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Cardiac involvement in patients of dengue fever in reference to ECG and Echocardiography – A tertiary care center study

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Introduction: Dengue rarely affects the heart but clinical symptoms of cardiac involvement may range greatly from silent illness to severe myocarditis resulting in death. Clinical features are asymptomatic and most are transient among patients with DF/DHF. **Material and methods:** It was an observational study conducted at the Department of General Medicine, Peoples College of Medical Sciences and Research Centre, Bhopal. The total duration of the study was One and a half years from Dec 2018 to May 2020. All dengue patients presenting to People's Hospital during one and half years from which data was collected using as per given proforma. **Results:** In the present study group of 58 patients, it was found that 49 patients (84.5%) have not shown any cardiac abnormalities and 9 patients have abnormal values (15.5%) but are not significant. It is also found that the incidence of cardiac manifestations was more common in DHF and dengue shock syndrome which was 15.5% and 3.4%, respectively. **Conclusion:** 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. Involvement of multiple organs, as well as the presence of metabolic derangement, can further confuse the picture.

Keywords: Cardiac manifestations, Dengue, ECG, ECHO

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Introduction

Dengue rarely affects the heart but clinical symptoms of cardiac involvement may range greatly from silent illness to severe myocarditis resulting in death. Clinical features are asymptomatic and most are transient among patients with DF/DHF [1-3]. They are complex and mostly asymptomatic, although chest pain, palpitations, heartbeat abnormalities, hypotension, pulmonary edema, and shock are some of the symptoms that may be observed.

These also may be observed in the form of asymptomatic bradycardia to life-threatening myocarditis. Sinus bradycardia, transient ventricular arrhythmias, prolongation of the PR interval, nonspecific ST-segment and T wave changes, and transient atrioventricular blocks are some of the findings that can be seen in cases of dengue. Still, the significance of cardiac involvement in dengue infection is not fully understood.

Myocarditis, pericarditis, and cardiomyopathy after dengue have been also reported in the literature. It has been reported that the incidence of myocarditis and electrocardiographic changes have been noted as high as 13% and up to 62.5% respectively in patients. Although dengue-specific cardiac manifestation is uncommon impairment of myocardial function is common either in the disease's hemorrhagic type or in the associated shock. Dengue hemorrhagic fever or dengue shock syndrome is more vulnerable to the development of cardiac manifestations.

The occurrence and severity of cardiac involvement in dengue fever are not well known and very few studies have discussed the concerns of cardiac implications in dengue fever. Also, the significance of cardiac involvement in dengue infection is not fully understood. Hence the present study was planned to assess the cardiac manifestations of dengue fever and to identify subclinical/ latent cardiac involvement in the disease.

Material and methods

Study Design: Observational study

Duration of Study: One and a half years. (Dec 2018 to May 2020)

Place of Study: The study was conducted at the Department of General Medicine, Peoples College of Medical Sciences and Research Centre, Bhopal.

Source of Data: All the cases with dengue fever attending OPD/IPD in the Department of General Medicine, PCMS, and RC Bhopal during the above said period of one and a half years.

Sample Size: All dengue patients presenting to People's Hospital during one and half years from which data was collected using as per given proforma.

Inclusion Criteria

- All the cases with dengue fever attending OPD/IPD with positive dengue serology (RDT) in the Department of General Medicine of PCMS and RC Bhopal were included in the study.
- Age > 15Years

Exclusion Criteria

- Patients on medication(beta-blockers, digoxin) affecting the heart rate/rhythm
- Patient with preexisting cardiac disease, DM, HTN, COPD.
- Age <15 years.

Data Collection Procedure

Patients who had given written informed consent been are enrolled after reading the consent in the local language. All patients of fever with body ache coming to OPD/IPD were investigated for dengue fever by the rapid diagnostic test. All testing was performed according to the manufacturer's instructions. Patients who had been positive dengue serology were screened by Electrocardiography and Echocardiography for cardiac involvement. Patients diagnosed with Dengue fever were also subjected to routine blood investigations like complete hemogram, renal function tests, liver function test, chest radiography, and ultrasonogram of the abdomen.

