

Effect of Enteric Fever on Hematological Cells Parameters

Dr. Israr Ullah Rahimee¹ and Dr. Mohammad Azim Azimee²

¹Senior Teaching Assistant, MD, Department of Microbiology, Faculty of Nangarhar Medical, Jalalabad, AFGHANISTAN.

²Associate Professor, MD, Department of Biochemistry, Faculty of Nangarhar Medical, Jalalabad, AFGHANISTAN.

¹Corresponding Author: israrullahrahimee@gmail.com



www.jrasb.com || Vol. 3 No. 2 (2024): April Issue

Received: 03-04-2024

Revised: 13-04-2024

Accepted: 19-04-2024

ABSTRACT

Background: *Salmonella typhoid* and *paratyphoid* are the agents that cause Enteric fever (Typhoid fever). It is primarily a disease of developing countries because of poor sanitation standards.

Fever is a prominent and well-known feature of the illness that increases steadily to a maximum degree. The hematological criteria of an affected individual are changed by this infectious disease. To ascertain the different hematological cells parameters in our sample population, we conducted the investigation.

Patients and Methodology: The study, which involved 100 Afghans, was carried out at the Nangarhar University Teaching Hospital between June and November of 2022.

A case-control study design was used. Fifty individuals (Cases) who had a confirmed diagnosis of Enteric fever (Typhoid fever) based on typhoid (IgG and IgM) were included in the study. As a control group, fifty healthy individuals with negative typhoid (IgG and IgM) results and no other complaints were included in the study.

For both the case and control groups, a complete blood count was performed. Hemoglobin (Hb), White Blood Cell Count (WBC), and Platelet Count (PLT) are regarded as hematological markers. Every patient was also interviewed, and a questionnaire was employed. Numerous demographic factors were questioned, including sex, age, economic status, level of education, and clinical symptoms. SPSS version 16 was then used to analyze the collected data.

Results. In the current research, over all 100 patients were enrolled (50 were case, and 50 were control group). The mean age \pm SD of the patients under the study were 38.74 \pm 15.22 years. The most common hematological changes observed were; anemia (32%), thrombocytopenia (24%), leukocytosis (8%) & leucopenia (22%). Fever was the most common presenting symptom (78%) and abdominal symptoms were about 38%. Most of the people were of lower socioeconomic state and were uneducated.

Conclusion: This study shows that Enteric fever is bacterial infection and are acquired by enteral route. This disease commonly affects people of low socioeconomic states and those that are uneducated. Fever was the most commonly presenting symptom in these patients. Enteric fever causes changes in the hematological cells parameters which is probably due to bone marrow suppression, which is transient and shows response to therapy.

Keywords- Enteric fever, hematological changes, *Salmonella typhoid*.

I. INTRODUCTION

In many developing and developed nations alike, typhoid fever (Enteric fever) is a serious public health hazard [1]. It is the second most prevalent cause of fever after malaria and is indigenous to the tropics. *Salmonella typhi* is the causative agent of typhoid fever (enteric fever), which is typically contracted by humans

consuming contaminated food or water that has been contaminated with the urine or feces of infected carriers. It primarily affects youth and young adults, with over 12.6 million cases of morbidity worldwide and an around 600,000 deaths every year [2]. In poorer nations, attack rates as high as 1100 instances per 100,000 people have been reported [3]. Bad personal hygiene, particularly when it comes to contaminated food and drinking water,

is the main cause of the illness [4,5,6]. Thus, the most prevalent method of transmission is direct fecal oral [7]. Consuming fresh fruits and vegetables that have been fertilized by human excrement as well as contaminated milk and milk products when they have not been thoroughly decontaminated can further spread the infection. By transferring infectious agents to food, flies function as a mechanical carrier of the bacteria that infect humans. Typhoid fever epidemics are caused by the pollution of water sources [8], typically when a big number of people drink from the same water source [6]. There is an incubation period of roughly 10 to 14 days after consumption [9]. During this time, the bacteria leave the gut and travel via the blood, where they proliferate, before arriving in the gall bladder, liver, spleen, and intestinal lymph nodes [10]. Nonetheless, they tend to concentrate in the intestine, where they produce ulcers and inflammation. There is frequently a lesion in the intestinal tract, increasing the risk of internal bleeding and perforation [10]. Typhoid fever (Enteric fever) frequently results in intestinal perforation, which is followed by intestinal contents leaking into the abdominal cavity (peritonitis). Clinical signs of typhoid fever include a high temperature that does not go away, headaches, constipation, acute exhaustion, joint pain, splenomegaly, intestinal inflammation with the development of ulcers, and an iconic rose-spot eruption on the abdomen. [9]. Affected individuals with typhoid fever have been linked to certain physiological alterations, which are a component of the disease's pathogenesis. Scientific research on the related effects of typhoid fever on RBC, HB, WBC, and platelets is scarce. When developed, this study will identify the association between typhoid fever and hematological alterations in both male and female patients. It will also assist in evaluating the hematological changes associated with these individuals. illnesses like thrombocytopenia, leucopenia, anemia.[10].

