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Original Research Article

A cross sectional study on clinical profile and complications associated with diphtheria in Sir Ronald Ross Institute of Tropical and Communicable Diseases, Hyderabad, Telangana State

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ABSTRACT

Background: Diphtheria is a potentially fatal infection caused by *Corynebacterium (C.) diphtheriae* strains and occasionally by toxigenic *C. ulcerans* and *C. pseudotuberculosis* strains. Although effective vaccines are available all over the world, this disease has the potential to re-emerge. As there are few studies regarding clinical profile, complications, and immunization status among adult in Telangana, this study will bridge the gap in information regarding demographic data, clinical features, immunization status, and the presence of complications.
Methods: Cross sectional study done for a period of 8 months from March-October 2019 at Sir Ronald Ross Institute of Tropical and Communicable Diseases, Hyderabad. Study was done on 150 diphtheria (clinical and microbiologically) positive cases admitted. The collected data was entered in Microsoft excel and analysed using Epi info v.7.2.6.6.
Results: Out of the total study participants 34% belong to 10-14 years age group 99.3% had patch over tonsil, 98.7% had fever. Among the study participants, 19.3% had electrocardiography (ECG) abnormalities, 10.7% had breathing problems, 11.3% had both ECG abnormalities and breathing problems, 7.3% had diphtheria myocarditis. 20.7% were completely immunized and 46% were partially immunized, 6.6% patient's immunization status were unknown and 26.7% of the patients were unvaccinated. The occurrence of complications was common among Muslims (p=0.001), rural residence (p=0.0005). Educational qualification was significantly associated with occurrence of complications (p=0.04), and people coming from lower socioeconomic strata had more complications compared to others (p≤0.05) Unvaccinated people suffered from more complications compared to vaccinated people (p=0.002).
Conclusions: There is an age shift in the occurrence of diphtheria increasingly over 5 years of age.

Keywords: Diphtheria, Immunization, Clinical profile

INTRODUCTION

Diphtheria is a potentially fatal infection caused by toxigenic *Corynebacterium (C.) diphtheriae* strains and occasionally by toxigenic *C. ulcerans* and *C. pseudotuberculosis* strains. Diphtheria is usually an acute respiratory infection, typically characterized by the formation of a pseudo membrane in throat, but cutaneous infections are also possible. Systemic effects like myocarditis and neuropathy, which are associated with increased fatality risk, are due to diphtheria toxin, an exotoxin produced by pathogen which inhibits protein synthesis and causes cell death.[1]

9622 cases were reported in India in the year 2020. The South-East Asia region was the source of 55–99% of all reported cases each year during this period. The analysis further showed a significant under-reporting of cases to World Health Organization (WHO), particularly from the African and Eastern Mediterranean regions. The true burden of disease is therefore likely to be greater than reported.[2]

After the introduction of a primary series of childhood diphtheria vaccination in a population where diphtheria is endemic, two epidemiologic stages have been described. In the first stage, disease incidence shifts from predominantly pre-school pattern to a greater proportion of cases in school-age children. In the second stage, cases are seen primarily in adolescents and young adults aged >15 years. Infection in infants younger than 6 months is rare due to the presence of maternal antibodies.[3]

Although effective vaccines are available all over the world, this disease has the potential to re-emerge in countries where the recommended vaccination programs are not well sustained, and increasing proportions of adults are becoming susceptible to diphtheria these days.[1]

As the disease is still persisting in a few states and published reports of the disease do exist in Indian literature indicating outbreaks, secular trends and a shifting epidemiology over the years.[4,5] There is a resurgence of Diphtheria cases with a high mortality rate which is contributed by incomplete vaccination, which stresses the need for improvement and strengthening of the immunization status of children.[6] As there are few studies regarding clinical profile, complications and immunization status among adult in Telangana, this study will bridge the gap in information regarding demographic data, clinical features, immunization status, and the presence of complications and the association between sociodemographic characteristics and the occurrence of diphtheria.

The objectives of the study were: to study the sociodemographic characteristics of the study population; to study the clinical profile of the study subjects; to study the association between sociodemographic characteristics and the occurrence of diphtheria complications; and also to study the association between immunization and the occurrence of diphtheria complications.

METHODS

This is a cross sectional study done for a period of 8 months from March 2019-October 2019.

Study design

The study was a cross sectional type of study.

Period of study

The period of study was for 8 months (March 2019-October 2019).

