



INVESTIGATION OF AN OUTBREAK OF DIPHTHERIA IN SOJITRA TALUKA OF ANAND DISTRICT, GUJARAT

Community Medicine

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ABSTRACT

Background: Diphtheria is a highly contagious and life threatening vaccine preventable disease (VPD). However past three decades of implementation of Universal immunization programme in India, sporadic cases of diphtheria continue to uproot making it pertinent to study social and epidemiological determinants of diphtheria. **Objectives:** 1) To confirm the existence of diphtheria outbreak 2) To study the magnitude and distribution of outbreak with reference to time place and person 3) To identify implementation of control and preventive response of health care system to the same. **Methods:** A cross-sectional epidemiological study was carried out by State Rapid Response Team from BJMC Ahmedabad visiting Sojitra Taluka of Anand District as 12 cases and 7 deaths, suspected of Diphtheria were reported there. Team interacted with Health Officials, families of cases and collected information regarding the cases and activities carried out so far. **Result:** Out of seven deaths, two cases were Laboratory confirmed and rest five were clinically suspected with CFR of 58.3%. Immunization status of all cases were unknown with no records. Contact listing done and erythromycin prophylaxis given to all. Mass Immunization of all children below 15 years of age was carried out. 327 beneficiaries in Balinta and 2031 in Kasor village of Sojitra taluka were vaccinated in outbreak response Immunization. **Conclusion:** Low Immunization status, difficult terrain and lack of awareness regarding immunization was found to be major factor responsible. People being inclined towards 'Dharmguru' (Superstition) rather than going to Hospital based treatment for their illness.

KEYWORDS

Diphtheria, Epidemiology, Immunization, Outbreak Investigation

INTRODUCTION:

Diphtheria is an acute infectious disease caused by toxigenic strain of Gram-positive facultative anaerobic bacilli *Corynebacterium diphtheria*. It is an upper respiratory tract infection characterised by three major clinical types: anterior nasal, faucial and laryngeal; however the skin, conjunctiva, vulva and other parts of the body may be affected. The mortality rate, which is generally 5%–10%, may be as high as 20% in children below 5 years and adults over 40 years of age. Incidence of the disease, which was more than a million per year during the beginning of the 19th century declined by 95% over the past three decades owing to the routine children immunization. (k.park, 2019)

The EPI of WHO recommends three doses of DPT vaccine starting at six weeks of age with additional doses of diphtheria vaccine in countries where resources permit. Many national immunization programmes, including the UIP in India offer two booster doses at 16–24 months and between 5 to 6 years of age. Since severity of pertussis infection decreases with age, so in place of DPT, only 2 doses of DT vaccine 4 weeks apart with a booster dose 6 months to 1 year later is given to children over 5 years of age. For immunizing children over 12 years and adults, the preparation of choice is dT. After three doses of primary vaccines, protective levels of antitoxin develop in 94–100% of the children. However without booster doses, over the time toxoid induced antibody drops below protective level. (WHO, immunization, vaccines and biologicals, 2018)

However, despite of this sharp drop in cases, the data about diphtheria cases reported to WHO indicate that India accounts for a substantial proportion of global burden of diphtheria. In 2019 India contributed 41.8% of the total 22,986 diphtheria cases reported globally. Due to the vaccine preventable nature of the disease and initial steady decline, not much attention has been shed towards this disease which has not only continued over the past decade in India but has also been sixth in the list with highest mortality rate in India. (WHO, WHO vaccine-preventable diseases: monitoring system. 2020 global summary, 2020) An Outbreak is defined as the unusual occurrence in a community or region of disease, specific health related behaviour or health related

events clearly in excess of "expected occurrence". (Bhatt, 2017) The prime purpose of an outbreak investigation is to control, limit its spread and plan preventive strategies to reduce or eliminate the risk of such outbreaks in future. (Bhatt, 2017)

MATERIALS AND METHODOLOGY:

The present study attempts to bring into light the underlying epidemiological factors in a case of outbreak of diphtheria in Sojitra taluka of Anand district in Gujarat. Till 14/10/19 seven cases from which four deaths, one lab confirmed and rest suspected of diphtheria were reported in the Balinta village of Sojitra taluka of Anand district, a central district of Gujarat state. To investigate and give recommendations to contain the outbreak, a state Rapid Response Team (RRT) consisting of experts from Community Medicine, Medicine, Pediatrics and Microbiology visited the district on 15/10/2020. The RRT Team reached Sojitra taluka of Anand district and met Taluka health officer who briefed us about the details of the cases and action taken following outbreak. After that meeting was held with EMO, RCHO, state immunization officer and other paramedical staff about the current status of outbreak and details about clinical presentation, their investigations and management protocol were gathered. After five days we got information regarding more cases (three deaths and two suspected) being reported from the adjoining village of Sojitra taluka. (Kasor village). Families of the deceased cases and their contacts were interviewed and detailed history from the relatives were taken. Clinical examination of few contacts were done. Also action taken by the local health team was assessed.

