Dengue in Children: Prolife of Hematological and Biochemical Parameters

Chhaya Gupta*, Neeru Gupta, Jatin Munjal and Shephali Sharma
Sri Balaji Action Medical Institute, Paschim vihar, New Delhi, India

ABSTRACT

Background: Dengue is the most important emerging tropical viral disease in the world today. The World Health Organisation (WHO) estimates 50 million dengue infections occur annually and almost half the world’s population lives in countries where dengue infection is endemic[1]. Over the past several years, the epidemiological profile of dengue has been changing progressively and is currently characterized by an increase in the number of cases in children under 15 years of age[2].

Aim and objective: To evaluate and co-relate the hematological and biochemical data in children during the evolution of dengue fever and to predict the severity of the disease.

Methods: It is a retrospective study of 30 seropositive dengue cases below 18 years of age carried out in the period of Jan 2016 to Nov 2016. Their hematological and biochemical parameters were studied at Sri Balaji Action Medical Institute, New Delhi.

Conclusion: Awareness, early recognition and early diagnosis are important for favorable outcome. Hematological and biochemical profile are very helpful tools for disease monitoring and can be helpful in prediction of prognosis. Thrombocytopenia is a feature of dengue.

Keywords: Dengue, Children, Complete Hemogram, Biochemical Profile.

Introduction

Dengue is an acute febrile disease. The etiologic agent of dengue is the dengue virus [DENV], which belongs to the Flaviviridae family and the Flavivirus genus and has four serotypes [DEN-1, DEN – 2, DEN – 3, DEN – 4]. Dengue is the most common arthropod borne viral disease transmitted by mosquito of the genus Aedes aegypti and is one of the most significant diseases because it is associated with high rates of morbidity and mortality[1,2,3,4].

This disease currently represents a major public health issue especially in tropical and subtropical countries, where environmental conditions enable the development and proliferation of mosquito which breeds exclusively in domestic man made water receptacles[2,4].

Dengue shows a cyclical trend with a peak in September, October, November every year. It is a disease with a wide clinical spectrum and a wide variety of presentation, ranging from asymptomatic to an undifferentiated fever (viral syndrome) to the more severe forms such as severe dengue (SD) or Dengue Haemorrhagic Fever (DHF)[3]. The WHO organization revised its case definitions in 2009 and now distinguishes as Dengue fever, Dengue fever with warning signs and severe dengue fever[1].

The study by RochaLA et al observed the changing epidemiological trend in Brazil with shift being observed in the age group of the affected population[6]. There are few reports on the clinical and laboratory differences in children and adults with dengue[2,7,8].

The initial febrile illness begins with rapid onset of high grade fever which is accompanied by retroorbital headache, severe myalgia, arthralgia, nausea, vomiting (more common in children) and general fatigue. A confluent maculopapular rash (more common in children) appears during end of febrile stage. Petechiae and purpura indicate capillary fragility[8].

Although most children recover directly after the initial stage, a small proportion will develop systemic capillary leakage. Delayed diagnosis of severe dengue is associated with high mortality (up to 40%). Therefore warning signs for deterioration are of utmost clinical importance[2,8].

Material and Methods

This is a descriptive, observational retrospective study of secondary data obtained from the medical records of 30 patients under the age of 18 who had serological diagnosis of dengue fever at Sri Balaji Action Medical Institute, New Delhi, India. Conducted in period January to November 2016. The cases included in the study showed positive dengue NS1 (Non structural proteins-1 antigen) or IgM
serology performed by Enzyme Linked Immunosorbant Assay (ELISA).

Complete haemogram including haemoglobin, haematocrit (Hct), total leucocyte count, differential count and platelet count were noted. Haemogram profile was done on Automated Hematology analyser sysmex XN1000. Peripheral smear examination was done in all the patients.

Biochemical parameters like Aspartate Transaminase (AST), Alanine Transminase (ALT), total protein, Albumin and globulin were done by spectrophotometric method done on Cobas c501.

Hemoglobin of patients were grouped as <10gm/dl, 10-15gm/dl, >15gm/dl. Haematocrit was grouped as <35%, 35 – 45%, >45%. The hematocrit parameter to evaluate hemoconcentration was Ht>38%[2]. Total leucocyte counts of the patients were grouped as <4000, 4000 to 11000, >11000 cells/cumm. Leucopenia was defined as total leukocyte count < 4000cells/cumm. Lymphocytosis was defined as >45% lymphocytes in the differential count.

Thrombocytopenia was defined as a platelet count of <150000/µl. Platelet counts of the patients were grouped as <20,000/µl, 20,000 – 50,000/µl, 50000 – 1 lakh/µl, 1-1.5 lakh/µl, >1.5 lakh/µl.

AST result >50IU/L and ALT result >50 IU/L were considered to be high.

Hypoalbuminemia was defined as an albumin level of less than 3.4 g/dL for patients 7 months or older and less than 2.5 g/dL for patients younger than 7 months.[9] Patients diagnosed to have co-infection with malaria, chickungunya or enteric fever by relevant investigation were excluded from the study.

**Result**

In a study period of Jan to Nov 2016, We have 214 seropositive Dengue cases, out of which 35 (16.3%) were children. One case showed co-infection with chickungunya and two showed co-infection with enteric fever. Two cases were on OPD basis whose details were not available. Therefore these 5 cases were excluded from the study.

Month wise distribution of cases is as depicted in Fig1. There is a surge in the number of cases in the monsoon period i.e September, October and November. The presenting symptoms of the patients are shown in Fig2. Fever, nausea, vomiting and abdominal pain were the most frequent complaints. The pattern of dengue seropositivity is depicted in Fig3.