Place of study

This study was done in Sir Ronald Ross Institute of Tropical and Communicable Diseases, Hyderabad also known as Fever Hospital which treats infectious diseases like diphtheria, diarrhoea, measles, mumps, cholera, fever cases. It has separate wards for each disease. Cases from all over the state and adjoining states come over here for treatment.

Study population

The study population consisted of diphtheria (clinical and microbiologically) positive patients who were admitted.

Sample size

The size of the sample was 150.

Sampling method

Convenient sampling method was used for sampling.

Inclusion criteria

The study included: clinically proven, and microbiologically proven cases of diphtheria.

Exclusion criteria

Patients who did not give consent to participate in the study were excluded.

Methodology

Before data collection informed consent was taken from the respondents. A semi-structured questionnaire was administered and all the respondents were interviewed face to face by the researcher. Information was gathered regarding socio-demographic profile, and clinical profile from 150 participants. The collected data was entered in Microsoft excel and analysed using Epi info v.7.2.6.6.

Data entry and analysis

Microsoft excel version 2016, Epiinfo v 7.2.6.6 was used for data entry and analysis.

RESULTS

Out of the total study participants 34% belong to 10-14 years age group and 64.7% of the study population were males. Majority, 59.3% were Muslims by religion. Among the study population. 58% of the study participants were living in joint family. Majority, (92%) of the study participants were unemployed. 42% had primary education. Among the cases 39.3% belong to class IV socio-economic status according to modified Kuppuswamy classification (Table 1).

Majority 99.3% had patch over tonsil, 98.7% had fever, 88.7% had throat pain and cervical lymphadenopathy, 88% had difficulty in swallowing, 72.7% had sore throat, 48.7% had enlarged tonsils, 15.3% had swelling over neck area, 14.7% had typical bulls' neck, 7.3% had nausea and

vomiting, 6.7% had patch over uvula and 3% had patch over tongue, 2.7% had abdominal pain and 1.9% had hoarseness of voice (Table 2).

Table 1: Sociodemographic profile of study participants.

Parameters	Frequency (N)	Percentage
Age (years)		
0-5	22	14.7
5-9	37	24.6
10-14	51	34
15-19	20	13.3
20-24	10	6.7
25-29	7	4.7
>30	3	2
Sex		
Females	53	35.3
Males	97	64.7
Religion		
Hindu	60	40
Muslims	89	59.3
Christians	1	0.7
Education		
Primary education	63	42
Secondary education	28	18.7
Intermediate education	3	2
Graduates	1	0.6
Illiterates	55	36.7
Occupation		
Employed	12	8
Unemployed	138	92
Socioeconomic class		
Class I	13	8.7
Class II	15	10
Class III	41	27.3
Class IV	59	39.3
Class V	22	14.7
Residential status		
Urban	78	52
Rural	72	48

Among the study participants 7.3% had diphtheria myocarditis, 19.3% had ECG abnormalities, 10.7% had breathing problems, 11.3% had both ECG abnormalities and breathing problems, 3.3% had nerve palsies, 2% had albuminuria and 54% did not have any complications (Table 3). Among the study participants 20.7% were completely immunized and 46% were partially immunized, 6.6% patient's immunization status were unknown and 26.7% of the patients were unvaccinated (Table 4 and Figure 1).

Among the total study participants occurrence of complications were common among Muslims (p=0.001), rural residence (p=0.0005). Educational qualification was significantly associated with occurrence of complications (p=0.04), and people coming from lower socioeconomic strata had more complications compared to others (p≤0.05) (Table 5).

Table 2: Clinical profile of diphtheria cases.

Clinical profile	Number	Percentage (%)
Patch over tonsil	149	99.3
Fever	148	98.7
Throat pain	133	88.7
Cervical lymphadenopathy	133	88.7
Difficulty in swallowing	132	88
Sore throat	109	72.7
Tonsil enlarged	73	48.7
Swelling over neck area	23	15.3
Bulls neck	22	14.7
Nausea and vomiting	11	7.3
Patch over uvula	10	6.7
Patch over tongue	6	4
Abdominal pain	4	2.7
Hoarseness of voice	3	1.9

Table 3: Complications among diphtheria cases.

Parameters	Number	Percentage
Diphtheria myocarditis	11	7.3
ECG abnormalities	29	19.3
Breathing problems	16	10.7
ECG abnormalities and breathing problems	17	11.3
Nerve palsies	5	3.3
Albuminuria	3	2
Nil	81	54

Table 4: Immunization history of diphtheria cases.

