Ministry of Health
Sri Lanka

National Guidelines

Guidelines on Management of Dengue Fever & Dengue Haemorrhagic Fever In Children and Adolescents

Revised and expanded edition

November 2012

In Collaboration with the
Sri Lanka College of Paediatricians

Ministry of Health - Sri Lanka

National

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This document includes the new concepts on management of Dengue Haemorrhagic Fever patients and replaces the existing national guidelines on clinical management of Dengue Fever / Dengue Haemorrhagic Fever published by Epidemiology Unit, Ministry of Health in 2010.

These guidelines were developed based on the best available evidence at the time of writing. The guidelines will be reviewed periodically when new evidence becomes available.

Please forward your comments and suggestions to the following address by post or e-mail.

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Guidelines Development Committee

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Foreword

Recent trends on morbidity and mortality of Dengue illness has caught the attention of people of various walks of life. The in-ward and the outpatient departments of the hospitals of Sri Lanka are receiving increasing numbers of patients with dengue illness.

This newly revised national guidelines, on management of dengue fever and dengue haemorrhagic fever in children and adolescents, developed by the epidemiology unit of ministry of health in collaboration with the Sri Lanka College of Paediatricians is expected to further improve existing knowledge and bridge any gaps on the above topic.

I hope that this document would have a positive influence on the management of patients with dengue illness.

Dr. Y.D.N. Jayathilaka
Secretary
Ministry of Health

Preface I

Dengue haemorrhagic fever has caused many a young life to be lost in the country in the recent past. In 2010 guidelines were developed on the management of Dengue fever and Dengue haemorrhagic fever in Children and Adolescents. This has clearly helped reduce the mortality due to Dengue. These guidelines however needed to be updated due to new issues that had to be addressed. Like on the previous occasion a team of clinicians from the Sri Lanka College of Paediatricians and members of the Epidemiology Unit of the Ministry of Health have come together to share their expertise in updating these guidelines.

Until the public health issues surrounding Dengue are dealt with in the country, clinicians will continue face a significant workload due to Dengue. Undoubtedly this guideline will provide them the necessary knowledge and the confidence to deal with the majority of patients. There will however be patients who require management beyond these guidelines. In these instances advice should be sort from clinical experts in the field who are ready and willing to assist.

I congratulate and thank the team of Paediatricians and members of the Epidemiology Unit who have contributed towards the development and the updating of these guidelines. I also wish to thank the WHO for their support.

It is my earnests wish that all clinicians who deal with children and adolescents with Dengue will make the best use of these guidelines to further reduce the mortality in these patients.

Prof. Asvini Fernando
President
Sri Lanka College of Paediatricians

Preface II

The impact of Dengue illness on the health care system of Sri Lanka has made it one of the household names in the recent past. It has influenced various other fields such as economy, policy making and environmental sciences. This highlights the need of frequent update of the knowledge on clinical management of dengue illness.

The epidemiology unit of ministry of health conducted a series of meetings with a group of specialists who contributed to the previous guidelines in 2010 and who were endorsed by the Sri Lanka College of Paediatricians to revise the prevailing national guidelines on the management of dengue fever and dengue haemorrhagic fever in children and adolescents. This is intended to reach all levels of the health care services which would lead to reduction in morbidity and prevention of mortality due to dengue illness.

I extend my gratitude to each and every one who contributed towards the creation of this guideline.

Dr Paba Palihawadana
Chief epidemiologist

Identifying the beginning and the end of the
Critical phase (leaking phase),
meticulous monitoring, judicious fluid management during the critical phase, vigilance, anticipation, early detection and treatment of ***concealed bleeding and other complications*** *are the most crucial factors in reducing*
morbidity and mortality in patients with
Dengue Haemorrhagic Fever (DHF)

A DHF patient well-managed from the onset of leaking should not need Intensive Care admission except very rarely

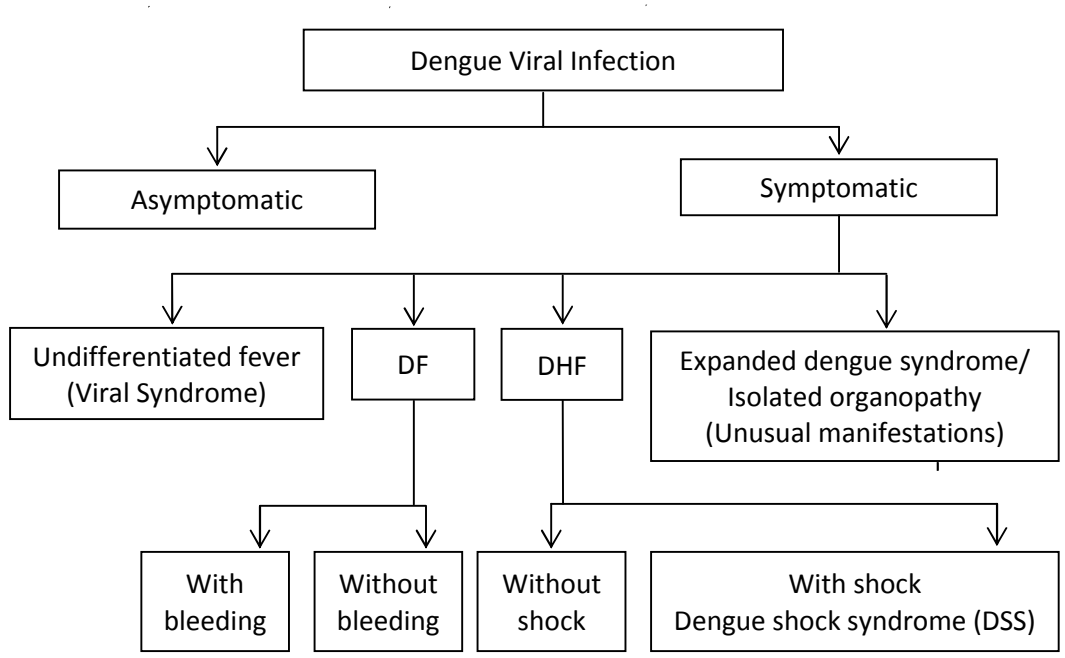
1. Introduction

Many patients infected with dengue virus remain asymptomatic (90%). Others after an incubation period of approximately 6 (3-14) days develop a febrile illness which could turn out to be one of the following:-

1. Undifferentiated febrile illness
2. Dengue Fever (DF)
3. Dengue Haemorrhagic Fever (DHF)
4. Unusual Dengue‡

In-ward patients suspected of dengue illness include patients with DF and DHF. Differentiation between the two is difficult during the initial few days.

Figure: Classification of Dengue Viral Infection



Courtesy: Comprehensive guidelines for prevention and control of dengue and Dengue Haemorrhagic Fever. Revised and expanded edition. (SEARO Technical Publication Series No. 60) 2011

‡Unusual Dengue (Expanded Dengue Syndrome) - please see page 32

Undifferentiated fever

Those who have been infected with dengue virus, especially for the first time (i.e. primary dengue infection), may develop a simple fever indistinguishable from other viral infections.

Case Definitions of DF and DHF

Dengue Fever (DF)

Clinical criteria that define DF include a 2-7 day illness with high fever headache, retro-orbital pain, myalgia, arthralgia/ bone pain, rash and haemorrhagic manifestations E.g. positive tourniquet test, or petechiae, with no evidence of plasma leakage.

Dengue Haemorrhagic Fever (DHF)

In the first few days of DHF patients will have sign and symptoms similar to that of DF. However in DHF, (usually beyond day 3) will develop features of plasma leakage.

