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Decoding Dengue: insights from a tertiary health care hospital

Raghul Saravanan^{1*}, Pragadeesh Palaniappan², Supraja Nagarathinam³, Aarthe

Raghul⁴

1- Department of Social Medicine, SIMS hospitals

2-Department of Community Medicine, Sri Ramachandra Medical College and Research Institute, Sri Ramachandra Institute of Higher Education and Research (SRIHER)

3-Department of Community Medicine, Sri Lalithambigai Medical College and Hospital, Dr. MGR Educational & Research Institute, Chennai, Tamilnadu, India.

4-Department of Anatomy, Sree Balaji Medical College and Hospital, Bharath Institute of Higher Education and Research(BIHER)

Postal address where the research work has been carried out : 7, WorksRoad, Chromepet, Chennai 600044. Tamilnadu, India

Address for correspondence: New number 10, old Number 20, Sowrashtra Nagar, 4th street, Choolaimedu, Chennai 600094, Tamil Nadu, India

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ABSTRACT:

Background: Dengue poses a significant public health challenge in tropical and subtropical regions, predominantly in urban and semi-urban areas. Dengue currently holds the top spot as the most important mosquito-borne viral disease worldwide, putting roughly half of the global population in danger. Even with the widespread knowledge about this arboviral disease, there is a dearth of understanding of the clinical parameters that can be altered in Dengue. Further, the platelet trends are not clearly understood which has been attempted in this study.

Aim: To assess demographic and clinical characteristics of individuals affected by dengue

Methods: A cross-sectional study was carried out on patients who tested positive for either NS1 or Dengue IgM or both and were admitted in the Department of Medicine and Pediatrics, in a tertiary health care hospital, Chennai from August to October 2022. The collected data were entered into MS Excel and analyzed using SPSS software version 21.

Results: During the study period a total of 104 patients participated in the study. In this study, the most common symptom of dengue was fever (99%), followed by myalgia (51%), headache (34.6%), and vomiting (32.7%). The mean hospital stay in the current study was 3.76 ± 1.82 days. Additionally, platelet trends were observed. There was a fall in mean platelet value from day 1 to day 6 of observation.

Conclusion: Exploring the demographic and clinical characteristics of dengue is crucial for understanding its spread, identifying at-risk populations, improving diagnosis and treatment, advancing research, and enhancing public awareness.

KEYWORDS: Dengue fever, vector borne disease, platelet count, infections

INTRODUCTION:

Dengue poses a significant public health challenge in tropical and subtropical regions, predominantly in urban and semi-urban areas. This arboviral disease is caused by four unique serotypes of the virus, namely DENV1, DENV2, DENV3, and DENV4, which are spread to humans via the bite of a virus-infected *Aedes* mosquito. Infection with one serotype provides lifelong immunity to that specific serotype but only temporary immunity to the others. Subsequent infections with different serotypes can lead to more severe forms of the disease, such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS), which can be life-threatening if not promptly treated.

Dengue currently holds the top spot as the most important mosquito-borne viral disease worldwide, putting roughly half of the global population in danger. Annually, an estimated 100 to 400 million dengue infections occurs throughout the world.¹ In recent decades, dengue fever has become more prevalent worldwide. According to WHO data, the number of cases recorded rose from 505,430 in 2000 to 5.2 million in 2019. Since most cases are mild or asymptomatic and can be treated on their own, the true number of dengue cases is likely underreported.² The most severely impacted regions are the Americas, South-East Asia, and Western Pacific, with Asia accounting for around 70% of the world's disease load.¹

A global upsurge in dengue cases has been observed in 2023, following a slight decline in cases between 2020 and 2022 due to the COVID-19 pandemic and lower reporting rates. This upsurge is characterized by a substantial rise in the number, scale, and concurrent appearance of multiple outbreaks, extending into previously unaffected geographical areas.³ The National Centre for Vector Borne Diseases Control (NCVBDC) in India reports that as of 2023, there were 94198 cases of dengue nationwide and 91 dengue-related deaths.⁴ In 2023, Tamil Nadu, India, recorded approximately 4,148 cases of dengue, resulting in three fatalities related to the disease.⁴

The WHO 2009 classification system categorizes dengue fever into two main groups: uncomplicated and severe.⁵ The severe category includes dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). However, it's worth noting that the 1997 WHO classification⁶ is still commonly referenced and used in clinical practice and research, particularly in regions where dengue fever is endemic. While India has traditionally experienced the classical clinical manifestations of dengue virus infection, recent outbreaks have revealed a plethora of unconventional presentations.⁷

Exploring the demographic and clinical characteristics of dengue is crucial for understanding its spread, identifying at-risk populations, improving diagnosis and treatment, advancing research, and enhancing public awareness. Chennai, as the capital city of Tamil Nadu, is located in the southern part of India and has experienced periodic dengue outbreaks over the years. The current study aims to present a complete overview of the demographic and clinical characteristics of individuals affected by dengue admitted to the tertiary health care hospital in Chennai, Tamil Nadu, between August 2022 and October 2022. The study seeks to contribute valuable insights to the existing body of knowledge on dengue epidemiology and management. The findings may also inform healthcare policies, improve clinical practices, and guide public health strategies aimed at reducing the burden of dengue in Chennai and similar settings in southern India.

