RESEARCH PAPER

Assessment of Complete Blood Count Parameters for Differentiating Dengue from Non-Dengue Febrile Illness: A Comparative Study in a Resource-Limited Setting in Rural Thiruvallur, Tamil Nadu

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ABSTRACT

Background: In India, dengue fever—a virus spread by mosquitoes—remains a serious public health concern, especially in areas with little resources and few sophisticated diagnostic tools. One widely accessible and reasonably priced test that may offer early diagnostic hints is the Complete Blood Count (CBC).

Materials and Methods: This retrospective observational study was carried out between October 2023 and March 2024 in Nemilichery, Thiruvallur District, Tamil Nadu, with 425 febrile patients (79 dengue; 346 non-dengue). Descriptive statistics, t-tests, chi-square tests, and logistic regression were used to assess laboratory, clinical, and demographic data.

Results: Dengue patients were hospitalized more frequently (22.8% vs. 0%, $p<0.001$) and were substantially younger (mean 25.2 vs. 30.7 years, $p=0.015$). Dengue patients had lower platelet counts (208.6 vs. 267.4 $\times10^3/\mu L$, $p<0.001$), WBC counts (5.47 vs. 7.48 $\times10^3/\mu L$, $p<0.001$), and eosinophil percentages (1.42% vs. 2.22%, $p=0.029$), while other parameters remained equivalent. The prevalence of abnormalities in urinalysis was substantially higher in non-dengue subjects ($p<0.001$). Thrombocytopenia, leukopenia, and eosinopenia were found to be independent predictors of dengue by logistic regression, accounting for approximately 31% of diagnostic variability. In healthcare settings with limited resources, practical cut-offs (platelets <150,000/µL; WBC <5,000/µL; eosinophils <1.5%) may facilitate quick triage and early intervention.

Keywords: Dengue Fever, Complete Blood Count, Thrombocytopenia, leukopenia, eosinopenia

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INTRODUCTION

Dengue fever, a mosquito-borne viral disease caused by the dengue virus (DENV), has emerged as one of the most serious and rapidly spreading public health concerns globally. The World Health Organization (WHO) estimates that approximately 390 million dengue infections occur annually, of which nearly 96 million are clinically apparent, ranging from mild dengue fever to severe manifestations like dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS) [1]. The disease is endemic in over 100 countries, with the highest burden concentrated in Southeast Asia, the Western Pacific, and the Americas [2]. In India, recurrent outbreaks of dengue have placed enormous strain on public health systems, particularly in low-resource settings where access to advanced diagnostic modalities is limited.

The Complete Blood Count (CBC) is one of the most widely used and reasonably priced tests in basic and secondary healthcare. Leukopenia, thrombocytopenia, hemoconcentration (high haematocrit), and lymphocytosis are examples of haematological abnormalities that are commonly seen in dengue and have been used as supportive criteria for diagnosis in endemic situations [3,4]. These anomalies are linked to both the host-induced immune response and direct viral effects on the bone marrow [4]. But these alterations are not unique to dengue; they can also be observed in other feverish diseases such typhoid, malaria, chikungunya, and viral respiratory infections, which can make diagnosis difficult [4].

In resource-limited settings where serological and molecular tests for dengue diagnosis such as NS1 antigen, IgM/IgG ELISA, or RT-PCR are either unavailable or delayed, CBC parameters may serve as essential early indicators. Several studies have suggested that patterns such as persistent thrombocytopenia and a rise in hematocrit are more predictive of dengue than in other febrile illnesses [4]. Despite this, the utility of CBC in differentiating dengue from non-dengue fevers remains under-explored in community health centres and district hospitals, particularly in rural areas.

In light of this, it is imperative to look into whether a methodical examination of CBC parameters might assist in promptly and affordably differentiating dengue from other feverish conditions. Clinicians can make well-informed judgments on hospitalization, fluid therapy, and complication monitoring with the help of this

differentiation. Furthermore, during dengue outbreaks, finding trustworthy haematological indicators might greatly improve the triage procedure in high-volume settings.

Therefore, this study aims to compare the CBC parameters between laboratory-confirmed dengue patients and febrile patients without dengue in a resource-limited healthcare setting. The findings are expected to contribute to improving early diagnostic accuracy and guiding clinical management in similar healthcare environments.

