

Original Research

Study of clinical, biochemical and hematological profile of dengue fever in southern Odisha with special reference to platelet parameters and its prognostic value.

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OBJECTIVE: To assess the clinical profile, biochemical and haematological parameters of patients with Dengue fever and evaluate the prognostic value of the platelet parameters in the recovery of the patients.

METHODS: Data of IPD patients with an established diagnosis of Dengue fever were collected. Seventy-two patients underwent a clinical and haematological evaluation, and values were analysed according to the study's objectives.

RESULTS: The total sample of Dengue fever patients (n=72) included 46 males and 26 females, with the majority of patients above 30 years of age (males=31, females=15). The clinical profile of all patients was taken, viz., age distribution, residence status, duration of fever (< 3 days & > 3 days). Majority of patients had chills and rigor (M=40, F=26), myalgia (M=36, F=21), nausea and vomiting (M=31, F=15), joint pain (M=43, F=25) and headache (M=45, F=26). Bleeding manifestations and other systemic involvements were less likely to be seen. Laboratory investigations were conducted to detect Dengue virus infection and other relevant infections. Requirement for transfusion, viz., blood (M=6, F=5), platelet (M=21, F=14) with more number of platelet units requirement seen in males (n=21). Haematological parameters profile revealed substantial improvement in platelet-related parameters and platelet indices (increase in TPC ($p<0.001$), PCT ($p<0.001$), PLCR, and MPV ($p<0.001$).

CONCLUSION: The study's findings on the increased platelet indices (MPV, IPF, PLCR, plateletcrit) during the recovery phase of Dengue provide valuable insights. These parameters can serve as essential tools for prognosticating Dengue, empowering healthcare professionals with practical knowledge for better disease management.

INTRODUCTION

Dengue fever, also known as breakbone fever or 7-day fever, is a mosquito-borne virus transmitted by *Aedes aegypti* and *Aedes albopictus*, prevalent in tropical and subtropical areas, and is the leading cause of arthropod-borne viral disease, posing a significant health concern. Commonly presenting with high fever, arthralgia, and severe muscle spasm, it poses a significant public health issue affecting millions of people annually.¹ The clinical presentation of Dengue viral infections ranges from asymptomatic to severe illness that may lead to death if not properly managed. The symptomatic cases are diagnosed as undifferentiated febrile illness (UF), dengue fever (DF), dengue hemorrhagic fever (DHF), dengue shock syndrome (DSS), and unusual dengue (UD) or expanded dengue syndrome (EDS).²

In India, there is an apparent increase in the frequency and number of outbreaks, along with the co-circulation of all four serotypes, suggesting nationwide hyperendemicity of dengue.³ In Odisha, eight of 30 districts reported dengue

cases in 2010, which increased to 25 in 2011 and 29 in 2012.⁴ With the passing years, the geographical distribution became more widespread, with a high incidence seen in coastal districts.

Platelets and hematocrit values are commonly measured during the acute stages of dengue infection. Thrombocytopenia is considered a predictor of dengue hemorrhagic fever (DHF).⁵ Hemoconcentration is also a common finding due to increased plasma fluid leakage, leading to a higher hemoglobin concentration per unit volume of blood. The CBC parameters change daily during the course of dengue fever.⁶

Platelet indices (PI) are a group of platelet parameters, viz., platelet count, mean platelet volume (MPV), platelet distribution width (PDW), platelet large cell ratio (P-LCR), plateletcrit (PCT), and immature platelet fraction (IPF), which provide a valid method for measuring disease. This study aims to investigate the clinical profile and biochemical and hematological parameters of dengue fever patients and to assess the role of platelet indices in the severity of

dengue infection, which can be of great help in limiting morbidity and mortality associated with the disease.

METHODS

This is a single-centre prospective observational study with a sample size of 72, conducted in the Department of General Medicine, MKCG MCH, Berhampur, Odisha, from September 2022 to April 2024, following Institutional Ethical Committee approval. Random convenience sampling was done, and written informed consent was obtained from all participants.

A predesigned, pretested questionnaire-based case record form (CRF) was used to collect and record data. Socio-demographic data, along with clinical features and physical examination details, were recorded. The serum profile, platelet, and hematological parameters were collected on admission day and after recovery, and their significance was assessed.

Inclusion criteria were All patients aged ≥ 16 yrs with clinical features and serologically positive for Dengue infection (NS1Ag with/without IgM/IgG positive on rapid card test) admitted to the General Medicine Department who had given consent to participate in the study. **Exclusion criteria** included patients with coinfections or those taking antiplatelet drugs. Statistical analysis was performed using MS-EXCEL and IBM SPSS v17 (Chicago, IL, USA). A P-value < 0.05 was considered the threshold for statistical significance.

