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Original Article

Microbiology Section

Proportion of Dengue Cases Before and During the COVID-19 Pandemic: A Retrospective Study

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ABSTRACT

Introduction: Dengue is a viral haemorrhagic fever that has become endemic in most tropical and subtropical countries, including India. There is a well-established surveillance system in India, where cases are notified in real time. The Coronavirus Disease 2019 (COVID-19) pandemic came as a learning tool, as the entire world concentrated on control and preventive measures, while relatively little attention was given to endemic diseases.

Aim: The present study aimed to determine the proportion of dengue cases before and during the pandemic, along with seasonality and seroprevalence.

Materials and Methods: This retrospective study was conducted from January 2018 to December 2024 at Rajarajeswari Medical College and Hospital, Bengaluru, Karnataka, India. The study population included all patients referred to the Microbiology department with suspected dengue. All samples were processed by immunochromatographic assays detecting IgM, IgG, and NS1 antigen according to standard protocols. The study included patients of both genders aged 5 to 60 years. Results were entered into log registers and maintained. The data were collected, compiled, and analysed to understand the prevalence of dengue in the area. Data were collected retrospectively from January 2018 to December 2024. Descriptive statistics were employed, and results were summarised in tables and figures; p-values were determined.

Results: In the present study, the total number of dengue-positive tests was 3173 from January 2018 to December 2024. The highest number of cases was reported in 2019 (1,108), followed by 327 cases during the during pandemic (2020-2022). There was a 73% reduction in the number of cases. The highest number of cases was reported from June to September, followed by a gradual decline. In our study, the most common immunological marker was NS1, indicating acute infection, followed by IgM.

Conclusion: Before and after the pandemic, the number of dengue cases reportedly increased fourfold. There was an unforeseen reduction in the number of cases during the pandemic; surveillance systems, as well as control and preventive measures for endemic diseases, were at a halt. There is a need for a parallel healthcare system that can function as two sides of a coin, managing both pandemics and endemic diseases.

Keywords: Co-infection, Coronavirus disease 2019, Dengue surveillance, Seasonal variation

INTRODUCTION

Dengue, a viral infection transmitted by vectors, is an endemic disease in India and remains a persistent public health challenge alongside other vector-borne diseases [1]. In India there is continuous real-time monitoring of cases, which are reported and documented through the Integrated Health Information Platform (IHIP) [2]. This platform helps in real-time monitoring, analysing trends, and detecting potential outbreaks. The health system faced an interruption when the COVID-19 pandemic struck, testing the resilience of global healthcare systems [3,4]. An estimated 100 million dengue cases occur each year, with the majority of cases in Southeast Asia, followed by Latin America [5]. A study examining the correlation between dengue and COVID-19 found that dengue incidences across the studied area decreased by 16% during the pandemic compared with pre-COVID-19 time [6,7]. In the early stages, the clinical diagnosis of dengue and COVID-19 can be challenging to differentiate because of their shared clinical and laboratory features [8,9]. Both typically begin with an undifferentiated fever accompanied by nonspecific signs and symptoms. Before the onset of complications and systemic infection, several laboratory parameters may show similar results, such as leukopenia and thrombocytopenia [10,11]. Before COVID-19 there were dedicated healthcare interventions like IHIP, mosquito control, and vector-control measures to monitor these endemic diseases, but COVID-19 consumed all resources, time, and manpower and hampered workflow globally. Healthcare sectors have focused primarily on combating COVID-19, often sidelining the ongoing threat of other diseases, such as vector-borne infections, which continue to demand attention [12,13]. As reported by WHO, during the pandemic there was a significant reduction in reported dengue cases compared with other years, although data for this period are not complete [14,15].

Hence, the present study was conducted to analyse the trend of dengue cases over seven years (2018-2024), which could help demonstrate increases or decreases in the number of cases reported before and during the pandemic. The study helps to understand the trend of the disease over seven years and shows a significant shift in the number of cases reported during the pandemic. The COVID-19 pandemic is a novel experience and serves as a learning tool to design healthcare facilities that do not ignore routine epidemics and endemic diseases such as dengue.

