Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Microbiology Research

Journal homepage: https://www.ijmronline.org/

Original Research Article

Clinical and laboratory profiles of dengue fever subtypes in a tertiary care hospital in India: A retrospective study

Narayan Kamath[1,2]*, Darshan Mahyavanshi[3], Mustafa Vohra[2], V K Das[4]

[1]*Dept. of Microbiology, NAMO Medical Education and Research Institute, Silvassa, Dadra and Nagar Haveli, India*
[2]*Dept. of Microbiology, Shri Vinoba Bhave Civil Hospital,, Silvassa, Dadra and Nagar Haveli, India*
[3]*Dept. of Community Medicine, NAMO Medical Education and Research Institute, Silvassa, Dadra and Nagar Haveli, India*
[4]*Dept. of Health & Family Welfare, Shri Vinoba Bhave Civil Hospital, Silvassa, Dadra and Nagar Haveli, India*

ARTICLE INFO

Article history:
Received 18-07-2024
Accepted 05-08-2024
Available online 26-09-2024

Keywords:
Dengue
Dengue genotype
Clinical profile
Dengue fever
RTPCR

ABSTRACT

Background: Dengue fever is a viral infection transmitted by mosquitoes and manifests in different forms, ranging from classic dengue fever to more severe dengue hemorrhagic fever.
Aim and Objective: This study studies demographic, virological, clinical, hematological, and biochemical data, of dengue patient and their relationship with dengue fever type.
Materials and Methods: This study analyzed data from 178 confirmed cases of dengue infection in a tertiary care hospital Union Territory of Dadra and Nagar Haveli and Daman and Diu, India. Demographic data, clinical presentations, dengue serotypes, and biochemical and hematological profiles were collected and analyzed to understand the distribution of dengue virus serotypes and the severity of clinical manifestations.
Results: The majority of patients were young males, with a mean age of 27 years. The prevalence of DENV-2 was significantly higher than that of the other serotypes, indicating its dominant circulation within the study population. The clinical features included fever (100%), headache (92.70%), myalgia (84.83%), and nausea/vomiting (64.61%). Hematological abnormalities were prevalent, including anemia (42.20% in males and 33.33% in females), thrombocytopenia (67.97%), and neutropenia (21.91%). Biochemical profiles showed elevated liver enzyme levels, with 75.84% of patients having elevated alanine aminotransferase levels. The results also showed that, as the severity of dengue fever increased, there were notable changes in hematological and biochemical parameters, such as decreased hemoglobin, hematocrit, platelet counts, elevated liver enzymes, bilirubin, and markers of renal function.
Conclusion: This study underscores the critical need for targeted public health strategies in regions with a high prevalence of DENV-2, and the importance of specific clinical markers in managing and predicting the progression of dengue. These insights could guide therapeutic interventions and public health measures, ultimately reducing disease burden.

1. Introduction

Dengue fever, a major mosquito-borne tropical disease caused by the dengue virus (DENV), has emerged as a significant global public health concern, particularly in tropical and subtropical regions.[1] The Union Territory of Dadra and Nagar Haveli and Daman and Diu in India, like many other regions in the country, has been burdened by this disease.[2,3] Dengue is caused by four distinct serotypes (DENV-1, DENV-2, DENV-3, and DENV-4), which are associated with a range of symptom severities from mild fever to severe hemorrhagic fever and shock syndrome.[4]

* *Corresponding author*.
E-mail address: nktallur@gmail.com (N. Kamath).

https://doi.org/10.18231/j.ijmr.2024.036

Research indicates that these serotypes differ in severity and geographic distribution, with dominant shifts affecting the disease incidence and severity. For example, a change from DENV-3 to DENV-2 can trigger more severe outbreaks owing to antibody-dependent enhancement (ADE).[5]

Dengue fever can range from a mild, self-limiting illness to a severe and potentially life-threatening condition. The most prevalent form, commonly referred to as "classic dengue fever," is characterized by high fever, severe headache, pain in the eyes, and muscle and joint aches, accompanied by nausea, vomiting, and a rash.[6] These symptoms typically appear 3-14 days after infection and resolve within a week. Severe dengue involves critical complications, such as plasma leakage, significant bleeding, and organ damage, which evolve from classic symptoms within 3-7 days. Dengue hemorrhagic fever (DHF) is a severe form of the disease, characterized by increased vascular permeability, low platelet count, and bleeding.[7]

The clinical diagnosis of dengue is challenging due to its broad spectrum of symptoms, ranging from mild flu-like fever to severe and potentially fatal complications.[3] Key laboratory findings, including thrombocytopenia, leukopenia, hemoconcentration, and elevated liver enzymes, are routinely used to assess the severity and prognosis of dengue infection.[8–12] Understanding the associations between dengue genotype, hematological and biochemical profiles, and disease severity is crucial for developing predictive models that allow early detection, effective resource allocation, and improved patient outcomes.

