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Typhoid fever in children: clinical presentation and risk factors

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Abstract *Objective:* The diagnosis of typhoid fever based on widal test is on the rise despite its set back. We prospectively reviewed over one year period, cases of typhoid fever admitted in our centre to document the pattern of clinical presentation, risk factors and the reliability of Widal test in its diagnosis.

Methods: This was a prospective study carried out in a Nigerian Teaching Hospital. All children, whose parents consented, admitted with a diagnosis of typhoid fever using the Centre for Disease Control and prevention (CDC) case definition for typhoid fever, between 1st January and 31st December 2010, were consecutively reviewed using a structured questionnaire.

Results: A total of 42 patients were admitted out of which 35 were analysed, the remaining 7 were excluded because consent was not obtained. The disease was more common in males than females with M: F ratio of 3:2. The study gives the incidence of suspected typhoid of 30.5 per 1000 admission. The age range of the study population was 6 months to 15 years with cases being common among the age group five to nine years 13(37.1%). It has a bimodal peak of occurrence as it occurs commonly in April/May and in August/September. The disease was common in the low socioeconomic classes. All the 35 patients had fever (100%), vomiting 25 (71.4%), typhoid psychosis 3 (8.6%) and 4 (11.4%) had intestinal perforation. Culture was positive in 8 (22.9%) of the patients. Widal test were significant in 20 (57.1%) with a sensitivity of 62.5%, specificity 44.4%, positive predictive value 25%, negative predictive value 80% and the efficiency of the test was 48.6%.

Conclusion

The incidence of typhoid fever in this study is 30.5 per 1000 admission, it is common during rainy and harmattan period. The use of Widal test is not too helpful in diagnosis of typhoid fever. Therefore, culture samples should be done in all cases of suspected typhoid fever.

Keywords: *Salmonella spp*, Widal test, Culture

Introduction

Typhoid fever caused by *Salmonella typhi* and *paratyphi*, a common cause of prolonged febrile illness is a major public health problem especially in the developing world.[1] The disease has attained global distribution and is an important cause of morbidity and mortality. [2] it is more prevalent in developing countries due to poor sanitation, poor standard of personal hygiene and consumption of contaminated food.[3] Contamination of water supply due to ineffective or inadequate sewage disposal results in outbreak of the disease in urban areas.[1, 3]

Diagnosis is based on isolation of *Salmonella typhi* or *paratyphi* from culture of blood, urine, bone marrow or stool.[4] Although bone marrow aspirate gives the highest isolation rates; the technique is invasive and traumatic. In developing countries particularly in rural communities where lack of materials, equipment and expertise makes it impossible to perform cultures, let alone technique of bone marrow aspiration, the diagnosis of typhoid fever is rarely confirmed.[1, 5] Up to 70% cases of typhoid fever have negative blood culture, which has been attributed to self medication (antibiotic usage before hospital presentation) especially in urban areas. [5]

In all areas with endemic typhoid, widal test may be

Table 2: Majority of children 29(82.9%) were of low

confusing because of non specific reaction, lack of standardization, inter laboratory variation and high false positive and false negative results.[6] Clinical diagnosis remain the first line in the management of typhoid fever, but this is difficult due to variable symptoms, paucity of distinctive physical signs, occurrence of sub-clinical infection and numerous differential diagnosis.[7-9] For the purpose of this research the CDC clinical case definition for the diagnosis of typhoid fever was adopted.[10] Malaria is also endemic in Nigeria and it is difficult to differentiate clinically the presentation of typhoid fever from malaria or brucellosis,[7, 8] without laboratory support. Isolation of typhoid organism from patient suspected of having typhoid fever is the definitive diagnosis. Recently we have observed an increase in clinical diagnosis of typhoid fever in children in our centre this prompted us to look into the pattern of presentation, risk factors and the reliability of Widal test in the diagnosis of typhoid fever.

Subjects and methods

This is a prospective study carried out at the University of Maiduguri Teaching Hospital (UMTH) situated in Maiduguri the capital of Borno State, north-eastern Nigeria. Although a tertiary facility, in addition provides secondary and primary services. All children admitted with a diagnosis of typhoid fever based on the CDC case definition for the clinical diagnosis of typhoid fever [10] that were admitted into Emergency Paediatric Unit (EPU) or Paediatric Medical Ward (PMW) from 1st January to 31st December 2010 were studied, using a structured questionnaire to document the age, sex, symptoms and / or signs at presentation, social class based on socio-economic and cultural background, [11] source of water supply, month of presentation, salmonella cultured from blood or stool which were taken on the first day of admission before the commencement of antibiotics. Urine culture was not taken routinely in all the patients, a single widal test was done on all the patients on the first day of admission, drugs used in the treatment on admission and the outcome of the patients were also documented. Data analysis was conducted using SPSS software and presented in form of frequency distribution, histogram and bar charts. Indices to determine the diagnostic usefulness of widal test were calculated using method of Galen and Gambino.[12] Test of significance was done using Chi square test where applicable and $p<0.05$ was considered significant.

