Original Research Article
The study of cardiac manifestations in patients with dengue infection and correlation of cardiac manifestations to warning signs of dengue

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Abstract
Background: World Health Organization estimates that 50-100 million dengue infections occur every year with 22000 deaths. The increasing magnitude of the problem together with its changing epidemiology is an important public health concern. The aim of this study was to observe the presence of Electrocardiographic changes in patients of dengue infection and to evaluate whether there were any related clinical cardiac manifestations and correlation of cardiac manifestations to warning signs of dengue.

Methods: This study was conducted at tertiary care institute in department of medicine. Data obtained from 74 patients over the period of one year fulfilling inclusion criteria were studied.

Results: 16 patients had no warning signs, 58 patients had warning signs, out of which 39 patients had two or more warning signs, while 19 patients had single warning sign. Most common warning sign in this study was abdominal pain and Vomiting while Hepatomegaly was the least common warning sign. The most common cardiac abnormalities noted were rhythm abnormalities of which the commonest was sinus bradycardia, found in around 56% of the patients. There was statistically significant correlation between cardiac manifestations and all the warning signs except lethargy/restlessness and Hepatomegaly.

Conclusions: The most common cardiac manifestations noted were transient rhythm abnormalities, of which sinus bradycardia was the commonest. There was statistically significant correlation between cardiac manifestations and all the warning signs except lethargy/restlessness and hepatomegaly.

Keywords: Electrocardiography, dengue infection, cardiac manifestations.

Introduction
Dengue is the common mosquito borne endemoeidemic arboviral infection in many of the tropical and subtropical regions of the world. About 50 million dengue infections occur annually and approximately 2.5 billion people live in dengue endemic countries.¹ India have recorded increasing incidence of dengue infections in recent years. Dengue infection was first reported in India from Chennai in 1780. Today dengue viral infection is documented in almost all parts of India. During 1996, one of the most severe
outbreaks of DF/DHF occurred in Delhi, with 10,252 cases and 423 deaths being reported (country total being 16,517 cases and 545 deaths). In 2006, the country witnessed an outbreak of DF/DHF with 12,317 cases and 184 deaths. The incidence of dengue is increasing in the last few years. During 2010, a total of 28,292 cases were reported, which increased to 50,222 in 2012 and 75,808 in 2013 – the highest since 1991.\(^2,3\) The case fatality ratio (CFR – deaths per 100 cases) has declined from 3.3% in 1996 to 0.4% in 2010 after the national guidelines on clinical management of DF/DHF/dengue shock syndrome (DSS) were developed and circulated in 2007.\(^4\) This further declined to 0.3% in 2013.

Dengue is transmitted by the mosquitoes Aedes aegypti and Aedes albopictus, which are found throughout the world. Symptoms of infection usually begin 4 - 7 days after the mosquito bite and typically last 3 - 10 days.\(^5,6\) Dengue virus belong to genus Flavivirus and family flaviviridae and dengue is caused by any one of the four serologically related viruses, designated as DEN-1, DEN2, DEN-3 and DEN-4.\(^7\)

Classical dengue fever is seen 4 - 6 days after an infective mosquito bite, with sudden onset of fever (biphasic often), severe headache, chills, generalized pains in muscles and joints, often is associated with maculopapular rash. There is leucopenia, relative lymphocytosis, thrombocytopenia and haemorrhagic manifestations may occur.\(^8\) Severe dengue infections may give rise to many complications such as liver failure, disseminated intravascular coagulation, encephalopathy, myocarditis, acute renal failure, and haemolytic uremic syndrome. Although these complications are generally rare, in recent years they have been reported with increasing frequency. Cardiac manifestations in dengue virus infection can range from asymptomatic bradycardia to life threatening myocarditis.\(^9\) Various studies have quoted several cardiac manifestations of dengue infection like sinus bradycardia, transient AV blocks, transient ventricular arrhythmias, myocarditis and pericardial effusion.\(^10,11\)

The aim of this study was to observe the presence of Electrocardiographic changes in patients of dengue infection and to evaluate whether there were any related clinical cardiac manifestations and correlation of cardiac manifestations to warning signs of dengue.

**Material and Methods**

This was a prospective study, conducted at tertiary care institute in department of medicine over the period of one year. In this duration 160 patients admitted with suspected dengue fever were selected for the study. Out of them, 74 ELISA confirmed IgM dengue sero-positive cases were satisfying WHO criteria.\(^12\)

**Inclusion criteria**

- Fulfilling the WHO criteria for dengue.
- Age group of ≥ 15 years.
- ELISA confirmed IgM dengue sero-positive cases.

**Exclusion criteria**

- Patients with history of pre-existing heart disease.
- Patients with electrolyte abnormalities.
- Patients on medications affecting the heart rate / rhythm.

