Management of Dengue 'Critical Phase'

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Natural course of DHF

Day 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

Fever

Shock

Febrile phase

Critical phase

Convalescent phase

Hematocrit

Plasma leakage

Stop leakage

Reabsorption

Pleural effusion, Ascites

Fluid overload

IV fluid: NSS, DAR, DLR
Colloid: 10%Dextran-40
M+5% Deficit
(= 4,600 ml in adult)

Sometimes high Hct, increase urine output

W B C

Tourniquet test+

WBC	6,000-9,000	≤5,000				
Platelet count	200,000		≤100,000	<50,000	<30,000	Plt rising
Hct	35	38	45 (rising 20%)			
Albumin			≤3.5 gm%			

Professor Siripen Kalayanarooj

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)**

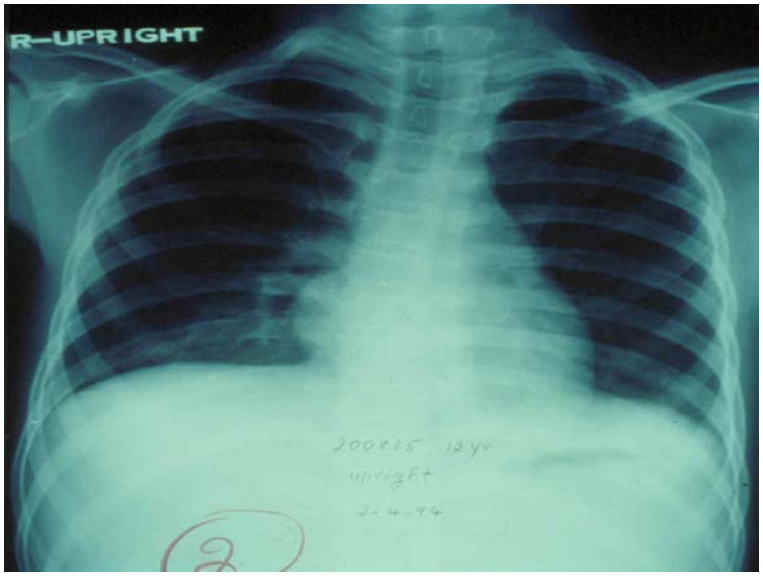
CRITICAL / LEAKAGE PHASE

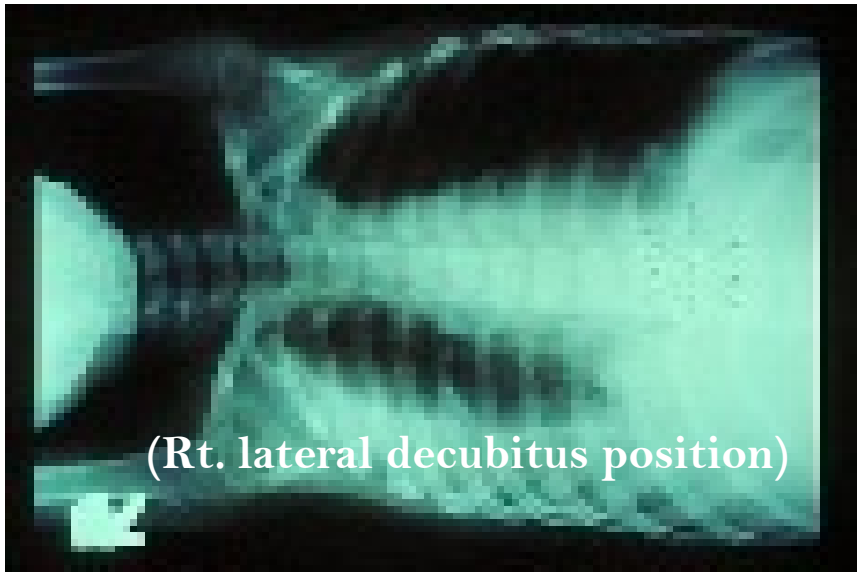
- **Rapid leakage: shock in < 24 hrs.**
  - **Morning: plt 80,000 and evening plt 30,000/mm3**
- **Slow leakage: shock > 24 hours**

