Dengue Patients at the Children’s Hospital, Bangkok: 1995-1999 Review

by

Siripen Kalayanarooj#, Vanya Chansiriwongs and Suchitra Nimmanitya
Queen Sirikit National Institute of Child Health (Children’s Hospital), Bangkok, Thailand

Abstract

A retrospective review was done of 5,332 patients who were admitted to the Children’s Hospital (Inpatient Department-IPD) with the diagnosis of dengue fever (DF)/dengue haemorrhagic fever (DHF) between 1995-1999. During the same period, 17,908 dengue patients were seen at the Outpatient Department (OPD). The OPD:IPD ratio of dengue patients was about 3:1. Dengue viruses were identified in 2,398 cases (50.6%). DEN-3 was the predominant serotype found in about half of the cases. DEN-1, DEN-2 and DEN-4 were found in 25.8%, 20.9% and 2.7% cases respectively. The percentage of admitted patients was recorded as 19% DF, 56.3% DHF and 24.7% dengue shock syndrome (DSS). Most DHF/DSS patients recovered with only crystalloid solutions. Dextran-40 was used in 28.6% and 3% of DSS and DHF patients, while blood transfusion was needed in 12.9% and 5.3% of DSS and DHF patients, respectively. Platelet concentrate was given only in 0.4% of DSS patients. The mean amount of IV fluid given to DHF and DSS patients during critical periods was about moderate dehydration, i.e. 95.2 ml/kg and 56.1 ml/kg and the mean duration of IV fluid was 32.6 hours and 37.6 hours, respectively. Overall clinical diagnosis using the WHO criteria 1997 was confirmed in 96.8% patients (98.1% for DHF and 91.5% for DF).

Compared to a situation about 10 years earlier, the age incidence of dengue patients showed an increasing trend. More DF patients were seen and less DSS patients were found. It is important to note that 55.9% of DSS patients had fever at the time of shock, which was different from what had been learnt that almost all DSS patients were afebrile at the time of shock. There was some increase in the unusual manifestations, i.e. 7% as compared to less than 3% earlier. Encephalopathy accounted in only 0.7% of the cases while associated conditions and infections were found in 2.7% and 3.4% of cases. More patients were found with elevated liver enzyme, AST and ALT, but no increase in the incidence of hepatic failure/encephalopathy. Complication of fluid overload, which could lead to death was found more than before, 4% vs <1%, because of early intravenous fluid administration. The case fatality rate (CFR) reduced from 1.36% to 0.2%.

Keywords: Dengue patients, diagnosis, WHO criteria, epidemiological and clinical shift, Children’s Hospital, Bangkok.

# For correspondence: sirip@health.moph.go.th
Introduction

Dengue infection is the most important of the mosquito-borne human viral diseases. There has been a dramatic increase in the number of cases and the severity of the disease in the past 30 years. Currently some 2.5 billion of the world’s population, primarily in tropical developing countries, is at risk of dengue. Tens of millions of cases are estimated to occur each year; hundreds of thousands of these are of the more severe dengue haemorrhagic fever (DHF) that is a leading cause of childhood hospitalization and death in many countries(1).

It was in 1958 when the first outbreak of DHF was recorded in Thailand. Even though the case fatality rate has come down from 13.9% in 1958 to 0.19% in 2000, the morbidity seems to be on the increase(2). The epidemiology and clinical manifestations of dengue in Thailand have been described earlier(3). This study aims (i) to assess the WHO criteria for the diagnosis of DF and DHF and to evaluate the fluid management of DHF patients as recommended by WHO; and (ii) to compare variations in the epidemiological and clinical manifestations of DF/DHF/DSS as of today, in comparison to the situation prevailing 10 years ago.

Methods and materials

Hospital records of the DF and DHF patients who were admitted to the Children’s Hospital (Queen Sirikit National Institute of Child Health), Bangkok, supported by serological and/or virological confirmation between 1995-1999, were reviewed.*

* Laboratory confirmations were undertaken by the Armed Forces Research Institute of Medical Sciences (AFRIMS), Bangkok.

Serology was done by ELISA and/or haemagglutination inhibition (HI) technique. Polymerase chain reaction (PCR) technique and/or viral isolation were used to identify dengue viruses.

Most of the diagnoses of DF and DHF at the Children’s Hospital were based on the WHO clinical criteria(3). The DHF severity was also classified according to the WHO criteria(4).

