

Study of cardiac manifestations in patients presenting with dengue infection at a tertiary hospital

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Abstract

Background: Dengue fever has emerged as one of the most important viral disease, associated with mortality. Clinical manifestations of cardiac involvement can vary widely from silent disease to severe myocarditis resulting in death. Present study was aimed to assess the cardiac manifestations of dengue fever and to identify subclinical/ latent cardiac involvement in the disease. **Material and Methods:** This study was conducted in patients of age > 18 years, either gender, admitted with diagnosis of dengue fever (confirmed with serological test), willing to participate in study. **Results:** In the present study, 142 patients satisfying inclusion/exclusion criteria were assessed. Majority of the patients were from the age group of 31- 40 years (28.17 %) followed by 41- 50 years of age group (23.24 %). Majority (57.75%) of the patients were male in the current study. As per serology findings, majority of patients were NS1 Positive (47.89%), IgM positive (19.72%) and IgG Positive (13.38%). In present study, 14.79 % were troponin T positive and 17.61 % had significant CK-MB values (> 25). 59.86 % patients had normal ECG, significant ECG findings were Broad 'QRS' Complex (10.56%), Diffuse 'T' Wave Inversion (9.86%), Non-Specific 'ST' Segment Changes (9.86%), Sinus Bradycardia (9.15%) and Low Voltage 'QRS' Complex (0.70%). In 92.96 % patients 2D ECHO was normal, significant 2D ECHO findings were anterior wall hypokinesia (2.82%), mild PAH + mild TR + hypokinesia anterior wall (1.41%), mild PAH + mild TR (0.70%), LVH (0.70%), DCM secondary to dengue myocarditis (0.70%) and mild AML prolapse (0.70%). **Conclusion:** Transient cardiac abnormality, as evidenced by changes in heart rate, rhythm and raised CK MB and troponin I levels in patients with dengue fever are important markers and such patients should undergo thorough evaluation and follow-up even after discharge.

Keywords: Cardiac manifestation; Dengue; NS1 antigen / IgM antibody, myocarditis

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INTRODUCTION

Dengue fever has emerged as one of the most important viral disease, associated with mortality. Dengue fever has a self-limiting course in the majority of cases, but in the

acute phase, it can present with multi-organ involvement. Infection with a dengue virus serotype can produce a spectrum of clinical illness, ranging from asymptomatic or may cause undifferentiated febrile illness (viral syndrome), DF, or dengue hemorrhagic fever (DHF) including dengue shock syndrome (DSS).¹ Some patients develop severe clinical manifestations, including bleeding, organ impairment, and endothelial dysfunction with increased capillary permeability causing hypovolemic shock that can lead to cardiovascular collapse.² Cardiac involvement in dengue fever is often underdiagnosed due to the low index of clinical suspicion and its overlapping clinical manifestations. Clinical manifestations of cardiac involvement can vary widely from silent disease to severe myocarditis resulting in death. Rhythm abnormalities, hypotension, arrhythmias, myocarditis, myocardial

depression with symptoms of heart failure and shock, and pericarditis have been reported.^{3,4} Due to increasing incidence of dengue fever and associated morbidity as well as mortality, clinicians need to focus on both the sub-clinical and clinical cardiac manifestations in dengue fever via clinical examination, laboratory, ECG and 2 D-ECHO findings. Present study was aimed to assess the cardiac manifestations of dengue fever and to identify subclinical/latent cardiac involvement in the disease.

MATERIAL AND METHODS

This study was conducted in Department of Medicine, Maharashtra Institute of Medical Sciences and Research, Latur, India. Present study was hospital based; prospective, observational study conducted during January 2020 to June 2021 (18 months duration). Study approval was obtained from institutional ethical committee.

Inclusion criteria: Patients of age > 18 years, either gender, admitted with diagnosis of dengue fever (confirmed with serological test), willing to participate in study.

Exclusion criteria: Patients treated on OPD basis, Hospitalization <1 day, patient with a history of cardiac disease or patient receiving cardiac drugs interfere with electrocardiography (ECG) reading or known abnormality on 2 D ECHO. Known cases of hypertension or diabetes mellites for > 5 years. Diagnosis not confirmed. Patient unwilling to participate.

