

AN OBSERVATIONAL STUDY OF INCIDENCE OF POSITIVE THROAT SWABS FOR DIPHTHERIA IN CHILDREN IN A TERTIARY CARE HOSPITAL IN JHARKHAND, INDIA

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ABSTRACT

Introduction: Diphtheria is an acute toxic infection causing cough, sore throat, dysphasia, hoarseness of voice, fever or headache due to *Corynebacterium* species, mainly *Corynebacterium diphtheriae* and, less often, by few strains of *Corynebacterium ulcerans*. India has witnessed several outbreaks of Diphtheria in recent times as reported from various states. In scenario of changing epidemiology of diphtheria in rest of India, studies reporting clinical profile remain scanty in our state of Jharkhand. Hence we decided to analyze the clinical and demographic profile of diphtheria cases which would not only help in early recognition of cases but also in providing timely treatment which may reduce morbidity and mortality. It will also help in early preparedness to combat in case of any outbreak of diphtheria and strengthen the immunization coverage in unimmunized areas of Jharkhand. **Methods:** A total of 136 patients were registered and their personal records as name, age, sex, contact address and other relevant information were taken and their throat swab samples were collected using full aseptic and antiseptic precaution and samples were sent to the Microbiology Laboratory immediately after collection for gram staining and culture. **Results:** In this study, a total of 136 throat swabs were collected among which 16 (11.76%) samples were found to have growth and remaining 120 (88.23%) samples showed no growth. The most commonly isolated bacteria was *Staphylococcus aureus* (44%), followed by *Candida* (38%) and 3% for *Streptococcus pneumoniae*, *Klebsiella pneumoniae* and *E.coli*. None of the samples detected *Corynebacterium diphtheriae* in throat infections amongst patients examined at RIMS, Ranchi. The immunization status in the present study shows that 62.5% of children being fully immunized as per National Immunization Schedule, 33.8% of children were partially immunized while 3.7% of children were unimmunized. Among 6 months to 1 year age group 04 (28.6%) were fully immunized and 10 (71.4%) partially immunized. Similarly, among >1 year to 5 years age group 53 (58.9%) were fully immunized, 35 (38.9%) partially immunized and 02(2.2%) were unimmunized. Among age group >5 years to 18 years age group 27 (84.4%) were fully immunized, 02(6.25%) partially immunized and 03(9.4%) were unimmunized. **Limitations:** we could not perform Polymerase Chain Reaction (PCR) and serology in present study. Also the Official statistics were difficult to obtain as existing surveillance systems in our region rely on passive reporting where most cases are known to go unreported. **Conclusion:** The present study was aimed at assessing the incidence of diphtheria in children coming to RIMS, Ranchi. The absence of bacteriologically confirmed cases of diphtheria may be attributed to successful vaccination coverage against diphtheria by Pentavalent and/or DPT vaccine.

INTRODUCTION

Diphtheria is an acute toxic infection characterized by cough, sore throat, stridor, dysphagia, hoarseness of voice, fever or headache due to *Corynebacterium* species, mainly *Corynebacterium diphtheriae* and, less often, by few strains of *Corynebacterium ulcerans*.^[1] *Corynebacteriae* are distributed worldwide and has not only local manifestation in the form of pseudomembrane

over fauces, anterior nares, larynx, tracheobronchial tree but also causes cardiovascular, neurological, skin and renal injury. As per a WHO data, India reported 6,094 cases in 2014 which decreased to 2,365 cases in 2015 but rose again to 3,380 in 2016, to 5293 in 2017. 8,788 was the figure in 2018 while in 2019 the number of new cases reported was 9622^[2] While the higher proportion of cases fell in the age group of less than 5 years in the pre vaccination era,^[3,4] but now the main age group being

affected is that of the older children falling in the age range of 5-19 years and adult. According to the national surveys, the coverage of three primary doses, first and second booster diphtheria vaccines were 90% 60% and 36% respectively^[5] which could explain the increasing susceptibility of older children and adults.

India has witnessed several outbreaks in recent times as reported from various states. In scenario of changing epidemiology of diphtheria in rest of India, studies reporting clinical profile remain scanty in our state of Jharkhand. Rajendra Institute of Medical Sciences (RIMS), Ranchi is a premier medical institute of Jharkhand where pediatric group patients come from all corners of state and nearby states like Bihar, West Bengal, Chhattisgarh and Orissa. Cases of upper respiratory tract infections frequently come for diagnosis and treatment in pediatric OPD and IPD with the diagnostic facility available in the Department of Microbiology, RIMS. This may reflect actual incidence of diphtheria in Jharkhand state. Hence we decided to analyze the clinical and demographic profile of diphtheria cases among them which would not only help in early recognition of cases but also in providing timely treatment which may reduce morbidity and mortality. It will also help in early preparedness to combat in case of any outbreak of diphtheria and strengthen the immunization coverage in unimmunized areas of Jharkhand.

Table 1: Bacteria isolated from the throat swab culture.