Clinical and laboratory data relating to DF, DHF and dengue shock syndrome (DSS) cases were analysed using the SPSS programme.

Results

Number of OPD and IPD cases

There were 17,908 patients diagnosed with dengue infection (DF, DHF or DSS) at the Outpatient Department (OPD) and 5,332 of these were admitted to the Children’s Hospital (Inpatient Department-IPD) between 1995-1999. The number of OPD cases ranged from 1,533 in 1995 to the maximum of 5,823 in 1997. The IPD cases ranged from 539 in 1995 to the maximum of 1,479 in 1997. The ratio of OPD:IPD cases ranged from 2.8 to 7.1. About 4.1% were referred patients from both government and private hospitals.

Laboratory confirmation: Serology and virus identification

The serological and/or virological confirmations for dengue were performed in 4,743 patients (89.0%). There were 22.7% primary infections and 77.3% secondary infections. Primary infection ranged from
20.1% in 1999 to 24.3% in 1997 when the number of dengue cases was the highest. Secondary infection ranged from 75.7% in 1997 to 79.8% in 1999.

In DF patients, 38.5% had primary infection and 61.6% had secondary infection while in DHF/DSS patients, 19.1% had primary infection and 80.9% had secondary infection.

Identification of dengue viruses (1995-1999) was successful in 2,398 patients (50.6%). One dengue isolate could not be identified and one patient had evidence of two concurrently circulating dengue infections (DEN-2 and DEN-1). DEN-3 (50.6%) was the predominant serotype during these years, followed by DEN-1 (25.8%), whose circulation increased continuously from 18.5% in 1995 to 32.5% in 1999. DEN-2 (20.9%) was the highest in 1995 and recorded a prevalence of 30% and declined continuously to a level of 19.6% in 1999. DEN-4 (2.7%) was the rare serotype all through this study period and its prevalence ranged from 0.5 in 1997 to 8.1% in 1999.

**Disease presentations**

Nineteen per cent of the total DF patients in the study period were admitted to the hospital. Admission rates ranged from 14.4% in 1998 to 22.9% in 1996. About 25% of the admitted dengue patients had shock. The percentage of the patients entering shock ranged from 15.3% in 1999 to 27.7% in 1997.

**Age and sex**

The mean age for DF cases was observed as 7.9 years, DHF 8 years and DSS 8.1 years. The mean age for DHF and DSS was the same (p>0.46). There was a significant increase in the mean age of dengue patients from 7.6 years in 1995-1996 to 8.1-8.2 years in 1997-1999. There was a visible shift in the age groups showing peak incidence. The age group 5-9 years was the most affected by DF. In 1995, 46.25% of the cases were in the age range of 5-9 years and 28.4% in the age range of 10-14 years as compared to 1999 when 41% were in the age range of 5-9 years and 33.2% in the age range 10-14 years.

No gender difference was observed in the DF, DHF or DSS patients.

**Signs and symptoms**

Abdominal pain (1995-99) was the most common complaint in dengue patients (38%) – 30.1% for DF, 35.4% for DHF and 49.9% for DSS. History of myalgia in DF, DHF and DSS patients were 12.9%, 9.9% and 8.8%, respectively. Maculopapular rash during the febrile phase was found in 11.6%, 6.7% and 4.9% of DF, DHF and DSS patients, respectively. Typical convalescence rash was found in 19.4%, 19.3% and 18.9% of DF, DHF and DSS patients.

**Sensitivity of WHO case definition, 1997**

The clinical presentations and laboratory findings of DF patients are included in Table 1. Tourniquet test was positive in 90.1%, 93.5% and 87.4% of DF, DHF and DSS
patients, respectively. Hepatomegaly was found in 80.4%, 89.9% and 95.5% of DF, DHF and DSS patients, respectively. Shock was found in 24.7% of all admitted dengue patients (44% of all DHF patients). It was noted that of all shock cases, 55.9% were febrile at the time of shock, with temperatures ranging from 38 to 39°C. About 10% of all DHF patients developed shock after admission.

A platelet count of ≤100,000 cells/cumm. was found in 50.2%, 93.8% and 92.1% of DF, DHF and DSS patients, respectively. The mean platelet count in DF, DHF and DSS patients were 123,599, 63,855 and 53,452 cells/cumm., respectively.