Data Management and Statistical analysis: Microsoft Excel® 2010 was used for the compilation of data while MedCal® (version 19.0.5) software was used for statistical treatment. Full patient information was included and maintained during the entire study period. The supervisor monitored the completeness and quality of the gathered data periodically.

Results

This study comprised 58 patients who attended the Department of Medicine, People's College of Medical Sciences and Research Centre, People's University,

Bhopal (M.P.) from December 2018 to May 2020.

The present study design is an observational and cross-sectional study. Most of the variables used in the present study are categorical. Hence frequency and prevalence were calculated. Chi-square test of association was also used to find if there was any relationship between two categorical variables. Characteristics of the population and variables of a recruited patient population concerning different classifications are tabulated and they graphically illustrate their distribution in different groups.

A total of 58 patients were selected for the study. The age of patients ranged from 15 to 56 years with a mean age of 27.94 years. Majority were in the age groups from 15-25 (27, 46.6%) years and followed by 26-35 years (19, 32.8%), 46-55 years (19.0%) and 56-65 years (1, 1.7%). The gender distribution among the study population was found accordingly- Male (36, 62.1%) and Female (22, 37.9%).

Table-1: Distribution of patients according to the presenting complaints.

Type of Complaint	No. of Patients (n=58)	Percentage
Fever	58	100
Gum Bleeding	3	5.2
Body Ache	58	100
Rashes	17	29.3
Hematemesis	2	3.4
Nose Bleeding	5	8.6
Subconjunctival Haemorrhage	6	10.3

The major presenting complaint among patients was fever and body ache present in all patients. Rashes were observed in 17 (29.3%) cases. Subconjunctival hemorrhage, nose bleeding, and gum bleeding were accounted for in 6 (10.3%), 5(8.6%), and 3(5.2%) cases respectively and hematemesis was observed in only 2(3.4%) cases.

Table-2: Distribution of patients according to the type of dengue.

Dengue Type	No. of Patients (n=58)	Percentage
Dengue Fever	49	84.5
Dengue Haemorrhagic Fever	7	12.1
Dengue Shock Syndrome	2	3.4
Total	58	100

Out of the total 58 patients, 49 (84.5%) had dengue fever and 7 (12.1%) had dengue hemorrhagic fever and only 2 (3.4%) had dengue shock syndrome.

Table-3: Distribution of patients according to the ECG findings.

Distribution of ECG Findings	No. of Patients (n=58)	Percentage
Normal ECG	25	43.1
Broad 'QRS' Complex	8	13.7
Diffuse 'T' Wave Inversion	8	13.7
Low Voltage 'QRS' Complex	1	01.7
Non-Specific 'ST' Segment Changes	9	15.51
Sinus Bradycardia	7	12.06
Total	58	100

ECG findings - Non-Specific ST Segment Changes (9, 15.5%) was observed in maximum cases. Broad QRS "Complex'' and Diffuse 'T' Wave Inversion were accounted for in 8 (13.7%) cases. The above parameters were suggestive of myocarditis and were accounted for in 9 cases (15.5%). Sinus Bradycardia and "Low Voltage 'QRS' Complex" was present in 7(12.1%) and 1(1.7%) cases respectively.

Table-4: Distribution of patients according to the echocardiography findings.

Distribution of ECHO Findings	No. of Patients (n=58)	Percentage %
Diastolic Dysfunction	1	1.7
Global Hypokinesia	0	0.0
LVEF % (Normal)	58	100
Serositis	8	13.7
Pericardial Effusion	1	1.7

Diastolic dysfunction and pericardial effusion were presented in only 1(1.7%) cases.

Table-5: Distribution of cardiac manifestation among dengue type.

