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A Correlative Study of ECG Changes in Dengue Fever

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Abstract
Dengue is one of the most emerging viral diseases globally and it is classified as a major global health threat by world health organization (WHO).It is mosquito-borne viral infection caused by Flavivirus and transmitted by vector Aedes Aegypti. It is acute, infectious and self-limiting illness which has variable clinical manifestations ranging from asymptomatic to shock or death. Cardiac involvement is not uncommon in dengue, still in majority cases it remain underdiagnosed which further contributes to serious complications and sometimes leading to mortality
Aim and Objectives
 1. *To study the correlation between Dengue fever and its effect on Cardiac function through ECG changes.*
 2. *To find conclusive evidence of correlation between ECG and dengue associated cardiac dysfunction*
Methods: *Patients admitted in our hospital with diagnosed Dengue will be enrolled.*
Patients will be evaluated on the basis of:
 • *History of illness*
 • *Clinical examination*
 • *Relevant investigations*
 • *Treatment given*
 • *Response to treatment*
Conclusion: *Cardiac involvement is not uncommon in dengue ,still in majority cases it remain underdiagnosed which further contributes to serious complications and sometimes leading to mortality. The exact mechanism of involvement of heart in dengue remains unclear. Presence of myocarditis in dengue patients is not always significant but it should alert the treating clinicians that such patients may require regular and continuous monitoring. It is necessary to create awareness and knowledge of cardiac complication of dengue fever between clinicians and patients, which will help us in early recognition and prompt treatment.*

Introduction

Dengue is one of the most emerging viral diseases globally and it is classified as a major global health threat by world health organization (WHO)[4].It is mosquito-borne viral infection caused by Flavivirus and transmitted by vector Aedes Aegypti[1]. It is acute, infectious and self-limiting illness which has variable clinical manifestations ranging from asymptomatic to shock or death[4]. Cardiac involvement is not

uncommon in dengue ,still in majority cases it remain underdiagnosed which further contributes to serious complications and sometimes leading to mortality[1]. The exact mechanism of involvement of heart in dengue remains unclear.

Aim and Objectives

1. To study the correlation between Dengue fever and its effect on Cardiac function through ECG changes.
2. To find conclusive evidence of correlation between ECG and dengue associated cardiac dysfunction.

Materials and Methods

The study was a prospective observational study conducted at MGM Medical College and Hospital, Navi Mumbai.

100 patients fulfilling the inclusion and exclusion criteria were enrolled in the study.

The study was conducted in November 2015 to November 2017 for a period of 3 years.

Inclusion Criteria

1. Patient age 16 to 60.
2. Patient must be Dengue IgM or NS1 or both positive
3. Negative for Malarial Parasite on Peripheral smear or Rapid Antigen Test

Exclusion Criteria

1. All patients with pre-existing cardiac disease
2. Patients with co-infection of malaria or leptospirosis

3. All patients on beta-blockers, Digoxin, Amiodarone, Anti-Neoplastic Drugs or similar drugs known to alter cardiac function[3].
4. Patients with other systemic diseases like Anemia, CKD or Sepsis.

Materials

Study Design: Prospective observational study

Study population − Patients admitted in MGM Hospital & OPD patients with diagnosis of Dengue.

Duration: The study will be performed for a period of 3 years from November 2015 to November 2017.

Setting: Department of Medicine, MGM Medical College Hospital, Kamothe.

Methods

Patients admitted in our hospital with diagnosed Dengue will be enrolled.

Patients will be evaluated on the basis of:

- History of illness
- Clinical examination
- Relevant investigations
- Treatment given
- Response to treatment