The primary objective was to analyse the trend of the disease over the period; the secondary objective was to determine the seasonal variation of the disease and analyse the various immunological markers tested positive during the same period.

MATERIALS AND METHODS

The present retrospective study was conducted in the Department of Microbiology, Rajarajeswari Medical College and Hospital. Data were collected retrospectively from January 2018 to December 2024, with data extraction and analysis performed from December 2024 to February 2025. It was a time-bound study, and all subjects available in the study were included. The study was submitted to the ethical committee, and approval was obtained with the number RMCH/IEC/07/2023. Patient details (age, gender, year of hospital visit) were obtained from the laboratory registers.

Inclusion criteria: The study population includes all patients, regardless of sex or age, who were referred to the microbiology department with suspected dengue. These patients presented with fever as the primary symptom, often accompanied by chills and rigors, and were seen in the Outpatient Department (OPD) or admitted to the ward.

Exclusion criteria: Patients without symptoms suggestive of dengue were excluded.

Study Procedure

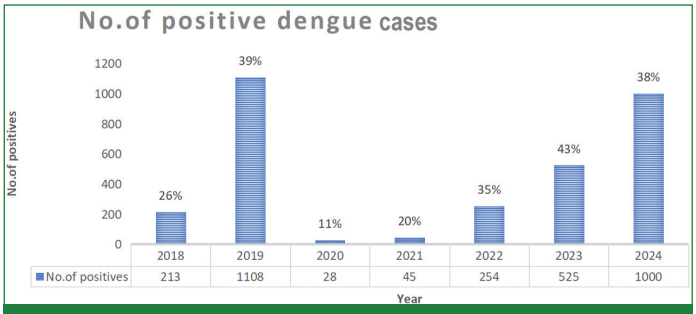
All samples were processed according to standard protocols. Blood samples received by the Department of Microbiology were subjected to rapid immunochromatographic assays to determine Non-Structural protein 1 antigen (NS1) , Immunoglobulin M (IgM), Immunoglobulin G (IgG) immunological markers. Commercially available kits (immunochromatographic rapid cards for NS1, IgG, IgM) were procured from Dengue Rapid Card (NS1, IgG, IgM) in vitro diagnostic reagents, J. Mitra & Co. Pvt., Ltd., Okhla Industrial Area, New Delhi, Lot No. DBA381124. Plasma/serum separated from the blood samples was used for the rapid tests. The tests were performed as per the manufacturer's instructions, and results were interpreted [16]. The test results were documented in the laboratory register and maintained. The data included patient details, chief complaints, number of blood samples collected, number of samples positive for dengue, and seroprevalence. The data were collected, compiled, and analysed to understand the prevalence of dengue in the area.

STATISTICAL ANALYSIS

Descriptive statistics were employed to summarise the characteristics of the study participants and the frequency of dengue across different variables, and accompanying text. A Z-test was applied to assess statistical significance in the proportion of cases across the years.

RESULTS

In the present study, the total number of tests positive for dengue was 3,173 from January 2018 to December 2024. The highest number of cases was reported in 2019 (1,108), accounting for 39% of cases, followed by 327 cases during the pandemic (2020-2022). The highest rise was observed in 2024 (1,000), with a prevalence rate of 38%. As per [Table/Fig-1, 1a and 1b] fewer cases were documented during the COVID-19 period (299 over two years) compared with the pre-pandemic and tail-end periods. A Z-test was conducted to assess statistical significance, with p-values <0.05 for the comparison of before vs during the pandemic, and <0.00001 for the comparison of during vs tail-end. This suggests that the time periods are associated with a significant change in the number of cases. The highest number of cases occurred from June to September, followed by a gradual decline, which correlates with the monsoon season and the associated increase in mosquito breeding sites. In our study, the most common immunological marker was NS1, indicating acute infection, followed by IgM; IgG indicating secondary infection was also detected along with NS1 and IgM [Table/Fig-3].