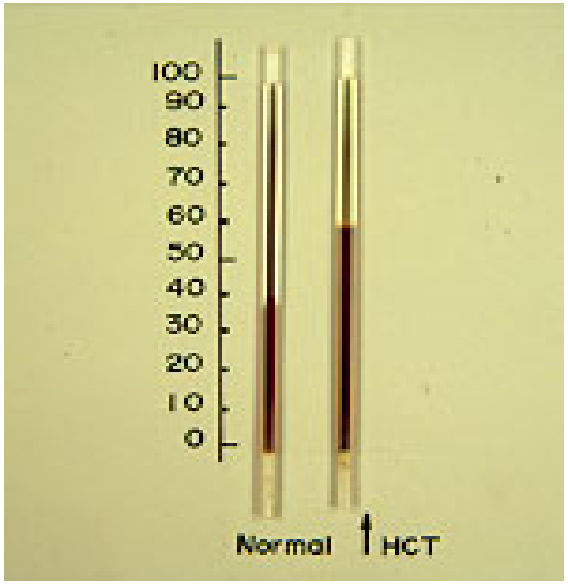
How to detect plasma leakage

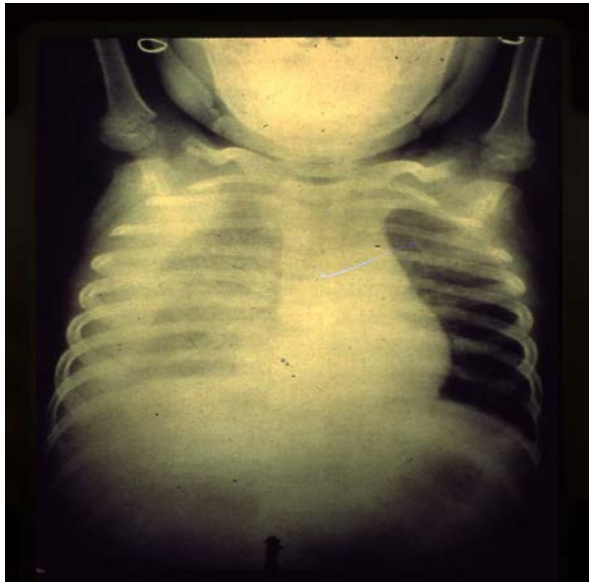
- Fever ↓
- Platelet < 100,000 /cu.mm
- Evidence of plasma leakage
  - hemoconcentration ≥ 20%
  - pleural effusion (CXR, U/S)
  - ascites (physical exam, U/S)
  - serum albumin <3.5 gm% in normal or < 4 gm% in obese or decrease 0.5 gm% from baseline
  - thickening of gall bladder / fluid in hepato-renal pouch / gall bladder edema (U/S)

Evidences of plasma leakage in DHF/severe dengue







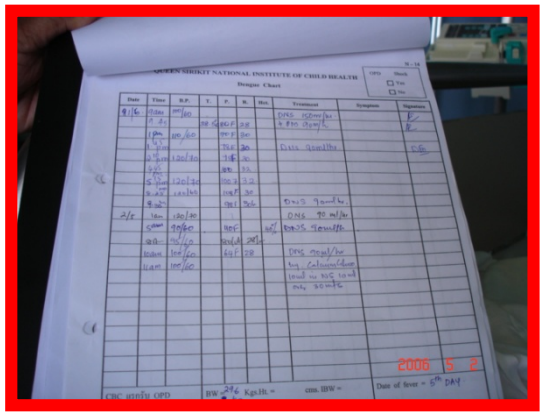


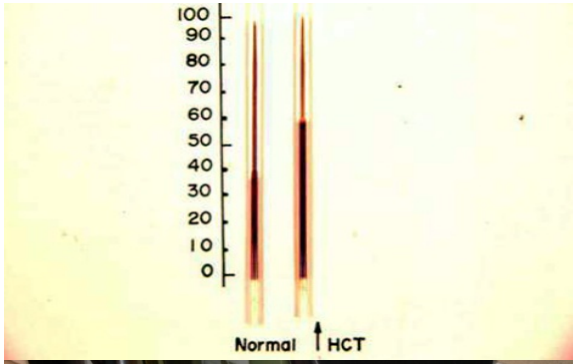
Indications for giving IV fluid
(when, what, amount, how)

- **Persistent vomiting**
- **Signs of moderate to severe dehydration**
- **Hct rising ≥ 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.