A written informed consent was taken from patients. Patients details such as demographic data, clinical history, findings of physical examination, laboratory investigations (rapid tests for dengue IgM and IgG dengue or non-structural protein1, complete blood count, liver function test including aspartate aminotransferase and alanine aminotransferase, renal function tests, coagulation studies), ECG, chest X-ray, and abdominal ultrasonography were noted in case record proforma. Special investigations such as cardiac enzymes (troponin, CPKMB), 2 D echocardiography were done whenever required. Patients were followed up till 15 days after discharge. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

RESULTS

In the present study, 142 patients satisfying inclusion/exclusion criteria were assessed. Majority of the patients were from the age group of 31- 40 years (28.17 %) followed by 41- 50 years of age group (23.24 %). Majority (57.75%) of the patients were male in the current study.

Table 1: Age and gender distribution of patients studied

Age in years	Gender		Total
	Male	Female	
19-30	16 (11.27%)	11 (7.75%)	27 (19.01%)
31-40	23 (16.2%)	17 (11.97%)	40 (28.17%)
41-50	18 (12.68%)	15 (10.56%)	33 (23.24%)
51-60	15 (10.56%)	9 (6.34%)	24 (16.9%)
>60	10 (7.04%)	8 (5.63%)	18 (12.68%)
Total	82 (57.75%)	60 (42.25%)	142 (100%)

As per serology findings, majority of patients were NS1 Positive (47.89%), IgM positive (19.72%) and IgG Positive (13.38%).

Table 2: Dengue serology

Dengue Test	No. of Patients (n=142)	Percentage
NS1 Positive	68	47.89%
IgM positive	28	19.72%
IgG Positive	19	13.38%
IgM and IgG positive	14	9.86%
IgM and NS1 Positive	11	7.75%
NS1 and IgG Positive	2	1.41%

In present study, 14.79 % were troponin T positive and 17.61 % had significant CK-MB values (> 25).

Table 3: cardiac enzymes

Characteristics	No. of Patients (n=142)	Percentage
Troponin		
Positive (>0.017)	21	14.79%
Negative (<0.017)	121	85.21%
CK-MB		
<25	25	17.61%
>25	117	82.39%

59.86% patients had normal ECG, significant ECG findings were Broad 'QRS' Complex (10.56%), Diffuse 'T' Wave Inversion (9.86%), Non-Specific 'ST' Segment Changes (9.86%), Sinus Bradycardia (9.15%) and Low Voltage 'QRS' Complex (0.70%).

Table 4: ECG Findings

ECG Findings	No. of Patients (n=142)	Percentage
Normal ECG	85	59.86%
Broad 'QRS' Complex	15	10.56%
Diffuse 'T' Wave Inversion	14	9.86%
Non-Specific 'ST' Segment Changes	14	9.86%
Sinus Bradycardia	13	9.15%
Low Voltage 'QRS' Complex	1	0.70%

In 92.96 % patients 2D ECHO was normal, significant 2D ECHO findings were anterior wall hypokinesia (2.82%), mild PAH + mild TR + hypokinesia anterior wall (1.41%), 'mild PAH + mild TR (0.70%), LVH (0.70%), DCM secondary to dengue myocarditis (0.70%) and mild AML prolapse (0.70%).

Table 5: 2D ECHO findings

ECHO Findings	No. of Patients (n=142)	%
Normal	132	92.96%
Anterior Wall Hypokinesia	4	2.82%
Mild PAH + Mild TR + Hypokinesia Anterior wall	2	1.41%
Mild PAH + Mild TR	1	0.70%
LVH	1	0.70%
DCM Secondary to Dengue Myocarditis	1	0.70%
Mild AML Prolapse	1	0.70%

DISCUSSION

Dengue is a mosquito-borne viral infection that causes significant morbidity in endemic regions. Globalization, increased air travel, lack of effective mosquito control measures and unplanned urbanization have led to an increase in its incidence with expansion of its geographic and demographic distribution.⁵ Laboratory tests may reveal increased hepatic enzyme levels, leukopenia and thrombocytopenia, which are abnormalities consistent with but nonspecific for dengue fever.⁵ Various forms of cardiac involvement in dengue infection include transient atrioventricular block, relative bradycardia and myocarditis, and patients may develop acute pulmonary edema or cardiogenic shock. Although severe cardiac complications, such as myocarditis, have been reported in the literature, their frequencies have still not been established.^{5,6}

