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Original Research Article

A Study to Evaluate the Clinical and Laboratory Characteristics of Typhoid Fever in Newborns and Children with a Potential Focus on Gender Difference: An Observational Study

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Abstract

Aim: The aim of the present study was to assess the clinical and laboratory profile of typhoid fever in infants and children with possible gender differentiation.

Methods: The present study was a hospital-based, prospective and a cross-sectional study that was carried out at Department of Pediatrics on 200 subjects that were selected using purposive sampling technique.

Results: The majority of the patients fell between the age range of 5-15 years, accounting for 68% of the total population. This was followed by the age group of 1-5 years, which constituted 26% of the sample. The signs and symptoms of typhoid fever were examined based on age. The symptoms of headache, anorexia, and irritability demonstrated statistical significance in relation to typhoid fever ($p<0.05$). The indicators most often seen in the study population were abdominal distention, splenomegaly, and hepatomegaly. The presence of a coated tongue was seen only within the age range of 5 to 15 years. There was an absence of rose markings in all of the instances. Upon doing a study of the signs based on age, it was seen that there were no statistically significant variations in the occurrence rates of any indications among the three age cohorts. Four instances within the age range of 5-15 exhibited the presence of relative bradycardia, whereas its absence was seen in the other age groups. Anaemia was detected in a total of 116 individuals, constituting 58% of the sample population. Mean hemoglobin percentage of all cases involved in the study was 10.7% with SD of 1.5.

Conclusion: Typhoid fever is a significant public health issue mostly impacting those in the school-age demographic. Public health interventions include many strategies aimed at promoting and safeguarding the well-being of populations. These measures encompass the supply of potable water, adequate sanitation facilities, dissemination of knowledge on diseases and their transmission, and promotion of optimal hygiene practices.

Keywords: Fever, Infants, Typhoid Fever, Clinical and Laboratory Profile.

Introduction

Enteric fever is a tropical infectious illness characterised by its multi-systemic nature. The causative agents responsible for the infection are Salmonella enterica serotype Typhi (S. typhi) or Salmonella enterica serotype Paratyphi A, B, or C. The prevalence of this condition is widespread in a majority of economically disadvantaged nations, with India exhibiting a substantial illness burden of 214.2 cases per 100,000 inhabitants annually. [1] The prevalence of endemic diseases in underdeveloped nations may be ascribed to factors such as substandard living conditions, inadequate hygiene practices, insufficient sanitation infrastructure, contamination of water sources, and limited access to universal immunization programmes. The age range often afflicted by the condition is typically between five and 19 years in children. However, in some endemic regions of Asia, it is also prevalent in children who are younger than two years of age. [2] The clinical signs exhibit a lack of specificity, potentially resulting in a delay in both diagnosis and treatment, hence increasing the risk of severe consequences that may prove deadly. The range of presenting problems might span from minor constitutional symptoms to serious consequences affecting

numerous organs. The role of clinical suspicion is crucial in the process of diagnosis. Typical manifestations include elevated body temperature, emesis, gastrointestinal disturbances, discomfort in the stomach region, respiratory symptoms such as coughing, cephalalgia, and a state of diminished energy. The preferred diagnostic method is blood culture; however, it is worth noting that in around 70% of cases, the culture yields negative results as a result of the indiscriminate use of antibiotics prior to hospital admission. [3]

The evaluation of a paediatric patient who presents with fever is a consistent problem for the majority of paediatric practitioners. Typhoid fever is a prevalent aetiology of fever in paediatric patients, exhibiting a diverse range of clinical manifestations and notable distinctions in the observed signs and symptoms when compared to adult cases. Research conducted in South Asia has shown that the occurrence of typhoid fever is more prevalent among children under the age of 5 years. This age group also has a greater prevalence of complications and hospitalization compared to other age groups. The definitive diagnostic method for identifying typhoid fever is the detection of a positive culture outcome from blood, urine, or stool samples. [4] The Widal agglutination test, a well-established diagnostic tool for typhoid fever, is widely used in many regions, particularly in poor nations. [5]

