A clinical study of diphtheria cases in a pediatric population in tertiary care hospital in western Maharashtra

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ABSTRACT

Background: Although DPT immunization has been a part of universal immunization program since its inception, still diphtheria continues to be endemic in India and also leading to morbidity in children, especially in areas in the border of the two states. Cases coming to tertiary care level are only tip of iceberg. **Objectives:** To study the clinical profile, morbidity, and mortality of the diphtheria cases admitted to the Pediatrics Department of a tertiary care hospital and to study their immunization status. **Materials and Methods:** A hospital-based cross-sectional study was conducted from 1 January, 2012, to 31 June, 2013, on clinically suspected diphtheria cases. Detailed history and clinical examination were done, and their immunization status was recorded. **Results:** Total 36 clinically suspected children of diphtheria were studied. Sex ratio was 1:1. 12 cases were from 1 to 5 years age group, whereas 15 cases were between 6 and 10 years and remaining 9 cases aged more than 10 years. Among 36 cases, 4 (11.11%) were fully, 11 (30.55%) were partially immunized, and 21 (58.33%) were not immunized. The most common symptom observed was fever in 34 (94.44%) cases followed by throat pain in 25 (69.44%) cases and difficulty in swallowing in 23 (63.88%) cases. Case fatality rate was 13.88%. Maximum numbers of cases were observed during the rainy season. **Conclusion:** High prevalence of diphtheria in the age group of 5-15 years suggests the need for completing immunization schedule specially booster doses. Immunization activity needs to be strengthened in borderline districts as most of the cases in the present study were from the areas in the border between states.

Key words: *Children, Diphtheria, Immunization*

Diphtheria is a preventable and infectious disease characterized by the local production of the membrane in the respiratory system [1]. The organism has still existed in a highly immunized population [2]. Although DPT immunization has been a part of universal immunization program (UIP), the total immunization coverage is much less than the total number of beneficiaries [3]. The occurrence of the disease depends on the immunization coverage [4].

Due to less immunization coverage at border district areas of the states, the bulk of diphtheria admissions is increasing at tertiary care center especially in border districts such as Solapur. For efficient management and favorable outcome, early diagnosis is a must. We planned to study the clinical profile and seasonal variation of the morbidity and mortality of the children admitted with suspected diphtheria and to study their immunization status in a tertiary care hospital.

MATERIALS AND METHODS

A hospital-based, cross-sectional study was conducted on children <12 years of age admitted with clinically suspected diphtheria in Pediatric Department during the period from January 2012 to June 2013. Approval for the study was obtained from the Institutional Ethical Committee. Informed consent was taken from informant before recruitment of subjects. A detailed history from informant/caretaker was taken, and physical examination was done. Investigations such as complete blood count and throat swab smear and culture for Clostridium were sent.

Children who received all doses (primary+booster doses) of immunization as per his or her age according to UIP of India were considered as fully immunized. Children who missed any one or more doses were considered as partially immunized, and children who did not receive even a single dose of vaccine were categorized as non-immunized [5]. A suspected case of diphtheria was defined as a child having symptoms of pain in throat, cough, and fever, difficulty in swallowing and breathing and the presence of pseudomembrane anywhere in the throat with or without bull neck. All the children fitting in the operational definition and admitted during the study period were included in the study.

All the cases were managed as per the standard guidelines and were monitored for development of complications. All cases were given anti-diphtheritic serum after skin sensitivity, crystalline penicillin, tracheostomy, hemodynamic support, and respiratory support wherever necessary. The data were analyzed using MS

Office Excel sheet and statistical tests such as Chi-square and Fisher Exact test were used.

RESULTS

Total 36 clinically suspected children of diphtheria were admitted in the 18 months study period. The mean age of the study population was 7.04±3.29 years. 12 (33.33%) cases were ≤5 years of age, whereas 24 (66.66%) cases were more than 5 years of age. Cases from both the sexes were equal, i.e., 18 (50%). Out of 36 cases, only 13 (36.11%) were positive for Klebs–Löffler bacillus (KLB) on smear examination while on throat swab culture, 12 (33.33%) cases were positive for KLB.

Fever was one the most common symptoms, seen in 34 (94.44%) cases followed by throat pain in 25 (69.4%) and difficulty in swallowing in 23 (63.88%) as shown in Table 1. All 36 cases had patch in the throat on examination and of them, 9 had signs of airway obstruction, and 3 required tracheostomy. 31 (86.11%) cases were cured and discharged while 5 (13.88%) died; thus, case fatality rate was 13.88%. Average duration of stay for all survivors was 9.6 days, whereas for non-survivors, it was 3.2 days. 7 cases had complications at the time of admission, among them 5 had myocarditis and 2 had disseminated intravascular coagulation (DIC). Out of 5 cases with myocarditis, only 1 survived and of 2 DIC cases, one survived. One child developed neuropathy after successful discharge which recovered gradually.