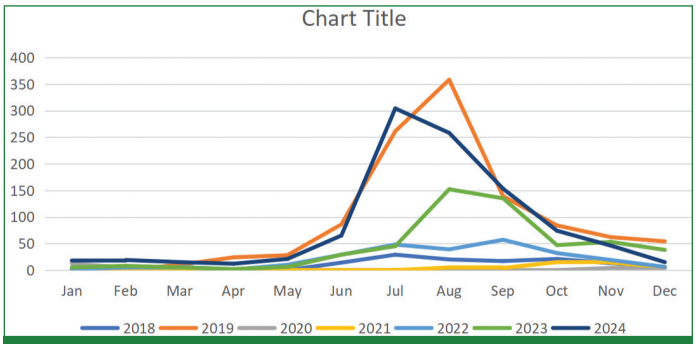
[Table/Fig-1]: Shows total number of positive cases in each year.

Period	Year	No. of cases	No of positive cases
Before pandemic	2018	794	213
	2019	2842	1108
During pandemic	2020	236	28
	2021	216	45
	2022	721	254
		Z score	5.30
		p-value	<0.00001

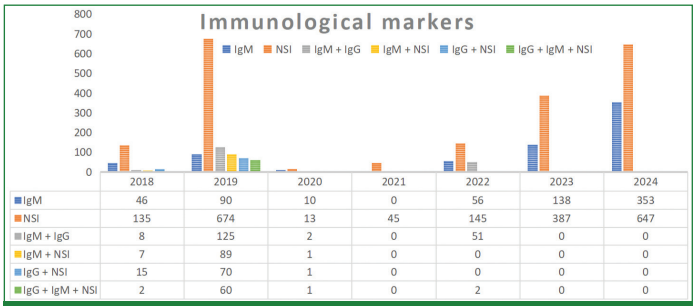
[Table/Fig-1a]: Comparison of proportion of cases before pandemic (2018-2019) to cases documented during pandemic (2020-2022).

Period	Year	No. of cases	No. of positive cases
During pandemic	2020	236	28
	2021	216	45
	2022	721	254
Tail end pandemic	2023	1216	525
	2024	2618	1000
		Z-score	7.38
		P-value	<0.00001

[Table/Fig-1b]: Comparison of proportion of cases during tail end of pandemic (2023-2024) to cases documented during pandemic (2020-2022) Z-test is applied.



[Table/Fig-2]: The seasonal variation of the disease from 2018-2024.



	2018	2019	2020	2021	2022	2023	2024
IgM	46	90	10	0	56	138	353
NSI	135	674	13	45	145	387	647
IgM + IgG	8	125	2	0	51	0	0
IgM + NSI	7	89	1	0	0	0	0
IgG + NSI	15	70	1	0	0	0	0
IgG + IgM + NSI	2	60	1	0	2	0	0

[Table/Fig-3]: Various immunological markers that were tested positive from 2018-2024.

DISCUSSION

Among vector-borne infections, dengue has been a perennial dilemma for decades. Although health programmes such as the National Vector Borne Disease Control Programme (NVBDCP) and the Integrated Health Information Platform (IHIP) function effectively for passive sentinel surveillance that can help in the prevention and control of dengue, there is an incremental rise in cases each year [17]. In 2023, India reported 289,235 cases of dengue, up from 28,066 in 2010 [18]. The simultaneous outbreaks of dengue and COVID-19 in tropical and subtropical cities could have had potentially catastrophic effects. This study was conducted to determine the proportion of cases before, during, and at the tail end of the COVID-19 pandemic. In our study, for 2018-2024, the periods 2018-2019 were regarded as pre-pandemic, 2021-2022 as during-pandemic, and 2023-2024 as tail end of the pandemic. The present study shows a decline in cases from 1,255 to 299 during the pandemic; similar findings were recorded in a study