Typhoid fever is a pathological condition characterized by a systemic infection caused by the bacterium Salmonella enterica serotype typhi. This highly adapted pathogen, exclusive to the human species, has evolved remarkable strategies for long-term survival inside its host, therefore facilitating its own persistence and dissemination. Children that have low body weight and demonstrate resistance to therapy are especially vulnerable. It is recommended to cleanse your hands with an antiseptic solution both after urination and before to eating meals. The use of these measures will effectively mitigate the transmission of typhoid fever and mitigate its overall impact on public health. The use of food items from external sources, especially during the summer season, such as ice cream and sliced fruits, is associated with a notable susceptibility to acquiring typhoid fever. The administration of typhoid immunizations has a crucial role in reducing the overall impact of the illness. It is essential to encourage parents to ensure that their children get immunizations.

The objective of the current research was to evaluate the clinical and laboratory characteristics of typhoid fever in newborns and children, with potential consideration of gender differences.

Materials and Methods

The present study was a hospital-based, prospective and a cross-sectional study that was carried out at Department of Pediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India for 12 months on 200 subjects that were selected using purposive sampling technique.

The inclusion criteria considered were the infants and children with fever for ≥5 days, those with positive blood culture for S. typhi and/or Widal agglutination test 1:160 or more dilution for O and/or H antigen. Children suffering from other systemic illness like congenital heart disease, tuberculosis, malignancy, terminal stage of any disease or protein energy malnutrition (PEM>Grade 3 as per Indian Academy of Pediatrics classification)[6] or whose guardians refused to give consent were excluded from the study.

After obtaining ethical approval from Institutional Review Board (IRB) of NGMCTH, a written consent was taken from parent/guardian of the subject. Detailed history and physical examination for fever, hepatomegaly, splenomegaly, bradycardia, anemia etc. was done according to a pre-designed proforma. Socioeconomic status was graded according to modified Kuppuswamy's scale. [7]

All patients included in this study underwent complete blood investigation to estimate the total and differential leukocyte count, hemoglobin level and serum transaminases (ALT, AST) by using fully automated complete analyzer, Nihon Kohden Ceitac E. Widal test was done by using semi-quantitative tube agglutination (titration) method in patient with history of fever of >7 days duration. The titre of the patient was taken as the highest dilution of the serum sample that gave a visible agglutination. Titre of 1:160 or more dilution for O and/or H antigen was considered positive. Blood culture and sensitivity test was done in all cases by collecting 5 ml of venous blood was and incubated overnight at 37°C in brain heart infusion broth.

All the variables regarding the clinical symptoms, signs and the results of laboratory investigations were recorded and analyzed using SPSS version 17. The findings were tabulated in percentage and mean±standard deviation (SD) was calculated. The statistical analysis using Chi-square was carried out and a p-value <0.05 was considered statistically significant.

Results

Table 1: Distribution of patients according to age and gender

Age group (years)	Gender				Total (n=200)	
	Female (n= 80)		Male (n= 120)			
	No.	%	No.	%	No.	%
Infants	4	5	8	6.66	12	6
1-5	12	15	40	33.34	52	26
5-15	64	80	72	60	136	68

Most of the patients were in the age group of 5-15 years (68%) followed by 1-5 years (26%).

Table 2: Distribution of clinical symptoms and signs according to age

Signs and symptoms	Infants	1-5 years	5-15 years	P-value
Pain abdomen	--	19	44	0.1
Headache	--	8	84	0.000
Vomiting	3	28	34	0.1
Constipation	--	10	32	0.2
Diarrhea	5	30	10	0.000
Cough	--	14	16	0.3
Anorexia	--	28	85	0.005
Rose spot	--	--	--	--
Sick looking	5	30	70	0.3
Restless	3	10	20	0.7
Irritable	5	35	16	0.000
Coated tongue	--	--	16	0.4
Abdominal distension	3	30	70	0.1
Abdominal tenderness	--	16	45	0.5
Splenomegaly	5	20	60	0.2
Hepatomegaly	2	25	55	0.8
Icterus	--	6	20	0.5
Cyanosis	0	8	4	0.3
Pallor	0	15	32	0.6

The signs and symptoms of typhoid fever were analyzed according to age. Headache, anorexia and irritability were statistically significant symptoms for typhoid fever ($p<0.05$). The most frequently observed signs were abdominal distention, splenomegaly and hepatomegaly. Coated tongue was found only in the age group 5-15. Rose spots were not observed in any of the cases. On the analysis of the signs according to age, there were no significant differences in the frequency of any signs in the three age groups.