Evidence of plasma leakage as shown by 20% rise in haematocrit (Hct) was found in 42.3% and 63.8% of DHF and DSS patients, respectively. Pleural effusion was found in 84.2% and 96.1% of DHF and DSS patients, respectively, who had had chest X-ray done.

Overall clinical diagnoses of DF and DHF, based on the WHO criteria 1997, were confirmed in 96.8% (91.5% for DF and 98.1% for DHF) patients.

**Other laboratory data**

**Clinical blood count (CBC)**

White blood count WBC ≤ 5,000 cells/cumm. was found in 77.7%, 73.2% and 56.1% of DF, DHF and DSS patients, respectively. The mean WBC of DF, DHF and DSS patients was 4,104, 4,347 and 5,541 cells/cumm., respectively.

Atypical lymphocyte (AL) was found in 8%, 9% and 9% in DF, DHF and DSS patients respectively.

In DF, DHF and DSS patients, the findings of tourniquet test positive + WBC ≤ 5,000 cells/cumm. were found in 70%, 69.4% and 51.5%, respectively.

**Liver function test (LFT)**

The mean aspartate aminotransferase (AST) in DF, DHF and DSS patients was 109 units (U), 192 U and 423 U, respectively. About 95% of dengue patients had elevation of AST. Most of them had mild elevation of AST (78.5% of DF, 70.6% of DHF and 58.7% of DSS patients). Elevation of AST > 200 U was found in 9.6% of DF, 25.3% of DHF and 39.2% of DSS patients (Table 2).

---

**Table 1: Results of use of WHO criteria for the diagnosis of DHF at the Children's Hospital during 1995-1999**

<table>
<thead>
<tr>
<th>Clinical Manifestations</th>
<th>DF</th>
<th>DHF</th>
<th>DSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever duration (days)</td>
<td>4.9</td>
<td>5.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Positive tourniquet test (%)</td>
<td>90.2</td>
<td>93.6</td>
<td>87.7</td>
</tr>
<tr>
<td>Hepatomegaly (%)</td>
<td>80.4</td>
<td>89.9</td>
<td>95.5</td>
</tr>
<tr>
<td>Shock (%)</td>
<td>–</td>
<td>–</td>
<td>44.0</td>
</tr>
<tr>
<td>Evidence of Plasma leakage</td>
<td>–</td>
<td>42.3</td>
<td>63.8</td>
</tr>
<tr>
<td>• Rising HCT &gt; 20%</td>
<td>–</td>
<td>84.2</td>
<td>96.1</td>
</tr>
<tr>
<td>• Pleural eff %</td>
<td>–</td>
<td>42.3</td>
<td>63.8</td>
</tr>
<tr>
<td>Platelet count ≤ 100,000 cells/cumm (%)</td>
<td>50.2</td>
<td>93.8</td>
<td>92.1</td>
</tr>
</tbody>
</table>

– = Nil
The mean alanine aminotransferase (ALT) in DF, DHF and DSS patients was 53 U, 88 U and 159 U, respectively. About 55.3% of dengue patients had elevation of ALT. Most of them had mild elevation of ALT (31% of DF, 48.4% of DHF and 50.4% of DSS patients). Elevation of ALT >200 U was found in 3.9% of DF, 8.8% of DHF and 16.3% of DSS patients (Table 3).

Table 2: AST range as observed during 1995-1999 in DF, DHF and DSS cases

<table>
<thead>
<tr>
<th>AST Range</th>
<th>DF (%)</th>
<th>DSS (%)</th>
<th>DHF (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-40 Units</td>
<td>100 (11.9)</td>
<td>24 (2.1)</td>
<td>103 (4.1)</td>
<td>227 (5.1)</td>
</tr>
<tr>
<td>&gt;40-200 Units</td>
<td>662 (78.5)</td>
<td>656 (58.7)</td>
<td>1,779 (70.6)</td>
<td>3,097 (69.1)</td>
</tr>
<tr>
<td>&gt;200 Units</td>
<td>81 (9.6)</td>
<td>438 (39.2)</td>
<td>638 (25.3)</td>
<td>1,157 (25.8)</td>
</tr>
<tr>
<td>Total</td>
<td>843</td>
<td>1,118</td>
<td>2,520</td>
<td>4,481</td>
</tr>
</tbody>
</table>