The exact mechanism of the cardiac injury in dengue fever remains unknown, however it is proposed that the direct invasion of the cardiac myocyte by the virus and damage to the cardiac cells by the ongoing inflammatory damage are the major mechanism of the cardiac manifestations. Although shock in DHF/DSS has been attributed largely to decreased intravascular volume due to capillary leakage of plasma into the interstitial space, a few recent studies have reported that it may be due to cardiac involvement.⁷ Although there is a paucity of data regarding the cardiac manifestation of dengue, the incidence of cardiac manifestation in various studies ranged from 16.7% to 71%, including cardiac failure, electrocardiogram (ECG) changes (sinus bradycardia, sinus tachycardia, and T wave inversion), 2D echocardiography (2DEcho) changes (reduced ejection fraction), and elevated cardiac enzymes (Troponin T, CK MB).^{8,9} Sukhwani N¹⁰ studied 58 patients, 84.5% have not shown any cardiac abnormalities and 15.5% have abnormal values but are not significant. Incidence of cardiac manifestations was more common in DHF and dengue shock syndrome which was 15.5% and 3.4%, respectively. In study of 60 patients, Gururaj VG *et al.*,¹¹ noted that mean age was 36.8 years, commonest clinical presentation was retro orbital pain (85%) followed

by fever (76.6%). CK-MB was elevated in 2 cases (3.3%) and Troponin I was elevated in 2 cases (3.3%). Most common cardiac abnormalities noted was sinus bradycardia, found in 53.33 percent and was transient. There were 2 cases with myocarditis, 1 case with first degree AV block, 1 case with LBBB, 1 case with Atrial fibrillation, 1 case with complete heart block. Arati K *et al.*,¹² noted that CKMB and Troponin I at admission were raised in 18% and 72% respectively. On ECG, 56% of the patients had normal rhythm, 15% had sinus Bradycardia, 9% had sinus tachycardia, 10% had T wave changes, 3% had ST Changes, 2% had Sinus Bradycardia with T Wave Changes, 2% had Sinus Tachycardia with T wave changes and 1% had LVH and 2% had Abnormal Rhythm. Similar findings were observed in present study. Mohit Arora¹³ studied 120 patients of dengue fever, 33.33% of the patients had petechia and only 9 patients having active bleeding manifestation at the time of presentation. A raised CK-MB and Troponin I was observed in 33.3% and 26.7% patients. Abnormal ECG findings noted among 15.8% with abnormal heart rate. Rhythm disturbance was noted in 5% of the patients with AV block being the most common (66.67%). Cardiac manifestation in the form of myocarditis was observed in 37.50% of the patients. In study by Papalkar PV *et al.*,² mean age of the patients was 38 ± 16.69 years. Patients of dengue fever, DHF, and dengue shock syndrome were 51, 7, and 2 respectively. The most common ECG abnormality was sinus bradycardia seen in 9 (15%) patients, followed by sinus tachycardia in 6 (10%) and ST-T changes in 5 (8.33%). Echocardiography was normal in 54 (90%) patients, systolic dysfunction was found in 4 (6.67%) patients, and pericardial effusion was found in 2 (3.33%) patients. Eight (13.33%) patients had abnormal CK MB values. It is widely agreed that dengue hemorrhagic fever is an immunologically mediated disease, a mechanism similar to those involved in causing viral myocarditis, may play a role in the development of dengue virus related myocarditis.¹⁴ Management of myocarditis is a crucial point, usually managed conservatively. ST-T changes seen in dengue are almost always benign, transient and secondary to myocarditis, not requiring specific intervention.¹⁵ The increased production of cytokines including tumor necrosis factor-alpha and interferon-alpha and release of other chemical mediators is responsible for rise in vascular permeability and abnormal leakage of plasma leading to pericardial effusion.¹⁶ Most electrocardiographic changes are transient and resolve by three weeks without requiring any intervention. A thorough evaluation is warranted in symptomatic patients as well as non-resolving /worsening rhythm disturbances.

CONCLUSION

Transient cardiac abnormality, as evidenced by changes in heart rate, rhythm and raised CK MB and troponin I levels in patients with dengue fever are important markers and such patients should undergo thorough evaluation and follow-up even after discharge.

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