Case ▫ **Refer** ▫ **Walk in**

OPD ▫ **Shock** ▫ **Non shock**

IPD ▫ **Shock** ▫ **Non shock**

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 (Haemetemesis, Malena, Bleeding PV etc.)
5. UOP <0.5ml /Kg/hr
6. CRFT > 2 sec

Date	Time	BP	Temp	PR	RR	PP	RR	HCT (%)	Clinical/ Lab/ Treatment	Nursing Care/ Signs	INTAKE				OUTPUT		
											Blood/ rate & Amount	IV Amount	Oral	Total	Urine/ Stool	Vomit /Bleed	Total

CBC Day of Admission

Hct = **WBC =**
Plt = **Lym =**
PMN =

BW= **kgs.** **Hight =** **cms**
IBW = **kgs.**

Maintenance fluid =

M + 5% Deficit =

Date of Fever **Day of Illness**
TT
Liver
Bleeding
Epistaxis
Abdomen

Name		Age	HN	AN
	Ward	Attending Physician		

Pulse: F = Full M= Moderate W= Weak N = Not Palpable

Good consciousness

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 ≤ 100,000 CELLS/MM3.)

- 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

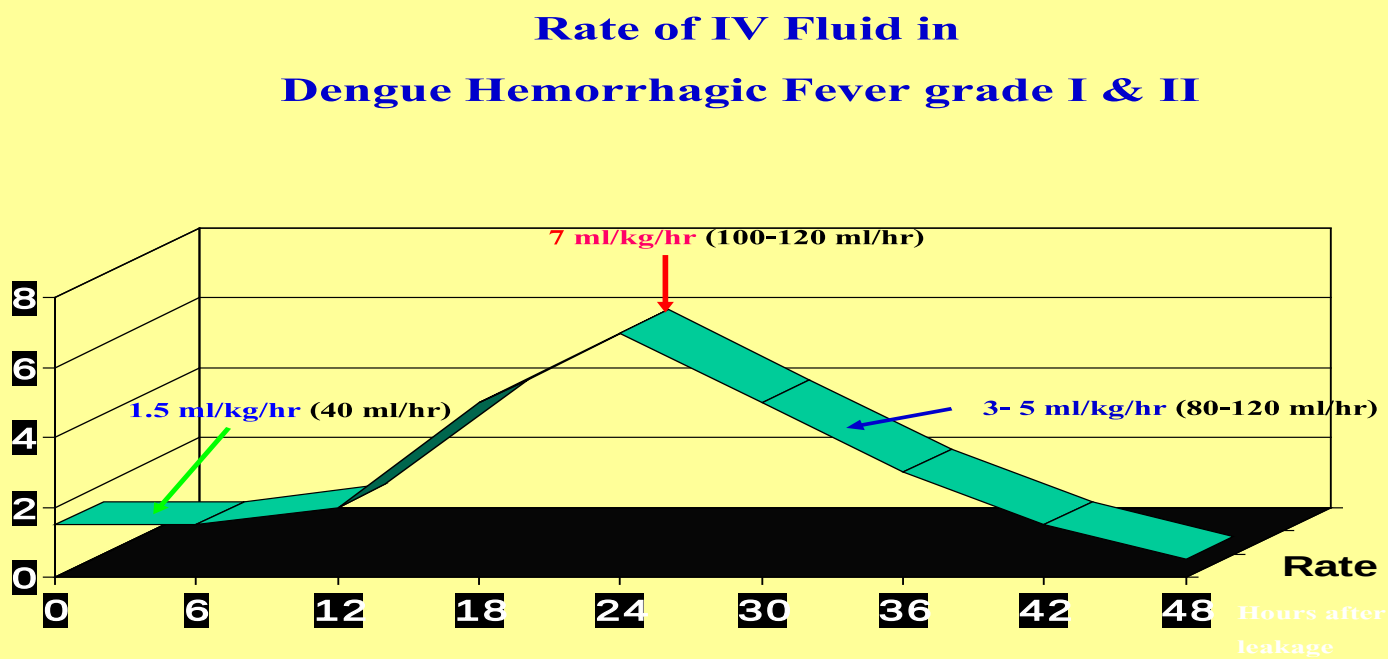
= 4,600/24 hr = 191.67 ml/hr
= 191.67/50 kg = 3.83 ml/kg/hr

RATE IV FLUID : COMPARE ADULTS AND CHILDREN

	Child (ml/kg/hr)	Adult (ml/hr)
M/2	1.5	40
Maintenance (M)	3	80
M +5%D	5	100-120
M +7%D	7	150
M + 10%D	10	300 - 500