Table 3: ALT range observed during 1995-1999 in DF, DHF and DSS cases

<table>
<thead>
<tr>
<th>ALT RANGE</th>
<th>DF (%)</th>
<th>DHF (%)</th>
<th>DSS (%)</th>
<th>TOTAL (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-40 Units</td>
<td>549 (65)</td>
<td>1,081 (42.8)</td>
<td>372 (33.3)</td>
<td>2,002 (44.6)</td>
</tr>
<tr>
<td>&gt;40-200 Units</td>
<td>262 (31.0)</td>
<td>1,221 (48.4)</td>
<td>564 (50.4)</td>
<td>2,047 (45.6)</td>
</tr>
<tr>
<td>&gt;200 Units</td>
<td>33 (3.9)</td>
<td>221 (8.8)</td>
<td>182 (16.3)</td>
<td>436 (9.7)</td>
</tr>
<tr>
<td>Total</td>
<td>844</td>
<td>2,523</td>
<td>1,118</td>
<td>4,485</td>
</tr>
</tbody>
</table>

The mean albumin (ALB) level in DF, DHF and DSS patients before plasma leakage was 4.5, 4.5, and 4.3 gm%, respectively. The mean ALB level of DHF and DSS patients after plasma leakage was 4.1 and 3.6 gm%.

The mean cholesterol (CHOL) level in DF and DHF/DSS patients before plasma leakage was 151, 148, and 145 mg%. The mean ALB level of DHF and DSS patients after plasma leakage was 127 and 112 mg%.

**Coagulogram**

There were 38.4%, 64.1% and 73% of DF, DHF and DSS patients, respectively, who had prolonged partial thromboplastin time (PTT), the PTT ratio >1.3.

There were 6.4%, 7.6% and 13.3% of DF, DHF and DSS patients who had prolonged thrombin time (TT), the TT ratio >1.3.
There were 1.3%, 5.2% and 13% of DF, DHF and DSS patients who had prolonged prothrombin time (PT), the international normalizing ratio (INR) >1.3.

**Unusual manifestations**

Some unusual manifestations were observed among the study group. These are given in Table 4.

<table>
<thead>
<tr>
<th>Associated infections and conditions</th>
<th>1995 (%)</th>
<th>1996 (%)</th>
<th>1997 (%)</th>
<th>1998 (%)</th>
<th>1999 (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encephalopathy</td>
<td>5 (0.9)</td>
<td>5 (0.9)</td>
<td>9 (0.6)</td>
<td>13 (0.9)</td>
<td>3 (0.5)</td>
<td>34 (0.7)</td>
</tr>
<tr>
<td>Associated conditions</td>
<td>12 (2.2)</td>
<td>10 (1.8)</td>
<td>51 (3.5)</td>
<td>40 (2.9)</td>
<td>13 (2.1)</td>
<td>126 (2.7)</td>
</tr>
<tr>
<td>Associated infections</td>
<td>19 (3.5)</td>
<td>20 (3.6)</td>
<td>44 (3.0)</td>
<td>56 (4.0)</td>
<td>21 (3.4)</td>
<td>158 (3.4)</td>
</tr>
<tr>
<td>Total</td>
<td>36 (6.7)</td>
<td>35 (6.3)</td>
<td>104 (7.0)</td>
<td>109 (7.8)</td>
<td>37 (5.9)</td>
<td>318 (6.9)</td>
</tr>
</tbody>
</table>

Encephalopathy was found in 0.7% of all dengue patients. Its occurrence ranged from 0.5% in 1997 and 1999 to 0.9% in 1995, 1996 and 1998.

Associated infections were found in 3.4% of all dengue patients. Its occurrence ranged from 3% in 1997 to 4% in 1998. Most of them were respiratory tract, gastrointestinal and urinary tract infections.

Associated conditions were found in 2.7% of all dengue patients. Their occurrence ranged from 1.8% in 1996 to 3.5% in 1997. Most of them were thalassemia and G-6-PD deficiency.

**Management**

Crystalloid solution (5%DAR)* was given to 40.1%, 82.7% and 100% of DF, DHF and DSS patients, respectively. The mean amount of IV fluid given to DF, DHF and DSS patients was 19.1, 56.1 and 95.2 ml/kg, respectively. Moderate dehydration is 88 ml/kg/day.

