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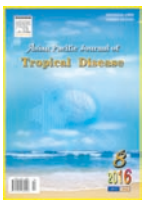

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Frequency of typhoid fever and its association with seasonal variations in Taxila, Pakistan

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ABSTRACT

Objective: To analyse seropositivity rates of salmonella with seasonal variations in the population of Taxila and the surrounding rural areas.
Methods: The study was conducted among 760 suspected patients with symptoms of fever, headache, nausea and decreased white blood cells count screened for the typhoid fever. Blood samples collected from the suspected patients were tested for seropositivity by slide agglutination (Widal test) and Immunochromatographic test, *i.e*. Typhidot.
Results: From overall 760 suspected patients of typhoid fever only 192 (25.26%) samples were positive for Widal and Typhidot test. The peak seropositivity rates were identified during the months of April–June, while decreased cases were observed from January to March. Age wise distribution of typhoid fever reflected that age groups of 10–15 years and 25–35 years were at higher risks of developing enteric fever with respect to age groups of 5–10 years and 61–70 years, respectively. On gender basis evaluation, females (24.49%) were slightly at low risks of developing typhoid fever than males (25.9%).
Conclusions: The present study highlights a higher burden of typhoid fever in Taxila and the surrounding areas population that directly reflects the poor hygienic condition and contamination of drinking water. The frequency of typhoid fever fluctuates with seasonal variations as higher rates found during the summer as compared to winter season.

1. Introduction

Bacterial infectious disease like typhoid fever is commonly caused by a bacillus *Salmonella typhi*, while other major pathological strains causing paratyphoid fever include A, B and C[1]. Typhoid fever is still one of the most prevalent infectious diseases found in hilly areas, mountains and valleys during summer season and is considered as one of the most important causes for fever detection in developing countries[2,3]. Usage of contaminated drinking water and food supplies with faecal wastes may be the basic source for the transmission in areas where it is highly prevalent[4]. In humans, the most common diseases caused by *Salmonella typhi* (a non-capsulated, non-spore forming bacillus bacterium) include gastroenteritis, bacteraemia and enteric fever[5,6].

Globally estimated infection as well as annual death rates of typhoid fever showed that it is a major death causing infectious disease in many underdeveloped areas of the world with 12–33 million cases and resulting into 0.216–0.600 million deaths, respectively[7,8]. Among Asian countries, it was reported that Pakistan and India had increased the incidence rate of typhoid fever as compared to Indonesia, Vietnam and China[9,10]. In 2013, the study conducted in Children Hospital, Quetta, reported 18.66% serological positive cases for enteric fever[11].

According to the cultural and historical background of Taxila and surrounding hilly areas. It was considered as the greatest centre

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The study protocol was performed according to the instructions provided by manufacturer (HiMedia Laboratories Pvt. limited) for Widal and (Reszon, Salanger, Malaysia) for the Typhidot to detect the antibodies in patient serum and approved by the Ethical committee of ALI family clinic and Lab Taxila, Ahmad clinical Lab Ethical committee and Care clinical laboratories Taxila ethical committee. Informed consent was obtained from each patient and witten consent from Dr. Zain Ali, Head of Ali family clinic Lab, Muslim Kiyani, Head of Ahmad Clinical lab Taxila and Head of Care Clinical laboratories Dr. Mahroof Hussain.

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of civilization and learning in the world. However, lack of modern infrastructure development in this area needs to rebuild its position in the world. There is no previous study existing of such a nature in Taxila to show the exact figure of the prevalence of typhoid fever. This study is an important step in improving the healthcare system as well as diagnosis of salmonella, a causative agent of typhoid fever.

2. Materials and methods

Taxila, a famous city of the Punjab, Pakistan, is situated at 32 km northwest of Islamabad and Rawalpindi. It lies 549 m above the sea level. Patients mostly belonged to Taxila city and surrounding hilly areas, Margalla, Jaulian, Khanpur and Kohala Bala. This study was planned in Department of Medical Lab Technology, University of Haripur and conducted at Ali Family Hospital and Laboratory, Care Clinical Laboratories and Ahmad Lab from January 2015 to June 2015. Due to non-availability of advanced diagnostic facilities like blood culture, only Widal and immunochromatographic tests, *i.e.* Typhidot, were preferred for the diagnosis of typhoid fever. Suspected patients with clinical details like decreased white blood cells (WBCs) count, fever from 2–3 days ago, nausea, diarrhoea, cough and cold were evaluated. Both males and females were included in the study with all age groups from 0–10 years and up to 70 years with the mean age of 35 years. By following the standard guidelines of sample collection, approximate 3 mL sterile blood samples were collected and put in gel tubes to clot and centrifuged at 3000 r/min for 5 min. After that, clear serum was obtained, which was either used for Widal test or Typhidot test. Both Widal and Typhidot were conducted according to the instructions provided the manufacturer (HiMedia Laboratories Pvt. limited) and (Reszon, Salanger, Malaysia) for the detection of antibodies in the patient serum. In Widal, one drop of patient serum (25 μL) was added into each four cells on glass slide and mixed with a drop of antigen solution (25 μL) of *Salmonella typhi* O, *Salmonella typhi* H, *Salmonella paratyphi* AH and *Salmonella paratyphi* BH, respectively. Similarly, other two cells on slide each containing a drop of positive and negative (25 μL) control were mixed with a drop of *Salmonella typhi* H antigen solution. In each step of mixing solutions, a sterile stir was used. Similarly, Typhidot is a rapid antibodies immunoglobulin G/immunoglobulin M detection immunochromatographic assay. A drop of seum (50 μL) was added into the well on device and a drop of buffer with possible care to avoid the bubble formation and results were noted within 10–15 min. Results obtained with respect to age, gender and month on the basis of above mentioned methods were statistically analysed and presented in tabular as well as in graphical forms by using Microsoft Excel and multiple tools.

