

## Diphtheritic myocarditis: A case series and review of literature

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### ABSTRACT

Myocarditis in patients with diphtheria is a toxin-mediated complication that sets in after one week of onset of respiratory illness. Early administration of antidiphtheritic serum in patients with clinical diphtheria before the onset of myocarditis is of utmost importance to prevent this fatal complication. We report three patients who presented late in illness after the myocarditis had set in, to stress on the need of prompt administration of antitoxins by primary care physicians and highlight the importance of immunization.

**Keywords:** Corynebacterium diphtheria, diphtheria, toxin

### Introduction

*Corynebacterium diphtheriae* is a toxin-producing, gram-positive bacillus that causes diphtheria. The clinical manifestations of diphtheria range from asymptomatic carrier state to respiratory disease with or without manifestations due to the dissemination of toxins to heart, nervous system, and kidney. The global incidence of diphtheria is decreasing because of increased vaccine coverage.<sup>[1]</sup> Although similar decreasing trends have been noticed in India, more than 8000 cases were reported from India in 2018.<sup>[1]</sup> We report three cases of fatalities, possibly due to myocarditis in three patients with diphtheria.

### Case Series

#### Case 1

A two-year-old unimmunized girl presented with high-grade fever and dry cough for 15 days and respiratory distress for the

last two days. She was not immunized for diphtheria vaccine. On examination, she was pale, febrile, and irritable with a pulse rate of 140/minute (min), blood pressure (BP) of 98/60 millimetres of mercury (Hg), and a respiratory rate of 60/min. She had poor oral hygiene and a confluent greyish white pseudomembrane in oropharynx extending till vocal cords. On respiratory examination, she was found to have inter-costal retraction and bilateral wheeze with fine crepitations. Her liver span was 8 centimetres. Considering hypoxic irritability, poor oxygenation on blood gas and compromised airway, she was intubated. Her electrocardiogram (ECG) showed sinus tachycardia with non-specific ST segment and T wave changes. Serum CPK-MB was elevated (7 ng/ml). On day three of admission child started desaturating. Her chest X-ray picture was suggestive of congestive heart failure. She was given antibiotics, diphtheria antitoxin and anti-failure measures, but she succumbed on the same day of presentation.

#### Case 2

A 10-year-old girl was admitted with difficulty in swallowing for the past seven days. She had a history of fever with painful bilateral neck swelling 18 days back. She was immunized until nine months of age but did not receive any DPT boosters. On

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examination, she was found to have a nasal twang and a weak gag. She had no motor or sensory deficits, but her nerve conduction test was suggestive of axonal motor polyneuropathy involving upper and lower limbs too. Her echocardiography showed global hypokinesia with an ejection fraction of 20%. Her CPK-MB was raised (10 ng/ml). With a diagnosis of post diphtheritic bulbar palsy and myocarditis, she was given diphtheria antitoxin and intravenous immunoglobulin. However, she developed sudden refractory ventricular tachycardia and succumbed on the same day.

### Case 3

A 10-year-old unimmunized boy, a case of aplastic anaemia, developed a high-grade fever for seven days with swelling of the neck and painful deglutition. Local examination revealed confluent greyish-white membrane over his tonsils and oropharynx. His ECG showed sinus tachycardia with non-significant T wave and ST-segment changes. His throat swab was suggestive of diphtheria and was given diphtheria antiserum. However, he developed ventricular tachycardia and respiratory distress on the third day of presentation. He was intubated but succumbed to the illness.

## Discussion

Myocarditis is a potentially fatal complication of diphtheria. It is, in fact, the most important cause of mortality in patients with diphtheria. In a study by Meera *et al.*, all deaths except one was attributed to myocarditis [Table 1].<sup>[2]</sup> In a study by Jayashree *et al.*, mortality in patients with myocarditis was significantly higher compared to those without myocarditis [Table 1].<sup>[3]</sup>

The onset of myocarditis may coincide with the improvement of respiratory symptoms. The mean interval between the start of respiratory symptoms and the development of myocarditis ranges from 6.5 to 8.5 days in some studies, although this interval has been reported to be as long as 25 days [Table 1].<sup>[3-5]</sup> In our

series, the interval ranged from 7 to 18 days. It is important to intervene and give antitoxin before the myocarditis sets in as the antitoxin is not able to act on the toxin bound to the myocardium. All our patients presented after myocarditis had set in. Although we gave antitoxin to neutralize the remaining free toxin in the system, it did not help to improve the outcome. It is imperative to stress on the fact that patients with features suggestive of clinical diphtheria should be immediately given anti-diphtheria serum by the primary care physicians or referred early to tertiary care centre without waiting for laboratory results.

Myocarditis is more commonly seen in those individuals with more severe respiratory symptoms. In a study by Kneen *et al.*, presence of bull neck and pseudomembrane with confluent coverage of tonsils with/without extension to the palate, pharyngeal wall, nose or larynx were predictors for development of myocarditis [Table 1].<sup>[6]</sup> In our series, confluent pseudomembrane and bull neck were noticed in two patients each.