The following criteria are necessary for the case definition of DHF

1. High fever or recent history of acute fever
2. Haemorrhagic manifestations †* (at least a positive tourniquet test)
3. Thrombocytopenia of ≤100,000 cell/mm^3
4. Objective evidence of leaky capillaries

† In patients who have definite evidence of plasma leakage, presence of haemorrhagic manifestations is not essential for the diagnosis of DHF. However the term "DHF" is retained because these patients may develop overt or concealed bleeding during the course of illness.*

2. Natural course of the illness

Understanding of the disease process will help in proper management that will reduce the degree of morbidity and mortality. Dengue Haemorrhagic Fever is a dynamic disease. Its clinical course changes as the disease progresses and consists of three stereotypic phases;

1. Febrile phase
2. Critical phase
3. Convalescent phase

Febrile phase (of both DF & DHF)

- High fever 2-7 days.
- Facial flushing, skin erythema, headache, retro-orbital pain, myalgia, arthralgia, nausea and vomiting.
- Haemorrhagic manifestations include petechiae, purpura, gum or nasal bleeding, gastrointestinal bleeding, haematuria, menorrhagia and positive tourniquet test.
- Total white cell count could be high (particularly in infants – refer page 33) or normal initially and drop towards the latter part to levels below 5000/mm^3.
- Platelet count is normal initially and will come down to ≤100,000/mm^3 in about 50% of DF and almost 100% of DHF patients.

- Tender hepatomegaly favours a diagnosis of DHF
- Erythematous/maculo-papular rash is seen more in DF than in DHF

DF and DHF in febrile phase

Dengue Fever and Dengue Haemorrhagic Fever are two different clinical conditions from the beginning. They look very similar in the first few days. When a patient presents with dengue or dengue like illness the differentiation between DHF and DF will be a key factor in guiding the management.

- **Thrombocytopenia** and **Leucopenia** (White Blood Count-WBC <5,000/mm^3) are seen in the febrile phase of both DF and DHF.
- Presence of **haemorrhagic manifestations** in febrile phase does not indicate that the patient has DHF because haemorrhagic manifestations can be found in both DF and DHF.

It is often difficult to differentiate DF from DHF in the febrile phase of the illness. Therefore, suspected DF and DHF patients should be closely followed up in order to identify the DHF patients going into plasma leakage phase to ensure correct fluid management during the critical phase.

3. Diagnosis & Management at OPD level & by primary care physician

3.1 When to suspect Dengue illness (DF/DHF) in a child with acute onset of fever

Presence of some of the following features:

- Headache & retro-orbital pain
- Nausea or vomiting
- Arthralgia & myalgia
- Rash (diffuse, erythematous, macular)
- Positive tourniquet test † * (negative test does not exclude the possibility of dengue)
- Leucopenia (WBC <5000/mm^3)
- Platelet count ≤ 150,000/mm^3
- Rising Haematocrit (HCT) 5-10%

† * *tourniquet test is done by measuring the blood pressure using a cuff of appropriate size for each patient (the width is to cover 2/3 of the upper arm). Raise the pressure to midway between systolic and diastolic blood pressure for 5 minutes. Release the pressure and wait for one minute before reading the result. Positive test is considered when there are ≥ 10 petechiae per square inch.*

Some patients may present with atypical manifestations like respiratory symptoms such as cough, rhinitis or injected pharynx and gastro-intestinal symptoms such as constipation, colicky abdominal pain, diarrhoea or vomiting with or without the classical clinical presentation described above.

If a patient with high fever is seen with flushed face/extremities and a positive tourniquet test (even with normal platelet count) with leukopenia (WBC <5000 /mm^3) without any focus of infection, it is very likely that the patient is having Dengue illness.

3.2 Management of those who do not need admission

1. Ensure adequate oral fluid intake. Approximate guide for fluid intake during this stage is age appropriate maintenance fluid requirement. This should consist of oral rehydration fluid, king coconut water, other fruit juices, kanji or soup rather than plain water. Exclude red and brown drinks.
2. Adequate physical rest (off school)
3. Tepid sponging for fever
4. Paracetamol 10-15mg/kg/dose for fever (Do not exceed 60mg/kg/24hrs). Warn that the fever may not fully settle with paracetamol and advise not to take excess.
5. Anti-emetics and H_2 receptor blockers if necessary.
6. **Necessarily avoid all NSAIDs in any form and steroids** as they may induce severe bleeding.
7. Review daily with Full Blood Count (FBC). **First FBC** should be done on the **third day of fever/illness** and daily thereafter if the platelet count is >150, 000/ mm^3. FBC should be done twice daily if the platelet count is <150, 000/ mm^3. However, a FBC is recommended on the first day of fever/contact during infancy and in patients with co-morbidities.
8. **Advise** parents to **return immediately for review** if any of the following occur on/beyond Day 03:
   - Clinical deterioration with settling of fever
   - Inability to tolerate oral fluid
   - Refuse to eat or drink
   - Feeling extremely thirsty
   - Severe abdominal pain/ vomiting
   - Cold and clammy extremities
   - Bleeding manifestations including inter-menstrual bleeding or menorrhagia
   - Not passing urine for more than 6 hours
   - Behaviour changes: Confusion, restlessness, lethargy, irritability

3.3 Criteria for admission

Medical officers are expected to use clinical judgment regarding admission. However, it is essential to admit the following patients:

- All patients with a platelet count of $\leq 100{,}000/mm^3$
  (Platelet count above $100{,}000/mm^3$ but below $150{,}000/mm^3$ and dropping rapidly may be admitted depending on the circumstances)
- All patients with **warning signs** after day 3 of fever/ illness.

Following warning signs in suspected DF/ DHF warrant admission for intense and close monitoring:

- Abdominal pain or tenderness
- Persistent vomiting
- Cold extremities and features of shock
- Clinical fluid accumulation: pleural effusion, ascites
- Mucosal bleeding
- Lethargy, restlessness and drowsiness
- Liver enlargement >2cm
- Laboratory:
    - Increase in HCT >10%
    - Decrease in platelet count $\leq$100,000/mm^3
    - Elevated SGOT well above SGPT

- The following categories of patients with probable dengue also should be admitted:
    - Infants
    - Obese patients
    - Patients with major co-morbidities / medical problems (diabetes, nephrotic syndrome, Chronic renal failure, haemolytic diseases, poorly controlled asthma)
    - Adverse social circumstances- living alone, living far from health care facility without reliable means of transport, unreliable parents

4. In-ward Management of DF / DHF

4.1 Febrile phase

4.1.1. Management of patients still in febrile phase

1. Ensure adequate oral fluid intake.
   If the patient is vomiting or dehydrated and not taking adequate oral fluid may need IV fluids. Total fluid requirement (oral + IV) will depend on the degree of dehydration (May even go up to Maintenance + 5% over a 24 hr period). The rate of infusion has to be reduced soon after correction of dehydration. From the 3rd day onwards, one needs to be cautious of the volume of fluid administered as the patients with DHF will be entering the critical phase.

   When IV fluids are needed during the **febrile phase,** (when the patient has not entered the critical phase) use 5% dextrose in N/2 for infants below 6 months and N**.** saline for others.
2. Adequate physical rest
3. Paracetamol 10-15mg/kg/dose for fever (do not exceed 60mg/kg/24hrs) with tepid sponging as needed
4. **Avoid all NSAIDS and steroids**
5. Monitoring: Use monitoring chart I (Febrile phase) - Annexure III

4.1.2. Monitoring during febrile phase

- Temperature four hourly
- Vital parameters - pulse, blood pressure (both systolic and diastolic), respiratory rate, and capillary refill time – 3 hourly (may need more frequent monitoring depending on the clinical situation)
- Intake and output
- FBC daily (or even twice daily when platelet count is dropping below 150,000/mm^3)
- HCT once/twice daily

4.2 Critical phase: (seen only in DHF)

4.2.1. Key Points

- The critical phase is heralded by the onset of plasma leakage

- Platelet count dropping below 100,000/mm^3 is the most useful and the earliest indicator that the patient is probably entering the critical phase (leaking phase).

- **During critical phase plasma leakage is the main cause for shock, subsequent bleeding, organ failure and death.**

- The critical phase occurs towards the late febrile phase (often after the 3rd day, usually occurs between the 4th to 5th day but may sometimes go up to the 7th day). It is extremely rare within the first 2 days of fever.

- Rapid drop in temperature may occur as the patient enters the critical phase (In DF and other viral infections as fever subsides the patient's general condition improves, but in DHF it may get worse). During the early phase of plasma leakage many patients may still have fever, but the intensity will be lower.

