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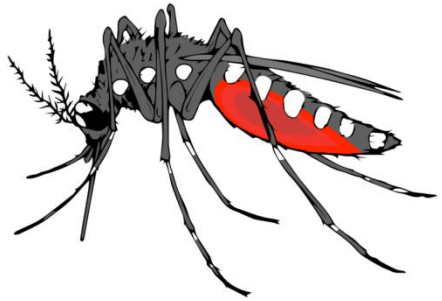

Management of Non-shock Dengue and Dengue with Comorbidities

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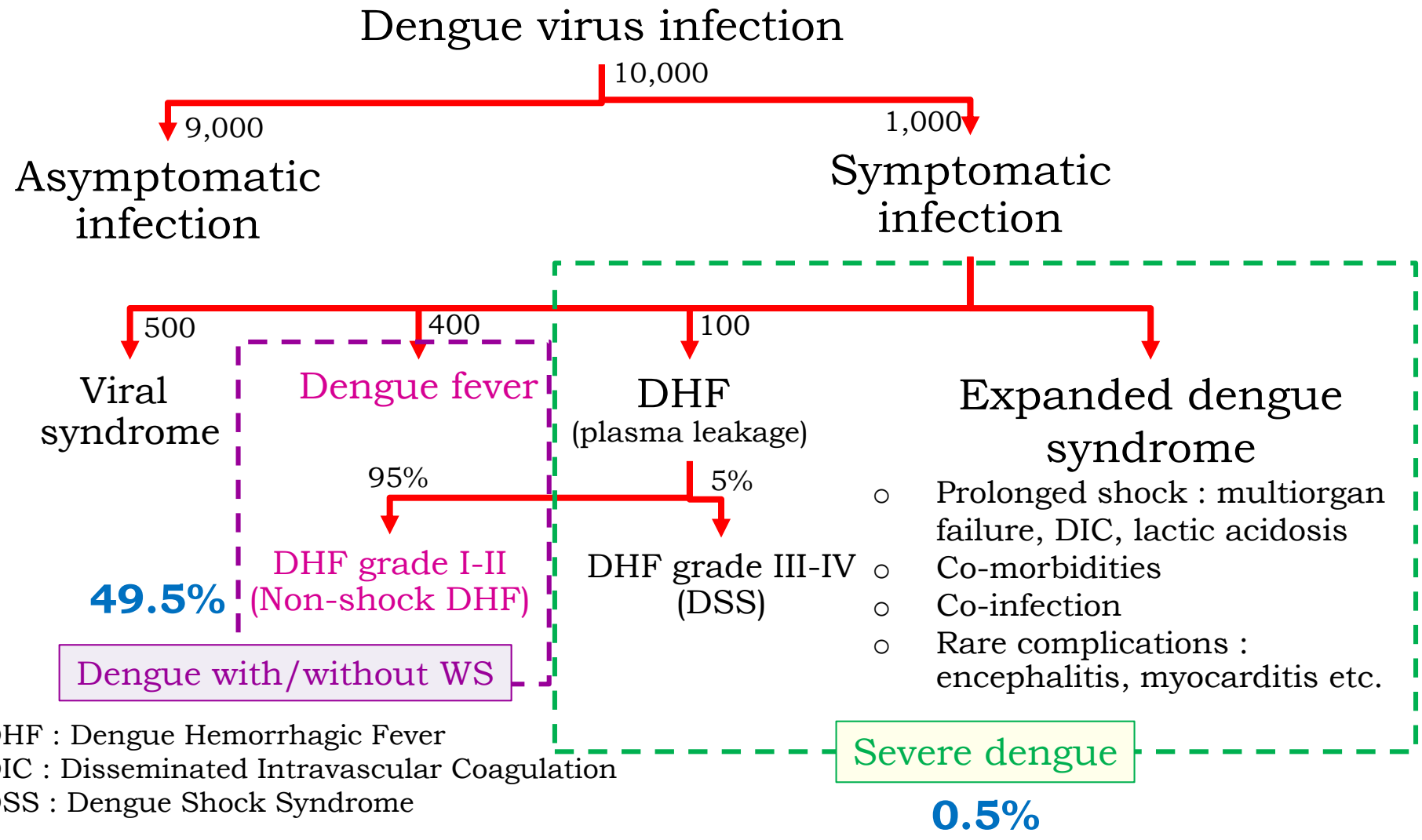
Classification of Dengue Severity



DHF : Dengue Hemorrhagic Fever
DIC : Disseminated Intravascular Coagulation
DSS : Dengue Shock Syndrome

Pathogenesis in Dengue Severity

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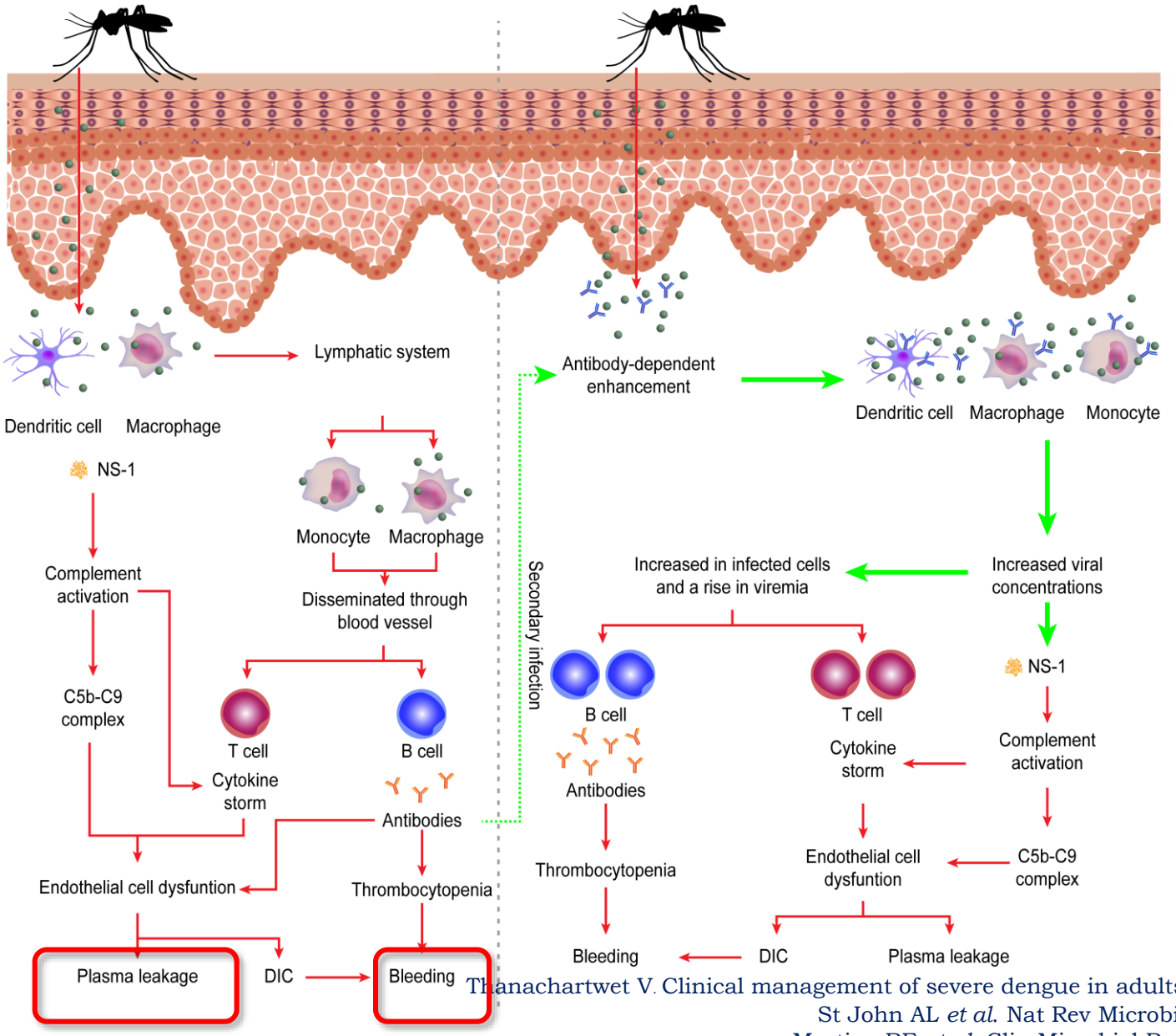

