ORIGINAL ARTICLE

HEMATOLOGICAL PARAMETERS IN PEDIATRIC PATIENTS WITH ENTERIC FEVER

Abdul Khaliq, Zia Muhammad, Hameed Ul Haq, Tabinda Shadab, Syed Mohsin Ali Shah, Sabir Khan

[1]Department of Paediatrics, Khyber Medical College/Khyber Teaching Hospital, Peshawar - Pakistan

ABSTRACT

Objective: To determine the frequency of ventricular tachycardia in patients with acute coronary syndrome (ACS) during the first 24 hours of admission

Objective: To evaluate hematological parameters in pediatric patients with enteric fever admitted to the Department of Child Health at Khyber Teaching Hospital, Peshawar, Pakistan.

Materials and Methods: This was a retrospective chart review of 219 patients admitted to the ward who met our inclusion criteria. The data collected was from September 20, 2022, to September 20, 2023. They were managed in accordance with the department's protocol. Blood culture data for patients with Enteric fever were collected and recorded. Data were analyzed using SPSS-23.

Results: A total of 219 patients participated in this study. The average age was 7.51±3.36 years. Of these patients, 61.6% (n=135) were male, and 38.4% (n=84) were female. Seventy-six percent showed signs of anemia. Regarding hematological parameters and gender, anemia occurred in 87% of females compared to 69% of males, with a significant association (p=0.002). Neutropenia was more common among males (13%) than females, while leucopenia (15.5%), thrombocytosis (12%), thrombocytopenia (25%), bi-cytopenia (20%), and pancytopenia (6%) were more common in females. Anemia (90%) and neutropenia (19%) were most frequent in the youngest age group (1-5 years), with significant links (p=0.000 and 0.014, respectively). Leucopenia (13%) and pancytopenia (6%) were common among the oldest group, aged 11-15 years. Thrombocytopenia (24%) and bi-cytopenia (21%) were prevalent among patients aged 6 to 10 years.

Conclusion: Enteric fever is endemic in our region. Hematologic abnormalities are a feature of enteric fever and can be used as a diagnostic clue for early diagnosis.

Keywords: Enteric Fever, Thrombocytopenia, Anemia, Neutropenia.

This article may be cited as: Khaliq A, Muhammad Z, Haq HU, Shadab T, Shah SMA et al. Hematological Parameters In Pediatric Patients With Enteric Fever. J Med Sci 2025 October - December;33(4):202-205

INTRODUCTION

Enteric fever is a common infectious disease and remains a significant public health concern in developing countries. It is a systemic illness caused by the Gram-negative bacterium Salmonella enterica. Enteric fever includes typhoid fever caused by Salmonella typhi and paratyphoid fever caused by Salmonella paratyphi A and B. Salmonella typhi accounts for approximately 97% of enteric fever cases worldwide. Each year, about 215,000 deaths occur out of more than 26 million cases of enteric fever and 5 million cases of paratyphoid infection globally. The incidence of typhoid fever in Central Asia, South Asia, Southeast Asia, and South Africa exceeds 100 cases per 100,000 people annually, classifying these countries as having high typhoid fever rates. Children face higher mortality rates due to weaker immune systems and greater exposure to fecal matter. With proper treatment, the death rate drops below 1%, but if antibiotics are delayed or not administered, it can increase to 10%. [5, 6]

The total white blood cell count is usually within or below the normal range (Leucopenia). Leukocytosis may indicate intestinal perforation or other pyogenic infections. There is mild normochromic, normocytic anemia with thrombocytopenia. [7-10] Enteric fever can be mistaken for dengue fever and malaria and must be diagnosed and treated early to prevent complications. Some studies have shown that thrombocytopenia might serve as a marker of severity in Enteric fever and help identify those at risk of developing complications.[11] The hematological signs of enteric fever include bi-cytopenia and pancytopenia, which, besides aiding in diagnosis, can also help monitor the disease progress and response to treatment. Since a complete blood count is usually the initial test ordered, it can assist in diagnosis when combined with a detailed history and clinical findings. It is an inexpensive and sim-

Correspondence
Dr. Zia Muhammad
Associate Professor
Department of Paediatrics, Khyber Medical College/Khyber Teaching Hospital, Peshawar - Pakistan
Cell: +92-321-9086395
Email: Abdul Khaliq: drziamuhammad@gmail.com
Date Received: 09/12/2025
Date Revised: 17/12/2025
Date Accepted: 23/12/2025

ple test that can be performed at almost any healthcare facility without delays. The purpose of this study is to assess hematological parameters in pediatric patients with enteric fever, identify those at risk of early complications, and carry out appropriate, timely interventions.