METHODOLOGY

A Retrospective observational study done in Nemilichery, Thirunindravur, an urban field practice area attached to a medical college in Thiruvallur District, Tamil Nadu, India, approximately 35,451 urban residents. The duration of the study was six months (October 2023 to March 2024), all febrile patients who attended the outpatient department (OPD) were selected.

Inclusion Criteria: Patients of all ages presenting with acute febrile illness, patients who underwent complete blood count (CBC) testing, 3 or more days of fever at the time of presentation were included for the study.

Exclusion Criteria: Patients with a history of chronic medical conditions affecting CBC parameters (e.g., chronic kidney disease, hematological disorders), febrile patients who are already diagnosed with a confirmed infectious cause other than dengue (e.g., malaria, pneumonia, otitis media)

DATA COLLECTION

In the present retrospective study, 425 individuals with feverish illnesses were included. The medical information was used from the Medical information Department. Age, gender, complete blood count (CBC) characteristics (total leukocyte count, differential count, hematocrit, platelet count, hemoglobin), dengue test findings (NS1 antigen, IgM), length of fever, and admission status (OPD or hospitalized) were among the information gathered. Patients were divided into two groups: non-dengue febrile (negative for both NS1 and IgM, n = 346) and dengue-positive (NS1 antigen or IgM positive, n = 79). Descriptive statistics (means, standard deviations, frequencies, percentages) were used for all variables in the statistical analysis; t-tests were used for continuous data and chi-square tests for categorical data, such as gender distribution and admission status; and logistic regression was used for predictive analysis to find CBC parameters linked to dengue positivity.

Ethical Considerations: The study is entirely retrospective and record-based using anonymized secondary data. No direct patient involvement; HIPAA-compliant measures taken to mask identifiers.

RESULTS

The present study included a total of 425 patients – 79 with confirmed dengue and 346 with non-dengue febrile illness, presenting to a resource limited health care facility. The analysis focused on demographic characteristics, hospitalization rates, complete blood count (CBC) parameters, urinalysis findings and multivariate predictors of dengue. The present study results were tabulated.

Demographic and clinical characteristics

The mean age of dengue patients (25.2 +/- 15.1 years) was significantly lower than that of non-dengue patients (30.7 +/- 18.3 years, $p = 0.015$). The age group most affected in both categories was 19 – 35 years. However, the difference across age categories was not statistically significant ($p = 0.34$). There was no significant gender difference between groups (dengue: 53.2% male, 46.8% female; non dengue: 54.3% male, 45.7% female; $p = 0.85$).

Day of illness at presentation and Hospital Admission:

Day 3 was most common for both groups (dengue: 29%; non dengue: 27%). Hospitalization was significantly more frequent among dengue patients (22.8%) compared to none in the non-dengue group ($p<0.001$), suggesting greater illness severity or adherence to dengue specific protocols upon diagnosis.

Haematological findings (CBC Profile)

Thrombocytopenia and leukopenia were significantly more prominent in dengue patients(both $p<0.001$) This finding is consistent with prior Indian and global studies highlighting platelet and leukocyte suppression in dengue infection [4]. Eosinopenia (lower eosinophil percentage) also showed statistical significance ($p=0.029$). Similar observations of eosinophil suppression during acute viral febrile illness have been reported in dengue cohorts [5]. Other cell lines (neutrophils, lymphocytes, monocytes, and basophils), haemoglobin and haematocrit were not significantly different between two groups (Table 1).

Table 1: Comparison of Hematological Findings Among Dengue and Non-Dengue Patients

Parameter	Dengue (Mean ± SD)	Non-Dengue (Mean ± SD)	p-value	Interpretation
Platelet count	208.6 ± 83.3 x10³/µL	267.4 ± 82.4 x10³/µL	<0.001	Lower in dengue (Thrombocytopenia)
WBC (TLC)	5.47 ± 2.94 x10³/µL	7.48 ± 3.41 x10³/µL	<0.001	Lower in dengue (Leukopenia)
Eosinophils (%)	1.42 ± 2.30	2.22 ± 3.04	0.029	Lower in dengue (Eosinopenia)
Hemoglobin (Hb)	12.95 ± 1.77	12.86 ± 2.27	0.73	Comparable
Hematocrit (PCV)	41.76 ± 4.77	41.49 ± 6.44	0.73	Comparable
Neutrophils (%)	64.1 ± 17.2	65.5 ± 16.5	0.52	Comparable
Parameter	Dengue (Mean ± SD)	Non-Dengue (Mean ± SD)	p-value	Interpretation