- **Critical phase will last for about 24 to 48 hours.**

- DHF is a very dynamic disease where haemo-dynamic state can change very rapidly to profound shock and death.

- The rate of leaking is highly variable from patient to patient.

- The leak usually starts slowly, increases gradually, reaching a peak usually around 24 hours then slows down and ceases altogether at the end of leakage phase (usually within 48 hours from the onset).

- If the patient had been in hospital from febrile phase it is important to identify the exact timing of the onset of leakage. **Identifying the beginning and the end of the critical phase is a key factor in guiding fluid therapy in DHF.**

- It is important to monitor patients frequently specially towards the peak of leaking with readiness to resuscitate with fluids immediately. (Predict the peak and look for intense leak around the peak with monitoring.)

- Duration of critical period for a patient detected at the entry into the critical phase is usually 24- 48 hrs. If the patient presented in shock patient may have been in critical phase for a significant period of time, probably up to 24 hrs. Therefore, there is a possibility that some patients will have approximately another 24 hours remaining in the critical phase. If a patient is already dehydrated during the latter part of the febrile phase (due to Vomiting, Diarrhoea or lack of adequate fluid intake) and hydration is not corrected he or she might go into shock before 24 hours. In this instance the remaining duration of the critical phase may be more than 24 hours.

Remember: until the very last stage of shock a patient can appear conscious and very alert and if pulse and Blood pressure (pulse pressure) are not measured early shock could be missed.

4.2.2. Early detection of the critical phase (plasma leakage)

1. Platelet count dropping below 100,000/mm^3 should alert the clinician that the patient may be in or entering the critical phase of DHF. Remember: The patient with a platelet count below 100,000/mm^3 may be in one of the following three categories:
   - DF (about half of DF patients will have a platelet count below 100,000/mm^3)
   - DHF febrile phase (leaking not started yet)
   - DHF critical phase (early or late)

2. When platelet count drops below 100,000/mm^3, any of the following parameters indicates that the patient has entered the critical phase:

I. A **progressively rising haematocrit** towards 20% suggests that the patient may have entered the critical phase. **Remember:** Patients who have received IV fluids (sometimes even with excessive oral fluids) or bleeding may not show a rise in HCT especially as much as 20%**.**

II. **Rising haematocrit ≥20%.** The 20% is calculated by taking into consideration the baseline haematocrit (Hct). For example, if the initial Hct is 35% an increase of Hct up to 42% indicates a 20% increase. When the baseline Hct is not known, it is safe to assume that the baseline HCT is around 35 and may be slightly lower in young children and infants and higher in older children. Remember that the infants have lower HCT due to physiological and iron deficiency anaemia. If the baseline HCT is not known MCV will help to predict the baseline HCT.

III. **Objective evidence of fluid leak** out of the vascular compartment in **early** critical phase **detected radiologically**
   - Pleural effusion: Chest X Ray R/lateral decubitus, Ultra sound scan Chest
   - Ascites: Ultra sound scan abdomen

IV. When in doubt following **biochemical parameters** suggest that the patient is in the critical phase:
   - Serum albumin* of < 3.5g/dl or if albumin has dropped by ≥ 0.5g/dl
   - Serum cholesterol* of <100mg/dl or if cholesterol has dropped by 20mg/dl (Non-Fasting)

   * *not routinely recommended due to the costs involved, but useful when there is doubt. Since the baseline values may vary, a significant drop during the illness is suggestive of plasma leak*

4.2.3. Monitoring During Critical Phase

Since the critical phase is very dynamic and the rate and total duration of leaking is highly variable from patient to patient **it is of paramount importance to monitor frequently and very carefully** during this phase.

Hence, it is important to maintain monitoring charts. Please refer to annexures IV and V

- Annexure IV - Monitoring chart II for patients during critical phase
- Annexure V - Monitoring chart III for patients during the peak of leakage and during shock

Monitoring should include total fluid administered (oral+ IV) and the following clinical parameters:

- Pulse
- Blood pressure (BP)
- Pulse pressure (the aim is to maintain a pulse pressure close to 30mmHg during the entire critical phase)
- Capillary refill time (CRFT)
- Warmth / coldness of peripheries
- Respiratory rate
- Urine output (UOP) in ml/kg/hr using the same weight used for fluid calculation.
  (Aim is to maintain UOP between 0.5 - 1.0ml/kg/hr)
  Indications for catheterization
  - All high risk patients during critical phase (Refer page 21)
  - Patient with shock
  - Patient with complications
  - Diagnosed DHF(USS evidence of leaking) with gradually dropping platelets below 50,000/mm^3
- Evidence of overt bleeding and quantification

Vital signs should be monitored hourly when the patient is stable during critical phase. However, frequency of monitoring should be increased to every 15 minutes when the patient is leaking rapidly or while in shock until haemo-dynamic stability is achieved.

Regular HCT measurements (4-6 hourly) in non-shock patients and more regularly in patients who develop shock are essential.

Golden triad of In-ward management of Critical phase of DHF

- ♠ Early detection of beginning and recognizing the end of plasma leakage
- ♠ Meticulous monitoring, accurate and fine titration of fluids depending on the rate of leak **(Rate of infusion should match the leaking as determined by Pulse pressure, heart rate, HCT and UOP)**
- ♠ Anticipation, early detection and treatment of **concealed bleeding and other complications**

4.2.4. Fluid Management in the Critical Phase

- ***Calculation of fluid quota for the critical period***
  - Fluid quota **is only a guide** for management of dengue patients during the critical period of DHF.
  - Patients managed using fluid within this safe quota, are less likely to develop fluid overload.
  - When fluid requirement is calculated (both oral and IV), calculate it for the Ideal Body Weight (IBW) or the Actual Body Weight (ABW) whichever is lesser.

The maximum amount of fluid recommended during the
Entire critical phase
(irrespective of its length)
should be
Maintenance + 5% of body weight (50ml/kg)

The fluid quota is aimed at giving just adequate amount of fluid without causing fluid overload (to maintain perfusion to vital organs). Once the fluid quota is exceeded chances of fluid overload is high. All patients will not need the full quota of M+ 5% fluid and many may need less than this, as the rate, peak and the duration of leaking are variable from patient to patient.

- ***Calculation of Ideal Body Weight***
  - Weight for height using a growth chart (50th centile) -Best Method (Annexure I and II)
  - Weight for age using a growth chart(50th centile)
  - In an emergency situation use these formulae

<1 year	$\frac{\text{Age (in Months)}+ 9}{2}$
1-7 years	(Age x 2)+ 8
>7 years	Age x 3
APLS	(Age + 4) x 2

Note: Actual body weight is taken for calculation of fluid requirement if it is lower than the IBW

- ***Calculation of total fluid quota for the critical period***

M (Maintenance) = 100ml/kg for first 10 kg
+50 ml/kg for next 10 kg
+20 ml/kg for balance weight

5% of body weight = 50ml x body weight (kg)

E.g. Body weight 22 kg
(This is the ideal or actual body weight, whichever is smaller)

M	= 100 x 10 + 50 x 10 + 20 x 2	=1540 ml
5%	= 50 x 22	=1100 ml
M + 5%	= 1540 + 1100	=2640 ml

Note: The maximum weight for which fluid is calculated in any patient **should not exceed 50 kg.** Accordingly M+5% **should not exceed 4600 ml** in any patient.

- ***Rate of administration of IV fluids***

  Guide to rate of administration in a patient without SHOCK

  - All patients entering the critical phase to start on IV **normal saline** or Hartmann's solution through IV cannula (largest possible size for the age) in addition to oral fluid. Initial fluid requirement (oral + IV) is 1.5 ml/kg/hr. Those who can drink well may be given IV fluids as 0.5ml/kg/hr to 'keep vein open' and the balance as oral. (Use N/2 + 5% dextrose in < 6 months infants; For those above >6 months when the patient is not taking orally for prolonged periods it is useful to give N Saline in 5% dextrose †*)

  - Calculate the total fluid quota for the patient (M+ 5%) at the beginning of critical phase. If the patient has been in the critical phase for some time, need to calculate the remaining volume of fluid which could be administered, considering the duration of critical phase elapsed and the amount of fluid already given during this period of time.