II. MATERIALS AND METHODS

Study area, study design and population

This is a case control study. This study was conducted on OPD patients in Nangahar university teaching hospital. All of 100 patients were included in the study (50 were case group and 50 were of control group).

Inclusion Criteria: The age range of case and control groups were between 18 and 70 years. Both sexes were included. Patients with complaints of fever and other related symptoms of Enteric fever were investigated for

typhoid. Diagnosis was confirmed by a typhoid (IgG and IgM) test for typhoid fever. All patients diagnosed with typhoid (IgG and IgM) positive test were selected as case group and typhoid (IgG and IgM) negative were selected as control group.

Exclusion Criteria: Patients who had started antibiotic treatment before presenting to our hospital were excluded. Patients suffering from other major systemic illness - history of liver disease, renal disease, hematological disorders, immunocompromised status (drugs/HIV) and or malaria were excluded.

Data collection

An informed consent was taken and a detailed clinical history was taken to rule out the confounding illnesses as listed above and also ask about the symptoms of current illness (typhoid or Enteric fever). Information of subjects recruited for the study was obtained by using a questionnaire which contains age, sex, socioeconomic status, education. Symptoms are also asked and are added to the question are. Using 5 ml disposable syringe, three ml of venous blood was drawn in from each patient for CBC and typhoid (IgG and IgM) test. Sample for CBC was collected in EDTA tube. As Nangahar is endemic for malaria, so A peripheral blood smear was prepared and studied in each case to study the general blood picture and presence of Plasmodium species. Blood was centrifuged and typhoid (IgG and IgM) test were done for all of them, case group were typhoid (IgG and IgM) positive and control group were typhoid (IgG and IgM) test negative. Also, CBC were done for all of them. Collected data were then analyzed and following results are obtained. Anemia was diagnosed by Hb < 12 g/dl, while PLT count < 150 × 10⁹/l and WBC count < 4.0 × 10⁹/l were used respectively to determine thrombocytopenia and leukopenia.

III. RESULTS

This was a case control study. Which is undergone by 100 subjects {50 of them were Enteric fever positive (case group) and 50 were Enteric fever negative healthy patients (control group)}. The age of patients in case group were (38.74±15.22) years. All of them were evaluated by doing blood hematological tests (Hemoglobin, TLC, Platelet count, Enteric fever antibody tests). Demographic parameters, clinical data and laboratory Parameter details were noted and analyzed using SPSS software version 16(SPSS Inc., Chicago, IL, USA).

The results of them are as follows.

Table 1: the demographical parameters of the patients

Variables	Category	Case group		Control group	
		No. of patients	Percentage (%)	No. of patients	Percentage
Education	Educated	22	44	28	56
	Uneducated	28	56	22	44
Economics	High	10	20	12	24
	Middle	17	34	18	36

	<i>Low</i>	23	46	20	40
Sex	<i>Male</i>	32	64	30	60
	<i>Female</i>	18	36	20	40

We can infer from the preceding table that the subjects in both groups shared the same demographic characteristics. According to the case group, 64% of the patients were men, meaning that men were twice as likely

as women to get enteric fever. Additionally, individuals with enteric fever are primarily from lower- and middle-class backgrounds. Our research indicates that those with less education are more susceptible to enteric fever.

Table 2: Comparison of clinical parameters among case and control groups.

