A Study of Hematological and Biochemical Parameters in Seropositive Cases of Dengue

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(Received: Oct 2017 Revised: Dec 2017 Accepted: Feb 2018)

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ABSTRACT

Introduction and Aim: Dengue Fever is the most common arboviral disease in the world and it is considered a major global health threat by the World Health Organization. Dengue infection presents with varied clinical conditions ranging from simple fever to shock. Dengue infection can lead to severe bleeding, shock, and death. Hence early and rapid laboratory diagnosis of dengue is crucial. The present study aims to investigate the age and sex prevalence in the spectrum of dengue and to correlate the haematological, serological and biochemical findings in relation to antigens and antibodies in dengue infection.

Materials and Methods: The present study was conducted in Department of Pathology, in a south Indian tertiary hospital between April 2015-September 2016. All the patients with immunochromatographic positive (NS1, IgM, and IgG) for dengue infection were included in the study. Their clinical history, laboratory data, and outcome were recorded.

Results: A total of 137 serologically positive patients were included in the present study. Of them, 67.2% (92) had dengue fever, 31.4% (43) had dengue haemorrhagic fever and 1.4% (2) presented with dengue shock syndrome. Males 53.3% (73) were more commonly affected than females (46.7% (64) with the M:F ratio of 1.1:1.NS1 positive cases constituted 48.1% (66), IgG positive cases accounted for 25.8% (35) cases, IgM, NS1+IgM and NS1+IgG were observed in 13.1% (18), 10.2%(14) and 2.9% (4) cases respectively. Thrombocytopenia was observed in 67.8% (93) cases and its association with NS1 antigen was significant. Hemoconcentration was seen in 28.4% (39) of the cases.

Conclusion: We conclude that early diagnosis of the infection with the help of complete blood examination and serological dengue tests can prevent the fatality of the disease.

Key Words: NS1 antigen, Dengue shock syndrome, thrombocytopenia, DEN V, Hemoconcentration

INTRODUCTION

According to the World Health Organization (WHO), there are about 390 million new cases per year of dengue infection worldwide. Dengue infection presents with varied clinical conditions ranging from simple fever to shock. Dengue infection can lead to severe bleeding, shock, and death. Hence early and rapid laboratory diagnosis of dengue is crucial. Hematological, serological and biochemical parameters are important entities which indicate and assess the severity of the disease. The aim of present study is to study the age and sex prevalence in the spectrum of dengue infection and to correlate the haematological, serological and biochemical findings in relation to antigens and antibodies in dengue infection

MATERIALS AND METHODS

The present study was conducted in Department of Pathology, in a tertiary Hospital for a period of 15 months between April 2015-September 2016. All the patients with immunochromatographic positive (NS1, IgM and IgG) for dengue infection were included in the study. The serological test for dengue was done using a rapid solid phase immunochromatographic test (SD dengue duo) for the qualitative detection of NS1 antigen and differential detection of IgM and IgG antibodies to dengue virus in human serum and confirmed by ELISA. Haematological and biochemical parameters were investigated

and studied in dengue infection confirmed cases. 4ml of blood was drawn, 2 ml of blood in EDTA vacutainers for complete hemogram, 2ml of blood in plain vacutainers for biochemical investigations. The blood counts were performed on fully automated hematology analyzer with a five part differential (Mindray BC-5380). The peripheral smears were stained with Leishman stain and studied by a pathologist. Complete blood count includes peripheral smear, RBC, WBC, hemoglobin, platelet counts, red cell indices and hematocrit. The biochemical investigations like hepatic enzymes-ALT, AST and ALP, blood urea and serum creatinine were performed on automated biochemistry analyzer (Mindray BS-390).The results were recorded and analyzed.

RESULTS

A total of 137 cases were studied, based on positive dengue test (Rapid card test), and were divided into 3 groups based on WHO classification. Out of 137 cases 92 (67.2%) patients were of Dengue fever, 43 (31.4%) were of Dengue haemorrhagic fever and 2 (1.4%) were Dengue shock syndrome. There was no fatality. Dengue infection was observed commonly in the age group between 11 to 30 years, with the mean age of 26.02 years [Table -1]. Seventy three (53.30%) were male and 64 (46.7%) were female out of 137 cases. The male and female ratio was about 1.1:1.In the serological investigations, the most common antigen observed was NS1 presenting in 66 (48.1%) cases followed by IgG in 35 (25.5%) cases. The positivity of NS1 among DF cases were 45 (48.9%) out of 91 cases and IgG was positive in 24(26.1%) cases. Among 43 cases of DHF, NS1 was positive in 21(48.8%) cases whereas IgG positivity was observed in 10 (23.2%) cases [Table -2]. Thrombocytopenia (< 1 lakh/ml) was observed in 93 (67.8%) out of 137 cases. Fifteen (10.9%) cases were below 20000/ml. There were 50 (75.5%) cases of thrombocytopenia among 92 NS1 positive cases, which is followed by 20 (57.2%) cases of thrombocytopenia among 35 IgG positive cases [Table-3]. We have calculated the hemoconcentration by hematocrit hemoglobin ratio, where the value of <3.5 is counted as normal and > 3.5 as increased in hemoconcentration1.Out of 137 patients studied 39 (28.4%) cases show raise in hemoconcentration. Raise in hemoconcentration was observed in 24 cases among DHF, 13 cases among DF. Both the cases of DSS exhibit Hemoconcentration [Table-4]. There was raise in hepatic enzyme concentration in about 50 (36.4%) cases. Serum ALT was raised in 18(13.1%) cases and AST in 25 (18.2%) cases [Table-5]. Serum urea was raised in 1 case among DHF and 2 cases among DSS. Serum creatinine was raised in 3 cases among DHF and 2 cases among DSS.

