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Haematological Changes in Dengue Fever in South Indian Population

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Original Research Article

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Abstract: Dengue fever (DF) is the most common acute febrile viral disease among all the arthropod-borne viral diseases caused by a single-stranded RNA virus of Flaviviridae family. The present study was undertaken to evaluate the hematological profile of seropositive (IgM) dengue fever patients and co-relate the hematological data to predict the severity of the disease. The study was conducted in Fatima Institute of Medical Sciences, Kadapa, and Andhra Pradesh. Total 140 IgM dengue positive cases were evaluated to know the haematological changes. The dengue positive cases were classified based on the clinical history, signs and symptoms, Haematological findings of the study with reference to the WHO criteria for dengue case definition. Demographic profile of the study population reveals that not much difference in male and female ratio (1.2:1). The most important abnormal haematological findings were platelet counts less than 50,000/cumm (38.5%). Haemoconcentration was also observed in 15% in results to the plasma leakage. Conclusion: Estimation of hematological findings during the critical phase (24-48 hrs) among DHF patients is crucial for the early detection of plasma leakage and to determine the adequacy of fluid therapy.
Keywords: Dengue fever, Dengue Hemorrhagic fever, Haematological Thrombocytopenia, Haemoconcentration.

INTRODUCTION

Dengue, the most common arboviral disease transmitted globally, is caused by four antigenically distinct dengue virus serotypes; DEN 1, DEN 2, DEN 3 and DEN 4 [1]. Infection by any one of the four serotypes of dengue virus (DENV) remains asymptomatic in the vast majority.

The dengue virus is a member of flavivirus group in the family Flaviviridae, is a single stranded enveloped RNS virus [2]. Dengue virus can grow in a variety of mosquitoes and tissue cultures. The first major epidemic of dengue fever (DF) occurred in the mid-1950s in Southeast Asia [1, 2].

Classical dengue fever is rare among indigenous people as most of the adults are immune. The first clinical case reported on dengue from 1789 of 1780 epidemic Philadelphia is by Benjamin Rush, who coined the term “break bone fever” because of the symptoms of myalgia and arthralgia [3]. The term dengue fever introduced only after 1828. The first epidemic of clinical dengue like illness was reported in Madras in 1780 and the first virologically proved epidemic of dengue fever in India presented in Calcutta and Eastern Coast of India in 1963-1964. Dengue infections may be asymptomatic, may lead to undifferentiated fever (or viral syndromes), dengue fever or DHF [1, 4]. Dengue infection from being a sporadic illness has become a regular post monsoon feature in many regions [5]. Dengue infection spread by the bite of Aedes mosquitoes [6]. The period of transmission from humans to mosquitoes begins one day before the start of fever up to the next day of illness corresponding to the viremia phase. After a female bites an individual in the viremia phase, viral replication (extrinsic incubation) begins in the vector in from eight to twelve days. In humans, the incubation period ranges from 3 to 15 days (intrinsic incubation) with an average of 5 days [7].

The extensive research studies in the past four decades have contributed the data to better understanding of the pathophysiology and pathogenesis of dengue hemorrhagic fever (DHF). The clinical presentations of DF vary from location to location and from epidemic to epidemic. Unlike DF, DHF occurs mainly in children and its clinical features are rather distinctive. Thrombocytopenia and haemoconcentration (an increase in the haematocrit of 20% or more) were representing the pathophysiological hallmarks of abnormal haemostasis and plasma leakage, respectively. The hematological changes observed in DF and DHF are hemoconcentration due to plasma leakage,

leucopenia, thrombocytopenia, lymphocytosis, changes in blood hemostasis [3, 8]. The purpose of the current study was to evaluate the hematological profile of seropositive (IgM) dengue fever patients and co-relate the hematological data to predict the severity of the disease.

MATERIALS & METHODS

One hundred and forty (140) of dengue seropositive (IgM) cases were included in the present prospective study. The study subjects of the present study were patients who attended the out-patient department or were admitted as in-patients in Fatima Medical College, Kadapa, and Andhra Pradesh. The study was reviewed and approved by the Institutional Ethical Committee.

Serologically confirmed IgM positive dengue fever patients and willing to participate in study were included in the study. Patients age less than 15 years or more than 60 years, preexisting substantial chronic liver disease, kidney or heart disease and history of hematological disorders were excluded from the study. The case definition of dengue fever (DF), dengue hemorrhagic fever (DHF) was classified based on clinical history according the WHO criteria. The hematological investigations conducted for each patient complete hemogram which includes hemoglobin, hematocrit, total count, differential count and platelet count. Peripheral smear examination was done for all the patients.