Epidemiological description of the affected area: Total population of Balinta village is 3687 with 647 houses and that of Kasor village is 13,975 with 2446 houses. Seven deaths were reported in Sojitra taluka from which two cases were laboratory confirmed and rest were clinically suspected cases of diphtheria. The diagnosis of diphtheria infections was based on clinical manifestations with bacteriological confirmation by standard microbiological methods. Outbreak investigation was done with the use of the following operational definitions:

Suspected case: Patient of any age with upper respiratory tract disease (pharynx, larynx, tonsils, nose), characterized by throat pain, mild fever, with adhering pharyngeal membrane and/or difficulty in swallowing or breathing. (Das PP, 2016)

Confirmed case: A symptomatic or asymptomatic case confirmed by isolation of toxigenic *Corynebacterium diphtheria*, or any suspected case that has an epidemiological link with a laboratory-confirmed case. (Das PP, 2016)

Contact: Any person living with a confirmed case, or frequenting his/her household or having some link (occupational, academic, or social) with a confirmed case. (Das PP, 2016)

Medical records were also examined to look into proximate causes of death and definitive diagnosis. Active search of cases was done by doing house-to-house survey in the villages by ANM and ASHAs, after imparting training on collection of demographic information, line listing of cases. Treatment protocol was implemented from the second week with erythromycin tab through ANMs, for all the symptomatic cases.

OBSERVATIONS:

The first case was reported on 2/10/20 with investigation being carried by the Balinta subcentre of Sojitra taluka on 4/10/20. RRT investigation of outbreak was held on 15/10/20.

CASE 1: 11 year old girl at Kharo area of Balinta village developed fever on date 22-9-2020 following which she took treatment at a private hospital and got relieved from the symptoms. However later on 29-9-2020 she developed swelling around the neck which continued to increase in size thereby leading to Dysphagia. She was carried to a tertiary care hospital where Pediatric and ENT department suspected diphtheria. They referred her to a tertiary care at Ahmedabad on 2-10-2020 where the samples were collected for lab diagnosis. Despite of the ongoing treatment, on 5-10-2020 the child succumbed to death due to ventricular tachycardia and diphtheritic myocarditis. Immunization status of the child was unknown and undocumented.

CASE 2: A 3 year old girl residing at Laxmipura area, Balinta village developed difficulty in breathing on 3-10-2020. Later on she developed swelling of leg and abdomen following which her parents took her to a nearby hospital on 5-10-2020 but due to fear of covid-19 they brought her back to home. She later died at home on the same night. As per the record at sub-center Balinta, she was fully immunized as per her age. DPT booster-1 was taken.

CASE 3: A 14 year old boy living at Khushalpura area of Balinta Village developed throat pain and fever for which his parents took him to 'Maharaj' (Dharmguru) of the village. His parents deferred the proper medical treatment due to their superstitious belief which ultimately led to their child's death on 27-09-2020. Immunization status of the deceased was unknown to both authorities and parents.

CASE 4: A 5 year old male child residing at Joganimata area of Balinta village developed fever on 5-10-2020 for which his parents took him to 'Baliya Bapji Ma'. During Diphtheria surveillance by Public health personnel he was brought to sub-center where on duty doctor examined him and advised to go to a tertiary care hospital; however his parents denied to do so due to their stringent superstitious belief. On 11-10-2020 child's health deteriorated and was taken to a Hospital at Petlad. But the parents refused to continue with further treatment. On 12-10-2020 they went to a private Hospital at Baroda as the child developed high grade fever, throat pain, cough and difficulty in breathing. On examination enlarged tonsils, white patches all over the posterior pharyngeal wall and cervical lymphadenopathy (stage IV) were found (clinically suspected case of diphtheria). Sample for the same was sent to the laboratory but it was rejected. Despite ongoing treatment he died on 13-10-2020. As per his parents he was immunized up to the age of 1.5 years but no documentation found.