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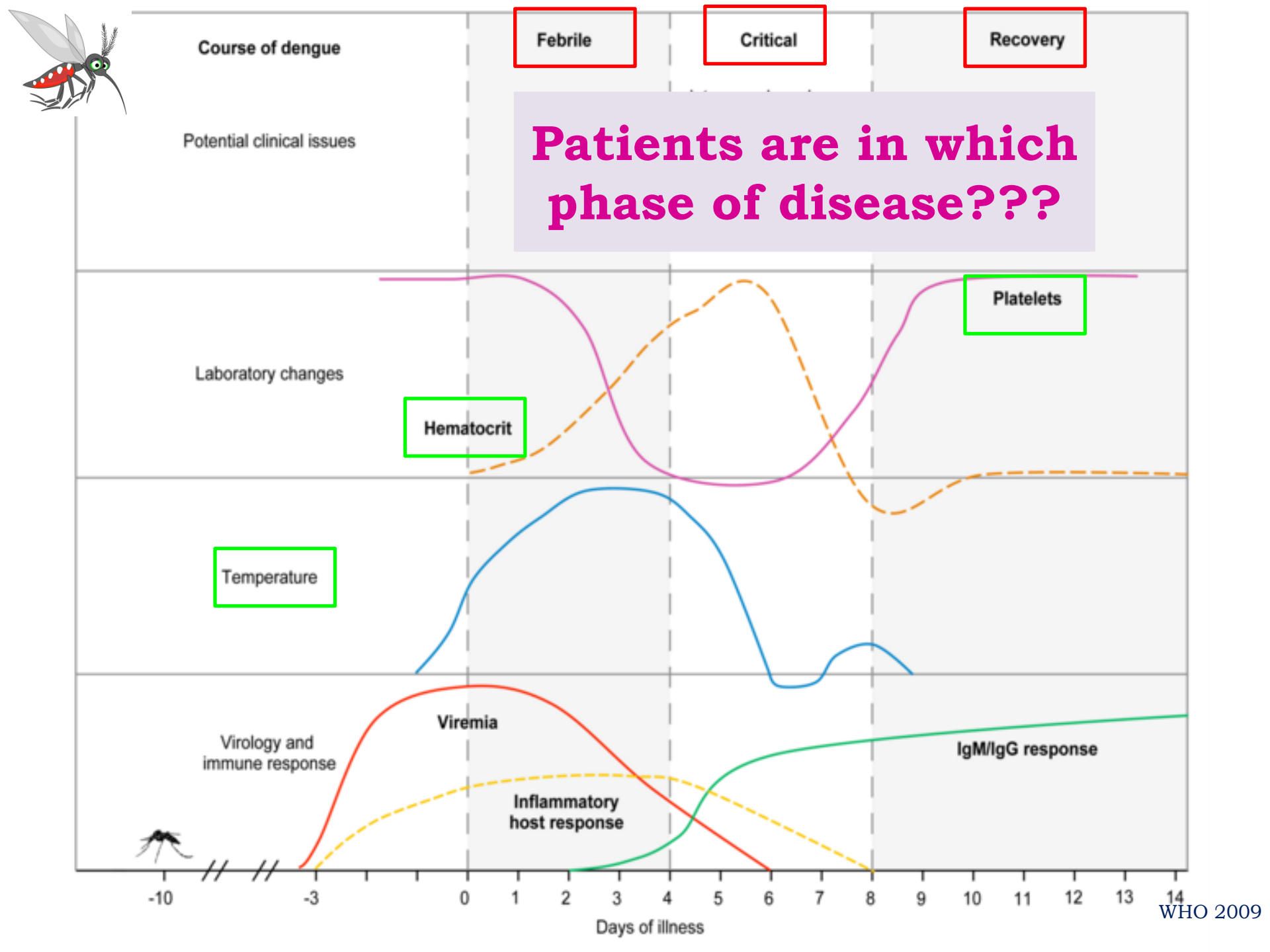
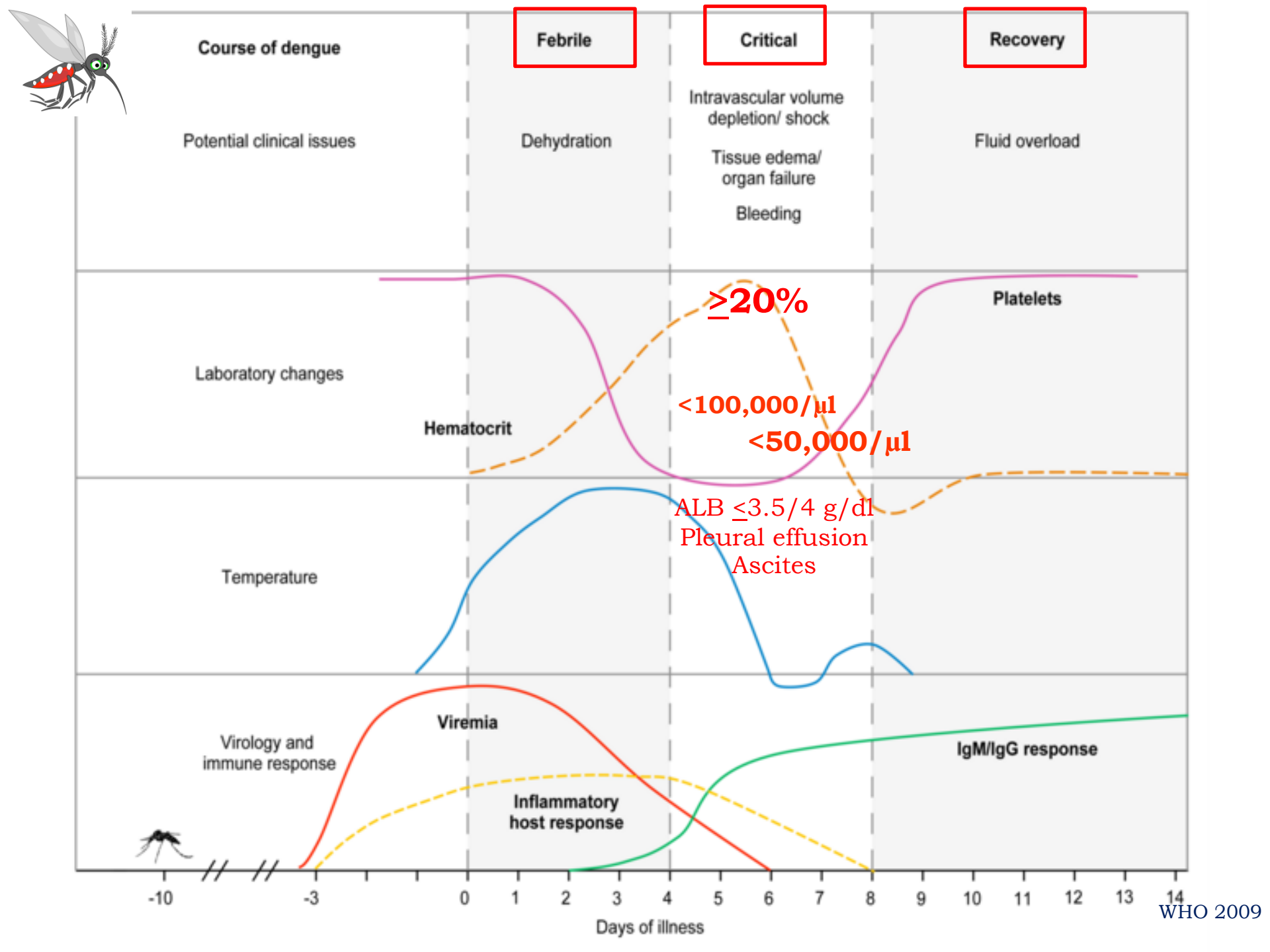

Course of dengue
Febrile
Critical
Recovery
Potential clinical issues
Patients are in which phase of disease???
Laboratory changes
Platelets
Hematocrit
Temperature
Virology and immune response
Viremia
IgM/IgG response
Inflammatory host response
-10
-3
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Days of illness

WHO 2009


Course of dengue
Febrile
Critical
Recovery
Potential clinical issues
Dehydration
Intravascular volume depletion/ shock
Tissue edema/ organ failure
Bleeding
Fluid overload
Laboratory changes
≥20%
Platelets
Hematocrit
<100,000/µl
<50,000/µl
ALB ≤3.5/4 g/dl
Pleural effusion
Ascites
Temperature
Virology and immune response
Viremia
IgM/IgG response
Inflammatory host response
-10
-3
0
1
2
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WHO 2009