MATERIAL AND METHODS

This was a descriptive cross-sectional study conducted in the pediatric department at Khyber Teaching Hospital from September 20, 2022, to September 20, 2023. It was a retrospective review of medical records and hospital charts using a consecutive sampling technique. The inclusion criteria were children of both genders aged 1 to 15 years with blood culture-proven enteric fever. Children under 1 year or over 15 years, as well as those with enteric fever and comorbidities such as malignancy, thalassemia major, chronic kidney disease, nephrotic syndrome, chronic liver disease, hemolytic anemia, celiac disease, immunodeficiency, or multi-organ failure, were excluded. After approval from the Ethical board, relevant data will be extracted from the medical charts/hospital records of patients admitted with blood culture-proven enteric fever between 20th September 2022 and 20th September 2023. Upon fulfilling predefined inclusion criteria, charts will be reviewed for information, including the patient's demographics and hematological measurements. Data will be analyzed using SPSS version 23. Numerical variables will be presented as Mean ± SD. Categorical variables will be shown as percentages and compared using the chi-square test. A P-value of <0.05 will be considered statistically significant.

RESULTS

A total of 219 patients were enrolled in this study. The mean age recorded was 7.51±3.36. Out of 219 patients, 61.6%(n=135) were male and 38.4%(n=84) were female. Figure 1 shows the frequency distribution of hematological parameters in the patients. Seventy-six percent of the patients manifested anemia. Table 1 displays the relationships between hematological parameters and patient gender. Anemia was present in 87% of female patients compared to 69% of male patients, showing a significant association (p=0.002). Neutropenia was more common in males (13%) than in females, while leucopenia (15.5%), thrombocytosis (12%), thrombocytopenia (25%), bi-cytopenia (20%), and pancytopenia (6%) were observed among females. However, these findings did not show a significant association.

The patients' ages were grouped into three categories: 1-5 years, 6-10 years, and 11-15 years. Table 2 shows the relationships between these age groups and various hematological characteristics. Anemia (90%) and neutropenia (19%) were most common in the youngest group (1-5 years), with significant associations (p=0.000 and 0.014, respectively). Leucopenia (13%) and pancytopenia (6%) were more frequent among the oldest group (11-15 years). Thrombocytopenia (24%) and bi-cytopenia (21%) were prevalent among patients aged 6 to 10 years.

DISCUSSION

Hematological changes are frequent in enteric fever, and although transient and responsive to the appropriate antibiotics, they can result in life-threatening complications. In our study, the average age of patients was 7.5 years, which aligns with another study conducted in Lahore but is older than a study in Karachi (5.7 years) and younger than a study from Turkey (10.6 years). [12, 13] Males were more affected by enteric fever, accounting for 62%, a result consistent with multiple national studies (65% in Lahore and 51% in Karachi) and international studies (52.5% in Turkey and 57.5% in India). Anemia was the most common finding among our patients, reported in 76% of cases. In a regional analysis, a meta-analysis found that ane-

Table No 1: Association between gender and hematological parameters.

		Male	Female	Chi square	P value
Anemia	**Yes**	93(69)	73(87)	**9.162**	**0.002**
	No	42(31)	11(13)		
Neutropenia	Yes	17(13)	7(8)	9.63	0.226
	No	118(87)	77(92)		
Leucopenia	Yes	13(10)	13(15.5)	1.692	0.139
	No	122(90)	71(84.5)		
Thrombocytosis	Yes	9(7)	10(12)	1.793	0.138
	No	126(93)	74(88)		
Thrombocytopenia	Yes	28(21)	21(25)	0.541	0.283
	No	107(79)	63(75)		
Bi-cytopenia	Yes	22(16)	17(20)	0.550	0.286
	No	113(84)	67(80)		
Pancytopenia	Yes	6(4)	5(6)	0.247	0.421
	No	129(96)	79(94)		

