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Original Article

Assessment of Cardiac Involvement in Children with Dengue Fever Using Electrocardiography and Echocardiography

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ABSTRACT

Background: Dengue fever is a major mosquito-borne viral infection with a wide spectrum of clinical manifestations. Cardiac involvement, though often underrecognized, may occur in the form of rhythm disturbances, myocardial dysfunction, and pericardial effusion, particularly in severe dengue.
Objective: To assess cardiac involvement in children with dengue fever using electrocardiography (ECG) and echocardiography and to evaluate its association with disease severity.
Materials and Methods: This hospital-based prospective observational study was conducted among 75 children aged 1–18 years with laboratory-confirmed dengue fever admitted to ESIC Medical College, Kalaburagi, from June 2025 to June 2026. All patients underwent clinical evaluation, laboratory investigations, ECG, and echocardiography. Cardiac abnormalities were analyzed and correlated with dengue severity.
Results: The majority of patients were aged 6–10 years (40%), and 56% were males. According to WHO classification, 56% had dengue fever, 30.7% had dengue with warning signs, and 13.3% had severe dengue. ECG abnormalities were observed in 27 patients (36%), with sinus bradycardia being the most common finding (16%). Echocardiographic abnormalities were detected in 24 patients (32%), including mild left ventricular dysfunction (13.3%), pericardial effusion (9.3%), moderate left ventricular dysfunction (6.7%), and myocarditis (2.7%). Overall cardiac involvement was present in 32% of patients. Cardiac abnormalities were significantly more common in severe dengue, being present in all severe dengue cases.
Conclusion: Cardiac involvement is a frequent complication of pediatric dengue fever and is strongly associated with disease severity. ECG and echocardiography are useful non-invasive tools for early detection of cardiac abnormalities and should be considered, particularly in children with warning signs and severe dengue.

Keywords*: Dengue fever, Children, Cardiac involvement, Electrocardiography, Echocardiography, Myocarditis, Left ventricular dysfunction.*

INTRODUCTION

Dengue fever is one of the most rapidly spreading mosquito-borne viral infections worldwide and represents a major public health challenge in tropical and subtropical countries. The disease is caused by the dengue virus, a flavivirus transmitted primarily by Aedes aegypti mosquitoes. According to the World Health Organization (WHO), the incidence of dengue has increased dramatically over recent decades, with children constituting a significant proportion of affected patients in endemic regions [1].

The clinical spectrum of dengue ranges from asymptomatic infection and uncomplicated dengue fever to severe dengue characterized by plasma leakage, hemorrhage, shock, and multi-organ dysfunction [2]. Although the hematological and vascular manifestations of dengue are well recognized, cardiac involvement has gained increasing attention in recent years due to its potential contribution to morbidity and mortality [3].

Cardiac manifestations in dengue infection may result from direct viral invasion of myocardial tissue, cytokine-mediated myocardial depression, immune-mediated injury, electrolyte disturbances, and microvascular alterations [4]. The cardiovascular abnormalities reported in dengue include sinus bradycardia, sinus tachycardia, atrioventricular conduction defects, ST-T segment changes, myocarditis, pericardial effusion, ventricular dysfunction, and, rarely, cardiogenic shock [5].

Electrocardiography (ECG) is a simple, non-invasive tool for identifying rhythm and conduction abnormalities, whereas echocardiography provides valuable information regarding myocardial contractility, ventricular function, chamber dimensions, and pericardial involvement [6]. Several studies have demonstrated transient cardiac abnormalities in dengue patients, particularly among those with severe disease. Wali et al. reported myocardial dysfunction and reduced ejection fraction in patients with dengue hemorrhagic fever [7]. Yacoub et al. observed significant impairment of cardiac function in severe dengue and suggested that myocardial dysfunction may contribute to circulatory instability and shock [8]. Similar observations have been reported by Miranda et al. and Salgado et al., who documented ventricular dysfunction and myocarditis in dengue patients [9,10].

