ORIGINAL RESEARCH PAPER

Cardiology

CORRELATION OF CARDIAC MANIFESTATIONS IN DENGUE

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ABSTRACT

Objectives: This study was done to study the prevalence of cardiac manifestations of dengue fever in patients presenting to our hospital and to find out the correlation of cardiac manifestations with the warning signs of dengue infection **Methods:** The study was conducted at Government Villupuram Medical College and Hospital, a tertiary care hospital in the month of July to December 2021. One hundred consecutive patients aged 15 years or more with positive dengue serology were interviewed and examined. ECG was done for all patients and selected patients underwent echo evaluation and troponin testing. The data was analyzed using statistical significance tests **Results:** Thirty-three patients had no warning signs, 59 patients had one warning sign or the other. Eight patients had severe dengue. The minimum pulse rate was 32/ minute. The most common cardiac abnormalities noted were rhythm abnormalities of which the commonest was sinus bradycardia, found in 34 percent. There was statistically significant correlation between cardiac manifestations and all the warning signs except persistent vomiting. Among severe dengue, fluid accumulation causing respiratory distress was found to have a significant correlation with the cardiac manifestations **Conclusions:** The most common cardiac manifestations noted were transient rhythm abnormalities, of which sinus bradycardia was the commonest. There was no evidence of Myocarditis in any of the patients .There was statistically significant correlation between cardiac manifestations and all the warning signs except persistent vomiting. Among severe dengue, fluid accumulation causing respiratory distress was found to have a significant correlation with the cardiac manifestations.

Introduction:

Dengue fever is an acute febrile infectious disease, caused by any of the four serotypes (1, 2, 3 or 4) of Dengue virus from the genus flavivirus. T he highest incidence of dengue is seen in Southeast Asia, India, and the American tropics.[1] Cardiac manifestations in dengue virus infection can range from asymptomatic bradycardia to life threatening myocarditis.[2,3] .There are many studies that quote several cardiac manifestations of dengue infection ranging from simple sinus bradycardia, transient AV bl o c ks , t r a n s i e n t ve n t r i c u l a r arrhythmias to severe myocarditis and pericardial effusion. We performed this study with the objective of studying the cardiac manifestations of dengue and to study the correlation of the cardiac manifestations to the severity of dengue.

Objectives of the Study

1. To study the prevalence of cardiac manifestations of dengue fever in patients presenting to our hospital.
2. To find out the correlation of cardiac manifestations to the warning signs of dengue and severe dengue.

Patients and Methods
Study design
Cross-sectional study

Setting
The study was conducted at Government Villupuram Medical College and Hospital, which is a tertiary care hospital, in the Department of Cardiology in the month of July to December 2021

Inclusion Criteria
- Age group of ≥ 15 years
- Patients fulfilling the WHO criteria for dengue
- Confirmed dengue serology

Exclusion criteria
- P atients on medications affecting the heart rate / rhythm
- Patients with history of pre-existing heart disease
- Patients with electrolyte abnormalities affecting the heart rate/rhythm
- Patients not willing to give consent for the study

Sample size
The prevalence of cardiac manifestations of dengue according to various studies conducted previously was around 50%. The sample size in our study was fixed at 100, assuming the anticipated prevalence of cardiac manifestations in dengue to be around 50%, assuming an error 5% (Za = 1.96) and b error 20% (Zb = 0.842) and a power of 80%, with a precision of 5%, according to the following formula.

$$n= \frac{(Za + Zb)^2 + pq}{d^2}$$

p = prevalence
q = 1 - p
d = precision

Method of sample collection
We interviewed all Patients with fever interviewed with a structured questionnaire. Dengue diagnosis was confirmed by Dengue IgM capture ELISA. We studied one hundred consecutive patients who fulfilled the inclusion criteria. We studied the Clinical profile of the patients and patients were classified as - dengue fever, dengue with warning signs and severe dengue (as per the current WHO classification). ECG was taken in all the patients. Selected patients underwent troponin testing and echocardiographic evaluation.

Statistical Tests
Statistical method used was chi square test. A value of p >0.05 is considered as not significant and p <0.05 as significant.

