DENGUE IN CHILDREN
INTRODUCTION

• Dengue is one of the ten leading causes of hospitalization and death in children.

• Globally - 20 million cases/yr. – 24,000 deaths/yr.

• It is important to know the typical and atypical presentations in dengue fever for early diagnosis and treatment.
ETIOLOGY

• Family Flaviviridae,

• Genus Flavivirus - 4 dengue virus serotypes :– DEN-1, DEN-2, DEN-3, DEN-4

• No cross-protection between serotypes
EPIDEMIOLOGY

- Dengue viruses are transmitted by mosquitoes of the Stegomyia family.
- Aedes aegypti, a daytime biting mosquito, is the principal vector.
- These species breed in water trapped in vegetation.
- Epidemics were common in temperate areas of the Americas, Europe, Australia, and Asia.
THE VECTORS

Aedes aegypti

Aedes albopictus
PATHOGENESIS

• Incompletely understood.

• Circulation of infection-enhancing antibodies at the time of infection is the strongest risk factor for development of severe disease.

• Rapid activation of the complement system.

• Capillary damage - internal redistribution of fluid, resulting in hemoconcentration, hypovolemia, increased cardiac work, tissue hypoxia, metabolic acidosis, and hyponatremia.
**Dengue case classification by severity**

Dengue ± warning signs

Without

with warning signs

Severe dengue

1. Severe plasma leakage
2. Severe haemorrhage
3. Severe organ impairment

**Criteria for dengue ± warning signs**

- **Probable dengue**
  - Live in/travel to dengue endemic area. Fever and 2 of the following criteria:
    - Nausea, vomiting
    - Rash
    - Aches and pains
    - Tourniquet test positive
    - Leucopenia
    - Any warning sign

- **Laboratory confirmed dengue**
  - (important when no sign of plasma leakage)

- **Warning signs**
  - Abdominal pain or tenderness
  - Persistent vomiting
  - Clinical fluid accumulation
  - Mucosal bleed
  - Lethargy; restlessness
  - Liver enlargement >2cm
  - **Laboratory**: Increase in HCT concurrent with rapid decrease in platelet count

* Requiring strict observation and medical intervention

**Criteria for severe dengue**

1. **Severe plasma leakage** leading to:
   - Shock (DSS)
   - Fluid accumulation with respiratory distress

2. **Severe bleeding**
   - as evaluated by clinician

3. **Severe organ involvement**
   - Liver: AST or ALT ≥1000
   - CNS: Impaired consciousness
   - Heart and other organs
Days of illness

Temperature

Potential clinical issues
- Dehydration
- Shock
- Bleeding
- Reabsorption
- Fluid overload

Organ Impairment

Laboratory changes
- Hematocrit
- Platelet

Serology and virology
- Viraemia
- IgM/IgG

Course of dengue illness:
- Febrile
- Critical
- Recovery Phases
# INVESTIGATIONS

<table>
<thead>
<tr>
<th>Virus detection and its components</th>
<th>Clinical sample</th>
<th>Diagnostic method</th>
<th>Methodology</th>
<th>Time to results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute serum (1–5 days of fever) and necropsy tissues</td>
<td>Viral isolation</td>
<td>Mosquito or mosquito cell culture inoculation</td>
<td>One week or more</td>
<td></td>
</tr>
<tr>
<td>Nucleic acid detection</td>
<td>RT-PCR and real time RT-PCR</td>
<td>1 or 2 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antigen detection</td>
<td>NS1 Ag rapid tests</td>
<td>Minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NS1 Ag ELISA</td>
<td>1 day</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Immuno-histochemistry</td>
<td>2–5 days</td>
<td></td>
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</tbody>
</table>
## INVESTIGATIONS

<table>
<thead>
<tr>
<th>Serological response</th>
<th>Paired sera (acute serum from 1–5 days and second serum 15–21 days after)</th>
<th>IgM or IgG seroconversion</th>
<th>ELISA</th>
<th>HIA</th>
<th>1–2 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum after day 5 of fever</td>
<td>IgM detection (recent infection)</td>
<td>ELISA</td>
<td></td>
<td></td>
<td>Minutes</td>
</tr>
<tr>
<td></td>
<td>IgG detection</td>
<td>IgG ELISA</td>
<td></td>
<td></td>
<td>1 or 2 days</td>
</tr>
</tbody>
</table>
Ig M AND Ig G

Enzyme Immunoassay

Onset of illness
Fever: viraemia
1º vs 2º infection
IgM: 1º vs 2º

1º infection (fever)

2º infection (fever)
<table>
<thead>
<tr>
<th>NS Ag(+) IgM(-) IgG(-)</th>
<th>first time infection (&lt;6 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS Ag(+) IgM(+) IgG(-)</td>
<td>first time infection (&gt;6 days)</td>
</tr>
<tr>
<td>NS Ag(-) IgM(+) IgG(-)</td>
<td>first time infection (&gt;6 days)</td>
</tr>
<tr>
<td>NS Ag(-) IgM(-) IgG(+)</td>
<td>previous infection NO second infection</td>
</tr>
<tr>
<td>NS Ag(+) IgM(+) IgG(+)</td>
<td>second infection (&gt;6 days) + past infection</td>
</tr>
<tr>
<td>NS Ag(+) IgM(-) IgG(+)</td>
<td>second infection (&gt;6 days) + past infection</td>
</tr>
</tbody>
</table>
Dengue Case Management