This study aimed to investigate dengue virus serotypes, clinical presentations, laboratory findings, and the relationship between dengue fever type among dengue-positive patients in a tertiary care hospital in India to identify predictors of disease severity and improve patient outcomes.

2. Material and Methods

2.1. Study design and participants

This retrospective observational study was conducted in a tertiary care hospital in the Union Territory of Dadra and Nagar Haveli and Daman and Diu, India, between June 1, 2023 and October 31, 2023. This region is endemic for dengue, with cases reported annually. The area experiences a tropical climate, with conditions favorable for the breeding of Aedes mosquitoes, the primary vectors for dengue transmission. The hospital serves as a major health care facility for the local population and surrounding areas, making it an ideal setting for studying dengue cases in this endemic region.

All patients clinically diagnosed with dengue fever at local healthcare facilities during this period were initially screened. Inclusion criteria were a confirmed dengue diagnosis by positive serotype-specific real-time RT-PCR testing of a serum sample and availability of complete medical records. Exclusions were made for patients with incomplete records, uncertain dengue status, or coinfections with other acute viral illnesses like chikungunya. A total of 178 RT-PCR confirmed dengue cases met eligibility and were included in the final analysis.

2.2. Data collection

Demographic and detailed clinical data were collected through an extensive review of electronic medical records (EMRs) and paper-based case files by two independent reviewers. The hospital utilized the HMS to maintain digital records. Demographic information gathered included age, sex, admission and discharge dates. A comprehensive case report form (CRF) was designed to systematically extract relevant clinical information from physician notes, nursing records, investigation reports and discharge summaries in the patient files. This included date of symptom onset, presenting symptoms (fever, rash, myalgia, arthralgia, headache, retro-orbital pain, nausea/vomiting, abdominal pain, mucosal bleeding, etc.), vital signs, and physical examination findings (pale tongue, flushed face, tourniquet test, organomegaly, effusions), results of laboratory tests like complete blood counts and liver/kidney function tests with dates, imaging findings if available, treatment details, final diagnosis and severity classification according to WHO criteria, duration of hospital stay, and patient outcome.

For any missing or ambiguous information in the records, the reviewers contacted the treating physicians to clarify or obtain additional details. All extracted data was double-entered into a password-protected database independently by the two reviewers. Any discrepancies between the entries were resolved through cross-verification of the source documents and adjudication by a third senior clinical investigator when needed.

2.3. Serotyping and viral detection

Dengue serotyping was performed at the National Institute of Virology (NIV) in Pune, a reference laboratory of the Indian Council of Medical Research (ICMR). For serotyping, NIV utilized an in-house validated TaqMan real-time RT-PCR assay. This assay employs serotype-specific probes to simultaneously detect and differentiate all four dengue virus serotypes (DENV-1, DENV-2, DENV-3, and DENV-4) from serum samples.

This multiplex assay involves RNA extraction, reverse transcription, and real-time PCR amplification, using serotype-specific primers and probes. The assay was validated for sensitivity and specificity in detecting all four dengue serotypes, with established lower limits of detection for each serotype. All procedures adhered to the ICMR quality control guidelines for molecular diagnostic testing.

2.4. Hematological and biochemical profiling

To monitor disease progression, repeated hematological and biochemical tests were performed throughout hospitalization. These tests were conducted–3-4 days after the onset of symptoms and subsequently as clinically indicated. While these repeated tests were performed to track disease progression, results from only the initial monitoring were available for inclusion in this study.

Hematological assessments were performed using a high-throughput automated hematology analyzer. Key parameters analyzed included hemoglobin levels, white blood cell count, hematocrit values, platelet count, and differential counts of neutrophils and lymphocytes. Standard quality control procedures were followed per manufacturer guidelines.

Biochemical tests were conducted on fresh serum samples using a biochemistry analyzer. The comprehensive metabolic panel included liver function enzymes (alanine aminotransferase [ALT], aspartate aminotransferase [AST]), serum creatinine, blood urea nitrogen, total protein levels, and bilirubin levels.

