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Study of hematological parameters in dengue cases

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Abstract

Introduction: Dengue virus is a flavivirus spread by mosquitoes. Dengue fever is a leading cause of morbidity and mortality from arthropod-borne illnesses, particularly in tropical regions, with around 96 million cases and 20,000 to 25,000 deaths annually. Dengue is a major preventable and treatable cause of morbidity and mortality. Early diagnosis of dengue is important for provision of special care which ensures marked reduction in the morbidity. Standard diagnostic methods include RT-PCR, Ig M antibody detection and NS1 antigen detection. Hematological examination is an essential step in the management of these patients. Hematological abnormalities such as thrombocytopenia, raised hematocrit, leucopenia with relative lymphocytosis and reactive lymphocytes can be identified through a complete blood count (CBC) and peripheral blood smear. This study aims to explore the hematological profiles of dengue-positive patients and their implications for patient management.

Materials and Methods: This is a study conducted in Civil hospital, Ahmedabad over a period of 3 months. Total 100 Patients with documented IgM antibody and NS1 antigen positivity were included in the Study. Hematological analysis was obtained from an automated hematology analyzer and subsequent peripheral smears were also screened.

Results: Dengue infection was more common in the adult age group with slight male preponderance. Hematological findings like decreased platelet count in 88% cases, Leucopenia in 39% cases, raised hematocrit in 15% cases and leucopenia with relative lymphocytosis in 25% cases were observed and reactive lymphocytes were seen in 22% on peripheral smear.

Conclusion: In patients with acute febrile illness, presence of thrombocytopenia, Leucopenia with relative lymphocytosis and reactive lymphocytes on peripheral smear can help in early recognition of severe dengue infection. A raised hematocrit, Leucopenia and thrombocytopenia warn clinician regarding the likelihood of patient having dengue hemorrhagic fever. Early recognition and prevention of complications are most important for a favorable outcome of the disease.

Keywords: Dengue, hematocrit, thrombocytopenia, leucopenia, reactive lymphocyte

Introduction

Dengue is a mosquito-borne viral disease that has seen a 30-fold increase in global incidence over the past 50 years, with nearly half the world's population living in endemic regions. The World Health Organization (WHO) classifies it as one of the 17 neglected tropical diseases [1]. Annually, there are an estimated 390 million infections, with around 96 million presenting clinically. The disease is particularly severe in Southeast Asia and the Western Pacific, with countries like India, Indonesia and Thailand among the most affected [2].

Dengue Fever presents as an acute illness lasting 2 to 7 days, with symptoms such as headache, retro-orbital pain, myalgia, arthralgia, rash, hemorrhagic manifestations. Two or more of these symptoms are typically present [1].

In endemic areas, early symptoms of dengue fever mimic many other prevalent diseases such as Chikungunya, Zika virus disease, malaria, urinary tract infection, typhoid, leptospirosis etc. Hence, for proper management exclusion of these conditions is very crucial [1].

The dengue virus, belonging to the Flavivirus genus, is a small, single-stranded RNA virus with four serotypes (DENV-1, DENV-2, DENV-3, and DENV-4). Infection with one serotype provides lifelong immunity only to that type, with limited cross-protection against others. The serotypes are genetically related but distinct, containing various subtypes identified through phylogenetic analysis. The virus genome includes structural proteins (C, M, E) and non-structural proteins (NS1-NS5), with NS1 being a key marker for diagnosis and involvement in immune responses [3].

Dengue is diagnosed by Reverse Transcription Polymerase Chain Reaction (RT-PCR) and detection of NS1 Antigen along with Ig M and Ig G antibodies by Enzyme immunoassay & Immunochromatographic test [4]. Hematological abnormalities being common like Thrombocytopenia, raised hematocrit, leucopenia with relative lymphocytosis etc.; Complete blood count can help in early diagnosis of severe dengues. When combined with a peripheral smear it can help in ruling out Malaria which is another cause of mosquito borne illness that may mimic a viral hemorrhagic fever. Both these tests can be deployed with low cost even in remote areas. Hematological parameter can provide valuable insights into disease severity and prognosis.