Observation and Result

The present study was conducted in MGM Hospital, Navi Mumbai within span of 3 years and involved total 100 patients of dengue fever.
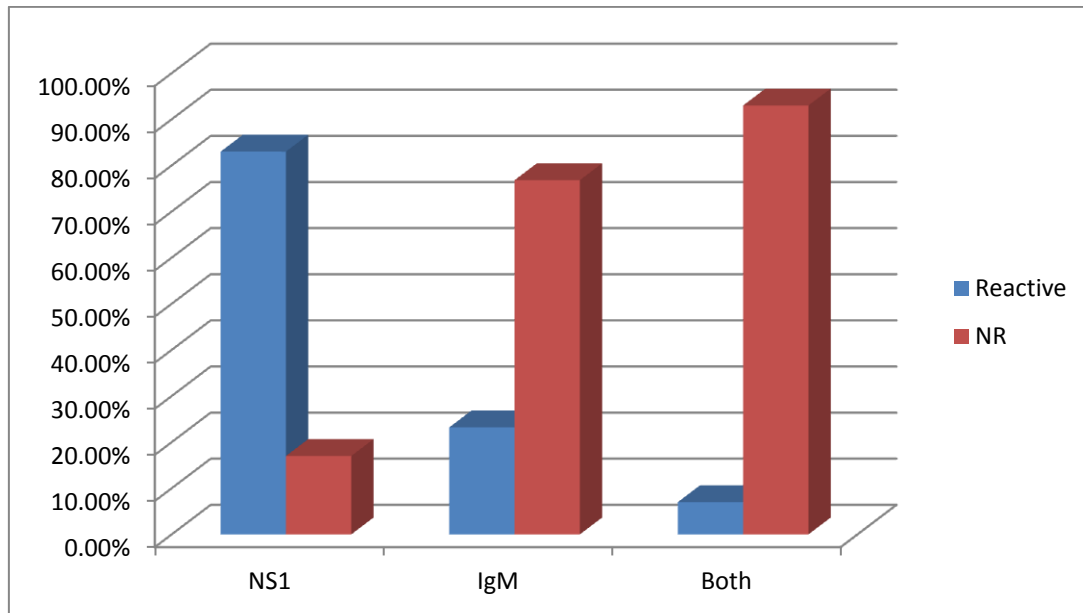
Dengue

Table 1 A: Dengue serotype distribution

	Reactive		NR		Total	
	Count	Row N %	Count	Row N %	Count	Row N %
NS1	83	83.0%	17	17.0%	100	100.0%
IgM	23	23.2%	76	76.8%	99	100.0%
Both	7	7.0%	93	93.0%	100	100.0%

Chart 1 A: Dengue serotypes distribution (NS1,IgM,Both)

- Our study included patients who were NS1 antigen, IgM and both positive.
- Out of 100 patients 87 were NS1 positive (87%), 23 were IgM positive (23%) and 7 patients were positive (7%) for both NS1 as well as for IgM.

ECG Changes

Table 2B: Distribution of ECG changes in dengue fever

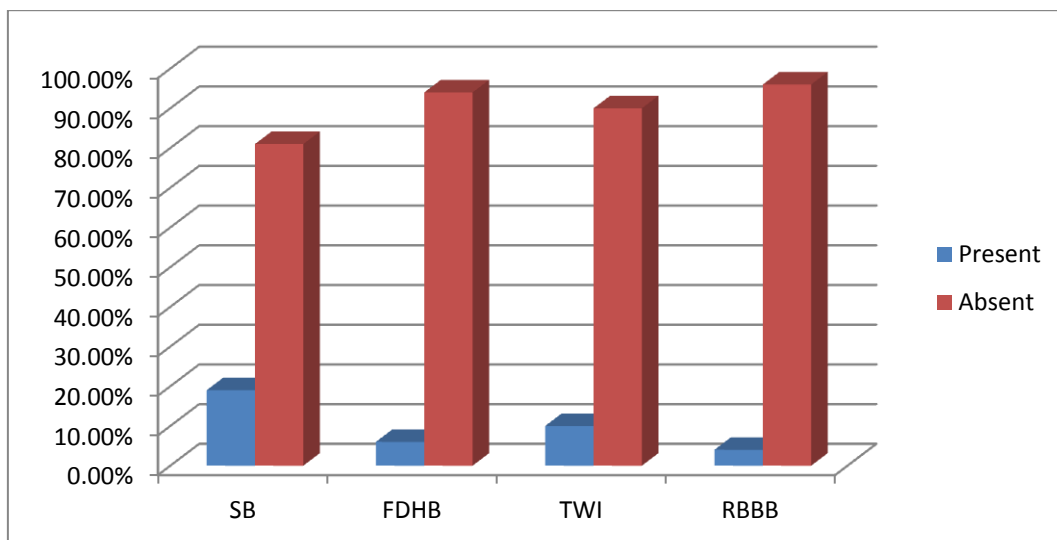|	Yes		No	
	Count	Row N %	Count	Row N %
SB	19	19.0%	81	81.0%
FDHB	6	6.0%	94	94.0%
TWI	10	10.0%	90	90.0%
RBBB	4	4.0%	96	96.0%