2.5. Statistical analysis

Statistical analyses were conducted using SPSS software version 28.0. Descriptive statistics like means were calculated for demographic variables, clinical characteristics, hematological and biochemical parameters stratified by dengue severity and serotype. The association between clinical severity and laboratory markers was analyzed using the chi-square test for categorical variables and one-way analysis of variance (ANOVA) for continuous variables. Statistical significance was set at $P < 0.05$.

3. Results

3.1. Demographic data

Surveillance data from 178 patients with confirmed Dengue infection in the Union Territory of Dadra and Nagar Haveli and Daman and Diu, India, revealed a diverse demographic profile. The age distribution of patients ranged from 2 to 63 years, with a mean age of 27 years. The interquartile range of ages ranged from 19.8 to 33 years, indicating a predominantly younger demographic among the study participants. The sex distribution was skewed toward men, with 109 male (61.23%) and 69 women (38.76%). Two mortality was seen both in men and suffering from Dengue hemorrhagic fever (DHF).

3.2. Distribution of dengue genotype

The prevalence of dengue virus serotypes among the positively tested individuals showed a significant dominance of DENV-2, accounting for 164 (92.13%) of the total cases (Table 1). The other serotypes were significantly less common, with DENV-1 identified in 7 cases, DENV-3 in 3 cases, and DENV-4 in 2 cases. Co-infections with multiple dengue virus serotypes were observed in a small proportion of confirmed cases. Specifically, 2.25% of cases showed co-infection with DENV-1 and DENV-2 serotypes, whereas 1.12% of cases exhibited co-infection with DENV-2 and DENV-3 serotypes. These findings indicate that although co-infections are relatively rare, they do occur, with DENV-2 being involved in both types of co-infections detected in this study.

3.3. Distribution of dengue fever

In analyzing dengue fever cases classified by type, age, and sex, our findings revealed a notable distribution across different categories (Figure 1). From the analysis, it is evident that dengue hemorrhagic fever accounts for the highest number of cases among all age and sex groups, followed by severe and classic dengue fever. This trend suggests a significant burden of the more severe forms of dengue fever. Classic dengue fever cases were evenly distributed between sexes, with each subgroup reporting 16 cases each for women and males, respectively. The prevalence of severe dengue fever was higher in individuals aged 15 years and older (44 cases), with a male predominance (36 cases) than in females (22 cases). In particular, the incidence of dengue hemorrhagic fever was substantially higher in the older age group, with 89 cases reported, indicating an age-associated risk factor. The sex distribution for dengue hemorrhagic fever also showed a male bias, with 57 cases compared to 31 cases in women. These results suggest that, while classic dengue fever affects both sexes equally, severe forms of the disease, including dengue hemorrhagic fever, are more common in older individuals, with a higher incidence observed in men.

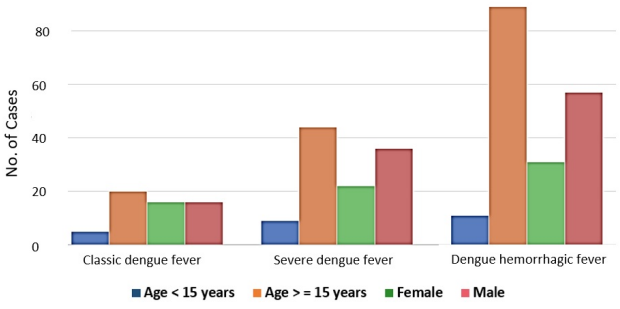

Figure 1: Dengue fever cases by type, age group, and gender distribution

3.4. Clinical features

This study analyzed the clinical characteristics of 178 dengue-positive patients (Figure 2). Fever was the most common symptom in all 178 cases (100%). Other common

symptoms included headache (92.70%), myalgia (84.83%), chills (79.78%), and nausea and vomiting (64.61%). Abdominal pain was reported in 50% of the cases, whereas diarrhea was observed in 29.78% of the patients. Mucosal bleeding and hepatomegaly were present in 28.65% and 21.35% of cases, respectively. Less frequent symptoms included abdominal distention (17.98%), rash (17.98%), eye pain (17.42%), and conjunctival hemorrhage (14.04%).