Aims and Objectives

1. To identify key hematological parameters that are altered in patients with dengue infection and could serve as reliable prognostic marker. In present study we assess incidence of leucopenia, Leucopenia with relative lymphocytosis, presence of reactive lymphocytes, platelet count variations including occurrence of thrombocytopenia and raised hematocrit levels in dengue positive patients.
2. To assess the significance of hematological marker for monitoring dengue progression including platelet count and hematocrit levels which may indicate worsening or recovery and guiding patient management.

Materials and Methods

This study is conducted in the Department of Pathology, B.J. Medical College and Ahmedabad for a period of 3 months. Total 100 patients of both genders admitted to wards with a diagnosed case of Dengue fever were included in this study. Results of positive Ig M antibody and the NS-1 Antigen Test were obtained from Laboratory Information System (LIS). Hematological analysis was carried out using an automated hematology analyzer and subsequently, Leishman stained peripheral blood smear were examined.

Results

Total 100 dengue positive patients included in the study and results are as follows

Table 1: Age and Gender wise distribution of cases

Age group	Male	Female	Total No of cases
11-20	18	16	33
21-30	23	17	42
31-40	6	7	12
41-50	5	5	10
51-60	1	1	2
61-70	1	0	1
Total	54	46	100

Cases ranged from 11-70 years of age with a maximum number of patients in the third decade. (Table 1). The male to female ratio is approximately 1.17:1. (Table 1).

Table 2: Clinical spectrum of cases

	Total
Degue fever	62
Dengue hemorrhagic fever	34
Dengue shock syndrome	4
	100

Majority of patient (62) were having Dengue fever. While 34 cases had dengue hemorrhagic fever and 4 cases were of Dengue shock syndrome (Table 2).

Distribution of hematocrit levels among DF, DHF and DSS is given in the Table 3, showing 15% of the cases had raised hematocrit suggesting hemo concentration. The majority of DF cases had hematocrit between 35-40%, while DHF cases were more frequently seen in 35-40% range. All DSS cases had hematocrit>40%.

Table 3: Hematocrit of patients

Hematocrit	DF	DHF	DSS	No of cases
<30	1	4	0	5
30-35	5	6	0	11
35-40	28	11	0	31
40-45	23	6	1	38
>45	5	7	3	15
Total	62	34	4	100

Table 4: Platelet count of patients and correlation of platelet count with bleeding

Platelet (per mm^3)	DF	DHF	DSS	No of cases	No of cases with bleeding
>100000	12	0	0	12	0
60-100000	17	1	0	18	0
20000-60000	33	20	2	55	16
<20000	0	13	2	15	12
Total	62	34	4	100	28

Laboratory investigations revealed that the most common haematological abnormality was thrombocytopenia. In present study out of 100 cases of dengue fever, 88 cases had thrombocytopenia, in which 55 patients had platelet count between 20,000-60,000, out of these 55 patients, 16 patients had bleeding manifestation. 15 patients had platelet count less than 20000(severe thrombocytopenia) and out of them 12 patients had bleeding manifestation. (Table 4)

Table 5: Total Leucocyte count of patients

Total leucocyte count (per cumm)	DF	DHF	DSS	No of cases (%)
<4000	13	23	3	39
4000-11000	41	9	1	51
>11000	8	2	0	10
Total	62	34	4	100

Total leucocyte counts were grouped as leucopenia, leucocytosis, and normal WBC count (Table 5). 39% cases had leucopenia.

Table 6: Lymphocyte% with relation to leucocyte count

Lymphocyte (%)	Total leucocyte count (per mm^3)			Total No of Cases
	<4000	4000-11000	>11000	
< 40%	14	43	6	63
> 40%	25	8	4	37
	39	51	10	100

37% of the patients had Lymphocyte percentage is more than 40%, 25% cases had leucopenia with relative lymphocytosis (Table 6).

In some cases, Peripheral smear showed reactive lymphocytes, showing dark basophilic cytoplasm and large nucleus while had plasmacytoid morphology (Figure1 and 2).