Platelet count	208.6 ± 83.3 x10³/µL	267.4 ± 82.4 x10³/µL	<0.001	Lower in dengue (Thrombocytopenia)
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Neutrophils (%)	64.1 ± 17.2	65.5 ± 16.5	0.52	Comparable

Urine analysis

Abnormal urinalysis findings (urine WBCs, leukocyte esterase, proteinuria) were significantly more common in the non-dengue group (p<0.001), supporting their value in favouring bacterial or non-dengue infections.

Logistic regression analysis

Independent predictors for dengue

Lower platelet count (p<0.001)

Lower WBC (p<0.001)

Lower eosinophil percentage (p=0.043)

Age and admission status were not significant independent predictors after adjusting for CBC parameters

The CBC based model explained approximately 31% of the diagnostic variability for dengue.

The predictive cut-offs for practical use (e.g., platelets <150000/µL; WBC <5,000/µL; eosinophils <1.5%) could be inferred for rapid triage in resource poor settings.

Table 2: Comparison of Demographic Characteristics between Dengue and Non-Dengue Cases (n = 425)

Variable	Dengue (n = 79)	Non-Dengue (n = 346)	p-value (Chi-square)
Gender	Male: 53.2% Female: 46.8%	Male: 54.3% Female: 45.7%	0.85 (NS)
Age (mean ± SD)	25.2 ± 15.1 years	30.7 ± 18.3 years	0.015 (t-test)
Age Categories	Most common: 19–35 yrs (54.4%)	Most common: 19–35 yrs (49.7%)	0.34 (NS)

Interpretation: No significant gender difference.

The dengue group was significantly younger, indicating a higher burden in younger adults (p = 0.015).

Table 3: Age-wise Distribution of Dengue and Non-Dengue Cases

Category	0–15 yrs	15–35 yrs	35–60 yrs	>60 yrs	Chi² p = 0.338
Dengue (%)	36.7%	54.4%	8.9%	0%	Not significant
Non-Dengue (%)	33.2%	49.7%	16.8%	0.3%	

Table 4. Comparison of Gender Distribution between Dengue and Non-Dengue Cases

Group	Male (%)	Female (%)	p = 0.851
Dengue	53.2%	46.8%	NS
Non-Dengue	54.3%	45.7%	

Gender did not differ significantly between groups in terms of dengue prevalence or CBC profile.

Table 5: Clinical Profile and Hospital Admission Status of Dengue and Non-Dengue Cases

Variable	Dengue	Non-Dengue	p-value
Days of Illness at Visit	Day 3 most frequent (29%)	Day 3 is most frequent (27%)	Not analyzed
Hospital Admission	22.8% (n = 18)	0%	<0.001

Significant association between dengue diagnosis and hospital admission (Chi-square = 82.3, p < 0.001).

Table 6: Association between Dengue Status and Hospital Admission

Group	Admitted (%)	Not Admitted (%)	p-value
Dengue (n=79)	22.8% (n=18)	77.2% (n=61)	< 0.001 (Chi^2)
Non-Dengue	0% admitted	100% not admitted	

Dengue diagnosis showed significant association with hospital admission, likely reflecting severity.

CBC abnormalities (esp. platelet and WBC trends) appear concordant with severity response.

Table 7: Comparison of Hematological Parameters between Dengue and Non-Dengue Cases

Parameter	Dengue (Mean ± SD)	Non-Dengue (Mean ± SD)	p-value (t-test)	Interpretation
Hemoglobin (Hb)	12.95 ± 1.77	12.86 ± 2.27	0.73 (NS)	Comparable
Hematocrit (PCV)	41.76 ± 4.77	41.49 ± 6.44	0.73 (NS)	Comparable
Platelet count	208.6 ± 83.3 x10^3/µL	267.4 ± 82.4 x10^3/µL	<0.001	Significantly lower in dengue
Total WBC (TLC)	5.47 ± 2.94 x10^3/µL	7.48 ± 3.41 x10^3/µL	<0.001	Significantly lower in dengue (Leukopenia)
Neutrophils (%)	64.1 ± 17.2	65.5 ± 16.5	0.52 (NS)	Comparable
Lymphocytes (%)	27.5 ± 15.6	25.9 ± 14.2	0.37 (NS)	Comparable
Monocytes (%)	5.96 ± 3.06	5.53 ± 2.09	0.15 (NS)	Slightly higher in dengue (NS)
Eosinophils (%)	1.42 ± 2.3	2.22 ± 3.04	0.029	Lower in dengue
Basophils (%)	0.37 ± 0.24	0.40 ± 0.25	0.39 (NS)	Comparable

