

Study of Diphtheria and Its Complications: A Retrospective Study from a Tertiary Care Hospital

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ABSTRACT

Aim and objective: To study clinical presentation and complication in diphtheria in pediatric age-group.

Materials and methods: Retrospectively 33 clinical diphtheria cases who got admitted to the isolation unit of Niloufer hospital from August 2019 to July 2020 were taken for this study. The epidemiological details, vaccination status, clinical profile, routine blood investigations along with SGOT, ECG, treatment given, and interventions done with outcome were studied.

Results: The common symptoms observed were throat pain seen in 26 cases (79%), fever seen in 25 cases (76%), dysphagia seen in 24 cases (75%), bull neck seen in 18 cases (55%), and palpitations seen in 06 cases (18%). Of the 33 patients, 4 (12%) patients had completed vaccination, 29 (88%) cases were either unimmunized or partially immunized as per their age. The complications observed were cardiac involvement evident through elevated serum transaminase and ECG changes seen in 06 cases (18%), neurological involvement seen in 05 cases (15%), renal failure seen in 04 cases (12%), thrombocytopenia seen in 02 cases (6%), and bleeding seen in 01 case (3%). Tracheostomy due to airway compromise required in six cases. A total number of nine (29%) patients died with complications.

Conclusion: Diphtheria incidence is relatively more in the age-group >5 years. The common symptoms are throat pain followed by fever, dysphagia, and bull neck. Common complications observed are myocarditis associated with high mortality, palatal palsy, renal failure, and thrombocytopenia. An increase in vaccination coverage is an effective preventive measure to reduce the incidence of diphtheria.

Keywords: Children, Clinical features, Complications, Diphtheria, Retrospective analysis.

Pediatric Infectious Disease (2021): 10.5005/jp-journals-10081-1307

INTRODUCTION

Diphtheria is an acute toxin-mediated infection caused by *Corynebacterium diphtheriae*, which is associated with skin and mucosal infection. The major virulence of the organism is its ability to produce a potent exotoxin, which inhibits protein synthesis and causes local tissue necrosis. Paralysis of the palate and hypopharynx is an early local effect of diphtheria toxin. Toxin absorption is also associated with systemic manifestations like acute tubular necrosis leading to AKI, thrombocytopenia, cardiomyopathy, and demyelination of nerves.¹ Diphtheria has a mortality rate of 5–10% among young children.² Recent diphtheria outbreaks among the younger age-group reflect inadequate vaccination coverage and have demonstrated the importance of sustaining high levels of coverage in childhood immunization programs.^{3–5}

AIMS

To study clinical presentation and complications in diphtheria in pediatric age-group.

OBJECTIVES

- To study the epidemiological variability and immunization status of affected children.
- To study the various complications and their incidence.
- To identify mortality and morbidity trends in diphtheria.

MATERIALS AND METHODS

Place of Study

Institute of Women and Child Health, Niloufer Hospital, Hyderabad.

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How to cite this article: Gampa M, Karna PN, Reddy KV, *et al.* Study of Diphtheria and Its Complications: A Retrospective Study from a Tertiary Care Hospital. *Pediatr Inf Dis* 2021;3(4):140–142.

Source of support: Niloufer Hospital

Conflict of interest: None

Study Population

A retrospective observational study was done in Niloufer Hospital on children admitted to isolation units over the past 1 year.

Study Design

Retrospective cross-sectional analysis.

Inclusion Criteria

- All children of age up to 13 years who fit into the WHO case definition of diphtheria which includes:
 - **Clinically compatible case**—Children with an illness of the upper respiratory tract characterized by pharyngitis, tonsillitis, or laryngitis and adherent pseudomembrane of pharynx, tonsils, larynx, and/or nose and lacks both a confirmatory laboratory test result and epidemiological linkage to a laboratory-confirmed case.

- **Epidemiologically linked case**—A suspected case that meets the definition and is linked epidemiologically to a laboratory-confirmed case.
- **Laboratory-confirmed cases**—which include organisms isolated by culture or microscopy with Albert's stain.

Exclusion Criteria

All other cases which do not fit into above criteria were excluded from the study.

Sample size: 33

Study duration: 1 year

Study period: August 2019 to July 2020

Methodology

All the cases which were admitted during the study period and fit into WHO definition of diphtheria case were collected retrospectively from the medical record department. Data were collected regarding demographic details, treatment status, complications like airway obstructions, palatal palsy, and other systemic effects of a toxin like myocarditis, renal failure, thrombocytopenia, and neurological effects and were analyzed.

Analysis

Cases and details were entered in Excel office 2020 consecutively and tabulated and centile analysis were done.