MATERIALS AND METHODS:

A cross-sectional study was conducted on patients who tested positive for either NS1, Dengue IgM, or both, using retrospective data collection methods. We recruited 104 patients with confirmed dengue fever who were admitted to the Departments of Medicine and Pediatrics, tertiary health care hospital in Chennai, during three months from August 2022 to October 2022. The selection of study participants required institutional ethical approval to ensure compliance with ethical standards, which was duly obtained.

The study involved a comprehensive review of patient records, with a specific focus on gathering detailed information regarding clinical characteristics, such as symptoms, disease progression, and treatment outcomes, as well as laboratory findings, including blood test results and other relevant diagnostic data. To ensure the accuracy and reliability of the collected data, only complete and thoroughly documented case record sheets were included in the analysis. This meticulous data collection process was essential for maintaining the integrity of the study results.

Once collected, the data was systematically entered into MS Excel for initial organization and cleaning. Following this, the data was imported into SPSS software version 21 for detailed statistical analysis. The analysis employed descriptive statistics, such as frequencies and means, to summarize and derive insights from the data.

The results of the analysis were meticulously presented in the form of tables and figures, which facilitated easier visualization and interpretation of the findings. The study's findings are intended to contribute to the existing body of knowledge on dengue fever, aiding in the identification of at-risk populations, improving diagnostic and treatment strategies, and enhancing public health interventions.

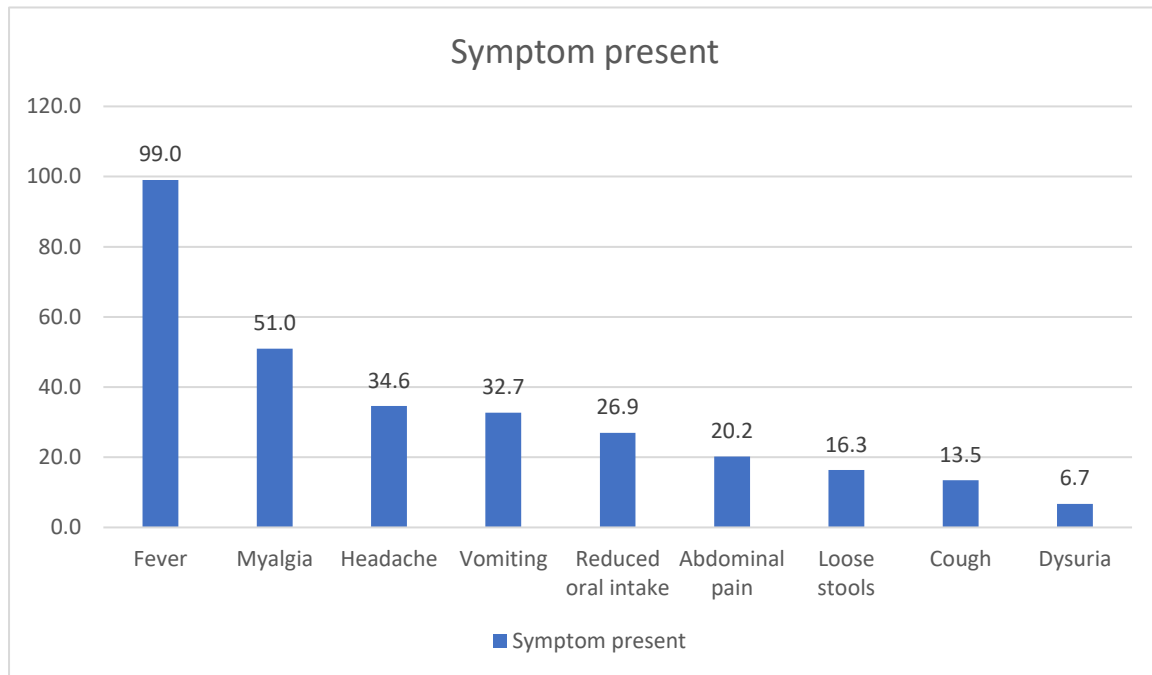
RESULTS:

The study included a total of 104 patients who were diagnosed with dengue. The mean age of the participants was 28.5 ± 16.4 years. Every 4 out of 10 study participants were in the age group of 21 to 40 years. About 60% of the study participants were male.