Table 1: Age Distribution of Dengue Infection

Age Group	Birth -10	11-20	11-20	31-40	41-50	51-60	61-70	>70	To-tal
No. of patients	6	42	42	13	7	4	4	2	137

Table 2: Serological Distribution of Antigen and Antibodies in spectrum of dengue infection

Spectrum of Dengue	NS1	IgM	IgG	NS1 + IgM	NS1+ IgG
DF (n=92)	45	14	24	8	2
DHF (n=43)	21	4	10	5	2
DSS (n=2)	0	0	1	1	0
Total	66	18	35	14	4

Table 3: Platelet Counts Distribution

Platelet count	NS1 (n=66)	IgM (n=18)	IgG (n=35)	NS1+IgG (n=14)	NS1+ IgM (n=4)
<20000	0	10	3	2	0
5 0000-1 lakh	50	2	17	7	1
Total	50	12	20	9	1

Table 4: Hemoconcentration Distribution by Hematocrit Hemoglobin Ratio

Hemocon-centation	DF (n=92)	DHF (n=43)	DSS (n=2)	Total (n=137)
>/= 3.5	13	24	2	39

Table 5: Hepatic Enzymes Distribution

Total Patients	Alanine Aminotransferase	Aspartate Aminotransferase	Alkaline Phosphatase
DF	2	1	0
DHF	14	22	5
DSS	2	2	2
Total	17	25	7

DISCUSSION

Dengue is caused by Dengue virus (DENV), a mosquito-borne flavivirus which is a single-stranded RNA positive-strand virus. There are 4 distinct but closely related serotypes of the virus that cause dengue (DEN-1, DEN-2, DEN-3 and DEN-4) with a wide range of diseases in humans, from a self-limited dengue fever to life-threatening syndromes namely Dengue hemmoraghic fever and Dengue shock syndrome. In 2014 a total of 40571 cases of dengue infection were reported in India out of which 137 cases

were fatal and in 2015, 99913 cases were reported with 220 fatalities which is more than two-fold increase in the occurrence of the disease. After the bite of an infected mosquito, the dengue virus enters the body and replicates within cells of the mononuclear phagocyte lineage (macrophages, monocytes, and B cells). Additionally, infection of mast cells, dendritic cells, and endothelial cells are known to occur (2). The incubation period of dengue infections is 7–10 days. A viraemic phase follows where the patient becomes febrile and infective. Thereafter, the patient may either recover or progress to the leakage phase, leading to DHF and/or dengue shock syndrome. Peak plasma viraemia correlates with the severity of dengue infections (3). Some of the postulated hypotheses on dengue immunopathogenesis are the antibody enhancement theory, cross-reactive memory T cells activation and the original antigenic sin (4), where all in a way cause an overproduction of cytokine release and it is termed as a cytokine storm. The mean age of dengue infection in the present study was 26.2 years with the range of 4 -83 years and male to female ratio was about1.1:1.The present study correlated with the study done by Malavige *et al*., (5) where the mean age was 26.6 years. The present study has shown av male preponderance (53.3%) as compared to the females (46.7%) with the male: female ratio being 1.1:1. Similar results were observed by Su DH *et al*., (6) who gave they male: female ratio as being 1.5:1.The commonest antigen detected in the present study was NS1 66 (48.1%) cases followed by IgG 35 (25.5%) cases out of 137 cases. The present study has similar findings with the study done by Gargi Ghosh *et al*., (7) where NS1 antigen accounted for 51.5% of the cases. But cases showing IgG positivity (25.5%) were more in the present study and this may be explained by the presence of more number of secondary infections in the present study population. In the present study thrombocytopenia (< 1 lakh) was observed in 93 (67.8%) cases out of 137 cases, among 93 cases 15 (10.9%) cases were presented with platelet count < 20000.The present study correlated with the research done by RD Kulkarni *et al*., (8) and Parameswarrappa Jyothi *et al*., (9) where they have observed thrombocytopenia in 68.8% and 61.6% of cases respectively. There were 48 (72.2%) cases of thrombocytopenia among 92 NS1 positive cases in the present study. The similar study of the association of thrombocytopenia with NS1 antigen was observed by RD Kulkarni *et al*., (8) wherein 130 cases positive for NS1, thrombocytopenia was evident in 103 (79.2%) cases, which correlated with the present study. Out of 137 patients studied we have observed 28.4% (39) cases with raise in hemoconcentration. A study, conducted by Malavige *et al*., (5) has evidence that out of 108 serologically positive cases 26% show increase in hemoconcentration. In the present study, maximum levels of hepatic enzymes recorded were 190 U/L, 205 U/L and 194 U/L in ALT, AST and ALP respectively. Increase in serum ALT and AST concentration was observed in about 30 (21.9%) and 29 (21.2%) cases respectively. There was an increase in liver enzymes especially ALT and AST in females with age less than 20 years of age in the present study. The similar finding was evident by Luiz Jose de Souza *et al*., (10).

Among DHF cases there was raise in ALT, AST, and ALP concentration in about 14(32.5%), 22 (51.1%) and 5 (11.6%) cases respectively, which was similar to the study conducted by Wahid SF *et al*., (11). In the present study out of 137 patients 95.6% cases presented with normal concentration of serum urea and creatinine. A study, conducted by Futrakul *et al*., (12) has reported that there is a mild elevation in serum creatinine in 43% out of 24 DHF cases.

CONCLUSION

The present study observed that dengue infection is common among young adults and a significant association of thrombocytopenia with NS1 antigen positivity has been found. Hence we conclude that early diagnosis of the patient with the help of complete blood examination and serological dengue tests along with prompt clinical care can prevent the fatality of the disease.

Compliance with Ethical Standards

This study was not funded by organization/agency

An informed consent was obtained from participants of the study

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