Children are particularly susceptible to severe manifestations of dengue and may develop cardiovascular complications that remain clinically silent unless actively investigated. Early recognition of cardiac involvement may facilitate appropriate monitoring, optimize fluid management, and improve clinical outcomes. Therefore, the present study was undertaken to assess cardiac involvement in children with dengue fever using electrocardiography and echocardiography and to evaluate its association with disease severity.

MATERIALS AND METHODS

Study Design and Setting

This was a hospital-based prospective observational study conducted in the Department of Pediatrics in collaboration with the Department of Medicine/Cardiology at ESIC Medical College, Kalaburagi, Karnataka, India. The study aimed to assess cardiac involvement in children diagnosed with dengue fever using electrocardiography (ECG) and echocardiography.

Study Duration

The study was conducted over a period of one year, from June 2025 to June 2026.

Study Population

The study included pediatric patients (aged 1–18 years) admitted with a confirmed diagnosis of dengue fever.

Sample Size

A total of 75 children diagnosed with dengue fever were enrolled in the study using a consecutive sampling method.

Inclusion Criteria

- Children aged 1–18 years
- Laboratory-confirmed dengue infection (NS1 antigen and/or IgM positive)
- Patients admitted during the study period
- Written informed consent obtained from parents/guardians

Exclusion Criteria

- Known pre-existing congenital heart disease
- History of chronic cardiac illness or cardiomyopathy
- Severe systemic illness unrelated to dengue that may affect cardiac status
- Patients on cardiotoxic drugs prior to admission

Clinical Evaluation

All enrolled patients underwent a detailed clinical assessment including history (fever duration, bleeding manifestations, warning signs) and physical examination with emphasis on hemodynamic status, pulse, blood pressure, and signs of plasma leakage or shock. Severity of dengue was classified according to WHO guidelines.

Laboratory Investigations

Routine laboratory investigations were performed for all patients, including:

- Complete blood count (CBC)
- Hematocrit levels
- Liver function tests (LFTs)
- Renal function tests (RFTs)
- Serum electrolytes

Cardiac Assessment

Electrocardiography (ECG)

A standard 12-lead ECG was performed for all patients at admission and repeated if clinically indicated. ECG findings were evaluated for:

- Sinus bradycardia or tachycardia
- ST-T segment changes
- Conduction abnormalities
- Arrhythmias

Echocardiography

Transthoracic echocardiography was performed using a standard pediatric echocardiography system. The following parameters were assessed:

- Left ventricular ejection fraction (LVEF)
- Regional wall motion abnormalities
- Pericardial effusion
- Myocardial contractility
- Chamber dimensions

Outcome Measures

The primary outcome was the presence of cardiac involvement in dengue fever as detected by ECG and/or echocardiography. Secondary outcomes included correlation of cardiac abnormalities with severity of dengue infection.

Statistical Analysis

Data were entered into a Microsoft Excel sheet and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, and categorical variables as percentages. The chi-square test was used for comparison of categorical variables, and a p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of ESIC Medical College, Kalaburagi. Informed written consent was obtained from parents or legal guardians of all participants. Confidentiality of patient data was strictly maintained throughout the study.

RESULTS AND OBSERVATIONS

A total of 75 pediatric patients with laboratory-confirmed dengue fever were included. All patients underwent clinical evaluation, laboratory investigations, ECG, and echocardiography.

Table 1: Age-wise distribution of patients (n = 75)

Age Group (Years)	Number of Patients	Percentage (%)
1–5	10	13.3%
6–10	30	40.0%
11–15	25	33.3%
16–18	10	13.3%
Total	75	100%

Table 2: Gender distribution (n = 75)

Gender	Number of Patients	Percentage (%)
Male	42	56.0%
Female	33	44.0%
Total	75	100%

Table 3: Clinical classification of dengue (WHO criteria)

Severity of Dengue	Number	Percentage (%)
Dengue fever (DF)	42	56.0%
Dengue with warning signs	23	30.7%

Severe dengue	**10**	**13.3%**
Total	**75**	**100%**

Table 4: Clinical manifestations (n = 75)

Clinical Feature	Number	Percentage (%)
Fever	**75**	**100%**
Myalgia	**54**	**72.0%**
Headache	**50**	**66.7%**
Rash	**32**	**42.7%**
Bleeding manifestations	**16**	**21.3%**
Hypotension/Shock	**10**	**13.3%**

