A USEFUL PRIMER ON MANAGEMENT OF DENGUE FOR THE MEDICAL PRACTITIONER

Introduction

Dengue fever is widespread in Southeast Asia. It creates panic and contributes to mortality, which is largely preventable. Delhi has been witnessing periodic Dengue outbreaks. It has been an endeavour to prepare this study guide on Dengue fever, to aid members of Delhi Medical Council arrive at a diagnosis and provide a ready reckoner for proper management of these patients. Several clinical guidelines of different countries and the WHO guidelines along with the NVBDCP guidelines have been consulted to formulate this study guide for the physicians and general practitioners.

Epidemiology and Pathogenesis

Dengue is an arbroviral illness, caused by Dengue virus of which four strains are known to cause illness – DEN1, DEN2, DEN3 and DEN4. Dengue virus is a flavivirus belonging to family Flaviviridae. It is transmitted by the infective bite of Aedes aegypti mosquito, which is also known as Tiger mosquito, because of its striped legs. It is a day-biting mosquito and thrives in fresh water reservoirs. In urban and semi-urban areas of developing nations, especially where there is a lot of ongoing construction work, fresh water collection occurs, inviting Aedes breeding and consequently Dengue infection. Dengue is prevalent throughout India in most of the towns and metropolitan cities. Outbreaks have also been reported from rural areas of Haryana, Maharashtra & Karnataka. Although Dengue is endemic in Delhi, there was a massive outbreak in Delhi in 1996, and since 2001, Dengue has continuously been on the surge. Every few years, there is an outbreak, following which the cases dip for the next couple of years, and then another outbreak and the cycle continues. It is believed that the immunity conferred by the virus may wane, besides, importantly over the years, there are new migrants into an area, who are yet not exposed to the Dengue virus, and those who are immune may move out of an area or die. Hence, the people with immunity gradually wane over the years, and therefore there is an outbreak, which simultaneously confers immunity to the population at large, and so the next few years, the number of cases dips, again giving way to an outbreak after a few years. Antibodies generated by Dengue in humans is type-specific, therefore, infection by DEN1 resulting in Dengue fever in an individual, does not preclude infection from being caused by any of the other three Dengue types.

Another important concept is the concept of ‘molecular mimicry’. An individual who is presently infected by a Dengue type, but has had preceding infection with another Dengue type, can experience a more severe Dengue clinical syndrome (Dengue with warning signs progressing to ‘severe’ Dengue), because the preformed antibodies recognise non-structural protein 1 (NS1) which has homology with cell-surface proteins on human platelets, endothelial cells and coagulatory molecules, causing their damage and dysfunction.

Case Definition & Clinical Features-

Dengue virus infection in humans can be asymptomatic or symptomatic. Most cases develop asymptomatic seroconversion following infection. Dengue infection is a systemic and dynamic disease, having a wide clinical spectrum composing of non-serious and serious manifestations. After an incubation period of 5-6 days (range 3-14 days) from the bite of an infective mosquito, the symptomatic illness can be divided in to three phases-

(1) Febrile phase
(2) Critical phase
(3) Recovery or convalescent phase

The febrile phase is associated with fever, and could be incapacitating because of high fever associated with severe myalgias, but the defervescence of fever is more ominous because it invariably coincides with the development of the critical phase. Hence, it is important that patients suspected of suffering from Dengue fever be monitored at this juncture. One must consider Dengue a possibility (Probable Dengue), especially in the monsoon and post-monsoon seasons in Delhi, for any fever with two or more of the following features-

- Nausea, vomiting
- Aches and pains (headache, retro-orbital pain, myalgia, arthralgia)
- Rash
- Positive tourniquet test
- Leucopenia
- Any warning sign/signs (discussed below)

Febrile Phase

Patients develop fever abruptly, which is a high-grade fever accompanied by facial flushing, bodyaches, myalgias, arthralgias, retroorbital eye pain, rubelliform rash, photophobia and headache. Anorexia, nausea and vomiting are common. There is severe malaise, and patient may feel incapacitated to perform even daily activities. Some patients may have a sore throat, loose motions, abdominal pain. It may mimic any viral or non-viral febrile illness, except for the retro-orbital eye ache which is usually not seen with non-dengue illnesses. A positive tourniquet test is also a helpful indicator to Dengue fever.

