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Original Article

Identifying the Risk Factors for Typhoid Fever among the Residents of Rural Islamabad

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Abstract

Background: During August 2015, unusually high typhoid fever cases were reported from rural Islamabad at Federal General Hospital (FGH), Islamabad.
Objectives: To determine the risk factors for typhoid fever outbreak and recommend preventive measures.
Study design, settings and duration: Outbreak investigation study conducted in Union Councils 19 & 22 of rural Islamabad in the catchment area for Federal General Hospital, from 7th July- 30th August 2015.
Subjects and Methods: A questionnaire was used to identify risk factors of typhoid fever. A case was defined as any resident of the rural Islamabad within the mauza Chatta Bakhtawar and Terlai Kalan presenting with high grade fever (>101 F) with one of the following signs/ symptoms; headache, abdominal pain and vomiting with positive typhidot test from 7th July- 30th August 2015. Two age and sex matched controls for each case was selected from the neighborhood. Epi Info 7 was used for analysis.
Results: Total of 50 cases and 100 controls were enrolled. Among cases 30 (61%) were females and 20 (39 %) males with M;F ratio of 1:1.5. Mean age was 23.0 years (9.9 ± SD). The most affected age group was 15-25 years (AR 0.19%, n=21). Only one case died (CFR 2%). Use of untreated public water after rains (OR 3.7 CI 1.6- 9.7 $p< 0.0002$), reconstruction areas and bursting/ leaking of water pipes (OR 4.017 CI 1.6-9.7 $p< 0.001$) and presence of confirmed typhoid cases at home /close contacts (OR 5.7 CI 2.019-16.18 $p< 0.0003$) were the significant risk factors found associated with the disease. Whereas using well/ private bore (OR 0.29 CI 0.329-0.653 $p< 0.001$) and hand washing practices (OR 0.7 CI 0.297-1.9 $p< 0.5$) had a protective effect. Multivariate analysis showed that use of untreated public water (OR: 3.34, CI: 1.52-7.29, $p< 0.002$), bursting/ leaking pipes (OR 2.86, CI 0.96-8.48, $p< 0.05$) were significantly associated with typhoid disease.
Conclusion: Contamination of drinking water with sewage during rain and frequent bursting and leaking of the pipes were the most common cause of this outbreak.
Key words: Typhoid fever, Islamabad, chlorination, public water.

Introduction

Typhoid fever is caused by ingestion of food or water contaminated with *Salmonella Typhi* or Paratyphi.[1] According to the global estimate, annually approximately 22 million new cases of typhoid occur with mortality in about 200,000.[2] The highest morbidity and mortality is noted in South Central and Southeast Asia. Furthermore the risk-factor and diagnostic sensitivity-corrected incidence of Asian countries revealed that Pakistan has the second highest incidence of typhoid fever with the estimated annual incidence of 412.9 per 100,000 person.[2]

Apart from the ingestion of contaminated food and water many social and demographic factors have been found to interplay with the high incidence in endemic settings like poor sanitation, contact with typhoid positive case or a carrier, educational status, overcrowding, dwelling near water bodies, flooding and poor hygiene.[3-5] Advance studies have demonstrated association of climatic variables such as rainfall, vapor pressure and temperature with the occurrence of disease.[5]

According to a systematic literature review on incidence of typhoid fever in low and middle income countries, incidence of typhoid in Pakistan was highest in the region.[2] A recent community based study from Quetta, Pakistan showed 14.63% serologically positive patients of typhoid fever with more cases from rural areas.[7] Another cross sectional study revealed that among febrile cases 36% were positive for typhoid. Although

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Authors Contribution

NJ did the conceptualization of project. SA and MT have done the data collection. Literature search and statistical analysis were done by NJ and FB. NJ, SA, MT and FB also done the drafting, revision and writing of the manuscript.

this was a cross sectional study but the target population were all using private health facilities for treatment.[8]

The World Health Organization (WHO) in 2008 recommended the typhoid vaccination for high risk population using targeted approach but unfortunately there is no planning for introduction of this vaccine into EPI program of the country.[6]

Pakistan also has high carrier rate which is believed to be a major factor responsible for high endemicity as described in a study from Karachi where almost 9% of the food handlers were carrying typhoid *S. enterica* serovars in their feaces.[9] The catchment area of Federal General Hospital Islamabad includes mauza Chatta Bakhtawar (UC 22) and Terlai Kalan (UC 19) and a study from same area previously reported the incidence of typhoid fever to be 63% among febrile patients.[10]

Islamabad is the capital city of Pakistan. It covers an area of 1,165.5 km^2 (450 mi^2) of which 906 km^2 (349.8 mi^2) is Islamabad proper. Islamabad Capital Territory comprises Islamabad city and surrounding rural areas. The rural area consists of 23 Union Councils, comprising some 133 villages, and city area has 27 Union Councils. The study was conducted in UC No. 19 and 22.[11]

Most published reports from rural Islamabad have only described the occurrence of disease but have not discussed risk factors. Current study was carried out in response to unusual rise in the number of typhoid cases in one area of Islamabad and the objective was to find out the risk factors and control current outbreak.

Subjects and Methods

A case control study conducted in Federal General Hospital (FGH) Islamabad and Union Councils 19 & 22 of rural Islamabad which is the catchment area for Federal General Hospital from 7th July- 30th August 2015.

Febrile patients admitted to or visiting the outpatient department (OPD) of FGH were enrolled as per case definition whereas controls were enrolled from Union Councils 19 & 22 of rural Islamabad using random sampling technique.

