International Journal of Pediatric Otorhinolaryngology 86 (2016) 68–71

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Diphtheria: It is still prevalent!!!

Avani Jain *, Sunil Samdani, Vinod Meena, Man Prakash Sharma

Department of Otolaryngology (ENT), Sawai Man Singh Medical College and Attached Group of Hospitals, Jaipur, Rajasthan, India

ARTICLE INFO

Article history:
Received 25 December 2015
Received in revised form 17 April 2016
Accepted 18 April 2016
Available online 21 April 2016

Keywords:
Diphtheria
Complications
Outcome

ABSTRACT

Background: Diphtheria is a respiratory infectious disease of childhood. It is a fatal disease and may cause complications if not recognized early and treated properly. Despite availability of effective vaccination it continues to be reported from many parts of the world particularly developing countries.
Objective: To assess the demographic and clinical characteristics of diphtheria patients, and the predictors of outcomes of respiratory diphtheria.
Methods: A prospective analysis of 180 patients with a clinical diagnosis of respiratory diphtheria admitted from 2011 to 2014 at a tertiary referral hospital. They were evaluated with respect to demographic details, immunization status, clinical features, complications and outcomes.
Results: Most common age group affected was children less than 5 years of age (87 cases, 48.33%). The peak incidence of diphtheria was seen in the months of September and October (111 cases, 62%). Majority of the patients were unimmunized (54%), followed by partially immunized (21%). The most common complication was respiratory in 80 cases (44%), followed by cardiac complications in 54 cases (30%), and renal (16%) and neurological complications (10%). Cardiac complications were associated with the highest mortality rate (63%). The presence of bull neck and pseudomembrane score >2 was associated with a high mortality.
Conclusion: Diphtheria is still a preventable public health problem in many developing countries. Improved vaccination coverage, including booster dosage, coupled with early detection and effective treatment, may all reduce incidence and mortality.

1. Introduction

Diphtheria is an acute infectious upper respiratory tract disease caused by toxigenic strains of *Corynebacterium diphtheriae*. It is a major preventable disease of childhood with a high morbidity and mortality. The organism is locally invasive and secretes exotoxins, which can lead to life threatening consequences mainly involving the heart muscle and nervous system. If diagnosed early, it responds to antitoxin therapy and appropriate antibiotics [1].

In the pre-vaccination era diphtheria was a leading cause of childhood mortality [2]. The incidence of diphtheria has gradually declined in developed countries owing to effective immunization programs since the 1920s [3]. However, there has been a recrudescence in these countries, largely attributed to waning vaccine immunity in adults and importation of cases from the endemic developing world and probably due to unidentified factors contributing to low incidence of the disease in some regions [4,5]. On the contrary, in developing countries, although the incidence has drastically declined, diphtheria still remains endemic and is responsible for fulminant complications including death [6]. Several factors like inadequate vaccination (due to irregular supply, misconception regarding the relative risk/benefits of immunization), poor socioeconomic standards, overcrowding, delayed reporting to hospitals, non-availability and delayed administration of antitoxin further contribute to high mortality. Early diagnosis and timely intervention help reduce the incidence and spread of infection in the community, and reduce the morbidity and mortality in the affected individuals.

The objectives of this study were to assess the demographic and clinical characteristics of diphtheria patients, and the predictors of outcomes of respiratory diphtheria. This study highlights that even with the spread of education and medical facilities in developing countries, like India, diphtheria continues to be prevalent. Also, even though there is a high prevalence of the disease, we found the shortage of literature which focused on the incidence, clinical profile and predictors of outcome of diphtheria patients.

2. Materials and methods

This study is a prospective analysis of 180 patients with a clinical diagnosis of respiratory diphtheria admitted from 2011 to 2014 at SMS Medical College and Hospital, Jaipur, Rajasthan, India. The age ranged from 0 to 20 years. They were evaluated with respect to demographic details, immunization status, clinical features,

* Corresponding author at: Flat No C-8, Tower 1, New Moti Bagh, New Delhi 110023, India. Tel.: +91 9910341347.
E-mail address: avanijain87@hotmail.com (A. Jain).

http://dx.doi.org/10.1016/j.ijporl.2016.04.024
0165-5876/

complications and outcomes. Written consent was taken from all the patients. Detailed clinical history was taken. The immunization status was documented as per the information given by the parents/guardians. Patients were divided on the basis of immunization into the following groups: unimmunized, partially immunized, adequately immunized, and unknown. Children were considered adequately immunized if they had received three or more doses of diphtheria toxoid containing vaccine by the age of 2 years. Throat swab for Albert's stain and culture were done and diphtheria was confirmed in all the cases. Pseudomembrane score was calculated for all the patients:

0 – Membrane cleared before presentation
1 – Nose only or incomplete/follicular coverage of tonsils
2 – Confluent coverage of tonsils
3 – As above, plus palate and/or pharyngeal wall
4 – As above, plus nose and/or larynx

Routine blood investigations including complete blood count (CBC), serum urea, creatinine, SGOT/SGPT, CPK-MB, and ECG were done in all the patients. In patients with cardiac complications, troponin-T (kit test) and echocardiography were also done. All patients were treated with intravenous anti-diphtheritic serum (ADS), benzyl penicillin and oral erythromycin. The duration of hospitalization was noted and patients were followed up for 6 months following discharge.