A total of 750 patients with suspected dengue treated at OPD and IPD of the Hospital for Tropical Diseases in Bangkok, Thailand between March 2018 and February 2020

83 patients were excluded as follows:
- No leftover samples for confirmation tests (29 patients)
- Transferred to other hospital or loss to follow-up (18 patients)
- No documents of comorbid conditions (15 patients)
- Negative DENV infection from confirmation tests (12 patients)
- No baseline laboratory parameters (9 patients)

667 patients with confirmed dengue were recruited in the study

318 (47.7%) patients with plasma leakage

349 (52.3%) patients without plasma leakage

Talukdar S, Thanachartwet V, Desakorn V, Chamnanchanunt S, Sahassananda D, *et al.* PLoS One 2021;16(7):e0255358. doi: 10.1371/journal.pone.0255358

Characteristic	Day 1 of fever onset				Day 2 of fever onset				Day 3 of fever onset				Day 4 of fever onset			
	Total	With PL	Without PL	P-value	Total	With PL	Without PL	P-value	Total	With PL	Without PL	P-value	Total	With PL	Without PL	P-value
Temp[a] (˚C)	n = 35	n = 17	n = 18		n = 99	n = 50	n = 49		n = 256	n = 131	n = 125		n = 419	n = 220	n = 199	
	39.0 (38.5–39.4)	39.0 (38.7–39.6)	38.7 (38.1–39.1)	0.134	38.9 (38.3–39.4)	39.0 (38.8–39.6)	38.8 (38.2–39.3)	0.066	38.5 (38.0–39.2)	38.7 (38.2–39.3)	38.3 (37.8–39.0)	<0.001	38.1 (37.5–38.8)	38.2 (37.8–39.0)	38.0 (37.8–38.6)	<0.001
MAP[a] (mmHg)	n = 35	n = 17	n = 18		n = 98	n = 50	n = 48		n = 256	n = 131	n = 125		n = 419	n = 220	n = 199	
	83 (79–96)	83 (78–97)	84 (80–92)	0.568	84 (77–93)	86 (79–95)	80 (76–92)	0.062	84 (76–94)	85 (78–96)	83 (75–93)	0.061	84 (76–92)	86 (77–92)	82 (75–91)	0.036
Cumulative fluid[a] (ml/day)	n = 4	n = 2	n = 2		n = 4	n = 2	n = 2		n = 123	n = 78	n = 45		n = 290	n = 184	n = 106	
	480 (119–765)	160 (78, 241)	750 (720, 780)	N/A	610 (396–1551)	610 (536, 683)	1095 (350, 1840)	N/A	500 (63–880)	540 (-42–922)	371 (130–708)	0.402	500 (-55–1105)	542 (-51–1238)	407 (-73–966)	0.199
WBC[a] ($\times 10^3$ cells/mm^3)	n = 27	n = 10	n = 17		n = 93	n = 48	n = 45		n = 256	n = 129	n = 127		n = 416	n = 218	n = 198	
	5.10 (4.10–7.00)	4.60 (4.00–6.48)	5.90 (4.00–7.70)	0.414	3.90 (2.90–5.50)	3.75 (2.65–5.10)	4.10 (3.35–5.65)	0.252	3.10 (2.48–4.20)	3.10 (2.55–4.10)	3.20 (2.40–4.20)	0.987	2.80 (2.30–3.80)	2.90 (2.30–3.82)	2.80 (2.20–3.72)	0.375
ALC[a] (cells/mm^3)	n = 19	n = 7	n = 12		n = 65	n = 34	n = 31		n = 196	n = 106	n = 90		n = 382	n = 198	n = 184	
	102 (41–141)	90 (45–108)	122 (0–176)	0.592	100 (32–202)	99 (0–207)	100 (44–207)	0.654	139 (76–224)	137 (76–212)	142 (76–236)	0.353	185 (92–331)	185 (93–390)	180 (89–306)	0.304
HCT rise[a] (%)	n = 27	n = 10	n = 17		n = 93	n = 48	n = 45		n = 257	n = 130	n = 127		n = 416	n = 218	n = 198	
	0.25 (0–7.63)	0.29 (0–9.74)	0 (0–6.42)	0.711	2.88 (0–7.32)	1.58 (0–7.59)	3.31 (0–7.13)	0.911	5.22 (1.03–11.58)	6.36 (1.37–13.36)	4.50 (0.74–9.58)	0.040	6.73 (2.76–12.20)	8.43 (4.70–15.01)	5.11 (1.13–9.36)	<0.001
PLT count[a] ($\times 10^3$/mm^3)	n = 27	n = 10	n = 17		n = 93	n = 48	n = 45		n = 257	n = 130	n = 127		n = 416	n = 218	n = 198	
	193 (154–215)	178 (148–215)	198 (158–214)	0.570	152 (116–181)	150 (110–172)	161 (126–207)	0.209	116 (75–146)	101 (64–142)	125 (90–156)	<0.001	85 (50–124)	73 (39–101)	106 (64–138)	<0.001
AST[a] (U/l)	n = 27	n = 10	n = 17		n = 93	n = 48	n = 45		n = 153	n = 96	n = 57		n = 237	n = 141	n = 96	
	21 (17–27)	22 (18–29)	19 (16–22)	0.219	37 (28–54)	38 (30–61)	28 (24–41)	0.012	50 (34–90)	60 (38–118)	36 (24–63)	<0.001	80 (47–154)	97 (57–178)	58 (39–91)	<0.001
ALT[a] (U/l)	n = 27	n = 10	n = 17		n = 93	n = 48	n = 45		n = 154	n = 97	n = 57		n = 237	n = 141	n = 96	
	22 (15–24)	22 (17–24)	20 (14–21)	0.125	30 (23–40)	32 (26–42)	23 (17–27)	<0.001	32 (21–56)	37 (25–76)	24 (16–37)	<0.001	51 (28–103)	54 (37–120)	38 (24–62)	<0.001
ALB[a] (g/dl)	n = 24	n = 10	n = 14		n = 66	n = 48	n = 18		n = 85	n = 58	n = 27		n = 128	n = 92	n = 36	
	4.8 (4.5–5.0)	4.8 (4.6–5.0)	4.5 (4.3–5.2)	0.349	4.7 (4.5–4.9)	4.7 (4.5–4.9)	4.5 (4.3–4.6)	0.008	4.4 (4.2–4.7)	4.4 (4.2–4.7)	4.4 (4.3–4.9)	0.656	4.2 (3.9–4.5)	4.0 (3.8–4.5)	4.3 (4.2–4.6)	0.001

Talukdar S, Thanachartwet V, Desakorn V, Chamnanchanunt S, Sahassananda D, *et al.*
PLoS One 2021;16(7):e0255358. doi: 10.1371/journal.pone.0255358

