

Original Article

Clinical profile and outcome of pediatric diphtheria cases admitted at a tertiary health care centre

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Objective : To study the clinical profile and outcome of pediatric clinical diphtheria patients admitted at a tertiary health care center.

Methods : A hospital-based prospective study was conducted in all clinically suspected diphtheria cases of pediatric age group, admitted in the pediatric isolation ward of tertiary health care and referral center from January 2015 to December 2018 (4 Years). Cases were diagnosed with detailed history, clinical examination and throat swab examination for Albert stain and culture. All cases are treated using the standard protocol.

Results : 46 diphtheria cases were enrolled who met the case definition of clinical diphtheria (consistent clinical symptoms with a sore throat, fever, cough, etc. with membranous tonsillitis). The majority of cases were between 09 to 11 years (43%); 60% were females. Most of the cases reported in September-October (44%). Poor immunization coverage is noted (90%) where 63% were unimmunized. Fever, cough and sore throat are predominant symptoms (93%) whereas dysphagia, stridor and bull neck were correlated with poor outcomes. Albert staining, as well as culture, showed good results. Amongst 46 patients, 08 patients were referred to higher centers owing to the unavailability of ADS. The outcome was satisfactory with total recovery in 78% while fatal in 03 cases (case-fatality rate: 8%).

Conclusions : Shift of age group, poor immune status, early diagnosis, and effective treatment showed good cure rates. Immunization status of each child should be actively enquired and catch up immunization should be promoted. A high index of suspicion towards diphtheria is required and early treatment should be initiated.

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Key words : *Corynebacterium diphtheriae*, Diphtheria, Diphtheria in children, Pediatrics diphtheria.

Since ancient times, diphtheria has been one of the deadliest and one of the most feared infectious disease globally. It caused many devastating epidemics mainly affecting children¹. Diphtheria is an acute infectious disease of the upper respiratory system ie, nasal, oropharyngeal and laryngeal. It is caused by toxogenic strains of *corynebacterium diphtheria*. It is fatal unless identified in the early course of the disease and treated. Still it is preventable as the highly potent and immunogenic vaccine is available. Due to poor routine vaccination coverage, still, it is a

Editor's Comment :

- Tonsillar Diphtheria is the commonest type in children.
- Early diagnosis and administration of Antidiphtheric serum results in a good outcome.
- Vaccination history should be enquired for any case of membranous tonsillitis.
- A high index of suspicion is required for early diagnosis, treatment, and a better outcome.

significant health problem in developing countries. Although Globally, the incidence of diphtheria has decreased dramatically due to effective childhood vaccination programs. During 2001-2005, nearly half of the diphtheria cases reported globally were from India and between 2011-2015 India had the largest total no of diphtheria cases reported worldwide. India accounted for more than 71% of the total of 4880 cases in the world in the year 2011³. Because of the significant proportion of the global burden of this deadly disease with many outbreaks reported in the recent past, India can be termed as the capital of diphtheria. There has been a re-emergence of diphtheria in many developing countries with low vaccine coverage and

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waning vaccine immunity in developed countries too. The number of cases reported to the World Health Organization has declined from 1,00,000 cases in 1980 to 2,500 cases in 2015. A similar decline was seen in India though India accounted for the majority of diphtheria cases globally.

In studies from states like Andhra Pradesh, Assam, Karnataka, Maharashtra, Rajasthan, Uttarakhand, and West Bengal, >50% of diphtheria cases were aged >5 years. According to the national level health surveys (NFHS 4- 2015-16), the coverage of 3 primary diphtheria vaccines ranged between 55.1 % and 78.4 % ie, just more than half of all children aged 12-36 months fully vaccinated with UIP recommended vaccines. The 5-year coverage of BCG and DPT3 in Indian children was 87% and 63% respectively. There is a reappearance of microbiologically confirmed cases of diphtheria in many parts of India. Poor immunization coverage, population migration, and overcrowded slums may be the etiological factors². The diphtheria toxin binds to various cells in the body including epithelial, nerve and muscle cells. After binding it interferes with enzymes necessary for protein synthesis leading to cell damage and ultimately cell death⁴.

MATERIALS AND METHODS

A hospital-based prospective study was conducted at Shri Bhausaheb Hire Government Medical College and Hospital, Dhule, Maharashtra, India, a tertiary care and referral center from Jan 2015 to Dec 2018. All clinically suspected cases of diphtheria, admitted in pediatric isolation ward were diagnosed with detailed history, clinical examination who met the case definition of clinical diphtheria (consistent clinical symptoms with a sore throat, fever, cough, etc. with membranous tonsillitis) and throat swab examination on Albert stain and Culture (Table 1). All cases were treated by using a standard treatment protocol. Inj Crystalline Penicillin in a dose of 2 lakh units per kg body weight in 4 divided doses i.v. after the skin sensitivity test for 14 days. Inj. Anti-Diphtheric Serum (ADS) given after skin sensitivity test as an intravenous infusion over 30 to 60 minutes. It was given in the dose of 40,000 units for mild nasopharyngeal lesions, 80,000 units for pharyngeal or laryngeal lesions of 2 days duration and 1,20,000 units for pharyngeal and laryngeal lesions with obstruction of airways or longer than 2 days duration. The child was vaccinated as per his / her previous immunization status according to national guidelines. Household susceptible contacts received erythromycin for 7 days. The data was entered in Microsoft excel, statistical tests were done by proportions and chi-square test.

RESULTS

The chi-square statistic is 2.9858. The p-value is 0.083998. This result is not significant.

The chi-square statistic with Yates correction is 2.286. The p-value is 0.130546 and is not significant. No significant difference between the two tests.