The collected data were tabulated and statistical analysis was done. Statistical analysis with the Student's *t*-test and Chi square test was used to identify the predictors of outcome. The criterion for statistical significance was $p < 0.05$.

3. Observations and results

Most common age group affected was children less than 5 years of age (87 cases, 48.33%). Males were more commonly affected than females (1.7:1). The age sex distribution of diphtheria patients is shown in Table 1.

The peak incidence of diphtheria was seen in the months of September and October (111 cases, 62%). There were no cases reported in the months of May, June and July (Fig. 1).

As per the immunization records (Table 2), majority of the patients were unimmunized (54%), followed by partially immunized (21%). Only 19% of the patients were adequately immunized. This could be attributed to ignorance about vaccination and false beliefs, lack of health care facilities, or low socioeconomic status.

The most common clinical features of diphtheria patients (Table 2) were fever (176 patients) and dysphagia (162 patients). Other common clinical features were cough, throat pain and bull neck. Difficulty in breathing was present in 63 of the patients; and 36 patients had stridor which required tracheostomy. The other less common clinical features were hoarseness of voice, bleeding from pseudomembrane and seizures. In our study, the incidence of mortality was 24.4% (44 deaths out of 180 patients).

In our study, the pseudomembrane score was more than 2 in 103 cases (57%), out of which 38 patients died. A pseudomembrane score more than 2 accounted for 86% of mortality, and was found to be statistically significant (chi square = 21.2051, p value < 0.0001; odds ratio 6.9, 95% CI 2.7–17.4). Therefore, pseudomembrane score of more than 2 is associated with a high mortality (Table 3).

Out of 180 patients, 61 (34%) had bull neck, of whom 34 died (Table 3). This accounted for 77% of the mortality and this result was found to be highly significant (chi square = 48.9227, p value < 0.00001; odds ratio 13.7, 95% CI 6.0–31.2). Thus, the presence of bull neck in diphtheria was associated with a high mortality.

The most common complication (Table 2) observed was respiratory in 80 cases (44%). This was followed by cardiac complications

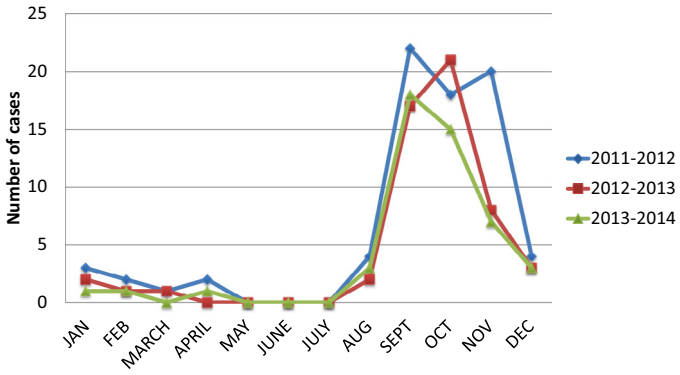

Fig. 1. Seasonal incidence of diphtheria in our study.

Table 1
Age and sex wise distribution in our study.

Age (years)	Male	Female	Total
≤5	50 (27.8%)	37 (20.5%)	87 (48.3%)
6–10	46 (25.5%)	20 (11.1%)	66 (36.7%)
11–15	16 (8.9%)	7 (3.9%)	23 (12.8%)
16–20	2 (1.1%)	2 (1.1%)	4 (2.2%)
Total patients	114 (63.3%)	66 (36.7%)	180 (100%)

Table 2
Clinical characteristics of diphtheria patients.

Clinical characteristic	Number of patients (%)
Immunization status	
Unimmunized	97 (54%)
Partially immunized	38 (21%)
Adequately immunized	34 (19%)
Unknown	11 (6%)
Clinical features	
Fever	176 (98%)
Throat pain	105 (58%)
Cough	114 (63%)
Dysphagia	162 (90%)
Bull neck	61 (34%)
Difficulty in breathing	63 (35%)
Stridor	36 (20%)
Hoarseness of voice	24 (13%)
Bleeding	11 (6%)
Seizures	4 (2%)
Complications	
Respiratory	80 (44%)
Cardiac	54 (30%)
Renal	29 (16%)
Neurological	17 (10%)

Table 3
Predictors of outcome.

	Number of cases			p value
	Survived	Deaths	Total	
Pseudomembrane score				<0.0001
1	15	3	18	
2	56	3	59	
>2	65	38	103	
Bull neck				<0.00001
Present	27	34	61	
Absent	109	10	119	
Complications				<0.00001
Others	110	16	126	
Cardiac	26	28	54	