Original Article

Typhoid Outbreak during the Pandemic of COVID-19 : A Report

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Background : In the 19th Week of 2020, Integrated Disease Surveillance Programme (IDSP) noted an unusual increase in the number of fever cases in Routine Syndromic Surveillance.

Objectives : The unusual increase of fever cases were investigated to identify the agent, the source of infection and to propose recommendations for control measures.

Methods : Active surveillance of fever cases done, blood samples, stool samples and water samples were collected from the affected area. The secondary data of indoor and outdoor patient were collected from the nearest health facilities.

Result : It was a single peak outbreak of typhoid, started from 1st May, 2020, had peaked during the 19th Week of May, 2020 and ended on 31st May, 2020. The epicentre of the outbreak was the residential colony of Industrial labour. The outbreak of Typhoid occurred due to conditions generated due to the pandemic of COVID -19. Two sources of active infection were found. First, contaminated supply of drinking water and second a food-handler, who was the carrier of Typhoid.

Interpretation and Conclusion : It is a lesson to learn that the local communicable diseases should be monitor during the pandemic. Otherwise, that can cause the situation of co-epidemic.

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Key words **: Enteric fever, *Salmonella typhi*, Surveillance.**

Typhoid (enteric) fever is an acute febrile illness caused by *Salmonella enterica* serovar *typhi* (*S typhi*)[1-4]. The global annual burden was estimated at approximately 12 million cases[1,2,5]. The incidence of typhoid and paratyphoid varies geographically, with South-Central and South-East Asia having the highest incidence typically exceeding 100 cases per 100,000 person-years for Typhoid[6]. Most of the outbreaks were reported due to drug-resistant strain of *Salmonella typhi*[7-10]. However, the other common identified risk-factors include a lack of clean drinking water, poor sanitation, inadequate hygiene practices and low socio-economic status[11-13], In some instances, the originating infection may be a chronic carrier who persistently sheds the bacterium as a result of infection of the gall bladder[14]. In India, typhoid incidence rates declined in 19 century[4]. However, typhoid fever outbreaks continue to be reported in the various States and Cities of India as Chandigarh,[14] Maharashtra[15,16], Bangalore[7], West Bengal[8,9,13], Pondicherry[10], Rajasthan[17,18]. However, only limited outbreaks of typhoid were subjected to the proper epidemiological investigation[15,16]. Typhoid surveillance is an integral part of the Integrated Disease Surveillance Programme (IDSP) in India. In the 19th Week of 2020, IDSP noted an unusual increase in the fever cases from the Village Surangi. The outbreak was investigated to identify the causative agent and source of infection,

Editor's Comment :

- This study is a lesson to be learned that surveillance of the local outbreak-prone diseases should not be overlooked, even during the pandemic. Otherwise, it may lead to co-epidemic conditions.

Materials and Methods

Study Setting :

The district of Dadra Nagar Haveli (DNH) is situated at latitude, 20°54'41'' N to 20°21'36'' N and Longitude – 72°54'41'' N to 73°13'13'' N in the Western Ghat. The 487 sq km area is forest hill area, occupied by mainly tribes (population 4.5 lakh) in 72 villages and one town. Owing to the subsidiary in taxes, many large (20), medium (564) and small (2118) industries have been established in this District of India. Approximately 2.5 lakh skilled and unskilled workforce comes to the

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DNH from different states of India. The Surangi is a village of the District DNH, located at 20°09'19.1"N 73°00'43.7"E. The total geographical area of the village is 1012.97 hectares and the total population of 5,016 peoples.