Rate of IV fluid

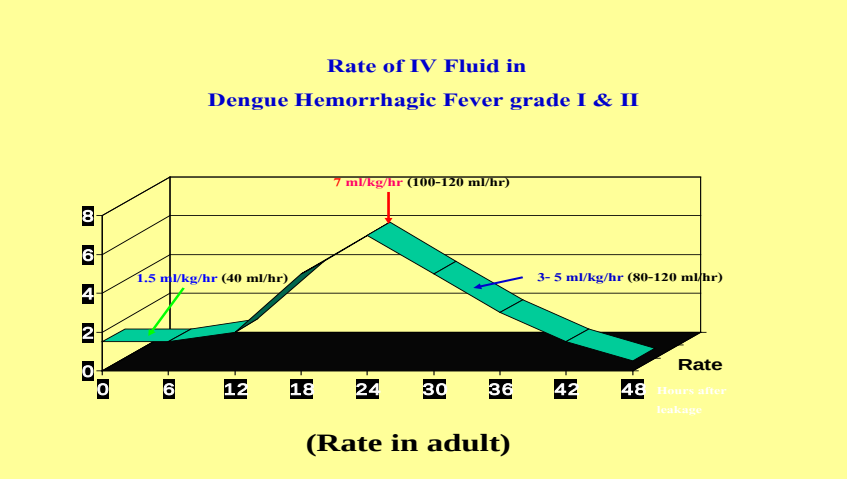
Non-shock



(Rate in adult)

Non-shock: rate depends on degree of thrombocytopenia & rising Hct

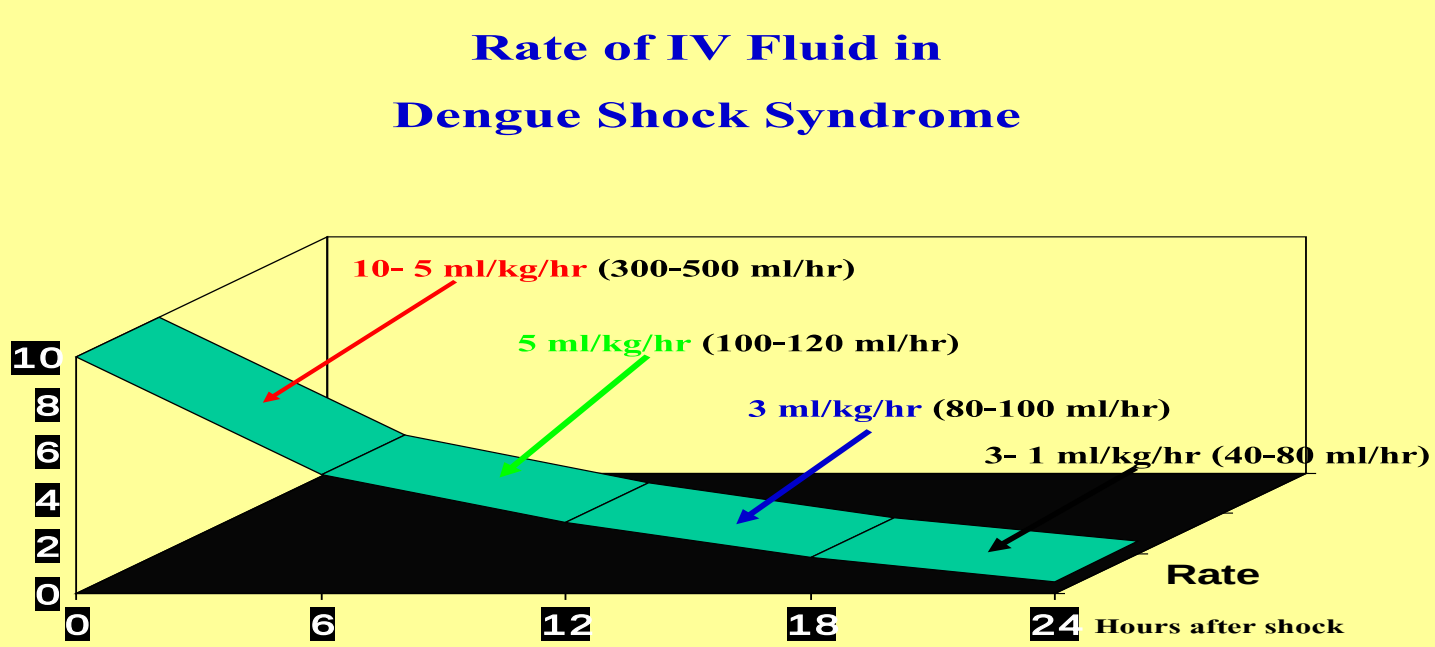
Rate of IV fluid (non-shock)



