Management of Dengue ‘Critical Phase’

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Day 1  2  3  4  5  6  7  8  9

**Fever**

**Febrile phase**

**Critical phase**

**Convalescent phase**

- **Hematocrit**

- **WBC** 6,000-9,000
  - ≤5,000

- **Platelet count** 200,000
  - ≤100,000
  - <50,000
  - <30,000
  - Plt rising

- **Hct** 35
  - 45 (rising 20%)
  - ≤3.5 gm%

**Plasma leakage**

**Stop leakage**

**Pleural effusion, Ascites**

**Plasma leakage**

**Stop leakage**

**Reabsorption**

**IV fluid: NSS, DAR, DLR**

**Colloid: 10% Dextran-40 M+5% Deficit**

(= 4,600 ml in adult)

**Professor Siripen Kalayanarooj**

- Sometimes high Hct, increase urine output

**Tourniquet test+**

- **WBC** 6,000-9,000
- **Platelet count** 200,000
- **Hct** 35
- **Albumin**
Hallmarks of DHF

- Plasma leakage – rising HCT (PCV) > 20 %. pleural effusion, ascites, hypoalbuminemia (serum albumin < 3.5 gm%)

- Abnormal hemostasis – bleeding tendency, thrombocytopenia, prolonged PTT, Prolonged TT, prolonged PT

The end of febrile phase
Febrile phase

- No IV fluid given, if the patients could eat and drink
- Encourage ORS 3 cc/kg/hr
- Plain water is not recommended
- If necessary, give 5% DSS with minimal rate
Severity of DHF

- Grade I – No shock
- Grade II – No shock, spontaneous bleeding
- Grade III – Shock
- Grade IV – Profound shock (unmeasurable BP/ Pulse)
• Rapid leakage: shock in < 24 hrs.
  ○ Morning: plt 80,000 and evening plt 30,000/mm³

• Slow leakage: shock > 24 hours
How to detect plasma leakage

• Fever
• Platelet < 100,000 /cu.mm
• Evidence of plasma leakage
  - hemoconcentration ≥ 20%
  - pleural effusion (CXR, U/S)
  - ascites (physical exam, U/S)
  - serum albumin <3.5 gm% in normal or < 4 gm% in obese or decrease 0.5 gm% from baseline
  - thickening of gall bladder / fluid in hepatorenal pouch / gall bladder edema (U/S)
Evidences of plasma leakage in DHF/severe dengue
Indications for giving IV fluid
(when, what, amount, how)

• Persistent vomiting

• Signs of moderate to severe dehydration

• Hct rising $\geq 10\%$, or not to eat and drink

• Dengue shock syndrome
Monitoring 4 parameters

Clinical

Vital signs q 2 hrs

Hct q 4-6 hours

Urine output (0.5 – 1 ml/kg/hr)
# Monitoring Chart for Dengue Patients

Instructions - Do CBC daily/bd and PCV 6 hrly. Monitor other parameters 3-4 hrly and when leaking detected monitoring every hour.

Indications to call for immediate advice:
1. Pulse rate > 120/min with fever or >100/min without fever.
2. Pulse Pressure 25-20 mmHg or less (in supine position)
3. Postural drop of SBP >20mmHg.
4. Significant bleeding (Haematemesis, Melena, Bleeding PV etc.)
5. UOP <0.5ml/Kg/hr
6. CRFT > 2 sec

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>BP</th>
<th>Temp</th>
<th>PR</th>
<th>RR</th>
<th>PP</th>
<th>RR</th>
<th>HCT (%)</th>
<th>Clinical/ Lab/ Treatment</th>
<th>Nursing Care/ Signs</th>
<th>INTAKE</th>
<th>OUTPUT</th>
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CBC Day of Admission
- BW = kgs.
- Hight = cms
- IBW = kgs.

Hct = WBC =
- Plt =
- Lym =

Maintenance fluid =
- M + 5% Deficit =

Name | Age | HN | AN | Pulse: F = Full M= Moderate W= Weak N = Not Palpable
---|-----|----|----|----------------------------------|
Ward |     |    |    |                                 |
Attending Physician |    |    |    |                                 |

<table>
<thead>
<tr>
<th>Date of Fever</th>
<th>Day of Illness</th>
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<tbody>
<tr>
<td>TT</td>
<td>Liver</td>
</tr>
<tr>
<td>Bleeding</td>
<td>Epistaxis</td>
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<tr>
<td>Abdomen</td>
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DETECTION OF SHOCK: DIFFICULT GOOD CONSCIOUSNESS

- No fever and rapid pulse: Impending shock?
- Narrowing of pulse pressure, e.g. 100/80, 110/90 mmHg
- Hypotension – think of bleeding
- Rapid/ weak pulse
- Delayed capillary filling time (>2 sec)
- Restlessness/ irritable
- Speak fowl language, rude behavior
Other causes of shock in Dengue patients