Table 5: Laboratory parameters (Mean ± SD)

Investigation	Mean ± SD
Hemoglobin (g/dL)	**12.5 ± 1.6**
Hematocrit (%)	**41.8 ± 4.7**
Platelet count (/µL)	**70,000 ± 25,000**
Total WBC count	**4,300 ± 1,200**
Serum sodium (mEq/L)	**134 ± 4.2**
Serum potassium	**3.9 ± 0.5**
SGOT (IU/L)	**100 ± 38**
SGPT (IU/L)	**88 ± 35**
Serum creatinine	**0.8 ± 0.3**

Table 6: ECG findings (n = 75)

ECG Findings	Number	Percentage (%)
Normal ECG	**48**	**64.0%**
Sinus bradycardia	**12**	**16.0%**
Sinus tachycardia	**8**	**10.7%**
ST-T changes	**5**	**6.7%**
Conduction abnormality	**2**	**2.6%**
Total	**75**	**100%**

Table 7: Echocardiography findings (n = 75)

Echocardiography Findings	Number	Percentage (%)
Normal study	**51**	**68.0%**
Mild LV dysfunction	**10**	**13.3%**
Moderate LV dysfunction	**5**	**6.7%**
Pericardial effusion	**7**	**9.3%**
Myocarditis features	**2**	**2.7%**
Total	**75**	**100%**

Table 8: Overall cardiac involvement (ECG + Echo)

Cardiac Involvement	Number	Percentage (%)
Present	**24**	**32.0%**
Absent	**51**	**68.0%**
Total	**75**	**100%**

Table 9: Cardiac involvement vs dengue severity

Severity of Dengue	Cardiac Involvement Present	Total	Percentage (%)
Dengue fever (DF)	**5**	**42**	**11.9%**
Dengue with warning signs	**9**	**23**	**39.1%**
Severe dengue	**10**	**10**	**100%**

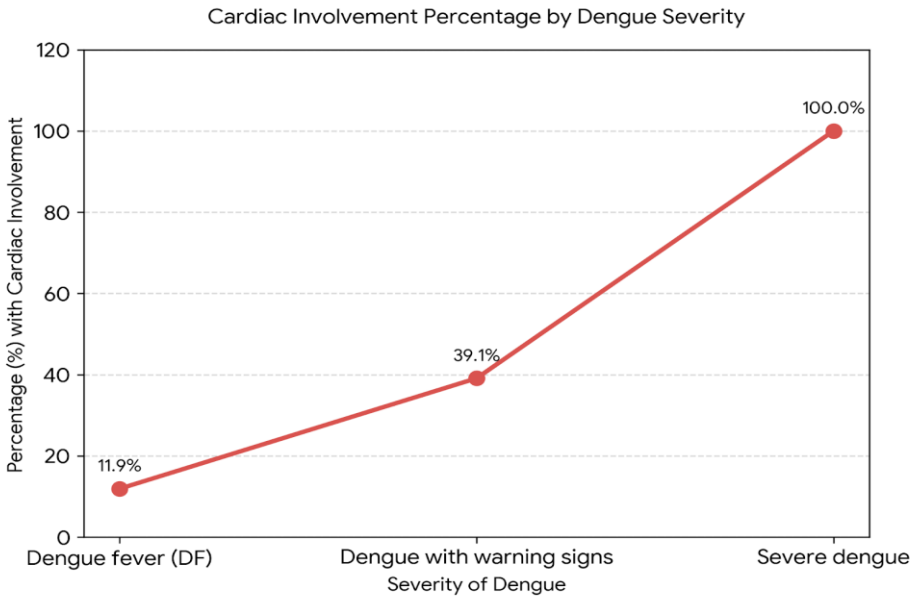

Table 10: ECG and Echocardiography correlation

ECG Status	Echo Abnormal	Echo Normal	Total
Abnormal ECG	**20**	**7**	**27**
Normal ECG	**4**	**44**	**48**
Total	**24**	**51**	**75**

DISCUSSION

The present prospective observational study evaluated cardiac involvement in 75 children with laboratory-confirmed dengue fever using ECG and echocardiography. The study demonstrated that cardiac abnormalities are relatively common among pediatric dengue patients and are significantly associated with disease severity.