Table No 2: Association between age groups and hematological parameters

Parameter		1-5 years	6-10 years	11-15 years	Chi square	P value
Anemia	**Yes**	65(90)	77(77)	**24(51)**	**23.983**	**0.000**
	No	7(10)	23(23)	23(49)		
Neutropenia	Yes	14(19)	8(8)	2(4)	8.375	0.014
	No	58(81)	92(92)	45(96)		
Leucopenia	Yes	8(11)	12(12)	6(13)	0.077	1.000
	No	64(89)	88(88)	41(87)		
Thrombocytosis	Yes	8(11)	7(7)	4(8.5)	0.895	0.671
	No	64(89)	93(93)	43(91.5)		
Thrombocytopenia	Yes	14(19)	24(24)	11(23)	0.537	0.776
	No	58(81)	76(76)	36(77)		
Bi-cytopenia	Yes	12(17)	21(21)	6(13)	1.577	0.440
	No	60(83)	79(79)	41(88)		
Pancytopenia	Yes	3(4)	5(5)	3(6)	0.293	0.922
	No	69(96)	95(95)	44(94)		

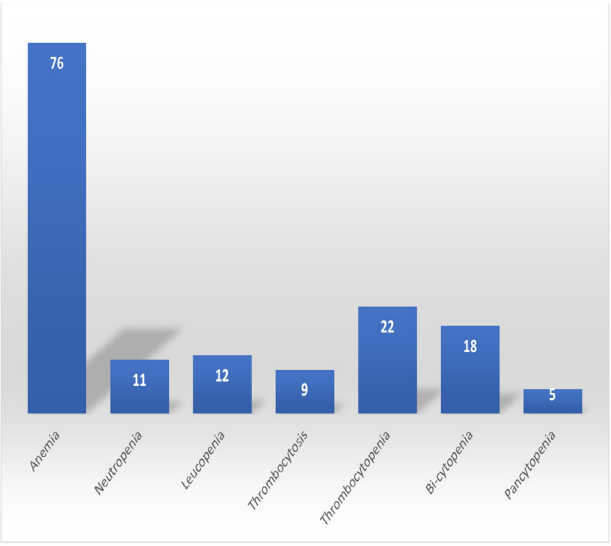

Fig 1: Age groups of breast cancer patients (n=230)

mia was most frequent among patients from South Asia (73%) and least common among those from the Middle East and North Africa (26%). Local studies also reported anemia as a frequent finding among patients with enteric fever (65.7%)[12]. Conversely, the frequency of anemia among Indian and Turkish children with enteric fever was lower, at 13.7% and 16%, respectively. [14, 15.] In addition, our study noted abnormalities in platelet counts, with 22% of patients having thrombocytopenia and 9% having thrombocytosis. Local and neighboring countries reported higher rates of thrombocytopenia, at 40% and 32.5%, while it was only 3% among Turkish patients. Neutropenia was less common among patients in Turkey (8%) but more common among patients in India (37.5%). [14]

In this report, anemia was significantly associated with gender, with females being more affected than males. In our region, being a female child is a risk factor for anemia, as indicated by a multi-level analysis from India. [15] Conversely, being a male child was linked to higher odds of more severe anemia in children from sub-Saharan Africa. [16] We observed a significant link between hematological disturbances (anemia and neutropenia) in the youngest age group (1-5 years): 90% had anemia and 19% had neutropenia. This finding aligns with a meta-analysis report: 71% in the 0-5-year age group. [9] Conversely, another local study found anemia to be common among the 11-15 years age group (71%). [12] In this study, leucopenia was common among the oldest age group (11-15 years), and thrombocytopenia among those aged 6-10 years. This finding contrasts with national and international studies, which reported leucopenia and thrombocytopenia to be more frequent in younger age groups. [9, 12]

CONCLUSION

Enteric fever is endemic in our area. Hematologic abnormalities are a feature of enteric fever and can serve as diagnostic clues for early detection. Further case-control studies are needed to establish the link between hematological parameters and enteric fever.

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CONFLICT OF INTEREST: Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE: NIL

Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Khaliq A	✓	✓	×	×	✓	×
Muhammad Z	✓	×	✓	✓	✓	×
Haq HU	✓	✓	×	×	×	✓
Shadab T	✓	×	✓	✓	✓	×
Shah SMA	✓	✓	×	×	×	✓
Khan S	✓	×	✓	✓	✓	×

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This Manuscript was approved by the Ethical Review Board of Khyber Medical College, Peshawar. Vide No. 530/DME/KMC. Dated: 01 09 2023