ORIGINAL ARTICLE

Cardiovascular manifestations among dengue fever patients at a tertiary care hospital

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ABSTRACT

Background: Clinical spectrum of dengue viral infection ranges from asymptomatic infection to dengue fever, dengue hemorrhagic fever, and dengue shock syndrome. Cardiac manifestation includes elevated cardiac biomarkers, arrhythmias, conduction disturbances, left ventricular dysfunction, and pericardial involvement. The objective of this study is to determine the frequency of overall cardiac manifestations and their types among patients with dengue fever at tertiary care hospital.

Material and Methods: This cross-sectional study was conducted in the Department of Internal Medicine at Liaquat National Hospital, Karachi. A total of 111 patients aged 18–75 years of either gender were enrolled. Cardiac involvement was defined by systolic or diastolic dysfunction, reduced ejection fraction, pericardial involvement, elevated biomarkers, or rhythm disturbances. Data were analyzed using SPSS version 25, with categorical variables expressed as frequencies and percentages, and associations assessed using chi-square or Fisher's exact test, considering $p \leq 0.05$ as significant.

Results: Overall cardiovascular manifestations were observed in 22 cases (20%). Most frequent abnormalities were sinus bradycardia in 19 patients (17.1%), systolic dysfunction in 17 (15.3%), and reduced ejection fraction in 18 (16.2%). Less common findings included troponin-I positivity in 5 patients (4.5%), ST-T wave changes in 3 (2.7%), and pericarditis in 1 (0.9%). No significant association was observed between demographic variables, comorbidities, cardiac function parameters, and occurrence of cardiovascular manifestations.

Conclusion: Cardiac manifestations were observed in a notable proportion of dengue fever patients. Most commonly abnormalities are sinus bradycardia, systolic dysfunction, and reduced ejection fraction.

Keywords: Dengue fever, Tachycardia, Narrow pulse pressure, Tachypnea

BACKGROUND

Dengue fever, a mosquito-borne viral disease caused by the dengue virus (DENV),[1] is the most rampant and has huge growth in the number of cases over the past 50 years. Over 50% of the world's population lives in regions with the risk of DENV infection, where its incidence has increased 30-fold in the last 50 years.[2] Detection of IgM or IgG antibodies is the standard for serologically confirming a dengue infection. The presence of IgM or high levels of IgG in acute serum collected from a suspected dengue case suggests a probable dengue infection.[3]

Dengue fever presents a spectrum of clinical manifestations ranging from self-limiting febrile illness to severe forms like dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). The progression to severe dengue is marked by increased vascular permeability, plasma leakage, and systemic inflammation, leading to life-threatening complications such as hypovolemic shock and multi-organ failure. Despite extensive research into its epidemiology and pathophysiology, the full spectrum of complications associated with dengue infection continues to be elucidated.[4,]

Dengue fever has been increasingly recognized as a potential trigger for cardiac complications. Studies have reported a significant association between dengue infection and cardiac manifestations, including myocarditis, pericarditis, and arrhythmias. However, the prevalence of cardiac incidents among dengue patients in Pakistan remains poorly understood.[6] Complications or severity of the illness increase particularly in older populations and those with comorbidities.[7] In addition, patients with severe dengue are especially prone to fatal myocarditis that results in death. Apparently, myocarditis is probably the most common sequela leading to the increased number of mortalities.[2] However, most patients with myocarditis have a subclinical illness with elevated enzymatic and electrocardiographic changes.[8] Recently, studies with

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dengue fever subjects showed that elevated troponin levels are highly sensitive in detecting minor myocardial injuries.[9]

Cardiac complications, though less commonly reported compared to hemorrhagic manifestations, can significantly impact patient outcomes and pose diagnostic and therapeutic challenges. The pathophysiology underlying cardiac involvement in dengue is multifactorial, involving direct viral invasion, immune-mediated injury, and the systemic effects of cytokine storm and vascular leakage.[10] Cardiac manifestations ranged from elevated biomarkers such as CKMB and Troponin I to abnormal electrocardiography and echocardiography. Depression of myocardial function is frequent in the hemorrhagic form of the disease or in the associated shock.[11]

Despite the recognized significance of cardiac complications in dengue fever, there is a paucity of comprehensive studies that systematically evaluate their incidence, clinical profile, and outcomes. Most existing data are derived from case reports and small case series, limiting the generalizability of findings and the development of evidence-based management strategies.[12] Cardiac manifestations of dengue fever include asymptomatic sinus bradycardia, transient AV blocks, transient ventricular arrhythmias, myocarditis and pericardial effusion however; no local study was found aiming to assess cardiac manifestation among dengue fever patients.

Therefore, our aim is to evaluate the cardiac manifestation among this population. Early identification of these symptoms can help avoid any problems and provide prompt supportive care.