RESULTS

Table-1: Distribution of study population according to age and WHO case definition criteria

Diagnosis / Case type	Age 15-20	Age 21-30	Age 31-40	Age 41-50	Age 51-60	Gender	
						Male(%)	Female(%)
Dengue Fever (n=99)	28	30	23	13	05	54 (54.5)	45(45.4)
Dengue Hemorrhagic fever (n=33)	10	07	08	05	03	20(60.6)	13(39.3)
Dengue Shock Syndrome (n=8)	03	02	02	00	01	5(62.5)	03(37.5)
Total	41	39	33	18	09	79 (56.4)	61(43.5)

WHO, World Health Organization

Table-2: Hematological Profile of abnormal laboratory investigations in study population

S. No	Investigations		No of cases (%)
1	Haemoglobin (gm/dl)	<10.0	41(29.2)
		10-15	78(55.7)
		>15	21(15)
2	Haematocrit (%)	<35	40(28.5)
		35-45	77(55)
		>45	22(15.7)
3	Total Leucocyte count (Cells/cumm)	<4,000	99(70.7)
		4,000-11,000	38(27.1)
		>11,000	03(2.1)
4	Lymphocytes (%)	>45%	76(54.2)
		Atypical	64(45.7)
5	Platelet count (per cumm)	<50,000	54(38.5)
		50,000-1,00,000	65(46.4)
		>1,00,000	21(15)

The study subjects were undergone laboratory investigations on 3rd day of onset of fever. The Demographic data of the study population presented in table 1. Out of 140 cases, 54(54.5%) were males, 45(45.4%) were females. According to the age, maximum cases (41) were 15-20 years followed by 29 in 21-30 years age group (Table 1). Evaluation of laboratory findings revealed that the most common haematological abnormality was Thrombocytopenia in 54 (38.5%) patients and 65(46.4%) patients had platelet count less than 1,00,000/cumm. Haemoglobin levels more than 15gm/dl observed in 21 (15%) cases. Hematocrit value (%) ranges from 35-45 found in 77 dengue positive cases (Table 2).

In the present study leucopenia seen in 99(70.7%) dengue patients, normal leucocyte count seen in 38 dengue patients. Lymphocytosis greater than 45% was found in 76(54.2%) dengue cases and Atypical lymphocytes were seen in 64(45.7%) cases (Table 2). On evaluation of Haemotological findings of the present study, out of 140 IgM positive dengue cases, 99 (70.7%) patients were DF, 33(23.5%) patients were DHF and 08(5.7%) patients were diagnosed to have DSS based on WHO criteria for case definition (Table 1).

DISCUSSION

Dengue fever (DF) has become a major global public health problem in India. The present study shows

the mean age of distribution was 34.5 years. The male to female ration in this study was 1.2:1, not much difference found in distribution among both sexes. Differences in gender ratio may changes depends on greater exposure to the vector due to more outdoor activities [9].

Children are at a high risk of getting infected by DHF than adults because it has been suggested that baseline microvascular permeability in children is greater than that of adults. In our study, the demographic data of the present study revealed those 15-20 years age groups are affected more. This was similar to the results reported by Neeraja*et al.* [10], Rocha &Tauil [11], and Avarebeel*et al.* [12].

Haemoconcentration was found in 15% of the patients, study conducted by the Achalkar [13] reported Haemoconcentration in more than 50% of the patients. Leukopenia was seen in 70.7% of the study population in our study, these results are in agreement to studies of Avarebeel*et al*. [12], Achalkar [13], and Ratageri*et al*. [14]. The most significant haemotological investigation to study dengue fever is platelet count, thrombocytopenia observed in 38.5% of the total study population. This may be due to depression of bone marrow due to acute stage of viral infection. Platelet count <100,000/cumm was reported by Ratageri*et al*. [14] and Basak and Talukder [15]. There may be reduced platelet production in bone marrow because of direct damage to the megakaryocytic precursors and also increased peripheral destruction by pre-existing antibodies leading to immune complex formation.

It was observed that 28.5% of study population had haematocrit less than 35%. Haematocrit value 35-45% was seen in 77(55%) followed by increased hematocrit value in 15.7% of the cases. Increase in the haematocrit represents the haemoconcentration from plasma leakage. Co-relating the changes in haemoconcentration with vital signs are important consideration to adjust fluid infusion rates to match the dynamics of plasma leakage. Lymphocytosis was found in 54.2% cases in which most of the samples revealed atypical lymphocytes. There was a decrease in lymphocytes at the onset of dengue fever, with an increase as the disease progressed; this was observed all three clinical classification of dengue fever.

CONCLUSION

Dengue fever evolves with laboratory alterations starting on the 3rd day, So that hematological profile of individual patients plays essential role in order to provide proper treatment, health care management and to diagnose the dengue fever. Frequent estimation of hematological findings during the critical phase (24-48 hrs) among DHF patients is crucial for the early detection of plasma leakage and to determine the adequacy of fluid therapy. This would reduce the morbidity and mortality arising out of serious complications of DHF. The positive laboratory results may be able to correlate with various types of DF, which will strengthen community awareness, early diagnosis, and management and vector control measures.

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