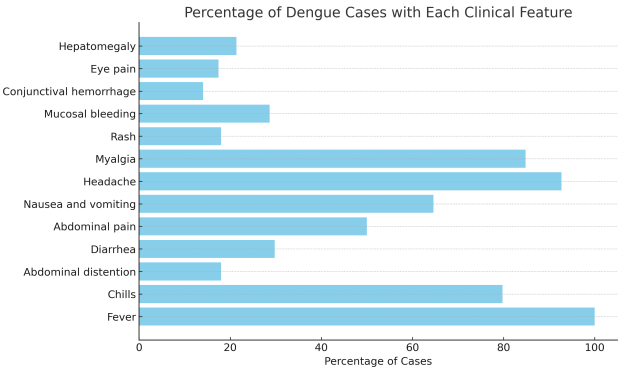

Figure 2: Prevalence of clinical features in dengue cases

3.5. *Hematological and biochemical profiling*

Hematological analysis (Table 2) indicated prevalent anemia, with 42.2% of men and 33.33% of females showing low hemoglobin levels. A white blood cell (WBC) count below the lower limit in 14.61% of the patients suggested leukopenia. Elevated hematocrit was observed in 29.36% of men and 18.84% of females, suggesting possible polycythemia or dehydration. Thrombocytopenia was expected, with 67.98% of the patients having platelet counts below the normal threshold. Neutropenia was identified in 21.91% of the patients, while most lymphocyte counts were normal or low, with only 8.43% showing possible lymphocytosis.

In our study, biochemical analysis (Table 2) revealed that 84.83% of the patients maintained normal total serum bilirubin levels, whereas 15.16% exceeded the upper limit. Elevated Alanine Aminotransferase (ALT) levels were observed in 75.84% of patients, exceeding the normal threshold of 42 IU/L, and Aspartate Aminotransferase (AST) levels were above the normal range in 60.11% of patients. In contrast, serum creatinine and blood urea nitrogen remained within normal limits for most patients, with 10.11% and 20.22%, respectively, exceeding these values. Furthermore, 74.71% of patients had total protein levels at or above the standard lower limit of 6.4 mg/dl.

3.6. *Association of clinical markers with dengue fever severity*

The clinical markers for three dengue infection spectra: classic, severe, and hemorrhagic fever are presented in Table 3. Dengue serotypes display varied frequencies in classic dengue fever, severe dengue fever, and dengue hemorrhagic fever, with DENV-2 not present in classic cases but appearing in severe cases. Hemoglobin levels are lower in dengue hemorrhagic fever for both men (12.2 ± 1.6 g/dl) and females (11.8 ± 2.4 g/dl), compared to classic cases, and hematocrit percentages increase with severity, exceeding normal ranges for men and women. WBC counts decreased from classic to hemorrhagic fever, falling below the standard threshold, and platelet counts also dropped significantly in hemorrhagic fever, far below the standard range. Neutrophil and lymphocyte counts deviate from normal, with neutrophils decreasing and lymphocytes increasing, both significantly associated with the severity of infection.

Platelet counts showed a clear correlation with dengue fever severity. The mean platelet count in classic dengue fever cases was 130,000 ± 50,000 cells/cumm. This decreased to 80,000 ± 30,000 cells/cumm in severe dengue fever. The lowest platelet counts were observed in cases of dengue hemorrhagic fever, with a mean of 50,000 ± 20,000 cells/cumm. The difference in platelet counts across these three categories of dengue severity was statistically significant, with a p-value of < 0.001. This indicates a strong association between decreased platelet count and increased severity of dengue infection.

Biochemical parameters further delineate the severity of the disease, with total serum bilirubin levels peaking in dengue hemorrhagic fever (0.9 ± 0.5 mg/dl) and the liver enzymes ALT and AST increasing substantially as the disease progresses to more severe forms, far exceeding normal values. Renal function markers, serum creatinine, and blood urea nitrogen also increased in patients with hemorrhagic fever, indicating a potential renal impact. Total protein levels decreased in all disease severities, with the lowest levels observed in hemorrhagic fever, suggesting a correlation between protein levels and disease progression. These findings, all statistically significant, highlight the potential of these parameters as indicators of disease severity and require careful laboratory monitoring to manage dengue fever effectively.

Table 1: Prevalence of dengue virus serotypes in confirmed cases

Dengue Serotype	**%**
DENV-1 & 2	2.25
DENV-1	1.69
DENV-2 & 3	1.12
DENV-2	92.13
DENV-3	1.69
DENV-4	1.12

Table 2: Distribution of hematological and biochemical parameters in dengue patients relative to normal laboratory values

