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Research Article

Prevalence and Associated Risk Factors of Typhoid Fever in Children Admitted in a Medical College Hospital

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Abstract: ***Introduction:*** Enteric fever is a common public health problem with variable clinical presentation. Typhoid fever is a waterborne and foodborne disease which predominantly affect the children. The incidence of typhoid fever peaks between 1yr to 15Yrs. ***Aim of the study****:* The knowledge of associated risk factors of typhoid fever will help to bring about rationale control strategies of the disease. ***Method:*** It was a hospital based prospective study conducted over a period of one year from January 2010 to December 2010 in the department of pediatrics, Ibrahim Iqbal Memorial Hospital Ltd (Affiliated by BGC Trust Medical College), Chittagong, Bangladesh. ***Results:*** A total of 285 patients were tested positive in which males were 149(52.3%) and females were 136(47.7%). The study shows that 68(23.86%) were in the group of 1-5 years of age, 133(46.67%) were in the range of 6 to 10 years, 84(29.47%) were in the range of 11 to 15 years old. Mean age of patients was 10.1±7.8 years. Common symptoms shown by patients who participated in the study included fever were 285(100%), fatigues were 190(66.67%), headache were 151(52.98%), Diarrhea were 58(20.35%) and anorexia were 110(38.60%). Complications were present in 23 patients, Acute Abdomen (Mesenteric lymphadenitis) was present in 10(3.51%) patients, Pneumonia was present in 5(1.75%) patients, Hepatitis was present in 3(1.05%) patients, Encephalopathy was present in 3(1.05%) patients and Osteomyelitis was seen in 2(0.70%).The most assessing risk factors typhoid fever Street vendors were 143(50.18%), then 73(25.61%) participants do not wash their hand properly when taking food and finally 69(24.21%) participants cannot maintained personal hygiene or sanitation. ***Conclusion:*** Water qualities have a great impact on the burden of typhoid fever among children. The identification of risk factors associated to the disease is of great importance in the development of rational control strategies of the disease.
Keywords: Salmonella typhi, Control, Widal test, Incidence.

INTRODUCTION

Typhoid fever is an infection having as causative agent *Salmonella typhi* related to the serotype *paratyphi* A, B and C [1]. These bacteria are a significant cause of morbidity and mortality especially in developing countries and exhibits multiple antibiotic resistance [2]. Studies by and Mike, (2008) shows that this disease is associated to low socio-economic status and poor hygiene, having humans as the only natural host of the infection since the bacteria grows best at 100°F which corresponds to the human body temperature. Transmission of the disease is through faecal oral route from contaminated food or water (WHO, 2018). Major clinical feature of the disease includes; malaise, fever, vomiting constipation, splenomegaly and hepatomegaly [3]. The disease can result to major complications such as internal hemorrhage and perforation. In the absence of effective treatment, this disease has a fatality rate of about 10 to 30 %. Typhoid fever is a threat to many tropical countries showing a worldwide estimate of about 212 million cases with 129,000 deaths yearly with children [4]. Reports from the Cameroons' Public Health ministry show a frequent diagnosis of typhoid fever in children in health facilities in Cameroon and have resulted in a public scare [3]. It is thus considered an endemic disease in Cameroon. One major challenge in the treatment of this disease in Cameroon is the high costs of its drugs. Control strategies to the disease are a possible way out to reduce the disease spread. However, absence of information associated to the risk factors of typhoid fever especially in children in Cameroon has made it not really possible to bring about effective control strategies to manage the disease. Most studies that were used for burden-of-disease estimation are from the South and South East Asian region. Only one study representing Africa was included. Therefore these estimates are considered conservative for the global burden of typhoid fever. Population-based

incidence estimates for typhoid fever are not available globally, but typhoid fever complications are frequently reported in the literature from almost all regions of the world [5, 6]. Typhoid fever is mainly spread by the faecal-oral route; therefore, transmission is high in areas where the risk of food and especially water contamination is high. Factors that influence contamination of drinking water are the non-availability of piped water, and improper drainage of sewage [7]. Individual risky behaviors such as not washing hands after defecation and before meals are another contributing factor for typhoid spread. In South East Asia, the incidence of typhoid fever in children is high in urban low socioeconomic squatter settlements where population density is high and living conditions are compromised [8]. Humans are the exclusive host for S. Typhi. The most common source of infection is the ingestion of food contaminated with S. Typhi [9]. Occasionally contaminated eggs and frozen oysters have been found to be associated with typhoid infection [10]. The documented risk factors based on studies in high-risk areas such as Pakistan are consumption of ice cream and flavoured ice drinks from street vendors, raw fruit and vegetables, and a history of contact with a typhoid patient before illness [11]. From the findings of this study, the knowledge of associated risk factors of typhoid fever will help to bring about rationale control strategies of the disease thus mitigating its spread.