- **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

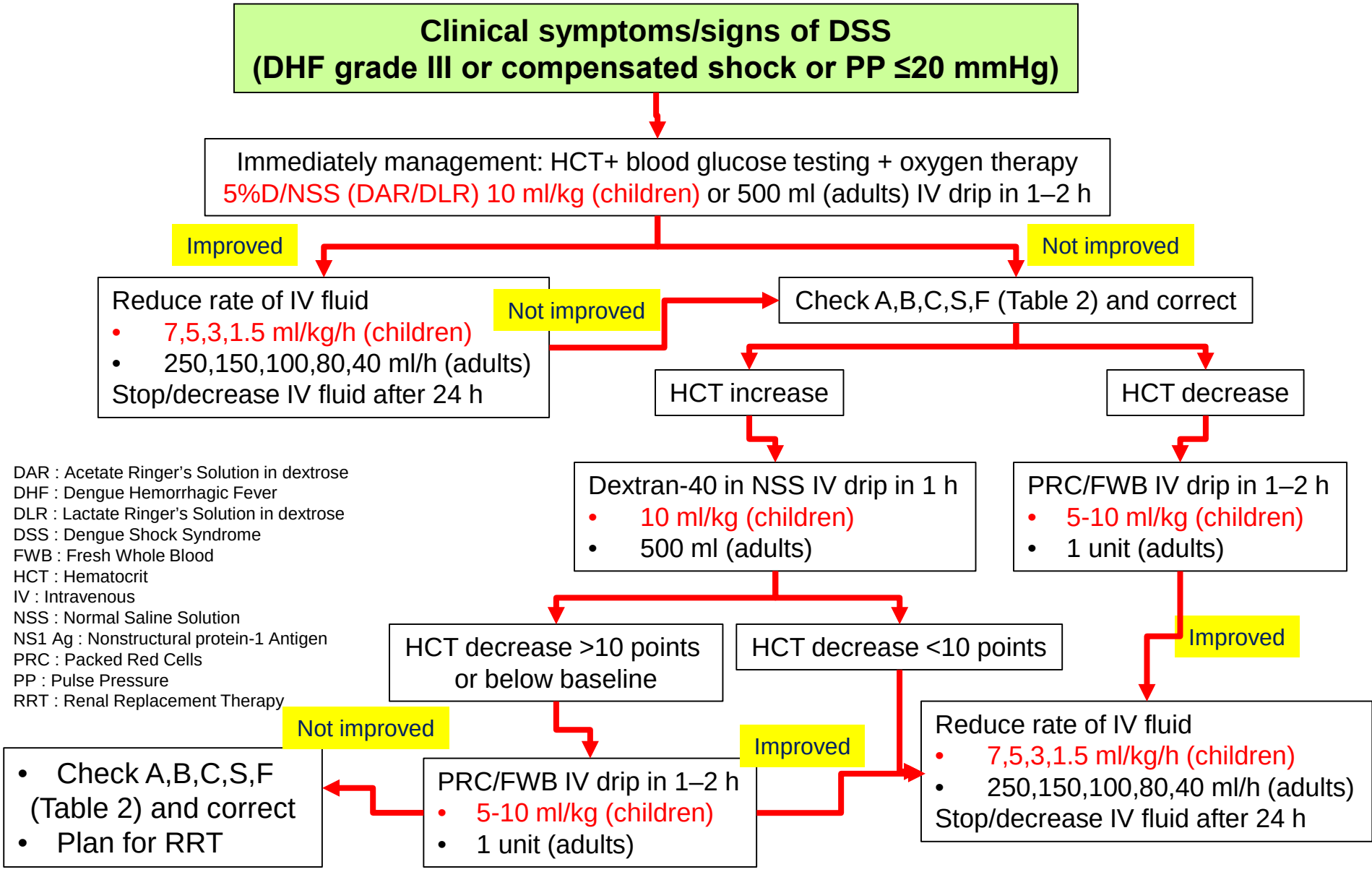
Shock

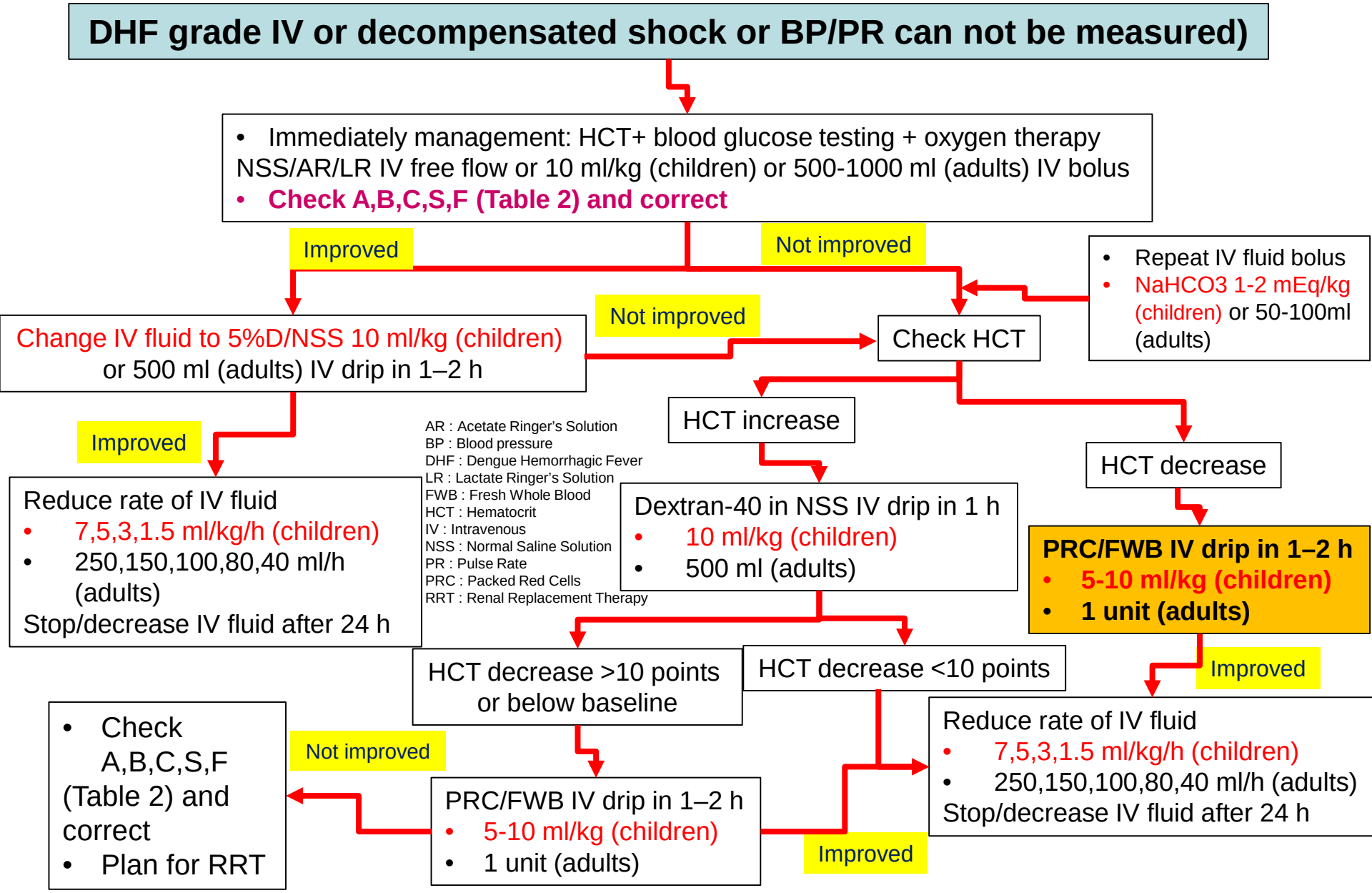


DSS – NSS (D) 10 ml/kg/hr or 500 ml/hr in adult,
If profound shock – free flow 15-30 mins, then reduce rate

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
Improved
Not 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
Not improved
Check A,B,C,S,F (Table 2) and correct
HCT increase
HCT decrease
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)
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
HCT decrease >10 points
or below baseline
HCT decrease <10 points
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
Not improved
Improved
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