Table 3: Distribution of clinical symptoms and signs according to gender

Signs and symptoms	Male (n= 120)		Female (n= 80)		P-value
	No.	%	No.	%	
Pain abdomen	36	30	32	40	0.3
Headache	65	54.16	52	65	0.3
Vomiting	48	40	32	40	0.5
Constipation	28	23.34	20	25	0.7
Diarrhea	36	30	12	15	0.3
Cough	16	13.34	16	20	0.6
Anorexia	80	66.66	60	75	0.6
Sick looking	80	66.66	56	70	0.7
Restless	30	25	8	10	0.2
Irritable	56	46.66	16	20	0.2
Coated tongue	4	3.34	12	15	0.1
Abdominal distension	64	53.34	48	80	0.01
Splenomegaly	64	53.34	44	55	0.8
Hepatomegaly	56	46.66	48	60	0.5
Icterus	12	10	16	20	0.4
Cyanosis	4	3.34	2	2.5	0.9
Pallor	40	33.34	12	15	0.1

Most of the symptoms were similar in both sexes. Almost all the signs and symptoms were more common in males as compared to females. Abdominal distention was significantly more in females as compared to males with a p-value of 0.01.

Table 4: Distribution of relative bradycardia in different age group and frequency of anemia

Relative bradycardia	Age			
	Infants	**1-5 Years**	**5-15 Years**	
Present	--	--	10	
Absent	8	44	98	
Total	8	44	108	
Anemia	**Frequency**	**Percent**	**Hemoglobin (gm/dl)**	
Present	116	58	**Mean**	**SD**
Absent	84	42	10.5	1.7

Relative bradycardia was present in 4 cases in the age group 5-15 and absent in other age groups. Anemia was found in 116 (58%) patients. Mean hemoglobin percentage of all cases involved in the study was 10.7% with SD of 1.5.

Table 5: Distribution of leukocytosis in different age groups

Age group (years)	Number	% age	P-value
Infants (n=12)	8	100	0.003
1-5 (n=52)	16	30.76	
5-15 (n=136)	25	18.38	

All of the infants showed leucocytosis whereas only 16 (30.76%) patients in age group 1-5 and 25 (18.38%) in age group 5-15 had leucocytosis, which was statistically significant with p-value of 0.003. Leucopenia was not observed in any patient.

Table 6: Differential leukocyte count in different age group

Age group (years)	Mean neutrophil	Mean eosinophil	Mean basophil	Mean monocyte	Mean lymphocyte
Infants	63.5	2	--	0.2	28
1 to 5 years	64.6	0.7	0.3	0.8	34.6
5 to15 years	66.4	1.7	0.1	0.8	32.4

The above table depicted differential leukocyte count in different age groups.

Discussion

Typhoid fever is a communicable illness that arises from the presence of gram-negative bacteria known as Salmonella enteric serovar typhi (S.typhi). In industrialized nations, the prevalence of typhoid fever is often around 15 cases per 100,000 individuals, mostly affecting travellers. Conversely, in underdeveloped nations, the estimated incidence rate ranges from 100 to 1,000 cases per 100,000 individuals. [4] The prevalence of this issue is seen in underdeveloped nations characterized by inadequate water sources and sanitary facilities. [8] The organism is exclusively hosted by the human population, serving as the only natural reservoir. In order to get infected, it is necessary to have either direct or indirect contact with an individual who is carrying the illness. The individual who is infected excretes the germs via their faces and urine. The primary means of transmission for S. typhi is via the consumption of food or water that has been contaminated with human faecal matter. [9]