Epidemiological Investigations —

During regular surveillance of fever under the IDSP unusual health events were reported from Surnagi Village of PHC Amboli in the week No 19 of the year 2020. The Rapid Response Team reached at the place on date 15/05/2020 and collected data from the patients of concerned locality like as age, gender, food habits, source of drinking water, profession and last date of visit at nearest Health Centers. Furthermore, the passive data of indoor and outdoor patients along with laboratory results were collected from concern health institutions. All the patients having symptoms of fever, headache, abdominal discomfort, loss of appetite, constipation, diarrhoea, dry cough, malaise and rash along with relative bradycardia were examined by the clinician. The blood samples were collected from the patients having symptoms of fever, headache, abdominal discomfort, loss of appetite, constipation, diarrhoea, dry cough, malaise and rash along with relative bradycardia.

Laboratory Investigations —

In routine, all health institutions are using Widal Tube Test (Tulip Diagnostics Private Limited) method as per IDSP protocols. The 15 ml blood was collected from the patient suffering from fever within the last 7-10 days, inoculated immediately into brain heart infusion broth (HiMedia Laboratories Pvt Ltd). The inoculated samples were kept in the incubator for 7 days. The causative organism was identified and Antimicrobial Sensitivity Test was done as per IDSP protocol.

Environmental investigations :

After the open interviews among suspected/ confirmed patients, health workers and local leaders, a hypothesis generated that the food handlers of the cafeteria may be the carrier or supply of water may be contaminated. The hygienic practices of food handlers were reviewed and stool samples were collected. The premises were examined to assess the sanitary situation and supply of water. The water samples were also collected from various sources like taps and tube well. The bacteriological analysis of water samples were done by the H_2S method.

Results

Epidemiological Investigations :

A total of 174 clinical suspected and laboratory-confirmed cases of typhoid were reported during the outbreak. The median age of patients was 22 years (Range 2 months – 50 years), 8.62 % of patients were required hospitalization and there no death was encountered. The attack rate among the age group of 15 to 24 years was 5.87 per 10,000 populations, followed by 2.05 in 25 to 34 years, 0.49 in 35 to 44 years, and 0.47 in 0 to 4 years. The lowest attack rate (0.08) was noticed in the age group of above 45 years followed by 0.22 in the 5 to 14 years. On the basis of gender-wise analysis, it was observed a male-biased trend. The outbreak started on 1st May 2020, peaked during the 19th Week of May, 2020, and ended on 31st May, 2020 (Fig 1). All clinically suspected/confirmed cases were residing in the same colony and all were working in the same industry.

The colony was a hostel-like structure with the common facility of kitchen, dining hall, toilet, bathroom and drinking water facility. A total 368 residents of the affected area were clinically examined. Out of 368, a total of 54 patients were found symptomatic as per case definition at the time of RRT visit. The blood samples were collected from symptomatic patients on the spot with verbal consent. Out of 54 blood samples, nine (16.67 %) blood culture samples were found positive for *Salmonella typhi*. Total 40 (74.07%) blood samples were found positive for Widal test at a cut off of 1/160 for H and O antigen. Total of five samples of stools were obtained from food handlers. Out of that one person was found as a career of *Salmonella typhi*. Total ten water samples were collected, out of that four samples were found bacteriological positive. The isolated organism (*Salmonella typhi*) from the affected area was susceptible to the following antibiotics, ampicillin, Amoxicillin / Clavulanic acid, Piperacillin / Tazobactam, Cetriaxone, Cefoperazone / Sulbactum, Cefepime, Ertapenem, Imipenem, Meropenem, Ciprofloxacin, Tigecycline, Colistin and Trimethoprime/ Sulfamethaxone. However, the isolated strain showed intermediate resistance to Nitrofurantoin and resistance to Cefuroxime, Cefuroxime Axetil,