Mild haemorrhagic manifestations viz. petechiae, mucosal (nasal and gum) bleed may be observed. Easy bruisability and bleeding from venepuncture sites is seen in some cases. Massive bleeding from any site (vaginal, gastrointestinal, oral) is uncommon. Hepatomegaly may develop as the fever persists. Leucopenia on a complete blood count (CBC) points to a high probability of dengue fever. Haematocrit should be noted for each patient from the CBC report and kept in mind by the treating physician, since it will help in identifying patients with warning signs and those who are likely to go in to critical phase and require greater observation/admission.

The characteristic symptoms of Dengue fever are outlined in **Table 1**, while laboratory investigations are outlined in **Table 2**.

Table 1- Characteristic symptomatology of Dengue fever

Fever
Headache, bodyaches, myalgias, arthralgias and retro-orbital pain
Anorexia, nausea & vomiting
Malaise, fatigue
Rash, petechiae, mucosal bleeds
Easy bruising and bleeding from venepuncture sites
Positive tourniquet test

Table 2- Laboratory & radiological findings in Dengue fever

1. Leucopenia
2. Thrombocytopenia
3. Rise in haematocrit secondary to volume depletion and capillary leaks
4. Transaminitis (Alanine & Aspartate transaminases elvelated)
5. Pre-renal azotemia (mild elevation of blood urea nitrogen and serum creatinine because of capillary leaks)
6. Chest X-ray- pleural effusion
7. Sonography of abdomen- Acalculous cholecystitis and/or ascites

It is imperative that the treating physician keeps an eye on the warning signs of dengue fever during this phase as well, since at times the critical phase can overlap with the febrile phase or in some cases, the febrile phase may be too short.

Critical phase

With defervescence of fever, the patient without an increased capillary permeability is likely to improve without going through the critical phase. Anorexia subsides, general well-being returns as fever defervesces.

However, patients with increased capillary permeability may manifest warning signs, primarily due to plasma leakage and need an extended period of observation and if warning signs are present, may require admission. The warning signs are mentioned in **Table 3**, and mark the beginning of the critical phase.

Table 3- Warning signs of Dengue

1. Persistent vomiting and severe abdominal pain
   - Early signs of plasma leakage and increasingly worsen, as shock ensues.
2. Increasing lethargy and restlessness, though mentally alert
   - May persist even in the shock stage.
3. Weakness, dizziness or postural hypotension
   - Manifestation of early shock
4. Haemorrhagic manifestations
   - Spontaneous mucosal bleeding and bleeding at previous venepuncture sites are important haemorrhagic manifestations to be paid attention to.
5. Increasing liver size and tender liver.
   - Commonly seen
6. Clinical fluid accumulation
   - Early fluid accumulation is detected sonologically (as mentioned in text)
7. Rising haematocrit accompanied by a rapid and progressive decline in platelet count
   - is the earliest sign of plasma leakage, is usually preceded by leucopenia.

Warning signs may begin in the febrile phase and a diligent physician will be able to pick it up early, since the temperature may come down to 37.5-38 ^{0}C or become sub-normal by the 3rd to 8th day of fever associated with progressive leucopenia and a rapid decrease in platelet count, which precedes plasma leakage (which is where Haematocrit monitoring is important). It is pertinent to mention here, that decreasing platelet counts interpreted along with declining total leucocyte counts may be an aid to assist the physician identify the onset of critical phase, before the haematocrit starts rising; but do not have any other relevance to dengue treatment. So, leucopenia and thrombocytopenia may help indicate (diagnose) onset of critical phase, but neither of the two have a role to play in the treatment of severe dengue patients. A rising haematocrit is one of the early signs indicating the onset of critical phase and precedes changes in blood pressure and pulse volume. This phase of clinically significant plasma leakage may last for 24-48 hours, but can vary.