The majority of patients fell between the age range of 5-15 years, accounting for 68% of the total population. This was closely followed by the age group of 1-5 years, which constituted 26% of the sample. The current research observed a higher prevalence of males. Consistent findings were seen in other research investigations. [10-13] The signs and symptoms of typhoid fever were examined with respect to age. The symptoms of headache, anorexia, and irritability demonstrated statistical significance in relation to typhoid fever ($p<0.05$). This finding aligns with previous research undertaken by Raj (2014), Chandrashekhar et al. (2015), and Gosai et al. (2016). [14-16] The present investigation found a higher prevalence of headaches among those aged 5-15 years, with 40 patients (54.1%) reporting this symptom. This finding aligns with previous studies done by Lefebvre et al [17], Joshi BG et al [18] , and Khan et al. [19] The indicators most often seen in the study population were abdominal distention, splenomegaly, and hepatomegaly. The presence of a coated tongue was seen only within the age range of 5 to 15 years. No instances of rose spots were detected in any of the patients. The examination of the signs based on age revealed no statistically significant variations in the occurrence rates of any indications across the three age cohorts. Anaemia was seen in a total of 55 individuals, accounting for 55% of the study population. The mean haemoglobin percentage of all patients included in

the research was 10.5%, with a standard deviation of 1.7. The majority of the investigations indicated a higher prevalence of leucopenia as opposed to leucocytosis. [16-18]

The prevalence of 10.7% in children under the age of two underscores the need of timely immunization as a preventive measure against the illness. This observation aligns with the conclusions drawn by Verma M et al. and Saha et al. [20,21] A further investigation conducted in Dhaka, Bangladesh by Hyder et al. focused only on a cohort of children aged two years and below. A total of 40 instances of enteric fever were identified during a 10-month timeframe, contradicting the prevailing notion that this age group seldom experiences such occurrences. [22] Four instances in the age range of 5-15 exhibited the occurrence of relative bradycardia, whereas its absence was seen in the other age groups. The research done by Ganesh et al. [23] revealed a prevalence of relative bradycardia in 15.2% of cases, mostly seen in children aged above 5 years. This finding is consistent with the results of the current study. In the current investigation, the absence of leucopenia was not detected, maybe attributable to the use of antibiotics by almost all patients prior to their presentation.

All of the newborns exhibited leucocytosis, but only 16 (30.76%) patients in the age range of 1-5 and 25 (18.38%) in the age group of 5-15 had leucocytosis. This difference was found to be statistically significant, with a p-value of 0.003. Leucopenia was not identified in any of the patients.

Conclusion

Typhoid fever is a significant public health issue, mostly impacting those in the school-age demographic. Public health interventions include many strategies aimed at promoting and safeguarding the well-being of communities. These interventions often involve the implementation of measures such as ensuring access to potable water, improving sanitation facilities, disseminating knowledge about diseases and their transmission, and fostering adherence to optimal hygiene practices. It is essential to provide comprehensive instruction on appropriate hand hygiene protocols to those employed in the food service industry, with particular emphasis on establishments such as hotels, hostels, and public schools. In addition, the implementation of typhoid vaccine and the judicious use of antibiotics guided by culture sensitivity patterns may contribute to the reduction of the overall burden of sickness.