Symptoms	Dengue Type			Percentage %
Sinus Bradycardia	DF	DHF	DSS	
Absent	48	2	1	51 (87.9%)
Present	1	5	1	7 (12.1%)
	49 (84.5%)	7 (12.1%)	2 (3.4%)	58 (100 %)
Significance level P < 0.0001				
Diastolic dysfunction	DF	DHF	DSS	
Absent	49	6	2	57 (98.3%)
Present	0	1	0	1 (1.7%)
	49 (84.5%)	7 (12.1%)	2 (3.4%)	58 (100 %)
Significance level P = 0.0246				
Pericardial Effusion	DF	DHF	DSS	
Absent	49	6	2	57 (98.3%)
Present	0	1	0	1 (1.7%)
	49 (84.5%)	7 (12.1%)	2 (3.4%)	58 (100 %)
Significance level P = 0.0246				
Myocarditis	DF	DHF	DSS	
Absent	45	4	0	49 (84.5%)
Present	4	3	2	9 (15.5%)
	49 (84.5%)	7 (12.1%)	2 (3.4%)	58 (100 %)
Significance level P = 0.0002				

Global hypokinesia was found absent in all cases, Serositis was presented in 8(13.8%) patients and pericardial effusion was seen in only (1, 1.7%).

In the present study group of 58 patients, it was found that 49 patients (84.5%) have not shown any cardiac abnormalities and 9 patients have abnormal values (15.5%) but are not significant. It is also found that the incidence of cardiac manifestations was more common in DHF and dengue shock syndrome which was 15.5% and 3.4%, respectively.

Discussion

Dengue is one of the most important emerging viral diseases globally. The incidence of dengue viral infection has seen an increasing trend in recent years in India. The majority of symptomatic infections result in a relatively benign disease course.

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 [4].

Dengue fever has been observed in all age groups in the present study population of 58 patients. The mean age of the population was 27.94 years with a male to female ratio of 1.6:1 indicating male preponderance.

Electrocardiography was normal in 84.5% of the study population and 15.5% had cardiac manifestations based on ECG. Although in a study by Kularatne, 62.5% of patients had abnormal ECG findings [5]. In the present study, ECG findings 'Non-Specific ST' Segment Changes' 9 (15.5%) was observed in maximum cases. 'Broad 'QRS' Complex' and 'Diffuse 'T' Wave Inversion' were accounted for in 8 (13.8%) cases. These parameters are suggestive of myocarditis.

The most common ECG abnormality noted was Non-Specific ST' Segment changes found in 15.5% patients, others i.e. Broad 'QRS' Complex, Diffuse 'T' Wave Inversion and Myocarditis and Sinus Bradycardia were had 12.1-15.8% contribution, only low voltage 'QRS' complex found in 3.4%% of the patients. On the other hand, Arora and colleagues reported a 37.5% prevalence of myocarditis with a positive correlation with the severity of dengue fever in their patients [6].

Lakshman et al. studied the prevalence of cardiac involvement among fifty admitted dengue patients and reported evidence of myocardial involvement in 16% and 30% of patients based on 2D- echo and biomarker testing, respectively [7]. Satarsinghe et al. in 2007 found that 24% of patients had echocardiographic abnormality without clinical features of myocarditis [8].

In the present study on ECHO, Sinus bradycardia was observed as maximum in 7 (12.1%) cases while diastolic dysfunction and pericardial effusion were presented in 1 (3.4%). Serositis was presented in 8 (13.8%) patients only. It was found that echocardiographic findings are often subclinical since most of the patients showed normal findings. In the study by Salgado et al. echocardiographic evaluation was done in 18 patients.

Three patients were noticed to have mild pericardial effusion and myocarditis was not seen in any patient. In the study by Gupta et al., systolic dysfunction was absent in all patients; mild diastolic dysfunction was present in 14.28 percent. Wiwanitkit et al., have described cases of dengue myocarditis [1][9][10].