Myocarditis has been reported in 19–68% of cases with diphtheria<sup>[2-4,6,7]</sup> [Table 1]. However, a significant proportion of these individuals will just present with ECG changes without any symptoms of failure or shock. Besides sinus tachycardia and bradycardia, atrioventricular blocks, bundle branch blocks (BBB), ST-T changes, T wave inversion and ventricular/atrial ectopics are seen in varying frequencies in patients with myocarditis [Table 1].<sup>[3,4,6-8]</sup> Mortality in acute cases is usually seen in patients with complete heart block or tachyarrhythmias such as ventricular tachycardia. In our series, two patients had ventricular tachycardia while one patient had non-specific ST-T changes. Those patients who recover from acute myocarditis have been seen to have high rates of mortality. In a series by Celik *et al.*, of the patients who recovered from myocarditis, left BBB and inverted T waves were found to be independent predictors of long-term mortality [Table 1].<sup>[9]</sup> Symptomatic diphtheritic myocarditis is associated with high mortality if untreated and

**Table 1: Summary of major reports on diphtheritic myocarditis**

S.n	Study details	Number of patients	Patients with myocarditis	Interval	ECG findings
1	Dung <i>et al.</i> , Vietnam, 2002		32 patients requiring pacemaker		A temporary pacemaker in all- 7 survived, 25 died
2	Kneen <i>et al.</i> , Vietnam, 2004	154	32 (21%)		First/ second/third-degree Heart blocks-7, BBB (7), Ischaemic changes (13), ectopics (12), increased QT (8)
3	Jayashree <i>et al.</i> , Chandigarh, India, 2005	48	32 (67%)	6.5 +/-2.4 days	BBB (6), complete heart block (9), ventricular tachycardia (6), supraventricular (2), junctional tachycardia (2)
4	Celik <i>et al.</i> , Turkey, India, 2006		32		LBbB and inverted T waves – a risk factor for long term mortality
5	Kole <i>et al.</i> , Kolkata, India, 2010	200	136 (68%)		T-wave inversion (86), AV conduction block (8), RBBB (4), ST-T changes (4), multiple atrial ectopics (6)
6	Samdani <i>et al.</i> , Jaipur, India, 2017		60		T wave inversion(20%), ST depression (13.3%), RBBB (5%), multiple atrial ectopics (3.3%)
7	Meera <i>et al.</i> , Hyderabad, India, 2019	435	83 (19%)	1	
8	Dash <i>et al.</i> , Chandigarh, India, 2019	99	35 (35%)	8.5 days	Conduction abnormality and heart block (9), ST depression (5), Ventricular tachycardia (7), Ventricular premature beats (2), Prolonged PR interval (2)

pacemakers have shown to be helpful in cases with complete heart blocks [Table 1].<sup>[10]</sup>

We report these three non-immunised or partially immunized cases who presented late in the course of illness with symptomatic diphtheritic myocarditis to highlight the importance of immunization. Early diagnosis and prompt administration of antitoxins by the primary care physicians can result in prevention of fatalities.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the legal guardian has given his consent for images and other clinical information to be reported in the journal. The guardian understands that names and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

### References

1. Sharma NC, Efstratiou A, Mokrousov I, Mutreja A, Das B, Ramamurthy T. Diphtheria. *Nat Rev Dis Primer* 2019;5:81.
2. M M, M R. Diphtheria in Andhra Pradesh-a clinical-epidemiological study. *Int J Infect Dis IJID Off Publ Int Soc Infect Dis* 2014;19:74-8.
3. Jayashree M, Shruthi N, Singhi S. Predictors of outcome in patients with diphtheria receiving intensive care. *Indian Pediatr* 2006;43:155-60.
4. Dash N, Verma S, Jayashree M, Kumar R, Vaidya PC, Singh M. Clinico-epidemiological profile and predictors of outcome in children with diphtheria: A study from northern India. *Trop Doct* 2019;49:96-101.
5. Vinod KS, Gupta N, Sahu H, Wig N. Late presentation of post diphtheritic myocarditis in a 15-year male. *JNMA J Nepal Med Assoc* 2017;56:475-7.
6. Kneen R, Nguyen MD, Solomon T, Pham NG, Parry CM, Nguyen TTH, *et al.* Clinical features and predictors of diphtheritic cardiomyopathy in Vietnamese children. *Clin Infect Dis Off Publ Infect Dis Soc Am* 2004;39:1591-8.
7. Kole AK, Roy R, Kar SS, Chanda D. Outcomes of respiratory diphtheria in a tertiary referral infectious disease hospital. *Indian J Med Sci* 2010;64:373-7.
8. Samdani S, Jain A, Meena V, Meena CB. Cardiac complications in diphtheria and predictors of outcomes. *Int J Pediatr Otorhinolaryngol* 2018;104:76-8.
9. Celik T, Selimov N, Vekilova A, Kursaklioglu H, Iyisoy A, Kilic S, *et al.* Prognostic significance of electrocardiographic abnormalities in diphtheritic myocarditis after hospital discharge: A long-term follow-up study. *Ann Noninvasive Electrocardiol Off J Int Soc Holter Noninvasive Electrocardiol Inc* 2006;11:28-33.
10. Dung NM, Kneen R, Kiem N, Bethell DB, Phu NH, Solomon T, *et al.* Treatment of severe diphtheritic myocarditis by temporary insertion of a cardiac pacemaker. *Clin Infect Dis Off Publ Infect Dis Soc Am* 2002;35:1425-9.