Results

A total of 42 patients were admitted with suspected typhoid fever, out of which 35 were analyzed. The remaining seven patients were excluded because consent was not obtained. During the same period, a total of 1,377 patients were admitted. The age range of the study population was 6 months to 15 years with cases being common among the age group five to nine years 13 (37.1%) making the incidence of suspected typhoid of 30.5 per 1000 admission. Most patients in this study were treated with ceftriaxone 65.7%, the outcomes of these treatments were excellent with 91.4% of the patients recovered fully with one death and two left against medical advice.

Fig I: Shows the distribution of typhoid fever by months of the year, it shows bimodal peaks of occurrence in April-May and August.

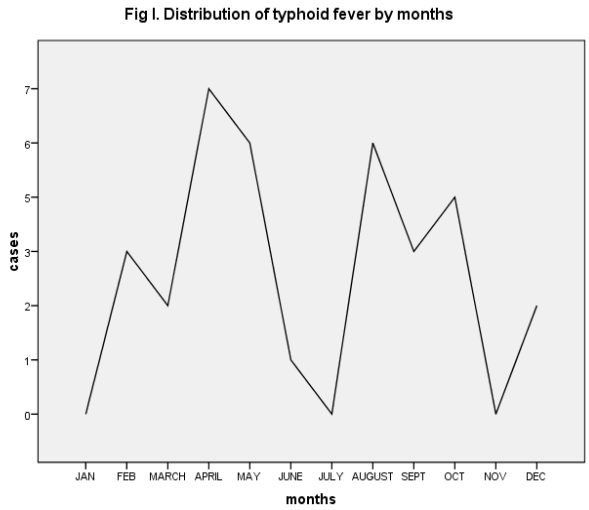
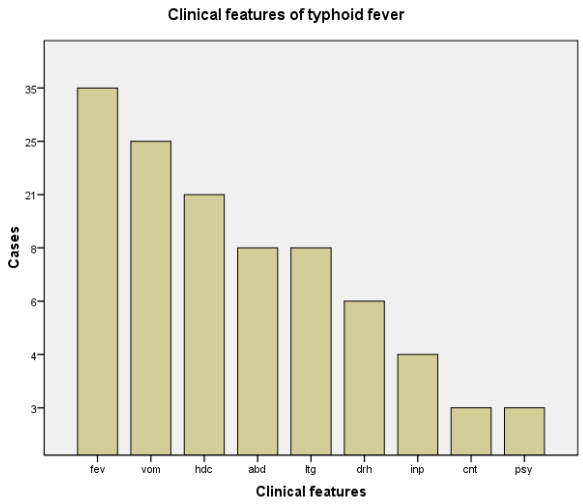


Table 1: Show age and sex distribution of clinically diagnosed typhoid fever. Ages of common occurrence in both sexes were five to nine years. The disease was commoner in male; (60%) than female (40%), making the M: F ratio of 3:2.

Table 1: Age and sex distribution of typhoid fever cases

Age	Male n (%)	Female n(%)	Total n (%)
<6 months	0	0	0
6-11 months	0	1 (2.9)	1 (2.9)
1-4 years	7 (20)	4 (11.4)	11 (31.4)
5-9 years	8 (22.9)	5 (14.3)	13 (37.2)
10-15 years	6 (17.1)	4 (11.4)	10 (28.5)
Total	21 (60)	14 (40)	35 (100)

Fig 2: Shows the clinical features of typhoid fever, all patients had fever 35(100%) which ranges from 5 days to 3 weeks at the time of presentation, vomiting was the second commonest symptom 25(71.4%) and headache 21(60%). Typhoid psychosis and perforation were the least findings at presentation; 3(8.6%) and 4(11.4%) respectively. The study also revealed that majority of the patients had their sources of drinking water from the water vendors 20(66.7%), community borehole 4(13.3%), underground water reservoir 3(10%) and tap water 3 (10%).



fev -fever, abd - abdominal pain, inp - intestinal perforation, vom -vomiting, ltg - lethargy, cnt -constipation, Hdc-headache drh -diarrhea, psy - psychosis

Table 2: Majority of children 29(82.9%) were of low social classes, while 2(5.7%) and 4(11.4%) were of middle and upper social class respectively.

Table 2: Distribution of typhoid fever cases by social class

Social class	Typhoid fever cases n (%)
I	2(2.7%)
Ii	2(5.7%)
Iii	2(5.7%)
Iv	17(48.6%)
V	12(34.3%)
Total	35(100%)

Table 3: Shows the prevalence of culture positive S*almonella typhi* from blood or stool. Only 8(22.9%) had positive cultures. The remaining 27 (77.1%) had negative cultures.

Table 3: Culture status of *Salmonella spp* among patients with typhoid fever

Clinically suspected typhoid fever	Frequency n (%)
Salmonella isolated	8 (22.9)
Salmonella not isolated	27 (77.1)
Total	35 (100)

Table 4: Shows the sensitivity of widal test result in predicting or isolating S*almonella species*. The test shows sensitivity of 62.5% with low specificity of 44.4% the positive predictive value of 25% and the negative predictive value of 80%. The efficiency of this test was low 48.6%.

