

The Vaccination Status and Complications in Patients of Diphtheria

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ABSTRACT

Background: Diphtheria is an infectious disease caused by "corynae-bacterium diphtheria" ¹. It usually pharynx, tonsils, larynx or any of them in isolation or in combination. It can involve skin as well. In some case, infection can spread to trachea as well. One of its characteristic features is presence of a membrane, which is a pseudo membrane.

Aim: To determine the vaccination status and complications in patients admitted with diphtheria.

Place and duration: Emergency pediatrics department, diphtheria section for one year

Study design: Cross sectional, observation study.

Methods: All patients fulfilling the inclusion criteria will be admitted in emergency. All such patients are evaluated by junior consultant/senior registrar of emergency. He examines the patient and document his findings on the pre-designed proforma. Throat swab is taken for staining and culture sensitivity. Antidiphtheric serum is arranged according to the condition of the patient.

Results: In this study total 106 patients were included. Mean age of the patients was 7.97±2.99 with 46.2% male and 53.8% females. Patients admitted with the complaint of fever were 102(96.2%) and 69(65.1%) with sore throat. The most common examination finding in the patients was throat congestion in 58.5% and 52.8% had tonsillopharyngitis. Most of the complications noted were: Tracheotomy, arrhythmia, LV dysfunction, dysphagia and neuropathy. 20.2% had bull-neck.

Conclusion: It has a high rate of complications and high rate of mortality. Early use of anti-toxins are essential to prevent complications.

Keywords: Diphtheria, Corynaebacterium, Tonsillar membrane, Anti-diphtheric serum, Anti-diphtheric toxoid.

INTRODUCTION

Diphtheria is an infectious disease caused by "corynae-bacterium diphtheria" ¹. It usually involves the respiratory tract and specifically its upper parts. It can cause infection of the pharynx, tonsils, larynx or any of them in isolation or in combination. It can involve skin as well. In some case, infection can spread to trachea as well. One of its characteristic features is presence of a membrane, which is a pseudo membrane. It's grayish-white in color and quite adherent to the tonsils, pharynx and/or larynx. If you try to remove it, bleeding may starts². However, throat examination is not usually encouraged in these patients to avoid its spread. On careful inspection of the child, patient has obvious swelling in the neck, being referred as, bull neck. It appears so because of combined effects of edema of mucous membranes as well as the soft tissues along with swelling/inflammation of lymph nodes.

Disease spreads from person to person, both through droplets and direct contact through secretions as well. Its incubation period ranges from 1 to 10 days; average is 2 to 5 days. Fortunately, there is no animal reservoir of this disease. There are seasonal variations of this disease in different areas. However, in cold weather, it spreads more because of close contacts of family members and especially children. It is rare before six months of age because of maternal antibodies in infants and it is rare in adults because of immunity. Certain people are at greater risk of acquiring the disease, like; school going and

unimmunized children. If the adults have co-morbid conditions and travel history of endemic area, he may be the sufferer as well³.

It is a highly communicable disease, organism may remain in the secretions of nose and throat up to six weeks as well after a person is infected. But one good thing about this disease is that once antimicrobial therapy is started, patient becomes non-infective in 72-96 hours⁴. Early diagnosis of disease is important, both for its treatment as well as the prophylaxis of others to prevent its spread. Clinical assessment is very important. Presence of a membrane which is grayish/white and usually extending to the uvula and soft palate, along with lymphadenopathy and swollen neck, giving the appearance of Bull-neck is pathognomonic of this disease. A swab should be taken from underneath the membrane, especially prior to starting of antimicrobials. It's better if a piece of membrane is taken and submitted to the laboratory.

Management should be started immediately in all strongly suspected patients to avoid its complications. Patient should be immediately isolated. Diphtheria anti-toxin should be administered as soon as possible. Its dose is variable; for laryngeal/pharyngeal diphtheria, dose is 20,000-40,000 I.U For nasopharyngeal diphtheria, it may range from 40,000 to 60,000 I.U. if the disease is extensive and "Bull-Neck" is there, dose should range from 80,000 to 100,000 I.U. All these patients need immediate administration of antimicrobial therapy. In sick patients, injection benzyl penicillin should be given parentally in four divided doses. If patient is sensitive to penicillin, IV erythromycin can be given for 14 days. In less severe cases, oral penicillin V or oral erythromycin can be given⁵.

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Recovery from diphtheria does not mean that patient is immune now. He should receive a complete course of diphtheria toxoid vaccine and a booster dose every 10 years.

As it is a vaccine preventable disease so all the children should receive vaccination according to recommended schedule which is at two, four and six months of age, followed by boosters at 18 months, 4-6 years, 14-16 years and then after every 10 years ⁶.

In our society, vaccination coverage is not up to mark. Especially routine boosters at 18 months as well as the boosters at ages of 4 to 6 years and 14 to 16 years are not available. Due to which, we often face outbreaks of diphtheria. We have observed that mortality and morbidity of patients is variable according to immune status of patients. We have planned this study to document the vaccination status and complications of patients admitted with diphtheria.

