- If the baby refuses to suckle on an "empty" breast, show the mother how to drip breast milk down her nipple as the baby suckles.
- Do not give the baby other milk feeds, especially if the baby is <6 months old and if the mother is still producing breast milk. If the mother's breast milk supply has completely dried up, F-75 (or F-100 if appropriate) may be necessary while waiting for her breast milk to come back. Do not give F-100 to infants < 6 months. If F-75 or F-100 are given, they should be given by cup or using a nursing supplementer:
  - To start with, give the baby or child the full amount of F-75 or F-100 for his/her weight (130 ml per kilo per day) using the nursing supplementer as much as possible to feed the baby or child. Each day, reduce the total provided by F-75 or F-100, as the mother's breast milk supply increases.
  - When not using the nursing supplementer, use a cup to feed the baby, not a bottle.
  - The baby should not be fed from a bottle by anyone. The baby should not be allowed to suck on a pacifier either, as this can interfere with breastfeeding.
  - Check the baby's weight and urine output daily, to make sure that s/he is getting enough to drink.

## ANNEX 15: MONITOR THE CHILD

Measurements to be done <b>EVERY 10 MINUTES</b> if treatment of severe dehydration, septic shock, or severe anaemia	Measurements to be taken and recorded <b>AT EACH FEED</b>	Measurements to be taken <b>every four hours</b>	Measurements to be taken and recorded at least <b>ONCE DAILY</b>
Signs of overhydration and heart failure: <ul style="list-style-type: none"> <li>▪ fast breathing respiratory distress</li> <li>▪ rapid pulse</li> <li>▪ engorgement</li> <li>▪ cold hands and feet</li> <li>▪ cyanosis of the fingertips and under the tongue</li> </ul>	<ul style="list-style-type: none"> <li>▪ Amount of F-75 or F-100 or BP-100 the child takes</li> <li>▪ Amount and frequency of vomiting</li> <li>▪ Frequency of breastfeeding</li> </ul>	<ul style="list-style-type: none"> <li>▪ Body temperature</li> <li>▪ Respiratory rate/chest drawing in</li> <li>▪ Heart rate/pulse</li> </ul>	<ul style="list-style-type: none"> <li>▪ Weight</li> <li>▪ Weight gain</li> <li>▪ Oedema</li> <li>▪ Frequency and type of stools</li> <li>▪ Dehydration</li> <li>▪ Cough</li> <li>▪ Liver size</li> <li>▪ Extremities</li> <li>▪ Palmar pallor</li> </ul>

Record this information accurately on inpatient charts (Critical Care Pathway –CCP, Annex 28) and other forms as appropriate.

### ASSESS WEIGHT GAIN DAILY:

Weigh child daily before a feed, not just after. If weight gain is:

- **Poor <5 g/kg/day:**
  - Child requires full reassessment
- **Moderate 5 – 10 g/kg/day:**
  - Check that intake targets are being met; night feeds are being given; or if an infection has been overlooked
- **Good > 10 g/kg:**
  - Continue to praise staff & mother/caretaker

## ANNEX 16: TREAT ASSOCIATED CONDITIONS

### Vitamin A deficiency

Corneal clouding, ulceration or Bitot's spot:

- Give Vitamin A D1, D2 and D14
- Chloramphenicol or Tetracycline eye drops (1%) 1 drop every 2–3 hours for 7–10days
- Atropine eye drops (1%) 1 drop tid for 3–5days
- Cover with eye pads that have been soaked in SN.

### Dermatosis

Signs:

- Hypo-or hyperpigmentation
- Desquamation
- Ulceration
- Exudation lesions often with secondary infections, including Candida

Treatment:

- Hygiene (bathe the child)
- Wipe with Permanganate 1%
- Apply Zinc oxide qid x 2 weeks
- Gauze dressing for raw area
- Omit nappies to keep the perineum dry
- If candidiasis, use oral Nystatine 100 000 UI qid or Miconazol cream apply qid for 2 weeks

### Parasitic Worms

For children  $\geq$  1 year of age. Do not give to children  $<$  1 year of age.

- Mebendazole 12-23 months -250mg – single dose, 24-59 months – 500 mg – single day  
OR  
Albendazole 200-400mg single dose OR  
bid for 7 days if *Strongyloidesstercoralise*
- Metronidazole
  - For Giardiasis 15mg/kg/day every 8 hours for 5 days
  - For Amibiiasis 30mg/kg/day every 8 hours for 7 days

## ANNEX 17: TARGET WEIGHT GAIN (15%)

Guidance Table to Identify the Target Weight for Children 6-59 Months			
Weight on admission <sup>a,b</sup>	Target weight: 15% weight gain	Weight on admission <sup>a,b</sup>	Target weight: 15% weight gain
4.1	4.7	11.1	12.8
4.3	4.9	11.3	13.0
4.5	5.2	11.5	13.2
4.7	5.4	11.7	13.5
4.9	5.6	11.9	13.7
5.1	5.9	12.1	13.9
5.3	6.1	12.3	14.1
5.5	6.3	12.5	14.4
5.7	6.6	12.7	14.6
5.9	6.8	12.9	14.8
6.1	7.0	13.1	15.1
6.3	7.2	13.3	15.3
6.5	7.5	13.5	15.5
6.7	7.7	13.7	15.8
6.9	7.9	13.9	16.0
7.1	8.2	14.1	16.2
7.3	8.4	14.3	16.4
7.5	8.6	14.5	16.7
7.7	8.9	14.7	16.9
7.9	9.1	14.9	17.1
8.1	9.3	15.1	17.4
8.3	9.5	15.3	17.6
8.5	9.8	15.5	17.8
8.7	10.0	15.7	18.1
8.9	10.2	15.9	18.3
9.1	10.5	16.1	18.5
9.3	10.7	16.3	18.7
9.5	10.9	16.5	19.0
9.7	11.2	16.7	19.2
9.9	11.4	16.9	19.4
10.1	11.6	17.1	19.7
10.3	11.8		
10.5	12.1		
10.7	12.3		
10.9	12.5		

<sup>a</sup> Or weight free of oedema

<sup>b</sup> If weight on admission is pair, round the weight up with 0.1 kg. Example: weight on admission is 9.2 kg, use 9.3 kg as weight on admission.

## ANNEX 18:REHABILITATION PHASE (FOR CHILDREN 6-59 MONTHS)

### Transition to F-100

When the child's appetite returns and oedema is reduced, the feeding of children 6-59 months is moved from F-75 to F-100

- Transition over 48-72 hours: feed the same amount of F-100 as last feed of F-75 then on the 3rd day increase each feed by 10 ml to reach 30 ml/kg/ feed of F-100

### Catch-up Growth

- Then, feed with F-100 (for amount of F-100, see Reference Card, see Annex 19)
- Range of daily volume of F-100:  
150ml/kg/day minimum — 220ml/kg/day maximum
- F-100 should be fed by cup (or cup & spoon), not a bottle (see Annex 13)
- Frequent BF on demand and before each F-100 feed, day & night
- Continue to provide individual BF support for mothers of all children < 2 years
  
- If infant is < 6 months old, DO NOT give F-100 or BP 100. For infants < 6 months, see Annex 20, 12 and 13:
  - Continue F-75 feeds with BF before each F-75 feed
  - Gradually transition to exclusive BF
  - Help mother to relactate if she has stopped BF

### If the child is to stay in the hospital to complete treatment:

- Continue to use F-100 for inpatient treatment until child reaches target (15%) weight gain.
- If the child is < 2 years old, provide breastfeeding or re-lactation support. Ensure that breastfeeding is going well and that the mother is breastfeeding frequently.
- Complete all elements of rehabilitation phase until child reaches target 15% weight gain.

### If the child will continue treatment as an outpatient

- Transition the child from F-100 to BP-100 for a few days before discharge.
- See Annex 20 to calculate quantity of BP-100 needed per day.
- The child should be able to eat 75% of the daily BP-100. This transition usually takes 24-48 hours. Test this for a few days before discharging to ensure that the child is consuming at least 75% of the daily BP-100 ration before discharging.
- If the child is < 2 years old, provide breastfeeding or re-lactation support (see Annex 14). Ensure that breastfeeding is going well and that the mother is breastfeeding frequently before discharging.

## ANNEX 19 – VOLUME OF F-100 PER FEED BY CHILD WEIGHT

## F-100 Reference Card



## Range of Volumes for Free-Feeding with F-100

Weight of Child (kg)	Range of volumes per 4-hourly feed of F-100 (6 feeds daily)		Range of daily volumes of F-100	
	Minimum (ml)	Maximum (ml) <sup>a</sup>	Minimum (150 ml/kg/day)	Maximum (220 ml/kg/day)
2.0	50	75	300	440
2.2	55	80	330	484
2.4	60	90	360	528
2.6	65	95	390	572
2.8	70	105	420	616
3.0	75	110	450	660
3.2	80	115	480	704
3.4	85	125	510	748
3.6	90	130	540	792
3.8	95	140	570	836
4.0	100	145	600	880
4.2	105	155	630	924
4.4	110	160	660	968
4.6	115	170	690	1012
4.8	120	175	720	1056
5.0	125	185	750	1100
5.2	130	190	780	1144
5.4	135	200	810	1188
5.6	140	205	840	1232
5.8	145	215	870	1276
6.0	150	220	900	1320
6.2	155	230	930	1364
6.4	160	235	960	1408
6.6	165	240	990	1452
6.8	170	250	1020	1496
7.0	175	255	1050	1540
7.2	180	265	1080	1588
7.4	185	270	1110	1628
7.6	190	280	1140	1672
7.8	195	285	1170	1716
8.0	200	295	1200	1760
8.2	205	300	1230	1804
8.4	210	310	1260	1848
8.6	215	315	1290	1892
8.8	220	325	1320	1936
9.0	225	330	1350	1980
9.2	230	335	1380	2024
9.4	235	345	1410	2068
9.6	240	350	1440	2112
9.8	245	360	1470	2156
10.0	250	365	1500	2200

<sup>a</sup> Volumes per feed are rounded to the nearest 5 ml.

**ANNEX 20: AMOUNT OF BP-100 PER CHILD BY WEIGHT**

One bar of BP-100 = 2 tablets (300 kcal)

Weight of Child (kg)	Bars per Week	Tablets per 2 Weeks	Bars per Day	Tablets per Day
4.0 – 4.9	21	84	3	6
5.0 - 6.4	28	112	4	8
6.5 – 8.4	35	140	5	10
8.5 – 9.9	42	168	6	12
10.0-10.9	49	196	7	14
11.0-12.4	56	224	8	16
12.5 – 13.9	63	252	9	18
≥14	70	280	10	20

***For inpatient care at the hospital:***

- If the child initially refuses BP-100, continue to offer every day (without forcing) until it is accepted.
- Give BP-100 according to the weight of the child. BP-100 should be given in small amounts during 24 hours. Breastfed children should be always offered breast milk. Plenty of clean water should be given to the child to drink.
- It is common for children to get some change in stool frequency when they change diet from F-100 to BP-100. This does not need to be treated unless the child loses weight.

