



ISSN (P): 2617-7226  
ISSN (E): 2617-7234  
[www.patholjournal.com](http://www.patholjournal.com)  
2024; 7(3): 01-03  
Received: 01-04-2024  
Accepted: 05-05-2024

**Dr. Kartikiben Rameshbhai Patel**  
3<sup>rd</sup> Year Resident, Department of Pathology, B. J. Medical College and Civil hospital, Ahmedabad, Gujarat, India

**Dr. Vaishali Anand**  
Assistant Professor, Department of Pathology, B. J. Medical college and Civil hospital, Ahmedabad, Gujarat, India

**Dr. Naziyabanu Mo Iqbal Momin**  
3<sup>rd</sup> Year Resident, Department of Pathology, B. J. Medical College and Civil hospital, Ahmedabad, Gujarat, India

**Dr. Hansa Goswami**  
Head of Department, Department of Pathology, B. J. Medical college and Civil hospital, Ahmedabad, Gujarat, India

**Corresponding Author:**  
**Dr. Kartikiben Rameshbhai Patel**  
3<sup>rd</sup> year resident, Department of Pathology, B. J. Medical College and Civil hospital, Ahmedabad, Gujarat, India

## Diagnostic importance of hematological parameters in dengue fever

**Dr. Kartikiben Rameshbhai Patel, Dr. Vaishali Anand, Dr. Naziyabanu Mo Iqbal Momin and Dr. Hansa Goswami**

**DOI:** <https://doi.org/10.33545/pathol.2024.v7.i3a.575>

### Abstract

**Introduction:** Dengue fever is one of the commonest arthropod-borne viral infections in tropical and subtropical countries. The virus is usually transmitted by the bite of female *Aedes Aegypti* mosquito (day biting) and outbreak occurs during rainy seasons. Other dengue virus vector is *Aedes Albopictus*. After the bite of mosquito, virus infect immature dendritic cells of skin through non-specific receptors. The dendritic cells migrate to lymph node and present viral antigens to T cells, this leads to activation of humoral and cellular immune response. Dengue begins after an incubation period of 4-7 days. There are four clinical syndromes: 1) Undifferentiated fever 2) Classical Dengue fever 3) Dengue haemorrhagic fever 4) Dengue shock syndrome. Therefore, early and rapid diagnosis is very important for patient management.

**Objectives:** To emphasize the importance of complete blood count and peripheral smears' findings in suspected dengue patients to make early diagnosis and prompt treatment.

**Methods:** Cross sectional observational study was carried and study included patients presenting with chief complaints of fever, headache and joint pain at the time of admission. Complete blood count and peripheral smear examination was done on each patient's venous sample collected in EDTA vacutainer. After analysing the sample with clinical correlation, samples showing leucopenia with relative lymphocytosis, thrombocytopenia and presence of reactive lymphocytes on smear were sorted out.

**Results:** This study includes 50 dengue positive patients in month of May and June 2024. Out of 50 Thrombocytopenia is seen in 35 cases (70%), Leucopenia is seen in 30 cases (60%), Lymphocytosis is seen in 35 cases (70%), Hematocrit >45% was seen in 8 cases, Reactive lymphocytes are seen in 26 cases (52%).

**Conclusion:** Through the above study it was concluded that hematological parameters (Leucopenia, Lymphocytosis, Thrombocytopenia) are an important diagnostic clue for dengue fever.

**Keywords:** Dengue, thrombocytopenia, leucopenia, reactive lymphocytes, hematocrit

### Introduction

Dengue fever is one of the commonest arthropod borne viral infections in tropical and subtropical countries having highest prevalence in Southeast Asia. Dengue is caused by one of the four serotypes of dengue virus (DENV 1, DENV 2, DENV 3, DENV 4) also referred to as a arbovirus that belongs to genus flavivirus of family Flaviviridae [1, 2]. Dengue virus infection is known to exist in India for a long time [3]. In developing nations like India, unplanned urbanization and migration of population from rural to urban areas with complete lack of proper sanitization facilities are important factors resulting in this situation [4].