Out of 36 children, 21 (58.33%) were unimmunized, 11 (30.55%) were partially immunized, and only 4 (11.11%) children were fully immunized as shown in Table 2. Immunization rates were less in females as compared to males. All the non-survivors were totally unimmunized; however, all fully and partially immunized cases were cured. The association between mortality and immunization status was significant (Fisher Exact test=0.05, p=0.05). Table 3 shows that the immunization rate among children from Karnataka was lesser than the rates among children from Maharashtra state. Furthermore, proportion of unimmunized children was more in children from Karnataka (14, 66.66%) than from Maharashtra state (7, 33.33%). Although cases were reported throughout year, majority were seen from June to September during the rainy season.

Table 1: Distribution of diphtheria cases according to symptoms and sign

Symptoms*	Gender		Total
	Male	Female	
Patch	18	18	36 (100)
Fever	17	17	34 (94.44)
Pain in throat	12	13	25 (69.4)
Difficulty in swallowing	8	15	23 (63.88)
Cough with hoarseness	12	3	15 (41.66)
Swelling of neck	4	3	7 (19.44)
Difficulty in breathing	2	1	3 (08.33)

*Multiple responses

DISCUSSION

Historically, diphtheria has been primarily a childhood disease affecting population younger than 10 years of age. In this study also, maximum number of cases (27, 75%) were below or equal to 10 years of age. Incomplete immunization or not receiving a booster dose of DT/DPT vaccine is an important reason behind increasing incidence of diphtheria in the age group of 10-15 years [6]. However, 9 (25%) cases were from 10 to 15 years of age group. In our study, sex ratio was 1:1, whereas Himanshu et al. found it as 1:1.7 and Sharma et al. reported it as 1.6:1 [6-7]. Level of immunity against diphtheria in developing countries declines in late childhood due to lack of booster doses besides weaning of immunity and also decreased herd immunity due to changing epidemiology of diphtheria as a result of improving lifestyle [8].

In our study, 4 (11.11%) cases were fully immunized, 11 (30.55%) cases were partially immunized, and 21 (58.33%)

Table 2: Distribution of diphtheria cases according to immunization status, age, and gender

Age groups (years)	Immunization status N (%)						Total
	Fully immunized		Partially immunized		Not immunized		
	Male	Female	Male	Female	Male	Female	
1-5	1	0	2	1	5	3	12 (100)
6-10	1	0	1	4	3	6	15 (100)
>10	2	0	1	2	2	2	9 (100)
Total N (%)	4 (11.11)	0 (0)	4	7	10	11	36 (100)

*χ^2=0.087 (between gender and immunization status). d.f.=2, p>0.05 Not significant

Table 3: Distribution of diphtheria cases according to immunization status and state of residence

State of residence	Immunization status N (%)			Total
	Fully immunized	Partially immunized	Not immunized	
Maharashtra	4 (100)	3 (27.27)	7 (33.33)	14 (38.88)
Karnataka	0 (0)	8 (72.72)	14 (66.66)	22 (61.11)
Total (%)	4 (100)	11 (100)	21 (100)	36 (100)

*χ^2=7.182. d.f.=2, p<0.05 Significant

cases were unimmunized. This indicates unsatisfactory immunization coverage with DT/DPT vaccine in respective areas of their residence. Out of 36, 14 (38.88%) cases were from Maharashtra state and 22 (61.11%) cases were from Karnataka state. Immunization status among children from Maharashtra state was statistically better ($p<0.05$) than immunization status among children from Karnataka state. Parande et al. observed similar views about immunization status of north Karnataka state which is adjacent to Maharashtra border [9].

Although statistically insignificant, gender bias was observed pertaining to immunization status in the present study subjects. In the south Indian states and Maharashtra, gender bias is marginal with Kerala showing favorable condition for females [10]. However, the equal incidence of diphtheria was observed in the present study. The most widely quoted diphtheria mortality rate is 5-10% and may reach higher than 20% in children younger than 5 years of age [8]. Matheria et al. found case fatality rate in his study as 23.67% [11]. In the present study, case fatality rate was 13.88%, and all of these were unimmunized. Association between outcome and immunization status was significant (Fisher Exact test=0.05).

The present study showed patch in 36 (100%) children, fever in 34 (94.44%), bull neck in 7 (19.44%), and hoarseness of voice in 15 (41.66%). Similar symptomatology was observed by Pancharoen et al. in his study [12]. In our study, as well as in the study by Pancharoen et al., airway obstruction was the most common complication [12]. However, only three among nine required tracheostomy in our study. In a study by Pancharoen et al., there was a significant association between death and cardiac complications. Similar findings were seen in our study also, and 4 out of 5 cases with myocarditis died.

Diphtheria is still not a lost entity as cases are coming to tertiary care level. Immunization activity needs to be strengthened in borderline districts as most of the cases in the present study were from the borderline state. We need to do community-based evaluation of immunization coverage by house to house survey. Our study showed that complete immunization, early diagnosis, and early treatment do matter in preventing the complications and mortality. A limitation of our study was small sample size. Second, study results cannot be generalized to the community as the study is hospital based. For this, lager community-based studies with an emphasis on immunization status are required.

CONCLUSION

Although a vaccine preventable disease, diphtheria is still a matter of concern for public health. Its high prevalence in 5-15 years age group suggests the need for completing the immunization schedule, especially booster doses. Immunization activity needs to be strengthened in border districts as most of the cases in the present study were from areas at the border of two states.

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