	Range	No. of patient N (%)	Normal lab value
Hematological test			
Hemoglobin g/dl	Male ≤13	46 (42.20)	M: 13-16
	Female ≤ 12	23 (33.33)	F: 12-15
WBC count (cells/cumm)	< 4,000	26 (14.60)	4,000-10,000/cumm
	≥ 4,000	152 (85.39)	
Hematocrit (%)	Male > 50	32 (29.35)	M: 41-50
	Female > 46	13 (18.84)	F: 36-46
Platelet count (cells/cumm)	< 150,000	121 (67.97)	150,000-450,000/cumm
	≥ 150,000	57 (32.02)	
Neutrophil (cells/cumm)	< 1500	39 (21.91)	1500-8000
	≥ 1500	139 (78.08)	
Lymphocyte (cells/cumm)	≤ 2900	163 (91.57)	900-2900
Biochemical test			
Total Serum Bilirubin (mg/dl)	≤ 1	151 (84.83)	0.2-1 mg/dl
	> 1	27 (15.16)	
ALT (IU/L)	≤ 42	43 (24.15)	3-42 IU/L
	> 42	135 (75.84)	
AST (IU/L)	< 37	71 (39.88)	5-37 U/L
	≥ 37	107 (60.11)	
Serum Creatinine (mg/dl)	≤ 1.4	160 (89.88)	0.6-1.4 mg/dl
	> 1.4	18 (10.11)	
Blood Urea Nitrogen (mg/dl)	≤ 21	142 (79.77)	8-21 mg/dl

Table 3: Correlation of serotype, hematological, and biochemical markers with severity of dengue fever forms

Test	Classic dengue fever Mean ± SD	Severe Dengue fever Mean ± SD	Dengue hemorrhagic fever Mean ± SD	P-value	Normal lab value
DENV-1	0 ± 0	0 ± 0	3 ± 0	0	**NA**
DENV-1 & 2	1 ± 0	3 ± 0	0 ± 0	0	**NA**
DENV-2	31 ± 0	52 ± 0	81 ± 0	0	**NA**
DENV-2 & 3	0 ± 0	2 ± 0	0 ± 0	0	**NA**
DENV-3	0 ± 0	0 ± 0	3 ± 0	0	**NA**
DENV-4	0 ± 0	1 ± 0	1 ± 0	0	**NA**
Hemoglobin, Male (g/dl)	14.5 ± 1.0	13.8 ± 1.4	12.2 ± 1.6	< 0.001	M: 13-16
Hemoglobin, Female (g/dl)	13.2 ± 1.8	12.5 ± 2.1	11.8 ± 2.4	< 0.05	F: 12-15
Hematocrit, Male (%)	45 ± 3	47 ± 5	49 ± 6	< 0.001	M: 41-50
Hematocrit, Female (%)	39.6 ± 5.4	39.8 ± 6.3	44.64 ± 7.2	< 0.001	F: 36-46
WBC count (cells/cumm)	5,500 ± 1,500	5,800 ± 1,200	4,200 ± 1,000	< 0.001	4,000-10,000/cumm
Platelet count (cells/cumm)	130,000 ± 50,000	80,000 ± 30,000	50,000 ± 20,000	< 0.001	150,000-450,000/cumm
Neutrophil (cells/cumm)	2,700 ± 900	2,280 ± 720	1,920 ± 600	< 0.001	1500-8000
Lymphocyte (cells/cumm)	1,350 ± 450	1,640 ± 360	1960 ± 300	< 0.001	900-2900
Total Serum Bilirubin (mg/dl)	0.8 ± 0.3	0.6 ± 0.5	0.9 ± 0.5	< 0.001	0.2-1 mg/dl
ALT (IU/L)	40 ± 20	80 ± 40	120 ± 60	< 0.001	3-42 IU/L
AST (IU/L)	60 ± 25	100 ± 50	150 ± 75	< 0.001	5-37 U/L
Serum Creatinine (mg/dl)	0.9 ± 0.2	1.4 ± 0.3	1.8 ± 0.4	< 0.001	0.6-1.4 mg/dl
Blood Urea Nitrogen (mg/dl)	15 ± 5	20 ± 7	29 ± 9	< 0.001	8-21 mg/dl
Total protein (mg/dl)	7.0 ± 0.5	6.5 ± 0.6	6.8 ± 0.7	< 0.01	6.4-8.2 mg/dl

4. Discussion

The demographic profile of dengue patients in our study, characterized by a mean age of 27 years and male predominance (61.23%), is consistent with other epidemiological findings across India, where the disease predominantly affects younger populations, with a slight male bias. Studies have suggested that these demographic patterns may reflect significant exposure to mosquito breeding sites and outdoor activities among these populations.[13,14] A systematic review and meta-analysis of 233 dengue infection studies in India by Ganeshkumar et al. (2018) reported a median age of 22 years.[14] Similarly, a study in a dengue infection of a tertiary care hospital in western Maharashtra revealed a gender distribution of 61.1% males and 38.8% females, ranging from 19 to 88 years of age. The higher incidence of dengue in young adults and men has been attributed to increased exposure owing to work-related activities and increased mobility. Understanding these demographic patterns is crucial for developing targeted public health interventions such as educational campaigns aimed specifically at these high-risk groups.

