



## Diphtheria Myocarditis - Clinical Experience At A Tertiary Care Hospital - A Cross-Sectional Observational Study

### KEYWORDS

Diphtheria Myocarditis Electrocardiography Arrhythmias

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**ABSTRACT** *Background: Diphtheria is endemic in India with high incidence of myocarditis. Objectives: To study the clinical profile, Electrocardiography, Echocardiography findings, Serum electrolytes, Creatinine and Immunization in patients with Diphtheria myocarditis. Methods: A single centre observational study (July 2014 to December 2015) of clinically confirmed diagnosis of diphtheritic myocarditis patients. Results: A Total of 41 cases were enrolled, of whom 39 patients died. Only two patients survived. Males :Female ratio was 1.27:1. Most common age group was 5-10 years 20 patients (51.2%). Partial immunization was seen in 24 (61.6%), no immunization in 15 (38.4%) patients. Complete heart block was most common ECG change noted in 21(53.8%), Left bundle branch block in 7(17.9%) patients. Severe LV dysfunction was seen in 24 (62%) patients. Raised serum creatinine was seen in 5(12.9%) patients. Most common mode of death was malignant ventricular arrhythmias seen in 26 (66.6%) patients. Conclusion: The mortality is higher with dyselectrolytemias, ECG changes and unimmunized status.*

### INTRODUCTION

Diphtheria is an acute bacterial infection caused by bacillus *Corynebacterium diphtheriae*<sup>1</sup>. It was first observed by Klebs in 1883 and cultivated by Loeffler in 1884<sup>2</sup>. The treatment that is antitoxin was developed in 1920. In India the developing country diphtheria still remains endemic with high mortality resulting from fulminant complications like diphtheritic myocarditis and renal failure. The factors responsible for endemicity in india are inadequate coverage of vaccination, poor socioeconomic status, delayed presentation, delayed administration of antitoxin. With the wide abundance of the cardiovascular diseases of atherosclerotic etiology, the one with infectious etiology especially myocarditis is of less importance and having scarcity in literature. We have assessed the clinical profile of diphtheritic myocarditis patients and their immunization status along with the electrolyte imbalance, electrocardiographic and echocardiographic features.

### METHODOLOGY

#### STUDY DESIGN AND PATIENT POPULATION

This was a single centre observational study. Cases admitted between July 2014 to December 2015 with clinically confirmed diagnosis of diphtheritic myocarditis shifted from "Sir Ronald Ross Institute of Tropical and Communicable Diseases" Hyderabad were enrolled in the study. The study was approved by ethical committee of the institution. Each patient have been enrolled in the study after written and informed consent from them or their parents. Patients with structural heart disease, congenital heart disease and with previous ECG changes from excluded from the study. Each patient have been analysed based on the preformed casesheet at admission. The details of the immunization status was obtained from the parents. The occurrence of shortness of breath, palpitations, chest pain, hypotension and decreased urine output was assessed. The 12 lead ECG and 2-dimensional echocardiography and biochemical profile was done at admission and repeated whenever required. Patients with symptomatic bradycardia and complete heart block were placed on temporary

pacemaker. Each patient was analyzed till discharge.

### STATISTICAL ANALYSIS

Statistical analysis was performed using Medcalc15.4 version. Continuous variables are expressed as mean+ standard deviation.

### RESULTS

A Total of 41 cases who were eligible were enrolled in the study. Mean age of presentation was 10.98±3.38 years. Among 41 cases enrolled in the study 39 patients died. Only two patients survived. Mortality was 95%. Of the patients who died 22 (56.4%) patients were males and 17(43.5%) were females. Of the patients who died most common age group affected was 5-10 years with 20 patients (51.2%). Most common symptoms were fever and difficulty in swallowing food seen in 94.8% patients. Partially immunized patients were 24 (61.6%) and 15(38.4%) patients were not immunized at all. No patient was completely immunized.

Among patients who died 15(38.5%) patients were having cultures positive and remaining(61.6%) were negative for culture.

Among patients who died Complete heart block was seen in 21(53.8%), Left bundle branch block was seen in 7(17.9%) patients, 5(12.8%) patients had sinus tachycardia, 3(7%) patients had right bundle branch block, 2(5.1%) patients had junctional rhythm, 1(2%) patient had T-Wave inversion. Among patients who died 24(62%) patients had severe LV dysfunction, 2(5%) patients had moderate LV dysfunction, 8(20%) patients had mild LV dysfunction and 5(13%) patients had normal LV function. Among patients who died 5(12.9%) patients had serum creatinine more than 1.5 and remaining 34(87.1%) patients had serum creatinine <1.5mg/dl.