The severity of plasma leakage is reflected by the degree of haemoconcentration occurring over the baseline haematocrit. Therefore, having a baseline haematocrit and monitoring it is the most important tool to identify the critical phase and also manage patients appropriately. Early institution of intravenous fluid therapy can reduce the degree of haemoconcentration and also aid in early recovery. Moreover, in the early stages, ascites and pleural effusion may not be evident clinically. Sonography of the chest or a lateral chest decubitus X-ray film may be helpful to diagnose pleural effusion and sonography of the abdomen may reveal gall bladder oedema and ascites, before clinical detection. Haemorrhagic manifestations such as easy bruising and bleeding at venepuncture sites may simultaneously occur at this stage. However, haematocrit monitoring is the simplest tool in clinical practice. Cases of 'Dengue with warning symptoms' mostly recover with intravenous hydration. Some cases will deteriorate in to 'severe dengue'.

The small category of patients who deteriorate in to 'severe dengue' cannot be identified early in the course of illness. Some patients develop shock when a critical volume of plasma leakage occurs, the warning signs of which are tabulated in Table 1. Shock is characterised by a cold clammy skin (sub-normal body temperature) and prolonged shock will result in hypoperfusion, metabolic acidosis, progressive organ impairment and multi-organ dysfunction and disseminated intravascular coagulation (DIC). Severe bleeding as a result of DIC in severe shock will result in a drop of haematocrit and a rise in leucocyte counts (secondary to stress of severe bleeding). Therefore, it is important to keep a vigil on dengue patients for the warning signs, since declining haematocrit and rising leucocyte counts should not be taken as a sign of recovery if warning signs are present. Rather than patient going in the recovery phase, patient is deteriorating in to 'severe dengue' if warning signs are present.

Severe Dengue is defined in Table 4

Table 4- What constitutes 'Severe Dengue'

A dengue patient with one or more of the following-

1. Severe plasma leakage that leads to shock (dengue shock) and/or fluid accumulation with respiratory distress.
2. Severe bleeding (as judged by clinician).
3. Severe organ impairment
    a. Liver involvement- AST or ALT ≥1000
    b. Central nervous system- Impaired consciousness
    c. Heart and other organs affected.

The Shock syndrome that ensues in Dengue is a typical hypovolaemic shock and behaves in a physiologic continuum, and if untreated progresses from asymptomatic capillary leakage to compensated shock to hypotensive shock and ultimately to cardiac arrest.
Tachycardia is the earliest response to hypovolaemia occurring due to extensive capillary leaks in Dengue, although at times tachycardia may fail to manifest, because of the bradycardia that may be seen because of the direct effects of the dengue virus. Tachycardia may be associated with quiet tachypnoea and peripheral vasoconstriction with reduced skin perfusion (cold extremities, delayed capillary refill of > 2 seconds, weak pulse).
As shock continues, peripheral vasoconstriction increases, raising diastolic pressure, thus in this stage of compensated shock, systolic pressure may be normal or slightly higher, diastolic pressure rises, and pulse pressure narrows. This is compensated state of shock. A pulse pressure of ≤ 20 mmHg may be an ominous sign and indicate possible deterioration in to decompensated shock. Tachycardia and tachypnoea worsen, extremities become cold, clammy and cyanosed, and Kussmaul's breathing may be noticed, before the decompensated shock ensues, wherein the blood pressure dips, peripheral pulses may not be palpable, and there is associated change in the mental state. Till the stage of compensated shock, characteristically, a dengue patient is mentally clear and alert.
It is important to note that transition from warning signs to compensated shock may take a few hours and another few hours may elapse in the transition from compensated shock to decompensated shock, but it may take only minutes for cardiorespiratory collapse and cardiac arrest to occur, once the patient has reached the stage of decompensated (hypotensive) shock. Therefore, it is important that dengue patients are identified at the stage of 'warning signs' and 'early compensated shock', so that timely management can be offered and mortality reduced in dengue patients.
It is pertinent to mention here, dengue patients have variable degrees of coagulation disturbances and also thrombocytopenia, but these are not sufficient in themselves to cause major bleeding. However, major bleeding whenever it occurs in dengue is associated with profound shock, wherein it occurs in combination with thrombocytopenia, hypoxia, acidosis, leading to multiorgan dysfunction and advanced disseminated intravascular coagulation. Occasionally, bleeding may occur because of analgesic or corticosteroid use or due to co-morbidities viz. peptic ulcers, liver or renal failure. Deaths in dengue patients have reportedly occurred from profound and prolonged shock resulting from plasma leakage, and complicated by bleeding or fluid overload; and not solely because of massive bleeding.