References

1. Ochiai RL, Acosta CJ, Danovaro-Holliday MC, Baiqing D, Bhattacharya SK, Agtini MD, Bhutta ZA, Canh DG, Ali M, Shin S, Wain J. A study of typhoid fever in five Asian countries: disease burden and implications for controls. Bulletin of the World Health Organization. 2008 Apr;86(4):260-8.
2. Laishram N, Singh PA: Clinical profile of enteric fever in children. J Evolution Med Dent Sci. 2016, 5:114-116.
3. Rabasa A, Mava Y, Pius S, Timothy SY, Baba UA: Typhoid fever in children: clinical presentation and risk factors. Niger J Paediatr. 2013,40:60-63.
4. Zulfiqar Ahmed Bhutta. Enteric Fever (Typhoid Fever). In: Kliegmen RM, Stanton BF, St. Geme JW, Schor NF, Behrman RE, editors. Nelson Textbook of Pediatrics. 20th ed. Philadelphia: Elsevier; 2015. pp 1388-93.
5. Acharya T, Tiwari B R, Pokhrel B M. Baseline Widal agglutination titre in apparently healthy Nepalese blood donors. JHAS. 2013;3(1):27-30.
6. Parthasarathy A et al. IAP Textbook of Pediatrics 3rd Edn. Jaypee Brothers Medical Publishers (P) Ltd: 2006;120-39.
7. Bairwa M, Rajput M, Sachdeva S. Modified Kuppuswamy's Socioeconomic Scale: Social Researcher Should Include Updated Income Criteria, 2012. Indian J Community Med. 2014; 38:185–6.
8. Hetal N. Jeeyani, Baldev S. Prajapati, Afroz Bloch. Enteric Fever in Children-Clinical profile, sensitivity patterns and response to antimicrobials. GCSMC J Med Sci. 2015; 4(1): 40-3.
9. B. Prajapati, GK. Rai, SK. Rai, HC. Upreti, M. Thapa, G. Singh, RM Shrestha. Prevalence of Salmonella typhi and paratyphi infection in children, a hospital based study. Nepal Med Coll J. 2008;10(4):238-44.
10. Mithilesh S, Raju G. Pediatric nature of enteric fever with emerging antibiogram: a cross sectional study. Int J Pediatr Res. 2018;4(2).
11. International Journal of current Microbiology and Applied sciences. 2015;4(12):541-7.
12. Devaranavadagi RA. A study on clinical profile of typhoid fever in children.Int J Contemp Pediatr. 2017;4(3);1067-107.
13. Mehul MG, Hareshwaree. BH, Payal HP, Abeda. GM. A study of clinical profile of multidrug resistant typhoid fever in children. NJIRM. 2011;2(3):87-90.
14. Raj C. Clinical profile and antibiotic sensitivity pattern of typhoid fever in patients admitted to pediatric ward in a rural teaching hospital. Inte Jour of Medi Res & Health Sci. 2014;3(2):245-8.
15. Chandrashekar A, Sodhi K, Dalal S.S. Study of clinical and laboratory profile of enteric fever in pediatric age group. International Journal of

Basic and Applied Medical Sciences. 2013;3 (3):16-23.
16. Gosai M, Hariyani B, Purohit H, Momin G. A study of clinical profile of multidrug-resistant typhoid fever in children. NJIRM. 2011;2(3) :87-90.
17. Lefebvre N, Gning SB, Nabeth P, Ka S, Ba-Fall K, Rique M et al. Clinical and laboratory features of typhoid fever in Senegal. A 70-case study. Med Trop (Mars). 2005;65(6):543-8.
18. Joshi BG, Keyal K, Pandey R, Shrestha BM. Clinical profile and sensitivity pattern of Salmonella serotypes in children: A hospital-based study. J. Nepal Paediatr. Soc.2011; 31(3):180-3.
19. Khan M, Soofi S, Ochiai R, Khan M, Sahito S, Habib M, Puri M et al. Epidemiology, clinical presentation, and patterns of drug resistance of Salmonella Typhi in Karachi, Pakistan. J Infect Dev Ctries. 2012;6(10):704-14.
20. Verma M, Chhatwal J, Saini V, Singh T: Enteric fever below 2 years of age. Indian Pediatr. 1996; 33:229-30.
21. Saha SK, Baqui AH, Hanif M, et al.: Typhoid fever in Bangladesh: implications for vaccination policy. Pediatr Infect Dis J. 2001; 20:521-4.
22. Hyder RT, Yasmeen BN, Ahmed S, Islam MS, Islam F: Clinical profile and outcome of enteric fever in hospitalized children aged 6 months to 2 years. North Int Med Coll J. 2013; 5:301-305.
23. Ganesh R, Janakiraman L, Vasanthi T, Sathiyasekeran M. Profile of typhoid fever in children from a tertiary care hospital in Chennai-South India. Indian J Pediatr. 2010;77 (10):1089-92.