Chart 2 B: Distribution of ECG changes in dengue fever

> In our study, we studied different ECG changes those were occurring in dengue positive patients with myocardial involvement. Observed ECG changes were Sinus bradycardia, First degree heart block, T wave inversion and Right bundle branch block. From our study, we observed that out of 100 dengue positive 39 patients shows significant ECG changes.

> Out of 39 patients, 19(19%) patients showed sinus bradycardia, 10 (10%) patients showed T wave inversion, 6 (6%) patients showed First degree heart block and 4(4%) patients showed right bundle branch block.

Cardiac Markers against Dengue
Comparison against NS1
Table 3 A: Comparison of cardiac marker and ECG Changes against NS1

		NS1			
		Reactive		NR	
		Count	Column N %	Count	Column N %
SB	Yes	16	19.3%	3	17.6%
	No	67	80.7%	14	82.4%
FDHB	Yes	6	7.2%	0	.0%
	No	77	92.8%	17	100.0%
TWI	Yes	5	6.0%	5	29.4%
	No	78	94.0%	12	70.6%
RBBB	Yes	3	3.6%	1	5.9%
	No	80	96.4%	16	94.1%

Chi-Square test result
Table 3 B: Comparison of cardiac marker and ECG Changes against NS1

		NS1
SB	Chi-square	.024
	d.f.	1
	p-value	.876
FDHB	Chi-square	1.307
	d.f.	1
	p-value	.253
TWI	Chi-square	8.575
	d.f.	1
	p-value	**.003**[*]
RBBB	Chi-square	.189
	d.f.	1
	p-value	.664

> In our observational study, we also included the comparison of ECG changes with specific dengue antigens i.e. NS1, IgM and both.

> Total 83 patients of NS1 antigen, 28 (33.7%), 16 (19.3%)patients showed sinus bradycardia, 6 (7.2%) were showing FDHB, 5 (6.0%) were showing TWI and 3 (3.6%) patients showing RBBB.

p-value for the chi-square test greater than that of 0.05 for indicates no significant association between the respective parameters; while as p-value less than that of 0.05 indicates significant association (values marked in bold are significant)[7]

Comparison with IgM
Table; 3 4A: Comparison of cardiac marker and ECG Changes against IgM

		IgM			
		Reactive		NR	
SB	Yes	6	26.1%	13	17.1%
	No	17	73.9%	63	82.9%
FDHB	Yes	0	.0%	6	7.9%
	No	23	100.0%	70	92.1%
TWI	Yes	5	21.7%	5	6.6%
	No	18	78.3%	71	93.4%
RBBB	Yes	1	4.3%	3	3.9%
	No	22	95.7%	73	96.1%

Pearson Chi-Square Tests
Table 4 B: Comparison of cardiac marker and ECG Changes against IgM

		IgM
SB	Chi-square	.918
	d.f.	1
	p-value	.338
FDHB	Chi-square	1.933
	d.f.	1
	p-value	.164
TWI	Chi-square	4.469
	d.f.	1
	p-value	**.035**[*]
RBBB	Chi-square	.007
	d.f.	1
	p-value	.932

> Comparison of ECG changes with Dengue IgM patients showed following results:

➢ 6(26.1%) showing SB, 5 (21.7%) were showing TWI, 1(4.3%) was showing RBBB and no one positive for FDHB with dengue IgM.

➢ p-value for the chi-square test greater than that of 0.05 for indicates no significant association between the respective parameters; while as p-value less than that of 0.05 indicates significant association (values marked in bold are significant)[7].

