Clinical profile of children with diphtheria admitted to tertiary care center

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ABSTRACT

Background: Diphtheria is a vaccine-preventable deadly disease affecting the children. It may cause complications and even death if not detected early. Diphtheria still continues to be reported from many regions of India despite extensive vaccine coverage. **Objective:** The objective of the study was to assess the clinical presentation, complications, and outcome of diphtheria. **Materials and Methods:** This hospital-based prospective study was conducted from August 2017 to June 2019 in a hospital of South India. All diphtheria cases admitted during this period were included in the study and their clinical presentations, complications, and outcome were recorded. **Results:** A total of 93 children were studied; of them, 92 children improved and discharged while 1 (1.06%) child died of respiratory obstruction due to laryngeal edema. Diphtheria was more common in 6–10 years age group and in season between October and January. A total of 4 (4.2%) children had sinus bradycardia, 8 (8.4%) myocarditis, 10 (10.6%) palatal palsy, and 3 (3.2%) children had laryngeal edema. **Conclusion:** Diphtheria is a significant cause of morbidity and mortality in unimmunized and partially immunized children even in the present era.

Key words: *Diphtheria, Laryngeal edema, Myocarditis, Palatal palsy, Unimmunized*

Diphtheria continues to be a serious health issue in children mainly due to lack of complete effective immunization. In India, diphtheria continues to be the one of the main causes of mortality in children [1]. Non-immunization, waning immunity, and lack of booster doses are the main reasons for new diphtheria infections. Poor socioeconomic status and overcrowding further increase the burden of the disease [2]. Diphtheria is a vaccine-preventable disease caused by *Corynebacterium diphtheriae*. It commonly infects pharynx and upper airways. Droplet spread is common mode of transmission. After invasion, bacteria cause tissue swelling and necrosis, leading to local symptoms such as fever, neck swelling, dysphagia, sore throat, and airway obstruction.

Dirty gray-white pseudomembrane is noted at the site of invasion, which is the pathognomonic of diphtheria. Bacteria release toxin which enters bloodstream, leading to systemic toxicity. Exotoxin is responsible for systemic effects. Involvement of heart leads to myocarditis, conduction block, and arrhythmia and central nervous system involvement leads to palatal palsy, cranial nerve palsy, neuritis, and neuropathy. Toxin-mediated inhibition of protein synthesis is essential mechanism for all systemic manifestations. Toxin leads to DNA fragmentation and cytolysis by inhibiting elongation factor-2 activity. Myocarditis may occur in around 10–25% of patients with respiratory diphtheria and has high mortality rate [3]. This study was done to assess the clinical presentation, complications, and outcome of diphtheria.

MATERIALS AND METHODS

This prospective study was conducted in the pediatric department of a tertiary care center of South India from August 2017 to June 2019. All children aged up to 18 years admitted to pediatric intensive care unit or pediatric ward with throat swab positive for *C. diphtheriae* were included in the study. Patients getting discharged against medical advice and children whose parents did not give consent for the study were excluded from the study. Ethical clearance was obtained from the Institutional Ethical Committee before the start of the study.

All suspected cases of diphtheria (who presented with cough, fever, and sore throat) are admitted according to our hospital protocol. Throat swab was sent for Albert staining and culture. Vitals were monitored and symptomatic treatment was given. Once the throat swab or culture was positive for *C. diphtheriae*, child was included in the study after taking consent from guardian. Personal details, history of immunization against diphtheria, and examination findings were recorded in pro forma. Anti-diphtheria serum was given. Complications if any were managed accordingly. All patients are admitted in pediatric ward for 14 days. Throat swab was repeated after 14 days. Children with negative throat swab report were discharged Figure 1.

They were called for follow-up after 1 week from the date of discharge to look for any further complications. Patients were readmitted if there were any complications noted during follow-up and treated further till recovery of complications. Myocarditis and asymptomatic bradycardia were diagnosed

Table 1: Clinical profile of diphtheria

Variables	Number (%)
Gender	
Male	49 (52.6)
Female	44 (47.3)
Age	
<6 years	3 (3.2)
6–10 years	65 (69.8)
>10 years	25 (26.8)
Immunization status	
Unimmunized	38 (40.4)
Partially immunized	56 (59.5)
Seasonal distribution	
July–September	39 (41.9)
October–January	43 (46.2)
February–May	11 (11.8)