Characteristic	Day 5 of fever onset				Day 6 of fever onset				Day 7 of fever onset				Day 8 of fever onset			
	Total	With PL	Without PL	P-value	Total	With PL	Without PL	P-value	Total	With PL	Without PL	P-value	Total	With PL	Without PL	P-value
Temp[a] (˚C)	n = 554	n = 296	n = 258		n = 580	n = 300	n = 280		n = 553	n = 283	n = 270		n = 389	n = 222	n = 167	
	37.7 (37.0–38.4)	37.8 (37.2–38.5)	37.5 (37.0–38.3)	0.013	37.2 (36.8–37.8)	37.2 (36.8–37.8)	37.0 (36.7–37.8)	0.103	36.8 (36.5–37.2)	36.9 (36.6–37.8)	36.8 (36.5–37.1)	0.022	36.6 (36.5–37.0)	36.6 (36.5–37.0)	36.6 (36.5–37.0)	0.948
MAP[a] (mmHg)	n = 554	n = 296	n = 258		n = 580	n = 300	n = 280		n = 554	n = 283	n = 271		n = 389	n = 222	n = 167	
	81 (74–90)	83 (75–91)	80 (74–88)	0.056	79 (72–87)	80 (73–87)	77 (71–85)	0.006	78 (72–86)	79 (73–88)	76 (71–84)	0.006	78 (72–87)	80 (73–89)	77 (71–83)	0.001
Cumulative fluid balance[a] (ml/day)	n = 456	n = 276	n = 180		n = 521	n = 296	n = 225		n = 547	n = 305	n = 242		n = 548	n = 305	n = 243	
	580 (-12–1349)	670 (100–1645)	296 (-162–966)	<0.001	630 (-192–1535)	915 (-36–1942)	291 (-482–1005)	<0.001	381 (-565–1470)	600 (-362–1910)	232 (-653–982)	<0.001	250 (-711–1385)	420 (-664–1682)	100 (-780–936)	0.003
WBC[a] (×10^3 cells/mm^3)	n = 548	n = 293	n = 255		n = 566	n = 294	n = 272		n = 544	n = 280	n = 264		n = 383	n = 221	n = 162	
	3.00 (2.30–4.30)	3.10 (2.30–4.60)	2.90 (2.30–3.90)	0.231	3.80 (2.70–5.32)	4.20 (2.70–5.90)	3.55 (2.70–4.90)	0.014	4.90 (3.50–6.60)	5.10 (3.90–6.80)	4.30 (3.22–6.28)	0.002	5.20 (4.20–6.70)	5.30 (4.40–6.90)	4.80 (3.88–6.40)	0.017
ALC[a] (/mm^3)	n = 517	n = 284	n = 233		n = 556	n = 292	n = 264		n = 540	n = 279	n = 261		n = 380	n = 219	n = 161	
	297 (160–692)	333 (180–797)	270 (144–599)	0.016	711 (336–1270)	818 (401–1362)	582 (266–1071)	<0.001	912 (500–1516)	943 (574–1496)	876 (458–1602)	0.239	869 (518–1334)	910 (525–1334)	816 (510–1348)	0.591
HCT rise[a] (%)	n = 549	n = 294	n = 255		n = 567	n = 295	n = 272		n = 545	n = 281	n = 264		n = 384	n = 222	n = 162	
	7.61 (3.03–13.38)	10.59 (4.87–16.32)	5.50 (2.16–9.00)	<0.001	7.50 (3.01–12.27)	9.84 (4.32–16.11)	5.66 (1.70–9.09)	<0.001	5.22 (1.39–10.15)	6.84 (2.36–12.20)	3.78 (0.90–8.00)	<0.001	3.48 (0–7.69)	3.75 (0–9.06)	3.03 (0–6.94)	0.070
PLT count[a] (×10^3/mm^3)	n = 548	n = 293	n = 255		n = 566	n = 294	n = 272		n = 544	n = 280	n = 264		n = 383	n = 221	n = 162	
	61 (31–97)	46 (23–76)	82 (47–119)	<0.001	45 (25–74)	34 (19–55)	62 (36–94)	<0.001	50 (29–78)	39 (24–60)	67 (39–92)	<0.001	64 (40–90)	57 (35–89)	72 (48–94)	<0.001
AST[a] (U/l)	n = 269	n = 167	n = 102		n = 238	n = 152	n = 86		n = 179	n = 124	n = 55		n = 131	n = 95	n = 36	
	116 (58–212)	135 (79–270)	72 (42–132)	<0.001	128 (76–232)	154 (88–267)	107 (64–180)	0.002	141 (80–253)	152 (97–260)	89 (55–199)	0.003	142 (59–267)	165 (88–315)	72 (40–211)	0.004
ALT[a] (U/l)	n = 269	n = 167	n = 102		n = 238	n = 152	n = 86		n = 179	n = 124	n = 55		n = 130	n = 95	n = 35	
	62 (34–126)	72 (45–127)	42 (23–91)	<0.001	77 (47–153)	88 (50–176)	62 (38–102)	0.001	99 (50–178)	108 (56–181)	70 (34–159)	0.016	117 (65–230)	135 (70–228)	98 (52–246)	0.166
ALB[a] (g/dl)	n = 170	n = 125	n = 45		n = 165	n = 125	n = 40		n = 121	n = 98	n = 23		n = 75	n = 58	n = 17	
	4.0 (3.7–4.3)	3.9 (3.5–4.2)	4.3 (3.8–4.6)	<0.001	3.8 (3.4–4.1)	3.6 (3.3–4.0)	4.2 (4.0–4.6)	<0.001	3.7 (3.4–4.0)	3.6 (3.3–3.9)	4.2 (4.0–4.4)	<0.001	3.8 (3.4–4.2)	3.6 (3.4–4.0)	4.3 (4.2–4.8)	<0.001

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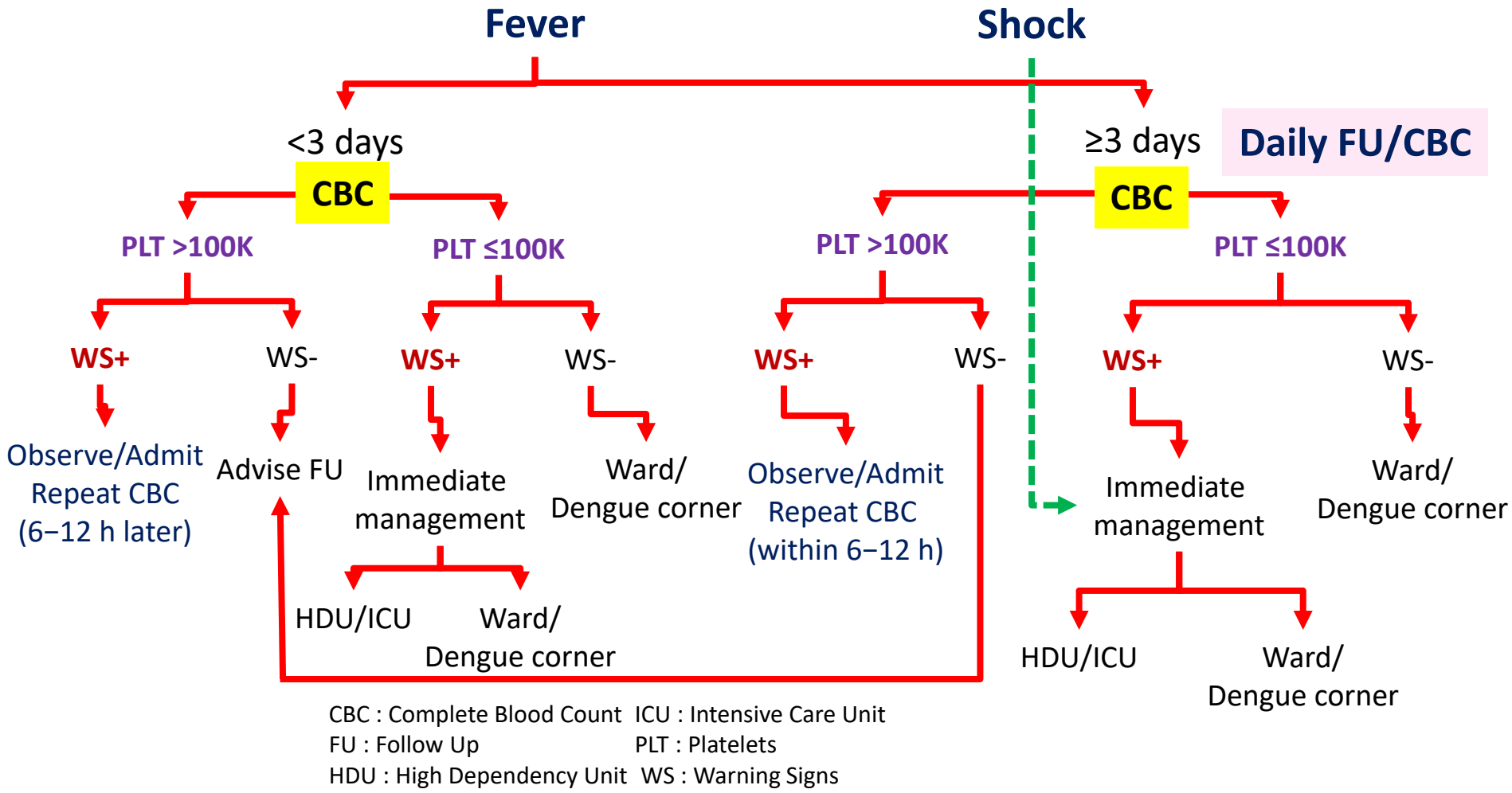
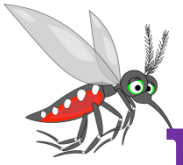
OPD Triage



CBC : Complete Blood Count ICU : Intensive Care Unit
FU : Follow Up PLT : Platelets
HDU : High Dependency Unit WS : Warning Signs

Warning Signs for Progression to Severe Disease in Dengue

- No clinical improvement when fever subside
- Abdominal pain or vomiting >3 times/day (persistent vomiting)
- Abnormal bleeding
- Altered sensorium, drowsiness, irritable, restlessness
- Refuse to eat or drink
- Dizziness, fainting, syncope, cold clammy skin or sweating
- Decrease urine volume in 4-6 hours