Recovery Phase

Once the critical phase passes off, ordinarily in 24-48 hours, the recovery phase lasts next 48-72 hours when gradual resorption of fluid occurs from the third spaces back in to the vascular space. Patient's lethargy and gastrointestinal symptoms abate, appetite returns, haemodynamic status improves and diuresis occurs (as the third space losses reduce). A confluent erythematous or petechial rash may be observed, at times pruritic. Haematocrit stabilises or may be reduced because of the resorbed fluid, blood counts normalise, though leucopenia recovers faster than the platelet counts. Respiratory distress may occur occasionally, as the massive ascites or pleural effusion

occurring in the critical phase (supplemented by vigorous intravenous hydration) causes transient hypervolemia, while it is ultimately eliminated from the body by diuresis.

DENGUE IS A NOTIFIABLE DISEASE and local municipal health authorities need to be informed about even probable cases of Dengue, so that the public health authorities can take appropriate timely action.

Case Definitions in this regard are important and for notification purposes, definitions as available on the NVBDCP website should be used, which keeps updating the same from time to time. The last guidelines were issued in 2008, and are under updation now in 2014.

Differential Diagnosis

There is a whole lot of differential diagnosis of febrile illnesses for dengue, since dengue fever presentation has quiet a non-specific presentation. Most viral illnesses including influenza can have the fever, bodyaches and myalgias commonly seen with dengue viral illness. At the time dengue fever is seen (monsoon and post-monsoon periods), malaria and enteric fever are other commonly occurring diseases. If the full-fledged fever with rash and haemorrhagic syndrome is seen, then apart from dengue, other viral haemorrhaghic fevers seen in India are the Crimean-Congo Haemorrhagic fever (a few cases of which were reported from India a couple of years back) and the Kaysanur Forest Disease (KFD). KFD cases are at times seen in Delhi, because of the student population and their relatives, which keep going to Karnataka which is endemic for KFD and coming back to Delhi.

Table 5 outlines the various characteristic features for illnesses constituting the differential diagnosis of dengue fever.

Table 5- Differential diagnosis of Dengue fever

Illness	Characteristic features	Differentiation from Dengue
Influenza	Fever, bodyaches, myalgias, catarrh	Rhinitis and cough are uncommon
Malaria	Fever (high grade) with chills, firm splenomegaly	Leucopenia and warning signs of Dengue uncommonly seen with malaria.
Enteric fever	Continuous fever (Step-ladder rise) with soft splenomegaly	Bodyaches unlikely in enteric fever, soft splenomegaly not seen with Dengue. Leucopenia less common in Enteric fever. Ascites and pleural effusion unlikely.
Chikungunya fever	Fever, rash, arthralgia, malaise, leucopenia	Symmetric arthritis of small joints is pathognomonic of Chikungunya
Primary HIV syndrome	Fever, malaise, rash, generalised lypmhadenopathy	Lymphadenopathy unusual with Dengue
Sepsis, septicaemic shock/meningoccaemia	Fever, rash, leucopenia, thrombocytopenia & shock	Fever in Dengue subsides/has subsided by the time shock supervenes. Pulse pressure is low in Dengue shock and peripheries are cold, as compared to septic shock, where peripheries are warm initially.
Leptospirosis	Fever, jaundice, rash, renal failure, suffused conjunctivae, thrombocytopenia.	Exposure to water sources, conjunctival congestion and jaundice are suggestive of leptospirosis.
Yellow fever	Jaundice, renal failure and central nervous system impairment are associated with fever; and has high mortality.	Jaundice is unusual in Dengue, while renal failure in dengue is initially pre-renal (because of volume depletion) and later on secondary to shock.
Acute cholecystitis	Fever, pain, vomiting, right hypochondrial tenderness & guarding, Positive Murphy's sign.	In Dengue, acalculous cholecystitis occurs during phase of defervescence, invariably associated with ascites. Ascites in not seen with acute calculous cholecystitis