  - Subsequent rate of infusion will depend on the rate of leak (which will highly vary from patient to patient and even in the same patient from time to time) judged by pulse, BP, pulse pressure, CRFT, HCT and UOP.

  - Patients who are in shock due to plasma leakage usually have narrowing of pulse pressure ≤ 20mmHg and patients with bleeding usually present with hypotension.

  - Calculate the UOP in ml/kg/hr, at each void, using the same weight used for fluid calculation. In a patient who is stable **hourly urine output is the best guide to decide the rate of infusion**. Urine output of **only 0.5 -1 ml/ kg/hour** is sufficient to maintain renal functions during the critical period. **If the UOP is above 1 ml it suggests that infusion rates are too high. If the UOP is <0.5ml/kg/hr it may suggest inadequate fluids. In such situations catheterization may be required.**

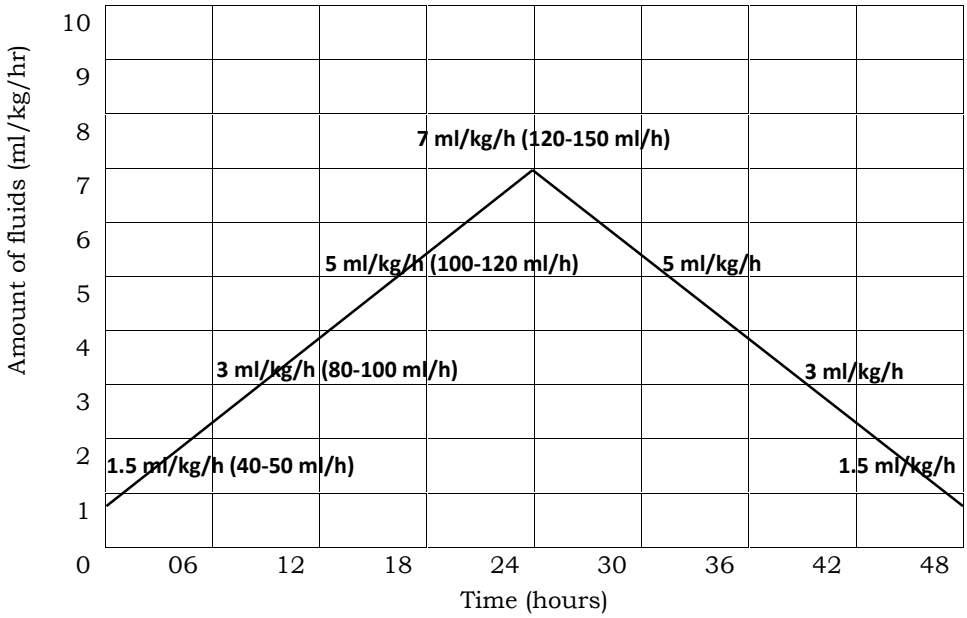
†**When "dextrose saline" is not available, such a solution could be made by adding 50ml of 50% dextrose to 450ml of normal saline.*

- If a higher rate of maintenance fluid is unable to maintain the pulse pressure, fluid boluses (N.saline or colloids 10ml/kg/hr) should be used.

- Individual patient's rate of fluid requirement will depend on his/her rate of leakage. The rate of IV fluid administration has to be adjusted **frequently** depending on vital signs especially pulse rate, BP, pulse pressure, HCT, CRFT, urine output.

Use **Chart I** below as a guide in non-shock patients while remembering that there is wide variation in the rate of leak from patient to patient

Chart I: Guide to rate of fluid intake in Critical Phase - without shock



Fluids for adolescents are mentioned with-in brackets.

Courtesy of WHO Collaborating Centre for Case Management of Dengue/DHF/DSS, Queen Sirikit National Institute of Child Health, Bangkok, Thailand

This pyramid is only graphically describing the pattern of leaking and the fluid requirement in a classical dengue patient who will gradually leak with an increasing rate in the beginning, then come to a peak and then start slowing down to finally stop in not more than 48 hrs from onset of leaking. However this pattern may not be seen in many patients. Some patients leak for less than 48 hrs and some may not leak for more than 24 hrs.

For smooth management it is best not to adjust the rate of Crystalloid fluid infusion blindly on a time scale (eg 1.5ml/kg/hr for first 6 hrs and then 3ml/kg/hr next 12 hrs etc), as this may lead to fluid overload and sometimes unwarranted shock.

A rate as high as 7ml/kg/hr is only very rarely needed and even rates as high as 5ml/kg/hr if needed will only be needed for a short period (usually less than a couple of hrs) in a very large majority of patients. The rate has to be adjusted frequently depending on the observations of monitoring the pulse pressure, heart rate, UOP and HCT.

Guide to Rate of Fluid Intake in a patient with SHOCK

Early detection of shock

Symptoms

- Sweating
- Abdominal pain
- Restlessness
- Altered conscious level

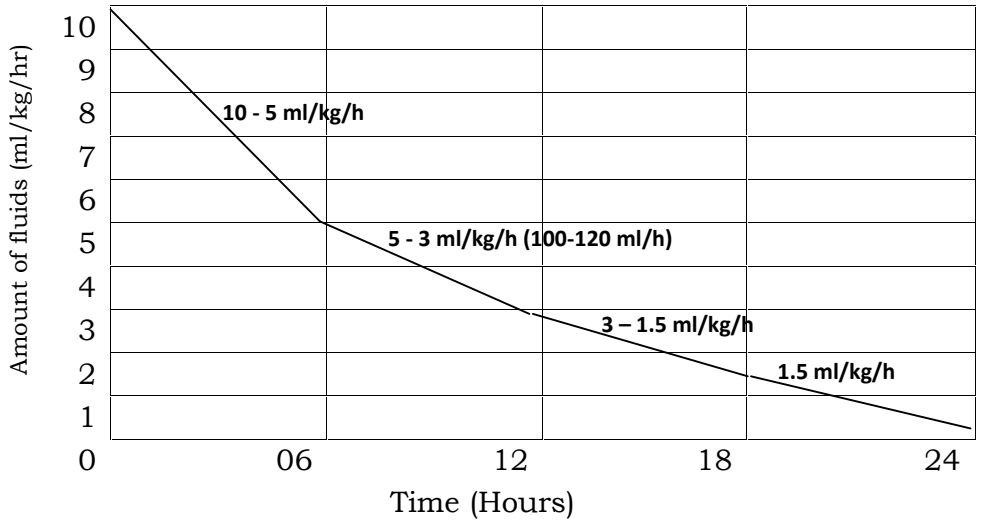
Signs

- Cold extremities
- Prolonged capillary refill time >2 sec
- Unexplained tachycardia
- Increasing diastolic pressure
- Narrowing of pulse pressure ≤20mmHg

- As the peak of leaking occurs around 24 hours, a patient who has gone into significant shock will be in a stage of leaking that has passed about 24 hours and will only have about a further 24 hours before the leaking stops. Hence, if a patient presents with shock (cold clammy skin, pulse, BP unrecordable) one would assume that the patient had continued to leak before coming to hospital.
- Individual patient's fluid rates administered will depend on his/her rate of leak. The rate of IV fluid administration has to be adjusted all the time depending on vital signs specially pulse rate, BP, pulse pressure, HCT, CRFT, urine output.
- Total fluid quota M+5% should include the fluid given during resuscitation.

(You may use Chart II below as a guide for patients with shock while remembering that there is wide variation in rate of leak from patient to patient)

Chart II: Guide for the rate of IV fluids in profound shock after initial resuscitation



Courtesy of WHO Collaborating Centre for Case Management of Dengue/DHF/DSS, Queen Sirikit National Institute of Child Health, Bangkok, Thailand

Remember

The chart on the rate of fluid administration is only a guide.
Individual patient's fluid rates will depend on the rate of leak in that patient.
The rate of IV fluid administration has to be adjusted frequently depending on vital signs, HCT and UOP.
Many patients can be managed with very much lower rates than shown and less than the quota of M + 5%.