**Observation and Result**

**Table 1:** Baseline clinical characteristics of dengue patients

| Character          | Number of patient |
|--------------------|-------------------|
| Sex                |                   |
| Male               | 46                |
| Female             | 28                |
| Age range (years)  |                   |
| 15-30              | 14                |
| 31-45              | 31                |
| 46-60              | 18                |
| >60                | 11                |

A total of 74 patients admitted to our hospital with fever and IgM dengue positive status fulfilling inclusion criteria were included. Out of which 46 were males and 28 females.
Mean age was 39.3 ± 12 years, a youngest patient was 16 years and oldest was 66 years old. No patient died in present study.

Table 2: Warning signs of dengue

| Warning signs    | Number of patients |
|------------------|--------------------|
| Persistent vomiting | 32                 |
| Abdominal pain    | 37                 |
| Mucosal bleed     | 13                 |
| Lethargy          | 22                 |
| Hepatomegaly      | 08                 |
| Shock             | 01                 |
| Respiratory distress | 04               |

Table 2: Warning signs of dengue

Fever was present in all patients. Other clinical manifestations include abdominal pain 50%, persistent vomiting 43%, petechial haemorrhage 5%, Hepatomegaly 8%, shock 1%, respiratory distress 5%. Minimum platelet count in this study was 12000/cmm, while mean platelet count in this study was 21435.42/cmm. Severe hepatic derangement (SGPT >1000) was not detected in this study, highest SGOT/SGPT was 345/436 in this study.

Warning signs and symptoms includes respiratory distress, oxygen, severe abdominal pain, excessive vomiting, altered sensorium, confusion, convulsions, rapid and thready pulse, narrowing of pulse pressure less than 20 mmHg, urine output less than 30 ml/hour, laboratory evidence of thrombocytopenia/coagulopathy, metabolic acidosis, derangement of liver/renal function tests.

Table 3: Electrocardiographic (ECG) changes in dengue patients

| ECG changes            | Number of patients |
|------------------------|--------------------|
| Sinus rhythm           | 09                 |
| Sinus tachycardia      | 06                 |
| Sinus bradycardia      | 44                 |
| First degree heart block | 05              |
| Ventricular ectopics   | 11                 |

Table 3 shows ECG changes in dengue patients in our study. Sinus bradycardia was the most common ECG finding in present study while first degree heart block was least common.

Table 4: Correlation of warning signs to ECG abnormality

| Warning signs    | ECG abnormality | Yes | No |
|------------------|-----------------|-----|----|
| Persistent vomiting | 19              | 13  |
| Mucosal bleed     | 10              | 03  |
| Abdominal pain    | 29              | 08  |
| Lethargy          | 11              | 11  |
| Hepatomegaly      | 03              | 04  |
| Sock              | 01              | 00  |
| Respiratory distress | 03             | 01  |

Table 4 shows the correlation between warning signs and ECG changes in dengue patients. There was statistically significant correlation between ECG abnormalities and abdominal pain and mucosal bleed.

Discussion

Increase in the number of dengue cases over the past few years has been attributed to rapid unplanned urbanization with unchecked construction activities and poor sanitation facilities contributing fertile breeding areas for mosquitoes, it is also seen that increase in alertness among medical personnel following the epidemics and availability of diagnostic tools in the hospitals have contributed to the increased detection of cases. Fever was the most common presentation (100%), which is in unison with other similar studies from India and South-East Asia. Headache and myalgia were seen in majority of cases. Similar result were found by Kumar S et al in their study. Mean age group of present study is 29.3 years youngest was 18 years and oldest was 50 years and age group that is mostly affected in other studies like Neeraja M in Hyderabad was 20-39 years.

Most common warning sign in this study was abdominal pain (50%) and vomiting (43%). In the study by Thien et al with dengue patients fever and persistent vomiting was noted in 39% of cases and was most common warning sign. Kumar S et al in their study found similar results. In this study cases showed sinus bradycardia in 59% and ventricular ectopics in 15% cases and sinus tachycardia in 13% cases. While in other
studies Gupta V et al showed 18% Brady cardia, 64% relative bradycardia, and 14% sinus tachycardia.18

**Conclusion**  
Most common electrocardiographic change in dengue viral fever patient was sinus bradycardia, which resolved spontaneously over period of 36 to 48 hours. Sinus rhythm, First degree heart block and ventricular ectopic were other ECG manifestation in these patients. There was no evidence of myocarditis in any of the patients. In present study ECG abnormalities were common but all the ECG changes were reversible and no patient died in our study. There was statistically significant correlation between warning signs and ECG changes in dengue patients.

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