***The child should be able to at least 75% of BP-100 (according to weight) for a few days before he/she is discharged from inpatient care.***

## ANNEX 21: SPECIAL TREATMENT FOR SAM INFANTS < 6 MONTHS

Health care providers should take special care in the management of SAM in infants < 6 months, which normally requires a combination of

- improved or re-established breastfeeding;
- temporary or longer-term therapeutic feeding; and
- nutrition, psychological and medical care for mothers

### If the mother is present

- Provide nutrition rehabilitation with intensive breastfeeding counselling and support to the mother.
- Children less than 6 months should not be moved onto F-100 or BP-100. They should be fed with supplementary suckling method (see Annex 12) using F-75 until the child is gaining adequate weight (20g per day for 5 days) on breast milk alone.
- **Baby should be exclusively breastfeeding before being discharged.**
- Bottles should not be used to feed F-75, supplemental suckling or cups should be used instead (Annex 12 or 13).
- The mother may need nutrition, medical and psychological support in order to breastfeed.

### If the mother is not breastfeeding or is absent

- If the mother has stopped breastfeeding, work with the mother on re-lactation. Babies should be fed with the supplementary suckling method using F-75 as described in Annex 12 and gradually moved to exclusive breastfeeding.
- Provide F-75 together with medical treatment according to the National Interim Guidelines for Management of Acute Malnutrition.
- If the mother has died, the inpatient care staff must discuss feeding options with the grandmother or other caretaker. Options include re-lactation of the grandmother if she is willing (which could be encouraged through supplemental suckling at the inpatient care facility) or asking another woman in the family or community who is lactating to nurse the child. In the absence of other options, the child should be fed with F-75 until s/he is gaining weight and then gradually fed with locally available & appropriate complementary foods before being discharged. The baby should not be given F-100 or BP-100.

### Discharge criteria

Infants < 6 months should continue treatment as inpatients until they are cured of any medical complications, are BF exclusively and have reached their target weight gain. If the mother has died or is absent, they should continue as inpatients until they are cured of any medical complications and other options for feeding at home with locally available foods are ensured. Infants < 6 months should not be given BP-100 at discharge or at follow up visits.

**ANNEX 22: ENSURE CORRECT CASE MANAGEMENT PRACTICES**

<b>Common Incorrect Practices– These cause deaths, so avoid them!!</b>	<b>Correct Practice</b>
<ul style="list-style-type: none"> <li>▪ <b>Child not fed at night (F-75 and BF if &lt; 2 years)</b></li> </ul>	<b>During initial treatment ensure that the child is fed every 2 hours, day &amp; night. Feeding is never less frequent than every 4 hours.</b>
<ul style="list-style-type: none"> <li>▪ <b>IV fluids given even though child is not in shock</b></li> </ul>	<b>Give IV only if signs of shock (cold hands plus slow capillary refill or weak/fast pulse).</b>
<ul style="list-style-type: none"> <li>▪ <b>IV albumin/amino acids given</b></li> </ul>	<b>Do not give these.</b>
<ul style="list-style-type: none"> <li>▪ <b>Diuretics given to treat oedema</b></li> </ul>	<b>Do not give these. Oedema will resolve with correct initial treatment using F-75 with correct minerals and vitamins.</b>
<ul style="list-style-type: none"> <li>▪ <b>High protein diet given immediately</b></li> </ul>	<b>Give F-75 until the child stabilizes, then start F-100. Do not ever give F-100 to infants &lt; 6 months old.</b>
<ul style="list-style-type: none"> <li>▪ <b>Antibiotics not given because no clinical signs of infection</b></li> </ul>	<b>Presume infection and give antibiotics to all SAM children as described in the guidelines.</b>
<ul style="list-style-type: none"> <li>▪ <b>Standard ORS used instead of ReSomal</b></li> </ul>	<b>Give ReSoMal to SAM children with diarrhoea.</b>
<ul style="list-style-type: none"> <li>▪ <b>Child left uncovered at night</b></li> </ul>	<b>Provide blanket and ensure the child is covered at night. Additionally, use Kangaroo Mother Care for infants.</b>
<ul style="list-style-type: none"> <li>▪ <b>Anaemia treated with iron from admission</b></li> </ul>	<b>Wait to start iron until the child has been on F-100 for 2 days</b>

## **ANNEX 23: PROVIDE SENSORY STIMULATION**

Provide sensory stimulation and emotional support to all children with SAM

The child must be provided with:

- Tender, loving care
- A cheerful, stimulating environment
- Structured play therapy for 15–30 min/d
- Physical activity as soon as child is well enough
- Maternal (and other family members) involvement in these activities when possible. For example, in comforting, feeding, bathing and play.

## **ANNEX 24: PREPARE FOR FOLLOW UP**

While the child is still an inpatient, educate the mother/caretaker and ensure that s/he understands:

- Child's recovery & growth depend on continuing good care at home.
- How to feed child BP-100 & other appropriate foods (enriched borbtor) after recovery. Provide caretaker with BP-100 leaflet.
- To feed child at least 5 times a day & to continue to BF frequently (on demand, at least 8 times in 24 hours), day and night.
- How to continue any medications at home.
- Danger signs & need to bring child back immediately if any signs occur.
- How to practice good home and food hygiene.
- Her child's follow-up routine at this hospital or at a specific HC
- That her child will be 'cured' when the child reaches her/his target (15%) weight gain and should continue treatment as inpatient or outpatient (if feasible) until then. This usually takes 2-6 weeks. After that time, the child should receive additional follow up and care at the nearest HC.

## **ANNEX 25:DISCHARGE PROCEDURES**

If child is discharged as ‘cured’ (ie reached target 15% weight gain before discharge):

- Explain that the child has been ‘cured’ and what this means. Congratulate caretaker.
- Remind caretaker that follow-up is the final stage of SAM treatment, as the child is still vulnerable.
- Explain that child needs to be brought back for 3 specialized OPD visits at the hospital (OR that child is transferred to a HC where outpatient SAM is available).
- Explain that the first follow-up visit appointment is in 7 days.
- Provide 1 weeks’ supply of BP-100 and any needed medications and explain how to take these at home.
- Review danger signs (no or poor appetite, high fever, frequent watery stools with blood or diarrhoea lasting more than 4 days, difficult or fast breathing, vomiting, oedema) & need to bring child back immediately if any signs occur.

In addition, explain to caretaker that child can be transitioned to appropriate complementary foods at home and should continue frequent breastfeeding (at least 8 times per day until child completes treatment).

If child is being discharged as ‘non-cured’ to continue treatment as hospital outpatient OR child is being transferred to a HC with outpatient SAM:

- Explain that child needs to be brought back for 3 specialized OPD visits at the hospital (OR that child is transferred to a HC where outpatient SAM is available).
- Explain that the first follow-up visit appointment is in 7 days.
- Provide 1 weeks’ supply of BP-100 and any needed medications and explain how to take these at home.
- Review danger signs (no or poor appetite, high fever, frequent watery stools with blood or diarrhoea lasting more than 4 days, difficult or fast breathing, vomiting, oedema) & need to bring child back immediately if any signs occur.
- Provide needed appointment form for specialized OPD at hospital (OR referral slip to HC if child is being transferred to a HC with outpatient SAM)
- Remind the caretaker that the child is ‘cured’ when s/he has achieved her/his target 15% weight gain, this usually takes a total of 2-6 weeks (including the time as an inpatient)

In addition, explain to caretaker that child can be transitioned to appropriate complementary foods at home and should continue frequent breastfeeding (at least 8 times per day until child completes treatment).

## ANNEX 26: PROTOCOL FOR FOLLOW-UP SPECIALIZED OPD VISITS

### The timing of 3 specialized OPD visits after discharge is:

- 1st follow-up visit - 7 days after discharge
- 2nd follow-up visit - 14 days after 1st visit
- 3rd follow-up visit - 14 days after the 2nd visit

*\* Refer the child back to inpatient care if s/he is not progressing at any follow-up visit*

### The following Protocol should be followed at each of the 3 visits:

Remember that weight changes are the most important means to monitor the child's progress

Assess child's progress and need for inpatient referral or a home visit (if possible):

- ✓ Weight the child and assess weight gain (Check against target weight gain of 15%)
  - ✓ Conduct a medical check up
  - ✓ Conduct Appetite test (See Annex 27)
- 
- Complete routine drugs
  - Continue BP-100 (provide 2 weeks' supply at 1<sup>st</sup> & 2<sup>nd</sup> follow-up visit, 3 weeks' supply at 3<sup>rd</sup> visit)
  - Provide counselling on how to use BP-100 at home
  - Provide breastfeeding or re-lactation support for children <2 years
  - Counsel on:
    - Infant and Young Child Feeding (IYCF) – good feeding and continued, frequent breastfeeding (day & night)
    - Hygiene
    - Danger signs – no or poor appetite, high fever, frequent watery stools with blood or diarrhoea lasting more than 4 days, difficult or fast breathing, vomiting, development of oedema
    - How and when to give the child any prescribed medicines
  - Advise when to return with child for next visit

## ANNEX 27: APPETITE TEST

**Why do the appetite test?** Malnutrition changes the way infections and other diseases express themselves. A poor appetite means that the child is likely to have a significant infection or a major metabolic abnormality such as liver dysfunction, electrolyte imbalance, and cell membrane damage or damaged biochemical pathways. These are the patients at immediate risk of death. A child with poor appetite is unlikely to eat BP-100 at home & will continue to deteriorate or die.

### *How to do the appetite test*

- The appetite test should be conducted during inpatient care & at every follow up visit.
- Explain to the caretaker the purpose of the appetite test and how it will be carried out.
- The caretaker should wash her hands.
- The caretaker should sit comfortably with the child on her lap and offer the child the BP-100 to eat. BP-100 may need to be made into a porridge using boiled water for children too young to take it as a bar (most children 6 -24 months will prefer it as a porridge).
- The caretaker should offer the child the BP-100 encouraging the child all the time. If the child refuses then the caretaker should continue to quietly encourage the child and take time over the test. The test usually takes a short time but may take up to one hour. The child must not be forced to take the BP-100. The child needs to be offered plenty of fluids to drink. If the mother is breastfeeding she should offer breast milk. If not, water should always be offered regularly whilst the child is taking the BP-100.

### *Interpreting the result of the appetite test*

**Good:** The child takes at least 3-4 mouthfuls of BP-100, at least ½ tablet.

**Poor or Refused:** The child does not take at least 3-4 mouthfuls of BP-100, does not take at least ½ tablet. The child should be referred to hospital for inpatient care until appetite returns.