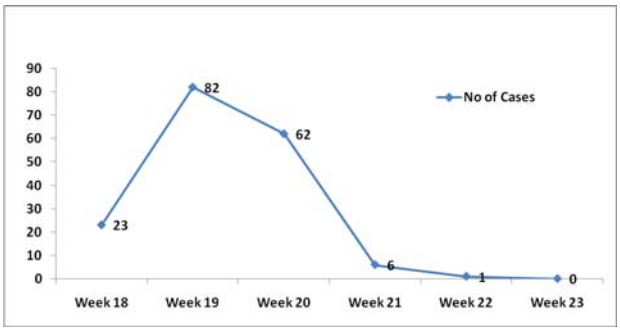

Fig 1 — Showing weekly trend of positive cases

Table 1 — *Showing antibiotic sensitivity pattern of isolates (N=9)*

Antibiotic	MIC	Interpretation
Ampicillin	≤2	S
Amoxicillin / Clavulanic acid	≤2	S
Piperacillin / Tazobactam	≤4	S
Cefuroxime	4	R
Cefuroxime Axetil	4	R
Cetriaxone	≤1	S
Cefoperazone / Sulbactum	≤8	S
Cefepime	≤1	S
Ertapenem	≤0.5	S
Imipenem	≤0.25	S
Meropenem	≤0.25	S
Amikacin	≤2	R
Gentamicin	≤1	R
Nalidixic Acid	≥32	R
Ciprofloxacin	1	S
Tigecycline	≤0.5	S
Nitrofurantoin	64	I
Colistin	≤0.5	S
Trimethoprime / Sulfamethaxone	≤20	S

Amikacin, Gentamicin, Nalidixic Acid and Nitrofurantoin (Table 1). All the patients also received ceftriaxone either alone or in combination with other drugs and all were recovered.

Discussion

The present report is a classical example of the co-epidemic. The outbreak of typhoid occurred due to conditions generated due to the pandemic of COVID-19. The complete lockdown was implemented on the 15th week of 2020 in India. All kinds of movement were restricted during the lockdown; the peoples were surviving with minimum available resources. Therefore, the outbreak was happened due to overcrowding, poor hygiene & sanitation and unavailability of safe drinking water, in the residential area. The unsafe drinking water, poor sanitation, inadequate hygiene practices, drug-resistant and asymptomatic carriers are the common cause of the typhoid outbreak in India[1,11]. In the present investigation, two sources of active infection were found. First, was contaminated supply of water and second food-handler, who was the carrier of typhoid. However, dense population, unplanned construction, poor sewerage systems, poor sanitation and inadequate hygiene practices were contributing to making the residents of the hotspot more vulnerable. The single peak and one-month duration of the outbreak indicate that the source of infection was common in the outbreak which is in accordance with earlier outbreak reports of typhoid[11]. In the previous investigation, the high attack rate of typhoid was reported in 0-4 year age group and we found low attack rate in said age group because the maximum proportion of cases belongs to the 20-24 year age group.[4] In the present investigation, the high attack rate was observed in the age group 15 to 24 years, followed by 25 to 34 years and 35 to 44 years. This highest attack rate in the working-age group of people might be due to the same age group of migrant workers of the residential campus of industry. In the blood culture, 16.67 % of samples were found positive for only *Salmonella typhi*. This indicates that the active transmission was ongoing at the time of the investigation. In India, the multidrug-resistant is an important cause of typhoid outbreak[2, 3, 7-10, 13] but the organism isolated from the blood culture of all patients in the present investigation was found sensitive to the common antibiotic. The findings of the study verified the existence of a single outbreak of typhoid cases with a single strain of the organism.

Conclusion :

On the basis of observations, we formulated a number of recommendations. The vaccination policy of typhoid may be implemented to vulnerable populations like industrial labour. The health status, availability of safe drinking water, adequate sanitation and hygiene practices may be monitored in the time frame. From the present study, it was concluded that prompt surveillance, early detection and management of the patient is helpful to contain the outbreak. Furthermore, it is a lesson to learn that the local communicable diseases should be monitored during the pandemic. Otherwise, that can cause the situation of co-epidemic.

Limitations :

The outbreak was restricted up to industrial colony where most of the residents were migrated, males of working age group those were residing without family. Therefore, the findings of the present study were not representing the actual scenario of the local population. The samples of water were tested by H_2S Method, which is indirect evidence of *Salmonella typhi* in water. Moreover, the sero-typing of the isolate was not performed.

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