Table 1: Demographic details of dengue patients (N=104)

Category	Frequency (Percentage)
Age	
<20 years	39 (37.5)
21-40 years	44 (42.3)
41-60 years	15 (14.1)
>60 years	5 (5.8)
Gender	
Male	61 (58.7)
Female	43 (41.3)

In this study, the most common symptom of dengue was fever (99%), followed by myalgia (51%), headache (34.6%), and vomiting (32.7%). Out of all the dengue patients, 2.9% showed symptoms like abdominal distension, rash, or throat pain. Gum bleeding, tooth pain, decreased urine output, seizure, or Malena were observed in only 1.9% of the study participants. The least common presenting complaint was either nasal bleed, petechial spots, LOC, scrotal ulcer, erythematous rash, nasal discharge, constipation, hematuria, or ear pain, with only one of the participants showing any of these symptoms.

Figure:1 Clinical profile of dengue cases- Common symptoms of patients with Dengue(N=104)

All patients admitted with Dengue were treated with Intravenous fluids. About 27% of the dengue patients were started on empirical antibiotics but once Dengue was confirmed the antibiotics were de-escalated. There was one patient each diagnosed with Hepatitis C positive, Influenza positive and Malaria positive respectively along with Dengue. 2 of the patients who had blood cultures sent had Salmonella typhi positive. 1 patient had Candida tropicalis and 1 patient had E.coli positive in urine culture. Platelet transfusion and leucodepleted PRBS were required for 7 and 1 dengue patients respectively. In serological markers for Dengue – NS1 antigen was positive among 84.5%, Dengue IgM was positive in 47.2% and Dengue IgG was positive in 46.3%(where data were available). Only about 4% of the participants had hospital stays of more than 7 days

Table 2: Medical management, serological markers for Dengue, hospital stay of Dengue patients(N=104)

	Frequency	Percentage
Intravenous fluids		
Yes	104	100
Antibiotics		
Yes	28	26.9
Platelet transfusion		
Yes	7	6.7

Leucodepleted PRBS		
Yes	1	1
Serological markers for Dengue		
Dengue NS1 Positive (N=103)	87	84.5
Dengue IgM Positive (N=72)	34	47.2
Dengue IgG Positive (N=67)	31	46.3
Hospital stay (days) (Mean \pm SD=3.76 \pm 1.82)		
≤ 7	100	96.2
> 7	4	3.8

There was a slight decrease in the mean hemoglobin value from admission(13.36g/dl) to the value recorded before discharge(13.13g/dl), which could be attributed to hemodilution. On the other hand, there was an increase in the mean WBC value at admission($4716.06/\text{mm}^3$) as compared to the last recorded value before discharge($6350.32/\text{mm}^3$). About 52.9% of the dengue patients had leucopenia whereas 5.8% of the patients had leukocytosis. The mean urea and creatinine values were found to be within the normal range. However, there was a wide standard deviation in the mean value of total bilirubin, AST, ALT, and Alkaline phosphatase, which could be attributed to deranged values in 21 cases who had mild to severe hepatitis. Among the study participants, USG abdomen was done for 21 patients. Common findings were- Gall bladder edema(8 patients), Hepatomegaly(6 patients), Splenomegaly(5 patients), Cholelithiasis(2 patients), Gall bladder distension(2 patients). Moreover, the mean sodium value was observed to be in the hyponatremic range (134.95mg/dl), which is the most common electrolyte disturbance in dengue fever. About 37 of the participants(41.6%) had hyponatremia (out of 89 available data for sodium level)The mean potassium, chloride, and bicarbonate values were found to be within the normal range.

Table 3: Laboratory characteristics of dengue patients:

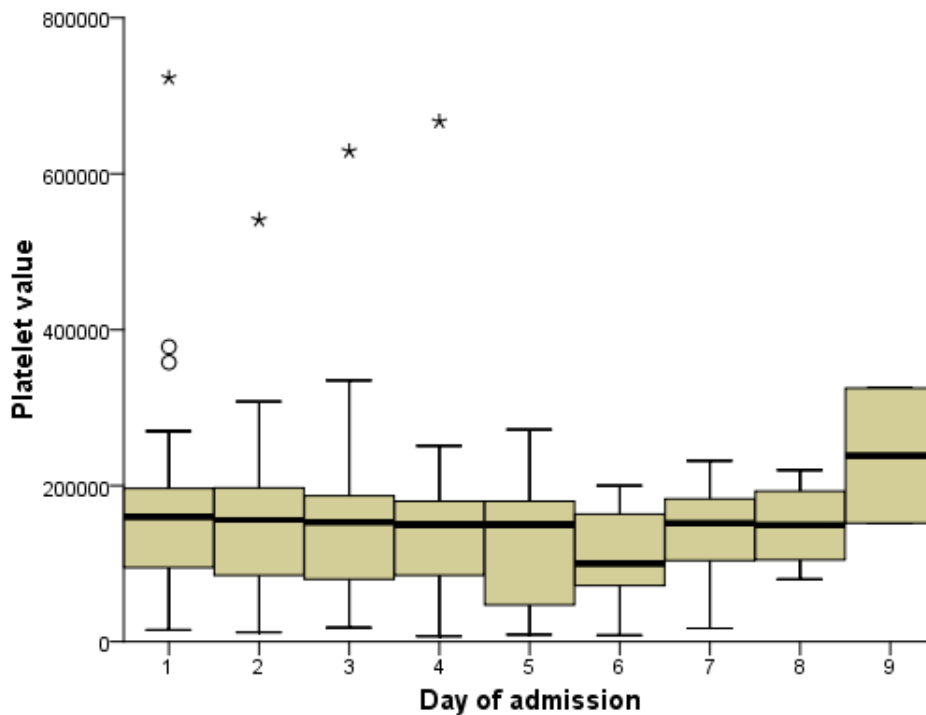
	Frequency	(Percentage)	At admission (Mean \pmSD)	Range (Minimum to Maximum)
Hemoglobin(g/dl)				
Low	30	28.8	13.36 \pm 2.01	7.3 - 18.5
Within normal	74	71.2		

limits (WNL)				
PCV(%)				
Low	31	29.8	39.39 ± 5.25	25.8 - 54.1
WNL	68	65.4		
High	5	4.8		
WBC count (per mm ³)				
Low	55	52.9	4716.06 ± 3286.03	1340 - 24860
WNL	43	41.3		
High	6	5.8		
Urea (mg/dl)				
WNL	74	71.2	18.37 ± 7.15	8 - 50
High	30	28.8		
Creatinine (mg/dl)				
WNL	98	94.2	0.82 ± 0.27	0.16 - 1.75
High	6	5.8		
Total bilirubin (mg/dl)				
WNL	83	79.8	0.84 ± 0.97	0.03 - 8.40
High	21	20.2		
Aspartate aminotransferase -AST(U/l)				
WNL	70	67.3	90.73 ± 85.44	13.0 - 519
High	34	32.7		
Alanine transaminase -ALT (U/l)				
WNL	71	68.3	58.68 ± 56.14	8.0 - 290
High	33	31.7		
Alkaline Phosphatase (U/l)				
WNL	86	82.7	81.30 ± 48.24	33.0 - 299
High	18	17.3		
Sodium (mEq/l)				
Low	42	40.4	134.94 ± 3.43	127 - 144
WNL	62	59.6		
Potassium (mEq/l)				

Low	17	16.3	3.99 ± 0.56	2.28 - 6.27
WNL	83	79.8		
High	4	3.8		
Chloride (mEq/l)				
WNL	86	82.7	102.87 ± 4.52	94 - 125
High	18	17.3		
Bicarbonate(mEq/l)				
Low	23	22.1	23.27 ± 2.90	13 - 28.00
WNL	81	77.9		

There was a fall in platelet level from day 1 to day 6 in the current study after which there is a gradual rise in platelet level. In the figure * and ° denotes outliers. 38.5% of the study participants had thrombocytopenia on day 1 of admission rest had normal platelet value at admission. The mean Platelet value(per mm³) at day 1 to day 9 in the present study are as follows: 157021(Day1), 145014(Day 2), 146527(Day 3), 140222(Day 4), 116595(Day 5), 113348(Day 6), 139588(Day 7), 149500 (Day 8), 238500(Day 9).

Figure 2: Box plot showing the platelet trends of cases from day 1 to day 9 of admission



DISCUSSION:

The clinical and laboratory profile of dengue cases plays a crucial role in enabling healthcare providers to diagnose the disease early and effectively. It helps in identifying the severity of the condition, guiding treatment decisions, and monitoring the progression of the illness. Furthermore, this information is essential for risk assessment and outbreak response, enabling public health officials to develop effective strategies to control the spread of the disease. Overall, understanding the clinical and laboratory profile of dengue cases is vital for ensuring patient safety and mitigating the impact of outbreaks on public health.