Throat swab	Number of isolates	Percentage
Growth	16	11.76
No Growth	120	88.23
Total	136	

Table-2: Prevalence of bacteria in throat swab culture.

Isolated organisms	Number of isolates	Percentage of bacteria
Staphylococcus aureus	07	44
Streptococcus pneumoniae	01	06
Klebsiella pneumoniae	01	06
Corynebacterium diphtheriae	00	00
E.coli	01	06
Candida	06	38

Table-2 and Figure-1: depicts the prevalence of bacteria in throat swab. The most commonly isolated bacteria was Staphylococcus aureus (44%), followed by Candida (38%) and 3% for Streptococcus pneumoniae, Klebsiella pneumoniae and E.coli. None of the samples detected Corynebacterium diphtheriae in throat infections amongst patients examined at RIMS, Ranchi.

The immunization status in the present study shows that 62.5% of children being fully immunized as per National Immunization Schedule, 33.8% of children were partially immunized while 3.7% of children were unimmunized due to various reasons as shown in table 3.

MATERIALS AND METHODS

Selection of Patients: This study was conducted in the outpatients and inpatients department of Pediatrics, RIMS, Ranchi from August 2019 to July 2020. A total of 136 patients were registered and their personal records as name, age, sex, contact address and other relevant information were taken and their throat swab samples were collected.

Collection of Samples: Using full aseptic and antiseptic precaution throat swabs were collected using sterile swab and the samples were sent to the Microbiology Laboratory immediately after collection for gram staining and culture. All the samples collected were properly labeled with patient's IPD/OPD number and date.

Examination of Samples: Throat swabs collected from those patients were examined microbiologically using culture technique and direct microscopy.

RESULTS AND DISCUSSION

In this study, a total of 136 throat swabs were collected from August 2019 – July 2020, among which 16 (11.76%) samples were found to have growth and remaining 120 (88.23%) samples showed no growth as shown in the Table-1.

Table 3: Immunization status of children as per National Immunization Schedule participated in the study and fulfilling inclusion criteria. (n=136).

Immunization status	No. of children	Percentage
Fully immunized	85	62.5
Partially immunized	46	33.8
Unimmunized	05	3.7

Table 4 shows immunization status of children in different age groups. Among 6 months to 1 year age group 04 (28.6%) were fully immunized and 10 (71.4%) partially immunized. Similarly, among >1 year to 5 years age group 53 (58.9%) were fully immunized, 35 (38.9%)

partially immunized and 02(2.2%) were unimmunized. Among age group >5 years to 18 years age group 27 (84.4%) were fully immunized, 02(6.25%) partially immunized and 03(9.4%) were unimmunized.

Table 4: Children stratified according to immunization status of different age group participated in the study and fulfilling inclusion criteria.(n=136).

AGE GROUP	No. Of children fully immunized	No. Of children partially immunized	No. Of children unimmunized
6MONTHS-1YEAR	04	10	00
>1 YEAR-5 YEARS	53	35	02
>5 YEARS-18YEARS	27	02	03

DISCUSSION

The findings of this study showed that five species of bacteria was 44% Staphylococcus aureus followed by 38% Candida and 6% for Streptococcus pneumoniae, E.coli, Klebsiella pneumoniae.

This study showed that bacteria are major causes of infection and diseases in human throat. These findings corroborates that of previous workers who reported that bacterial species (Staphylococcus species, Streptococcus species and Coliforms) were responsible for most cases of throat infections.

Jadhav E et al^[6] in 2013 showed in the study on pattern of organisms in throat swab culture that out of 375 cases, staphylococcal aureus was isolated in 87 cultures (23.2%). 62 cultures (16.5%) revealed streptococci. Klebsiella pneumoniae was seen in 16 reports(4.3%) . Escheresia Coli was grown in only 6 cultures(1.6%).

Wakode P.T. et al^[7] in 2003, in their study on the overview of throat swab culture & sensitivity at a Govt. Medical College, Yavutmal found that out of 305 throat

swab culture reports, only 130 showed the reports of pathogenic organisms. Out of that 77 reports (25.2%) suggested staphylococcus aureus, 32 reports (10.5%) revealed streptococci, Klebsiella in 7 reports (2.3%), candida in 4 reports (1.3%) and E.coli in 1 report (0.3%).

Meera M. et al^[8] in 2013, in their clinical and epidemiological study on Diphtheria in Andhra Pradesh observed the growth of staphylococcus aureus in 32.1%, streptococci in 12.6%, candida in 2.1%, klebsiella in 3.1%, E.coli in 1.2% and C. diphtheriae in 4.7%.

In the present study, the growth of different microorganisms in throat swab culture of study participants were found in 16 cases and no growth in 120 cases. Maximum number (10 cases) of growth of microorganism were in the age group of >5years – 18 years. Staphylococcus aureus were isolated in 7 cases (5.2%) of throat swab culture which is the highest among all microorganisms. Candida was isolated in 6 cases (4.4%) and 1 case (0.7%) each of Streptococcus pneumonia, E.coli and klebsiella were isolated.