3. Results

About 760 clinically suspected patients of typhoid were included in the study for the determination of enteric fever by using Widal in 445 patients while Typhidot in 315 patients. About 192 patients were positive with net prevalence of 25.26%. Out of those 192 patients, 77 (40.10%) were evaluated by Typhidot test and 115 (59.90%) were screened with Widal test.

On the basis of age, the age group of children ranging from 0–10 years old, 16 (18.39%) cases were positive out of 87 total suspected children. Whereas in age group ranging from 11–20 years old, 111 suspected patients were evaluated and only 23 patients were positive indicating 20.72% prevalence. Similarly in age group of 21–30 years old, about 49 (28.48%) patient were positive out of 172 suspected patients. In age group of 31–40 years old, about 162 patients were included and 68 (41.97%) were recorded as positive. In age group from 41–50 years old, 18 cases were positive with the prevalence of 15.65%. Similarly, in age groups ranging from 51–60 and 61–70 years old, only 18 patients were positive with prevalences of 17.74% and 13.72%, respectively.

On the basis of gender, 107 male patients were positive out of total 413 with 25.90%. But in female as compared to male, 85 patients were positive out of 347 with 24.49% prevalence rate.

Similarly, monthly calculated results showed variable positivity rates of typhoid fever from January to June ended with the minimum number of cases in month of January. Nineteen cases out of 109 with 17.43% prevalence were positive whereas the maximum number of cases were noted during the month of May and June. Out of 274 cases, 81 were positive with 29.56% prevalence rate. Similarly, during the months of February, March and April, their seropositivity rates were 24.77%, 24.78% and 23.8%, respectively (Figure 1).

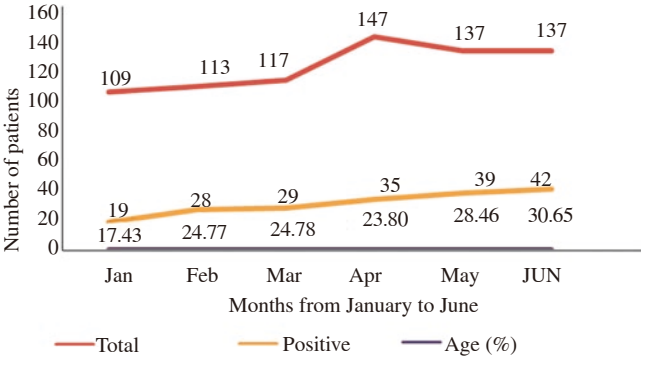

Figure 1. Monthly variable rates of typhoid fever in Taxila and its surrounding areas.

4. Discussion

Pakistan and India are the worldwide hotspots for typhoid fever as compared with Egypt, Mexico, Peru, Indonesia and Nepal reported by Sulaiman and Sarwari[12]. Similarly, a survey from Karachi, Pakistan, reported that blood culture and serological proven cases with an incidence of 170 and 710 per 100000 accordingly[13].

In this study, patients suspected of typhoid fever were aseptically isolated for six months from January to June to evaluate monthly variable seropositivity rates of typhoid fever in Taxila, Pakistan. The

maximum isolates were calculated positively from April to June and minimum numbers of isolates positive showed during January to March. Out of 274 patients, about 81 were noted as positive with prevalence of 29.56% in months from April to June. From January to March, a total of 76 patients were serological positive with 22.41% prevalence out of 339 suspected patients.

As there was no prior study evaluating the monthly variable rates of typhoid fever in Taxila and the nearby hilly areas. The findings in this study are comparable with previous studies which reported increased seropositivity rates of typhoid fever during summer season as compared to the winter season[11,14-16]. Use of unhealthy beverages in hot summer, lowered ground water-table level and water being stagnant are the related risk factors for this variable seasonality of typhoid fever[17].

Minor differences on the basis of gender were calculated, as they were equally present in both females and males according to the studies done by Abdel Wahab *et al.*[18], whereas Fazile and Khan *et al.*[19] reported that females were less infected than males. Another study in Khyber Pakhtunkhwa, Pakistan, found that females were more infected than males[20], which was contrary to the research findings done in Iran[21].

It is concluded by this study that typhoid fever is still a burden on developing countries like Pakistan, which is mostly contributed by the rural areas due to improper sanitation and non-availability of the advanced diagnostic facilities for early diagnosis. Thus, it is necessary to build the epidemiological diseases control system as well as antibiotic therapy units in the rural areas in developing countries to control the infectious diseases. It is crucial to ensure safe water supply for drinking and identification of chronic carriers of the bacteria.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

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