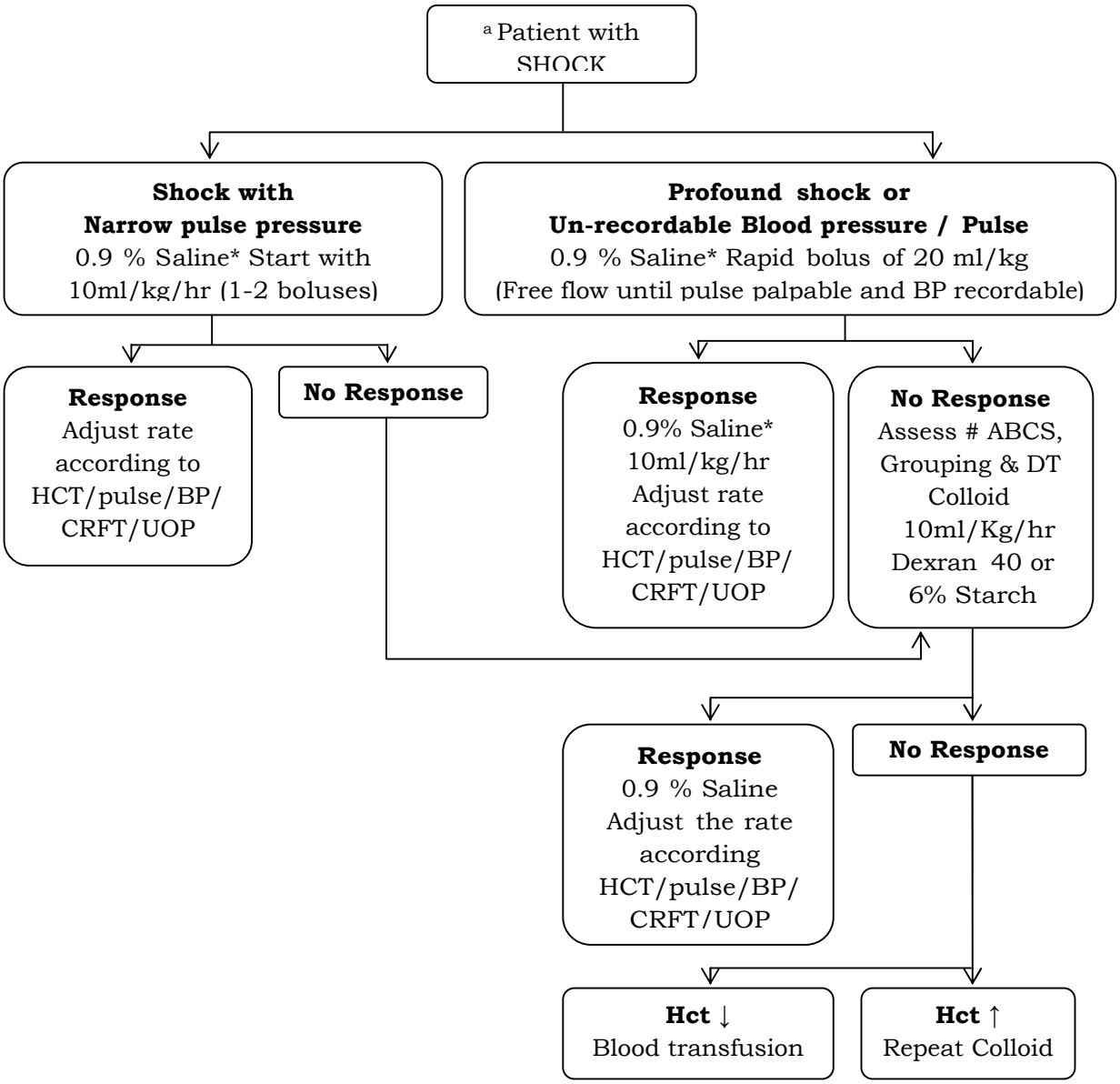
M +5% VOLUME AND THE RATES SHOWN IN THE FIGURE ARE ONLY A GUIDE WHICH ONE SHOULD TRY NOT TO EXCEED

If the rate of IV fluids cannot be reduced gradually as shown in the graph ABCS** should be checked and corrected.

It is also worth noting that though it is possible to manage some patients with less than M+5% volume of fluid it should always be done only by maintaining a UOP >0.5ml/kg/hr and adequate pulse pressure > 30 mmHg throughout the critical phase with frequent monitoring. Remember that fluid restriction without such monitoring would otherwise lead to prolonged shock!

**ABCS A- Acidosis B- Bleeding C- Calcium S- Sugar

Figure: Algorithm on management of Shock in DHF



[a] All patients in shock – Call for help; ensure adequate oxygenation, Keep flat/head low

* 5% dextrose in N Saline is a useful alternative to N Saline when available especially in patients who are likely be without any food intake for prolonged periods. In such patients assess blood sugar intermittently.

[#] ABCS A- Acidosis B- Bleeding C- Calcium S- Sugar

- ***Indications for Colloids (Dextran 40 and 6% Starch)***
  1. In the management of shock after 2 crystalloid boluses if the pulse /BP has not picked up.
  2. Development of shock when already having a fluid overload or the amount of fluid received over a period of time appears to be in the direction of exceeding M + 5% deficit

Key points – Colloid administration

- Both dextran 40 and 6% Starch (Hydroxy Ethyl Starch) are recommended **only during the critical phase** (24 to 48h) of DHF.
- They should only be used as boluses over a maximum period of one hour (10ml/kg/h) at a time and not as infusions unlike saline. (a half bolus could be 5ml/kg given over 30 minutes)
- Dextran may sometimes interfere with grouping and cross matching of blood. It is advisable to preserve a sample of blood for grouping and cross matching before initiating Dextran. (However this may defer when using newer technique for cross-matching).
- One could use up to 3 doses of Dextran 40 (each as 10ml/kg/hour) during a 24 hour period (6 doses within 48 hours). 6% Starch (HES) could be given up to 5 doses (each as 10ml/kg/hour) per 24 hours (10 doses within 48 hours).
- When Normal saline is given it remains in circulation only for about 1 to 2 hours or less during rapid leaking. Even fluids like fresh frozen plasma (FFP) will readily leak and will not hold blood pressure for long periods. A colloid (dextran or 6% Starch) will remain longer.

Very Important:

While in the critical phase if the patient deteriorates with no haemo-concentration (or if HCT drops) one has to suspect concealed bleeding

Comparable rate of IV fluid in adults and children
(both with Shock and without Shock)

The rates for children weighing more than 50kg are same as the rate for adults

Note	**Children** Rate (ml/kg/hour)	**Adult** Rate (ml/hour)
Half the maintenance M/2	1.5	40 - 50
Maintenance (M)	3	80 - 100
M + 5% Deficit	5	100 - 120
M + 7% Deficit	7	120 - 150
M + 10% Deficit	10	300 - 500

Source:

Holiday MA, Segar WE. Maintenance need for water in parenteral fluid therapy Pediatrics 1957; 19: 823.[79]

Note: For an adolescent patient (even for an adult) with an IBW of 50kg the corresponding rate of fluid administration compared to a child needing a rate of 3ml/kg/hr is only 100ml/hr and not 150ml/hr

End of critical phase is indicated by stable vital signs, returning of HCT to normal along with clinical improvement and diuresis.

4.3. Management of complicated DHF

High risk patients for complications:

- Infants
- Obese patients
- Prolonged shock
- Bleeding
- Encephalopathy
- Underlying diseases
- Pregnancy (In adolescents)

Causes of death in DHF patients:

Primary causes of death are prolonged shock, fluid overload or both, and rarely due to unusual dengue. **Secondary** causes of death are a consequence of the primary cause. Eg: Multi organ failure with massive bleeding due to prolonged shock; Heart failure / pulmonary oedema due to fluid overload.