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Indications for Admission

Patients with diagnosis of dengue or probable dengue have at least 1 of the following:

- No clinical improvement when fever subside
- Abdominal pain, persistent vomiting and/or poor appetite with moderate to severe dehydration
- Significant bleeding indicates as blood loss > 300 ml (adults)
- Clinical symptoms and signs of dengue shock syndrome
- Decrease urine volume in 4-6 hours
- WBC ≤5,000 cells/mm^3* in high risk groups
  - infants, elderly
  - pregnant women
  - prolonged shock
  - abnormal bleeding
  - underlying diseases
  - neurological manifestations
- PLT ≤100,000/mm^3 with weakness and/or poor appetite
- Rising HCT ≥10%
- Family concern

* WBC ≤5,000 cells/mm^3 : Nearly leakage phase

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Management of Non-shock Dengue (Febrile Phase)

- **Control fever:**

✓ Place tepid sponging at least 15 minutes for reducing fever
  - Cold water immersion : heat convection 0.1°C/min
  - Place tepid sponging 15 min : reduce body temp 1.5°C

✓ If the patient is shivering, stop tepid sponging and using a light sheet to cover body rather than a heavy blanket.
  - Shivering is a regulatory mechanism to increase heat in body.
  - Cover body with a light sheet would help heat evaporation better than using a heavy blanket.

Courtesy by General Thanom Supaporn, MD.
Short guideline for dengue case management 2023

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Management of Non-shock Dengue (Febrile Phase)

- **Control fever:**

✓ Take acetaminophen only if fever is over 38.5°C

✓ Recommended doses of acetaminophen should be given at least 4 hours apart, when taken as an overdose can cause hepatitis.

✓ Avoid taking aspirin, NSAIDs and steroid due to increase the risk of severe bleeding, acute hepatitis and acute kidney injury

Management of Non-shock Dengue (Febrile Phase)

- **Diet and fluids:**
  - ✓ Advice to give soft, balanced and nutritious diet such as ice cream, milk or fruit juice
  - ✓ Avoid eating black or red-color foods/drinks as these may interfere with the interpretation of vomiting blood
  - ✓ Avoid drinking plain water which may cause electrolyte imbalance particularly low serum sodium level
  - ✓ Oral electrolyte solution (ORS) is recommended if the patient refuses to take oral food.

Indications for Starting IV Fluid

1. Patients with persistent vomiting
2. Patients with signs of moderate to severe dehydration
3. Patients having plasma leakage in the critical phase with HCT rising ≥10%* or can not eat or drink ORS
4. Patients with dengue shock syndrome

Note *Patients with bleeding may not have HCT rising.

Comparisons the Effects of Oral and IV Fluid Replacement in Adults with Non-shock DHF In Taiwan

- A observational study in adult patients (>18 years) with non-shock DHF admitted to a medical centre in southern Taiwan
- Comparing the effects of oral hydration (n=19) and IV fluid replacement (n=30)
- No significant difference was found in demographics, clinical manifestations and HCT between the two groups.
- No significant difference was found in daily PP, HCT and PLT between the two groups for 7 days in hospital.
- Patients with IV fluid replacement :
  - ✓ Had a significantly longer hospital stay compared to those with oral hydration (7.4±2.7 days vs. 5.3±2.2 days, P=0.007)
  - ✓ Prone to develop pleural effusion and/or pulmonary edema

Lee IK *et al.* Trans R Soc Trop Med Hyg 2010;104(8):541-5. doi: 10.1016/j.trstmh.2010.05.003.

How to Choose Type of IV Fluid?

1. Isotonic crystalloid :

- 5% dextrose in normal saline
- 0.9 sodium chloride

2. Balanced crystalloid :

- Acetated Ringer's with/without 5% dextrose
- Lactated Ringer's with/without 5% dextrose

3. Colloid :

- 5% human albumin
- 10% Dextran-40 in NSS

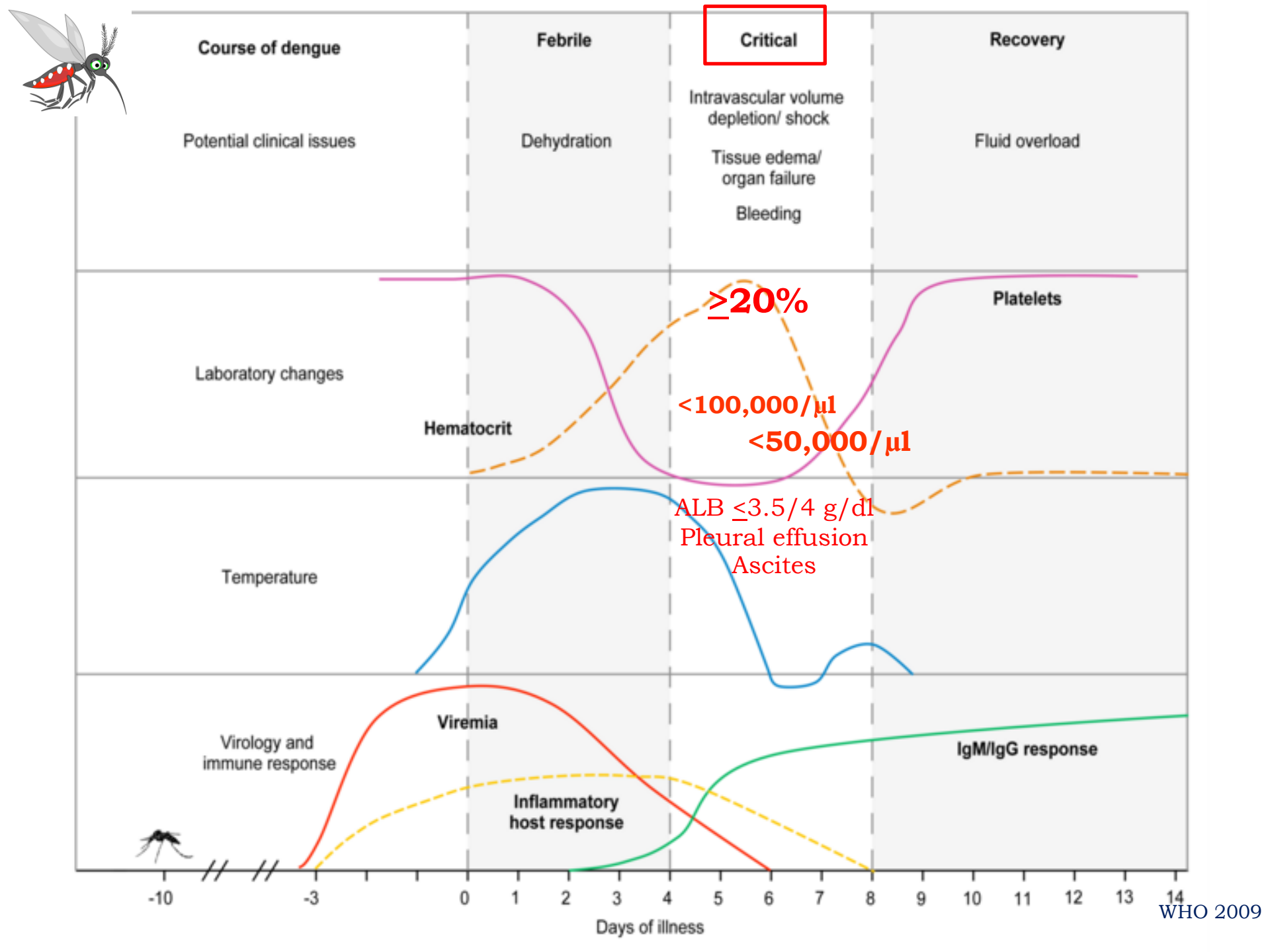
Note: Patients with BS >200 mg/dl should avoid providing IV fluid containing 5% dextrose.

Rates of IV Fluid Infusion in Non-shock Dengue (Adults)

Degree of HCT rising:

- If HCT rising <20%, starting IV fluid less than maintenance rate (40-60 ml/h)
- If HCT rising ≥20%, starting IV fluid at maintenance rate (80–100 ml/h)
- If HCT rising >25%, starting IV fluid at more than maintenance rate (100–120 ml/h)

Note: Doses of IV fluid indicating above include oral fluid intake.