Variables	Category	Case group		Control group	
		No. of patients	Percentage (%)	No. of patients	Percentage (%)
Fever	<i>Present</i>	39	78	-	
	<i>Absent</i>	11	22	50	
Abdominal pain	<i>Present</i>	18	36	-	
	<i>Absent</i>	32	64	50	
Anorexia	<i>Present</i>	18	36	-	
	<i>Absent</i>	32	64	50	
Headache	<i>Present</i>	12	24	-	
	<i>Absent</i>	38	76	50	
Diarrhea	<i>Present</i>	13	23	-	
	<i>Absent</i>	37	74	50	

This table shows that all control group subjects had no clinical signs and symptoms, but in case group the results of clinical signs and symptoms are as follows. Fever was the most common presenting symptom in

nearly all patients. Abdominal pain and anorexia were also present in about one third cases. Also, diarrhea and headache were of the least presenting symptoms.

Table 3: Comparison of the various hematological parameters in both case and control groups

Blood test	Case group		Control group	
	No. of patients	Percentage (%)	No. of patients	Percentage (%)
Hemoglobin<12gm/dl	16	32	5	10
WBC count>11000 cells/mm3	4	8	3	6
WBC count<4000cells/mm3	11	22	2	4
Thrombocytopenia <1.5 lac	12	24	1	2

This data demonstrates that anemia was present in 32% of typhoid-positive patients, leukocytosis was more common than leukopenia, and thrombocytopenia was present in roughly 24% of patients, which differed significantly from the control group.

IV. DISCUSSION

In developing nations, enteric fever is associated with a high rate of death and morbidity, particularly in children [11]. Water, drinks, or food that has been tainted can transmit the bacilli. The most common cause of enteric fever is poor personal hygiene. It is prevalent in areas with inadequate sanitation, particularly those where human excreta pose a risk of contaminating the water supply. It is a systemic infection that manifests itself in various ways. Fever, headaches, anorexia, relative

bradycardia, diarrhea or constipation, and abdominal pain are typical presenting symptoms [12].

By this reason in our study cases were more in uneducated and of low economic state patients. and Fever is the most frequent presenting symptom in our study as well.

Enteric fever is diagnosed on the basis of clinical suspicion and is validated by laboratory testing. When treated properly, enteric fever is a transient febrile condition with few sequelae and a 0.2% chance of death [13]. Positive cases were frequently observed in young people in the current investigation, which is consistent with the Wasfy et al. study [14].

Males are more affected than females in our study group. This holds true for another research as well. Hematological abnormalities such as anemia, leucopenia, leukocytosis, thrombocytopenia, and occasionally pancytopenia is frequently observed in cases of enteric fever. Hem phagocytosis and bone marrow

suppression are thought to be key players in the production of hematological abnormalities [15]. Hemoglobin is often normal in patients throughout the early stages of the disease, but it gradually drops; as a result, different studies find varying outcomes. Anemia was present in 32% of the patients in our study, which is comparable to the findings of Ahmed et al. (38%) and Alam (31%) [16–17], but less than that of Joseph et al. [77.8%] and Rasoolinejad et al. (79.4%) [1]. Most of the patients had normal leukocyte counts [18], which is in line with previous reports [19]. One prevalent hematological finding in cases of enteric fever is reportedly leucopenia. While leucopenia was found in 22% of the individuals in our study, Ahmet et al. [21] and Rasoolinejad et al. [22] found it in 18% and 11.2% of the cases, respectively. 40% of the cases had thrombocytopenia, which was more than the 10% and 9.1% of cases that previous investigators had noted.

V. CONCLUSION

Our research led us to the conclusion that men are more likely than women to get enteric fever, and this can be linked to the fact that male subjects have a higher level of enteric fever-causing predisposing factors, likely as a result of their social and occupational practices. This means that male subjects tend to have a greater immunity to this infection than do female subjects.

People with poor socioeconomic status and little education are also more likely to have enteric fever. The most frequent initial symptom is fever, though gastrointestinal issues can also occasionally manifest. Patients with enteric fever experience severe hematological abnormalities. Antimicrobial therapy will address these temporary alterations.

Limitations

- Incomplete resources and small sample size affect research accuracy
- No interest of patients in participating research programs

Recommendations

- All patients residing in endemic areas should be evaluated for enteric fever,
- Personal hygiene is crucial for the prevention of enteric fever.
- Additional study is needed to determine hematological connections among individuals with positive blood cultures for enteric fever.