Any resident of the the mauza Chatta Bakhtawar and Terlai Kalan of rural Islamabad presenting with high grade fever (upto 101 F) with or without headache, tachycardia, abdominal pain /vomiting with positive typhidot in FGH, Islamabad. Among typhoid confirmed cases, only those were included who were the residents of the catchment area of FGH i.e. Union councils 19 & 22 to select matched controls.

Neighbour of a case was one who did not suffer from typhoid symptoms during the study period. Age and demographic status matching controls (n=100) in a ratio of 1:2 with cases (n=50) were selected

A pretested and validated questionnaire was used to gather information on the demographics, signs and symptoms, diagnostic tests performed and risk factors for developing typhoid fever. After taking the informed written consent, both patients and controls were enrolled and one male and female researcher filled the questionnaire by face to face interview. Frequencies, univariate and multivariate analysis were performed using epi Info.

The study was approved by the Ethical Review Board of Federal General Hospital, Islamabad.

Results

A total of 50 cases fulfilling the case definition were enrolled from FGH. Among cases 30 (61%) were females and 20 (39 %) males with a male to female ratio of 1:1.5. Mean age was 23.0 years (9.9 ± SD). The most affected age group was 15-25 years (n=21, AR 0.19%). Only one case died (Case Fatality Rate 2%) due to complications. The clinical presentations were largely indistinguishable, with most cases exhibiting a progressive fever (n=40, 80%), followed by headache (n= 15, 30%) and tachycardia (n=05) and a limited number had abdominal rash (n=3).

Table 1: Univariate analysis of associated factors.

Risk factors	*Odds Ratio*	*95% Confidence Interval*	*p Value*
Cases from areas having burst sewer pipes/ reconstruction of supply line	4.017	1.6 - 9.7	0.00141
Public water supply	3.7	1.80 - 7.6	0.000250
Tanker water	0.7	0.297 - 1.9	0.05
Private bore/ well water	0.29	0.13-0.653	0.001
Typhoid case at home	5.7	1.019 - 16.18	0.000376
Water storage for hours before drinking	2.7	1.079 - 4.579	0.0285

Table 2: Multivariate analysis.

Risk factors	*Odds Ratio*	*95% Confidence Interval*	*p Value*
Cases from areas having burst sewer pipes/ reconstruction of supply line	2.868	0.96-8.48	0.05
Public water supply	3.34	1.52-7.29	0.002
Typhoid contact at home	4.976	1.401- 16.92	0.010
Water storage for hours before drinking	3.519	1.48-8.323	0.004

Use of untreated public water after rain (OR 3.7 CI 1.6- 9.7 *p* value 0.0002), areas having construction, areas with burst/ leaking water pipes (OR 4.017 CI 1.6-9.7 *p* value 0.001) and presence of confirmed typhoid cases at home or in close contacts (OR 5.7 CI 2.019-16.18 *p* value 0.0003) were the significant risk factors for

typhoid outbreak. Those using well/ private bore (OR 0.29 CI 0.329-0.653 p value 0.001) and adhering to hand washing practices (OR 0.7 CI 0.297-1.9 *p* value 0.5) had a protective effect (Table-1).

Multivariate analysis showed that use of untreated public water, burst/ leaking pipes were statistically associated with typhoid illness (Table-2).

Discussion

The present study showed that consumption of untreated public water, living in areas where construction was being undertaken, areas with burst/ leaking water pipes and presence of confirmed typhoid cases at home or in close contacts were the significant risk factors for typhoid outbreak. Study also highlighted that there were more female (61%) typhoid cases than males. Similar findings were from a study [12] in which the typhoid incidence was higher among females, suggestive of a greater risk of exposure through household activities, including preparation of contaminated food and caring for children (a high risk group for Typhoid). The reason for higher number of females in our study could be that data is from a public sector hospital with almost free or subsidized treatment and study area is suburbs of capital which has relatively educated and well to do population allowing easy mobility of females. However, contradicted to this Dewan et al [5] revealed that there were more male typhoid cases (1.36) in their study, reason may include that males are either more susceptible to typhoid, or more likely to present for hospital treatment than females.

Most affected age group among was 25-35 years of age which is similar to many other studies highlighting the fact that this is the adolescent and working age group who are quite frequently exposed to eating out and drinking unsafe water.[13,14] However, a study from Bangladesh showed the two extreme age groups (pediatric and above 60 years) are most affected.[12] In the current study we did not include the pediatric group.

Use of public water supply as a determinant of disease is one of the findings in our study and same is reflected in a cross sectional study done for geo-mapping of the typhoid and malaria cases in Pakistan[11] where they found the disease to be less prevalent in people using bottled or bore water. Use of bore or tanker water supplied by Capital Development Authority was safe as seen in this study and as reported from Rawalpindi.[5] Another important determinant of the disease was storage of water for hours before drinking, which actually gives the time to coliform to multiply and hence contaminate water more with passage of time.

Having a typhoid case at home or in neighbors describes the possible feco-oral contamination. Studies from the same settings indicated the same findings.[5] A study from Karachi found a high prevalence of carriers to be responsible for high endemicity which supports our hypothesis that living with a case or carrier is a determinant for developing the disease.[9]

Present study has revealed that majority of the participants (98%) responded that they wash hands with soap and water before meals and after attending toilets however investigators did not actually look for availability of soap and water at homes so we are limited to describe the true picture with regard to hand washing. However it is a proven determinant and protective factor described in almost all the studies.[5,12]

It was a public sector hospital based study so the data is not generalizable to the population. Mostly severe cases visit hospital leading to selection bias. Moreover the pediatric cases are not included in this study therefore the determinants of infection in this group are also missed.

Use of untreated public water after rains and frequent bursting and leaking of pipes were the most probable cause of this outbreak. Timely chlorination of public water tanks, repair of pipes and health education sessions led to control of outbreak.

Conflict of interest: None declared.

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