Haematological profile of Dengue Fever

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Abstract

Background: Dengue is one of the most important viral diseases especially in the tropical regions. Dengue is caused by dengue virus (DEN) and is transmitted to humans by the bite of Aedes aegypti mosquito. Early clinical features of dengue infection are variable among patients, and initial symptoms are often nonspecific resembling any viral illness. Therefore, specific laboratory tests are necessary for an accurate diagnosis.

Aim: To study the hematological profile of serologically diagnosed dengue patients in a tertiary care hospital.

Methods: A total of 175 cases of dengue with serological confirmation of either dengue specific NS1 antigen assay and/or IgM and/or IgG antibodies were studied for the evaluation of haematological parameters from May 2019 to July 2019.

Results: Maximum patients 55 (31.4%) were in age group of 21-30 years. A total leukocyte count of less than 4,000 cell/mm3 was present in 145 (82.85%) patients. 26.28% (46) of patients were having hematocrit >45%. 47 (26.85%) patients had mild thrombocytopenia; 105 (60%) had moderate thrombocytopenia, and 18 (10.28%) had severe thrombocytopenia. 21.14% had a hemoglobin level of more than 15 g/dl.

Conclusion: Haemoconcentration, leucopenia, thrombocytopenia gives clues to test for dengue serology so that dengue cases can be diagnosed in their initial stages as these cases does not have specific medical therapy, hence clinical recovery monitoring is largely dependent on haematological parameters.

Keywords: Dengue fever, hemoconcentration, leucopenia, thrombocytopenia

Introduction

The word dengue is believed to have originated from Swahili language “ki denga pepo”, which describes sudden cramp like seizure. The clinical symptoms suggestive of dengue virus infection can be traced back to Chinese Chin Dynasty (265-420 AD) where disease was considered as water poison and was known to be associated with water and insects[1].

Dengue is one of the most important viral diseases especially in the tropical regions. According to the WHO almost 50 million people get dengue infection annually and WHO estimates almost half of the world’s population lives in countries having endemicity for dengue infection[2].

Dengue is caused by dengue virus (DEN) and is transmitted to humans by the bite of Aedes aegypti mosquito[3]. Infection is caused by one of the four serotypes of the dengue virus (DEN-1, DEN-2, DEN-3 and DEN-4) also referred to as an arbovirus (arthropod-borne viruses) that belongs to the genus Flavivirus of the family Flaviviridae. The virus serotypes are closely related but antigenically distinct. It is a disease with a wide clinical spectrum and a wide variety of presentations, ranging from asymptomatic to an undifferentiated fever to the more severe life threatening forms such as Dengue hemorrhagic fever (DHF)/ dengue shock syndrome (DSS[4].

Early clinical features of dengue infection are variable among patients, and initial symptoms are often nonspecific resembling any viral illness. Therefore, specific laboratory tests are necessary for an accurate diagnosis[2]. Some DF patients develop the more serious form of the disease DHF with symptoms that include a decline in fever and presentation of hemorrhagic manifestations, such as microscopic hematuria, bleeding gums, epistaxis, hematemesis, melina, and ecchymosis. These patients may progress into DSS, which can lead to profound shock and death if not treated[4].

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Clinical Diagnostic criteria of DHF (WHO)

- Sustained high fever lasting 2–7 days;
- Petechiae or epistaxis with a positive tourniquet test
- Thrombocytopenia (platelet count ≤100×109/L);
- Evidence of plasma leakage -hemoconcentration (an increase in hematocrit ≥20% above average for age, sex and population), pleural effusion and ascites[4].

Laboratory diagnosis of dengue virus infection depends upon demonstration of specific antibodies in serum samples by haemagglutination inhibition, complement fixation, neutralization test or ELISA. Reverse transcriptase PCR and hybridization probes for nucleic acid are other newer tests for diagnosis[5].

Clinical diagnosis of early dengue patients is challenging as it presents with nonspecific symptoms. Since there are many infectious diseases which have similar clinical features, a combination of clinical and laboratory parameters could be used as markers to diagnose early dengue infection[6]. Early diagnosis and monitoring is largely dependent on haematological parameters[5]. So this study aims to study the hematological profile of serologically diagnosed dengue patients.

