

COMPLICATIONS AND OUTCOME OF DIPHTHERIA IN ADMITTED PEDIATRIC PATIENTS AT A TERTIARY CARE SETTING IN PESHAWAR

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ABSTRACT

Objectives: To determine the frequency of complications of Diphtheria infection in our admitted pediatric patients and their outcome.

Methodology: This prospective observational study was conducted at Department of Pediatrics, Lady Reading Hospital, Peshawar. All patients admitted to the isolation unit of Pediatric Department from March 2016 to December 2017 were included in the study. During the study period, a total of 56 patients aged 6 months to 16 years having pharyngeal diphtheria were enrolled. Each patient was closely monitored and evaluated through X-ray chest, complete blood counts, blood chemistry, electrocardiography, cardiac enzymes and echocardiography. Patients were followed for 6 weeks and Diphtheria complications along with their outcome were recorded and analyzed using Microsoft Excel.

Results: Out of total 56 patients, 39 (69.64%) were males and 17 (30.35%) were females. Most of them (64.28%) were school age children with age range 5-10 years. Eleven patients (19.64%) out of 56 developed major complications. Among these 09 (16%) had myocarditis and 2 (3.5%) had polyneuropathies. Five patients (8.92%) died during the study period due to myocarditis and severe rhythm disturbance.

Conclusion: Cardiac complications of pharyngeal diphtheria were found to be the most common and fatal followed by polyneuropathy.

Key Words: Diphtheria, Outcome, Vaccination, Complications, Myocarditis

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INTRODUCTION

Diphtheria is a disease that can affect almost any mucous membrane and skin of the human body. It is caused by a Gram positive, aerobic, non-spore-forming pleomorphic bacillus called *Corynebacterium diphtheriae*¹. Through its exotoxins, it causes various serious complications. Though a vaccine preventable disease, diphtheria remains endemic in resource-poor countries including Pakistan². The persistence of diphtheria with its severe complications and fatality in children in Asia is due to poor vaccine compliance, ignored booster doses, poverty, improper surveillance and delayed or non-availability of anti-diphtherial antibodies/sera (ADS)³. While diphtheria has been almost completely eliminated from developed countries through immunization, its reported occurrence is about 50 cases yearly in North America and Europe⁴. This resurgence may be due to immigration from endemic countries and the waning diphtherial immunity in adults⁵.

Though air way obstruction is a risk of respiratory failure in pharyngeal diphtheria, it is the exotoxin relat-

ed complications which are more serious and fatal especially cardiac involvement^{1,6}. Exotoxin induced damage to other organs include kidneys (proteinuria) and neuropathies causing paralysis.

Diphtherial toxic cardiomyopathy and myocarditis cause death through heart failure and arrhythmia if not treated carefully⁷. Myocarditis occurs from 2nd to 3rd week of pharyngeal diphtheria in 10-25% cases which proves fatal in 50-60% of patients^{6,8}. The appearance of gross ECG changes like A-V dissociation, complete heart block and bundle-branch block in a diphtherial patient is pathognomonic of myocarditis. T waves inversion and ST segment shifts are considered the earliest and commonest ECG finding of diphtheritic myocarditis. The patients with extensive pharyngeal diphtheria and bull neck are at high risk of myocarditis. To reduce mortality from pharyngeal diphtheria, all clinically diphtheritic patients need immediate hospitalization, early initiation of treatment with diphtheria antitoxin (ADS) and antibiotics as well as close cardiac monitoring.

Diphtheria control and eradication through effective immunization with minimum of 90% coverage is the

only best approach⁹. This study was conducted to find out the complications and mortality of Diphtheria at our set up. There is a lack of local literature on the subject. Our study will help in creating awareness and will lead to increased vigilance of pediatricians to emphasize on complete vaccination and early diagnosis of the disease.

METHODOLOGY

This prospective observational study was conducted on patients of pharyngeal diphtheria in the age range from 6 months to 16 years, admitted in isolation unit of Department of Pediatrics, Lady Reading Hospital, Peshawar from March 2016 to December 2017. Before starting the study, a proper approval from hospital research and ethical committee was obtained. A written informed consent was sought from the patients' guardian before inclusion in the study. Non probability consecutive sampling technique was used and all diagnosed Diphtheria patients were included in the study except those with previous known neuropathies, renal diseases and cardiac problems including past ECG changes. Due to low prevalence (0.65/100,000) we preferred to take all diagnosed cases.

All these patients were admitted to isolation unit along with supportive measures like oxygen, intravenous fluids and were treated with antitoxins (ADS) and intravenous benzyl penicillin. Every patient was regularly monitored with heart rate, respiratory rate, blood

pressure, oxygen saturation (with pulse oximetry), urine output and serial ECGs. Serum cardiac enzymes including SGOT, CK-MB, Trop-T, serum creatinine and urea were followed and repeated when needed in all these patients. The patients who developed serious cardiac complications were managed in pediatric cardiology unit and were closely followed. The data was entered and analyzed using Microsoft Excel for Diphtheria complications like cardiac involvement, polyneuropathies and fatality. Data were presented in the form of tables.

