Epidemiological Investigation of a Typhoid Outbreak

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Abstract

Background: An outbreak of typhoid fever among school children of a school in military station in central India is reported here. It comprises of 98 students out of which 87 students were from one school.

Methods: Detailed epidemiological case sheets were filled for cases and active case finding surveys were conducted among the school students during the period of study. It included 3313 students of the affected school.

Result: Attack rate of the affected school was 2.62 percent (RR 13.38, 99 % CI of RR 10.8, 16.12). Blood samples were found to have *Salmonella typhi* in 5.43%. Eighty six blood samples (87.75%) were positive for Widal test. Sanitary survey revealed fecal contamination of water supply leading to the outbreak.

Conclusion: We recommend having a sound vaccination programme for children, adequate chlorination of water supply and formation of local groups at school level to monitor water quality on a daily basis.

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Key Words : Typhoid fever; Epidemiological investigation

Introduction

Typhoid fever, the generalized infection of the reticuloendothelial system caused by *Salmonella enterica* serovar Typhi is the quintessential infectious disease associated with inadequate sanitation and the paediatric population disproportionately bears the burden of clinical disease [1]. Typhoid fever is endemic in India [2]. Since 1990, the epidemics of *Salmonella enterica* serovar Typhi have been reported from different parts of India including Kolkata [3]. An outbreak of typhoid fever among children of a school in military station in central India is reported here. The study comprises of 98 students of four different schools out of which 87 were from one school. All cases were admitted to the nearest Military Hospital (MH). First case was admitted on 30 Aug 2005 and the last case was admitted on 08 Nov 2005. The methods of field investigation and relevant findings are discussed.

Material and Methods

Detailed epidemiological case sheets to ascertain the cause of outbreak were prepared for all the cases admitted in the local MH. Active case finding surveys were conducted among the school students during the period of study. It included 3313 students of the affected school. Only the school students were affected and no staff member had any sickness. There were no cases in the family members of the affected children.

The case definition of confirmed case was a patient with fever lasting for at least three days, with confirmed positive blood culture of *S typhi*. A probable case of typhoid was a

patient with fever lasting for at least three days with a positive serodiagnosis or antigen detection test but without *S typhi* isolation. [4]. Rest were admitted on clinical suspicion in view of the ongoing outbreak. All admissions were subjected to Widal test by tube method. Ninety two blood cultures were taken. All blood samples for culture and serology were analysed at the laboratory of nearest MH where the students were admitted. A sanitary survey was carried out in and around the school to locate defects in water supply system and sewage disposal. Record of bacteriological survey of water samples from the school was scrutinized.

Results

Ninety eight students of four different schools in the station were admitted as typhoid fever cases which included 87 (88.7%) students of one school. Break up of cases as per the case definition is given in Table 1. The maximum cases occurred in the month of Oct 05. This gives an incidence rate of 26.56 per 1000, of which 18 (18.3 %) students were girls. The students were between 5 to 17 years of age. The relative risk for those exposed as compared to those not exposed was 13.4 (95 % CI of RR 10.8, 16.12). The difference in attack rate between the two groups (Table 2) was statistically significant.

All children recovered without any complication. Detailed survey of records of hospital admissions of the period under study reveal seven admissions of troops due to typhoid over the duration with maximum four admissions during Oct 05. No cases were seen among families. Clinical profile consisted of fever (100%), vomiting (23%), diarrhea (6%), nausea (3%), pain abdomen (2%) and headache (4%). Chest pain and cough was reported by one case each. Time distribution graph of cases showed multiple peaks indicating common source

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Table 1**Breakup of typhoid cases as per the case definition**

Confirmed cases	05 (5.10%)
Probable cases	86 (87.76%)
Possible cases on clinical suspicion	07 (7.14%)
Total	98 (100%)

repeated exposure nature of the outbreak. Out of 92 blood samples sent, five (5.43%) blood culture samples were positive for *Salmonella typhi*. Eighty-six (87.75%) blood samples were positive for Widal test at a cut off of 1/ 160 for H and 1/ 200 for O antigen.

No carrier among food handlers was found. Sanitary survey of the school and surrounding military units was carried out. Water supply of the school was by two shallow tube wells maintained by the school. The water was not being chlorinated. Although water meant for drinking is provided through Aqua guards which are under annual maintenance contract, other unchlorinated water points meant for gardening purposes exist and are accessible to children. Water samples were found to have high presumptive coliform count of upto 160 per 100 ml. There were eight soak wells located within an area of 20 acres within the school campus. Dysfunctional soak well with spillage of sewage into surrounding area was present at a distance of 25 feet from one of the tube wells.

Discussion

During outbreaks of typhoid, paediatric population bears the burden of disease [1]. Sinha et al [3], report that children between 2 to 3 years of age as the most susceptible group. In the present study the children were between 5 to 17 years of age. Others state 5 to 19 years as the most affected age group [2]. In the present study acute phase serum was tested. Repeat serology was carried out in 18 cases which showed upto four fold rise in titre. Serology can be negative in up to 30% of culture-proven cases of typhoid fever [4]. In the present study the serology was positive in 87.7 % cases. Upto 5.4 % cases were confirmed by a positive blood culture for *S typhi*. Similar low rates of culture positivity have been reported by others also [5], possibly due to prior antibiotic therapy. The outbreak occurred due to contaminated water supply with *S typhi*. Poor water quality and fecal contamination of drinking water resulting in outbreaks of typhoid fever have been reported [6,7]. Explosive outbreaks have been reported where water supply has failed [8]. There is an element of recall bias in the study towards consumption of raw drinking water by the affected children and the primary case could not be identified. These are the potential weaknesses of the study.

Table 2**Attack rate amongst students who consumed and those who did not consume contaminated water**

Exposure to contaminated water	Typhoid		Total
	Present (%)	Absent (%)	
Present	87 (2.63)	3226 (97.37)	3313 (100)
Absent	11 (0.196)	5594 (99.804)	5605 (100)
Total	98 (1.098)	8820 (98.902)	8918 (100)

RR = 13.7, (95% CI of 10.8 to 16.12), Chi square = 113.18, df = 1, p < 0.0001

The present study reveals the dangers of dual water supply in the absence of adequate health education, lack of adequate supervision and importance of chlorination of all types of water supply. We recommended vaccination programme for children against typhoid, chlorination of water supply for schools and participation of school authorities in monitoring water supply.

Conflicts of Interest

None identified

Intellectual Contribution of Authors

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Drafting & Manuscript Revision : Lt Col BS Dhadwal

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