RESULTS

- Among the affected children 12 (36%) children were <5 years old.
- Among the cases, males were 21 (64%) and females were 12 (36%).
- Four (12%) of the cases were fully immunized for their age and the remaining 29 (88%) cases were non-immunized or incompletely immunized or immunization status was not known.
- Symptoms most commonly observed among cases were (1) Throat pain in 26 (79%) cases, (2) fever in 25 (75%) cases, (3) dysphagia in 24 (75%) cases, and (4) bull neck in 18 (55%) cases.
- Out of 33 cases, 6 (18%) cases had myocarditis which was evident through elevated SGOT and ECG changes, among them, 4 (66%) succumbed.
- Neurological complications like palatal palsy were observed in 5 (15%) cases. Among them, 1 (20%) had succumbed.
- Acute renal failure was observed in 4 (13%) cases, with a mortality of 2 (50%).
- Airway compromise which required tracheostomy was seen in 6 (18%) of cases among them 2 cases had died.

Clinical Characteristics

Table 1 shows various clinical features, complications, and their frequency.

DISCUSSION

Diphtheria morbidity and mortality continue to be high in several developing countries. It is still a public health problem in underdeveloped countries including India.⁶

The diagnosis of diphtheria still remains mainly clinical, supported by microbiological evidence of *Corynebacterium* by Albert's stain and confirmation by positive culture.⁷ In our study of suspected cases, Albert staining was positive in 8 (24%) cases

Table 1: Table showing demographic and symptomatology data

<5 years	12 (36%)
>5 years	21 (64%)
Male:female	1.7:1
Immunized	4 (12%)
Not immunized	29 (88%)
Throat pain	26 (79%)
Fever	25 (76%)
Bull neck	18 (55%)
Myocarditis	6 (18%)
Palatal palsy	5 (15%)
Tracheostomy	6 (18%)
Death	9 (27%)

which come under laboratory-confirmed cases compared to 32% in a retrospective study from Bengaluru by Basavaraja.^{8,9}

In our study population, 4 (12%) cases were immunized fully, 29 (88%) cases were not immunized or incompletely immunized. Minimum immunization coverage of 90% in children and 75% in adults is required to prevent the spread of diphtheria.¹⁰ There is an age shift of occurrence of diphtheria noted recently and 40–45% were above the age of 5 years.^{11,12} This was initially noted in the Russian epidemic and China outbreak but for the first time in India similar observations were made in a study by Sharma.¹³ Similarly, in our study, <5 years 12 (36%) children were affected and >5 years 21 (64%) children were affected. This is similar to recent patterns observed in other studies which represent a shift in age-group. A decrease in the incidence of diphtheria with age shift explains increasing in the vaccination coverage rate but this is not completely achieved.

The most common clinical features observed in our study were throat pain, fever, dysphagia, and bull neck. In a study conducted by Meshram and Patil, similar patterns of clinical features were observed, where the most common feature is throat pain followed by bull neck and respiratory difficulty.¹⁴ Common features in diphtheria are mostly due to local effects of the toxin.

The patients with cardiac involvement may be asymptomatic with ECG changes and/or raised SGOT, or symptomatic. The ECG changes of myocarditis may be sickle-like sagging of the ST-segment, arrhythmias (supraventricular or ventricular), abnormal Q waves, repolarization abnormalities, ST-segment elevation, T-wave inversion, isoelectric T waves, and QTc interval prolongation, atrioventricular block, bundle branch block, hemiblock, etc.¹⁵ Out of 33 cases, 6 (18%) cases developed myocarditis with elevated SGOT and ECG changes which is a life-threatening complication of diphtheria, which was observed mostly in the first 2 weeks of disease with a high mortality rate of 70% with ventricular tachycardia in our study.

The latency period for neurological manifestations varied from 10 days to 3 months.¹⁶ The first indication of neuropathy was paralysis of the soft palate and posterior pharyngeal wall.¹⁷ Bulbar dysfunction typically developed during the first 2 weeks. Oculomotor and ciliary paralyzes were seen after 3 weeks. Palatal palsy was observed in 5 (15%) cases. Diphtheria polyneuropathy carried a good prognosis hence timely diagnosis and differentiation from other neuropathies is a prerequisite for rational management and contact tracing.¹⁸ Diphtheria can cause kidney injury by toxin-induced tubular necrosis. As in our study, renal involvement was

seen in 4 (13%) of cases that required renal replacement therapy among them 2 cases had improved over time.¹⁹

There were 9 deaths with a case fatality rate of 27% in our study in Hyderabad. The case fatality rate in the Basavaraja study from Karnataka⁹ study was 41% whereas it ranged from 32 to 56.3% in different centers in north India, and 42.9% in west India.²⁰ India accounted for 17.7% of the total World's population in 2018 but reported 53% of global diphtheria in that year.

CONCLUSION

Diphtheria is a highly infectious disease and associated with high mortality which can be potentially prevented through proper vaccination. In children, diphtheria presents with mostly throat pain, fever, dysphagia, and complications in the form of myocarditis, palatal palsy, thrombocytopenia, and renal failure. Cardiac complications are highly associated with mortality. Therefore, it is necessary to anticipate and monitor for complications to decrease mortality. Awareness of immunization, contact tracing, and surveillance can decrease the burden of the disease.

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