CASE 5: A 6 year old female patient living at Kasor village of Sojitra taluka developed white patch over the tonsils on 14/10/20 following which she was taken to the 'dharmguru'. Later after her brother's demise due to the same, she was rushed to the hospital in Baroda on 23/10/20 where she took her last breath on 24/10/20. Sample was taken to the laboratory for investigation where it came out to be diphtheria positive. Immunization status remains unreported. Her sibling died on

23/10/20 with similar complaints

CASE 6: A 5 year old male patient who is the sibling of above mentioned case 5, developed fever and difficulty in eating on 14/10/20 following which he too was taken to the 'dharmguru' and as per his advice, the parents did not bring the child to any hospital for examination which later resulted in his death at home on 23/10/20. His immunization status was also unknown to parents and authorities. He was diagnosed as clinically suspected diphtheria.

CASE 7: An 8 year old male patient residing in Kasor village developed similar symptoms and was too diagnosed as suspected case of diphtheria. His immunization card was missing and no records found at the PHC.

No signs and symptoms were found during examination of siblings of all seven cases during outbreak field visit. Except for second case, no records regarding the immunization status of the siblings were found. Parents being unaware about the same. In second case, the sibling of the deceased was found to be completely immunized but DPT booster-2 was not taken. No significant travel history was present.

The health care system responded to the outbreak by carrying out active and passive community surveillance during which 327(29.5%) out of 1107 children in Balinta village and 2031(67.6%) out of 3002 children in Kasor village were examined and immunized with DPT, DT and dT. Case management along with Erythromycin chemoprophylaxis for 3 days were provided to close contacts. Discussion meetings with the health staff, village committee and dharmguru along with immunization awareness activities were carried out.

With concern towards immunization status, awareness of the village people regarding the same remains unsatisfactory and neither mamta card nor other documents pertaining to immunization was found in any households during the visit. 96% of eligible children (2020-21 report) were not vaccinated and no previous IDSP reports were found. It was found that the Health seeking behaviour of community is inclined towards the village 'Dharmguru' rather than the government health facilities or the private practitioners. The standard of treatment and laboratory testing is also not up to the mark at the health centres.

DISCUSSION:

Although diphtheria is a childhood VPD, it still persist as a major public health concern with low vaccination coverage as a primary cause of outbreak. Diphtheria is conventionally diagnosed clinically and confirmed by the laboratory testing. Here most cases were reported suspected as per the definition and only two cases were lab confirmed. Clustering of the cases was found in Balinta and Kasor villages of Sojitra taluka. History of absence of any documentation of vaccination by both parents and health staff and clinically compatible features with diphtheria pointed towards outbreak of diphtheria. (A.M KADRI, 2019) In the above scenario of outbreak, superstitious belief of the community driven by their tradition and livelihood along with the lack of knowledge regarding vaccination has proven to be the driving factor.

According to the central bureau of health intelligence, maximum cases (41,627 with 897 deaths) have been reported from Ten Indian States (Andhra Pradesh, Assam, Delhi, Gujarat, Haryana, Nagaland, Maharashtra, Rajasthan, Karnataka and West Bengal) between the year 2005-2014. (RAO, 2019) More recent cases outbreak have been reported from Anand district of Gujarat itself (2020) and the other from Banaskantha district of Gujarat (forty cases with eight deaths in 2019). Other states like Karnataka (Kalburgi and Vijayapura district) also reported a similar scenario. (A.M KADRI, 2019) (RAO, 2019)

Several studies carried out over the last 30 years at different places in this country also reported that diphtheria occurs more frequently during the month of August to November as seen here in our study also where cases were reported in month of October-November. (Mahanta, 2010)

As per the above mentioned results and discussion, lesser number of vaccinated children in all age groups (0-15 years) were observed in Balinta village while in Kasor village children between 10-15 years were vaccinated less. The findings were consistent with other studies like the one conducted in Banaskantha and Rajkot district where

maximum cases were below 10 years. In Karnataka 27% and 26% cases were between 5-7 years and 10-16 years respectively. (A.M KADRI, 2019) (RAO, 2019)

In current study the case fatality rate was found to be as high as 58% with maximum between 5 to 15 years of age (Graph 1). The study from Banaskantha district reported CFR of 17% with highest cases between 5-10 years while it was 5% from Karnataka in 2019-20. (A.M KADRI, 2019) (RAO, 2019)

In Gujarat, the percentage of children of 12-23 months who have received all the vaccines as found in NFHS IV was 50.4 in both in rural and urban areas. Gujarat is one of the few states in India where full vaccination coverage has declined during the seven-year period since NFHS-2 (from 53% in NFHS-2 to 45% in NFHS-3) (Graph 2). In Anand district of Gujarat, the percentage of children of 12-23 months who are fully immunized is 61.4% as per NFHS IV. (NFHS) Lack of manpower and willpower of Health Care Personnel at PHC with inadequacy of health education reflects the gap in the routine immunization system. Investing in education and specifically health education would be important means of countering the ignorance. As seen here, IDSP reporting were unavailable which calls for need of a strong surveillance system that would not only trigger disease control activities but also plan, implement and evaluate programs.