Prolonged shock

- Delayed diagnosis/ delayed resuscitation and late presentations are the usual reasons for prolonged shock
- Shock lasting > 4 hours (Prolonged shock) will lead to organ failure and prognosis of such a patient is very gloomy;
  - Liver failure - prognosis 50%
  - Liver + Renal failure - prognosis 10%
  - Three organs failure (+respiratory failure) - prognosis very bleak

Fluid overload

- Use of hypotonic saline, excess fluids or fluid given beyond the time of leakage is the usual causes for fluid overload.
- Features of fluid overload
  - Early signs and symptoms include puffy eyelids, distended abdomen (ascites), tachypnoea, mild dyspnoea.
  - Late signs and symptoms include all of the above, along with moderate to severe respiratory distress, shortness of breath and wheezing (not due to asthma) which are also an early sign of interstitial pulmonary oedema and crepitations. Restlessness/agitation and confusion are signs of hypoxia and impending respiratory failure.

Unusual dengue

Single organ involvement Eg: Encephalopathy / Encephalitis

Massive bleeding

In DHF massive bleeding is usually concealed and may be seen during autopsy. It is usually a consequence of acidosis, coagulopathy and DIC due to prolonged shock.

4.3.1. ABCS

Consider ABCS when there is no improvement in spite of adequate fluid therapy.

A: Acidosis, **B**: Bleeding, **C**: Calcium, **S**: Sugar

Acidosis

- Acidosis is not uncommon in profound shock and prolonged acidosis makes patients more prone to more advanced DIC which contributes to massive bleeding.
- Acidosis should be corrected early.
- Early correction of acidosis when the pH is <7.35 together with HCO_3 level <15 mmol/1 is recommended as the correction of acidosis is known to prevent bleeding and DIC in Dengue. (This is different from the recommendation for correction of acidosis in septic shock.)
- One may use empirical $NaHCO_3$ 1ml/kg slow bolus (max 50ml) diluted in equal volume of normal saline if the patient has no clinical improvement (still in shock with cold clammy skin and cyanosis) after 15-30 minute of initial IV fluid resuscitation for shock. If the amount of $NaHCO_3$ needed in a single dose is above 10ml, a specialist should be consulted.

Bleeding

Indications for Blood Transfusions

1. If there is significant overt bleeding
2. When one suspects concealed bleeding
    - When HCT drops without clinical improvement
    - Severe metabolic acidosis and end-organ dysfunction despite adequate fluid replacement.

Note:

1. Even with bleeding the HCT drop may take time (4-5hrs). When the patient does not show improvement it is important to do repeat HCTs frequently.
2. Haemoglobin level may remain normal despite significant blood loss.
3. Remember: Bleeding could be concealed in DHF

Use Packed Red cells (PRC)

- Use PRC at 5ml/kg once and repeat only if needed.
- 5ml/kg of PRC will increase HCT by 5 points. (Eg: 30 to 35)
- Even if bleeding is likely and if HCT is >45% do not give blood without bringing down the HCT first by giving a colloid.

Hypocalcaemia

- Hypocalcaemia is common in DHF. Almost every patient with complicated DHF has hypocalcaemia.
- When a dengue patient has a convulsion it could be due to hypocalcaemia.
- To detect hypocalcaemia: Measure serum Ca^{2+} level or Corrected
- QT interval (not always evident) in ECG

When to give calcium?

- Give empirical calcium **if** the patient is **complicated** and deteriorating or not showing expected improvement to fluid.
- Dose 1ml/kg of 10% Ca Gluconate slow IV bolus over 15-20min diluted in equal volume of N saline (look for bradycardia while pushing slowly) **Max: 10ml**. Can be repeated even 6 hourly if the patient is not improving.

Hypoglycaemia

Prevention of Hypoglycemia

As hypoglycemia is common in DHF one should try to prevent it during the management. This could easily be done by using Normal saline with 5% Dextrose as maintenance fluid in the management of DHF. You can either use commercially available Dextrose saline (0.9% NaCl with 5% Dextrose) or this solution can be prepared by adding 50 ml of 50% Dextrose to 450 ml of 0.9% NaCl.

Treatment of Hypoglycemia

The immediate goal in the treatment of hypoglycemia is to increase the plasma glucose to at least 70 mg/dL. Rapid improvement in blood sugar is normally seen after administration of 10% dextrose, 2 ml/kg by IV push, followed by continuous IV dextrose at a rate of at least 8 mg/kg/min. Glucose levels should be repeated frequently; for continuing hypoglycemia, additional boluses should be given, and the basal glucose infusion should be increased in 10%-15% increments.

4.3.2. Hyponatremia

- Hyponatremia is common in DHF.
- Mainly due to the use of hyponatremic fluids:
  N/2 NaCl, N/5 NaCl, Water
- When a dengue patient has a convulsion it could be due to hyponatremia.

To prevent Hyponatremia

- Do not use hyponatremic IV Fluids
- Do not use water alone as oral fluids
- Use 0.9% NaCl as IV Fluid
- Use ORS, Fruit juices and King Coconut water as oral fluids

3% NaCl is given in:

- Symptomatic hyponatremia (Hyponatremic convulsions)
- Hepatic encephalopathy with serum sodium <120meq/l

Dose of 3% NaCl is 3-5ml/kg slow IV through a larger vein preferably through a central vein

4.3.3. Adjunct Therapy

Indications for platelet transfusion

- Prophylactic platelet transfusion is **NOT recommended.**
- Each platelet pack is 50-150ml and unnecessary use of platelets will contribute to fluid overload
- Platelet transfusions are needed only on very few occasions, preferably to be decided by the Consultant in the ward.
- Thrombocytopenia is unlikely to produce spontaneous bleeding in DHF/DSS. Even with low platelet counts (close to or <20,000/mm^3) if there is no significant bleeding do not give platelets. Petechiae are not an indication for platelet transfusion. In DHF thrombocytopenia can cause bleeding with trauma or surgery (E.g. Insertion of a Central venous pressure (CVP) line when platelet count is <20,000/mm^3).

Indications for Recombinant factor VII

- Consider **only** in cases with bleeding where the cause of bleeding is due to other reasons
- E.g. Peptic ulcer, trauma etc. as a temporary measure until surgical intervention is done in surgically correctable bleeding. Even when factor VII is used for such exceptional situations it may need to be repeated in 6-10 hours as the action does not last long.
- **No indication for routine use** in cases with generalized bleeding due to Disseminated Intravascular Coagulation, prolonged shock and multiple organ failure**.**

Indications for Inotropic support

- Very limited in DHF
- May do more harm than good by giving a false impression about BP. Sometimes BP could be maintained by inotropes only at the expense of vasoconstriction which further compromises peripheral perfusion.
- May consider using inotropes only if significant persistent hypotension after adequate fluid resuscitation
- If a decision is made to introduce inotropes it is important to ensure that there is adequate volume of fluid in circulation confirmed by adequate CVP (It is best for the patient to have a CVP line in such instances).

Indications for steroids and IV immunoglobulin.

- There is insufficient evidence to support the use of intravenous immunoglobulin and steroids in the management of dengue patients.
- ***Use of steroids (hydrocortisone, dexamethasone and methyl prednisolone) and/or immunoglobulin is NOT recommended.***

Indications for fresh frozen plasma transfusion. (FFP)

- FFP will readily leak and will not hold blood pressure for long periods.
- FFP transfusions lead to fluid overload as even correction of coagulopathy need a large volume (40-50ml/kg).
- FFP transfusions do not produce sustained changes in the coagulation status and do not reduce the bleeding outcome in patients with DHF/DSS.
- Can produce anaphylactic reactions and transmission of blood borne diseases like HIV, Hep B etc.

Prophylactic transfusion of FFP is NOT recommended

I.V. Frusemide

- Useful both in the critical phase and convalescent phase (recovery phase) in many patients.
- Unlike in some other conditions a dose as small as 0.5mg/kg is likely to produce the desired results in most patients with normal renal functions
- Since IV frusemide could produce hypotension and shock it is important to specially monitor patients very frequently (every 10-15 minutes) for at least 1-2 hours after each frusemide dose, at all stages.