MATERIAL AND METHODS

The study was designed as a cross-sectional investigation and was carried out in the Department of Internal Medicine at Liaquat National Hospital, Karachi, over a period of 6 months from 1st July 2025 to 31st December 2025 following approval of the synopsis and ethical clearance from institutional ethical and review committee of LNH with approval no: Ref App # 1233-2025-LNH-ERC. The target population comprised patients presenting with dengue fever who fulfilled the World Health Organization (2009) criteria for dengue infection. Laboratory confirmation was established either by a positive dengue non-structural protein 1 (NS1) antigen test or by detection of dengue-specific IgM antibodies in acute-phase sera using ELISA. The Wan nor Arifin online sample size calculator was used to calculate a sample size of 111 patients using an expected frequency of 36.66 in cardiac manifestation, a margin of error of 9%, and a confidence level of 95%. The margin of error was set at 9% to guarantee reasonable accuracy and at the same time make the study possible within its own means and time constraints. The non-probability consecutive sampling method was employed, in which all eligible patients that met the criteria of the study were recruited one after another until a sufficient sample size was reached. Informed consent of all the participants was taken in written form before enrolment.

Eligibility criteria included male and female patients aged between 18 and 75 years with confirmed dengue infection. Patients with known cardiac disease, recent myocardial infarction within the preceding month, cardiomyopathy, or those receiving medications known to affect heart rate or rhythm were excluded. Baseline demographic and clinical data were collected using a structured proforma, including age, sex, residence, body mass index, and relevant comorbidities such as diabetes mellitus, hypertension, and anaemia. These variables were documented to allow stratification and control of potential confounders.

All enrolled patients underwent a standardized diagnostic work-up. Complete blood count and was performed at admission. A 12-lead electrocardiogram (ECG) was obtained during the febrile phase and repeated at 24-hour intervals if abnormal to detect dynamic changes. ECGs were interpreted for sinus tachycardia, sinus bradycardia, nonspecific ST-T wave changes, inverted T waves, first-degree atrioventricular block, and right bundle branch block. Echocardiography was performed after admission by trained personnel and included assessment of left ventricular ejection fraction, systolic and diastolic function, wall thickness, transmitral Doppler velocities, and tissue Doppler indices. Pericardial effusion was also evaluated. Cardiac biomarkers, specifically troponin I, were measured at admission, with values <0.30 ng/ml considered normal. In patients with elevated troponin I, repeat testing was performed to confirm persistence or resolution. Plasma leakage was diagnosed by the presence of pleural effusion, pericardial effusion, or ascites. All the test performed were routine test and needed no extra funding's.

Cardiac involvement was defined as the presence of one or more of the following: left ventricular systolic dysfunction (LVEF <50%), transient diastolic dysfunction graded according to standard criteria, myocarditis compatible with European Society of Cardiology definitions (elevated biomarkers with depressed LVEF), pericarditis or pericardial effusion, or elevated cardiac biomarkers. Overall cardiac manifestation was considered present if patients demonstrated tachycardia, narrow pulse pressure, or tachypnea in addition to the above findings. This operational definition ensured that both clinical and subclinical cardiac abnormalities were captured.

The data were summarized and examined with Statistical Package of the Social Sciences (SPSS) version 25. Shapiro Wilk test was used to measure the distribution of quantitative variables. Normal variables such as age and body mass index (BMI) were presented as mean ± Standard deviation, but variables that are not normally distributed (troponin I and ejection fraction) were presented as median and interquartile range. Frequencies and percentages were used to present categorical variables such as gender, comorbidities and particular cardiac manifestations. To control confounding, stratification was done on the potential effect modifiers which included age, gender, BMI, hypertension, diabetes, anemia, smoking status, troponin I levels and ejection fraction. After stratification, chi-square test or Fisher exact test was used to determine the relationship between categorical variables. A p-value of 0.05 and below was taken as significant. The threat of bias was reduced through a rigorous compliance with the inclusion and exclusion criteria, equalization of the definitions of diagnoses, and the standardization of data collection protocols in all the participants.

RESULTS

There were 111 patients with dengue fever. Table-I shows the demographics. The cardiovascular manifestations were detected in 22 patients (19.8%). Sinus bradycardia (19; 17.1%), reduced ejection fraction (18; 16.2%) and systolic dysfunction (17; 15.3%) were the most frequently occurring abnormalities.

The mean age of the participants was 36.16 years ±14.42 years and 58 individuals (52.3%) fell within the age range of 35 years and below. There were 74 (66.7%) males, and most of them were urban dwellers (104; 93.7%). Co-morbidities were rare: hypertension 13.5%, diabetes mellitus 7.2% and anemia 9.9%.

Table-II shows the relationship between demographic, clinical, and functional cardiac variables and major cardiac manifestations. No significant association was observed between sinus bradycardia, systolic dysfunction, low ejection fraction, or Troponin-I positivity.