Even if the caretaker/health worker thinks the child is not taking the BP-100 because s/he doesn't like the taste or is frightened, the child still needs to be referred to inpatient care. After showing sufficient appetite in inpatient care, the child can be referred back to outpatient treatment.

### *Follow-up*

- Discuss appetite and observe the child eating BP-100 at every follow up visit.
- Failure of an appetite test at any time is an indication to investigate causes & take corrective action.
- If the appetite is “good” during the appetite test but weight gain is poor, explore further to find the cause(s).
  - Does the child have vomiting, diarrhoea or fever?
  - Does the child have a cough or fever at night?
  - Is the child consuming his/her full daily ration of BP-100 every day?
  - Is the child being given other foods before taking their full daily ration of BP-100?
  - If the child is under 2 years of age, is the child being breastfed on demand, at least 8 times in 24 hours, day and night?
  - Look for underlying disease. If none found discuss with caretaker about other possibilities for low or no weight gain – these could include sharing of the BP-100, poor preparation or hygiene practices, use of unsafe water, etc. If possible a home visit should be arranged. If all causes have been investigated and low weight gain persists the child will need referral to inpatient care for further investigations for underlying cause(s).

**ANNEX 28: INPATIENT CHARTS for SEVERE MALNUTRITION  
(CRITICAL CARE PATHWAY (CCP) & OTHERS (see attached 5 pages)  
Page 6 is Follow up OPD form**

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# NEONATOLOGY

1. Newborn Resuscitation and Post Resuscitation Care ..... 472
2. Neonatal Jaundice ..... 481

# NEWBORN RESUSCITATION AND POST RESUSCITATION CARE

*By Dr. Phay Narith and WHO Teams*

## I. INTRODUCTION

Approximately 10% of newborns require some assistance to begin breathing at birth. Less than 1% requires extensive resuscitative measures.

We divided this processes of newborn resuscitation in 2 parties according to the level of each health care facilities (health center, referral hospital and national hospital).

## II. GENERALITY

Prior to all deliveries, ensure newborn resuscitation area and equipment are available and ready to use. If there is a radiant warmer, it should be warming up (although it will only be used for resuscitation). One cloth should be placed on a firm surface of the resuscitation area with suction bulb, ventilation bag and mask, stethoscope, hat and clock/timer in easy reach/view. All equipment should be tested before delivery.

Notes:

- 1) Ventilation should be done with room air by using a bag and mask. 100% oxygen during newborn resuscitation has been shown to be dangerous and should not be used.
- 2) Helping Babies Breathe (HBB) training is in alignment with the Safe Motherhood Protocol for Referral Hospitals.

A series of swift steps must be carried out on all babies immediately after birth, to ensure that **babies requiring assisted ventilation receive this within one minute** after birth.

## III. NEWBORN RESUSCITATION

**(for health center or referral hospital who is not equipped in material as CPAP and intubation)**

- Dry the newborn immediately and thoroughly by wiping the eyes, face, head, front, back, arms and legs. Thorough drying takes at least 30 seconds.
- Assess baby's breathing while drying.
- If newborn is gasping or not breathing after a thorough drying, check if airway blocked.

- Only if block is present, introduce the suction tube or bulb into the baby's mouth, then each nostril, suction while withdrawing the tube.
- If not breathing, briefly give extra stimulation by rubbing with cloth.
- If newborn is still not breathing even after all the above steps, clamp and cut cord quickly, transfer to newborn resuscitation area keeping baby covered with a dry cloth and with chest exposed and head covered with a hat. Call for help. Tell the mother that you are trying to help her newborn breathe.
- Position the head so that the neck is slightly extended and chin lifted up and forward to open up the upper airway (sometimes newborns will start breathing following this action).

Note: Do not overextend the neck or use rolls under the neck or shoulders as this will narrow the airway.



Figure 7.23: Correct position of the head for bag and mask ventilation

If still not breathing, start bag and mask ventilation:

- Place the mask over the baby's chin, mouth and nose. Do not cover eyes with the mask. (See Figure)
- Form a firm seal between the mask and the face (use mask size 1 for normal birth weight newborn and size 0 for low birth weight newborn).
- Squeeze the bag and observe the rise of the chest; if the chest does not rise when the bag is squeezed at any time, take steps to improve ventilation:
  - reposition head, to ensure chin lifted up and forward and the neck neither overextended nor flexed.
  - Ensure there are no air leaks from around the mask.
  - squeeze the bag harder with whole hand.
- Squeeze the bag 30 – 50 times a minute (optimum 40 times a minute). Squeeze-two-three, squeeze-two-three.
- Some babies may improve quickly and begin breathing well after brief bag and mask ventilation.

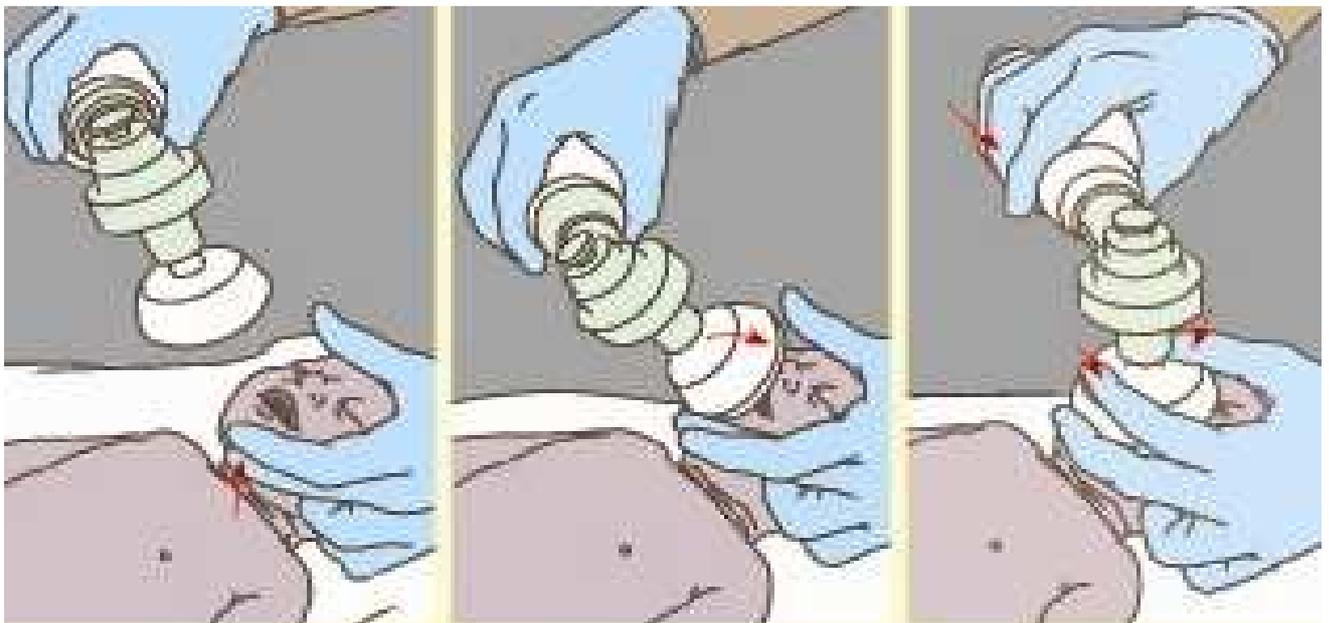


Figure: Positioning the Mask and Checking the Seal.

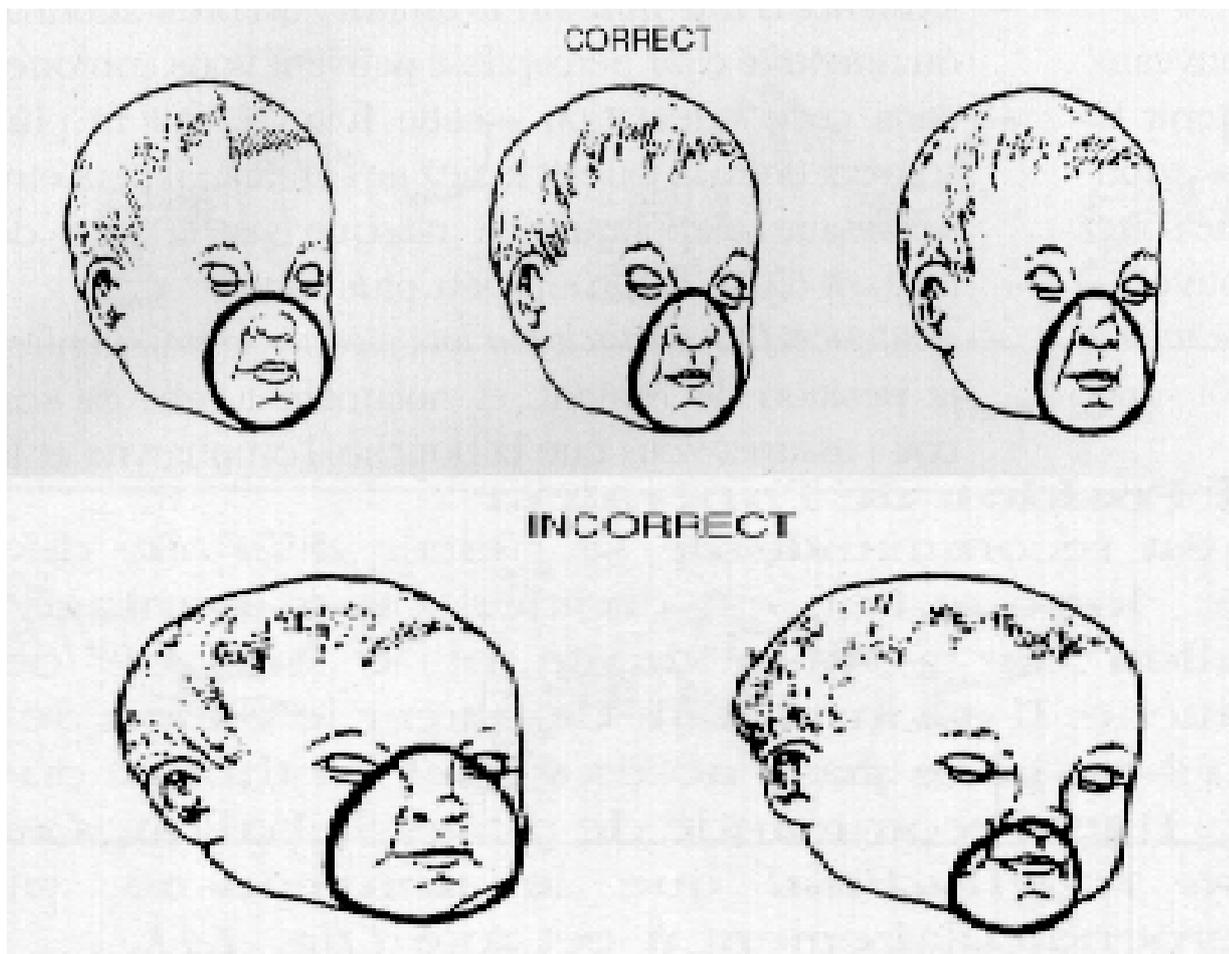


Figure: the correct and incorrect position

Assess breathing while ventilating with bag and mask.