Laboratory Diagnosis for clinicians

Laboratory diagnosis of Dengue is essential for two particular reasons. Firstly, to confirm the clinical diagnosis and secondly to provide information for epidemiological surveillance. However, it is to emphasise that laboratory diagnosis is not essential for clinical management of dengue cases unless and until a differential diagnosis is entertained for other infectious diseases or in suspected atypical dengue cases.

Acute illness (1-5 days), serum testing can be performed for antigen (NS1 antigen) detection. Rapid tests take minutes, while ELISA based tests take a day. Immunohistochemistry takes 2-5 days.

After 5th day of onset of fever, antibody detection can be performed. IgM detection (by ELISA or rapid tests) indicates recent infection, while IgG detection indicates past infection. On an average, IgM specific antibodies are detected in 50% of the dengue patients by days 3-5 after the onset of fever, increasing to 95-98% for days 6-10. Low levels of IgM may be detectable even after three months of fever. Dengue-specific IgG levels become elevated at 9-10 days and may remain elevated for decades.

However, in a secondary infection, a rapid and higher levels of IgG antibodies are seen, which may remain for 30-40 days, and lower levels of IgM are seen.

Figure 1 diagrammatically depicts the immunoglobulin responses in case of a primary infection (first infection with Dengue virus in an individual) and a secondary infection (second and subsequent infections with a Dengue virus in an individual).

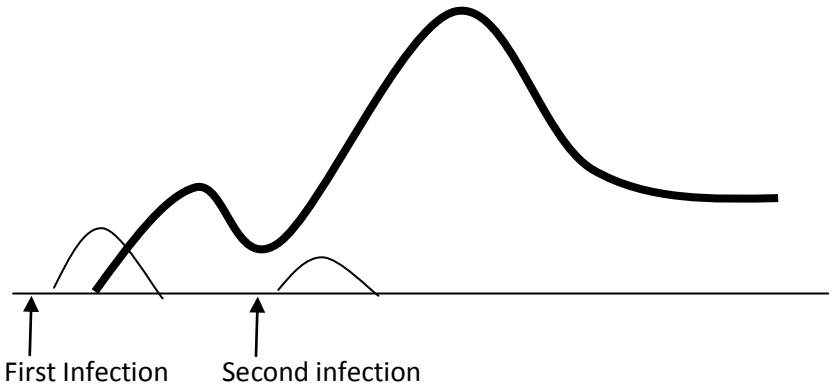

FIGURE 1- Antibody responses in Dengue infections (narrow line is for IgM response and thick line is for IgG response)

Nucleic acid detection techniques (by RT-PCR) take time of 1-2 days and are not practically suitable for testing because of their high cost and time-delay in diagnosis and lack of easy accessibility.

Laboratory confirmation of a dengue case- refers to a confirmation of dengue infection, by detection of the virus, viral genome or NS1 antigen, or seroconversion of IgM to IgG in paired sera. A positive IgM serology or a haemagglutinin inhibition test antibody titre of 1280 or higher (comparable figures by ELISA in a single specimen), are all sufficient for a laboratory confirmation of a dengue infection.

Management

When any patient with fever or probable dengue comes to the out-patient clinic setting, the physician needs to suspect dengue and needs to focus on the points highlighted in Table 6.

Table 6- What needs to be done in an out-patient setting when the patient is first seen?