Demographic details:

The mean age of the participants in the current study was 28.5 ± 16.4 years, which is similar to the result of a study done by Padmaprakash KV et al., (30.6 ± 10.4 years)⁸ and George T et al., (37.8 ± 19.4 years)⁹, Patil et al., (35.03 ± 5.07 years)¹⁰. The study found that there were slightly more males than females, which is consistent with previous research conducted by George T et al., Nagaram PP et al., and Habib et al.,^{9,11,12}. The reason for similar demographic details in different studies and the current study could be to ensure that the findings are comparable and reliable.

Clinical profile:

In terms of clinical profile, fever, myalgia, and headache were the most common symptoms, with fever being present in all cases. These findings align with several other studies conducted by Rao AA et al., Padmaprakash KV et al., Dhivya P et al., George T et al., Banthia et al., and Ismail et al.,^{8,9,13-15}. The consistent clinical manifestations of the disease across different populations and periods highlight the importance of understanding and managing the condition. Common findings of USG abdomen in the current study was gall bladder edema followed by hepatomegaly. Whereas in a study done by Dhivya P et al., and Banthia ET et al.,^{14,15}, the common finding in the USG abdomen was hepatomegaly. Variations in disease severity, timing of imaging, can lead to differences in ultrasound (USG) abdomen findings between the current study and past studies.

Medical management and dengue serology:

About 85% of the study participants tested positive for NS1 antigen, which was similar to the study done by Ismail et al.,¹⁶ and Habib et al.,¹² where NS1 tested positive in 3/4th of the dengue patients. The similar dengue serology pattern in the current study conducted in India and past studies conducted in Bangladesh and Pakistan may be due to the shared regional dynamics of dengue virus transmission, including similar circulating virus serotypes and environmental conditions conducive to dengue spread across these neighboring countries.

The mean hospital stay in the current study was 3.76 ± 1.82 days which was similar to findings by Ismail et al.¹⁶ where the mean length of stay was 4.8 ± 2 days, Patil et al.,¹⁰ where the mean length of stay was 3.65 ± 1.39 days. Consistent patient management protocols, healthcare system practices, and effective treatments over time may have contributed to similar mean length of stay between current and past studies.

Lab characteristics:

Leucopenia was noted in 55% of the dengue patients in the current study which is slightly higher when compared to the study done by Dhivya P et al.,¹⁴ where leucopenia was noted in 36%. A study done by Nagaram PP et al.,¹¹ had about 55% of the cases with Leukopenia which is similar to the current study findings. But a study done by Banthia BL et al.,¹⁵ had 67.2% of dengue patients with Leucopenia. The difference in white blood cell (WBC) counts among dengue patients in the current study and past studies could be due to factors like patient characteristics, disease severity, and timing of blood tests. Hyponatremia was noted in about 41.6% of the study participants in the current study which was similar to finds of Ismail et al, Karoli et al.,^{16,17}. As hyponatremia is the most common complication of dengue, there is a similarity between the present and past studies.

Platelet trends:

There was a fall in mean platelet value from day 1 to day 6 of in the current study which was similar to the study done by Chaloe Wong J et al.,¹⁸. The consistent platelet trends observed in dengue patients in both the current study in India and past studies in Thailand suggest that dengue infection affects platelet levels similarly across different geographic locations.

CONCLUSION:

The demographic and clinical profile of Dengue was studied in detail focusing on the platelet trends which proved to be similar across different geographic locations. The public need to be made aware of the consequences of this disease and opt for early diagnosis and treatment to prevent the progress of the disease into life-threatening complications. Studies done to know the patterns in dengue transmission can provide life-saving essential information to combat the disease, identify and diagnose dengue cases, and implement mosquito-control efforts. By elucidating the demographic and clinical characteristics of dengue patients in this specific healthcare setting, the study aims to contribute valuable insights to the existing body of knowledge on dengue epidemiology and management. The findings may also inform healthcare policies, improve clinical practices, and guide public health strategies aimed at reducing the burden of dengue in Chennai and similar settings in southern India. Sufficient

knowledge, a positive attitude and correct practice for dengue control are essential to put an end to this disease.

CONFLICT OF INTEREST: There was no conflict of interest among the authors

FUNDING SOURCES: No funding was received for conducting this study

AUTHOR CONTRIBUTION:

Raghul Saravanan planned the entire study, collected the data and did the analysis, Pragadeesh Palaniappan contributed to the introduction part of the study, Supraja Nagarathinam did the abstract and conclusion part in the current study, Aarthe Raghul compiled the discussion of this study. The authors checked the final content of the article

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