- At any time if baby starts breathing or crying, stop ventilation and observe to ensure that the baby continues to breathe well, listen for any grunting and observe for any chest in-drawing.

If baby gasping or not breathing well, continue bag and mask ventilation for one minute, then assess heart rate by feeling for cord pulsations or by using a stethoscope just long enough to assess beats per minute.

If heart rate is  $<100$  bpm this is slow, continue ventilation at 30-50 breaths per minute.

Reassess the heart rate at 3, 5 and 10 minutes. If heart rate remains  $<100$  bpm and the baby is not breathing well continue bag and mask ventilation and consider transfer for specialized care. During transfer, baby must receive continued bag and mask ventilation, oxygen if necessary and available, thermal care and be accompanied by a health worker and caregiver.

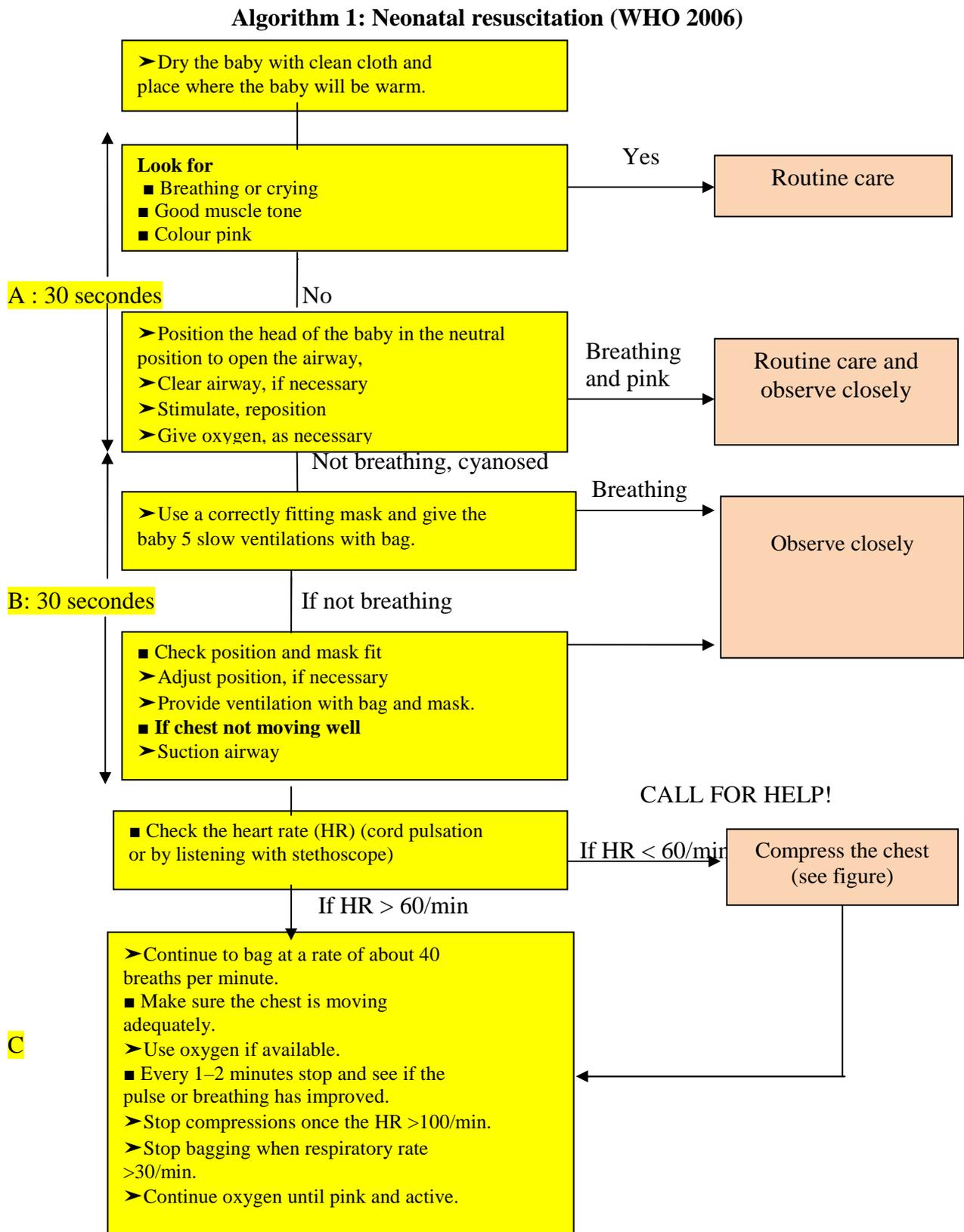
If heart rate is  $>100$  bpm this is normal but continue bag and mask ventilation until the baby is breathing well. Observe for breathing effort and improvement in color and stop ventilation when the baby is breathing, pink and the heart rate stays  $>100$  beats per minute.

In babies who have a normal heart rate ( $>100$  bpm), improved color but are not breathing, continue bag and mask ventilation. A slow decrease in the rate of ventilation over several minutes may allow the baby to breathe spontaneously. Stop bag and mask ventilation when baby breathing well.

If after 10 minutes of ventilation with good chest movement the baby is not breathing and has **no** heart rate: Stop bag and mask ventilating. Explain to the mother that the baby is dead and give emotional support. (See Algorithm 1)

#### IV. NEWBORN RESUSCITATION

(for national hospital or referral hospital who is equipped in material as CPAP and intubation)



Algorithm 2 of newborn resuscitation (Guilline 2010/AAP)

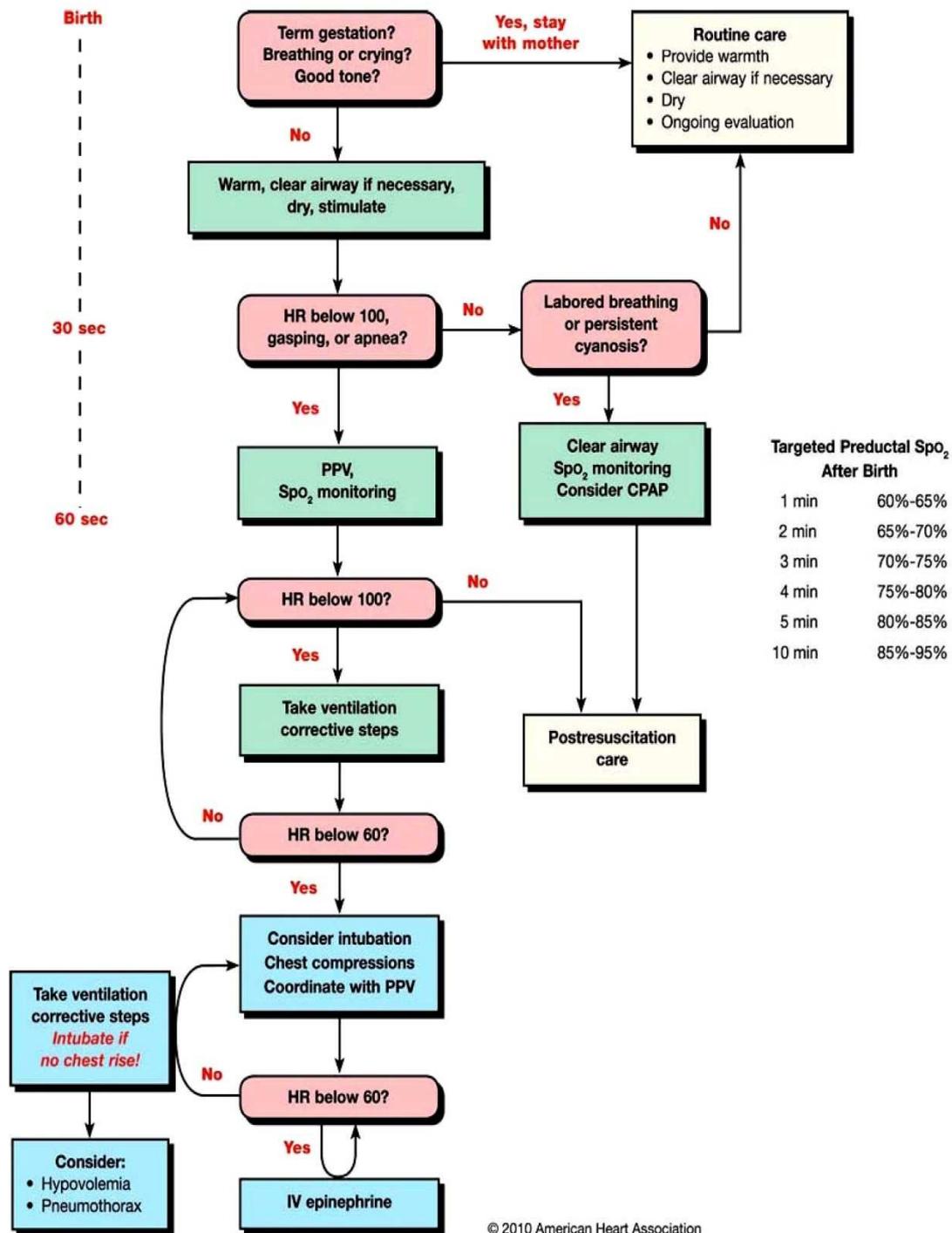


FIGURE. Newborn Resuscitation Algorithm.

© 2010 American Heart Association

**NB:**

**(1)-Positive-Pressure Ventilation (PPV)**

-Indication

- If the infant remains apneic or gasping, or if the heart rate remains < 100 per minute after administering the initial steps, start PPV.

**-Technique**

- Rates: 40 to 60 breaths per minute.
- Inflation pressure: an initial inflation pressure of 20 cm H<sub>2</sub>O may be effective, but  $\geq 30$  to 40 cm H<sub>2</sub>O may be required in some term babies without spontaneous ventilation.

**-Efficacy criteria**

- Successful ventilation is signified by adequate chest rise, symmetric breath sounds, improved pink color, heart rate  $>100$  beats/min, spontaneous respirations, and improved tone.

**(2)-CPAP (continuous positive airway Pressure), If available****-Indication**

- Infants born preterm
- Infants who are breathing spontaneously, but with difficulty, following birth. Starting infants on CPAP reduced the rates of intubation and mechanical ventilation, surfactant use, and duration of ventilation, but increased the rate of pneumothorax.
- Spontaneously breathing preterm infants who have respiratory distress may be supported with CPAP or with intubation and mechanical ventilation.