Course of dengue
Febrile
Critical
Recovery
Potential clinical issues
Dehydration
Intravascular volume depletion/ shock
Tissue edema/ organ failure
Bleeding
Fluid overload
Laboratory changes
≥20%
Platelets
Hematocrit
<100,000/µl
<50,000/µl
ALB ≤3.5/4 g/dl
Pleural effusion
Ascites
Temperature
Virology and immune response
Viremia
IgM/IgG response
Inflammatory host response
-10
-3
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Days of illness

WHO 2009

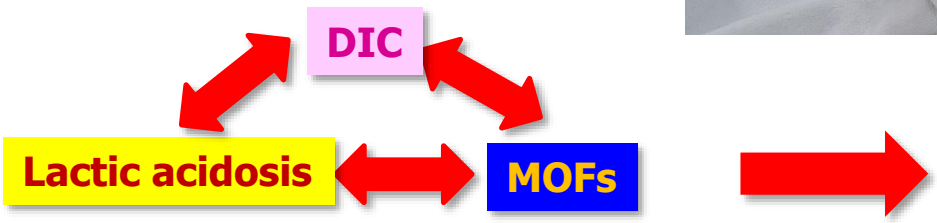
Clinical and Laboratory Parameters for Monitoring in Critical Phase of Non-shock Dengue

- **Clinical:**
  - Fever, appetite, bleeding, abdominal pain, vomiting
  - Dizziness, fainting, syncope, consciousness
- **Vital signs:**
  - Temperature: every 4–6 hours
  - BP, PR, PV, RR, CRT, cold clammy skin/cold extremities: every 2–4 hours
- **Hematocrit:**
  - q 4–6 hours or more frequent in cases of suspected bleeding and after blood transfusion
- **Urine output:**
  - q 4–8 hours and keep urine output 0.5–1 ml/kg/h
  - Obese patients and pregnant women keep urine output 0.5 ml/kg/h

Keypoint for Management of Dengue Patients in Critical Phase : Early Dx of DSS

Adults with Multi-organs Failure in DSS

Prolonged shock : Vicious cycle
(lactic acidosis, multi-organ failure, DIC)



CFR >90%

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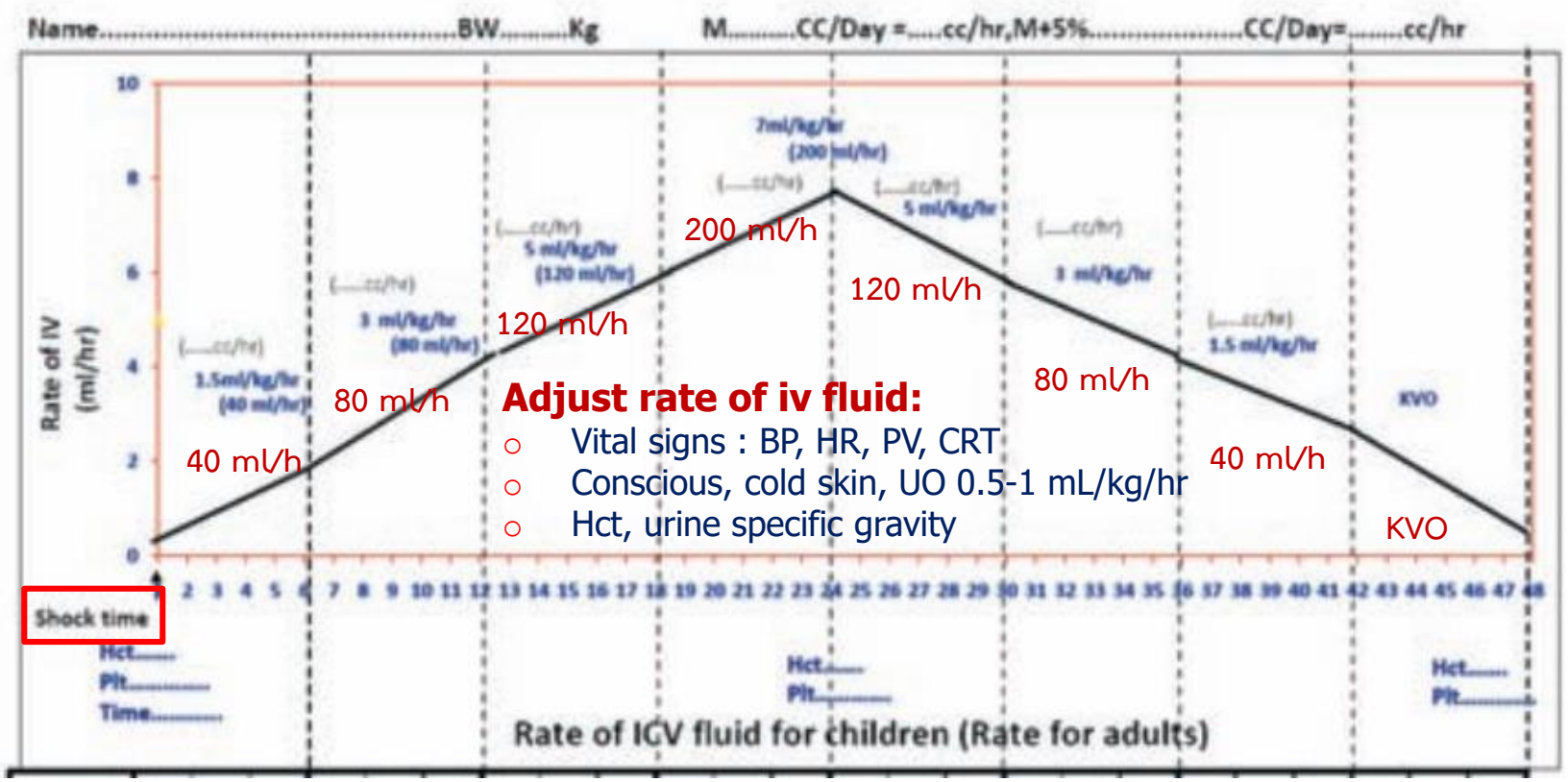
Dengue Shock Syndrome

- **Circulatory failure** :
  - ✓ Rapid and weak pulse
  - ✓ Cold clammy skin particularly cold extremities
  - ✓ PP <20 mmHg (25% of adults with DSS)
- **Hypotension with tissue hypoperfusion** :
  - ✓ Dizziness, fainting, syncope, decrease urine volume, restlessness, altered mental status
  - ✓ Capillary refill time >2 second

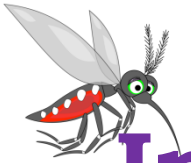
https://www.dms.go.th/backend//Content/Content_FIle/Bandner_(Small)/Attach/25640302103903AM_CPG%20Adult%20Dengue.pdf

Rate of IV infusion in non-shock DHF

Reabsorption of extravasated plasma occurs in 60 hours after platelets count ≤100,000/mm^3 or enter into critical phase.



Kalayanarooj S. and Nimmannitya S. In: Guidelines for Dengue and Dengue Haemorrhagic Fever Management. Bangkok Medical Publisher, Bangkok 2003.
WHO 2011. https://apps.who.int/iris/handle/10665/204894f



Indications for Giving Dextran 40

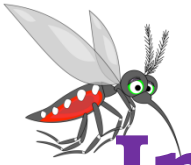
- Patients having unstable vital signs and HCT rising after receiving a large amount of isotonic crystalloid
- Patients having signs of fluid overload and respiratory distress, but HCT still rising
- Patients having HCT rising 25-30% from baseline while receiving IV fluid according to the guidelines

Note

- 5% albumin can be used in patients DSS or prolonged shock who having AKI.
- However, patients who receiving 5% albumin may develop more plasma leakage than those with Dextran 40 as oncotic pressure of 5% albumin is similar to plasma.
- Bleeding tendency may occur with large volume of dextran (does >1000 mL).

Hints to Dextran-40 infusion

- 500 ml (adults) IV drip in 1 h as a bolus dose
- Check HCT before and immediate after Dextran-40 infusion
  - If HCT decrease >10 points or below baseline indicate significant bleeding



Indications for Blood Transfusion

- Significant bleeding : blood loss >300 ml or HCT decrease >10 points or below baseline after Dextran-40 transfusion (adults)
- HCT rising <20% from baseline if patients develop shock
- Unable to reduce rate of IV fluid according to the guidelines and decrease HCT compared to prior HCT
- Decrease HCT with no clinical improvement
- Intravascular hemolysis indicates as black color urine in patients with hematologic disorders such as G6PD deficiency, thalassemia, and thalassemia trait etc.