Dextran-40 (colloid solution) was used in 3% and 28.6% of DHF and DSS. The mean amount of Dextran-40 for DHF and DSS patients was 13 and 18.4 ml/kg, respectively.

Blood transfusion was given to 2.1%, 5.3% and 12.9% of DF, DHF and DSS patients, respectively.

Plasma was given to 0.1% and 4.1% of DHF and DSS patients, respectively.

Platelet concentrate was given to only 0.4% of DSS patients.

* 5% dextrose in acetated Ringers’ solution
The average duration of IV fluid administration was 32.6 and 37.6 hours for DHF and DSS patients.

### Outcomes

Fluid overload and early interstitial edema and/or congestive heart failure were found in 4% of all DHF patients. Almost all of these patients were referred patients. Furosemide was given to these patients, some of whom needed ventilatory support.

The average duration in hospital was 3.3, 3.9 and 4.2 days for DF, DHF and DSS patients, respectively.

The case fatality rate (CFR) was 0.2% (DHF patients) and ranged from 0% to 0.3%. The CFR for DSS patients was 0.7%.

### Discussion

The number of dengue patient admissions at the Children's Hospital corresponds to the number of the reported cases in the country. In 1997 and 1998 when there were two consecutive large epidemics of dengue, the number of admissions was 1,400-1,500 cases. In non-epidemic years, the number of admissions ranged from 500-600 cases. The ratio between OPD:IPD was about 3:1, except in 1999 when the ratio was 7:1:1, when the National Plan for Prevention and Control of Dengue was established to celebrate the King's 72nd birthday and there was an increased awareness among the people of this disease.

Most of the admitted patients had secondary infections (77.3%). Although more than 90% of the DHF patients had secondary infection, the majority did not develop DHF. In this study, 61.6% of the patients with secondary infections ended up with DF. Cases of primary infection usually, but not all, result in DF. In this study, 19.1% of the primary infections resulted in DHF.

Tourniquet test was positive in about 90% of DF and DHF patients, as it was repeated every day until defervescence. In DSS, tourniquet was positive in 87.4% cases which was lower than in DF and DHF. This might be due to false negative finding if it was performed during shock. Usually it is not repeated after shock, because the final diagnosis of DSS was already made from the presence of rising Hct and thrombocytopenia. Some experienced clinicians can make clinical diagnosis of DHF from clinical, physical examinations and CBC findings without doing tourniquet test. Tourniquet test is one of the four WHO criteria for making DHF diagnosis. In most DHF cases there was no record of tourniquet test and other bleeding manifestations (petechiae), and DHF could not be diagnosed according to these WHO criteria. For these reasons, WHO criteria for making the diagnosis of DHF needs modification, and it should be based on only two laboratory criteria, i.e. thrombocytopenia and evidence of plasma leakage.

Hepatomegaly was found in 80% of the DF and >90% of the DHF/DSS patients. The percentage of hepatomegaly was rather high as compared to other reports because it was recorded every day until discharge. DHF patients had a tender and larger liver size as compared to DF patients. Usually, the maximum enlargement of the liver happens one day after shock or defervescence.

The finding of tourniquet test positive + WBC ≤ 5,000 cells/cumm. was found in 70% of DF patients. This helped in the diagnosis of DF as reported earlier without resorting to the expensive serological test.
Platelet ≤ 100,000 cells/cumm. was found in one-half of the DF patients and >90% of the DHF/DSS patients. The platelet count was observed to be the lowest one day after shock or defervescence. The platelet value correlated very well with the disease severity as reported earlier. DSS had the lowest mean platelet count as compared to DHF and DF patients.

Evidence of plasma leakage was better demonstrated by right lateral decubitus chest X-ray. It was shown in 84.2% and 96.1% of the DHF and DSS cases.

Lowering of the albumin value by 0.4 to 0.7 gm% from the previous value was another significant evidence of plasma leakage in DHF/DSS patients. Single value of albumin is very difficult to be used as an indicator of plasma leakage because the mean value of albumin during leakage was 4.1 gm% which covers the normal range. Single albumin value of <3 gm% may indicate plasma leakage and value between 3-3.5 gm% may suggest plasma leakage in the previously healthy patients.