**-Technique (See CPAP protocols in the service)****(3)-Endotracheal Tube Placement (AAP/AHA 2012), If available****-Indication:**

Endotracheal intubation may be indicated at several points during neonatal resuscitation :

- Initial endotracheal suctioning of non vigorous meconium-stained newborns
- If bag-mask ventilation is ineffective or prolonged
- When chest compressions are performed
- For special resuscitation circumstances, such as congenital diaphragmatic hernia or extremely low birth weight.

**-Technique:**

Guidelines for endotracheal tube size and depth of insertion in infants with different birthweights are shown in Table 1 (Nelson Textbook 2011)

**-Efficacy criteria**

- Successful ventilation is signified by adequate chest rise, symmetric breath sounds, improved pink color, heart rate  $>100$  beats/min, spontaneous respirations, and improved tone.

**Table 1:** Guidelines for tracheal tube size and depth of insertion

Tube size (mm internal diameter)	Depth of insertion from upper lip (cm)	Weight (g)	Gestation (wk)
2.5	6.5-7	<1,000	<28
3	7-8	1,000-2,000	28-34
3/3.5	8-9	2,000-3,000	34-38

Tube size (mm internal diameter)	Depth of insertion from upper lip (cm)	Weight (g)	Gestation (wk)
3.5/4.0	≥9	>3,000	>38



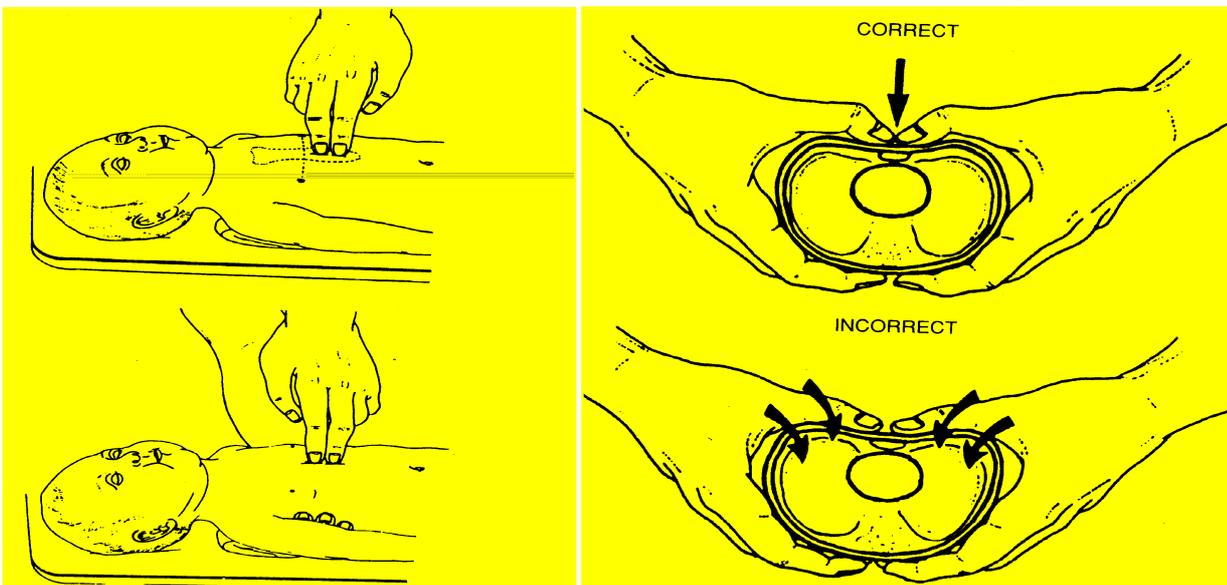
#### (4)-Chest Compressions

-Indication:

- Heart rate < 60 per minute despite adequate ventilation with supplementary oxygen for 30 seconds.

-Technique:

- Compressions should be delivered on the lower third of the sternum to a depth of approximately one third of the anterior-posterior diameter of the chest. Because the 2 thumb–encircling hands technique may generate higher peak systolic and coronary perfusion pressure than the 2-finger technique, the 2 thumb–encircling hands technique is recommended for performing chest compressions in newly born infants (See Figure). There should be a 3:1 ratio of compressions to ventilations with 90 compressions and 30 breaths. Respirations, heart rate, and oxygenation should be reassessed periodically, and coordinated chest compressions and ventilations should continue until the spontaneous heart rate is ≥ 60 per minute.



Two fingers technique

Two thumbs–encircling hands technique

-Possible complications:

- rib fracture, pneumothorax, myocardial contusion and laceration liver.

### (5)-MEDICATIONS

Drugs are rarely indicated in resuscitation of the newly born infant. Bradycardia in the newborn infant is usually the result of inadequate lung inflation or profound hypoxemia, and establishing adequate ventilation is the most important step toward correcting it.

#### Rate and Dose of Epinephrine Administration

Epinephrine is recommended to be administered intravenously (the priority if IV line established) or intratracheally.

The recommended dose is 0.01 to 0.03 mg/kg per dose (or 0.1 to 0.3 ml/kg/dose). The dose may be repeated every 3-5 min. Higher IV doses are not recommended because animal and pediatric studies show exaggerated hypertension, decreased myocardial function, and worse neurological function after administration of IV doses in the range of 0.1 mg/kg. The concentration of epinephrine for either route should be 1:10,000 (0.1 mg/mL).

-Indications:

- ✓ if the heart rate remains < 60 per minute despite adequate ventilation (usually with endotracheal intubation) with 100% oxygen and chest compressions, administration of epinephrine or volume expansion, or both, may be indicated.
- ✓ Astystole (Nelson 2011, DIU de néonatalogie Lyon I 2007)

-Efficacy criteria

- ✓ HR > 100beats/mn (DIU de Néonatalogie , Lyon I 2007)

### (6)-VOLUME EXPANSION

Volume expansion should be considered when blood loss is known or suspected (pale skin, poor perfusion, weak pulse) and the baby's heart rate has not responded adequately to other resuscitative measures. **An isotonic crystalloid solution (sérum physiologique/LR/Albumine 4%) or blood** is recommended for volume expansion in the delivery room. The recommended dose is 10 mL/kg, which may need to be repeated. When resuscitating premature infants, care should be taken to avoid giving volume expanders rapidly, because rapid infusions of large volumes have been associated with intraventricular hemorrhage.

### (7)-Glucose 10%

Newborns with lower blood glucose levels are at increased risk for brain injury. Intravenous glucose infusion should be considered as soon as practical after resuscitation, with the goal of avoiding hypoglycemia.

-Dose: 2.5 ml/kg/h in continuous infusion (syringe pump) or Burette?

-Avantage: cardiac and cerebral energy intake (DIU de Néonatalogie Lyon I 2007)

## V. POST RESUSCITATION CARE

\*In babies breathing well with 30-60 breaths per minute (normal range) without severe chest indrawing or grunting or cyanosis:

- Put the baby in direct skin-to-skin contact on the mother's chest and do routine newborn care including observation for feeding cues.

- Reassure the mother

\*Babies who received continuous ventilation for >5 minutes needs monitoring every 15 minutes for 2 hours.

- Look at the chest for indrawing.
- Take vital signs: heart rate, respiratory rate and temperature
- Listen for grunting
- Observe for cyanosis

\*Babies breathing >60 or <30 breaths per minute or with severe chest indrawing or grunting or cyanosis may benefit from supplemental oxygen if available. Prepare to transfer to specialized services accompanied by SBA and a carer:

- Put baby in direct skin-to-skin contact with the mother to keep baby warm
- Continue to give oxygen by nasal cannula or face mask until breathing 30 – 60 breaths per minute and no severe chest indrawing; monitor oxygen saturation if equipment available.
  - Anytime the respiratory rate becomes normal (30-60 breaths per minute) and the chest-indrawing, grunting or cyanosis stops, decrease and eventually stop giving the oxygen.
  - Newborns breathing < 20 breaths per minute need bag and mask ventilation
- Explain to mother what care is being given and why.
- Follow protocol for persistent breathing difficulties.

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# NEONATAL JAUNDICE

*By Dr. Lim Vanith*

## I- INTRODUCTION

Jaundice can be detected clinically when the level of bilirubin in the serum rises above  $85\mu\text{mol/l}$  ( $5\text{mg/dl}$ ). Approximately 60% of term babies and 85% of preterm having visible jaundice. Most of these cases are benign but it is important to identify those babies at risk of acute bilirubin encephalopathy and kernicterus.

## II- EPIDEMIOLOGY

The incidence of hyperbilirubinaemia varies. A study in the UK and Ireland showed an incidence of severe hyperbilirubinaemia (maximum unconjugated serum bilirubin  $\geq 510$  micromol/L [ $29.8$  mg/dL]) of 7.1 per 100,000. A study in Denmark showed an incidence of extreme hyperbilirubinaemia ( $492$  micromol/L [ $28.8$  mg/dL]) of 25 per 100,000. The risk for neonatal hyperbilirubinaemia is higher in male neonates and increases progressively with decreasing gestational age.

## III- AETIOLOGY

Jaundice can be divided into abnormal or normal:

### 1- Abnormal (non physiological)

- Jaundice started on the first day of life
- Jaundice lasting longer than 14 days in term, 21 days in preterm infants
- Jaundice with fever
- Deep jaundice: palms and soles of the baby deep yellow

### 2- Normal (physiological)

- Skin and eyes yellow but none of the above

### 3- Abnormal jaundice may be due to

- Serious bacterial infection/sepsis (Septicaemia, meningitis, urinary tract infection and intra-uterine infection)
- Haemolytic disease due to blood group incompatibility (ABO or Rhesus) or G6PD deficiency
- Congenital syphilis or other intrauterine infection
- Liver disease such as hepatitis or biliary atresia
- Hypothyroidism
- Cephalhematoma, subaponeurotic haemorrhage
- Breastfeeding and breastmilk jaundice

#### 4- Prolonged jaundice in the newborn

- visible jaundice (serum jaundice >85µmol/l) that persist beyond 14 days of life in a term infant or 21 days in a preterm infant.