Table 4: Sensitivity of Widal test results in predicting or isolating *Salmonella spp*

Widal test	Salmonella spp		
	Isolated	Not isolated	Total
Significant titre	5	15	20
No significant titre	3	12	15
Total	8	27	35

Sensitivity of Widal test-62.5%
Specificity of Widal test-44.4%
Positive predictive value-25%
Negative predictive value-80%
Efficiency of Widal test-48.6%

Discussion

This study has shown that typhoid fever is common in children aged 5-9 years, with age specific incidence of 37.2%. This is lower than the observation made by Onile and Odugbemi in Ilorin.[13] In Mumbai the age specific incidence of typhoid fever was reported to be 66.4% in children aged 5-15 years.[14] Pandey et al [15] reported incidence of 86.5% occurring in children five years and above. All these reports showed that children are highly exposed to this infection. On the contrary, report from New Delhi [16] showed high incidence of 52.5% occurring in children below 5 years of age, whereas Ekeme and Anan [17]observed high incidence in age group 20-30 years. These can not be compared with present review as the number of children below 15 years of age was very small compared to the total number they studied.

We found that there is apparent preponderance of typhoid fever in males than females. This may be due to over indulgence activities of boys than girls therefore exposure to sources of infection. The assertion by Alfred and Edet [18] that there may be genetic predispositions to typhoid fever in female since their finding showed high incidence in female children may contradict the fact that X-chromosomes confers some immunity to infections and females are doubly endowed.[19] Moreover most of their study populations were adults and their findings of high incidence in respect to sex is much lower in children and the elderly, this might furthermore make submission of genetic predisposition unlikely.

This study also revealed that cases of typhoid are more common in April-May and August; this may not be unconnected with Maiduguri weather pattern; where we experience harmattan and sandstorms in April-June and heavy rain in August. Sandstorm may contaminate surface and underground waters which will lead to typhoid fever. Dhawan and Desai [20] have reported that the incidence of typhoid fever can be reduced greatly by providing clean water and proper hygienic conditions to the population. This confirmed our findings that revealed most of the children's sources of drinking water were from wells and water vendors which can easily be contaminated.

Poverty and infections usually forms a vicious cycle, therefore it is not surprising that most of the children in the present review came from the lowest social class four and five. In the same vein Ogunbiyi and Onabowale [21] documented that the disease was associated with socio-medical problems posed by poor standards of living and hygiene. The symptoms of typhoid fever from this review are not different from findings of various researchers, [2, 3] with fever, abdominal pain, headache

and vomiting being very common. These symptoms are not specific to typhoid, as malaria [7, 9] and even brucellosis [8] and other common childhood infections [9] can present with these symptoms. In this study only 22.9% of the clinically diagnosed typhoid fever was confirmed bacteriologically by culture of blood and or stool. Though bone marrow aspirate was not done in any of our patients, this still gives room for wrong clinical diagnoses. Other factors for low yield of culture results may be wide spread use of antibiotics before hospital presentation.[1, 7, 14] Other investigators have reported even much higher negative culture reports.[1, 14]

Widal test is widely used in Nigeria, [22] but our results revealed that it has a sensitivity of 62.5%, low specificity of 44.4% and the efficiency of this test is also low 48.6%. This shows that the Widal test alone is unreliable tool in the diagnosis of typhoid fever and should be backed up with culture positive results. This view has been shared by various authors, [17, 22, 23] some have even suggested the withdrawal of widal test in routine clinical practice. Most patients in this study were treated with ceftriaxone 65.7%, the outcomes of these treatments were excellent with 91.4% of the patients recovered fully. Incidentally this have agreed with documentation by Abuobeida [23] that Salmonella because of widespread resistance to chloramphenicol and amoxycillin has responded well to quinolones and cephalosporins especially ceftriaxone.

Conclusion

Typhoid fever remains a significant health problem in developing countries like Nigeria. The incidence of 30.5 per 1000 admission is high and therefore effort at providing clean potable drinking water, health education on personal hygiene, environmental sanitation and proper sewage disposal could be a preventive measure. In addition the availability of appropriate well equipped laboratory facilities for the diagnosis of typhoid fever by culture would enable the institution of appropriate treat ment. It is in our opinion that the use of widal test should be evaluated properly in Nigeria and see if the test should be abandoned. This will save the patients a lot of financial resources. It will also save gross abuse of antibiotics and on the long run prevent antibiotic resistant.

Limitations of the study

The following were the limitation of this study; urine culture were not done routinely, none of the patient had bone marrow biopsy for identification of the salmonella spp. Investigation to isolate *Brucella spp* was not carried out, though all patients had peripheral blood film for malaria parasites and those that are positive had antimalarial treatment. All these could have helped to improve the diagnosis or exclude typhoid fever in these patients.

Conflict of interest: None
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