MATERIALS & METHOD

It was a hospital based prospective study conducted over a period of one year from January 2010 to December 2010 in department of pediatrics, Ibrahim Iqbal Memorial Hospital Ltd (Affiliated by BGC Trust Medical College), *Chittagong*, Bangladesh.

Inclusion criteria:

All the patients in the age group of 1 to 15 years with clinically suspected enteric fever ICT for salmonella typhi or Blood culture was positive were included in this study.

Exclusion criteria:

- Age less than one year or more than 15 years.
- Patients who had received antibiotics prior to admission.
- Patients with co morbid conditions.

Blood culture:

An aliquot (1ml for children) of fresh blood was immediately processed for culture. Blood culture was done by lysis centrifugation method and inoculated on blood agar and Mac Conkey agar media and incubated for 48 hours at 37° C [14, 15]. Suspected bacterial colony was identified by Gram staining and standard biochemical tests [14, 16]. Serotype of Salmonella spp. was identified by slide agglutination test by specific 'O' (lipopolysaccharide), 'H' (flagella) antisera [16].

ICT Test:

Enteroscreen-WB ICT kit Typhi manufactured by Zephyr Biomedical (Verna Industrial Estate, Verna, Goa, India) was used to detect Salmonella IgM/IgG antibodies against an outer membrane protein of Salmonella Typhi. Test was carried out as per manufacturer's instruction and reading was taken after 15-30 minutes based on appearance of coloured band in the control region and test region. The band in test region represented presence of either anti-Salmonella IgM or IgG. ICT was considered positive if any anti-Salmonella IgM, IgG or IgM+IgG band appeared positive in any sample.

RESULTS

All patients who were confirmed positive for typhoid took part in the study during that period. A total of 285 patients were tested positive in which males were 149(52.3 %) and females were 136(47.7%) in (Figure-1). The table-1 shows that 68(23.86%) were in the group of 1-5 years of age, 133(46.67%) were in the range of 6 to 10 years, 84(29.47%) were in the range of 11 to 15 years old. Mean age of patients was 10.1±7.8 years. Common symptoms shown by patients who participated in the study included fever were 285(100%), Fatigues were 190(66.67%), Headache were 151(52.98%), Anorexia were 110(38.60%), Constipation were 92(32.28%), Diarrhea were 58(20.35%), Abnormal pain were 47(16.49%), Coated tongue were 165(57.89%), Toxic look were 139(48.77%), Hepatomegaly were 10(3.51%), Splenomegaly were 25(8.77%), Pallor(mild) were 86(30.18%), Jaudice were 11(3.86%) and Abdominal distension were 2(0.7%). Amongst the symptoms, most of the patients presented with fever 285(100%) having temperatures ≥100°F (Table-1). Fatigue was also common in the patients. Some of the patients acknowledged that before being brought to the hospital for check-up they had already taken medications to reduce fever. Laboratory analysis showed that all the typhoid fever cases detected were due to *S. paratyphi* A (Table-1). Complications were present in 23 patients, Acute Abdomen (Mesenteric lymphadenitis) was present in 10(3.51%) patients, Pneumonia was present in 5(1.75%) patients, Hepatitis was present in 3(1.05%) patients, Encephalopathy was present in 3(1.05%) patients and Osteomyelitis was seen in 2(0.70%) as shown in (Table-2). A one-way ANOVA (Table-3) carried out on the data obtained from drinking water sources showed a significant difference ($P < 0.05$) between the mean populations of respondents on the sources. A majority of the respondents used tube well as the major source of drinking water (23.98 ± 3.20^{a}). There was no significant difference in the population of respondents whose source of drinking water was wells, river, streams and other sources. The table shows the socioeconomic status index was considered based on monthly income of parents or guardians in households. The most assessing risk factors typhoid fever Street vendors were 143(50.18%), then 73(25.61%)