Causes of prolonged jaundice:

**\* Unconjugated hyperbilirubinaemia**

- Septicaemia or urinary tract infection (UTI)
- Breast milk jaundice, hypothyroidism
- Haemolysis: G6PD deficiency, congenital spherocytosis
- Galactosaemia
- Gilbert syndrome

**\* Conjugated hyperbilirubinaemia**

- Biliary tree abnormalities
- biliary atresia-extra, intra-hepatic choledochal cyst
- paucity of bile ducts: Alagille Syndrome
- Idiopathic neonatal hepatitis syndrome
- Septicaemia or UTI
- Congenital infection TORCHES
- Metabolic disorders: citrin deficiency, galactosaemia, progressive familial intrahepatic cholestasis (PFIC), alpha-1 antitrypsin deficiency
- Total parenteral nutrition

### IV-DIAGNOSIS

#### 1. History

- Age of onset
- Previous infant with neonatal jaundice, kernicterus, neonatal death, G6PD deficiency
- Mother's blood group
- Gestation : the incidence of hyperbilirubinaemia increases with prematurity
- Presence of abnormal symptoms such as apnoea, difficulty in feeding, feed intolerance and temperature instability

#### 2. Physical examination:

- general condition, gestation and weight, sign of sepsis, hydration status
- signs of kernicterus e.g. lethargy, hypotonia, seizure, opisthotonus, high pitch cry
- Pallor, cephalhematoma, subaponeurotic haemorrhage
- Signs of intrauterine infection e.g. petechiae, hepatosplenomegaly

#### Clinical assessment of neonatal jaundice ( Kramer's rule)

Zone	Jaundice(detected by blanching the skin finger pressure)	Estimated serum bilirubin(µmol/l)
1	head and neck	100
2	over upper trunk above umbilicus	150
3	lower trunk and thighs	200
4	over arms, legs and below knee	250
5	hands, feet	>250

Note: This may be difficult in dark skinned infant

**Indications for referral to hospital:**

- jaundice within 24 hours of life
- jaundice below umbilicus
- jaundice extending to sole of feet: urgent may need exchange transfusion
- family history of significant haemolytic disease or kernicterus
- any unwell infant with jaundice
- prolonged jaundice more than 14 days

**3. Laboratory**

The clinical impression of jaundice should be confirmed by a serum bilirubin measurement, where possible. The investigations depend on the likely diagnosis and what tests are available, but may include:

- Total serum bilirubin
- Full blood count to look for signs of serious bacterial infection (high or low neutrophil count with >20% band forms), and to look for signs of haemolysis
- Blood type of baby and mother, and Coombs test
- Syphilis serology such as VDRL tests
- G6PD screen, thyroid function tests, liver ultrasound
- Blood and urine culture if infection is suspected

**Transcutaneous Bilirubinometry**

Bilirubin levels can be measured transcutaneously by a transcutaneous bilirubinometer.

Available devices differ in accuracy, safe use of this device requires knowledge of the accuracy of the particular device being used. If a transcutaneous bilirubin level is approaching the threshold for phototherapy (greater than 200 µmol/l) then a total serum bilirubin level measurement is recommended.

**V- TREATMENT****1- Phototherapy if**

- Jaundice on day 1
- Deep jaundice involving palms and soles of the feet
- Prematurity and jaundice
- Jaundice due to haemolysis

- **Treatment of jaundice based on serum bilirubin level**

Term and preterm neonates with hyperbilirubinaemia should be treated with phototherapy or exchange transfusion guided by the following cut-off levels of serum hyperbilirubinaemia:

AGE	PHOTOTHERAPY		EXCHANGE TRANSFUSION	
	Healthy newborns ≥35 weeks gestation	newborns <35 weeks gestation or any risk factors	Healthy newborns ≥35 weeks gestation	newborns <35 weeks gestation or any risk factors
Day 1	Any visible jaundice		260 µmol/l (15 mg/dL)	220 µmol/l (10 mg/dL)
Day 2	260 µmol/l (15 mg/dL)	170 µmol/l (10 mg/dL)	425 µmol/l (25 mg/dL)	260 µmol/l (15 mg/dL)
Day ≥3	310 µmol/l (18 mg/dL)	250 µmol/l (15 mg/dL)	425 µmol/l (25 mg/dL)	340 µmol/l (20 mg/dL)

- **Phototherapy**

- phototherapy light source Wavelengths in the blue-green spectrum are effective

- position light source 35-50cm from top surface of the infant
  - expose infant appropriately
  - cover infant's eye
  - turn infant every 2 hours
  - monitor serum bilirubin levels as indicated
  - monitor infant's temperature 4 hourly to avoid chilling or overheating
  - ensure adequate hydration
  - discontinue phototherapy when bilirubin is 30 $\mu$ mol/l below phototherapy level
  - allow parental-infant interaction
  - turn off photolights during feeding and blood taking
- **Complications of phototherapy**
    - overheating
    - water loss
    - diarrhoea
    - ileus (preterm infants)
    - rash (no specific treatment required)
    - retinal damage (theoretical)
    - parental anxiety/separation
    - bronzing of infants with conjugated hyperbilirubinemia
  - **Ceasing phototherapy**
    - Visual estimations of the bilirubin level or estimation by transcutaneous monitor in infants undergoing phototherapy are not reliable.
    - Phototherapy should be stopped once serum bilirubin is 50 mmol/l (3 mg/dl) or below the phototherapy threshold.
    - Infants should be followed up 48 hours after discharge

## 2- Exchange transfusion

- Blood exchange transfusion to lower the serum bilirubin level and reduce the risk of kernicterus
- A total serum bilirubin level at or above the exchange transfusion level should be considered a medical emergency. Commence intensive (multiple light) phototherapy immediately and discuss further care with a neonatologist
- Immediate exchange transfusion is recommended even if the total serum bilirubin is falling if a baby is jaundiced and displays signs of intermediate to advanced staged of acute bilirubin encephalopathy which include:
  - lethargy, hypotonia, poor feeding with high pitched cry
  - hyper alert or irritable
  - hypertonia, arching, retrocolis-opisthotonus
  - obtunded to comatose, apnoea, seizure
- Exchange transfusion should only be performed by trained personnel in neonatal intensive care unit with full monitoring and resuscitation capabilities.

## VI-PREVENTION

- Test all pregnant women for ABO,Rh(D) during pregnancy
- Encourage all mothers to breastfeed their babies 8-12 times a day
- Supplementation with water does not affect bilirubin level and is not recommended
- Educate parents regarding signs of adequate hydration,feeding and signs of jaundice

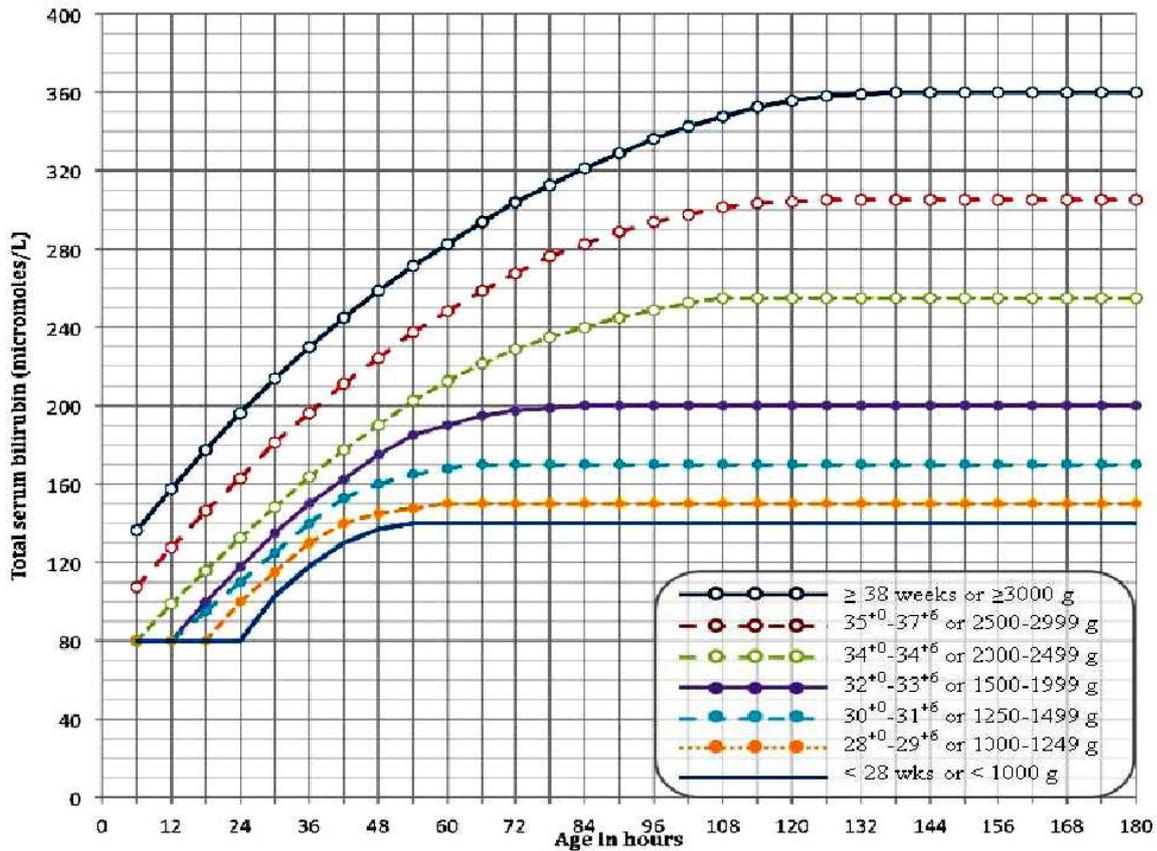
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## Appendix A: Phototherapy guidelines for all gestational ages

### Babies under phototherapy:

- Check the total serum bilirubin level 12-24 hourly but if the total serum bilirubin level is greater than (>) 30 micromoles/L above the line, then check the total serum bilirubin level 4-6 hourly
- Stop phototherapy if the total serum bilirubin level is greater than (>) 50 micromoles/L below the line and consider rechecking the total serum bilirubin level in 12-24 hours



