



ORIGINAL RESEARCH PAPER

Pediatrics

CARDIAC INVOLVEMENT IN CHILDREN WITH DENGUE FEVER

KEY WORDS: Dengue, Cardiac involvement, sinus tachycardia (ECG), Cardiac function, 2D-Echo

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ABSTRACT

INTRODUCTION: Dengue is the mosquito born systemic and dynamic disease caused by flavivirus with four distinct serotype (DENVirus type 1 to 4)
METHODOLOGY: The prospective study was done at a tertiary care center at ahmedabad from September 2018 to October 2018. Children less < 12 years of age with dengue fever were evaluated and enrolled for cardiac involvement with CXR, ECG, 2D Echo, CPKMB, TROPONIN I.
RESULTS – Total 79 patient with dengue fever were enrolled and classified as dengue without warning sign(n=38, 48%), dengue with warning sign(n=24, 30%) and severe dengue(n=7, 9%). Among these 47% of study population shows cardiac manifestation, sinus tachycardia and decrease in ejection fraction are common to occur and cardiac manifestation seems to be increasing with severe form of disease.
CONCLUSION – Cardiac involment in children are common to occur with dengue fever but most of the cardiac involvements are sub clinical in form of sinus tachycardia. The cardiac involvement increasres with severe dengue fever.

INTRODUCTION:

Dengue ranks as the most important mosquito borne viral disease in the world. It is the most rapidly spreading mosquito borne viral disease of mankind with a 30-fold increase in global incidence over the last 5 decades. The dengue virus (DENV) is transmitted to humans by mosquitoes of the Aedes family¹. All four dengue virus serotypes (DENV-1, DENV-2, DENV-3, DENV-4) can cause the disease which can present as a mild self-limiting illness, dengue fever (DF), or as the more severe forms of the disease, dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS)².

The World Health Organization (WHO) 2009 guidelines classify patients into three groups; dengue without warning signs, dengue with warning signs and severe dengue³.

Early laboratory confirmation of dengue infection is crucial. Among the methods available for dengue diagnosis, virus isolation provides the most specific test result. Detection of IgM or IgG antibodies is the standard for serologically confirming a dengue infection. An up-to-date test for early diagnosis of dengue infection is dengue NS1 antigen detection⁴.

Dengue is known to affect several systems in the human body. Myocardial involvement may be the direct effect of the virus itself or due to cytokine production⁵. Myocarditis has varied presentations, can be clinical or subclinical^{6,9}. There is paucity of data regarding cardiac involvement in dengue. From the available data, the incidence of cardiac manifestations ranged from 16.7% to 71%. This included cardiac failure, echocardiogram (ECG) changes like sinus bradycardia, sinus tachycardia, T wave inversion, 2D Echocardiography changes like reduced ejection fraction, elevated cardiac enzymes (Troponin I, CPK MB)⁶⁻⁸ and cardiomegaly on chest x-ray. This wide variation in data could be because of the different criteria used for defining cardiac manifestations. The main difficulty in describing the manifestations and frequency of cardiac involvement in dengue is the lack of clear criteria to define cardiac involvement. Hypotension, shock, arrhythmias and pulmonary edema have all been described in severe

cases of dengue. However, patients with severe dengue can have gross derangement of hemodynamics and homeostasis as a consequence of plasma leakage and tissue hypoperfusion. For example, shock and pulmonary edema can occur as a result of plasma leakage or volume overload due to acute kidney injury. Thus, even if concurrent cardiac involvement were present, it would be difficult to differentiate it in the clinical setting. The degree to which myocardial dysfunction contributes to shock is not clearly known. In a cohort of dengue patients on whom echocardiographic assessments were performed, mean left ventricular ejection fraction (LVEF) was similar in patients with and without shock; furthermore, depressed left ventricular function was more commonly seen in patients without shock⁹.

MATERIALS AND METHODOLOGY:

INCLUSION CRITERIA:

- Children aged >1 month and < 12 years who are either Dengue NS 1 positive or Dengue IgM positive or both.

EXCLUSION CRITERIA:

- All children with known case of congenital or acquired cardiac diseases.

METHODOLOGY:

A prospective study was carried out at a tertiary care teaching hospital in Ahmedabad, India during September to October 2018. Total 79 children were enrolled in the study after taking informed consent from the guardians. These children were treated as per the WHO protocol for treatment of dengue. Chest radiograph, ECG and 2D Echocardiography were done on all children who were stable and shift able for the investigations. CPK-MB was done within first 24 hours of admission. Abnormalities of mean heart rate and rhythm were noted and correlated clinically.

RESULT AND DISCUSSION:

Among the 79 patients studied, 62% were male and 38% were female. Cardiac manifestations were seen in 47% of the study population. Among those with cardiac manifestations, sinus tachycardia was the most common manifestation(29%)

followed by ejection fraction <55 % (16%). Other abnormal ECG changes seen were sinus bradycardia (6% in patients with severe dengue and 4 % in dengue with warning signs) and T wave inversion (13% in dengue with warning signs and 12 % in severe dengue). Only 3 % of the study population had cardiomegaly.

Gupta et al⁸ reported that 78.5% patients with severe dengue in their study had elevated CPK-MB level. In the present study, 29% of the patients with severe dengue had elevated CPK-MB levels. This may be due to the fact that majority of the children in this study had dengue with/without warning signs, in which CPK-MB elevation was less likely.