participants do not wash their hand properly when taking food and finally 69(24.21%) participants cannot maintained personal hygiene or sanitation. The status was categorized as follows; 21(7.37%) were in the group of below high socio economic status index (>50,000 BDT), 45(14.79%) were in the group of below higher medium socioeconomic status index (between 41,000-50,000 BDT), 63(22.11%) were in the group of below medium socioeconomic status index (< 31,000-40,000 BDT), 71(24.91%) were in the group of below lower medium socioeconomic status index and 85(29.82%) were in the group of below lower socioeconomic status index (Table-3). Household water treatment methods outlined in the questionnaire included; boiling of water, filtering of water using purchased water filters. A significant difference was recorded among participants on use of treatment methods. Majority of the respondents did not use any treatment method on water before drinking. Others used either boiling or filtering of the water as their water treatment technique.

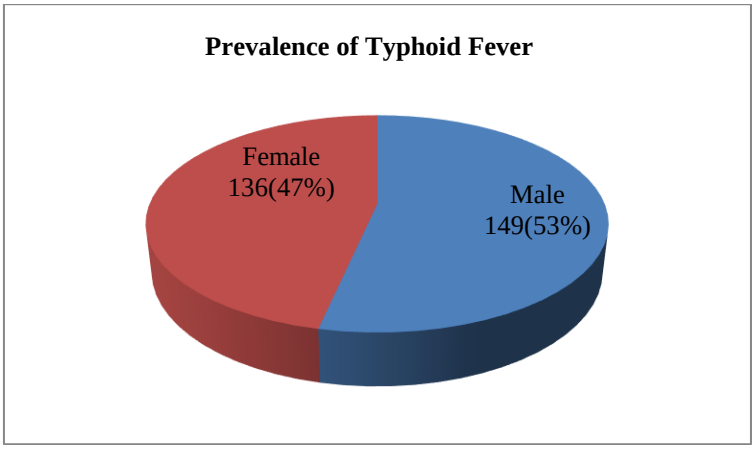

Fig-1: Prevalence of Typhoid Fever according to gender distribution (N=285)

Table-1: Demographic and Clinical Presentation of Patients:

Characteristics	N	Percentage (%)
Participants according to age (Years)		
1-5 Years	68	23.86
6 to 10 Years	133	46.67
11 to 15 Years	84	29.47
Clinical signs and symptoms		
Fever (>100°F)	285	100
Fatigue	190	66.67
Headache	151	52.98
Anorexia	110	38.6
Constipation	92	32.28
Diarrhea	58	20.35
Abnormal Pain	47	16.49
Coated tongue	165	57.89
Toxic look	139	48.77
Hepatomegaly	10	3.51
Splenomegaly	25	8.77
Pallor	86	30.18
Jaudice	11	3.86
Abdominal distension	2	0.7

Table-2: Complications

Complications	N	Percentage (%)
Acute Abdomen(Mesenteric lymphadenitis)	10	3.51

Pneumonia	5	1.75
Hepatitis	3	1.05
Encephalopathy	3	1.05
Osteomyelitis	2	0.70

Table-3: Assessing risk factors associated with typhoid Fever

Characteristics	N	Percentage (%)
Source of Drinking Water		
Tube well	169	59.3
River and stream	71	24.91
Other sources	45	15.79
Assessing Risk Factors		
Street vendors	143	50.18
Hand wash	73	25.61
Sanitation	69	24.21
Socioeconomic status index (monthly income)		
<=20000 BDT	85	29.82
21000-30000 BDT	71	24.91
31000-40000 BDT	63	22.11
41000-50000 BDT	45	15.79
>50000 BDT	21	7.37

Table 4: Mean population distribution of respondents on sources of drinking water

Sources of drinking water	Mean population of respondents
Tube well	23.98 ± 3.20^{a}
River and stream	5.80 ± 1.50^{b}
Other sources (alternate source)	4.70 ± 1.80^{b}
Mean respondents	11.09±2.10
P=0.001 (P<0.05)	