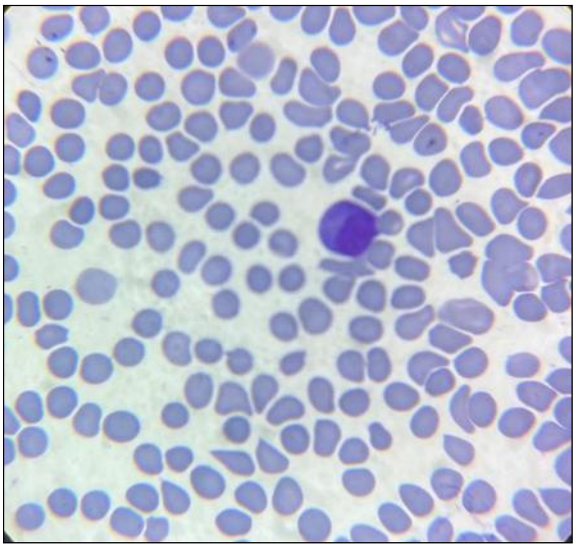

Fig 1: Lymphocyte showing dark basophilic cytoplasm and large nucleus

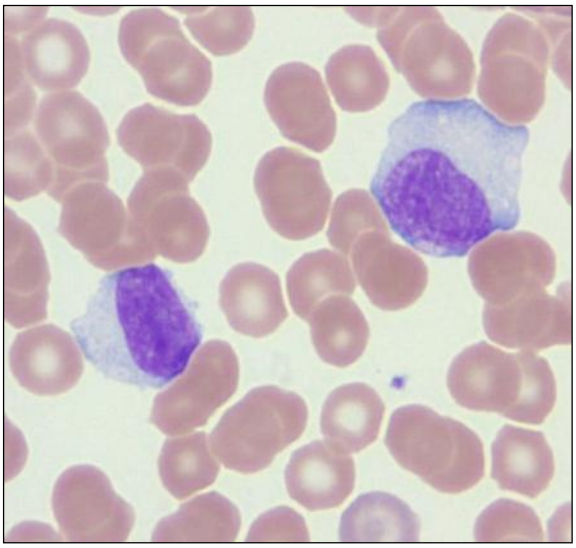

Fig 2: Lymphocyte has plasmacytoid morphology

Table 7: Summary of Hematological findings observed in dengue cases

Hematological abnormality	No of cases
Hematocrit>45	15
Thrombocytopenia(<100000/mm^3)	88
Leucopenia	39
Leucopenia with relative lymphocytosis	25

Discussion

Hematological parameters of 100 Patients with documented IgM antibody and NS1 positivity were seen during our the study.

Table 8: Comparision of age and Gender distribution

	Study by Deshwal *et al.* [5]	Study by Meena *et al.* [6]	Present study
Male:Female ratio	2.67:1	1.70:1	1.17:1
Majority of patients in age group	21-40 (62.91%)	21-40 (50%)	21-40 (54%)

Studies by Deshwal *et al.* and Meena *et al.* were showing male preponderance in dengue positive cases [6, 7]. Similar results were seen in our study in which the M:F ratio was 1.17:1. This may be due to the increased risk of exposure of male gender to mosquito bites during outdoor occupational activities (Table 8).

In the present study majority of patients i.e., 54 cases were in the age group of 21-40 years. It was more common in younger population. Observations made by Meena *et al.* showed that majority of patients 50% were in age group of 21-40 years which is almost similar to the present study [6]. This may be due to young adults are being more active outside from the home. (Table 8).

Table 9: Comparision of Clinical profile of the disease

	DF	DHF	DSS
Study by Meena *et al.* [6]	84%	12%	2%
Study by Farhan F *et al.* [7]	70%	23%	7%
Study by Supriya *et al.* [8]	88%	10.9%	0.9%
Present study	62%	34%	4%

Dengue fever was common clinical spectrum observed in present study. Similar findings were noted by Farhan F *et al.*, Meena *et al.* and Supriya *et al.* [7, 8] (Table 9).