Dengue was significantly associated with lower platelet count (thrombocytopenia), lower WBC count (leukopenia) and lower eosinophils. These parameters statistically differ from non-dengue febrile patients ($p < 0.05$), supporting CBC's diagnostic utility.

No statistically significant differences were noted in hemoglobin, hematocrit, neutrophils, lymphocytes, monocytes, MCV, MCH, or MCHC.

Table 8: Association of Urine Examination Findings with Dengue Status

Parameter	Association with Dengue	Significance
Urine WBCs, leukocyte esterase, and proteinuria	Significantly more abnormalities in non-dengue group	$p < 0.001$

Urinary abnormal findings help rule out dengue in favour of bacterial infections.

Table 9: Summary of Significant Differences between Dengue and Non-Dengue Cases

Category	Dengue (n = 79)	Non-Dengue (n = 346)	Significance
Age (yrs) mean ± SD	25.2 ± 15.1	30.7 ± 18.3	$p = 0.015$
Platelets (10^3/µL)	208.6 ± 83.3	267.4 ± 82.4	$p < 0.001$
WBC (10^3/µL)	5.47 ± 2.94	7.48 ± 3.41	$p < 0.001$
Admission (%)	22.8%	0%	$p < 0.001$
Eosinophils (%)	1.42 ± 2.30	2.22 ± 3.04	$p = 0.029$

Table 10: Multivariable Logistic Regression Analysis of Factors Associated with Dengue Infection

Variable	Coefficient	Std. Error	z	p-value	95% CI	Interpretation
Intercept	2.34	0.65	3.58	0.0003	1.06, 3.62	-
Platelet	-0.0084	0.0019	-4.39	<0.0001	-0.0121, -0.0046	Lower platelets = higher odds of dengue
WBC	-0.224	0.053	-4.25	<0.0001	-0.327, -0.121	Lower WBC = higher odds of dengue
Eosinophils	-0.153	0.076	-2.02	0.043	-0.301, -0.005	Lower eosinophils = higher odds of dengue
Age	-0.0105	0.0099	-1.05	0.293	-0.030, 0.009	Not significant
Admission	+24.69	24,478.53	0.001	0.999	-47,952, 48,002	Not significant (model instability due to small

						number of admissions)

Key Findings in logistic regression analysis:
Lower platelet count, lower total WBC count, and lower eosinophil percentage are each independently associated with higher odds of dengue diagnosis in this dataset ($p < 0.05$ for each).
Age and admission status did not show significant independent predictive value after adjusting for CBC parameters, though younger age is descriptively more common among dengue cases.
The model overall is highly significant, accounting for roughly 31% of the outcome variability.