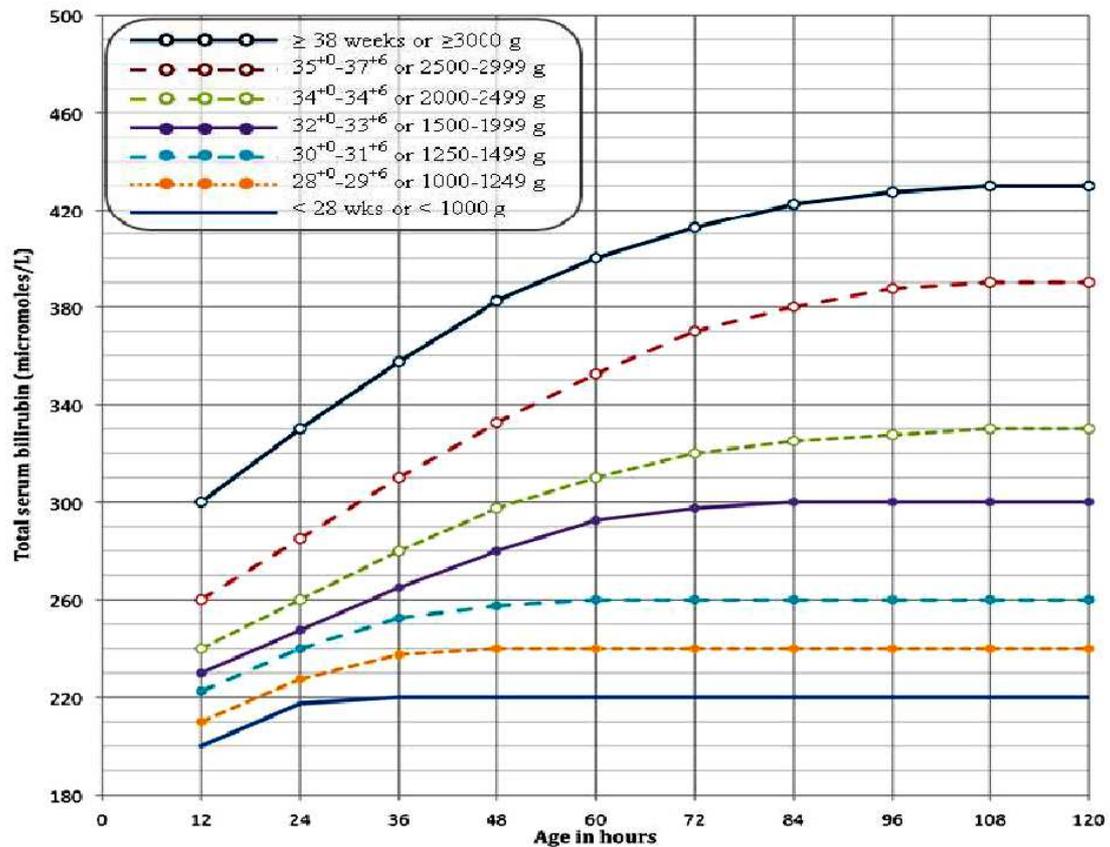
Adapted from:

- American Academy of Pediatrics Subcommittee on Hyperbilirubinaemia. Management of Hyperbilirubinaemia in the Newborn Infant 35 or more weeks of gestation. *Pediatr* 2004;114(1):297-316
- Horn AR, Kirsten GF, Kroon SM, Henning PA, Moller G, Pieper C et al. Phototherapy and exchange transfusion for neonatal hyperbilirubinaemia. *SAMJ* 2006;96(9):819-824

Queensland Maternity and Neonatal Clinical Guidelines Program: Neonatal Jaundice: prevention, assessment and management: Guideline No. MN09.7-V3-R11

## Appendix B: Exchange transfusion guidelines for all gestational ages

- Babies who present with a total serum bilirubin level above threshold should have an exchange transfusion done if the total serum bilirubin level is not expected to be below the threshold after 6 hours of intensive phototherapy
- Immediate exchange is recommended if there are signs of bilirubin encephalopathy and usually also if the total serum bilirubin level is greater than 85 micromoles/L above the threshold at presentation
- Exchange if total serum bilirubin level continues to rise faster than 17 micromoles/L per hour despite intensive phototherapy



Adapted from:

- American Academy of Pediatrics Subcommittee on Hyperbilirubinaemia. Management of Hyperbilirubinaemia in the Newborn Infant 35 or more weeks of gestation. *Pediatr* 2004;114(1):297-316
- Horn AR, Kirsten GF, Kroon SM, Henning PA, Moller G, Pieper C et al. Phototherapy and exchange transfusion for neonatal hyperbilirubinaemia. *SAMJ* 2006;96(9):824

Queensland Maternity and Neonatal Clinical Guidelines Program: Neonatal Jaundice: prevention, assessment and management: Guideline No: MN09.7-V3-R11

# VACCINATION



# សេចក្តីសង្ខេបរួម ទំរង់ជាភាសាខ្មែរ

**តើបាក់តេរីប្រភេទអ្វីដែលជាមូលហេតុបង្កអោយមានជំងឺរលាកសួតដែលឆ្លងនៅក្នុងសហគមន៍  
នៅក្នុងប្រទេសកម្ពុជា?**

**តើមានពិតមានអ្វីខ្លះនៃភាពស៊ាំរបស់មេរោគដែលជួបញឹកញាប់ជាងគេដែលបង្កជំងឺរលាកសួតឆ្លង  
នៅក្នុងសហគមន៍ នៅប្រទេសកម្ពុជា?**

ជំងឺរលាកសួតដែលឆ្លងនៅក្នុងសហគមន៍  
និងជំងឺរលាកផ្លូវដង្ហើមខាងក្រោមធ្ងន់ធ្ងរគឺជាមូលហេតុទីមួយនៃការស្លាប់របស់មនុស្សចាស់និង  
កុមារនៅក្នុងប្រទេសដែលមានប្រាក់ចំនូលទាប។ នៅឆ្នាំ២០១១ ក្រសួង  
សុខាភិបាលនៃប្រទេសកម្ពុជាបានរៀបរៀងការត្រួតពិនិត្យ  
និងកែតម្រូវឡើងវិញជាលើកដំបូងនៃមគ្គុទេសក៍ថ្នាក់ជាតិនៃការព្យាបាល ដែលមានស្រាប់  
ដែលក្នុងនោះរួមមានទាំងការព្យាបាលនៃជំងឺរលាកសួត។

សូមអរគុណថវិកាជំនួយឥតសំណងរបស់ភ្នាក់ងារបារាំងសំរាប់ការអភិវឌ្ឍន៍  
តាមរយៈវិទ្យាស្ថានប៉ាស្ទ័រ ដែលជាបណ្តាញនៃភាគីពាក់ព័ន្ធជាតិ  
និងអន្តរជាតិនៅប្រទេសកម្ពុជាដែលត្រូវបានបង្កើតនៅឆ្នាំ២០១២  
ដើម្បីផ្តល់ព័ត៌មានពិតជាក់ស្តែងអំពីជំងឺរលាកសួតដែលឆ្លងនៅក្នុងសហគមន៍  
បង្កឡើងដោយបាក់តេរីនៅប្រទេសកម្ពុជា និងកំរិតភាពស៊ាំនៃមេរោគនឹងថ្នាំផ្សេងៗ  
ដោយពឹងផ្អែកទៅលើទាំងទិន្នន័យដែលត្រូវបានបោះពុម្ពផ្សាយ  
និងទិន្នន័យដែលមិនត្រូវបានបោះពុម្ពផ្សាយ។

ទិន្នន័យអេពីដេមីសាស្ត្របង្ហាញក្នុងសេចក្តីសង្ខេបនេះទាក់ទងនឹងមេរោគបង្កអោយមានជំងឺ  
និងព័ត៌មានអំពីភាពស៊ាំរបស់មេរោគជាមួយនឹងថ្នាំផ្សេងៗ។ ព័ត៌មានទាំងនេះផ្តល់នូវភស្តុតាង  
ជាក់ស្តែងសំរាប់មគ្គុទេសក៍នៃការព្យាបាល។

*របៀបដាក់របាយការណ៍នេះជាឯកសារយោង: CALIBAN. Community-Acquired Lung Infections  
Bacteria and Antibiotics Network. Executive Summary. Phnom Penh, Cambodia. October 2012;*

## សារសំខាន់ៗ

- មេរោគដែលត្រូវបានរកឃើញជាទូទៅនៅលើអ្នកជំងឺរលាកសួតដែលឆ្លងនៅក្នុងសហមត៌ន៍ ក្នុងប្រទេសកម្ពុជាមិនខុសគ្នាខ្លាំងពីមេរោគដែលមាននៅប្រទេសជិតខាង រឺនៅប្រទេសលោកខាងលិចនោះទេ។ មេរោគដែលជួបប្រទះញឹកញាប់ជាងគេរួមមាន *S. pneumoniae* និង *H. influenzae* ។ បាក់តេរីក្រាមអវិជ្ជមាន (Gram negative) ដូចជា *K. pneumoniae* និង *B. pseudomallei* ក៏ត្រូវបានរកឃើញផងដែរ ជាពិសេសក្នុងករណីធ្ងន់ធ្ងរ។
- ទិន្នន័យដែលអាចរកបានអំពី *S. pneumoniae* បានបង្ហាញថាក្រុមមេរោគប្រភេទនេះនៅត្រូវជាមួយនឹងថ្នាំ amoxicillin ប៉ុន្តែការសិក្សាជាច្រើននៅប្រទេសកម្ពុជា ថៃ និង វៀតណាមដែលត្រូវបានដាក់បញ្ចូលនៅក្នុងការសិក្សានិងពិនិត្យឡើងវិញនេះ បានបង្ហាញថាមេរោគប្រភេទនេះ (ប្រមាណ ៧៥%) មានកំរិតភាពស៊ាំខ្ពស់ជាមួយនឹងថ្នាំ cotrimoxazole ។
- ក្រុមមេរោគ *H. influenzae* និង *B. pseudomallei* ដែលរកឃើញនៅមន្ទីរពេទ្យជាច្រើននៅត្រូវជាមួយនឹងថ្នាំ amoxicillin-clavulanic acid ។ ប៉ុន្តែទំរង់ធ្ងន់ធ្ងរនៃជំងឺរលាកសួតដោយមេរោគ *B. pseudomallei* ទាមទារនូវការព្យាបាលដោយថ្នាំផ្សេងទៀត (សូមមើលនៅក្នុងមគ្គុទេសក៍នៃ ការព្យាបាលថ្នាក់ជាតិដែលទើបតែត្រូវបានកែតម្រូវចុងក្រោយ)។
- ការស៊ាំនៃមេរោគ *K. pneumoniae* នឹងថ្នាំ amoxicillin-clavulanic acid និងcephalosporins ជំនាន់ទី៣ ត្រូវបានរាយការណ៍នៅក្នុងប្រទេសកម្ពុជា និងប្រទេសជិតខាង។
- ប្រភេទមេរោគដែលមិនប្រទះឃើញជាប្រក្រតី (atypical pathogens) អាចបង្កអោយមានជំងឺរលាកសួតដែល ឆ្លងនៅក្នុងសហមត៌ន៍ធ្ងន់ធ្ងរ។ មេរោគទាំងនេះត្រូវបានរកឃើញនៅក្នុងប្រទេសថៃ និងវៀតណាម (ជាពិសេសករណីកើតលើកុមារ)។ នៅប្រទេសកម្ពុជាវិញ ពិតមានពីចំនួនករណីជំងឺរលាកសួតបង្កឡើងដោយមេរោគដែលមិនប្រទះឃើញជាប្រក្រតី (atypical pathogens) មានតិចតួចណាស់។

**សេចក្តីសង្ខេប**  
**នេះ សំអាងលើ:**  
 ការសិក្សានិង ត្រួតពិនិត្យឡើងវិញដែលមាន លក្ខណៈជាប្រព័ន្ធនៃសេចក្តីរំលឹក ទ្រឹស្តីនៅក្នុងប្រទេស កម្ពុជា និងប្រទេសជិត ខាង