Transient decrease in left ventricular ejection fraction, left ventricular wall motion abnormality which improves with time is known to occur in patients with dengue.⁶⁻⁷ Similar findings were noted in our study. These cardiac changes were mild and self-limiting in majority of cases.

Inflammatory mediators like TNF-alpha, cytokines, interleukins, oxygen free radicals which are released during active viral infection can cause myocarditis. Direct effect of dengue virus and also dengue antigen associating with myocardial receptor site and triggering off an immunological response is also known to cause myocardial damage , which resolves with resolution of infection¹⁰⁻¹². This can explain the transient ECG, 2D Echo changes as well as the 2D Echo findings.

The limitations of our study were that it was done in a small number of patients, there was no control group.

TABLE 1: SEX DISTRIBUTION

Sex	Total no. (n)	Percentage (%)
Male	49	62 %
Female	30	38 %
Total	79	100 %

Table 2: Prevalence of cardiac manifestation

Cardiac manifestation	n= 79
Present	37 (47%)
Absent	42 (53%)

Table 3: Findings of cardiac investigations

Cardiac manifestation	Dengue without warning sign (n=38)	Dengue with warning sign (n=24)	Severe Dengue (n=17)	Total (n=79)
CPK-MB	0	2 (8%)	5 (29%)	7 (9%)
Troponin I	0	0	2 (12%)	2 (3%)
ECG changes				
Sinus tachycardia	13 (34%)	8 (33%)	2 (12%)	23 (29%)
Sinus bradycardia	0	1 (4%)	1 (6%)	2 (3%)
T wave inversion	2 (5%)	3 (13%)	2 (12%)	7 (9%)
Supraventricular tachycardia	0	0	0	0
Low voltage QRS	0	0	0	0
2D- ECHO findings				
Ejection fraction < 55%	2 (5%)	5 (21%)	6 (35%)	13 (16%)
Left ventricular wall motion abnormality	0	0	1 (6%)	1 (1%)
Pericardial effusion	0	0	0	0
CXR: Cardiomegaly	0	0	2 (12%)	2 (3%)

CONCLUSION:

Cardiac manifestations were present in nearly half of the patients studied with dengue fever, though most had sub clinical manifestations with sinus tachycardia and decreased ejection fraction being the commonest manifestations. Cardiac manifestations are more common in children with severe dengue.

AUTHORS CONTRIBUTION:

All authors have provided constructive input in drafting the article. They assure that this article is original and has not been published elsewhere.

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REFERENCES

1. Rice CM. Flaviviridae: The viruses and their replication. In "Fields Virology"(BN Fields,DM Knipe, and PM Howley,Eds.),Vol. 1.
2. Sam SS, Omar SF, Teoh BT, Abd-Jamil J, AbuBakar S. Review of dengue hemorrhagic fever fatal cases seen among adults: a retrospective study. PLoS neglected tropical diseases. 2013 May 2;7(5):e2194.
3. World Health Organization dengue guidelines for diagnosis, treatment, prevention, and control new edition 2009. Switzerland.
4. TDR/WHO. In Dengue: Guidelines for diagnosis, treatment, prevention, and control. Geneva, Switzerland: World Health Organization; 2009.
5. Satarasinghe RL, Arulmithy K, Amerasena NL, Bulugahapitiya U, Sahayam DV. 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):171-73.
6. Kabra SK, Juneja R, Jain Y, Singhal T, Dar L, Kothari SS, Broor S. Myocardial dysfunction in children with dengue haemorrhagic fever. National Medical Journal of India. 1998 Mar 1;11:59-61.
7. Yadav DK, Choudhary S, Gupta PK, Beniwal MK, Agarwal S, Shukla U, Dubey NK, Sankar J, Kumar P. The Tei index and asymptomatic myocarditis in children with severe dengue. Pediatric cardiology. 2013 Aug 1;34(6):1307-13.
8. Gupta VK, Gadpayle AK. Subclinical cardiac involvement in dengue haemorrhagic fever. J Indian Acad Clin Med. 2010 Apr;11(2):107-1.
9. Khongphatthanayothin A, Lertsapcharoen P, Supachokchaiwattana P, La-orkhun V, Khumtonvong A, Boonlartaveecheoke C, Pancharoen C. Myocardial depression in dengue hemorrhagic fever: prevalence and clinical description. Pediatric Critical Care Medicine. 2007 Nov 1;8(6):524-9.
10. Dhawan R, Khanna M, Chaturvedi UC, Mathur A. Effect of dengue virus-induced cytotoxin on capillary permeability. Journal of experimental pathology (Oxford, England). 1990 Feb;71(1):83.
11. Matsumori A, Sasayama S. Immunomodulating agents for the management of heart failure with myocarditis and cardiomyopathy—lessons from animal experiments. European heart journal. 1995 Dec 1;16(suppl. O):140-3.
12. Hober D, Poli L, Roblin B, Gestas P, Chungue E, Granic G, Imbert P, Pecarere JL, Vergez-Pascal R, Watre P, Maniez-Montreuil M. Serum levels of tumor necrosis factor- (TNF-), interleukin-6 (IL-6), and interleukin-1 (IL-1) in dengue-infected patients. The American journal of tropical medicine and hygiene. 1993 Mar 1;48(3):324-31.