Hematological Complications in Dengue

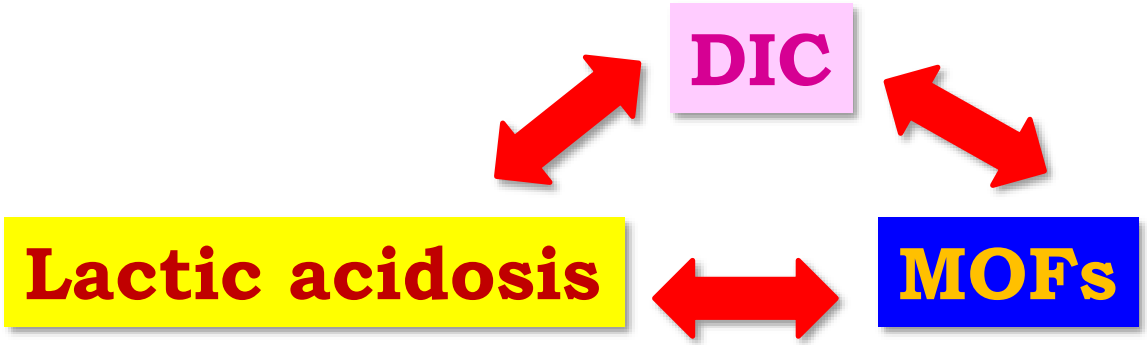
- **Abnormal bleeding**
  - ✓ **Minor** : petechiae, ecchymosis, gum bleeding, epistaxis, heavy and frequent menstrual bleeding
  - ✓ **Major** : Significant blood loss, requiring blood transfusion or intervention, ICH, GI bleeding
- **Lab. investigations**
  - ✓ Low platelet
  - ✓ Abnormal coagulogram

- DHF: Prolonged APTT & TT > PT
- DSS (prolonged shock): Prolonged APTT & TT & PT

Thanachartwet V. Clinical management of severe dengue in adults; 2017. pp 161-175.

Management of Bleeding in Dengue

- **Bleeding in dengue :** Low PLT, APTT prolong, PT prolong (liver failure)
- **PRC or LPRC >>>** PLT or FFP
- **Prolonged shock :** Vicious cycle



WHO, 2009; WHO, 2011

Risks for Progression to Severe Disease in Dengue

- Infants, pregnant women, elderly, and obesity
- Patients who have underlying medical illness of DM, HT, CVS, liver diseases, renal diseases and hematologic diseases
- Patients receiving anticoagulants, antiplatelets or NSAIDs

Risk predictors of progression to severe disease during the febrile phase of dengue: a systematic review and meta-analysis

Sorawat Sangkaew, Damien Ming, Adhiratha Boonyasiri, Kate Honeyford, Siripen Kalayanarooj, Sophie Yacoub, Ilaria Dorigatti*, Alison Holmes*

Risk of severe dengue

- Female (OR = 1.13, 95% CI = 1.01–1.26)
- Dengue virus serotype 2 was associated with severe disease in children.
- Secondary infections (OR 2.26, 95% CI = 1.65–3.09)
- Pre-existing comorbidities:
  - ✓ DM (OR = 4.38, 95% CI = 2.58–7.43)
  - ✓ HT (OR = 2.19, 95% CI = 1.36–3.53)
  - ✓ Renal disease (OR = 4.67, 95% CI = 2.21–9.88)
  - ✓ CVS disease (OR = 2.79, 95% CI = 1.04–7.50)

Sangkaew S, *et al.* Lancet Infect Dis 2021;21(7):1014-1026. doi: 10.1016/S1473-3099(20)30601-0.

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Meta-analysis : Risk Factors for Death in Dengue

Variables	OR	95%CI
DM	2.5	1.5-4.2
HT	2.4	1.4-4.1
Shock	308.1	42.6-2230.4

Guo C *et al.* Front Cell Infect Microbiol 2017;7:317. doi: 10.3389/fcimb.2017.00317.

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Diabetes Care in Hospital

- Perform HbA1c test on all patients with DM or hyperglycemia (BS >140 mg/dl), if not performed in the previous 3 months. **(B)**
- Insulin therapy should be initiated for treatment of persistent hyperglycemia (BS ≥180 mg/dl on two occasions). **(A)**
  - A target glucose range of 140-180 mg/dl for most critically ill and noncritically ill patients is recommended **(A)**
  - A target glucose range of 100-180 mg/dl for noncritically ill patients is recommended by experts.
- Continue home therapy with oral glucose-lowering drugs may be appropriate in certain circumstances of noncritical care setting.
  - Sodium-glucose cotransporter 2 (SGLT2) inhibitors should be discontinued due to the risk of euglycemic DKA in patients with infection.
- Blood glucose monitoring
- Consult with a specialized diabetes when possible **(C)**

ElSayed NA, *et al.* Diabetes Care. 2023;46(Suppl 1):S267-S278.

Antihypertensive Drugs in Dengue

- Risk factors for development of AKI in dengue :
  - Diabetes mellitus
  - DSS, MOFs
  - Patients receiving NSAIDs or Selective Cox-inhibitors
  - Patients receiving diuretics, ACEIs or ARBs as an anti-HT drug
  - Patients having bacterial co-infection
- Cardiac complications in dengue :
  - Cardiac dysrhythmia : 29-63%
  - Functional myocardial impairment : 40%
  - Myocarditis : 15%

Thanachartwet V. Clinical management of severe dengue in adults; 2017. pp 161-175.
Thanachartwet V. Clinical management of severe dengue in adults; 2017. pp 177-193.

PLOS ONE

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RESEARCH ARTICLE

Dynamic Measurement of Hemodynamic Parameters and Cardiac Preload in Adults with Dengue: A Prospective Observational Study

Vipa Thanachartwet[1]*, Anan Wattanathum[2], Duangjai Sahassananda[3], Petch Wacharasint[4], Supat Chamnanchanunt[1], Ei Khine Kyaw[1], Akanitt Jittmittraphap[5], Mali Naksomphun[6], Manoon Surabotsophon[7], Varunee Desakorn[1]

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* vipa.tha@mahidol.edu

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OPEN ACCESS

Thanachartwet V *et al.* PLoS One. 2016;11(5):e0156135. doi: 10.1371/journal.pone.0156135.

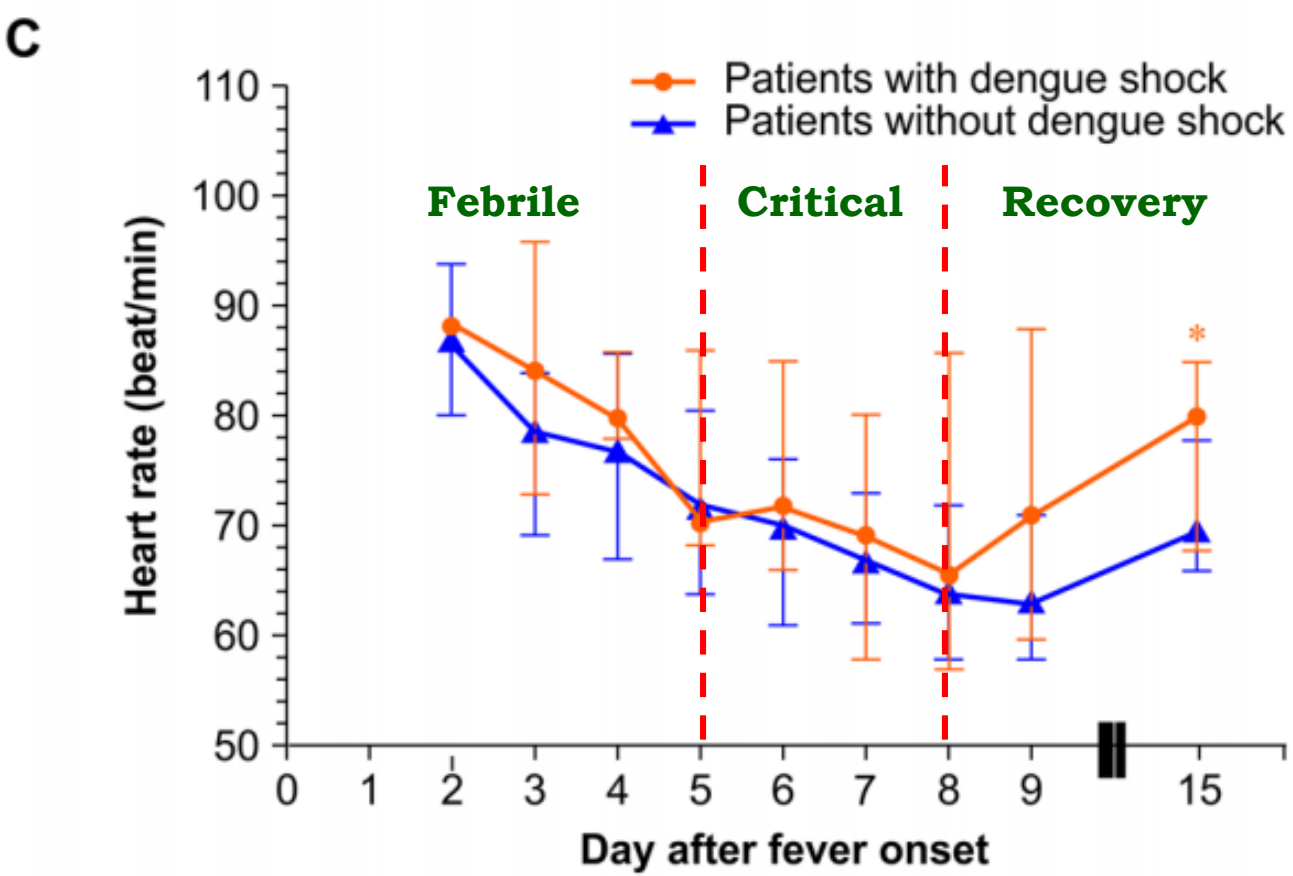
250 adults with suspected dengue admitted to the Hospital for Tropical Diseases, Mahidol University, Bangkok in Thailand