In our study, 178 dengue cases were confirmed using RT-PCR. Our results show that the dominance of DENV-2 is in line with several other regional studies that have also reported a high prevalence of this serotype in outbreak scenarios. Specific genotypes, such as DENV-2 Asian and DENV-3 genotypes, are associated with more severe clinical manifestations and a higher risk of dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS).[15–17] Changes in the predominant circulating dengue virus genotypes have also been observed to coincide with the increased incidence and severity of dengue outbreaks.[18] Therefore, the association between serotypes and clinical outcomes remains complex and may vary depending on the geographical region, genetic shift, and prevalent viral strains.

The distribution of dengue fever subtypes in the current study, with dengue hemorrhagic fever (DHF) being the most common, followed by severe dengue fever (SDF) and classic dengue fever (CDF), indicated a high burden of severe dengue, similar to other studies.[4] The most common symptom was fever, which was present in all 178 patients (100%), followed by headache (92.70%), myalgia (84.83%), chills (79.78%), and nausea and vomiting (64.61%). These findings are consistent with other studies that have reported fever, headache, myalgia, and nausea/vomiting as common symptoms of dengue fever.[19] Abdominal pain was reported in 50% of the cases, whereas diarrhea was observed in 29.78% of the patients. These gastrointestinal symptoms have been previously described in patients with dengue fever at various frequencies.[20,21] Mucosal bleeding and hepatomegaly were present in 28.65% and 21.35% of the cases, respectively. These findings are consistent with the WHO classification of dengue fever, which lists mucosal bleeding and hepatomegaly as indicators of severe disease progression.[22]

We report significant deviations from the normal hematological reference ranges among dengue patients, including anemia (low hemoglobin levels), possible leukopenia (low white blood cell counts), polycythemia or dehydration (elevated hematocrit percentages), widespread thrombocytopenia, and instances of neutropenia and lymphocytosis. Thrombocytopenia is the most common hematological anomaly and is significantly associated with severe dengue. Studies have reported thrombocytopenia in 56% of patient,[23] with half having thrombocytopenia on day 4 and approximately 80% on day 6.[24] One study found that lower platelet counts were associated with an increased risk of developing dengue hemorrhagic fever (DHF).[25] This is consistent with the World Health Organization's guidelines, which state that a platelet count of less than 100,000/μL is a warning sign for severe dengue. Leukopenia was the second most prevalent hematological finding in 36.7% of patients in one study[4] and in 20.8% of patients in another.[23]

Biochemical analysis revealed elevated levels of Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) in a notable proportion of patients, indicating liver involvement in dengue infection, consistent with other research findings.[26] Elevated liver enzyme levels, reflecting liver damage or dysfunction, have been commonly reported,[6] with elevated levels of AST and ALT in 58.5% and 44.3% of cases, respectively.[23] Higher mean levels of these liver enzymes were observed in patients with multiple serotype infections, particularly serotypes 2 and 3, suggesting a greater hepatotropic effect than serotype 1.[27] These hematological and biochemical abnormalities, highlighted by anemia, thrombocytopenia, neutropenia, and elevated liver enzyme levels, underscore the importance of close monitoring and supportive care in treating dengue patients.

The current study provides a detailed analysis of the association between clinical markers and severity of dengue fever. These findings suggest that specific hematological and biochemical parameters can indicate disease progression from classic dengue fever to severe dengue fever and dengue hemorrhagic fever. The results showed that as disease severity increased, there were notable changes in hematological and biochemical parameters, such as decreased hemoglobin, hematocrit, and platelet counts, as well as elevated liver enzymes, bilirubin, and renal function markers, as well as other findings.[6,23,24] In contrast, total protein levels decreased with severity, particularly in dengue hemorrhagic fever, suggesting nutritional depletion or increased vascular permeability. Other clinical features, such as abdominal pain, persistent vomiting, and mucosal bleeding, have also been reported as warning signs of progression to DHF or DSS.[27] A systematic review by

Moallemi et al. highlighted early biomarkers for predicting severe manifestations of dengue fever, emphasizing the importance of clinical classification in determining disease severity.[28]

The association of clinical markers with dengue fever severity underscores the importance of complete laboratory monitoring in the clinical management of dengue fever patients. The observed associations between dengue serotypes, laboratory profiles, and disease severity can aid in the early identification of high-risk individuals and guide appropriate interventions. Tertiary care hospitals play a crucial role in managing severe dengue cases and serve as valuable sources of data to understand the clinical and epidemiological aspects of the disease. Hospital-based studies provide information on the demographic characteristics, clinical profiles, and outcomes of dengue patients, which can inform the development of evidence-based management guidelines and public health strategies.