Values are expressed as mean ± SE

[a,b] Means accompanied by different superscripts differ significantly at P<0.05

Table 5: Mean distribution of respondents according to methods of household water treatment

Method of water purification	Mean population of respondents
None	18.99 ± 2.90^{b}
Boiling	7.00 ± 1.40^{c}
Use of water filters	18.00 ± 1.40^{b}

[a,b] Means accompanied by different superscripts differ significantly at P<0.05

DISCUSSION

Based on our knowledge, this is the first study done on the association of risk factors to typhoidfever in this part of Cameroon. The gender distribution of typhoid disease in which males were 149(52.3%) and females were 136(47.7%), suggesting that typhoid fever was more prevalent in males than in females among the age group in that locality. Similar research done in Bangladesh and South Africa showed that typhoid fever correlated with gender and case fatality is higher in males compared to females. A greater proportion of positive cases was detected among children with age range 5 to 9 (38.8 %) while a lesser proportion of patients was found in the age group below 5years (18.2 %). One reason for the high prevalence observed in the age group 5 to 9 is the underdeveloped immune system in growing children; this makes them more vulnerable to this enteric pathogen. The status was categorized as follows; 21(7.37%) were in the group of below high socio economic status index (>50,000 BDT), 45(14.79%) were in the group of below higher medium socioeconomic status index (between 41,000-50,000 BDT), 63(22.11%) were in the group of below medium socioeconomic status index (< 31,000-40,000 BDT), 71(24.91%) were in the group of below lower medium socioeconomic status index and 85(29.82%) were in the

group of below lower socioeconomic status index. Similar studies done by Vollaard (2004) show that the prevalence of typhoid infection washigher among lower income category households. Low income category household have high tendency of purchasing and eating cooked food from street vendors which predisposes them to typhoid infection. Street vendors have limited facilities for storing food and cleaning of dishes. This poor hygiene practice is a vehicle for disease transmission. Furthermore low income category household practice poor household hygiene due to lack of means of available portable water connected to their houses. Ram *et al*. (2007) also identified socioeconomic status as a significant risk factor associated in the occurrence of typhoid fever [11]. Most epidemiological studies have related the risk factors to typhoid fever of being waterborne or food borne [9]. Findings obtained from the data showed a significant difference ($P < 0.05$) between the mean populations of respondents' on the sources of drinking water. A majority of the respondents used pipe borne water as a source of drinking water though others still used wells, rivers and streams as their main source. Concerning sources of drinking water, UNICEF categorized water sources as improved drinking water source or unimproved drinking water source (UNICEF, 2012). Piped water in dwelling, yard or public taps was classified under improved drinking water source while unprotected springs and dug wells were classified as unimproved source of water. This classification was used to distinguish safe water sources from unsafe sources (UNICEF, 2012). People who drink water from safe sources stand a lower risk of typhoid infection than those who drink from unsafe sources [16]. Similar research carried out on microbial analysis of household wells revealed a high bacterial load and resistant strains of *Salmonella enterica* serover Typhi [7]. With respect to household water treatment methods, a significant difference ($P < 0.05$) was observed among the population of respondents. Some respondents did not use any household treatment method for water. This could contribute greatly to the prevalence of typhoid fever. Studies carried out by Ram, (2007) in Bangladesh demonstrated that drinking of unboiled water at home was a major risk factor in the occurrence of typhoid fever [11]. Boiling of water in clean containers before drinking could reduce the risk of typhoid fever. This is due to the fact that the *Salmonella typhi* bacteria grow best at a temperature of 37°C thus very high temperature s kills the bacteria. Boiling, the use of ceramic filters, bleach addition and solar disinfection has been household water treatment interventions introduced by the WHO [7].

Limitations of the study:

One possible limitation of this study was the limited number of participants which could greatly affect the statistical power of the study. Responses provided in the questionnaire for age group below 11 years was provided by parents and guardians which could introduce recall bias as regards the study.

CONCLUSION AND RECOMMENDATIONS

The results from the study have a lot of significance to health experts. Firstly, it highlights improvement of sanitation and hygiene as the most effective way to prevent the spread of the disease especially in children. Nonetheless, our findings also highlight the need for more sensitization of the public concerning the mechanism of transmission and effective control or preventive methods of the disease.

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