• Hypoglycemia
• Excessive vomiting
• Co-infections
Principles of IV fluid in DHF patients during leakage period

- **Isotonic salt solution**: NSS, DAR, DLR with or without dextrose
  - Check blood sugar if given IV without dextrose
  - 30% of DSS patients have hypoglycemia

- **Limited amount of fluid (oral + IV)** during leakage period (M +5% deficit or 4.6 L in adults)
  - If give more IV fluid, will cause more leakage that will interfere with respiration
  - If more volume is needed, switch to Dextran-40 (hyper-oncotic), plasma expander
IV FLUID IN CRITICAL (LEAKAGE) PHASE (PLATELET \( \leq 100,000 \) CELLS/MM\(^3\).)

- **Start** Isotonic salt solution when inadequate oral intake
- **Amount** = Maintenance + 5% Deficit in 24-48 hours
- **Shock** - 24 hours
- **Non-shock** – 48 hours
Principles of IV fluid in DHF patients during leakage period

• Minimal volume, just to maintain intra-vascular volume

• Adjust rate of IV fluid according to 4 parameters: clinical, vital signs, Hct, and amount of urine
CALCULATION OF M + 5% DEFICIT

Maintenance:
- First 1-10 kg. = 100 ml/ kg
- 10-20 kg = 50 ml/kg
- > 20 kg = 20 ml/kg

5% Deficit = 50 ml/kg

Example: adult 50 kgs

M = (10 X 100 ml) +
   (10 X 50 ml) +
   (30 X 20 ml)
   = 1,000 + 500 + 600
   = 2,100/day = 87 ml/hr

5% D = 50 X 50 ml
      = 2,500

M+5%D = 2,100 + 2,500
        = 4,600/day
        = 4,600/24 hr = 191.67 ml/hr
        = 191.67/50 kg = 3.83 ml/kg/hr
### RATE IV FLUID: COMPARISON OF ADULTS AND CHILDREN

<table>
<thead>
<tr>
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<th>Child (ml/kg/hr)</th>
<th>Adult (ml/hr)</th>
</tr>
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<tbody>
<tr>
<td>M/2</td>
<td>1.5</td>
<td>40</td>
</tr>
<tr>
<td>Maintenance (M)</td>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>M +5%D</td>
<td>5</td>
<td>100-120</td>
</tr>
<tr>
<td>M +7%D</td>
<td>7</td>
<td>150</td>
</tr>
<tr>
<td>M + 10%D</td>
<td>10</td>
<td>300 - 500</td>
</tr>
</tbody>
</table>
Non-shock: rate depends on degree of thrombocytopenia & rising Hct
• Hct rising < 20% starts with rate less than maintenance rate (1.5 ml/kg/hr)
• Hct ≥ 20% starts with maintenance rate ( 3 ml/kg/hr)
• Hct > 25%, the rate will be 7-8 ml/kg/hr
Rate of IV fluid

Shock

Rate of IV Fluid in Dengue Shock Syndrome

DSS – NSS (D) 10 ml/kg/hr or 500 ml/hr in adult, if profound shock – free flow 15-30 mins, then reduce rate
When not respond to conventional IV fluid treatment

- A – Acidosis (Prolonged shock: LFT, BUN, Cr)
- B – Bleeding (Hct)
- C – Calcium (Na, K)
- S – Blood sugar
Clinical symptoms/signs of DSS (DHF grade III or compensated shock or PP ≤20 mmHg)

Immediately management: HCT+ blood glucose testing + oxygen therapy
5%D/NSS (DAR/DLR) 10 ml/kg (children) or 500 ml (adults) IV drip in 1–2 h

Reduced rate of IV fluid
- 7,5,3,1.5 ml/kg/h (children)
- 250,150,100,80,40 ml/h (adults)
Stop/decrease IV fluid after 24 h

HCT increase

HCT decrease

HCT decrease >10 points or below baseline

Dextran-40 in NSS IV drip in 1 h
- 10 ml/kg (children)
- 500 ml (adults)

PRC/FWB IV drip in 1–2 h
- 5-10 ml/kg (children)
- 1 unit (adults)

Check A,B,C,S,F (Table 2) and correct

Improved

Not improved

Not improved

Check A,B,C,S,F (Table 2) and correct

Improved

Improved

Reduce rate of IV fluid
- 7,5,3,1.5 ml/kg/h (children)
- 250,150,100,80,40 ml/h (adults)
Stop/decrease IV fluid after 24 h

PRC/FWB IV drip in 1–2 h
- 5-10 ml/kg (children)
- 1 unit (adults)