Lowering of the cholesterol value by 21 to 33 mg% from the previous value was also another significant evidence of plasma leakage in DHF/DSS patients. Single value of cholesterol <100 mg% may indicate plasma leakage and value between 100-120 mg% may suggest plasma leakage in the previously healthy patients.

DF patients should have no coagulation abnormalities but in this study it was found that 38.4%, 6.4% and 1.3% had prolonged PTT, TT and PT in DF, DHF and DSS patients, respectively. The likely explanation was that these patients were actually DHF patients but the diagnosis could not be made because the rise in the Hct was not ≥20% and there was no other evidence of plasma leakage.

The percentage of DSS patients with prolonged PTT, TT and PT was higher than DHF patients. These findings support that there was disseminated intravascular coagulation (DIC) in more than half of the non-shock DHF patients and that shock further enhanced DIC. Prolonged PT was found mostly in patients with profound shock and usually associated with massive bleeding.

Encephalopathy was rare during this five-year period (0.7%). The common causes were hyponatremia, hypocalcemia and hypoglycemia. Hepatic encephalopathy cases were usually associated with prolonged shock and the prognosis was poor as compared to the above-mentioned metabolic causes.

Associated infections and conditions were found in 6% of the dengue patients. The most common associated infections were respiratory tract infections and diarrhoea. Salmonella was another common associated infection in dengue patients. The most common associated conditions were thalassemia and G-6-PD deficiency. Even though it was difficult to make the diagnoses in these DHF cases with associated infections and conditions, a careful follow-up and monitoring would definitely show evidence of plasma leakage and thrombocytopenia in every case.

IV fluid is needed in every shock case but it is not necessary to give IV fluid in non-shock cases if the patients could have adequate oral intake. In this study, 18.3% of the admitted DHF cases did not receive IV fluid. Most of the DHF/DSS patients recovered rapidly with the use of crystalloid solutions only. Dextran-40 and blood transfusion were given respectively to 8.7%
and 3.9% of the dengue patients. Those cases that needed blood transfusion usually had prolonged shock or had received aspirin or NSAID as an antipyretic drug. Platelet concentrate was rarely given to DHF/DSS patients (0.1%) at the Children’s Hospital. This supports the view that platelet transfusion is not necessary in most cases of DHF/DSS.

The average amount of IV fluid given during the leakage period in non-shock cases was less than maintenance +5% deficit, and in the DSS cases it was a little bit higher. This confirmed that the IV fluid estimation given to the DHF patients for the total duration of the plasma leakage was almost equal to the maintenance +5% deficit as per the WHO recommendation.

In general, the WHO recommendation for the management of DHF had been used at the Children’s Hospital and the results were excellent with the overall confirmation of 96.8%, i.e. 91.5% for DF and 98.1% for DHF. The CFR was 0.2% for the DHF patients and 0.7% for the DSS patients. It should be noted that almost all deaths that occurred here were among the very severe cases referred from other hospitals.

The comparative epidemiological and clinical manifestations of the dengue infection during the study period 1995-1999 and the period from 1982 to 1986 are summarized in Table 5.

Table 5: Comparative shift in epidemiological and clinical manifestations of DF/DHF/DSS during 1982-1986 and 1995-1999 at Children’s Hospital, Bangkok