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
Not improved
• Repeat IV fluid bolus
• NaHCO3 1-2 mEq/kg (children) or 50-100ml (adults)
Change IV fluid to 5%D/NSS 10 ml/kg (children) or 500 ml (adults) IV drip in 1–2 h
Not improved
Check HCT
Improved
HCT increase
HCT decrease
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
Reduce rate of IV fluid
• 7,5,3,1.5 ml/kg/h (children)
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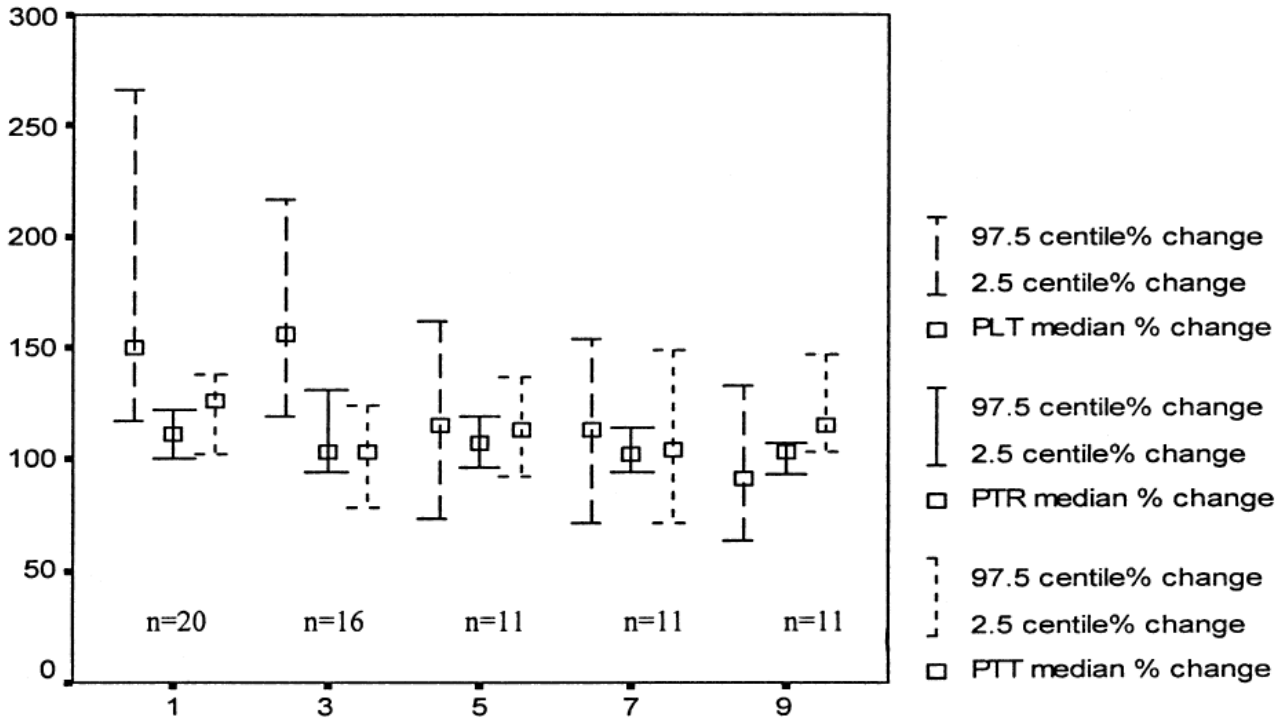
Stop/decrease IV fluid after 24 h
Dextran-40 in NSS IV drip in 1 h
• 10 ml/kg (children)
• 500 ml (adults)
PRC/FWB IV drip in 1–2 h
• 5-10 ml/kg (children)
• 1 unit (adults)
Improved
HCT decrease >10 points or below baseline
HCT decrease <10 points
• Check A,B,C,S,F (Table 2) and correct
• Plan for RRT
Not improved
PRC/FWB IV drip in 1–2 h
• 5-10 ml/kg (children)
• 1 unit (adults)
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

In case of suspected bleeding

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

Improvement of PLT/PT/APTT lasted <5 hours



Time in hour after transfusion

Lum LC *et al.* J Pediatr 2003;143(5):682-4

Indications for switching to colloidal solution

- **Signs and symptoms of fluid overload**
  - **Puffy eyelids, distended abdomen with ascites**
  - **Dyspnea/ Tachypnea**
  - **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)**