Table-I: Frequency distribution of demographic, clinical characteristics, and cardiac manifestations (n = 111)

Variable	Category	N (%)
Age (years)	Mean ± SD	36.16 ± 14.42
	≤35	58 (52.3)
	>35	53 (47.7)
Gender	Male	74 (66.7)
	Female	37 (33.3)
Area of Residence	Urban	104 (93.7)
	Rural	7 (6.3)
Comorbidities	Hypertension (HTN)	15 (13.5)
	Diabetes Mellitus (DM)	8 (7.2)
	Anemia	11 (9.9)
Cardiac Structural Abnormalities	Systolic Dysfunction	17 (15.3)
	Diastolic Dysfunction	1 (0.9)
	Low Ejection Fraction	18 (16.2)
	Pericarditis	1 (0.9)
Cardiac Electrical Abnormalities	Sinus Bradycardia	19 (17.1)
	ST-T Wave Changes	3 (2.7)
Cardiac Biomarkers	Troponin-I Positive	5 (4.5)
Age (years)	Mean ± SD	36.16 ± 14.42
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	Female	37 (33.3)
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	Anemia	11 (9.9)

Table-II: Association of demographic and clinical parameters with cardiovascular manifestations (n = 111)

Variable	Category	Sinus Bradycardia n/N (%)	p-value	Systolic Dysfunction n/N (%)	p-value	Low EF n/N (%)	p-value	Troponin- I Positive n/N (%)	p-value
Age	≤35 (n=58)	10/58 (17.2)	0.971	8/58 (13.8)	0.742	9/58 (15.5)	0.812	3/58 (5.2)	1.000*
	>35 (n=53)	9/53 (17.0)		9/53 (17.0)		9/53 (17.0)		2/53 (3.8)	
Gender	Male (n=74)	15/74 (20.3)	0.212	12/74 (16.2)	0.684	13/74 (17.6)	0.598	4/74 (5.4)	1.000*
	Female (n=37)	4/37 (10.8)		5/37 (13.5)		5/37 (13.5)		1/37 (2.7)	1.000*
Residence	Urban (n=104)	19/104 (18.3)	0.214*	16/104 (15.4)	1.000*	17/104 (16.3)	1.000*	5/104 (4.8)	
	Rural (n=7)	0/7 (0.0)		1/7 (14.3)		1/7 (14.3)		0/7 (0.0)	
Hypertension	Yes (n=15)	2/15 (13.3)	0.676*	2/15 (13.3)	1.000*	2/15 (13.3)	1.000*	1/15 (6.7)	1.000*
	No (n=96)	17/96 (17.7)		15/96 (15.6)		16/96 (16.7)		4/96 (4.2)	
Diabetes Mellitus	Yes (n=8)	1/8 (12.5)	0.719*	1/8 (12.5)	1.000*	1/8 (12.5)	1.000*	0/8 (0.0)	1.000*
	No (n=103)	18/103 (17.5)		16/103 (15.5)		17/103 (16.5)		5/103 (4.9)	
Anaemia	Yes (n=11)	3/11 (27.3)	0.397*	2/11 (18.2)	1.000*	2/11 (18.2)	1.000*	1/11 (9.1)	1.000*
	No (n=100)	16/100 (16.0)		15/100 (15.0)		16/100 (16.0)		4/100 (4.0)	

*Fisher's Exact test applied where expected cell count <5. Chi-square test applied where assumptions were met.

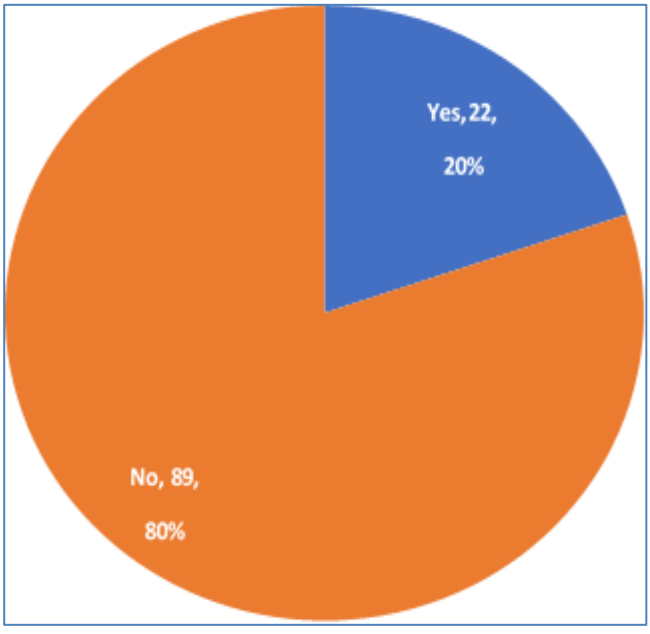

Figure-I: Distribution of overall cardiovascular manifestations.