DISCUSSION

Consistent with the published literature and clinical guidelines, this study confirms that CBC parameters provide valuable , cost – effective initial markers for differentiating dengue from other febrile illnesses, particularly in resource – limited environments without ready access to serological or molecular diagnostics.
Interpretation of key findings
Thrombocytopenia and leukopenia: This finding is consistent with prior Indian and global studies highlighting platelet and leukocyte suppression in dengue infection [4,5].
The observation that platelet count and WBCs are significantly lower in dengue aligns with mechanisms of dengue pathogenesis, where bone marrow suppression and immune – mediated destruction of platelets and leukocytes occur following infection by the dengue virus [6]
Eosinopenia: Similar observations of eosinophil suppression during acute viral febrile illness have been reported in dengue cohorts [7].
While eosinopenia is less discussed in dengue literature, its presencas an independent predictor may reflect acute – phase viral response and bone marrow suppression unique to dengue compared to more bacterial predominant fevers [9]
Non differentiation by haemoglobin/PCV/Neutrophil/Lymphocyte proportions:
The comparable values for these indices suggest that they are not helpful discriminators in the early diagnostic phase, echoing evidence that dynamic changes in these indices (e.g. rising haematocrit during plasma leakage) are more relevant later in severe dengue rather than at initial presentation.[10]
Urine abnormalities: When a urinary or systemic bacterial infection is suspected, higher rates of abnormal urinalysis in non-dengue patients can help rule out dengue. When there are no urinary tract abnormalities, this method can be used to prioritize dengue suspicion in situations with limited resources. [11]
Hospitalization and Age: Multivariate analysis revealed that only CBC values independently predicted dengue, despite the fact that younger age and greater admission rates were descriptive characteristics of dengue. The higher clinical acuity of confirmed dengue cases or local inpatient observation policies are probably the causes of the observed higher admission rate.
Utility in resource limited settings: CBC is rapid, inexpensive, and universally available and does not require sophisticated infrastructure. Identification of thrombocytopenia, leukopenia and eosinopenia can guide early diagnosis, triage and management reducing reliance on antibiotics and unnecessary admissions and optimizing limited resources.
Early detection: Incorporating these parameters in to fever protocols or decision aids may speed up dengue detection and management when case numbers surge, especially during seasonal epidemics.
Limitations: The study is limited by its hospital based cross sectional design, modest sample size for dengue positive cases, lack of longitudinal outcome data, and the absence of virological confirmation for all cases(particularly in the non-dengue group).
Relation to current evidence: The results support the World Health Organization's current recommendations, which emphasize leukopenia and thrombocytopenia as early indicators of dengue. Although it is currently underrepresented in important guidelines, the added usefulness of eosinophil % as shown in this study is a helpful adjunct, supported by new research in tropical medicine.
Previous Indian research also confirms the diagnostic value of platelets and establishes a standard for the application of basic haematological markers in dengue-endemic regions.

REFERENCES

1. World Health Organization. Dengue and severe dengue. WHO Fact Sheet. Geneva: WHO; 2023.
2. Bhatt S, Gething PW, Brady OJ, et al. The global distribution and burden of dengue. Nature. 2013;496(7446):504–507.
3. World Health Organization. Dengue: Guidelines for diagnosis, treatment, prevention and control. New edition. Geneva: WHO; 2009.
4. Jayashree K, Manasa GC, Pallavi P, Manjunath GV. Evaluation of platelets as predictive parameters in dengue fever. Indian J Hematol Blood Transfus. 2011;27(3):127–130.
5. Simmons CP, Farrar JJ, Nguyen VV, Wills B. Dengue. N Engl J Med. 2012;366(15):1423–1432.
6. Sathish JV, Wadekar MD, Jayashree S, Pooja C. Burden of Dengue and Chikungunya – A Retrospective Study. J Pure Appl Microbiol. 2021;15(2):772-776. doi: 10.22207/JPAM.15.2.30
7. Lee IK, Liu JW, Yang KD. Clinical characteristics and laboratory predictors in dengue infection. Am J Trop Med Hyg. 2009;80(4):651–655.
8. Gupta N, Srivastava S, Jain A, Chaturvedi UC. Dengue in India. Indian J Med Res. 2012;136(3):373–390.
9. Lee PX, Ting DHR, Boey CPH, Tan ETX, Chia JZH, Idris F, Oo Y, Ong LC, Chua YL, Hapuarachchi C, Ng LC, Alonso S. Relative contribution of nonstructural protein 1

in dengue pathogenesis. J Exp Med. 2020 Sep 7;217(9):e20191548. doi: 10.1084/jem.20191548. PMID: 32584412; PMCID: PMC7478733.
10.Chaloemwong J., Tantiworawit, A., Rattanathammethee, T. et al. Useful clinical features and hematological parameters for the diagnosis of dengue infection in patients with acute febrile illness: a retrospective study. BMC Hematol 18, 20 (2018). https://doi.org/10.1186/s12878-018-0116-1
11. Humaidi M, Tien WP, Yap G, Chua CR, Ng LC. Non-Invasive Dengue Diagnostics-The Use of Saliva and Urine for Different Stages of the Illness. Diagnostics (Basel). 2021 Jul 26;11(8):1345. doi: 10.3390/diagnostics11081345. PMID: 34441280; PMCID: PMC8393275.