Indications for IV Frusemide

- Midway in the infusion of colloids, during the Critical phase, when colloids are given to patients who are already fluid overloaded or who are likely to be overloaded depending on the fluids already given.
- During recovery phase when there is suggestion of pulmonary oedema or fluid overload.
- In patients passing less than 0.5ml/kg/hr of urine despite receiving adequate fluids and having stable BP, pulse, Hct to improve the UOP.
- Midway between blood transfusions during the Critical phase

4.3.4. Management of encephalopathy

Encephalopathy in DHF is mainly due to hepatic encephalopathy. The basic principal of management is maintenance of adequate cerebral perfusion pressure (CPP). To maintain adequate CPP one has to maintain Mean arterial pressure (MAP) and reduce Intra Cranial Pressure (ICP).

$$CPP = MAP - ICP$$

The following are recommendations

- Adequate airway oxygenation with O2 therapy. Intubation may be needed for those with respiratory failure or in semi-coma/coma
  Elective Intubation
  - Protect airway
  - Assist ventilation
  - Manage ICP (Control carbon dioxide)

- Fluid management
  - Aim for normovolaemic state
  - Minimal IV fluid to maintain adequate intra vascular volume, Ideally total IV fluid should not exceed 80% maintenance
  - Switch to colloids earlier if the patient continues to have a rising HCT and a large volume of IV is needed in cases with severe plasma leakage
  - CVP 6-8 cmH2O
  - UOP 0.5 -1 ml/kg/hr

- Maintain MAP
  - Adequate fluids
  - Inotropes
  - Vaso-pressures

- Reduce ICP
  - Keep head in midline position
  - Elevate head end of the bed at 15°-30° degrees
  - Avoid neck flexion
  - 3% NaCl 3-5 ml/kg
  - Controlled Hyperventilation (Pa CO_2 30-35 mmHg)

- Maintain blood sugar level > 70 mg/dl (refer page 25)
- Maintain Potassium at normal level
- Maintain Sodium at normal level
  - 3% NaCl if serum sodium <120meq/l

- Vitamin K IV administration: 3 mg for < 1yr, 5 mg for 1- 5yrs, 10mg for 5yrs and adults.

- IV Phenobarbitone to reduce cerebral metabolism and to control seizures.

- When high liver enzymes indicate hepatic encephalopathy other evidence for concealed bleeding should be looked for as it is one of the commonest causes of hepatic failure in DHF. Transfuse packed red cells as indicated. Other blood components such as platelets, FFP may not be given because the fluid overload can cause increased ICP.

- Cleaning the gut
  - NG Tube
  - Antibiotics Metronidazole
  - Lactulose

- Empirical antibiotic therapy may be indicated in case of suspected superimposed bacterial infections.

- H2 blockers or Proton pump inhibitors may be given to alleviate Gastro intestinal bleeding.

- Avoid unnecessary drug usage because most drugs have to be metabolized by the liver.

5. Convalescent phase (recovery phase)

This starts after the end of the critical phase and usually lasts 2-5 days. There will be reabsorption of extravasated fluid during this period.

Indicators that the patient has reached convalescent phase:

- Improved general well-being and improved appetite
- Appearance of convalescent rash (typically appears as white patches in a red background)
- Generalized itching
- Hamodynamic stability
- Bradycardia
- Diuresis
- Stabilization of Haematocrit (HCT may even be lower than baseline due to reabsorption)
- Rise of white cell count followed by a rise of platelet count

Complications during Convalescence

- **Fluid Overload** – Management already discussed above
- **Hypokalaemia** – Oral potassium supplements and fresh fruits; rarely may need addtion of potassium chloride to IV fluids.
- **Nosocomial infections**

The following criteria should be fulfilled before discharge from hospital.

- No fever for at least 24 hours (preferably 48 hrs) without the usage of antipyretic drugs
- At least two days have lapsed after recovery from shock
- Good general condition with improving appetite
- Normal HCT for age or HCT at baseline value or around 38 - 40 % when baseline value is not known
- No distress from pleural effusions or ascites
- When platelet count which is definitely rising and has risen above 50,000 /mm^3
- No other complications

6. Laboratory Diagnosis

Laboratory diagnosis of dengue is achieved by isolation of the virus, detection of antigen or genome or by detection of antibodies. Dengue virus can be isolated from blood sample collected during the first 4 -5 days of illness or from necropsy tissue samples. Virus isolation and typing is mainly used in research and surveillance.

Detection of genome by PCR from blood or from tissue specimens can be performed during the acute phase of the illness and used in routine diagnosis as well as in research and surveillance. However the cost of the assay and the availability of facilities limit the wide use of it in clinical practice. Dengue serotypes can be identified in both virus isolation and detection of genome.

Detection of NS-1 antigen from blood is another test which can be performed during the first 4 - 5 days of fever. ELISA format and Rapid Immune-chromatographic format is available commercially. ELISA format has a better sensitivity and specificity but rapid test has the advantage of an individual assay. Sensitivity of these tests varies depending on the antigen and other constituents used and ranges from 60-90%. Therefore a negative test result will not exclude dengue illness and treating the patient on clinical grounds is important.

Detection of Dengue IgM, IgG or both is performed on blood samples collected after the 5th day of illness. Range of assays both ELISA format and Rapid Immune-chromatographic format with varying sensitivity and specificity are available. They can be either in-house assays or commercial assays. ELISA assays, Immune-chromatographic assay and Haemagglutination inhibition assay are widely used in routine diagnosis, in research and surveillance. Use of rapid immune-chromatographic assays either as single or as combo assays is becoming popular as point of care assays / bedside assays.

Isolation of the virus, detection of antigen or detection of genome or detection of four fold increase in antibodies (seroconversion) confirms the diagnosis of dengue. Detection of IgM antibody or high titre IgG antibody is highly suggestive of dengue infection.

7. Transferring a patient to another institution

Facilities in some peripheral hospitals may not be adequate to manage a patient in DHF who has entered the critical phase. Furthermore, a patient in prolonged shock needs to be managed in an intensive care unit. Hence, such patients may be transferred to an institution with adequate facilities.

If the patient has signs of shock (ie Tachycardia, low blood pressure (pulse pressure 20 and cold extremities etc.) normal saline bolus of 10ml/kg over one hour (for an average adult – 500ml) is recommended before referral. Check capillary blood sugar (CBS) for hypoglycaemia and correct with oral or IV Dextrose before referral. IV fluids and oxygen inhalation should be continued during the transfer.

Every such transfer should be done after obtaining advice from the Consultant Paediatrician who will be receiving the patient and after resuscitating in accordance with the advice.

Proper resuscitation before transferring is especially important if the journey is going to take long. Adequate information regarding the patient should be provided in the transfer form and this should include daily fluid balance, investigation results and treatment given. It is important to send copies of the temperature and monitoring charts as well.

8. Unusual Dengue (Expanded Dengue Syndrome)

In different parts of the world there have been some reports of 'Unusual dengue' where the patients developed clinical features which are different to what is usually expected in DF or DHF. These include encephalopathy and neurological manifestations, organ failure such as hepatic renal cardiac and other isolated organ involvement which could be categorized as 'expanded dengue syndrome'. Some of these could be explained as complications of severe profound shock or as associations of underlying host conditions/diseases or co-infections. However if and when they are not associated with plasma leak they will also need different treatment according to the conditions. Currently available evidence on such unusual manifestations has not excluded other factors such as concurrent infections other than dengue through exhaustive methods and such conditions will need to be investigated more. However, it is very important to note that 'unusual dengue' is an extreme minority of the clinical spectrum and patients should not be categorized into this group without very detailed and careful evaluation of the clinical events, treatment given and response to treatment.

9. Management of Dengue during infancy

DHF has been documented in primary infection among infants whose mother was infected during pregnancy. Vertical transmission has been reported leading to neonatal DF or DHF.