REFERENCES

- [1] Stormaon MO, McIntyre PB, Morris J, Fasher B. Typhoid fever in children: diagnosis and therapeutic difficulties. *Pediatric Infectious Disease Journal*, 1997; 16: 713 -714.
- [2] Wasfy MO, Oyofa BA, David JC. Isolation and antibiotic susceptibility of Salmonella, Shigella and Campylobacter from acute enteric infection in Egypt. *Journal of Health, Population and Nutrition*, 2000; 18(12): 33 - 38.
- [3] Ivanoff B, Levine MM, Lambert PH. Vaccination against typhoid fever: present status. *Bulletin World Health Organization*, 1994; 72(6): 957 - 971.
- [4] Gasem MH, Dolmans WM, Keuter MM, Djokomoeljanto RR. Poor food hygiene and housing as risk factors for typhoid fever in Semarang, Indonesia. *Tropical Medicine & International Health*, 2001; 6(7): 484 - 490.
- [5] Ram PK, Naheed A, Brooks WA. Risk factors for typhoid fever in a slum in Dhaka, Bangladesh. *Epidemiology and Infection*, 2007; 135: 458 - 465.
- [6] Ochiai RL, Acosta CJ, Danovaro-Holliday MC. A study of typhoid fever in five Asian countries: disease burden and implications for controls. *Bulletin of the World Health Organization*, 2008; 86: 260 - 268.
- [7] Karkey A, Thompson CN, Tran-Vu-Thieu N. Differential epidemiology of Salmonella typhi and Paratyphi A in Kathmandu, Nepal: “A matched case control investigation in a highly endemic enteric fever setting.” *PLoS Neglected Tropical Diseases*, 2013; 7(9): 2391 – 2394.
- [8] Meltzer E, Stienlauf S, Leshem E, Sidi Y, Schwartz E. A large outbreak Salmonella Paratyphi A infection among Israeli travelers To Nepal. *Clinical Infectious Diseases*, 2014; 58: 359 - 364.
- [9] Jawetz, E, Melnick JL, Adelberg EA. Review of Medical Microbiology 12th Edition. Lange, Los Altos, California. 1976; pp 226 -228.
- [10] Turk DC, Porter IA. Medical Microbiology 3rd Edition. English Universities Press Limited. pp. 1982; 30 - 35.
- [11] Abro AH, Abdou AMS, Gangwani JL, Ustadi AM, Younis NJ, Hussaini HS. Hematological and biochemical changes in Enteric fever. *Pakistan Journal of Medical Sciences*.2009; 25(2): 166 – 171
- [12] B. M. K. Cheong. Enteric fever Presenting as Acute Cerebellar Ataxia and severe Thrombocytopenia. *The Medical Journal of Malaysia*. 2008; 63 (1): 77-78.
- [13] Lynch MF, Blanton EM, Bulens S, Polyak C, Vojdani J, Stevenson J, et al. Enteric fever in United States,1999- 2006.*JAMA* 2009;(302):859-865
- [14] Wasfy MO, Oyofa BA, David JC. Isolation and antibiotic susceptibility of salmonella, shigella and campylobacter from acute enteric infection in Egypt. *J Health Popul Nutr* 2000; 18:33 38.
- [15] Khosla SN, Anad A, Singh U. Hematological profile in Enteric fever. *Tropical Doctor* 1995; 25:156-8.

-
- [16] Malik AS. Complication of bacteriologically confirmed Enteric fever in children. *J Trop Ped* 2002; 48:102-8.
- [17] "Enteric fever: MedlinePlus Medical Encyclopedia". medlineplus.gov. Retrieved 2020-04 21.
- [18] Malik AS. Complication of bacteriologically confirmed Enteric fever in children. *J Trop Ped* 2002; 48:102-8.
- [19] Joseph J, Tarun KD, Jayanthi S. Correlation of clinical and hematologic profile with bone marrow responses in Enteric fever. *Am J Trop Med Hyg* 1997;57(3):313-16.
- [20] Rasoolinejad M, Esmail poor NB, Mogbel BA. Salmonella Hepatitis (analysis of hepatic involvement in 107 patients with Enteric fever). *Acta Medica Iranica* 2003;4.161-3.
- [21] Ahmet Y, Idris Y, Selahattin K. Clinical and laboratory presentation of Enteric fever. *International Pediatric* 2001; 4:227-31.
- [22] Jump up to: "Typhoid vaccines: WHO position paper" (PDF). *Relevé Epidemiology Hebdomadaries*. 83 (6): 49–59. February 2008. PMID 18260212. Archived (PDF) from the original on April 2, 2015