Materials and methods

This study conducted in Department of pathology, SN Medical college, Bagalkot, included clinically suspected 175 cases of dengue with serological confirmation of either dengue specific NS1 antigen assay and/or IgM and/or IgG antibodies. The study period was from May 2019 to July 2019.

Inclusion criteria:

- Febrile patients with positive NS1 antigen with or without IgM/IgG on rapid card tests.

Exclusion criteria:

- Patients with other identified illnesses like typhoid, malaria which were coexisted with dengue positive serology were excluded from the study.
- Pre-existing chronic diseases.

Sample size: Sample size calculation done using Open Epi Software version 2.3.1. According to study conducted by Tahlan A, Bhattacharya A, Singla N, Singh R. Haematological profile of dengue fever[4]. 86.9% of patients had platelet count <1,00,000/cumm = P,P=86.9%

- At 95% confidence level and 5% absolute precision
- Sample size is 175.
- Formula used = $[DEFF*Np(1-p)]/[d^2/Z^2_{1-A/2}*(N-1)+p*(1-p)]$

Serology derived from a venous blood sample was collected from the patients presenting with symptoms suggestive of dengue. A commercially available Dengue Day1 test kit was used to detect NS1 antigen and IgM and IgG antibodies. The test results were expressed as positives/negatives for antigen and both antibodies. Patients tested positive for NS1 antigen with or without IgM/IgG positivity on rapid card test were selected for the study.

Evaluation of hematological parameter was done by collecting 2 ml of samples on EDTA prefilled bottles which were examined for Haemoglobin count, Haematocrit, Platelet count, Total leucocyte count, Differential leucocyte count. The analysis is done by the automated cell counter analyzer Pentra ES 60. Hematocrit raised >20% of normal was considered as hemoconcentration. Leukopenia was taken as total leucocyte count < 4,000 /mm^3. Thrombocytopenia was taken as platelets count < 1,00,000 /mm^3.

Information about patients obtained were entered in proformas, taken in tabulated form in excel sheet and findings were compared with similar studies.

Results

A total of 175 patients were studied, diagnosed as dengue based on rapid card tests. Haematological parameters were analysed on all 175 patients. Maximum patients 55 (31.4%) were in age group of 21-30 years [Table 1]. Their ages ranged from 16 years to 98 years with a mean age of 37.18 years. Out of 175 cases 112 (64%) were males and 63 (36%) were females. [Table 2]

Table 1: Distribution of patients according to age. n=175

Age range (in years)	No. of cases	Percentage(%)
0-10	0	0
11-20	34	19.4
21-30	55	31.4
31-40	21	12
41-50	13	7.4
51-60	35	20
>61	17	9.71

Table 2: Distribution of patients according to sex. n= 175.

Sex	No of cases	Percentage (%)
Male	112	64
Female	63	36

Table 3: Distribution of patients according to Total Leucocyte Count(TLC). n=175.

TLC (cells/mm3)	No of cases	Percentage (%)
<4000	145	82.85
>11000	2	1.14
4000-11000	28	16

Table 4: Distribution of patients according to hematocrit. n=175.

Hematocrit (%)	No of cases	Percentage (%)
<40%	76	43.42
40-45%	53	30.28
>45%	46	26.28

Table 5: Distribution of patients according to platelet count. n=175.

Grade	Platelet count (cells/mm3)	No of cases	Percentage (%)
Low normal	>1,00,000	5	2.85
Mild	60,000-1,00,000	47	26.85
Moderate	20,000-60,000	105	60
Severe	<20,000	18	10.28

Table 6: Distribution of patients according to haemoglobin percentage (Hb). n=175

Hb (gm%)	No of cases	Percentage (%)
<10	33	18.85
10-12	35	20
12-15	70	40
>15	37	21.14

In the present study total leukocyte count ranged from 1200 to 12500 cell/mm3,with mean total leukocyte count was 3568.57cell/mm^3. A total leukocyte count of less than 4,000 cell/mm3 was present in 145 (82.85%) patients whereas a total leukocyte count of more than 11,000 cell/mm^3 was present in 2 (1.14%) patients. 28 (16%) patients had total leukocyte counts between normal range [Table 3].