The objective of the study was to determine the vaccination status and complications in patients admitted with diphtheria.

MATERIAL AND METHODS

This cross sectional, observation study was conducted in Emergency Pediatrics Department, Diphtheria Section for a period of one year. Patients of both genders from 1 to 14 years of age with typical membrane in throat were included in the study. While patients who have already taken anti diphtheric serum were excluded from the study.

All patients fulfilling the inclusion criteria will be admitted in emergency. Immediately all such patients are isolated from other patients and kept them in a separate room in emergency. All such patients are evaluated by junior consultant/senior registrar of emergency. He examines the patient and documents his findings on the pre-designed proforma. Intravenous line is secured. Throat swab is taken for staining and culture sensitivity. Other supportive investigations; like, complete blood count, CRP, blood culture is saved for support in further management. Antidiphtheric serum is arranged according to the condition of the patient. Test dose is given in all the patients under full monitoring. If there is no hypersensitivity, full dose is given in slow intravenous infusion. Along with serum, we also give benzyl-penicillin to all such patients, after test dose. His contacts were advised oral erythromycin and health authorities were notified. Health authorities do mopping up of area to detect unvaccinated children in family and closed vicinity and do vaccinate all to prevent further cases. After initial management all such cases are shifted to Isolation ward to complete the course of antibiotics and to observe the complications. Complications will be noted. Outcome of each patient will be documented.

RESULTS

In this study total 106 patients were included. Mean age of the patients was 7.97±2.99 with 46.2 % male and 53.8% females. Patients admitted with the complaint of fever were 102(96.2) and 69(65.1) with sore throat.

Table-I: Demographics (n=106)

	Mean (SD)
Age (in years)	7.97 ± 2.99
Weight (in kgs)	21.7± 8.51
Variables	Frequency (%)
Gender	
Male	49 (46.2)
Female	57 (53.8)
DPT no. of doses given	
1 st dose only	15 (14.2)
1 st dose and 2 nd dose	11(10.4)
1 st dose, 2 nd and 3 rd dose	27(25.5)
Vaccinated	
Yes	20(18.9)
No	13(12.3)
Partially	12(11.3)

Table-II: Clinical Features

Variables	Frequency (%)	Duration Mean (SD)
Presenting complaints		
Fever	102 (96.2)	6.66 (5.07)
Sore throat	69 (65.1)	5.93(5.12)
Cough	37 (34.9)	6.81(5.08)
Flu	7 (6.6)	7.00(2.75)
Neck swelling	22 (20.8)	3.61(2.30)
Variables	Frequency (%)	
Examination Findings		
Throat congestion	62 (58.5)	
Tonsils	56 (52.8)	
Vitally stable	21(19.8)	
Cervical lymphadenopathy	19(17.9)	
Investigations		
Hb g/dl		
6.9-8.9	8(9.41)	
9.0-10.9	29 (34.1)	
11.0-14.8	48 (56.4)	
Throat swab	55(51.9)	
Throat culture	47(44.3)	
Blood CS	25 (23.6)	
ECG findings		
Normal	75 (70.8)	
Abnormal	19 (17.9)	
Echo findings		
Normal	81 (74.4)	
Abnormal	13 (12.2)	

Table III: Treatment & Complications

Variables	Frequency (%)
Treatment	
Antitoxin	
Given	
Prophylaxis for contacts	
Positive	102 (96.2)
Complications	
Tracheotomy	84 (79.2)
Negative	80 (75.5)
Arrhythmias	
Positive	5 (4.7)
Negative	75 (70.8)
LV dysfunction	
Positive	10 (9.4)
Negative	71 (67.0)
Dysphagia	
Positive	48 (45.3)
Negative	39 (36.8)
Weakness/ Neuropathy	
Positive	3 (2.8)
Negative	77 (72.6)

Table IV: Outcomes

Variables	Frequency (%)
Discharge	37 (34.9)
Shifted	47 (44.3)
Lama	2 (1.9)
Death	5 (4.7)

The most common examination finding in the patients was throat congestion in 58.5 % and 52.8 % had tonsillopharyngitis. Table-II reports the clinical finding of the data. Most of the patients had normal ECG, Echo findings and HB level. Table III reports the Treatment and complications of the data. 96.2% of patients received antitoxin and prophylaxis for contact was given to 79.2% of the patients contacts. Most of the complications noted were: Tracheotomy, arrhythmia, LV dysfunction, dysphagia and neuropathy. 20.2% had bull-neck. Approximately, 37% had some degrees of anemia. ECG changes were noted in 17.9% of cases. Abnormal echo findings were noted in 12.2% of cases. Dysphagia was noted in 45.3% of cases. 44.3% cases were shifted to different departments after initial treatment and stabilization according to their ongoing complications. 34.9% patients were discharged and 4.7% patients died in first week of admission.