- 38 patients had underlying medical illness.
- 31 patients had mixed infection.
- 14 patients had negative results for dengue RT-PCR, micro-neutralization and anti-dengue virus IgM/IgG antibodies.
- 5 patients were <15 years of age.

162 hospitalized adults with confirmed dengue viral infection were recruited to the study

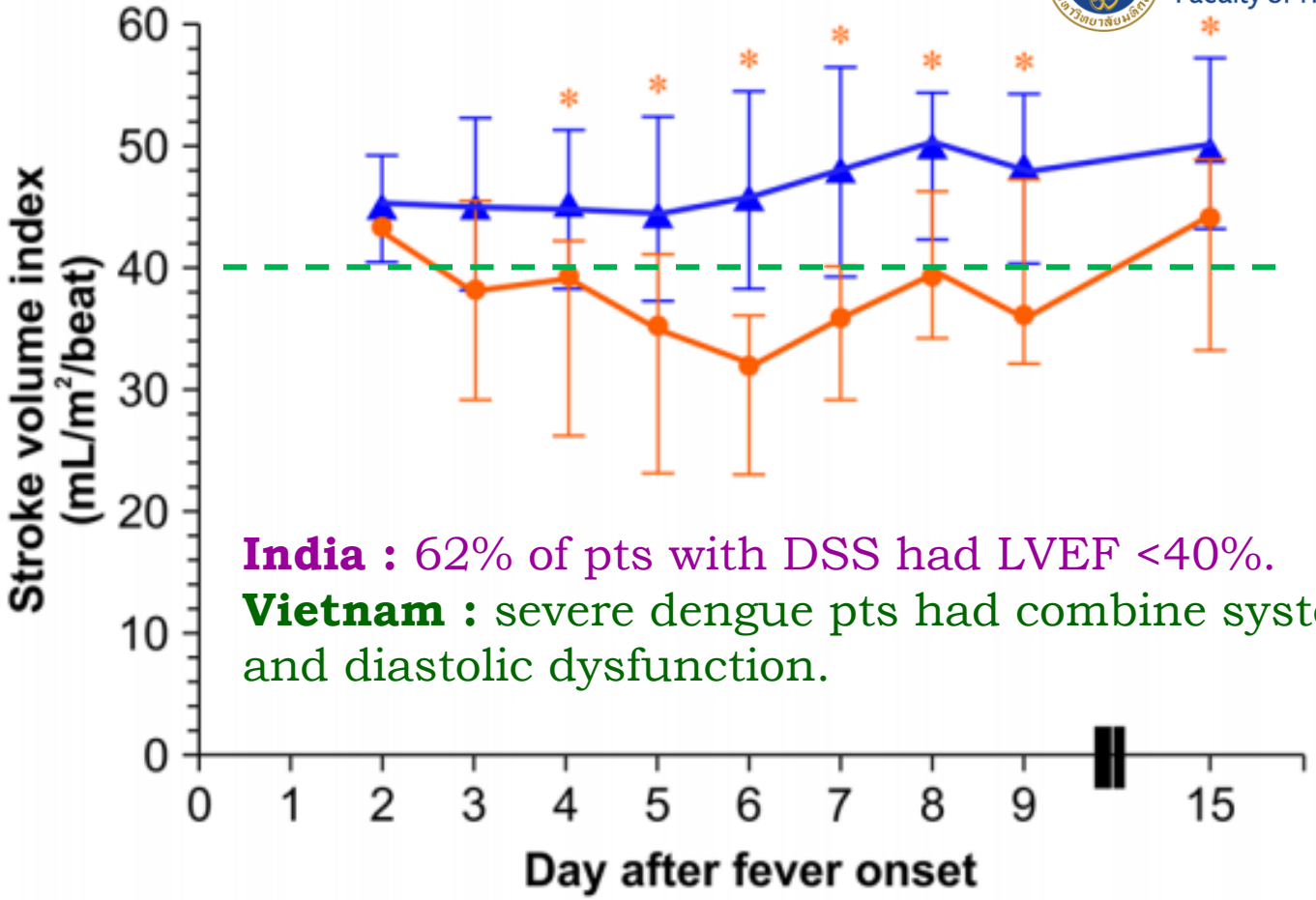
- 145 (89.5%) patients did not develop dengue shock during hospitalization.
- 17 (10.5%) patients developed dengue shock during hospitalization.

Thanachartwet V *et al.* PLoS One. 2016;11(5):e0156135. doi: 10.1371/journal.pone.0156135.



HR (beats/min)	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 15
Dengue with shock (n)	2	4	7	13	15	15	12	9	15
Dengue without shock (n)	26	50	94	122	130	110	68	34	137
P-value	NA	0.311	0.141	0.533	0.207	0.648	0.540	0.126	0.041

Thanachartwet V *et al.* PLoS One. 2016;11(5):e0156135. doi: 10.1371/journal.pone.0156135.



India : 62% of pts with DSS had LVEF <40%.

Vietnam : severe dengue pts had combine systolic and diastolic dysfunction.

SVI (mL/m²/beat)	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 15
Dengue with shock (n)	2	4	7	13	15	15	12	9	15
Dengue without shock (n)	26	50	94	122	130	110	68	34	137
P-value	NA	0.128	0.018	<0.001	<0.001	<0.001	0.003	0.024	0.005

Thanachartwet V *et al.* PLoS One. 2016;11(5):e0156135. doi: 10.1371/journal.pone.0156135.
Wali JP *et al.* Int J Cardiol. 1998; 64(1):31–6. Yacoub S *et al.* Crit Care Med. 2012; 40(2):477–83

Antiplatelets and Anticoagulants in Dengue

Risk of bleeding

- Age >75 years
- Diabetes, Hypertension
- Prior bleeding within the previous 3 months
- PLT count <100,000/mm^3
- Liver disease (INR >1.5)
- CKD (eGFR <30 $ml/min/m^2$)
- Combined use of an anticoagulant and an antiplatelet medication (ASA, NSAIDs etc.)
- Dual antiplatelet therapy

Decousus H, *et al.* Chest 2011;139:69. Huhtakangas J, *et al.* Stroke 2011;42(9):2431
Boulanger M, *et al.* Neurology 2016;87(9):870. Ehelepola NDB, *et al.* Am J Trop Med Hyg. 2020;102(1):17-19.
Chia PY, et al. J Infect. 2021;82(2):270-275.

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Management of Non-shock Dengue and Dengue with Comorbidities

Severe Plasma Leakage ⟷ **DSS** ⟷ **Severe Bleeding (GI bleeding)**

Prolong shock

Early detection/ Fluid Rx

Multi-organs Failure (AKI/ALF/Myocarditis/ARDS)

Appropriate ATB

Bacterial Infection


Thank you for your attention
Vipa Thanachartwet, Faculty of Tropical
Medicine, Mahidol University, Thailand