5. Conclusion

This study provides valuable information on demographic characteristics, circulating dengue virus genotypes, and the relationship between clinical and laboratory profiles in a cohort of dengue-positive patients at a tertiary hospital in Dadra and Nagar Haveli and Daman and Diu, India. The findings of this study emphasize the critical role of public health strategies in regions with a high prevalence of DENV-2 infection. Our results highlight the importance of specific clinical markers such as changes in hematological and biochemical parameters, which are crucial for managing and predicting the progression of dengue fever. As the severity of dengue fever increased, notable changes in these parameters, such as decreased hemoglobin, hematocrit, and platelet counts and elevated liver enzymes, bilirubin, and renal function markers, were observed. These insights can guide therapeutic interventions and public health measures, ultimately aiming to reduce the disease burden in the affected regions.

By providing specific data on the clinical and laboratory profiles of patients with dengue, this study supports the strategic planning and implementation of public health programs. These programs can be tailored to address the predominant serotypes and severity of disease in different regions, ultimately contributing to the reduction of dengue incidence and the mitigation of its impact on public health.

6. Ethical Considerations

The study was approved by the Institutional Review Board (IRB) of the Shri Vinoba Bhave Civil Hospital (approval no. DMHS/IEC/2016/214/3904), and written informed consent was obtained from all participants or their guardians before inclusion in the study.

7. Source of Funding

This study did not receive any specific grants from funding agencies in the public.

8. Conflict of Interest

The authors declare that they have no conflicts of interest.

References

1. Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, et al. The global distribution and burden of dengue. *Nature*. 2013;496(7446):504–7.
2. Zala DB, Khan V, Kakadiya M, Sanghai AA, Das VK. Circulation of dengue serotypes in the Union Territory of Dadra & Nagar Haveli (India). *Parasite Epidemiol Control*. 2018;3(3):e00069.
3. Khan V, Khan AS, Sanghai AA, Zala DB, Das VK. Distribution pattern of dengue cases in the tribal UT of Dadra & Nagar Haveli, India. *Int J Mosquito Res*. 2019;6(6):1–3.
4. Azin F, Gonçalves RP, Pitombeira MHS, Lima DM, Branco IC. Dengue: profile of hematological and biochemical dynamics. *Rev Bras Hematol Hemoter*. 2012;34(1):36–41.
5. Avrami S, Hoffman T, Meltzer E, Lustig Y, Schwartz E. Comparison of clinical and laboratory parameters of primary vs secondary dengue fever in travellers. *J Travel Med*. 2023;30(7):129.
6. Sami CA, Tasnim R, Hassan SS, Khan AH. Clinical profile and early severity predictors of dengue fever: Current trends for the deadliest dengue infection in Bangladesh in 2022. *IJID Reg*. 2023;9:42.
7. Dussart P, Duong V, Bleakley K, Fortas C, Try PL, Kim KS, et al. Comparison of dengue case classification schemes and evaluation of biological changes in different dengue clinical patterns in a longitudinal follow-up of hospitalized children in Cambodia. *PLoS Negl Trop Dis*. 2020;14(9):e0008603.
8. Rao AA, Raaju RU, Gosavi S, Menon S. Dengue Fever: Prognostic Insights From a Complete Blood Count. *Cureus*. 2020;12(11):e11594.
9. Kularatnam GAM, Jasinge E, Gunasena S, Samaranayake D, Senanayake MP, Wickramasinghe VP. Evaluation of biochemical and haematological changes in dengue fever and dengue hemorrhagic fever in Sri Lankan children: a prospective follow up study. *BMC Pediatr*. 2019;19(1):87.
10. Majumdar A, Kumar A, Biswas S. Automated complete blood count profile as a probable indicator of dengue fever severity in children. *J Sci Soc*. 2022;49(2):186.
11. Hussain W, Shaikh M, Hanif M, Ashfaq M, Ahmed H, Nisa B. Pattern and Outcome of Dengue Fever in a Pediatric Tertiary Hospital: A Retrospective Report. *Cureus*. 2021;13(3):e14164.
12. Mohindra R, Divyashree K, Kalyan M, Bora I, Soni RK, Suri V. The continuum of liver injury with severity of dengue fever: A retrospective observational study. *J R Coll Physicians Edinb*. 2024;54(1):7–13.
13. Chakravarti A, Arora R, Luxemburger C. Fifty years of dengue in India. *Trans R Soc Trop Med Hyg*. 2012;106(5):273–82.
14. Ganeshkumar P, Murhekar MV, Poornima V, Saravanakumar V, Sukumaran K, Anandaselvasankar A, et al. Dengue infection in India: A systematic review and meta-analysis. *PLoS Negl Trop Dis*. 2018;12(7):e0006618.
15. Sethupandi S, Gururaju D, Rao AP, Nanjundappa N. Clinical and Laboratory Profile of Patients with Newly Diagnosed Juvenile Idiopathic Arthritis: An Observational Study from a Tertiary Care Centre, Karnataka, India. *J Clin Diagn Res*. 2023;17(4):11–4.
16. Namrata KC, Thapa KB, Shrestha N, Paudel S, Pun CB. Clinical and laboratory profile of dengue fever in children from a tertiary care centre of Gandaki Province, Nepal. *J Gandaki Méd Coll-Nepal*. 2020;13(2):173–7.
17. Maisnam D, Billoria A, Prasad V, Venkataramana M. Association of Dengue Virus Serotypes 1&2 with Severe Dengue Having Deletions in Their 3′Untranslated Regions (3′UTRs). *Microorganisms*. 2023;11(3):666.