DISCUSSION

This paper has found a cardiovascular involvement in 19.8% of dengue fever patients, with the commonest abnormalities to include sinus bradycardia (17.1%), low ejection fraction (16.2%), and systolic dysfunction (15.3%). ST-T alterations, diastolic heart failure, and pericarditis were rare, and Troponin-I was positive in only some of the patients. The results are also in line with previous reports, which show that in some patients, dengue can implicate the cardiovascular system and tend to manifest as conduction abnormalities or temporary myocardial dysfunction. [7, 8, 9]

Sinus bradycardia is more common in our study than it has been in earlier studies, in which conduction abnormalities were found in about 15%--20% percent, indicating that the bradyarrhythmias could be an early sign of cardiac involvement in dengue infection^10,11. Likewise, the patterns of cardiac involvement were also

reported having bradyarrhythmias and systolic impairment findings, which upheld the results of the current research.[11]

The percentage of patients with decreased ejection fraction and systolic dysfunction in this study is higher compared with other past studies where systolic impairment was 10-12 percent.[13, 14] This difference can be caused by the difference in the patient population, the severity of illness, or the diagnostic criteria. The Troponin-I positive results were 4.5 percent which is consistent with the previous studies to indicate that biochemical evidence of myocardial injury is not too common but still is clinically significant.[15]

Rare conditions like diastolic dysfunction and pericarditis were seen infrequently and this is in line with the current data that indicate overt myocarditis and structural cardiac complications are unlikely in adult patients with dengue disease.[12]

More so, cardiovascular manifestations and demographic variables, comorbid conditions and functional parameters were found not to have a statistically significant association. This finding is in line with the observations that have been made in the past studies which reported that cardiac involvement in dengue is usually unpredictable and not related to baseline patient characteristics in a definite way.[16, 17] Similarly in a systematic review reported that cardiovascular involvement in dengue infection is heterogeneous and lacks a consistent association with baseline demographic or clinical characteristics. Their findings further emphasize the unpredictable nature of cardiac sequelae, supporting the observation that such manifestations may occur independently of identifiable risk factors.[18]

This study has several limitations that warrant consideration. First, the cross-sectional design restricts the ability to establish temporal or causal relationships between dengue infection and subsequent cardiac manifestations, as patients were evaluated only during the acute phase of illness. Second, the relatively modest sample size of 111 patients, calculated on expected prevalence estimates, may have limited the statistical power to detect subtle associations between demographic or clinical parameters and specific cardiac outcomes. Third, the study was conducted at a single tertiary care center in Karachi, which may reduce the generalizability of findings to other populations, particularly rural or resource-limited settings where diagnostic facilities are less comprehensive. These limitations highlight the need for larger, multicenter, longitudinal studies incorporating advanced diagnostic tools to better characterize the spectrum and clinical.

CONCLUSION

The study concludes that cardiovascular manifestations are not uncommon among patients with dengue fever, with a notable proportion developing abnormalities such as rhythm disturbances, systolic dysfunction, reduced ejection fraction, and biochemical evidence of myocardial injury. Further, the statistical analysis did not demonstrate significant associations with demographic characteristics, comorbidities, or baseline cardiac function parameters which demonstrated that cardiac involvement in dengue fever may occur independently of patient profile, highlighting the importance of clinical vigilance.

RECOMMENDATIONS

Routine cardiovascular monitoring should be integrated into the management of dengue patients, regardless of age, gender, or comorbid status, as cardiac involvement was observed across diverse subgroups without identifiable predictors. Early use of diagnostic modalities such as echocardiography and electrocardiography are advised to detect abnormalities that may otherwise remain unnoticed. Clinicians should maintain a high index of suspicion for cardiac complications in dengue, particularly in patients presenting with unexplained rhythm disturbances or reduced cardiac function. Furthermore, larger multicenter studies are recommended to explore the mechanisms, long-term outcomes, and potential preventive strategies for dengue-associated cardiac involvement, which may guide the development of standardized monitoring and treatment protocols.

CONFLICT OF INTEREST

None

GRANT SUPPORT & FINANCIAL DISCLOSURE

Declared none

AUTHOR CONTRIBUTION

Sabahat Ghafoor: Substantial contributions to study concept and design, and acquisition of data, manuscript drafting, critical revision, final

approval, accountable for all aspects of publication.

Kamal Ahmed: Substantial contributions to acquisition of data and supervision of research work, critical review of the manuscript for important intellectual content, final approval, accountable for all aspects of publication.

Isra Waqar: Substantial contributions to analysis and interpretation of data, critical revision of the manuscript, final approval, accountable for all aspects of publication.

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