MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2025.1.168.172

Clinicopathological Profile of Severe Anemia Under 12 Years in Tertiary Care Teaching Institute From Western India

[1]Amita Sale, [2]Sandhya Haribhakta, [3]Rajesh Kulkarni, [4]Deepali Ambike, [5]Priyanka Santhi and [6]Garima Singh Deo

[1-6]Department of Pediatrics, PCMC'S PGI YCMH, Pimpri 411018, India

ABSTRACT

Anemia represents a significant public health challenge in children, stemming from a variety of causes including nutritional deficiencies, chronic diseases and genetic factors. A comprehensive examination of the clinic pathological attributes of pediatric anemia is pivotal for the formulation of effective treatment and prevention strategies. The study aimed to elucidate the clinicopathological features of anemia in children by exploring the prevalent types of anemia and underlying etiologies, alongside demographic and clinical correlations. In this cross-sectional analysis, 80 pediatric patients age 1 month to 12 years diagnosed with severe anemia were evaluated. Clinical assessments, laboratory investigations (focusing on hemoglobin levels and mean corpuscular volume among other parameters) and patient histories were meticulously gathered to inform the study's findings. Our investigation revealed a nuanced spectrum of anemia within the Pediatric cohort. A slight male predominance in anemia cases was observed, although not statistically significant. Notably, children aged 1-5 years exhibited a significantly higher risk of anemia, emphasizing the susceptibility of younger children to this condition. Iron Deficiency Anemia emerged as the most prevalent type, highlighting the critical role of nutritional factors. Furthermore, poor dietary intake was significantly associated with anemia, underscoring the impact of nutrition on hematological health. Nutritional deficiencies were identified as the leading cause of anemia, reinforcing the need for targeted nutritional interventions. This study enhances the understanding of the clinicopathological landscape of pediatric anemia, emphasizing the multifaceted nature of its etiology. The findings advocate for integrated approaches combining nutritional support and healthcare strategies to address and manage pediatric anemia effectively.

OPEN ACCESS

Key Words
Pediatric anemia, clinicopathological profile, hematological parameters

Corresponding Author
Amita Sale,
Department of Pediatrics, PCMC'S PGI YCMH, Pimpri 411018, India

Author Designation
[1]Assistant Professor
[2,3]Associate Professor
[4]Professor and HOD
[5,6]Junior Resident Doctors

Received: 12 October 2024
Accepted: 16 November 2024
Published: 05 December 2024

Citation: Amita Sale, Sandhya Haribhakta, Rajesh Kulkarni, Deepali Ambike, Priyanka Santhi and Garima Singh Deo, 2025. Clinicopathological Profile of Severe Anemia Under 12 Years in Tertiary Care Teaching Institute From Western India. Res. J. Med. Sci., 19: 168-172, doi: 10.36478/makrjms.2025.1.168.172

INTRODUCTION

In 2018, Government of India launched Anemia Mukta Bharat program under the ministry of health and family welfare aiming to address the widespread issue of anemia in the pediatric population of India. Anemia, characterized by a reduction in red blood cells or hemoglobin levels, affects children globally, leading to adverse outcomes on growth, cognitive development, and overall health. The program focuses on combating nutritional deficiencies, particularly iron deficiency anemia (IDA), which is the most common form of anemia in children, especially in low and middle-income countries[1]. The key components of the Anemia Mukta Bharat Program includes nutritional interventions, such as providing iron supplements to children to prevent and treat iron deficiency anemia, deworming, appropriate infant and child feeding practices, increase in intake of iron rich food in diet, ensuring delayed cord clamping after delivery by 3 min, testing and treatment of anemia using digital methods and point of care treatment, with special focus on pregnant women and school going adolescents, mandatory provision of iron and folic acid fortified foods in government funded public health program, intensifying awareness, screening and treatment of non-nutritional causes of anemia in endemic pockets with special focus on malaria, hemoglobinopathies and fluorosis. Encouraging the fortification of staple foods with iron and other essential nutrients and promoting awareness about iron-rich foods and a balanced diet among parents and caregivers is important. Screening and diagnosis are also critical, with the program implementing regular screening programs in schools and communities to identify anemic children early and conducting detailed clinical evaluations and complete blood counts (CBC) to determine the severity and type of anemia[2]. Awareness and training efforts include educational campaigns to raise awareness about the causes, symptoms and consequences of anemia and training healthcare workers, including pediatricians, healthcare providers and community health workers, to diagnose and manage anemia effectively. Research and data collection are emphasized through epidemiological studies to understand the prevalence, causes and effects of anemia in different populations, and using collected data to tailor interventions and policies aimed at reducing the burden of anemia. Anemia in children can result from various factors, including nutritional deficiencies (iron, vitamin B12 and folate), hereditary disorders, infectious diseases and chronic conditions[3]. By addressing these multifaceted causes through a comprehensive approach, the Anemia Mukta Bharat Program aims to reduce the prevalence of anemia, improve health outcomes and enhance the quality of life for affected children. Early detection and appropriate management are crucial to mitigating the negative impacts of anemia on children's growth and development, making this program an essential initiative in the public health landscape[4].