**Presumptive Diagnosis:**
Live in / travel to endemic area plus
Fever and two of the following:
- Anorexia and nausea
- Rash
- Aches and pains
- Warning signs
- Leucopenia
- Tourniquet test positive

**Warning signs:**
- Abdominal pain or tenderness
- Persistent vomiting
- Clinical fluid accumulation
- Mucosal bleed
- Lethargy; restlessness
- Liver enlargement >2cm
- Laboratory: Increase in HCT concurrent with rapid decrease of platelet count

**Assessment**

Lab confirmed dengue (important when no sign of plasma leakage)

**Classification**

Co-existing conditions
Social circumstances

- negative
- positive

- Dengue without warning signs
- Dengue with warning signs
- Severe Dengue

**Group A**
May be sent home

**Group B**
Referred for in-hospital care

**Group C**
Require emergency treatment
<table>
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<tr>
<th>Group A</th>
<th>Patients who do not have warning signs and who are able to tolerate adequate volumes of oral fluids and to pass urine at least once in 6 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group B</td>
<td>Patients with co-existing conditions such as infancy, diabetes mellitus OR Existing warning signs</td>
</tr>
<tr>
<td>Group C</td>
<td>Patients with any of the following features: Severe plasma leakage with shock and/or fluid accumulation with respiratory distress Severe bleeding Severe organ impairment</td>
</tr>
</tbody>
</table>
FLUID THERAPY WITH COMPENSATED SHOCK

- Initiate intravenous therapy @ 5–7 ml/kg/hr for 1–2 hours
- Reduce to 3–5 ml/kg/hr for 2–4 hr
- If there is improvement after second bolus, reduce rate to 7–10 ml/kg/hr for 1–2 hours
- If there is improvement after second bolus, reduce rate to 7–10 ml/kg/hr for 1–2 hours
- No improvement and if HCT decreases, this indicates bleeding give blood

- Initiate intravenous therapy @ 10 ml/kg over 1 hour
- Reduce to 3–5 ml/kg/hr for 2–4 hr if worsening
- 10–20 ml/kg/hr for 1 hour
- If HCT decreases, give blood

reduce to 2–3 ml/kg/hr or less according to clinical response
Improvement

Hypotensive shock
Fluid resuscitation with 20 ml/kg over 15 minutes isotonic crystalloid or colloid

Yes

Improvement

Crystalloid/colloid 7-10 ml/kg/hr for 1 hour, then reduce to 2-4 ml/kg within 6-10 hours and change to crystalloid

If HCT Increases or is high Administer 3rd bolus fluid (colloid) 10–20 ml/kg over 1 hour

If HCT Incr

easing or high HCT decreasing

Administer 2nd bolus fluid (colloid) 10–20 ml/kg over ½ to 1 hour

HCT Increasing or high

Check Hematocrit

No

HCT decreasing

No Improvement

Consider significant occult/overt bleed
Initiate transfusion

If Hct low consider significant occult/overt bleed Initiate transfusion

No

No Improvement

If HCT low consider significant occult/overt bleed Initiate transfusion
MONITORING IN SHOCK STATE

- Alertness, comfort level and appetite
- Vital signs and peripheral perfusion
  (every 15-30 minutes until pt. is out of shock and then 1-2 hourly)
- Hematocrit
- Pleural effusion/ ascites
- Urine output – one hourly. Minimum 0.5 ml/kg/hour
  (if >2ml/kg reduce IVF)
HAEMATOCRIT

• Rising or persistently high Hct with stable vital signs.

• Decrease in Hct with unstable vital signs.

• Decrease in Hct with stable vital signs - decrease fluid input.

• Total IVF for 24 hrs. – should not be more then double the maintenance.
INCREASING RESPIRATORY DISTRESS

- PULSE VOLUME
- LOW  COLLOIDS/IVIG
- HIGH  FLUID RESTRICTION/DIURETIC
- NORMAL  CHEST X-RAY
  INC PL EFF  COLLOID/IVIG
  PUL EDEMA  FLD RES/DIU
WHEN TO STOP INTRAVENOUS FLUIDS

• Knowing when is critical to dengue management.

Definite stop

1. Features of intra vascular compartment overload
   • Hypertension with good volume pulse.
   • Breathing difficulties, pulmonary edema.

2. 48 hours after defervescence.
COMPLICATIONS

• Prolonged and/or profound shock.
• Severe bleeding with severe disseminated intravascular coagulopathy.
• Fluid overload.
• Respiratory distress and failure.
• Multi-organ dysfunction of liver, kidneys and neurological system.
• Irreversible shock and death.
PREVENTION

• Avoid mosquito bites through the use of insecticides, repellents, body covering with clothing, screening of houses, and destruction of A. aegypti breeding sites.
• If water storage is mandatory, a tight-fitting lid or a thin layer of oil may prevent egg laying or hatching.
• A larvicide, such as Abate can be used.
• Ultra-low-volume spray equipment effectively dispenses the adulticide, malathion from truck or airplane for rapid intervention during an epidemic.
• Recently vaccine has been licensed
THANK YOU