Anemia with haemoglobin<10gm/dl was observed in 10%(3/30) cases. Seventy percent of cases had haemoglobin in range of 10-15gm/dl. Laboratory investigation revealed that the most common haematological abnormality was platelet count <1,00,000/µl and hemoconcentration [Hct>38%] which was observed in 22 (73.3%) patients. Thirty six percent of patients had platelet count between 20,000-50,000/µl and thirty three percent cases had platelet count of <20,000/µl. Hct of the patients are grouped in Table2. Leucopenia was seen in 8 (26.6%) patients however normal counts were observed in 16 (53.3%) of cases. Leucopenia with lymphocytosis were seen in 4 (13%) of cases.

Liver function tests (LFT) showed increased levels of aspartate aminotransferase (AST) and alanine aminotransferases (ALT). AST was raised in 24 (85%)
Mean and median AST levels were 1393.3 IU/l and 165 IU/l respectively. Maximum derangement observed was 24,874 IU/l which was 620 times the cut off valve. ALT was raised in 23 (82.1%) patients (n=30). Alkaline phosphatase levels ranged from 56 to 421 IU/l (n=14). Total protein was < 6 g in 8 (42%) patients (n=19) and albumin < 3.5 g in 7 (36.8%) patients (n=19).

There was one mortality due to the disease. The patient had severe thrombocytopenia, markedly raised AST and ALT and deranged Prothrombin Time.
Table 1: Platelet profile of patients.

<table>
<thead>
<tr>
<th>Platelet count (per µl)</th>
<th>Results (n=30)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20,000</td>
<td>10</td>
<td>33</td>
</tr>
<tr>
<td>21000 – 50000</td>
<td>11</td>
<td>36.6</td>
</tr>
<tr>
<td>50000 – 1 lakh</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>1 – 1.5 lakh</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>&gt; 1.5 lakh</td>
<td>4</td>
<td>13.3</td>
</tr>
</tbody>
</table>

Table 2: Haematocrit % of patients.

<table>
<thead>
<tr>
<th>Haematocrit (%)</th>
<th>Results (n=30)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 35</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>35 – 45</td>
<td>18</td>
<td>60</td>
</tr>
<tr>
<td>&gt; 45</td>
<td>8</td>
<td>26.6</td>
</tr>
</tbody>
</table>

Table 3: Total leucocyte profile of patients.

<table>
<thead>
<tr>
<th>Total Leucocyte Count (cells/mm³)</th>
<th>Results (n=30)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4000</td>
<td>8</td>
<td>26.6</td>
</tr>
<tr>
<td>4000 – 11000</td>
<td>16</td>
<td>53.3</td>
</tr>
<tr>
<td>&gt; 11000</td>
<td>6</td>
<td>20</td>
</tr>
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Discussion

The first clinical case report of dengue was from Philadelphia by Berjanin Rush, who coined the term “Break Bone Fever” because of the symptoms of myalgia and arthralgia [10]. In India, dengue was first reported in 1946, DENV-1 was first reported in 1956 at vellore, DENV – 2 in 1956, DENV – 3 in 1965 and DENV – 4 in 1964 [10][11]. Due to changing climate, urbanization, poor living conditions and inadequate waste management, vector borne disease like dengue fever are becoming more common. Although vector control programs are launched in endemic countries every year, yet dengue fever has become a serious problem worldwide. India being a tropical country provides suitable weather for Aedes mosquito to grow and an increase in the disease burden has been noticed in recent years [12].

In our study there was a slight male preponderance. Similar observations have been made by De souza LJ et al[2], Patel K et al [13] and Dongre T et al[14]. Hypothetically this can be related to the increased risk of exposure of male gender to mosquito bites due to social, occupational and recreational activities[13].

The most significant laboratory abnormality seen in our patients was thrombocytopenia as also observed by Azin et al[5], De souza et al[2] Dongre T et al[14] and patel et al[13]. Haemorrhagic manifestation are very common with severe thrombocytopenia and severity of haemorrhagic tendency correlates with platelet counts. At times automatic counter gives a false low reading in case of large platelets. Such cases can be obviated by assessment of platelets on smears. Leucopenia was observed in 26.6% of patients however Patel et al[13] observed 56.92% patients with leucopenia. Leucopenia is due to the direct marrow suppression by the virus.

Patel et al[13] observed increase in concentration of atypical lymphocytes. It mainly represents that serum immunoglobulin production is enhanced during dengue viral infection, these are mostly against the specific serotype and obviously not protection to the infections caused by other serotypes [15].

LFT showed increased levels of AST and ALT in > 80 % of our cases which was comparable to 100% in a study by Bhaskar et al. [16] and 90 % by Kuo et al [17]. In 42.8 % of children AST levels were more than five times indicating that they are at higher risk of hepatic involvement and developing hepatic encephalopathy [16]. Forty two percent of our patients showed total protein of <6 gm and 36.8 % of patients had <3.5 gm albumin however it was different from Bhasker et al. They observed Hypoproteinemia with hypoalbuminemia in 74 % of cases. Hypoalbuminemia is an important factor of fluid loss into third space which is indicative of severity of Dengue infection [16]. Dengue fever is a self limiting disease. Dengue fever evolves with laboratory alteration starting on the 3rd day and becoming most evident on the 5th day with values restored to normal by 11th day. [13]. Dengue haemorrhagic fever causes morbidity and mortality. No antiviral treatment is available hence fluid and electrolyte replacement and supportive therapy are the available modalities of treatment. Due to lack of specific treatment it is important to implement public health policies and vector control measures to curtail the diseases [18].

Conclusion

Due to lack of an effective dengue vaccine as well as to the absence of targeted treatment options, the knowledge
and skills to recognize and diagnose the disease before it reaches its’ critical phase are of utmost importance. The complete haemogram is the most important guide to therapy and prognosis along with liver function test.

References