by Khan S. et al., who studied global dengue infection patterns during the 2 years of COVID-19 (2020-2021). The study found that, compared with the pre-COVID-19 period (2015-2019), there is an overall decrease in dengue cases by 16% during the COVID-19 pandemic [19]. This is concordant with our study, in which we observed a 76% reduction in the number of cases documented from the pre-pandemic to the pandemic period. However, during the first year of the COVID-19 pandemic, increases in dengue cases were observed in Brazil, Peru, Bolivia, Paraguay, Argentina, and Singapore, where they reported a 123% increase after detecting the Delta variant [20]. Decreases in case numbers during COVID-19 can be attributed to several factors, such as overlapping symptoms between COVID-19 and dengue in the early stages of the disease, lack of diagnostic facilities due to the conversion of healthcare facilities into dedicated COVID-19 centres, and paucity in the implementation of surveillance programs. This underscores the need for a definite protocol or health system that can operate in parallel with pandemic-focused healthcare.

Regarding seasonal variations, the highest number of dengue cases in our study occurred during the monsoon, from June to September. This could be attributed to rainfall, stagnation of water, more breeding sites, and increased vector density. To assess seasonal variation, data were analyzed on a monthly basis. Studies have shown an influence of seasons on the prevalence of the *Aedes aegypti* mosquito and the dengue virus [21]. The present study shows the highest number of cases reported from July to September, followed by a gradual decline to November. This corresponds with the monsoon pattern in this part of the country, thus showing a clear relationship between the monsoon and dengue. This is supported by studies conducted by Naik P. et al., and Kumar S. et al., [22,23].

Laboratory testing: In this study, samples were tested for the NS1 antigen and IgM antibodies for the early diagnosis of dengue fever. NS1 antigen is present in serum from the first day after onset of fever up to day 9 and is used as a diagnostic marker for early dengue infection. IgM antibodies become detectable on days 3-5 of illness in cases of primary dengue infection and persist for two to three months. There is widespread use of rapid immunochromatographic tests for detecting dengue, focusing on both the NS1 antigen and the IgM/IgG antibodies [22]. These tests are valuable for fast diagnosis, especially in outpatient settings where timely results are crucial for effective patient management and early intervention. The ability to differentiate between the antigen and the antibodies also aids in understanding the stage of infection, which is important for clinical decisions and preventing complications. In this study, isolated NS1 antigen was the most common marker identified, compared with isolated IgM, followed by other combinations including IgM and IgG antibodies. This combination would improve diagnostic yield and aid in the early diagnosis of dengue infection. The detection of NS1, IgM, and IgG in dengue infection has important clinical implications, especially for diagnosis, disease staging, and management. A positive NS1 indicates active viral replication. IgM indicates recent or primary infection, and IgG helps differentiate primary versus secondary dengue, which is crucial because secondary infections are more often associated with severe dengue (DHF/DSS).

Limitation(s)

The study was single-centred; better conclusions would have been drawn if it were multicentric. During the pandemic, hospital admissions were more centered on COVID-19, which could be one of the reasons for the decline in the number of dengue cases.

CONCLUSION(S)

The present study primarily focuses on determining the proportion of cases from 2018-2024, which showed a decline in cases during the pandemic. Although the COVID-19 pandemic was a new challenge and many measures were taken to control and prevent the disease, there were disruptions in controlling endemic diseases like dengue. There should be a parallel health-care system that remains functional during pandemics and does not hamper the surveillance and documentation of vector-borne diseases during such periods. This could be due to overlapping symptoms of dengue and COVID-19, and centres being dedicated to COVID-19 control, as in our setting. The system should be well prepared, with definite health protocols and dedicated, trained personnel to deal with health care during pandemics, so that the acute crisis can be managed without neglecting endemic diseases.

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