<table>
<thead>
<tr>
<th>Presentations</th>
<th>Elements</th>
<th>1982-1986 (%)</th>
<th>1995-1999 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemiology</td>
<td>Primary infection in DF</td>
<td>11.3%</td>
<td>38.5%</td>
</tr>
<tr>
<td></td>
<td>Secondary infection in DHF &amp; DSS</td>
<td>95.9%</td>
<td>77.6 - 88.4%</td>
</tr>
<tr>
<td>Serotype</td>
<td>DEN 1</td>
<td>6.9%</td>
<td>25.5%</td>
</tr>
<tr>
<td></td>
<td>DEN 2</td>
<td>42.1%</td>
<td>20.9%</td>
</tr>
<tr>
<td></td>
<td>DEN 3</td>
<td>25.5%</td>
<td>50.6%</td>
</tr>
<tr>
<td></td>
<td>DEN 4</td>
<td>25.5%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Mean Age</td>
<td>7.2</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>10-14 yr</td>
<td>22.4%</td>
<td>30.4%</td>
<td></td>
</tr>
<tr>
<td>Clinical and Laboratory findings</td>
<td>DF</td>
<td>10.7%</td>
<td>19.0%</td>
</tr>
<tr>
<td></td>
<td>DHF</td>
<td>22.7%</td>
<td>56.4%</td>
</tr>
<tr>
<td></td>
<td>DSS</td>
<td>66.6%</td>
<td>24.7%</td>
</tr>
<tr>
<td>Fever while in shock</td>
<td>&lt;1%</td>
<td>55.9%</td>
<td></td>
</tr>
<tr>
<td>Rising Hct ≥ 20%</td>
<td>&gt;90%</td>
<td>42.3-63.6%</td>
<td></td>
</tr>
<tr>
<td>Unusual manifestations</td>
<td>&lt;5%</td>
<td>6.9%</td>
<td></td>
</tr>
<tr>
<td>OT &gt;40 U</td>
<td>80.0%</td>
<td>94.9%</td>
<td></td>
</tr>
<tr>
<td>Fluid overload</td>
<td>&lt;1%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>CFR</td>
<td>1.36</td>
<td>0.2%</td>
<td></td>
</tr>
</tbody>
</table>
More primary infections (38.5%) were found during the study period as compared to 11.3% ten years ago. This may have been due to the change in the circulating dengue serotypes between the two periods. Probably during the study period, susceptible patients had DEN-1 as the primary infection since during 1982-1986, DEN-1 had accounted for only 6.9%.

All dengue serotypes were found circulating during this five-year study period. DEN-3 was the predominant serotype during this period, but it declined from the maximum of 55.5% to 39.8% in 1999. DEN-2 also had a declining trend from the maximum of 30% in 1995 to 19.6% in 1999. In contrast to DEN-3 and DEN-2, DEN-1 increased from 18.5% in 1995 to 32.5% in 1999. DEN-4 was rarely found. The range was from 0.5-8.1% during the past five years.

The percentage of dengue patients in the older age group of 10-14 years increased from 28% to 34%. This corresponded to the finding that the incidence of dengue in patients older than 15 years had increased from 5% to 30% of the total cases in 2001(3). The mean-age incidence had increased from 7.6 years to 8.1-8.2 years. The incidence among infants was the same as before, ranging from 4-6%(2).

About 20% of the patients admitted each year had the milder form of dengue illness. The proportion of more severe DSS admissions was about 25% as compared to 35% in the 1990s(1) and 66% in 1986. In 1999, DSS admission was lower (15%) as most patients were brought to the hospital early when proper IV fluid management was able to prevent shock.

Shock was found in 30.5% of all DHF patients. Classically, DSS patients have no fever while in shock(7). It was very interesting to find that 55.9% of the shock patients in this study still had fever while they developed shock, but the fever was not high, ranging between 38-39°C. This was due to early admission in the hospital and quick administration of IV fluid.

Rising Hct ≥ 20% was found only in 42.3% and 63.8% of the DHF and DSS cases while it was reported in >90% of the cases between 1982-1986. Most of the DHF/DSS cases had rising Hct levels, between 10-20%. Among these cases, the evidence of plasma leakage was confirmed by chest X-ray or physical findings of pleural effusion and/or ascites. The lesser degree of rising Hct was due to early IV fluid administration, the increased rate of IV fluid when Hct was increasing, and Hct not being done frequently. This posed a problem of DHF diagnosis based on the WHO criteria, for about half of the DHF patients did not have rising Hct ≥20%. Physical findings of pleural effusion and/or ascites should be added to the WHO criteria in the category of evidence of plasma leakage.

Elevation of AST and ALT was found in 94.9% and 55.3% of the dengue patients, which was higher than the previously reported level of 80%-85%. This could have been due to the presence of different dengue serotypes, particularly DEN-3 which was predominant during this period and was reported to be associated with liver
involvement\(^8\). This elevation of liver enzyme may possibly be related to the increased drug usage or to shock or other factors that would need to be studied further. This abnormal elevation of AST in most suspected cases of dengue infection may be used as an early indicator of dengue illness as suggested earlier\(^6\).

Acknowledgements

We are grateful to the AFRIMS for their continuing serological and virological laboratory support. This study was a part of the project “Clinical database management” at the Queen Sirikit National Institute of Child Health (Children’s Hospital) which was funded by UNCINPAC through the AFRIMS.

References