Of the patients who died 26(66.6%) patients died due to malignant ventricular arrhythmias, 5(12.8%) patients died

due to renal failure, 4(10.2%) patients died of respiratory arrest and 4(10.2%) patients died of sudden cardiac arrest. Of the patients who survived one was male who was 14 years old and other was female who was 13 years old. One patient had sinus tachycardia and the other patient had T-Wave inversion in V1-V4. Other parameters were within normal limits in both patients. Among patients who survived one was completely immunized and one was partially immunized. The demographic clinical biochemical profile of patients who died summarized in Table 1 and those of who survived in Table 2

**Table 1: Demographic and Clinical features, Biochemical profile of patients who died in the study:**

Characteristics	No. of patients N =39(%)
Age, years (Mean)	10.98 ± 3.38 yrs
Fever	37 (94.8)
Difficulty in Swallowing	34 (87.1)
Palatal palsy	2 (5.1)
Oliguria	5 (12.8)
Duration of hospital stay	
< 1 day	15 (38.4)
2-5 days	12 (30.7)
6-10 days	7 (17.9)
>10 days	5 (12.8)

Immunization status	
Complete	0
Partial	24 (61.6)
Nil	15 (38.4)
Cultures	
Positive	15 (38.4)
Negative	24 (61.6)
ECG changes	
Complete heart block	21 (53.8)
LBBB	07 (17.9)
RBBB	03 (7.6)
Sinus tachycardia	05 (12.8)
Junctional rhythm	02 (5.1)
T wave inversions	01(2.5)
LV function	
Normal	05 (13)
Mild dysfunction	08(20)
Moderate dysfunction	02 (5)
Severe dysfunction	24 (62)
Electrolyte imbalance	
Sodium	
<115	07 (17.9)
116 – 125	12 (30.7)
126-135	13 (33.3)
>135	07 (17.9)
Potassium	
<3.5	14(36)
3.5-4.5	15 (38)
4.5 -5.5	08 (21)
>5.5	02(5)
Calcium	
< 8.5	18 (46.1)

8.5 -9.5	20 (51.2)
>9.5	1(2.56)
Magnesium	
<1.5	4(10.2)
1.5-2	29(74.3)
>2	6(15.3)
Serum creatinine	
<1.5	34(87.1)
>1.5	5(12.9)

**Table 2: Demographic and clinical features of patients who survived**

#### DISCUSSION:

	first patient (F/13YRS)	Second patient (M/14YRS)
Clinical presentation	Fever, difficulty in swallowing	Fever, palpitations, difficulty in swallowing
Immunisation	Primary dose, no booster	Not done
Duration of hospital stay	27 days	8 days
Cultures	negative	Positive
Ecg changes	Sinus tachycardia	T-wave inversion v1-v4
Serum sodium	136	128
Serum potassium	2.7	4.1
Serum calcium	8.9	8.8
Serum magnesium	2.2	2
Serum creatinine	0.6	1.1

In India the incidence of diphtheritic myocarditis varies from 16% to 66%<sup>3</sup>. Myocarditis is the major cause of death seen in approximately 50% of the patients as noticed in a study conducted by Hawaldar et.al<sup>4</sup>. Myocarditis is independent predictor of death in patients with diphtheria<sup>5</sup>. In our study most common age group was 5-10 years(51.2%) with a mean age group of 10.98±3.38 years of overall cohort. Males were more common in our observation(23vs18).

For the control and prevention of diphtheria, diphtheria vaccine is scheduled in India for infants a series of four doses given at 2,4,6 and 15-18 months of age with booster dosage at 4-6 years of age. This shows that the patients presented in the study were not adequately immunized according to the schedule recommended (complete-0, partial-25, nil-16). From the above figures it is clear that the immunization is inadequate. The clinical features of the patient were varied such as fever, palatal palsy, difficulty in swallowing and oliguria. The ECG changes were varied with most common being complete heart block. The evidence of conduction block and arrhythmias in a patient with diphtheritic myocarditis is due to delayed treatment and infection of the myocardial conduction tissue by diphtheric toxin as emphasised in a study by M.M.et.al<sup>6</sup>. The mortality rate in our study was 95.1%, almost double that of Stockins et.al which showed a mortality of 46%<sup>7</sup>.

#### CONCLUSION

The mortality associated with diphtheria myocarditis is

higher in Indian population. The age group of the patients who died is lower than those who survived. Renal failure, ECG changes and unimmunized status were more common among those who died. As diphtheria can be prevented by adequate vaccination, efforts should be maximized for 100% coverage with three doses of diphtheria toxoid in children below one year of age and immunity towards it should be maintained by booster doses.

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