- Have a high index of suspicion that the febrile illness can be dengue
- Notify early to the public health authority about the probable/suspected case
- Manage patients in the early febrile phase of dengue
- Recognise the critical phase and identify early the stage of plasma leakage, initiate fluid therapy
- Recognise warning signs in the patients, so that they can be admitted and initiated on to intravenous fluid therapy
- Recognise and manage severe plasma leakage and shock, severe bleeding and severe organ impairment promptly and adequately

A complete blood count (CBC, which includes haemoglobin, haematocrit, total leucocyte count, platelet count) should be performed for all probable/confirmed cases on the first visit, to establish a baseline haematocrit of the patient. Daily CBC may be performed till the critical phase passes off. In resource-constrained settings, CBC should be performed at baseline and then after the 3rd day of illness and in those who have warning signs.

Ancillary investigations to rule out co-morbidities, other system abnormalities and complications may be required and need to be performed on a case-to-case basis.

For management purposes, several classifications have been evaluated, but have inherent problems. A simple and workable definition in order to streamline management has been outlined by the WHO and is pertinent to be followed. Each case of fever should be evaluated as to whether it could be a probable case of Dengue, second step should be to identify warning signs, and thirdly to identify whether it fits into “severe Dengue”.

The management guidelines are thus simplified. **A probable case of Dengue or a laboratory confirmed case of Dengue without any warning signs who is able to accept orally can easily be managed at home, with proper advice and instructions to report to emergency if there are any warning signs**. Bed rest, fluid replenishment and paracetamol 500 mg prn for fever, to a maximum of 4 g/day are to be prescribed till the duration of the critical phase.

Intramuscular injections should be avoided in patients having thrombocytopenia.

Table 7 summarises the types of patients who do not need any admission. Table 8 outlines indications for admission.

Table 7- Which patients one need not admit?

DO NOT ADMIT
Patient accepting orally
Health facility not very distant, and can be approached easily
Warning signs are Absent
Absence of co-morbidities
Absence of complications

Table 8- Which patients need admission?

ADMIT THE FOLLOWING
Patient unable to accept orally, viz. anorexia, nausea, vomitings
Health facility distant, or cannot be approached easily
Presence of any warning sign (mentioned in table 3)
Extremes of age viz. infants or elderly
Presence of co-morbidities viz. diabetes
Pregnancy
Presence of complications

If the patient has any warning signs, it needs admission and intravenous rehydration, even if the patient is able to accept orally. This is important because at this juncture intravenous rehydration and monitoring/close observation of the patient can prevent further deterioration, hasten recovery and also prevent "severe Dengue". Presence of co-existent conditions like pregnancy, infancy, old age and diabetes mellitus, which are considered to be risk factors, also indicate the need of admission in these patients. At times, people living alone or far from hospital may need to be admitted as well, to ensure adequate hydration.

Blood sample for reference haematocrit should be obtained, and isotonic solutions such as normal saline and ringer's lactate should be started @5-7ml/kg/hr for 1-2 hours, then reduce to 3-5 ml/kg/hr for 2-4 hours and then reduce to 2-3 ml/kg/hr, depending upon the clinical response.

The fluid infusion is to be titrated according to the clinical status and on the basis of the haematocrit response. If the haematocrit remains the same or rises only minimally, same rate of 2-3 ml/kg/hr may be continued. However, if clinical signs worsen and haematocrit rises rapidly, rate of infusion should be raised to 5-10 ml/kg/hr.

Intravenous infusions may be gradually reduced at the end of the critical phase, when the rate of plasma leakage decreases; and this is evidenced by adequate urine output and/or fluid intake, and return of haematocrit below the baseline value in a haemodynamically stable patient.

The vital signs need to be monitored every 1-4 hourly and urine output every 4-6 hourly, hameatocrit can be assessed every 6-12 hourly, while the patient is on intravenous fluids.

A patient classified as "**severe Dengue**", needless to say requires intensive care support and management.

For a patient having compensated shock, start intravenous crystalloid solutions at 5-10 ml/kg/hr over 1 hour and re-assess the situation. If patient improves, then fluid rates may be reduced to 5-7 ml/kg/hr for 1-2 hours and then gradually as for Dengue with warning signs, maintaining the fluids for up to 24-48 hours. If patient does not improve (Hct remains >50%), repeat a bolus of 10-20 ml/kg/hr for 1 hour. If patient improves after second bolus, reduce rate to 7-10 ml/kg/hr for 1-2 hours, and then continue to reduce as already mentioned.