Table 10: Comparision of no of platelet counts and bleeding manifestation

	Platelet count/mm^3				No of cases with bleeding (%)
	<20000	20000-60000	60000-100000	>100000	
Study by Meena *et al.* [6] (%)	15	61	14	10	14
Study by Supriya K *et al.* (%) [8]	15.33	41.33	28	15.33	13.80
Present study (%)	15	55	18	12	28

Platelet count is a crucial parameter in predicting hemorrhagic complications in dengue. Thrombocytopenia is due to the direct and antibody mediated destruction of platelets and megakaryocytes and also due to suppression of bone marrow by virus [9]. The most significant laboratory abnormality seen in our patients was thrombocytopenia (88%), as also observed by Study by Meena *et al.* and Supriya K *et al.* [6, 8] (Table 10).

Bleeding manifestation was noted in 28% cases. Observation made by Meena *et al.* bleeding was seen in 14% cases and Study by Supriya K *et al.* observed bleeding in 13.80% cases [6, 8]. Bleeding manifestation observed in 12 cases out of 15 cases of severe thrombocytopenia (<20000/mm^3) so bleeding incidence was 80%. Thus thrombocytopenia emphasizes the need for platelet monitoring to guide clinical management (Table 10).

In present Study, majority of DHF and DSS had moderate and severe thrombocytopenia (Table-4) Study by Azin FR, also observed moderate and severe thrombocytopenia in DHF cases [9].

Table 11: Comparision of hematocrit value with other studies

	Study by Patel *et al.* (%) [10]	Study by Meena *et al.* (%) [6]	Study by Md. Yousuf K *et al.* (%) [11]	Presest study
Hematocrit concentration >45	11.54	13	23.33	15

The rise in hematocrit was due to hemoconcentration attributed to plasma leakage as a result of increased capillary permeability. Hemoconcentration with an increase in the hematocrit of 20% or more is considered to be definitive evidence of increased vascular permeability and plasma leakage [12]. Monitoring hematocrit trends can help predict disease progression, particularly in patient at risk for DHF and DSS.

Table 12: Comparision of leucocyte count with different study

Leucocyte count/cumm	Study by Supriya *et al.* (%) [8]	Study by Patel *et al.* (%) [10]	Present study (%)
<4000	34.2	59.62	39
4000-11000	60.9	41.54	51
>11000	4.7	1.54	10

Leucopenia is a well-known manifestation in dengue, caused by viral suppression of bone marrow, which limits WBC production. In our study 39% of patients were having leucopenia. A study by Supriya *et al.* showed leucopenia in 34.2% of cases and in the study by Patel *et al.*, leucopenia was seen in nearly half the patients (56.92%) [8, 10]. (Table 12).

In present study, majority of DHF cases show leucopenia (Table-5). Study by Azin FR and *et al.*, also observed leukopenia was more pronounced in DHF [10]. Lymphocyte percentage >40% were seen in over 37% of patients in our study, which is comparable to findings by Patel *et al*., where 49.23% of dengue patients exhibited lymphocyte count >45%[10]. The percentage of lymphocytes in differential leucocyte count predict duration of the hospital stay. The higher the percentage of Lymphocytes, faster the recovery. This particularly important in remote areas. High risk patients can be reffered to a higher center before they develop complication of disease [13].

Table 13: Comparision of lymphocyte count percentage with different study

	Lymphocyte Count	No of cases
Study by Patel *et al.* [10]	>45%	49.23%
Present study	>40%	37%

Table 14: Different study showing Lecopenia with relative lymphocytosis

Cases show Lecopenia with relative Lymphocytosis	
Study by Supriya *et al.* [9]	40.2%
Study by Patel *et al.* [10]	16.15%
Present study	25%

Leucopenia with relative Lymphocytosis were seen in 25% cases. Study by Supriya at *et al.* and Study Patel *et al*. also observed leucopenia with relative lymphocytosis in 16.15% cases and 25% cases respectively.

Reactive lymphocytes was observed on peripheral smear in many cases. Similar observations were seen in studies done by Smita kadadavar [14] and Singh Yadav [15].

Conclusion

In present study, significant number of the cases in our study had thrombocytopenia, raised hematocrit, Leucopenia and reactive lymphocytes. Leucopenia, thrombocytopenia and raised hematocrit may serve as warning signs of possible dengue hemorrhagic fever. Understanding these indicators may help clinicians for timely management and more favorable outcomes.

Competing Interests

No conflict of interest.

Financial Support

Not available.

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