The majority of patients belonged to the 6–10 years age group (40%), followed by 11–15 years (33.3%). Male patients constituted 56% of the study population. Similar age and gender distributions have been reported by Kumar et al. and Shah et al., who observed a predominance of school-aged children and males among hospitalized dengue cases [11,12].

Based on WHO classification, 56% of patients had dengue fever, 30.7% had dengue with warning signs, and 13.3% had severe dengue. These findings are comparable to previous studies that reported a higher prevalence of uncomplicated dengue with a smaller proportion progressing to severe disease [8,13].

Fever was observed in all patients (100%), making it the most common clinical manifestation. Other common symptoms included myalgia (72%), headache (66.7%), rash (42.7%), bleeding manifestations (21.3%), and hypotension/shock (13.3%). These findings are consistent with the classical clinical profile of dengue infection described in previous studies [13,14].

Laboratory evaluation revealed thrombocytopenia, leukopenia, elevated hematocrit levels, and mildly elevated liver enzymes. These abnormalities reflect the characteristic hematological and biochemical changes associated with dengue infection and have been reported widely in earlier studies [4,14].

ECG abnormalities were observed in 36% of patients. Sinus bradycardia was the most common abnormality (16%), followed by sinus tachycardia (10.7%), ST-T changes (6.7%), and conduction abnormalities (2.6%). Similar findings were reported by Wali et al. and Gupta et al., who documented transient rhythm disturbances and conduction defects in dengue patients [7,15]. Sinus bradycardia may result from myocardial inflammation, autonomic dysfunction, or cytokine-mediated effects on the cardiac conduction system.

Echocardiographic abnormalities were detected in 32% of patients. Mild left ventricular dysfunction was present in 13.3% of cases, moderate dysfunction in 6.7%, pericardial effusion in 9.3%, and myocarditis in 2.7%. These findings are in agreement with previous studies that identified ventricular dysfunction and pericardial effusion as common manifestations of dengue-associated cardiac involvement [8-10].

Overall cardiac involvement was observed in 24 patients (32%). This prevalence is comparable to reports by Miranda et al. and Salgado et al., who demonstrated cardiac abnormalities in approximately one-third of dengue patients [9,10]. Variations in prevalence among studies may be attributable to differences in patient characteristics, disease severity, timing of investigations, and diagnostic criteria.

A notable finding of the present study was the strong association between dengue severity and cardiac involvement. Cardiac abnormalities were detected in only 11.9% of patients with uncomplicated dengue fever, compared with 39.1% of patients with warning signs and 100% of patients with severe dengue. These observations support the findings of Yacoub et al., who demonstrated that myocardial dysfunction is more frequent in severe dengue and may contribute significantly to hemodynamic compromise [8].

Correlation between ECG and echocardiographic findings showed that 20 of 27 patients with abnormal ECGs also had echocardiographic abnormalities. However, four patients with normal ECG findings demonstrated abnormal echocardiographic findings, suggesting that ECG alone may underestimate myocardial involvement. Therefore, echocardiography serves as an important complementary modality for detecting subclinical cardiac dysfunction in dengue patients.

The findings of the present study emphasize that cardiac involvement is a relatively common complication of pediatric dengue infection and is particularly prevalent in severe dengue. Routine cardiac evaluation using ECG and echocardiography may facilitate early diagnosis, appropriate management, and improved clinical outcomes in affected children.

CONCLUSION

Cardiac involvement is a common complication of dengue fever in children, occurring in 32% of cases in the present study. ECG abnormalities, particularly sinus bradycardia, and echocardiographic findings such as left ventricular dysfunction and pericardial effusion were frequently observed. Cardiac abnormalities were more common in severe dengue, indicating a significant association between disease severity and myocardial involvement. Routine ECG and echocardiographic evaluation may aid in the early detection and management of cardiac complications in pediatric dengue patients.

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