If the patient presents in hypotensive shock, a crystalloid or colloid solution needs to be infused at 20 ml/kg/hr for 15 minutes, and if patient improves, continue at 10ml/kg/hr for 1 hour, and then reduce gradually. If patient does not improve, and haematocrit is low, suspect bleeding; while if the haematocrit remains high, give a second bolus of colloids @10-20 ml/kg over 1 hour. If improving, then reduce rates gradually as already mentioned. Haemorrhagic complications at this stage may need to be treated with fresh packed red blood cells/whole blood.

Intravenous fluid therapy can be reduced or stopped if any of the following signs are present-

- Signs of cessation of plasma leakage
- Stable pulse and blood pressure and peripheral perfusion
- Hameatocrit reduces in the presence of a good pulse volume
- Afebrile for more than 24-48 hours
- Resolving abdominal symptoms
- Improving urine output

It is important to note continuing intravenous fluid therapy beyond 48 hours of the critical phase will put the patient at risk of pulmonary oedema and other complications viz. thrombophlebitis.

There is no role of any platelet transfusion in a patient of dengue. In fact, blood or blood component therapy has no role in dengue management, where the primary management rests on intravenous hydration. Whole blood or packed cell transfusions are only required in cases of hypovolaemic shock complicated by massive bleeding.

Table 9 summarises the criteria which indicate that intravenous fluid therapy can be reduced or stopped, while **Table 10** outlines the criteria for discharging dengue patients.

Table 9- Criteria for reducing or stopping intravenous fluid therapy in a patient recovering from Severe Dengue.

• Signs of cessation of plasma leakage (no increase in pleural effusion/ascites, improving dyspnoea and abdominal distension) • Stable pulse and blood pressure and peripheral perfusion • Hameatocrit reduces in the presence of a good pulse volume • Afebrile for more than 24-48 hours • Resolving abdominal symptoms • Improving urine output

Table 10- Criteria for discharge of Dengue patients

• Afebrile for 48 hours • Improvement in clinical picture including haemodynamically stable • Rising platelet counts • Stable haematocrit without intravenous fluid therapy (for over 24 hours) • Absent respiratory distress

Criteria for discharge in a case of dengue requires that the patient must be afebrile for 48 hours, has improvement in clinical picture, platelet count is rising, haematocrit is stable without intravenous fluids and there is no respiratory distress.

Other complications

Apart from shock and haemorrhagic complications, other complications such as hypoglycaemia and hyperglycaemia, metabolic acidosis, acid-base and electrolyte imbalances, acute respiratory distress and hypervolaemia, may occur and need to be managed accordingly. Co-infections, dual infections and nosocomial infections are not uncommon in dengue and should be kept in mind.

Prevention & Control

The aim is to control dengue outbreaks, interrupt or reduce transmission, and reduce or eliminate breeding sites of the vector mosquito at the individual, family and community levels.

Vector Control can be achieved by environmental management, biological control or chemical control. Environmental management includes environmental modification (long-lasting physical transformation o vector habitats), environmental manipulation (temporary changes to vector habitats) and changes in human habitations (mosquito-proofing of houses with screens on doors/windows). Biological control measures can be applied for large water bodies or large water containers, wherein larvivorous fish (Gambusia) or endotoxin producing bacteria (Bacillus thuringiensis) can be used. Chemical control measures can be used for permanent big water containers where water needs to be conserved or stored because of scarcity of water or irregular or unreliable water supply. Temephos granules are used as an effective larvicide, while pyrethrum spray can be used as an indoor spray as an adulticide (killing adult Aedes aegypti mosquitoes) and malathion fogging can be performed outdoors as an Ultra Low Volume Spray for killing adult mosquitoes.

Legislative measures need to be strengthened and there are several such provisions viz. model civic bye-laws, building construction regulation act (Byelaws related to over-head or underground tanks, mosquito-proof buildings, designs of sunshades/porticos, control of mosquitogenic conditions at construction site, etc.), environment health act (laws relating to proper disposal of junk and debris which can withhold rain water) and health impact assessments (before any development/construction projects). Under the Model civic byelaws, fine is imposed if breeding is detected.