In the present study, hematocrit value ranged from 9.3% -55.2% with a mean value of 39.15%. 43.42% (76) of patients had hematocrit <40%. 26.28% (46) of patients were having hematocrit >45% [Table 4]. In present study, the range of platelet count was 0.045-1.25 lakhs with a mean platelet count of 52,531 cells/ cu.mm. 47 (26.85%) patients had a mild thrombocytopenia; 105 (60%) had moderate thrombocytopenia, and 18 (10.28%) had severe thrombocytopenia. In this study 5 patients had a platelet level at the lower normal level ranging from 1.0 lakhs to 1.25 lakhs.[Table 5].

In present study the hemoglobin levels among these patients ranged from 3.4-16.9 g/dl with a mean of 12.72 g/dl. 21.14% had a hemoglobin level of more than 15 g/dl [Table 6].

Discussion

Dengue is viral hemorrhagic fever which can prove fatal therefore this study aimed to elucidate the positive haematological profile of serologically diagnosed dengue patients.

In the present study, out of 175 cases 112 (64%) were males and 63 (36%) were females with male to female ratio of 1.7:1. Most of these patients were adults because they form the working age group and therefore more exposure to insect bites. Further, in India females are usually better clothed than males, hence they are less exposed. In a study done by Meena KC et al and Gitika et al the male: female ratio was found to be 1.7:1 and 1.4:1 respectively which was similar to our study[1,6].

In the present study, hematocrit value ranged from 9.3% -55.2% with a mean value of 39.15%. 43.42% (76) of patients had hematocrit <40%. 26.28% (46) of patients were having hematocrit >45%. which is similar to the findings in the study done by Meena KC et al[1] where the mean hematocrit value of dengue positive cases was 39.08% and a hematocrit value >45% was found in 13% patients, <40% found in 54% patients. Rising hematocrit levels are a marker of the critical phase of dengue infection. The extent up to which hematocrit rises from the baseline can indicate the severity of plasma leakage and progression of disease from dengue fever to dengue haemorrhagic and shock state[7].

In the present study a total leukocyte count of less than 4,000 cell/mm^3 was present in 145 (82.85%) patients whereas a total leukocyte count of more than 11,000 cell/mm^3 was present in 2 (1.14%) patients. 28 (16%) patients had total leukocyte counts between normal range. In a study by Gitika et al[6] also showed leucopenia in majority of cases with TLC ranged from 1,500- 14,400 /mm3. Mean TLC was 4,900/mm3. TLC <4,000 was seen in 43 (43%) cases and >11,000/mm3 was seen in 09 (09%) cases. Whereas study by Vibha et al[5] showed majority of cases with TLC in normal range, (39%) cases had leukocyte count <4,000/ cu.mm, 49(49%) cases had leukocyte cases count 4,000 – 11,000/cu. mm and 12 (12%) cases had leukocyte

count >11,000 cu.mm. Leucopenia is the most prominent haematological change observed in many studies sometimes with counts of less than 2,000/ mm3. However mild leucocytosis with neutrophilia is seen at the onset of the disease developing leucopenia later on.

In present study, 47 (26.85%) patients had a mild thrombocytopenia; 105 (60%) had moderate thrombocytopenia, and 18 (10.28%) had severe thrombocytopenia which is similar to the findings in the study by Meena KC et al[1] where thrombocytopenia was observed in 90% of cases whereas study done by Gitika et al[6] showed thrombocytopenia (Platelets count <1lakh/ mm3) in only 54 (54%) cases.

In present study the hemoglobin levels among these patients ranged from 3.4-16.9 g/dl with a mean of 12.72 g/dl. 21.14% had a hemoglobin level of more than 15 g/dl whereas study by Gitika et al[6] showed similar findings with hemoglobin rangeing from 7.5-17.5 g/dl, mean hemoglobin value was 12.62g/dl. 6% had a hemoglobin level more than 15g/dl.

Conclusion: Improved diagnostic modalities are essential to meet up the increasing incidence of dengue cases. Thrombocytopenia was a prominent finding in our study validating the results of previous studies. Haemoconcentration, leucopenia, thrombocytopenia, and haemoglobin levels give enough clues to test for dengue serology so that dengue cases can be diagnosed in their initial stages. This facilitates early treatment and monitoring so that fatality rates can be reduced. This would minimize morbidity and mortality arising out of serious complications of dengue fever.

Acknowledgements: We acknowledge the technical staff of the central lab.

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Date received: May 29th 2020
Date accepted: July 6th 2020

Conflict of interest: Nil
Source of funding: Nil