The virus is usually transmitted by the bite of female *Aedes Aegypti* mosquito (day biting) and outbreak occurs during rainy seasons. Other dengue virus vector is *Aedes Albopictus*. After the bite of mosquito, virus infects immature dendritic cells of skin through non-specific receptors. The dendritic cells migrate to lymph node and present viral antigens to T cells, this leads to activation of humoral and cellular immune response. The virus consists of a spherical particle (40-50 nm) with a lipopolysaccharide envelop. Single stranded RNA genome encodes 3 structural glycoproteins: capsid(C), membrane (M) and envelope (E) and 7 non-structural proteins: NS1, NS2A, NS2B, NS3, NS4A, NS4B, and NS5.

Dengue begins after an incubation period of 4-7 days. Clinical features include: Sudden onset of fever, Frontal headache, Retro orbital pain, Back pain with severe myalgia. It is also known as backbone fever due to these symptoms. Often a transient macular rash appears on the first day with additional symptoms usually includes anorexia, nausea or vomiting.

Near the time of defervescence on day 3-5, a maculopapular rash appears first on the trunk and spread to the extremities and the face [6]. Epistaxis and scattered petechiae often noted in uncomplicated cases. Complicated cases are associated with hemorrhagic manifestation.

There are four clinical syndromes: 1) Undifferentiated fever 2) Classical Dengue fever 3) Dengue hemorrhagic fever 4) Dengue shock syndrome. Clinical diagnosis can be difficult as signs and symptoms are easily confused with malaria, leptospirosis and typhoid fever[1]. There is no specific treatment or vaccine currently available to this infection. Therefore, early and rapid diagnosis is very important for patient management.

**Aims and objectives**

To emphasize the importance of complete blood count and peripheral smears’ findings in suspected dengue patients to make early diagnosis and prompt treatment.

**Materials and Methods**

A cross sectional observational study was carried out on a series of patients attending and admitted in tertiary care centre, B.J. Medical College, Civil Hospital, Ahmedabad in month of April and May 2024.

Study included patients presenting with chief complaints of fever, headache and joint pain at the time of admission. Complete blood count and peripheral smear examination was done on each patient’s venous sample collected in EDTA vacutainer. After analysing the sample with clinical correlation, samples showing leucopenia with relative lymphocytosis, thrombocytopenia and presence of reactive lymphocytes on smear were sorted out. These patients were then advised NS1 antigen test (0-5 days of onset of fever/illness) or IgM antibody test and titer (more than 5 days of illness). 31patients positive for NS1 antigen and 19 patients positive for IgM antibody were then selected, making a total of 50 Dengue positive patients. The results then compared and correlated with the CBC & peripheral smear findings.

**Results**

These studies include 50 dengue positive patients in month of May and June 2024. With 30 males and 20 females male: female ratio is 1.5:1. Leucopenia, Lymphocytosis, thrombocytopenia, reactive lymphocytes and hematocrit of each patient was recorded and no. of patients having presence of particular parameter were then sorted out, showing the following results.

**Table 1: Platelet Count of Patients**

Platelet count(/cumm)	No. of patients (out of 50)
>150000 (ADEQUATE)	15
1,00,000-1,50,000 (REDUCED ON SMEAR)	10
60,000-1,00,000 (MILD THROMBOCYTOPENIA)	10
20,000-60,000 (MODERATE THROMBOCYTOPENIA)	12
<20,000 (SEVERE THROMBOCYTOPENIA)	3

Therefore Thrombocytopenia is seen in 35 cases (70%).

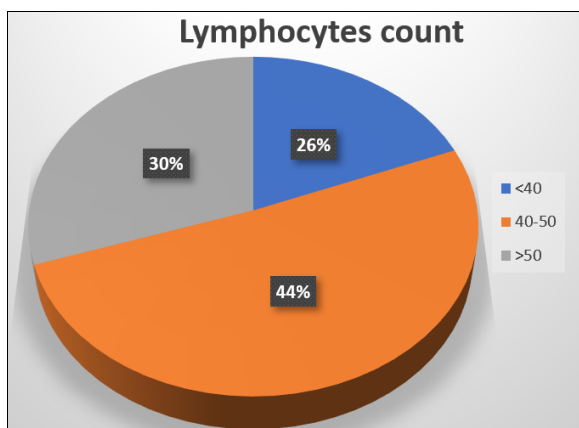
**Table 2: Total Leucocyte Count of Patients**

TLC (/cumm)	No. of patients (Out of 50)
<4000	30
4000-11000	15
>11000	5

Therefore leucopenia is seen in 30 cases (60%).