The overall incidence of cardiac manifestations was observed in 15.5%. Myocarditis and sinus bradycardia was found statistically significant with dengue type. Similar findings were observed in studies conducted by Arora and Patil, and Papalka et al [4] [6].

Arora and Patil found that the incidence of cardiac manifestations was 30%, 35.29%, and 53.33% in patients of dengue fever, DHF, and dengue shock syndrome, respectively. Cardiac manifestations were not found to be statistically significant when correlated to different age groups.

Since the number of patients in dengue fever and dengue shock syndrome categories was small, some patients did not give consent for echocardiography, and some patients were not able to be shifted to the examination room due to his/her severity of disease; statistical differences though analyzed may not be robust.

Similarly, no statistical significance between thrombocytopenia and occurrence of cardiac manifestations ($P<0.05$) was found. Thus, it can be postulated that similar to other factors, cardiac involvement also did not have any significant correlation with thrombocytopenia.

These reported findings are not consistent with the aspect of myocardial infestation in dengue. A study by Miranda et al. found that two patients had reduced left ventricular function, two had left ventricular segmental hypokinesia, and one had pericardial effusion [11]. The increased production of cytokines including tumor necrosis factor-alpha and interferon-alpha and release of other chemical mediators is responsible for the rise in vascular permeability and abnormal leakage of plasma leading to a pericardial effusion [12].

In the present study, it was found that pericardial effusion is minimal and asymptomatic, and often resolves with time. The need for pericardiocentesis does not arise most of the time since capillary leakage causing pericardial effusion is transient and a self-limiting phenomenon [13]. Similar findings were noted in a study by Yusoff et al [14].

As a result, fluid resuscitation in dengue should be guided by hematocrit, blood pressure, and urine output as overzealous fluid therapy can cause pericardial effusion [15]. The postulated underlying mechanisms for reduced left ventricular ejection fraction are immune in origin although myocarditis may be a contributory factor [16]. It is also postulated that the mechanism of cardiac dysfunction is the direct infection of cardiac muscle cells by DENV. [17].

Limitations

There are several important limitations of the present study. These are as follows:

- The present study is an observational/cross-sectional
- A small sample size (58).
- No check for dengue virus subtypes was done.
- Tertiary care center
- Moreover, the current study did not reach the desired number of patients to determine significant abnormalities in dengue due to quitting/unwillingness of
- Unavailability of diagnosis report in critically/ICU admitted patients.

Conclusion

The natural history of dengue infection usually follows a clear pattern. The majority of infections are asymptomatic and subclinical.

As the incidence of dengue increases, reports of atypical manifestations are also on the rise, although these may be underreported because of lack of awareness and under-diagnosis of dengue.

What does the study add to the existing knowledge?

The incidence of various complications, in both serologically diagnosed patients and those with merely a clinical diagnosis without supporting serology, is quite similar Cardiac involvement is not uncommon and is encountered in centers handling large numbers of dengue cases. 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. Involvement of multiple organs, as well as the presence of metabolic derangement, can further confuse the picture.

Author's contribution

Dr. Nitesh Sukhwani: Concept, study design

Dr. Rohit Chhari: Manuscript preparation

Reference

01. Gupta VK, Gadpayle AK. Subclinical cardiac involvement in dengue hemorrhagic fever. Journal, Indian Acad Clin Med. 2010;11(2)107-111.
[Crossref]

02. Wali JP, Biswas A, Chandra S, Malhotra A, Aggarwal P, Handa R, et al. Cardiac involvement in Dengue haemorrhagic fever. Int J Cardiol. 1998;64(1)31-36.
doi:10.1016/S0167-5273(98)00008-4 [Crossref]

03. Kaushik JS, Gupta P, Rajpal S, Bhatt S. Spontaneous resolution of sinoatrial exit block and atrioventricular dissociation in a child with dengue fever. Singapore Med J. 2010;51(9)e146-e148.
[Crossref]