Parameters	Number	Percentage
Completely immunised	31	20.7
Partial immunization	69	46
Unknown	10	6.6
Unvaccinated	40	26.7

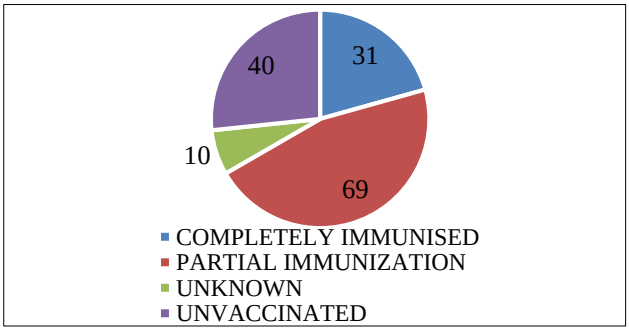

Figure 1: Immunization history of diphtheria cases.

Table 5: Association between sociodemographic parameters and diphtheria.

Parameter	With complications N (in %)	Without complications N (in %)	P value
Religion			
Muslims	45	44	0.001
Hindus	24	36	
Christians	0	1	
Residential status			
Rural	56	16	0.0005
Urban	13	65	
Employment status			
Unemployed	61	77	0.06
Employed	1	11	
Education			
Primary education	61	2	0.04
Secondary education	8	20	
Intermediate education	20	17	
Graduates	0	1	
Illiterates	35	20	
Socioeconomic class			
Class I	4	11	<0.05
Class II	8	7	
Class III	17	24	
Class IV	50	9	
Class V	21	1	

Unvaccinated people suffered from more complications compared to vaccinated people (p=0.002) (Table 6).

Table 6: Association between immunization status and diphtheria complications.

Immunization status	With complication	Without complication	P value
Vaccinated	42	68	0.002
Unvaccinated	27	13	
Total	69	81	

DISCUSSION

In the present study 34% belong to 10-14 years age group which is comparable to a study done by Rajkumar et al were 55.32% were >5 years.[7] In this study 64.7% of the study population were males which is comparable to the study done by Shetty et al where 61% of the study participants were males.[8] 52% of the study participants were from urban area and 48% were from rural area whereas in a study done by Shetty 16 out of 18 cases were from rural area.[8] It may be due to urban location of the study setting in the present study.

Majority 99.3% had patch over tonsil, 98.7% had fever, 88.7% had throat pain and cervical lymphadenopathy, 88% had difficulty in swallowing, 72.7% had sore throat, 48.7% had enlarged tonsils,15.3% had swelling over neck area, 14.7% had typical bulls neck, 7.3% had nausea and vomiting, 6.7% had patch over uvula and 3% had patch over tongue, 2.7% had abdominal pain and 1.9% had hoarseness of voice which was similar to a study done by Singh et al among 34 *Corynebacterium* positive cases, fever was present in 33 (97.1%), throat pain/dysphagia in 31 (91.2%), neck swelling in 22 (64.7%), palatal palsy in 6 (17.6%), and membrane was seen in 33 (97.1%) cases.[9] Similar findings were seen in studies done by Shetty et al, Prakash et al in tertiary health care settings.[6,8]

In the present study among the study participants 7.3% had diphtheria myocarditis, 19.3% had ECG abnormalities, 10.7% had breathing problems, 11.3% had both ECG abnormalities and breathing problems, 3.3% had nerve palsies, 2% had albuminuria and 54% did not have any complications which is similar to study done by Gmapa et al where the complications observed were cardiac involvement in (18%), neurological involvement seen in (15%), and renal failure seen in (12%).[10]

Among the study participants 20.7% were completely immunized and 46% were partially immunized, 6.6% immunisation status were unknown and 26.7% of the patients were unvaccinated where as in a study done by Prakash et al (18.2%) were completely immunized, (9.1%) was unimmunized and (72.7%) were partially immunized.[6]

Immunization status had significant association with the occurrence of complications in the present study which was similar to study done by Nagwing et al where poor outcome was significantly associated with the lack of basic or booster immunizations.[11]

CONCLUSION

The occurrence of complications among diphtheria patients had significant association with religion (p=0.001), rural residence (p=0.0005), educational qualification (p=0.04) lower socioeconomic strata (p≤0.05) and immunization status (p=0.002). There is an age shift in the occurrence of diphtheria increasingly over 5 years of age. This may be due to several factors like waning immunity with age, lack of booster doses. Resurgence of diphtheria, stresses upon need of improved surveillance, strengthening of the routine immunization system and additional booster doses.

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