Results:
The mean age of our study group was 45 years. The youngest patient was 15 years old and the oldest patient was 85 years

old. There were 54 males and 46 females in our study. Of the 100 patients studied, 79 patients were dengue NS1 positive (ELISA), 21 were positive for IgM dengue (ELISA). Of the 100 patients, 42 patients had persistent abdominal pain, 59 patients had persistent vomiting .Vomiting was the commonest warning sign. Forty-Five patients had mucosal bleeding, 12 had clinical evidence of fluid accumulation, five had restlessness, eight had hepatomegaly >2 cm (Table I). The minimum platelet count of the study population was 8,000/ cubic mm. the mean platelet count was 32,100 ± 22,395/ cubic mm. The maximum packed cell volume was 54 (Mean 41.6 ± 6.26).

Table I: Warning signs of Dengue(n=100)

Warning signs	No of cases
Abdominal pain	42
Persistent vomiting	59
Mucosal bleed	45
Fluid accumulation	12
Lethargy /restlessness	5
Hepatomegaly>2 cm	8

Of the 100 patients studied, three were found to be in shock, as evidenced by a systolic BP <90 mm of Hg. Nine patients were observed to have fluid accumulation sufficient to cause respiratory distress. Six patients had severe bleeding per vaginum, one patient each had hematuria, massive hematemesis and massive hemoptysis. Four patients developed ARDS . Four patients had severe hepatic derangement as evidenced by SGOT and SGPT values above 1000 IU. The highest SGOT and SGPT values were 1200 IU/L and 1567 IU/L respectively. Four patients had renal impairment. The Maximum serum creatinine value noticed was 2.1mg/dl (Table II)

Table II: Severity of Dengue(N=100)

Shock	3
Fluid accumulation causing respiratory distress	9
Severe bleeding	9
SGOT/SGPT>1000	4
Renal impairment	4
Impaired consciousness	3
ARDS	4

The mean pulse rate of the study population was 70/minute. The minimum pulse rate was 32/minute and the maximum pulse rate was 142/ minute.

Thirty-four patients had sinus bradycardia- it was the commonest rhythm abnormality noted.

Three patients had unexplained sinus tachycardia. Ventricular arrhythmias in the form of ventricular bigeminy, ventricular trigeminy (Figure 1) and ventricular tachycardia were noted in one patient each. All these changes reverted back to sinus rhythm in 24 hours. AV dissociation with sinus node dysfunction (Figure 2) was observed in one patient, which resolved in 24 hours. ST- T changes were noted in 11 patients.
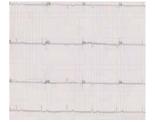

Fig. 1: ECG showing ventricular trigeminy
Fig. 2: AV dissociation with sinus node dysfunction

Troponin T testing was done in 18 patients and it was found to be negative in all. Echocardiographic evaluation was done in 18 patients. 3 patients were noticed to have mild pericardial effusion. Echocardiographic evidence of myocarditis was not seen. Of the 100 patients studied two patients expired, they succumbed to ARDS.

There was statistically significant correlation (p value< 0.05, Chi squ are t est) b etween cardia c manifestations and all the warning signs except persistent vomiting, which was the commonest warning sign noted (Table III).

Table III: Correlation of cardiac manifestations and warning signs of Dengue

Warning signs	Cardiac manifestations		P value
	No	Yes	
Abdominal pain	18	24	0.045
Persistent vomiting	30	28	0.37
Fluid accumulation	3	9	0.032
Mucosal bleed	20	26	0.005
Lethargy /Restlessness	0	5	0.018
Hepatomegaly >2 cm	1	7	0.017

Of the manifestations of severe dengue, only fluid accumulation causing respiratory distress was found to have a significant correlation (p value <0.05, Chi square test) with the cardiac manifestations of dengue (Table IV).

Table IV: Correlation of severe Dengue and cardiac manifestations of Dengue

Manifestations of severe Dengue	Cardiac manifestations		P value
	No	Yes	
Shock	18	24	0.045
Fluid accumulation causing respiratory distress	30	28	0.37
Severe bleeding	3	9	0.032
ARDS	20	26	0.005

Discussion

Cardiac manifestations in dengue virus infection is very common and can range from asymptomatic bradycardia to life-threatening myocarditis. There are many studies that quote several cardiac manifestations of dengue infection viz. sinus bradycardia, transient AV blocks, transient ventricular arrhythmias, myocarditis, systolic and diastolic dysfunction and pericardial effusion. Myocardial involvement may be the direct result of dengue virus infection in susceptible individuals or may be due to effects of cytokines / cellular mediators of immune response[4].The present study was done with the aim of studying the cardiac manifestations of dengue and to study the correlation of the cardiac manifestations to the severity of dengue.