At the individual level, use of mosquito-repellant creams, coils or liquid refills can be useful. Use of mosquito nets on doors and windows and around beds are also useful measures. Wearing light-coloured clothes, wearing dresses with little exposed parts (full-sleeves shirts and trousers), avoiding dark dingy corners and areas with heavy vegetation are also helpful measures to prevent oneself from mosquito bites. One should prevent water accumulation in and around the house viz. in coolers, beneath airconditioners, in flowerpots, unused tyres, polyethene packets, junk lying around the house/office spaces.

Conclusion

Dengue fever has gained its foothold in India and Delhi, is suffering because of the continuous development that it is facing. To be 'Dengue-free' is going to be a distant dream, specially till the time we are able to eradicate the mosquitoes from our households and work-places. Nevertheless, it is important that clinicians are able to have a high index of suspicion for dengue cases, there is a need to notify them and also it is important to manage them properly. The municipal health authorities have a set of guidelines which are tabulated in **Table 11**. A 'Formula of 20" has also been enunciated so as suspected or confirmed Dengue cases do not escape the attention of the treating physician. This Formula of 20 is elaborated in **Table 12**.

It is imperative that patients are identified in the 'Critical phase' and promptly managed with intravenous fluids so as to prevent deterioration in to 'Severe Dengue".

Dengue is preventable by preventing mosquito-breeding in the vicinity and by preventing mosquito-bites. But also, complications of dengue are preventable and therefore, it is important to be well-versed with dengue management.

Table 11- List of activities, which should be carried out under National Vector Borne Disease Control Programme

1. Confirmation of Dengue:
    - Dengue should be confirmed by NS1Ag within 5 days from the onset of fever. Later on it should be confirmed through Mac ELISA.
    - Suspected Dengue cases identified through Rapid kit test or Platelet count needs to confirmed by the above test i.e. NS1Ag within 5 days from the onset of fever. After 5 days it should be confirmed through Mac ELISA.
    - NS1Ag kits/Mac ELISA testing facilities are available free of charge in all the Sentinel Surveillance Hospitals.
2. Dengue management:
    - In all the Sentinel Surveillance Hospitals Dengue management facilities are available free of cost.
    - Dengue management services are available 24x7 in all these hospitals.
    - Fever clinics and dengue wards/beds are available in all these hospitals.
    - Blood banks/Blood Storage facilities are available free of charge in all these hospitals.
    - Availability of beds & platelets can be accessed from toll free number 1075 & 1800114377.
3. Referral System:
    - The critical cases need to be referred/ transferred to the above Hospitals.
    - The services of CATS Ambulances could be availed for critical cases needing admission and further management through helpline no.1099.
    - The EWS cases may be referred/ transferred to private Hospitals for Dengue Management which is free of cost.
4. Blood Bank Services:
    - Red Cross Society and other Private blood banks are providing their services on exchange basis and their services are available 24x7.
5. Information, Education & Communication (IEC):
    - IEC needs to be done in a bigger way to create awareness and sensitise the population at large regarding the preventive measures and consequences of Dengue.
    - Print media/electronic media could be utilised for dissemination of information using mobile phones.
    - Posters/ placards / calendars revealing preventive measures of vector borne diseases need to be displayed in the clinics/Nursing Homes/Medicare Centres.
    - Medicated bed nets/ mosquito repellent creams/ coils etc. should be used during Dengue/Malaria season.
    - School children, parents, teachers and other staff should be trained to create awareness among the students and get their support in control measures.

Table 12- Formula of 20(Courtesy: Dr. KK Agarwal)

Heart rate increases by 20 bpm

Systolic blood pressure dips by 20 mm Hg

Pulse pressure is less than 20 mm Hg

Petechiae > 20/sq. inch

Haematocrit rise by > 20%

Platelet count < 20,000/mm^3

THEN DO NOT IGNORE; START fluids @ 10-20 ml/kg/hour

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