**Table 3: Lymphocytes (Differential Count)**

Lymphocytes	No. of patients (out of 50)
<40	15
40-50	22
>50	13



**Fig 1: Lymphocytosis is seen in 35 cases (70%)**

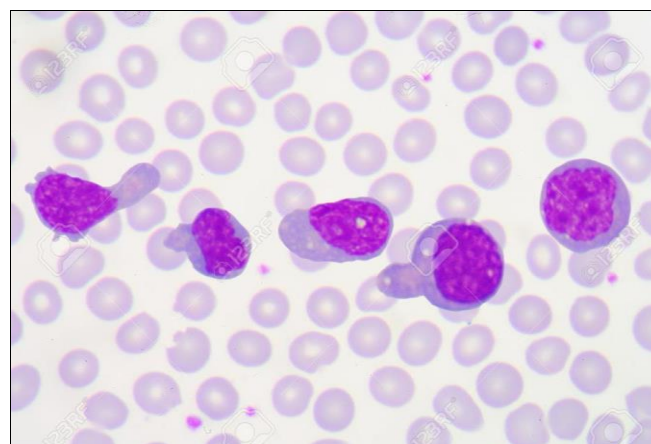
**Table 4: Hematocrit of patients:**

Hematocrit	No. of patients (out of 50)
<35	8
35-45	34
>45	8

In our study hematocrit >45% was seen in 8 cases. Rising hematocrit is evidence of plasma leakage due to increased vascular permeability indicating of hemorrhagic manifestation. So, majority of patients had classical symptoms without any adverse sequalae.

**Reactive lymphocytes**

Reactive lymphocytes are seen in 26 cases (52%).



**Fig 2: Reactive Lymphocytes**

These lymphocytes had increased cell size, increased amount of cytoplasm with characteristic tailing pattern of cytoplasm along with increased cytoplasmic basophilia.

## Discussion

### Laboratory investigation thus helps in diagnosis

Infection with one serotype confirms immunity to that serotype only. Cross reactive anti dengue antibodies from previous infection bind to new infecting serotype and

enhance viral uptake by monocytes and macrophages. This antibody dependent mechanism results in enhanced cascade of cytokines and complement activation causing endothelial dysfunction and consumption of coagulation factors leading to plasma leakage and hemorrhagic manifestations. Raised hematocrit is due to plasma leakage due to cytokines release and leucopenia and thrombocytopenia is due to virus induced bone marrow suppression [6].

**Table 5:** Comparison of hematological parameters: my study with munde dd and dussart p study

	Leucopenia with relative Lymphocytosis	Reactive Lymphocytes	Thrombocytopenia
Present study	60%	52%	70%
Munde DD. <i>et al</i> [4]	57%	52%	68%
Dyssart P. <i>et al</i> [7]	63%	72%	81%

NS1 antigen detection by ELISA method is done in acute phase of illness (0-5 days following the onset of symptoms or fever) [7]. IgM detection test by ELISA method - different pattern of antibody response is observed in primary and secondary infection. In primary infection, IgM detected 5 or more days after onset of illness and IgG from 10-15 days. In secondary infection, IgM appear earlier or same time frame but at lower titer while IgG increase rapidly [8]. Dengue antigen detection test by immunohistochemistry, immunofluorescence, Isolation of dengue virus and RNA are other methods used for diagnosis.

## Conclusion

Through the above study it was concluded that hematological parameters (Leucopenia, Lymphocytosis, Thrombocytopenia) are an important diagnostic clue for dengue fever. That give rise to enough time for treatment and management, early and prompt diagnosis of any symptoms with complete haemogram and dengue test can save a life rather than waiting for symptoms to progress and deteriorate.

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### How to Cite This Article

Patel KR, Anand V, Momin NMI, Goswami H. Diagnostic importance of hematological parameters in dengue fever. *International Journal of Clinical and Diagnostic Pathology.* 2024;7(3):01-03.

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