CONCLUSION:

Morbidity and mortality among younger age groups reflects poor childhood immunization coverage in the community against diphtheria with also waning immunity. Social determinants including poverty, poor access to health facilities, high illiteracy rate and seeking help from so called 'dharmgurus' all contributed in creating epidemiological situation where transmission of disease was easy resulting in outbreak. This is a matter of public health concern for all of us. Our health systems should gear up themselves to address this problem and appropriate strategies and micro-planning should be in place to cater to the needs of community.

It is evidenced from the study that early diagnosis and active treatment have potential to reduce CFR. (Mahanta, 2010) A good surveillance system with stringent immunization schedules therefore is the need of an hour to fill up the gaps identified in the system and detect any possible outbreak of diphtheria as early as possible.

LIMITATION:

This study was carried out as a part of outbreak investigation and secondary data were used for analysis. Detailed study of each and every case by investigators can give better quality results. (A.M KADRI, 2019)

TABLE I: OUTBREAK CASES IN SOJITRA TALUKA (dated from 2/10/20 till 25/10/20)

Cases in Balinta village	Age (years)	Gender	Lab confirmed	Suspected	Death
Case 1	11	Female	✓	-	✓
Case 2	3	Female	-	✓	✓
Case 3	15	Male	-	✓	✓
Case 4	5	Male	-	✓	✓
Case 5	3.5	M	-	✓	-
Case 6	5.5	F	-	✓	-
Case 7	6.5	F	-	✓	-
Cases in Kasor village	Age (years)	Gender	Lab confirmed	Suspected	Death
Case 1	6	Female	✓	-	✓
Case 2	5	Male	-	✓	✓
Case 3	8	Male	-	✓	✓
Case 4	1.5	Male	-	✓	-
Case 5	11	Female	-	✓	-

Table I shows only two cases were lab confirmed while all others were diagnosed under suspected diphtheria cases. Out of total 12 cases, 7 deaths (58.33%) were reported with no major gender and age difference.

TABLE II: Age wise distribution of beneficiaries vaccinated after outbreak.

Age group	Type of vaccine	Total no. of children		No. of beneficiaries till date of visit		% of children vaccinated	
		Balinta	Kasor	Balinta	Kasor	Balinta	Kasor
<5 year	DPT	358	1073	121	1056	33.7	98.4
<10 years	DT	401	867	132	515	33	59.4
<15 years	dT	348	902	74	460	21.2	50.99

As per above table, in Balinta village of Sujitra taluka, a lesser number of vaccinated children in all age groups seen.

TABLE III: Immunization status of Sojitra taluka (2019-20) as per IDSP data

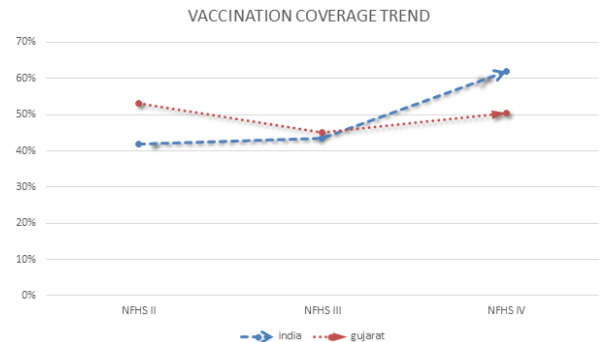
VACCINE	BALINTA VILLAGE			KASOR VILLAGE		
	Target	Achieved	%	Target	Achieved	%
Fully Immunized	65	48	74	280	231	82.5

As per above figures, the vaccine coverage was found low both in Balinta (74%) and Kasor (82.5%) village.



Graph 1: Age Wise Case Fatality Rate Of Sojitra Taluka

As per above figures, the vaccine coverage was found low both in Balinta (74%) and Kasor (82.5%) village



Graph 2: Vaccination (fully immunized) trend as per NFHS II- IV report of India and Gujarat

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