Table 5: Comparison of results of isolation of microorganisms in various studies with that of present study.

S. n.	Microorganism isolated	Wakode PT et al ^[7] (2003)	Jadhav E et al ^[6] (2013)	Meera M. et al ^[8] (2013)	Present study
1	Staph. aureus	25.2%	23.2%	32.1%	5.2%
2	Candida	1.3%	0.5%	2.1%	4.4%
3	Streptococcus	10.5%	16.5%	12.6%	0.7%
4	Klebsiella	2.3%	4.3%	3.1%	0.7%
5	E.coli	0.3%	1.6%	1.2%	0.7%
6	C.diphtheriae	0%	0%	4.7%	0%

No bacteriological positive cases of diphtheria have been found in our study. There could be two possibilities that

either due to successful immunization programme, most of the children have been covered or developed herd

immunity. But still there is possibility of presence of throat swab positive cases of diphtheria in community (which have not reported to hospital due to prior antibiotic use). There is always a need to have clinical and bacteriological surveillance in the society, otherwise it may lead to development of major epidemic as happened recently in many states in our country.

Ujwal M.V et al^[9] in 2019, in their study on the clinical profile and outcome of resurgence of diphtheria in rural north Karnataka reported that out of 22 children suspected of diphtheria, 4 (18.2%) were completely immunized, while 18 (81.8%) were partially immunized.

Shetty et al^[10] in their study on resurgence of diphtheria in South India, reported that 38.9% of children were fully immunized, 44.4% were partially immunized while 16.7% of the children were unimmunized.

Sangal L et al^[11] in the year 2016, to identify the epidemiology of Diphtheria and its recent outbreak in

north Kerala, reported that in children less than 10 years, 31% had been immunized with three doses of primary vaccination and 68% were either unimmunized or their immunization status was not known. In age group of more than 10 years, 3% cases had received five doses of diphtheria containing vaccine and 7% were partially immunized.

Dandinarasaiah M et al,^[12] in the year 2012, in their study on re-emergence of diphtheria in Karnataka observed that 11.5% were immunized either fully or partially and 57.7% were non immunized. While in 30.8% cases the immunization status was not known.

The immunization status in the present study shows that 62.5% of children being fully immunized as per National Immunization Schedule, 33.8% of children were partially immunized while 3.7% of children were unimmunized due to various reasons.

Table 6: Comparison of Immunization coverage in various studies with that of present study.

Sl. No.	Immunization status	Ujwal. M.V et al. ^[9] (2019)	Shetty et al ^[10] (2020)	Present study
1	Fully immunized	18.2%	38.90%	62.5%
2	Partially immunized	81.4%	44.40%	33.8%
3	Unimmunized	0.4%	16.70%	3.7%

HMIS data from WHO nodal office, Ranchi, Jharkhand shows full immunization coverage at 9-11 months was 90%, DPT first booster in 82%, DPT second booster in 43% of children in Jharkhand in 2019

CONCLUSION

The present study was aimed at assessing the incidence of diphtheria in children coming to RIMS, Ranchi. The absence of bacteriologically confirmed cases of diphtheria may be attributed to successful vaccination coverage against diphtheria by Pentavalent and/or DPT vaccine. It has been observed by different authors that neither natural infection nor vaccination provides complete or lifelong immunity against diphtheria reinfection or disease. The resurgence of diphtheria has been attributed to many factors including low immunization coverage in those sections or waning of immunity after natural infection or any previous vaccination, lack of antidiphtheric serum (ADS), antibiotic resistance, deteriorating health infrastructure etc.

Current study shows that similar situation may prevail in Jharkhand and nearby states. The lack of awareness and less penetration of health services amongst masses may also add to the possibility of emergence of diphtheria at any moment. Hence present study may help in early recognition of cases and timely treatment which may reduce morbidity and mortality and also help in early preparedness to combat in case of any outbreak of

diphtheria and by strengthening immunization coverage in unimmunized areas of Jharkhand.

Factors responsible for successful coverage of immunization in Jharkhand may be

- Vaccination is provided by the government to all children as per National Immunization Schedule.
- After launching of Mission Indradhanush in 2014, the vaccination coverage has improved in Jharkhand and whole country.

The incentives given to sahiya (ASHA) for motivating parents to immunize their children have lead to increased number of beneficiaries reaching for immunization.

Mother and Child Tracking system is also helping in timely immunization of children. A SMS alert is automatically sent to defaulter parents of children on their mobile phone regarding due immunization.

Limitation of our study: we could not perform Polymerase Chain Reaction (PCR) and serology in present study.

Challenges in estimating the burden of diphtheria in present study were many like widespread availability of antibiotics and initiation of treatment prior to sample collection which might have contributed to the increasing number of negative cultures. Official statistics were difficult to obtain as existing surveillance systems in our region rely on passive reporting where most cases are

known to go unreported. Keeping these things in mind WHO has started surveillance for diphtheria in Jharkhand with collaboration of Department of Microbiology, King George Medical University, Lucknow where better lab facilities are available. This initiative taken by WHO will strengthen our work.

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