Infants who develop primary dengue infection may have a simple fever indistinguishable from other viral infections. It may have a wide range of clinical presentations. Maculo-papular rashes (blanching erythema) may accompany the fever or may appear during defervescence. Upper respiratory and gastrointestinal symptoms (loose stool mimicking acute gastro-enteritis) are common. This may present with seizures mimicking febrile convulsions or aseptic meningitis. However, common causes for seizures due to DHF in infancy are hyponatremia, hypoglycaemia and hypocalcaemia. Septicaemia should always be considered in a febrile neonate.

Splenomegaly has been observed in young infants (especially under six months) clinically or by radiological examination (Ultra sound scan). Infants have less respiratory reserves, and are more susceptible to liver impairment (tender hepatomegaly) and electrolyte imbalance leading to hyponatremia.

DHF in infancy may not have leucopenia. Often Total WBC is > 10,000 (may be even 18-19 x 10^3). During latter part of infancy, infants have lower HCT due to physiological and iron deficiency anaemia. If the baseline HCT is not known MCV will help to predict the baseline HCT. AST is elevated due to early liver involvement. Hyponatremia is seen due to poor renal handling of sodium.

Key points

- Infants may have a shorter duration of plasma leakage (lasts for < 24 Hours - may be as short as 6 – 12 hours) and usually respond quickly to fluid resuscitation. Optimal management of fluids from the onset of entry into critical phase is vital for good outcome. Infants should be evaluated frequently for oral fluid intake (i.e. breast feeding) and urine output (hence early need for catheterization).

- Colloids (dextran 40 preferred) should be considered when high rates of crystalloids are required and following fluid resuscitation with crystalloids. (Use N/2 + 5% dextrose in < 6 months infants; For those above >6 months when the patient is not taking orally for prolonged periods it is useful to give N saline in 5% dextrose) Stop IV Fluids soon after the leaking phase. If IV fluids are continued beyond the leaking phase it leads to fluid overload. When a patient is identified to be in the leaking phase with definite evidence of leaking with pleural effusions etc strict fluid regimen is important and a senior clinician should decide on the risks and benefits of continuing breast feeding as this can sometimes lead to fluid overload. Further if liver enzymes are elevated to a level of liver failure or impending liver failure breast feeding may have to be temporarily withheld as proteins in the gut could worsen liver failure.

Home care advice (family education) for parents includes

- Caution on over-hydration in infants due to breast feeding
- Insecticide-treated mosquito nets can be effectively utilized to protect infants who sleep by day

References

- Comprehensive guidelines for prevention and control of dengue and dengue haemorrhagic fever. Revised and expanded edition. (SEARO Technical Publication Series No. 60) 2011

- Dengue: Guidelines for Diagnosis, Treatment, Prevention and Control New Edition, World Health Organization - TDR, 2009.

- Guidelines on Clinical Management of Dengue Fever / Dengue Haemorrhagic Fever, Epidemiology Unit Ministry of Health, Sri Lanka, 2005.

- Guidelines on Clinical Management of Dengue Fever / Dengue Haemorrhagic Fever, Epidemiology Unit Ministry of Health, Sri Lanka, 2010.

- Studies / Collaborative Studies on Dengue Infection / Dengue Haemorrhagic Fever, at Queen Sirikit National Institute of Child Health, Bangkok, Thailand.

- Workshops on Case Management of Dengue Haemorrhagic Fever, May and July 2010, Bangkok, Thailand.

Annexure I

Ideal body weight for Boys

Ideal weight taken as the weight for height on the 50th centile

Height (cm)	Ideal Body Weight (kg)	Height (cm)	Ideal Body Weight (kg)
100	15.5	138	31.5
101	15.75	139	32.33
102	16	140	33
103	16.33	141	34
104	16.66	142	35
105	17	143	35.5
106	17.33	144	36.33
107	17.66	145	37
108	18	146	38
109	18.5	147	39
110	18.75	148	39.66
111	19	149	40.5
112	19.5	150	41.33
113	20	151	42
114	20.25	152	42.66
115	20.5	153	43.33
116	21	154	44
117	21.33	155	45
118	21.66	156	45.5
119	22	157	46.33
120	22.5	158	47
121	22.75	159	47.75
122	23.33	160	48.5
123	23.5	161	49
124	24	162	49.75
125	24.5	163	50.5
126	25	164	51
127	25.33	165	52
128	25.66	166	53
129	26	167	53.75
130	26.66	168	54.5
131	27.33	169	55.25
132	27.66	170	56.33
133	28.33	171	58
134	28.66	172	58.75
135	29.5	173	60
136	30	174	62
137	30.66	175	64

Annexure II

Ideal body weight for girls

Ideal weight taken as the weight for height on the 50th centile

Height (cm)	Ideal Body Weight (kg)	Height (cm)	Ideal Body Weight (kg)
90	13	127	25.25
91	13.25	128	26
92	13.5	129	26.33
93	13.66	130	27
94	13.75	131	27.66
95	14	132	28.33
96	14.25	133	29
97	14.75	134	29.66
98	15	135	30.5
99	15.25	136	31.5
100	15.5	137	32
101	16	138	32.75
102	16.25	139	33.5
103	16.5	140	34.5
104	17	141	35
105	17.25	142	36
106	17.5	143	36.5
107	17.75	144	37
108	18	145	37.75
109	18.33	146	38.5
110	18.66	147	39
111	19	148	39.75
112	19.5	149	40.5
113	19.75	150	41
114	20	151	41.5
115	20.33	152	42
116	20.66	153	42.5
117	21	154	43.66
118	21.5	155	44
119	21.75	156	45
120	22.25	157	45.66
121	22.5	158	46.75
122	23	159	47.75
123	23.33	160	49
124	23.75	161	50
125	24.25	162	52.5
126	24.66	163	56

Annexure III

Monitoring Chart I - for Management of Dengue Patients – Febrile Phase

Patient to be monitored 3 – 6 hourly

Name of the patient .....BHT.....

Date time	HCT	Input (ml) Oral/ IV	HR /min	BP mmHg	Pulse Pressure	CRFT <2s/ >2s	Extremity Warm /Cold	RR	UOP /day Void/ catheter	UOP ml/kg/hr	Platelet Count 10^3	Treatment /Remarks

Annexure IV

Monitoring Chart II for Management of DHF Patients during Critical Phase

Patient to be monitored hourly

Name of the patient ……BHT…….Date and time of admission ……ward -……

Weight - ……	Height - ……	Ideal body weight - ……	M- ……	M+ 5% = ……ml

Critical Phase Commencing date and time -……End date and time …….

Fluid ml/Kg/ hr																								
10																								
9																								
8																								
7																								
6																								
5																								
4																								
3																								
2																								
1.5																								
1																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
used % / amount of fluid quota																								
HCT																								
HR																								
BP																								
Pulse Pressure																								
RR																								
CRFT																								
Extremities warm/cold																								
UOP void/catheter																								
UOP ml/Kg/hr																								
Platelet count																								

Monitoring Chart II for Management of DHF Patients During Critical Phase page2

Fluid ml/Kg/ hr																								
10																								
9																								
8																								
7																								
6																								
5																								
4																								
3																								
2																								
1.5																								
1																								
	25..	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
used % of fluid quota																								
HCT																								
HR																								
BP																								
Pulse Pressure																								
RR																								
CRFT																								
Extremities warm/cold																								
UOP void/catheter																								
UOP ml/Kg/hr																								
Platelet count																								

Annexure V

Monitoring Chart III to be used during the Peak of leakage and during the shock

Patient to be monitored every 15 minutes

Fluid Boluses Given

Normal Saline:……..

Starch: ……Maximum 5 per 24h / 10 per 48h

Dextran……..Maximum 3 per 24h / 06 per 48h

Other fluid: PRC/WB.....

Fluid ml/Kg/ hr																							
10																							
9																							
8																							
7																							
6																							
5																							
4																							
3																							
2																							
1																							
time																							
HCT																							
HR																							
BP																							
Pulse Pressure																							
RR																							
CRFT																							
Extremities warm/cold																							
UOP ml/Kg/hr																							
Platelet count																							

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