RESULTS

PATIENT CHARACTERISTICS: [TABLE 1](#)

In this study, $n=72$ patients were enrolled. A total of 26 patients were within the age range of 16-30 years (males=15, females=11), whereas the majority of patients ($n=46$) were in the >30 years age group, with predominantly males ($n=31$). Infection was more prevalent in urban areas ($n=45$) than in rural areas ($n=27$).

We found that the majority of patients ($n=40$) had a fever of <3 Days' duration, with a slightly higher mean temperature in males. Clinically, a higher prevalence of chills with rigor ($n=26$), headache ($n=26$), respiratory alterations ($n=2$), and CNS alterations ($n=3$) was observed among the female population. In contrast, nausea and vomiting ($n=31$), bleeding manifestations ($n=15$), altered sensorium ($n=10$), with CVS alterations ($n=2$) were predominant among the male population.

HEMATOLOGICAL PARAMETERS: TABLE-2

Statistical analysis using the paired t-test showed a significant mean difference ($p<0.05$) for all parameters, except hemoglobin level ($p=0.283$), indicating no significant change from admission to recovery ([Table 2](#)). The remaining parameters showed significant changes, with most values improving after recovery, including increases in MCV, MCHC,

and MPV, and decreases in serum urea and creatinine levels.

DISCUSSION

Our study investigated various clinical and demographic features of 72 patients with dengue fever. The outcomes offer insights into the prevalence, symptoms, and laboratory parameters connected with the disease. The participants were divided into two age groups: 16-30 years (males=15, females=11) and over 30 years (males=31, females=15), suggesting a higher prevalence of disease among males and the over-30 age group.⁷ Shepherd et al. (2023) conducted a prospective cohort study with only 19% of cases laboratory-confirmed, although the study included participants up to 85 years of age and underrepresented female participants.⁷

Based on place of residence, 27 patients were from rural areas (males=15, females=12) and 45 from urban areas (males=31, females=14), suggesting potential urban factors in Dengue transmission. Similar to our study, a comprehensive analysis by Man and Kraay et al (2023) and dynamic disease models by Andraud et al (2012) emphasized the significance of urban infrastructure and vector-host interactions in the spread of Dengue, stressing that urban environments have higher transmission rates due to large population densities and favourable conditions for mosquito reproduction.^{8,9}

Previous studies by Anuradha M and Dandekar RH in Perambur in 2014¹⁰ emphasized the significance of gender-specific differences in Dengue manifestations. It showed that females had a higher prevalence of chills and rigor, while both genders experienced common symptoms such as myalgia, nausea, joint pain, and headaches, similar to our study.

Our study revealed substantial improvements in platelet-related parameters and platelet indices between admission and recovery. The platelet count (TPC) notably increased from 124.15 ± 34.47 to 186.21 ± 24.94 , indicating a statistically significant recovery ($p<0.001$), likely due to thrombocytopenia, a common feature of viral infections such as Dengue fever. Similarly, the Plateletcrit level increased from 0.117 ± 0.031 to 0.233 ± 0.023 ($p<0.001$), reflecting an enhanced overall platelet mass, which is crucial for clotting. The Platelet Larger Cell Ratio (PLCR) and Mean Platelet Volume (MPV) also showed significant increases from 39.10 ± 3.78 to 42.05 ± 4.15 and from 8.32 ± 0.45 to 9.12 ± 0.45 , respectively ($p<0.001$), indicating active platelet regeneration and the production of larger, more clotting-efficient platelets, indicative of a healing process. Previous studies by Looi et al. (2021), Asha et al. (2023), and Majumdar et al. focused on platelet indices and found that platelet transfusions were necessary to manage thrombocytopenia in severe cases.¹¹⁻¹³ Our study found that 35 patients (21 males, 14 females) required platelet transfusion. Mukker and Kiran et al. (2018) and Yadav (doctoral dissertation, 2022) evaluated platelet indices in Dengue patients and found a high need for transfusions due to severe thrombocytopenia, findings similar to ours.^{14,15}

Table 1. Patients' characteristics

Age group (in years)	16-30 >30	Males 15 31	Females 11 15
Residence status	Rural Urban	15 31	12 14
Fever on day of admission	<=3 days >3 days	28 18	12 14
Distribution of temperature on the day of admission	Range Mean/SD	100.3-104.7 102.7±1.31	100.2-104.8 102.24±1.51
Chills and rigor	Yes No	40 6	26 0
Myalgia	Yes No	36 10	21 5
Nausea and vomiting	Yes No	31 15	15 11
Joint pain	Yes No	43 3	25 1
Headache	Yes No	45 1	26 0
Bleeding manifestations	Yes No	15 31	9 17
Altered sensorium	Yes No	10 36	4 22
CVS complications	Yes No	2 44	0 26
Respiratory system complications	Yes No	0 46	2 24
CNS complications	Yes No	2 44	3 23
Ascites	Yes No	2 44	5 21
Platelet transfusion	Required Not required	21 25	14 12

Statistically significant decreases in serum urea and creatinine ($p<0.05$) were observed, indicating improved kidney function and fluid balance post-recovery, with elevated levels at admission likely indicating AKI or dehydration during severe Dengue. This outcome aligns with a study conducted by Oliveira et al. Dengue-associated AKI: Clinical Kidney Journal, 2015, also reported AKI as a serious complication of Dengue.¹⁶ It emphasizes the importance of monitoring kidney function in Dengue patients to effectively manage and mitigate complications.