The mean age of our study population was 45 years. Of the 100 patients studied, 79 patients were Dengue NS 1 positive (ELISA), 21 were positive for IgM dengue (ELISA). In the study by Wichman et al,[5] IgM and IgG dengue testing was done to make a diagnosis of primary dengue infection and secondary dengue infection, respectively.

Forty one patients had no warning signs, 59 patients had one warning sign or the other. The most common warning sign observed was persistent vomiting, seen in 59 percent of the patients, whereas restlessness/lethargy was the least common warning sign noted, seen in 5% of the patients. Fifty-eight percent of the patients had one warning sign or the other. In the study by Thein, et al[6]on 108 patients with confirmed dengue fever, persistent vomiting was noted in 39% and it was the most common warning sign[6].

Hepatomegaly was the least common warning sign, seen in 2%, in their study and 58% of the patients had one warning sign or the other[6].

Eight patients had severe dengue. Three patients had shock, nine had fluid accumulation causing respiratory distress and nine had severe bleeding. Severe hepatic impairment was seen in four patients, renal impairment in four, ARDS in four and impaired consciousness in three patients. In the study by Thein, Leo et al,[6] 30 patients had severe dengue. Four patients had severe hepatic derangement as evidenced by SGOT and SGPT values above 1000 IU. The highest SGOT and SGPT values were 1200 IU/L and 1567 IU/L respectively. Four patients had renal impairment. The maximum serum creatinine value noticed was 2.1 mg/dl. Four patients had ARDS.

The mean pulse rate of the study population was 70/minute. The minimum pulse rate was 35/ minute and the maximum pulse rate was 142/minute. In the study by Latheef et al[7] mean heart rates were significantly lower in the dengue group 87.6 (±12.5) beats/min (dengue) compared to the control group. The commonest rhythm abnormality noted was sinus bradycardia, found in 32%. Three patients had unexplained sinus tachycardia. In the study by Gupta et al[1] ,sinus bradycardia was found in 14.28%, and sinus tachycardia 21.4%. AV dissociation with sinus node dysfunction was observed in one patient, which resolved in 24 hours. Kaushik et al have described atrioventricular dissociation and sino atrial exit block in a child with dengue fever[8]. Ventricular arrhythmias in the form of ventricular bigeminy, ventricular trigeminy and ventricular tachycardia was noted in one patient each. All these changes reverted back to sinus rhythm in 24 hours. Chuah et al[9] and Veloso et al[10] have described transient ventricular arrhythmias as a cardiac manifestation of dengue fever.

Troponin T testing was done in 18 patients and it was found to be negative in all. Obeyesekere et al[11] have described direct cardiac involvement in dengue fever patients as evidenced by positive cardiac biomarkers. Echocardiographic evaluation was done in 18 patients. Three patients were noticed to have mild pericardial effusion. Echocardiographic evidence of myocarditis was not seen in any patient. In the study by Gupta et al,[1] systolic dysfunction was absent in all patients; mild diastolic dysfunction was present in 14.28 %. Wiwanitkit et al[3] have described cases of dengue myocarditis[12,13]. There was statistically significant correlation between cardiac manifestations and all the warning signs except persistent vomiting which was the commonest warning sign noted. Kabra et al[14] in their study couldn't find any correlation between myocardial involvement and clinical severity of dengue. Among severe dengue, fluid accumulation causing respiratory distress was found to have a significant correlation with the cardiac manifestations.

Conclusions
Of the 100 patients studied, 33 patients had no warning signs,59 patients had one warning sign or the other. Nine patients had severe dengue. The most common cardiac abnormalities noted were rhythm abnormalities of which the commonest was sinus bradycardia, found in 34 percent. Ventricular arrhythmias in the form of ventricular bigeminy, ventricular trigeminy and ventricular tachycardia was noted in one patient each. AV dissociation with sinus node dysfunction was observed in one patient. All these changes reverted back to sinus rhythm in 24 hours .Of the 18 patients who underwent echocardiographic study, three had mild pericardial effusion. Troponin T was done in 18 patients and was negative in all.

There was statistically significant correlation between cardiac manifestations and all the warning signs except persistent vomiting. Among severe dengue, fluid accumulation causing respiratory distress was found to have a significant correlation with the cardiac manifestations.

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