DISCUSSION

In older studies like Patel UV *et al* (2004)⁵ the predominant age group was under five, the percentage was 61.9%. The median age of diphtheria cases in most of the recently published studies was >5 years. In our study, >90% of cases were ≥5 years of age. That is consistent with many recent studies done in states like Andhra Pradesh, Karnataka, Maharashtra, Rajasthan, and West Bengal². In a study by Talsania N *et al* (2011) 47% of cases were of the age group of 10-19 years age group⁶. The occurrence of diphtheria cases in under-five children reflects low coverage of primary diphtheria vaccination. There was a high proportion of cases in under-fives during the prevaccination era globally as well as during the eighties in India due to lower vaccination coverage.

Nowadays higher median age of most of the diphtheria cases in India indicates good primary vaccination coverage protecting under-five children at the same time increasing susceptibility of school-going and adolescent children to either on account of low coverage of diphtheria vaccines as well as declining immunity acquired by vaccination or naturally. Hence the age distribution of diphtheria cases

Table 1 — The socio-demographic characteristics, clinical features and outcome of the study participants

Demographic parameters	N (%)
Sex	
Male	19 (41.3)
Female	27 (58.7)
Age (in Years)	
<5	3 (6.5)
5-10	25 (54.3)
11-15	14 (30.4)
16-20	4 (8.7)
Clinical Features	N (%)
Fever	
Present	43 (93.5)
Absent	3 (6.5)
Cough	
Present	44 (95.7)
Absent	2 (4.3)
Stridor	
Present	44 (95.7)
Absent	2 (4.3)
Dyspnoea	
Present	9 (19.6)
Absent	37 (80.4)
Immunization Status	
Immunized	4 (8.7)
Unimmunized	17 (37)
Partly Immunized	8 (17.4)
Not Known	14 (37)
Epiglottitis	
Present	3 (6.5)
Absent	43 (93.5)
Bull Neck	
Present	5 (10.9)
Absent	41 (89.1)
Sore Throat	
Present	44 (95.7)
Absent	2 (4.3)
Microscopy	
Positive	33 (31.7)
Negative	13 (28.3)
Culture	
Positive	25 (54.3)
Negative	21 (45.7)
Outcome	
Cured	30 (65.2)
Referred to Higher Centre	7 (15.2)
AMA	6 (13.0)
Died	3 (6.5)

reflects the immunity status of the community. In our study, it indicates good primary vaccination coverage so shift of age group (ie, attack rates are lowest among infants, increasing with age, and reaching to its maximum among children of 10-14 years of age) in Dhule district and adjacent area. In a study by Phalkey RK et al.⁷In one surveillance study by Verma S et al, 2019 the median age of diphtheria cases was 5-9 years of age⁸. The coverage of the primary diphtheria vaccine in the country is around 80%, whereas, the coverage of diphtheria boosters is expected to be low⁹. In countries with temperate climates, most diphtheria cases occur during the cold months but in warmer climate countries, the transmission takes place throughout the year¹. In our study, >54% of cases occurred in winter months – from October to January (Table 2). In a study by Ray SK et al (1998)¹⁰, Bildhaiya GS et al (1972)¹¹ majority of the cases were admitted in August to October. In a study by Phalkey RK et al⁷, 82% patients had a cough, 73% had a low-grade fever, 64% had throat congestion, 64% had pseudo-membrane, 45% sore throat, 36% tonsillar patch, 27% dysphagia, 18% Bull neck (neck swelling) and 9% cases had difficulty in breathing, stridor and nasal discharge (Table 1).

The case fatality rate in our study was 8% that is comparable with 9% in a study by Phalkey RK et al⁷. Mortality is associated with poor immunization coverage and waning immunity over time. Early diagnosis and active treatment of the diphtheria cases will reduce the mortality. In a study by Patel UV et al⁶, case fatality was nil in completely immunized patients, 21.4% in partially immunized patients and 28.2% in unimmunized patients. Most of the diphtheria cases were unvaccinated. In our study 37% of cases were unvaccinated and 37% with unknown status, 17% partially immunized and 8.7% were immunized. In a study by Patel UV et al, 2004⁵ only 3% of patients were fully immunized, 30.8% partially immunized

Table 2 — Distribution of cases according to Years and Months

Year	2015	23 (50.0)
	2016	12 (26.1)
	2017	2 (4.3)
	2018	9 (19.6)
Months	January	7 (15.2)
	February	2 (4.3)
	March	2 (4.3)
	April	4 (8.7)
	May	1 (2.2)
	June	0 (0)
	July	2 (4.3)
	August	5 (10.9)
	September	5 (10.9)
	October	11 (23.9)
	November	3 (6.5)
	December	4 (8.7)

Which test is better?		
	Microscopy	Culture
Positive	33 (29) [0.55]	25 (29) [0.55]
Negative	13 (17) [0.95]	21 (17) [0.94]

and 65.4% were unimmunized. It is in consistent with the increasing trend of vaccination in India and Maharashtra.

RECOMMENDATIONS

Receiving the fourth and fifth doses (first and second boosters) is needed for complete protection against diphtheria. Hence coverage for the booster doses should be improved. As in many studies, the common age group is >10 years, it is better to change TT with Td which is administered in adolescents at the age of 10 and 16 years according to the National Immunization schedule.

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Contribution Details

Hatkar NK - Concept and Design, acquisition of data, analysis, and interpretation of data.

Rathod KG- Definition, Literature search, drafting the article and revising it critically.

Salunkhe YM-final approval of the version to be published.

Mohd. Ubaid ur Raheman – Statistical Analysis.

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