RESULTS

Out of total 56 of cases, 39 (69-64%) were male and 17 (30-35%) were females. Though the youngest patient enrolled was 9 months but majority (64.28%) of them were between 5 to 10 years of age as shown in Table 1. Most of the patients were from the southern area of Khyber Pakhtunkhwa; 48 cases (85.71%) were from 4 districts, i.e. Karak, Bannu, Lakki Marwat and Waziristan, as shown in Table 2.

Seven patients were partially immunized (didn't received complete three basic vaccines and the booster dose against diphtheria) and rest 49 (87.5%) were totally unvaccinated (Table 3). Cardiac complications were most frequently observed in 09(16%) patients while polyneuropathy was the other major complication observed in 2(3.57%) patients. Five (8.92%) patients died during the follow up period as shown in Table 3.

Table 1: Age and gender distribution of pharyngeal diphtheria (n=56)

Age Group	Total number	Male	Female
6 months - 4 years	13 (23.21%)	10/13 (76.92%)	3/13 (23.07 %)
5 years - 10 years	36 (64.28%)	22/36 (61.11%)	14/36 (38.88%)
11 years - 16 years	07 (12.5%)	7/7 (100%)	00
All	56	39/56 (69.64%)	17/56 (30.35%)

Table 2: Geographic distribution and immunization status of patients (n=56)

S/No.	District	No. of Patients	Immunization Status	
			Un-vaccinated	Partially vaccinated
1	Karak	19	19	0
2	Bannu	12	12	0
3	Waziristan	9	9	0
4	Lakki Marwat	8	8	0
5	Nowshera	3	1	2
6	Peshawar	2	0	2
7	Mardan	1	0	1
8	Buner	1	0	1
9	Bajuar	1	0	1

Table 3: Complications and outcome of pharyngeal diphtheria (n= 11)

Complications	Outcome	
	Survived	Died
Myocarditis (n=9)	04	05
Heart Failure (n=6)	04	02
AV-Dissociation (n=2)	00	02
Complete Heart Block (n=1)	00	01
Polyneuropathies (n=2)	02	0

DISCUSSION

In this study of 56 pharyngeal Diphtheria cases, there were more male (69.64%) than female (30.35%) children, whereas equally affected male and female children are reported in another study¹⁰. The majority of children (64.28%) were in the age range of 5-10 years which is nearly similar (71%) to a study conducted in India¹¹.

The Epidemic in southern districts of Khyber Pakhtunkhwa (85.71%) is due to poor vaccination, as almost all the enrolled patients (87.5%) were unvaccinated. Inadequate immunization and ineffective vaccine has been declared as the cause of endemicity of Diphtheria in India¹².

The cardiac involvement in diphtheria is through the exotoxins produced by these microorganism^{1,10}. Its occurrence in affected children is about 10% and responsible for the most of deaths in these patients^{1,8,10}. Our study showed cardiac complications in 16% of cases, while a study conducted in India reported myocarditis in 70% of patients having respiratory diphtheria¹¹. This huge difference may be due to their larger sample size. In our study 02 cases of diphtheritic polyneuropathy has been recognized. In a similar 6 months study from south India, 13 cases have been reported in 2013¹³. In our study, the respiratory muscles were not involved in the two cases with polyneuropathy, whereas in a study from India, 85.4% cases with respiratory muscle involvement have been reported in which 60.4% were ventilated¹⁴. Paralysis of posterior pharyngeal wall and soft palate are the earliest signs of diphtheric neuropathy¹⁵. Weeks later peripheral neuritis occur, along with secondary worsening of bulbar symptoms in some cases¹⁶. The recovery is complete in most of the cases like in our study.

The mortality in our study was 8.92% which is compatible with a study from India in which 5% deaths were reported¹¹. All the deaths occurred in patients with cardiac involvement in our study which is similar to other studies^{10,17-19}; while in contrast 3 out of total 5 deaths occurred due to neurological involvement in a study conducted in Kolkata India¹⁴. Amongst the cardiac in-

volvement, the A-V dissociation and complete heart block is the most lethal complication as in our study all the 3 patients with these complications died.

CONCLUSION

Diphtheria with its worst complications like myocarditis is still highly prevalent in Khyber Pakhtunkhwa province of Pakistan. AV-dissociations and complete heart blocks were the major causes of death in diphtherial myocarditis. Non-vaccination or poor implementation of extended program of immunization (EPI) seems the main reason for the persistence of Diphtheria in most districts of Khyber Pakhtunkhwa because none of 56 cases included in this study had completed the basic 3 doses and booster of Diphtheria vaccine.

RECOMMENDATIONS

Persistence of Diphtheria in our province needs attentions and can be easily eradicated through the following steps: Mandatory routine Diphtheria immunization and booster doses at 5 years and every 10 years; Early management of the contacts with antibiotics and vaccination; and Provision of ADS at health facilities and it's timely administration.

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CONTRIBUTORS

MHK conceived the idea, planned the study and drafted the manuscript. MI and IU helped acquisition of data and did statistical analysis. AAA did the literature search and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.