Table 2: Profile of complications

Complication	Number (%)	Day of presentation	Final outcome
Myocarditis	8 (8.6)	6–10th days of illness	All cases improved
Asymptomatic bradycardia	4 (4.3)	6–10th days of illness	All cases improved
Laryngeal edema	3 (3.2)	4–7th days of illness	Two improved and one died
Palatal palsy	10 (10.7)	14–20th days of illness	All cases improved

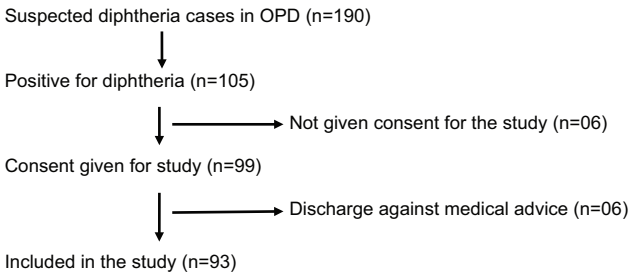

Figure 1: Flow chart showing enrollment of diphtheria case

clinically and by electrocardiogram (ECG) and two-dimensional echocardiography. Palatal palsy and laryngeal edema were diagnosed on the basis of clinical features.

Children who completed three primary doses at 4 weeks interval (starting from 6 weeks age) followed by booster doses at 16–24 months and 5 years were considered as completely immunized. Those children who missed even one dose from the aforementioned schedule were considered as partially immunized. Children who had taken any vaccine dose were considered as unimmunized. Statistical analysis was done using Chi-square test.

RESULTS

During the study period, 190 suspected diphtheria cases were admitted; of them, 105 were positive for diphtheria and were eligible for inclusion in the study. However, parents of six cases did not consent and six left against medical advice; therefore, a total of 93 cases were included in the final analysis. We found that diphtheria was more common in 6–10 years age group (69.8%) ($p>0.05$) as mentioned in (Table 1). Diphtheria cases were more common in winter season between October and January (46.2%), ($p>0.05$). Palatal palsy 10 (10.7%) was the most common complication in this study followed by myocarditis (8.6%) and asymptomatic bradycardia (4.3%) as mentioned in (Table 2). Laryngeal edema (3.2%) was the least common complication, but it was the cause of one death in the study.

DISCUSSION

Diphtheria morbidity and mortality continue to be high in developing countries like India. Even with the extensive immunization coverage in India, the cases of diphtheria still continue to be reported [4]. This is mainly due to partial or non-immunization of children. In the present study, 56 (60.2%) cases of diphtheria were reported in partially immunized children and 37 (39.7%) cases were reported in unimmunized children. Meera and Rajarao reported 1731 cases of diphtheria in unimmunized children [5]. In a study by Jain *et al*., majority of the patients were unimmunized (54%) followed by partially immunized (21%) children. This shows that partial or non-immunization is the major cause of diphtheria in children.

The gender distribution was almost equal in both males and females. In the present study, disease was more common (69.8%) in the age group between 5 and 10 years. Jain *et al.* reported that diphtheria is more common (48.33%) in <5 years of age group [6]. Ray *et al.* reported peak incidence of diphtheria in September and November [7]. In our study, maximum number of cases was found between August and January. This depicts the seasonal trend of diphtheria. Havaldar concluded that myocarditis was the most common cause of mortality (3.8%) in diphtheria [8]. In our study, 8 (8.6%) cases of myocarditis were reported and all got improved.

In this study, 10 (10.7%) cases of palatal palsy were seen which presented after 2–3 weeks of onset of illness. In a study by Prasad and Rai, 18 cases (64%) of palatal palsy were reported among 3–18 years age group and they were noted 1–3 weeks after pharyngeal diphtheria [9]. This shows that regular follow-up of diphtheria cases is needed after discharge. Furthermore, the severity of neurological complications depends on the extent of membrane formation and amount of toxin absorbed by Schwann cells of nervous tissue.

In this study, 4 (4.3%) cases of sinus bradycardia without myocarditis were reported. Samdani *et al.* reported 60 cases of diphtheria with ECG changes; of which, 68% of cases showed sinus tachycardia [10]. Cardiac conduction disturbance can occur in diphtheria without myocarditis [11]. As asymptomatic bradycardia usually presents without clinical feature, prompt monitoring for heart rate, blood pressure, and regular ECG is required to diagnose the condition [12,13]. There were few limitations of the study such as the small sample size and the short duration of the study.

CONCLUSION

Diphtheria remains the major cause of morbidity and mortality due to lack of immunization. It is also the cause of long-term morbidity such as palatal palsy, neuropathy, and cardiac conduction defects. All these complications could have been prevented by complete immunization of the child with diphtheria vaccine.

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