In our research, we observed no substantial variation in hemoglobin levels between admission and recovery ($p=0.283$). However, the Chaloemwong et al. (2018) study¹⁷ found that hemoglobin levels were higher from day 3 to day 10 of Dengue infection, with a peak on day 7. The stable hemoglobin levels in our study suggest effective management, potentially through interventions such as blood transfusions, which may not have been emphasized in Chaloemwong et al's study.¹⁷

This study addresses a gap in the current literature by providing a comprehensive analysis of clinical and demographic features among dengue fever patients from a specific regional cohort in Berhampur, Odisha, compared to

previous studies. The focus on platelet indices and recovery patterns, alongside demographic stratification by age, gender, and residence, offers a multidimensional perspective that enhances our understanding of disease manifestation and recovery. Additionally, the investigation into urban versus rural prevalence and its association with transmission dynamics provides new insights relevant to public health strategies in dengue-endemic regions. While previous studies have examined clinical and demographic profiles or individual laboratory markers, few have simultaneously tracked platelet recovery patterns and renal function improvements during hospitalization in this demographic. This dual focus, combined with a real-world hospital-based sample, offers a fresh perspective on disease progression, management, and recovery in Dengue, particularly in an underrepresented region. These factors collectively underscore the novelty and significance of this research.

LIMITATIONS

A small sample size of 72 participants limits the generalizability of the study's findings, and a preponderance of male participants could skew the outcomes. Also, this study

Table 2. Hematological Parameters

SERUM PROFILE	AT ADMISSION	AT RECOVERY	p-VALUE
HEMOGLOBIN	10.77±1.36	14.56±3.27	0.283
MCV	83.40±4.06	87.45±3.82	0.001
RBC count	4.98±0.32	5.38±0.32	0.001
HEMATOCRIT	41.56±3.27	34.56±3.27	0.001
MCH	26.66±1.13	30.07±1.14	0.001
MCHC	34.61±0.80	35.91±0.92	0.001
RWD(%)	15.40±2.51	16.60±2.55	0.001
TLC	4.75±1.01	4.86±1.05	0.001
NEUTROPHIL	61.56±4.98	66.27±5.09	0.001
LYMPHOCYTES	50.97±6.62	36.47±6.09	0.001
MONOCYTE	1.35±1.56	0.58±0.92	0.001
BASOPHIL	0.95±0.80	0.28±0.53	0.001
EOSINOPHIL	3.20±1.56	2.19±1.57	0.001
PLATELET INDICES			
TPC/PLT	124.15±44.47	186.21±40.94	0.001
IPF	5.30±2.33	12.13±2.94	0.001
PCT	1.17±0.81	0.23±0.05	0.001
PLCR	39.10±3.70	39.72±3.59	0.001
MPV	8.32±0.45	9.12±0.45	0.001
RENAL FUNCTION TESTS			
S.UREA	37.32±7.40	28.54±3.14	0.001
S.CREATININE	1.74±0.59	1.05±0.44	0.001
LIVER FUNCTION TESTS			
S.BILIRUBIN(T)	0.92±0.79	0.97±0.79	0.001
S.BILIRUBIN(D)	0.19±0.12	0.17±0.09	0.001
ALT	74.12±8.77	59.90±3.59	0.001
AST	133.56±19.90	60.56±10.88	0.001
S.ALKALINE PHOSPHATASE	205.71±32.48	137.55±7.35	0.001

was limited to a single medical college and hospital in Berhampur, Odisha, which may restrict the applicability of the findings to other regions with varying environmental and socio-economic conditions. The absence of a control group makes it challenging to compare the results with non-Dengue patients, limiting the ability to draw definitive conclusions about the disease's specific impact.

CONCLUSIONS

Platelet indices may serve as an effective tool for diagnosing and predicting outcomes in Dengue fever. It indicates whether a platelet transfusion is needed or whether watchful waiting is beneficial. With the advent of future technologies, these parameters would definitely be of immense help in the prognostication of Dengue.

AUTHOR'S CONTRIBUTION

Dr. Rupa Pradhan, Dr. Siba Narayan Jali, and Dr. Milan Pradhan were involved in conceptualizing protocols, data collection, and research. The manuscript was finalized, edited, and submitted for publication by Dr. Rupa Pradhan.

CONFLICTS OF INTEREST

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