- ការសិក្សានិង ត្រួតពិនិត្យឡើងវិញនៃទិន្នន័យដែលអាចរកបានពី ប្រទេសកម្ពុជា

**សង្ខេបលទ្ធផល: បាក់តេរីដែលជាមូលហេតុបង្កជំងឺរលាកសួតនៅប្រទេសកម្ពុជា  
(លើកលែងមេរោគរបេង)**

ដូចគ្នានឹងនៅប្រទេសថៃ និងវៀតណាមដែរ បាក់តេរី *streptococcus pneumoniae* និង *haemophilus influenzae* គឺជាមេរោគដែលរកឃើញញឹកញាប់ជាងគេនៅលើអ្នកជំងឺរលាកសួតដែលឆ្លងនៅក្នុងសហគមន៍និងមិនបង្កដោយមេរោគរបេងនៅចន្លោះឆ្នាំ ២០០៧ និង ២០១១។

នៅមណ្ឌលសុខភាព (កំរិត ១) បាក់តេរីប្រភេទ *S. pneumoniae*, *H. influenzae*, *P. aeruginosa* និង *K. pneumoniae* គឺជាមេរោគដែលត្រូវបានរកឃើញញឹកញាប់ជាងគេ (ទាំងលើមនុស្សចាស់ និងកុមារ)។

នៅមន្ទីរពេទ្យថ្នាក់ស្រុក/ខេត្ត (កំរិត ២) ជំងឺរលាកសួតនៅលើអ្នកជំងឺអាយុ ៥ឆ្នាំ និងច្រើនជាងនេះ គឺសុទ្ធសឹងតែបណ្តាលមកពីបាក់តេរីប្រភេទ *H. influenzae*, *K. pneumoniae*, *B. pseudomallei* និង *S. pneumoniae*។ យើងនៅខ្វះទិន្នន័យអំពីប្រភេទបាក់តេរីដែលបង្កជំងឺរលាកសួតដែលឆ្លងនៅក្នុងសហគមន៍លើកុមារ។

នៅមន្ទីរពេទ្យបង្អែក ឬថ្នាក់ជាតិ (កំរិត ២និង៣) ករណីធ្ងន់ធ្ងរនៃជំងឺរលាកសួតបណ្តាលមកពីបាក់តេរី គឺសុទ្ធសឹងតែទាក់ទងនឹងបាក់តេរីប្រភេទ *E. coli* និង *B. pseudomallei* ។ ប៉ុន្តែបាក់តេរីដែលត្រូវបានរកឃើញញឹកញាប់ជាងគេនៅលើកុមារវិញរួមមាន *S. pneumoniae*, *S. aureus* និង *H. influenzae*។

**សង្ខេបលទ្ធផល: ភាពស៊ាំរបស់មេរោគនឹងថ្នាំផ្សេងៗដែលជួបប្រទះញឹកញាប់ជាងគេនៅលើ ជំងឺរលាកសួតដែលឆ្លងនៅសហមគ្គីនៅក្នុង ប្រទេសកម្ពុជា និងប្រទេសជិតខាង**

- ភាពស៊ាំនឹងថ្នាំ *penicillin G* នៃបាក់តេរី *S. pneumoniae*  
 ត្រូវបានរាយការណ៍នៅក្នុងការសិក្សានៅប្រទេសថៃ និងវៀតណាម (ពី ១៧% ទៅ ៣៥% ក្នុងចំណោម ២៦៩ ក្រុមបាក់តេរីដែលត្រូវបានសិក្សាតាំងពីឆ្នាំ២០០២)។  
 ភាពស៊ាំនេះត្រូវបានពិពណ៌នាថាមានកំរិតទាបជាងនេះនៅប្រទេសកម្ពុជា (១៩% ក្នុងចំណោម ២៦ ក្រុមបាក់តេរីនៅកន្លែងសិក្សាមួយ ៤%ក្នុងចំណោម ៨៤ ក្រុមបាក់តេរីនៅកន្លែងសិក្សាមួយផ្សេងទៀត)។ កំរិតនៃភាពស៊ាំខ្លាំងនឹងថ្នាំ *cotrimoxazole* ត្រូវបានរាយការណ៍នៅក្នុងគ្រប់ការសិក្សានៅប្រទេសកម្ពុជា (៦៥% ក្នុងចំណោម ១២៥ ក្រុមបាក់តេរី)។
- ភាពស៊ាំនេះជាការប្រមូលមួយពីព្រោះថ្នាំនេះនៅតែជាថ្នាំដូរមុខគេនៅកន្លែងថែទាំសុខភាពជាច្រើនសំរាប់ការព្យាបាលជំងឺរលាកសួតដែលឆ្លងនៅក្នុងសហមគ្គី នៅប្រទេសកម្ពុជា។  
 ចំនួនករណីនៃភាពស៊ាំនឹងថ្នាំ *erythromycin* ក៏មានកំរិតខ្ពស់ផងដែរ ដែលស្ថិតនៅចន្លោះពី ៣២% ទៅ ៤៤% នៅគ្រប់កន្លែងថែទាំសុខភាពនៅប្រទេសកម្ពុជា និងលើសពី ៥០%នៅក្នុងប្រទេសថៃ និងវៀតណាម។ ប៉ុន្តែបាក់តេរី *S. pneumoniae* មានភាពស៊ាំតិចតួចនឹងថ្នាំ *amoxicillin* នៅក្នុងមន្ទីរពេទ្យកំរិតទី២មួយនៅប្រទេសកម្ពុជា ដែលអាចបង្ហាញបានថាថ្នាំ *amoxicillin* ក្នុងកំរិតខ្ពស់ នៅតែអាចជាជំរើសទី១សំរាប់ការព្យាបាលជំងឺរលាកសួតដែលឆ្លងនៅក្នុងសហមគ្គី ។
- ក្រុមបាក់តេរី *H. influenzae* មានកំរិតភាពស៊ាំខ្លាំងនឹងថ្នាំ *cotrimoxazole* នៅក្នុងមន្ទីរពេទ្យថ្នាក់ស្រុក/ខេត្តនៅក្នុងប្រទេសកម្ពុជា ដូចអ្វីដែលបានពិពណ៌នានៅប្រទេសថៃដែរ។  
 ក្រុមបាក់តេរី *H. influenzae* ឆ្លើយតបជាមួយនឹងថ្នាំ *amoxicillin-clavulanic acid* ៩៨% ទៅ ១០០%។  
 នៅប្រទេសកម្ពុជានិងប្រទេសជិតខាង ករណីជំងឺរលាកសួតធ្ងន់ធ្ងរដោយបាក់តេរី *H. influenzae* ឆ្លើយតបល្អនឹងក្រុមថ្នាំ *cephalosporins* ជំនាន់ទី៣។
- បាក់តេរីក្រុម *K. pneumoniae* ជាធម្មតាមានភាពស៊ាំនឹងថ្នាំ *ampicillin* និង *amoxicillin* ពេលត្រូវបានប្រើតែឯង។ ក្រុមបាក់តេរី *K. pneumoniae* នៅកម្ពុជាឆ្លើយតបល្អនឹងថ្នាំ *amoxicillin-clavulanic acid* ពី ៣៣% ទៅ ៧៨% ជាមួយនឹងបញ្ហានៃភាពស៊ាំនឹងថ្នាំដែលទើបតែមានឡើងដោយសារតែការផលិតនូវ *ESBL*។

ភាពស្មុំនៃបាក់តេរី *K. pneumoniae* និងថ្នាំ *cephalosporines* មានកំរិតខ្ពស់ដូចនៅក្នុងប្រទេសថៃ និងវៀតណាម។ ថ្នាំ *Amikacin* មានភាពសកម្មល្អនៅក្នុងការសិក្សាទាំង៤ ដែលសិក្សាអំពីការឆ្លើយតបរបស់ថ្នាំនឹងមេរោគ។ ថ្នាំ *Carbapenems* គឺជាជំរើសមួយផងដែរសំរាប់ព្យាបាលករណីធ្ងន់ធ្ងរ។

- បាក់តេរីក្រុម *B. pseudomallei* ជាធម្មតាមានភាពស្មុំនឹងក្រុមថ្នាំ *amino-glycosides* ។ នៅប្រទេសកម្ពុជា ថ្នាំ *amoxicillin-clavulanic acid* មានការឆ្លើយតបល្អជាមួយនឹងមេរោគ *B. pseudomallei* (មិនមានការធ្វើតែស្តសាកល្បងនេះនៅប្រទេសថៃ និងវៀតណាមទេ)។ *B. pseudomallei* នៅតែត្រូវជាមួយនឹងថ្នាំ *ceftazidime* ១០០% (ត្រូវការជាចាំបាច់លើករណីធ្ងន់ធ្ងរ) នៅគ្រប់ទីកន្លែង ហើយវាក៏មានការឆ្លើយតបល្អជាមួយនឹងថ្នាំប្រភេទ *cotrimoxazole* និង *chloramphenicol* ផងដែរ។

ភាពស្មុំរបស់មេរោគជាមួយនឹងថ្នាំផ្សះបណ្តាលអោយមានការកើនឡើងខ្ពស់នៃមរណភាព ការលេចឡើងជាជំងឺ និងថ្លៃថែទាំសុខភាពសំរាប់បុគ្គលម្នាក់ៗ និងប្រជាជនទាំងអស់។ ដោយសារតែការលេចឡើងនៃភាពស្មុំរបស់មេរោគជាមួយនឹងថ្នាំ និងការប្រើប្រាស់ថ្នាំផ្សះមុនពេលចូលសំរាកព្យាបាលនៅមន្ទីរពេទ្យបង្អែក ការចេញវេជ្ជបញ្ជាអោយប្រើប្រាស់ថ្នាំផ្សះ គួរតែត្រូវបានកែសំរួលអោយបានត្រឹមត្រូវទៅតាមការវិវត្តន៍នៃសភាពជំងឺរបស់អ្នកជំងឺ និងលទ្ធផលនៃការឆ្លើយតបរបស់ថ្នាំជាមួយនឹងមេរោគ (antibiograms) នៅពេលណាដែលការបណ្តុះមេរោគអាចធ្វើទៅបាន។



សៀវភៅនេះត្រូវបានផលិតដោយមានការគាំទ្រពីពលរដ្ឋអាមេរិក តាមរយៈទីភ្នាក់ងារសហរដ្ឋអាមេរិកដើម្បីអភិវឌ្ឍន៍អន្តរជាតិ (USAID)។ អត្ថន័យនៅក្នុងសៀវភៅនេះគឺជាការទទួលខុសត្រូវទាំងស្រុងរបស់អង្គការ University Research Co., LLC និងមិនឆ្លុះបញ្ចាំងពីទស្សនៈរបស់ USAID ឬរដ្ឋាភិបាលសហរដ្ឋអាមេរិកឡើយ។