Check A,B,C,S,F (Table 2) and correct

Plan for RRT

DAR : Acetate Ringer’s Solution in dextrose
DHF : Dengue Hemorrhagic Fever
DLR : Lactate Ringer’s Solution in dextrose
DSS : Dengue Shock Syndrome
FWB : Fresh Whole Blood
HCT : Hematocrit
IV : Intravenous
NSS : Normal Saline Solution
NS1 Ag : Nonstructural protein-1 Antigen
PRC : Packed Red Cells
PP : Pulse Pressure
RRT : Renal Replacement Therapy
DHF grade IV or decompensated shock or BP/PR can not be measured

- Immediately management: HCT+ blood glucose testing + oxygen therapy
  NSS/AR/LR IV free flow or 10 ml/kg (children) or 500-1000 ml (adults) IV bolus
- Check A,B,C,S,F (Table 2) and correct

**Improved**

- Change IV fluid to 5%D/NSS 10 ml/kg (children) or 500 ml (adults) IV drip in 1–2 h

**Not improved**

- Not improved
  - Check HCT
  - HCT increase
    - Dextran-40 in NSS IV drip in 1 h
      - 10 ml/kg (children)
      - 500 ml (adults)
  - HCT decrease
    - HCT decrease >10 points or below baseline
      - PRC/FWB IV drip in 1–2 h
        - 5-10 ml/kg (children)
        - 1 unit (adults)
    - HCT decrease <10 points
      - PRC/FWB IV drip in 1–2 h
        - 5-10 ml/kg (children)
        - 1 unit (adults)

**Not improved**

- Improved
  - Reduce rate of IV fluid
    - 7,5,3,1.5 ml/kg/h (children)
    - 250,150,100,80,40 ml/h (adults)
  - Stop/decrease IV fluid after 24 h

- Improved
  - Repeat IV fluid bolus
    - NaHCO3 1-2 mEq/kg (children) or 50-100ml (adults)

- Not improved
  - Improved
    - Repeat IV fluid bolus
      - NaHCO3 1-2 mEq/kg (children) or 50-100ml (adults)

**AR** : Acetate Ringer's Solution
**BP** : Blood pressure
**DHF** : Dengue Hemorrhagic Fever
**LR** : Lactate Ringer's Solution
**FWB** : Fresh Whole Blood
**HCT** : Hematocrit
**IV** : Intravenous
**NSS** : Normal Saline Solution
**PR** : Pulse Rate
**PRC** : Packed Red Cells
**RRT** : Renal Replacement Therapy
In case of suspected bleeding

- Blood transfusion
- Consider PLT transfusion when having major active bleeding

Improvement of PLT/ PT/ APTT lasted <5 hours
Indications for switching to colloidal solution

• Signs and symptoms of fluid overload
  o Puffy eyelids, distended abdomen with ascites
  o Dyspnea/ Tachypnea
  o Positive lungs signs: crepitation, rhonchi, wheezing

• Continue rising Hct

• Persistent high Hct > 25-30% from baseline

• Too much crystalloid solutions before plasma leakage (those patients who received IV fluid early before leakage started)
10% Dextran-40 in NSS

- Bolus dose; 10 ml/kg/hr or 500 ml/hr in adult usually brings Hct down by 10 points
- Hct before and after dextran
  - Think of Bleeding if:
    - Hct drop > 10 points
    - Hct drops below baseline
- Maximum dose per day = 30 ml/kg/day
- All through the course, may use up to 6 doses
- Aware that urine will be sticky and may not pass in reabsorption phase (need Furosemide?)
Choice of colloidal solutions

- **Plasma Substitute**: (can be used as initial fluid resuscitation but not for massive plasma leakage) (Iso-oncotic – 280 mosm):
  - Plasma (FFP)
  - Hemaccel
  - 6% Haes-steril
  - 6% Hetastarch (voluven)
  - Gelefudin
Almost no role !!!

- The osmolarity of plasma is equal to the patients’ plasma so it will not hold the plasma volume and it will leak into the pleural and peritoneal spaces.

- To correct the abnormal coagulogram, the dose is 40-50 ml/kg (equal to the patients’ plasma volume). There is no available space for that large volume.
Plasma leakage:
Natural course in severe cases

0                   24                   48                  72 hours

Reabsorption

Start
Shock
Equilibrium
Stop

Plt < 100,000 cells/cumm
Hct ↑

72 hours
Convalescence

• Reabsorption 8-12 hrs. after leakage is stopped
• Decreased the rate of IV fluid or stopped IV fluid

Convalescence rash, itching

A – appetite
B – bradycardia
C – Convalescence rash, itching
D – Diuresis: aware of hypokalemia
Key messages in giving IV fluid in DHF/severe dengue

- Entering critical period – thrombocytopenia: platelet count ≤ 100,000 and throughout plasma leakage time, 1-2 days (and 12-24 hours beyond)

- Shock: difficult to detect because patients are in good consciousness, able to walk and talk

- Not before and after stop leakage, if IV fluid is extend beyond this leakage phase, patients are at risk of fluid overload, which is one of the major causes of death
Thank you!