04. Papalkar P, Sarode R, Acharya S, Kumar S. Cardiac manifestations in dengue. Indian J Med Spec. 2019;10;30.
doi:10.4103/injms.injms_34_18 [Crossref]

05. Kularatne SAM, Pathirage MMK, Kumarasiri PVR, Gunasena S, Mahindawanse SI. Cardiac complications of a dengue fever outbreak in Sri Lanka, 2005. Trans R Soc Trop Med Hyg. 2007;101(8)804-808.
doi: 10.1016/j.trstmh.2007.02.021 [Crossref]

06. Arora M, Patil RS. Cardiac manifestation in dengue fever. J Assoc Physicians India. 2016;64(7)40-44.
[Crossref]

07. Lakshman A, Balasubramanian P, Nampoothiri R V, Vijayvergiya R, Bhalla A, Varma SC. Elevated cardiac biomarkers and echocardiographic left ventricular dysfunction at admission in patients with dengue fever- report from a tertiary care center in Northwest India. Trop Doct. 2018;48(4)261-265.
doi: 10.1177/0049475518785315 [Crossref]

08. Satarasinghe RL, Arultnithy K, Amerasena NL, Bulugahapitiya U, Sahayam D V. Asymptomatic myocardial involvement in acute dengue virus infection in a cohort of adult Sri Lankans admitted to a tertiary referral centre. Br J Cardiol. 2007;14(3)171-173.
[Crossref]

09. Salgado DM, Rodríguez JA, Garzón M, Cifuentes G, Ibarra M, Vega MR, et al. Caracterización clínica y epidemiológica de dengue hemorrágico en Neiva, Colombia, 2004. Rev Salud Publica. 2007;9;53-63.
doi: 10.1590/S0124-00642007000100006 [Crossref]

10. Wiwanitkit V. Dengue cardiac infection, a brief review. Acta Cardiologica Sinica. 2008;226–230.
[Crossref]

11. Miranda CH, Borges M de C, Matsuno AK, Vilar FC, Gali LG, Volpe GJ, et al. Evaluation of cardiac involvement during dengue viral infection. Clin Infect Dis. 2013;57(6)812-819.
doi: 10.1093/cid/cit403 [Crossref]

12. Singhi S, Kissoon N, Bansal A. Dengue and dengue hemorrhagic fever- management issues in an intensive care unit. J Pediatr (Rio J). 2007;83(2)22-35.
doi: 10.2223/JPED.1622 [Crossref]

13. Kohli U, Saharan S, Lodha R, Kabra SK. Persistent thrombocytopenia following dengue shock syndrome. Indian J Pediatr. 2008;75(1)82-83.
doi: 10.1007/s12098-008-0014-9 [Crossref]

14. Yusoff H, Roslawati J, Sinniah M, Khalid B. Electrocardiographic and echocardiographic changes during the acute phase of dengue infection in adults. J HK Coll Cardiol. 1993;1;93-96.
[Crossref]

15. Fernandes AIV, Mendes CL, Simões RH, Silva AEVF, Madruga CB, de Brito CAA, et al. Cardiac tamponade in a patient with severe dengue fever. Rev Soc Bras Med Trop. 2017;50(5)701-705.
doi: 10.1590/0037-8682-0361-2016 [Crossref]

16. Deen JL, Harris E, Wills B, Balmaseda A, Hammond SN, Rocha C, et al. The WHO dengue classification and case definitions- time for a reassessment. Lancet. 2006;368(9530)170-173.
doi:10.1016/S0140-6736(06)69006-5 [Crossref]

17. Salgado DM, Eltit JM, Mansfield K, Panqueba C, Castro D, Vega MR, et al. Heart and Skeletal Muscle Are Targets of Dengue Virus Infection. Pediatr Infect Dis J. 2010;29(3)238-242.
doi: 10.1097/INF.0b013e3181bc3c5b [Crossref]