Comparison against Both

Table A: Comparison of cardiac marker and ECG Changes against both serotype

		Both			
		Reactive		NR	
		Count	Column N %	Count	Column N %
SB	Yes	4	57.1%	15	16.1%
	No	3	42.9%	78	83.9%
FDHB	Yes	0	.0%	6	6.5%
	No	7	100.0%	87	93.5%
TWI	Yes	0	.0%	10	10.8%
	No	7	100.0%	83	89.2%
RBBB	Yes	0	.0%	4	4.3%
	No	7	100.0%	89	95.7%

Pearson Chi-Square Tests

Table B: Comparison of cardiac marker and ECG Changes against both serotypes

		Both
SB	Chi-square	7.115
	d.f.	1
	p-value	**.008**[*]
FDHB	Chi-square	.480
	d.f.	1
	p-value	.488
TWI	Chi-square	.836
	d.f.	1
	p-value	.360
RBBB	Chi-square	.314
	d.f.	1
	p-value	.575

➢ We also compared ECG changes with Patients who are positive for Both(NS1 and IgM).

➢ 4(57.1%) patients had SB. Other changes such as FDHB, TWI and RBBB were not seen in these patients.

➢ p-value for the chi-square test greater than that of 0.05 for indicates no significant association between the respective parameters; while as p-value less than that of 0.05 indicates significant association (values marked in bold are significant) [1].

In our study we studied NS1 antigen, IgM and both. Out of 100 patients 87 were NS1 positive (87%), 23 were IgM positive (23%) and 7 patients were positive (7%) for both NS1 as well as for IgM, which shows almost similar results of study by S. Sheetal et al[73] in Kerala, which was showing out of 100 dengue positive patients 79 were NS1 antigen positive and 21 were IgM positive. In our study, we studied different ECG changes those were occurring in dengue positive patients with myocardial involvement. Observed ECG changes were Sinus bradycardia, First degree heart block, T wave inversion and Right bundle branch block. From our study, we observed that out of 100 dengue positive 39 patients shows significant ECG changes. Out of 39 patients, 19(19%) patients showed sinus bradycardia, 10 (10%) patients showed T wave inversion, 6(6%) patient showed First degree heart block and 4 (4%) patient showed right bundle branch block. A case series conducted by Kularatne et al classified patients into two groups: cardiac and non-cardiac, based on the presence or absence of ECG abnormalities such as sinus bradycardia, atrioventricular conduction blocks, non-specific ST-T wave changes, Bundle branch blocks etc[17]. ECG changes were seen in 75 of 120 (62.5%) patients (cardiac group) and these patients were found to be more susceptible to fatigue, dyspnea, low peripheral oxygen saturation in room air (p = 0.001), chest pain (p = 0.001), and flushing of skin (p = 0.05) compared to 45 (37.5%) patients with normal ECGs (non-cardiac group). The study conducted by Yacoub et al[77] observed out of 79 dengue positive patients 51 had ECGs, out of which 18 ECGs showed

abnormalities in the form first-degree AV block, sinus bradycardia, T wave changes, and ST segment abnormalities 3/10 (30%) in dengue, 11/32 (34%) in DHF and 4/9 (44%) in DSS. Salgado et al study showed out 79 dengue positive patients 11 (14%) had ECG changes out of which 9 had Sinus Bradycardia, 2 had sinus tachycardia and 7 had T wave inversion. We also studied comparison of Cardiac markers with different serotypes of dengue, which showed:

1. Significant association between NS1 antigen and T wave inversion (as p-value 0.003)
2. Significant association between IgM and T wave inversion (p-value 0.035)
3. Significant association between both (NS1/IgM) and sinus bradycardia (p value 0.008).

Conclusion

Cardiac involvement is not uncommon in dengue, still in majority cases it remain underdiagnosed which further contributes to serious complications and sometimes leading to mortality[5]

The exact mechanism of involvement of heart in dengue remains unclear. Presence of myocarditis in dengue patients is not always significant but it should alert the treating clinicians that such patients may require regular and continuous monitoring. It is necessary to create awareness and knowledge of cardiac complication of dengue fever between clinicians and patients, which will help us in early recognition and prompt treatment.

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