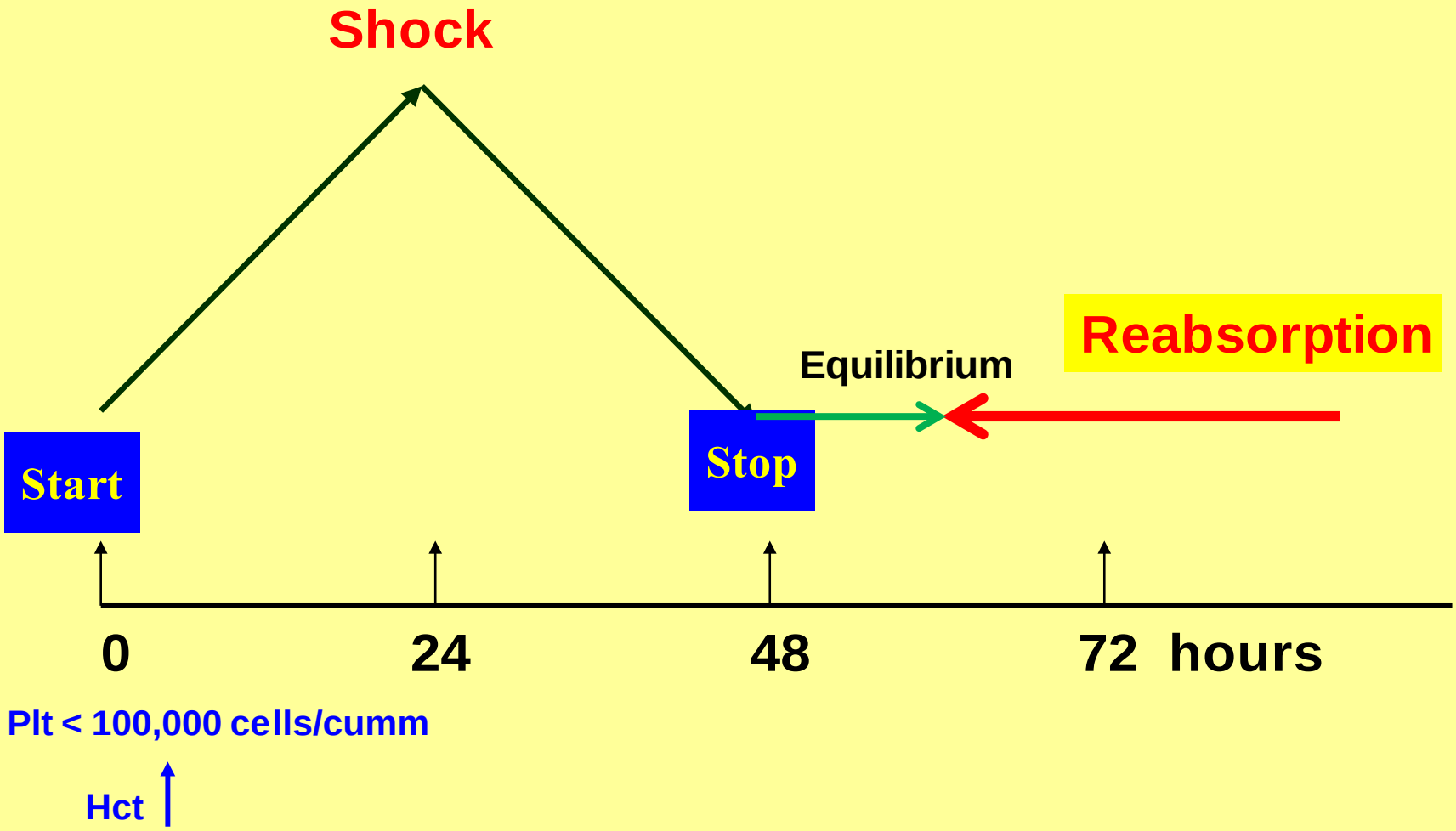
(Iso-oncotic – 280 mosm) :

  - **Plasma (FFP)**
  - **Hemaccel**
  - **6% Haes-steril**
  - **6% Hetastarch (voluven)**
  - **Gelefudin**

ROLE OF PLASMA IN DHF/DSS

- **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

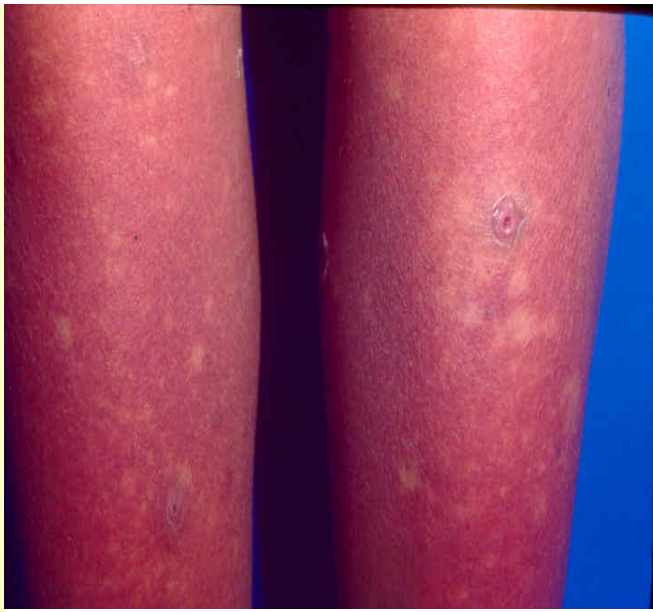
Plasma leakage : Natural course in severe cases



Convalescence

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

- **A – appetite**
- **B – bradycardia**
- **C – Convalescence rash, itching**
- **D – Diuresis: aware of hypokalemia**



Key messages in giving IV fluid in DHF/severe dengue

Should know disease phase of the patients : febrile, critical, convalescent phase

- **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!