18. Soo KM, Khalid B, Ching SM, Chee HY. Meta-Analysis of Dengue Severity during Infection by Different Dengue Virus Serotypes in Primary and Secondary Infections. *PLoS One*. 2016;11(5):e0154760.
19. Jaenisch T, Tam DTH, Kieu NTT, Ngoc TV, Nam NT, Kinh N, et al. Clinical evaluation of dengue and identification of risk factors for severe disease: protocol for a multicentre study in 8 countries. *BMC Infect Dis*. 2016;16(1):120.
20. Cavailler P, Tarantola A, Leo YS, Lover A, Rachline A, Duch M, et al. Early diagnosis of dengue disease severity in a resource-limited Asian country. *BMC Infect Dis*. 2016;16(1):512.
21. Halsey ES, Marks MA, Gotuzzo E, Fiestas V, Suarez L, Vargas J, et al. Correlation of Serotype-Specific Dengue Virus Infection with Clinical Manifestations. *PLoS Negl Trop Dis*. 2012;6(5):1638.
22. Muller DA, Depelsenaire ACI, Young PR. Clinical and Laboratory Diagnosis of Dengue Virus Infection. *J Infect Dis*. 2017;215(suppl_2):89–95.
23. Gulabani PB, Buch AC, Nair GR, Rathod H, Nanda S, Haseen S. Study of alteration of hematological and biochemical parameters among adult patients with dengue infection at a tertiary care hospital in Western Maharashtra. *Int J Acad Med*. 2023;9(4):216–23.
24. Chaloemwong J, Tantiworawit A, Rattanathammethee T, Hantrakool S, Chai-Adisaksopha C, Rattarittamrong E, 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*. 2018;18(1):20.
25. Pattnaik SS, Patil U, Aggarwal L, Patro S, Mishra P, Mohanty A. Exploring mean platelet volume and platelet count recovery in dengue patients: Findings from an observational retrospective clinical study. *Cureus*. 2024;16(7):e65553.
26. Trung DT, Thao L, Hien TT, Hung NT, Vinh NN, Hien PTD, et al. Liver Involvement Associated with Dengue Infection in Adults in Vietnam. *Am J Trop Med Hyg*. 2010;83(4):774–80.
27. Gupta A, Rijhwani P, Pahadia MR, Kalia A, Choudhary S, Bansal DP, et al. Prevalence of Dengue Serotypes and Its Correlation With the Laboratory Profile at a Tertiary Care Hospital in Northwestern India. *Cureus*. 2021;13(5):e15029.
28. Moallemi S, Lloyd AR, Rodrigo C. Early biomarkers for prediction of severe manifestations of dengue fever: a systematic review and a meta-analysis. *Sci Rep*. 2023;13(1):17485–5.

Author biography

Narayan Kamath, Professor

Darshan Mahyavanshi, Professor

Mustafa Vohra, Microbiologist https://orcid.org/0000-0002-5473-5219

V K Das, CEO and Consultant

Cite this article: Kamath N, Mahyavanshi D, Vohra M, Das VK. Clinical and laboratory profiles of dengue fever subtypes in a tertiary care hospital in India: A retrospective study. *Indian J Microbiol Res* 2024;11(3):198-205.