DISCUSSION

Diphtheria is a vaccine preventable disease. In many parts of the world, its cases are negligible and its incidence is on decline, especially after 1980s. Although there are surges of this disease off and on, in different countries of the world. Along with Russian republics, India is also one of those countries having significant number of cases. It is reported that during the time period of 2000-2015, India was contributor of more than 50% of cases¹. In our study, at one center, we have reported 106 cases in One year, whereas, India has reported more than 41000 cases in ten years (2005-2014)². In one single year (2017), a total of 8819 cases of diphtheria were notified globally since 2004. Diphtheria outbreaks were reported in different developing countries, like; Bangladesh, Yemen and Venezuela. Although incidence of cases decreased in most of the under-developed countries as well on the basis of 3 doses of diphtheria in expanded program of immunization (EPI) supported by WHO. Although different health authorities also introduced more boosters of diphtheria at different ages, like; 18months, 4-6 years and 9-16 years of age^{7, 8}. These three boosters helped a lot in reducing the incidences of these cases. Unfortunately, in our society, until recent past, three doses were used to be given in primary immunization. However, fourth dose has been recently added in this schedule. But, still. Due to lack of resources, we are unable to give booster doses at 4-6 years and 9-16 years age group.

In our study, average age is 7.9±2.99 years. This age group is different in different reports and different countries. In one of the study, they have reported that 37% of cases were more than 15 years of age. On overall analysis about 66% of the cases were more than 15 years of age. The differences of age groups may be due to immune status of children after three doses of primary immunisations, as well as 4th and 5th dose at ages of 18 months and 4-6 years⁹. In our study, 49 (46.2%) were males and other female children. 14.2% had received single dose of vaccination, whereas, 10.4% and 27% had received two and three injections respectively. It's a very alarming situation. However, it is important to identify the pathogens as well, as it is reported that in certain areas hypervirulent organisms may be responsible for outbreaks^{10,11}. These

were specially noticed in immigrants coming to developed countries¹². Importance of vaccination should never be under-estimated. During first half of twentieth century, diphtheric infection was one of the most serious illnesses in children with mortality rates varied up to 25%. Before the diphtheria-toxoid was available, more than 70% of cases were among children less than 15 years of age, which is very similar to our study, as many of our patients were either not immunized or partially immunized.

In our study, 96% of patients presented with some degree of fever, whether; low or high grade. Almost 65% of the patients had some degree of sore throat. Cough was present in 34% of patients, whereas, flu-like symptoms were present in about 6% of the patients. Bull-neck was present in 20% of the patients. A study conducted by Jain.et.al showed in their study that age group was less than 5 years in approximately 50% of the cases. Majority of their patients were also either unimmunized or partially immunized. They observed respiratory complications as most common, followed by cardiac, renal and neurological complications¹³. In our study, 52.8% patients had incidental findings of tonsillitis as well. Only 19.8% patients were vitally stable and 17.9% had cervical lymphadenopathy as well. Usually, diphtheria has no direct relationship with anemia. However, we have found that about 44% of patients had anemia.

One of the complications of diphtheria is abnormal ECG. In our patients, 17.9% had abnormal ECG. We had done echo in 94 of our patients. 13(12.2%) had abnormal findings on echocardiography. As we have patients with variable severity of illness, 24.5% Of our patients underwent tracheotomy. Cardiac complication is a known complication of diphtheria. It was present in 9.4% of the patients.

Diphtheria is reported with variable complications with their variable severities. Even elderly patients may present with cardiac complications as in this case reported in Sweden¹⁴.

In a study conducted in UK, 98% of cases were from human patients and rests were animals, which were 2%. Their range of age was quite variable; from 4-82 years. Among 33 of their toxigenic cases, 11 were admitted. They also identified that a large number of patients among these, either they were not immunized or only partially immunised¹⁵. In another study conducted in European countries. They have found that incidence of diphtheria has decreased over the years. However, off and on cases are being reported. During the decade starting from 2000, Latvia had reported highest numbers of cases from European region. Their 10 years incidence was 7 times higher than countries next in sequence, which were Georgia, Ukraine and Russian federation¹⁶. It's identified that major risk groups; infants with incomplete vaccinations or adults with waning immunity. This is similar to our study, as children in our study did not receive boosters at 18 months and 4.5 years of age. Due to which they have waning immunity after a decade, when they did receive last dose of vaccination, i.e., age of 14 months. In their study, they have noted that among symptomatic cases; major age groups involved were; 0-4 years, 5-15 years and 45-64 years¹⁶. Missing of vaccinations, whether intentional or unintentional can be a cause of increased incidence of vaccine-preventable diseases^{17, 18}.

Sometimes health care providers are unable to educate and counsel properly about benefits of vaccinations¹⁹. Due to these reasons, authors of one of the review article had recommended for compulsory vaccination wherever it is indicated²⁰.

CONCLUSIONS

It is still a common disease in unvaccinated population of developing countries. It has a high rate of complications and high rate of mortality.

Recommendations

1. Booster doses at ages of 18 months and 4.5 years are essential to prevent its incidence and mortalities.
2. Early diagnosis is very helpful in appropriate management.
3. Early use of anti-toxins are essential to prevent complications.

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