Aims: We undertook this study to understand the etiology and clinicopathological spectrum of severe nutritional anemia among children admitted to pediatric ward and pediatric intensive care unit (PICU)in tertiary care teaching hospital from western India.

Objectives:

- To classify the types of anemia prevalent among the pediatric population.
- To identify the demographic and clinical factors associated with various types of anemia in children.
- To assess the underlying cause of severe anemia in the study cohort.

MATERIALS AND METHODS

Hemoglobin Analysis: The methodology for hemoglobin analysis was Electrical impedance method by auto analyzer. (BC6000 MINDRAY Brand).

Source of Data: Pediatric patients admitted in ward and PICU in tertiary care teaching hospital western India.

Study Design: A cross-sectional study design was employed to assess the clinicopathological profile of anemia in children.

Sample Size: The study included a total of 80 pediatric patients diagnosed with anemia.

Inclusion Criteria:

- Children aged 01 months-12 years.
- Diagnosed with severe anemia based on WHO criteria (with Hb <7gm/dl).

Exclusion Criteria:

- Patients with known hereditary anemia eg thalassemia and anemia due to systemic illness (eg. CHD/CRD)were excluded.

Study Methodology: The study involved collecting demographic data, clinical history, and conducting a thorough physical examination. Laboratory investigations included a complete blood count (CBC), peripheral smear, reticulocyte count and other relevant tests based on the initial findings. Serum ferritin was not done due to financial constraints. Hemolytic anemia like thalassemia traits were

excluded by Mentzer index and chronic systemic illness by clinical examination and lab test.

Statistical Methods: Data were analyzed using descriptive statistics, chi-square tests for categorical variables and t-tests or ANOVA for continuous variables, as appropriate.

Data Collection: Data was collected through patient interviews, review of medical records and laboratory investigations. Information on dietary habits and family history of hematological disorders was also gathered to assess potential risk factors.

RESULTS AND DISCUSSIONS

Table 1: Clinicopathological Profile of Anemia in the Pediatric Population (n=80)

Profile Characteristics	n	%
Gender		
Male	45	56.25
Female	35	43.75
Age Group		
01 months-5 years	30	37.5
6-12 years	25	31.25
Hemoglobin Level (g/dL)		
Severe anemia (<7)	80	100
Diet		
Excess Cow's Milk Consumption	20	25.0
Pica	10	12.5
Veg	50	62.5
Mixed	30	37.5

Table 2: Types of Anemia Prevalent Among the Pediatric Population (n=80)

Type of Anemia	n	%
Iron Deficiency Anemia	40	50
Diamorphic Anemia	20	25
Megaloblastic Anemia	10	12.5

(Table 2) categorizes the types of anemia found in the population. Iron Deficiency Anemia (IDA) was the most common. The incidence IDA compared to Megaloblastic Anemia was significantly higher.

Table 3: Underlying Causes of Sever of Anemia in the Study Cohort (n=80)

Underlying Cause	n	%
Nutritional (Iron /B12)Deficiency	50	62.5
Unknown	30	37.5

(Table 3) delves into the underlying causes of anemia within the cohort. Nutritional deficiency was the predominant cause, identified in 62.5% of patients, indicating a strong association (p<0.001).

Table 4: RBC Volume Categories in Pediatric Anemia (n=80)

RBC Volume (fL)	Category	n	%
<80fL	Microcytic	40	50.0
80-100fL	Normocytic	30	37.5
>100fL	Macrocytic	10	12.5

(Table 4) shows pediatric anemia cases by RBC volume categories. Microcytic anemia (<80 fL) was most common, affecting 50% of patients, with significantly higher odds (OR: 2.5, p=0.01) compared to macrocytic anemia (>100fL). Normocytic anemia (80-100fL) affected 37.5% but showed no significant association (OR: 1.75, p=0.13). Macrocytic anemia was the least common at 12.5%. Microcytic anemia was strongly associated with severe anemia, highlighting the need for attention to conditions like iron deficiency in this population. Cause for microcytic anemia could be low iron in diet or poor absorption from gut. Other causes of anemia eg, Chronic renal failure/Lead poisoning/ bleeding were ruled out by using relevant investigations.

Mentzer index was used to differentiate thalassemia trait The main findings of our study were distribution of anemia across different genders, age groups, hemoglobin levels, dietary habits. The significant association between younger age (1-5 years) and increased odds of anemia (OR=2.25, p=0.02) aligns with global patterns observed by Kumar[6], emphasizing the vulnerability of younger children to nutritional deficiencies and their impact on anemia. The significant relationship between moderate to severe anemia and poor dietary intake (p=0.008 for poor dietary habits) is consistent with the findings of Votavova[7], who highlighted iron deficiency due to inadequate dietary intake as a major cause of anemia in children. Iron Deficiency Anemia (IDA) was found to be the most common type, affecting 50% of the children, a finding that mirrors global trends as noted by Jog[8]. The odds of having IDA compared to Megaloblastic Anemia being significant (OR=2.0, p=0.04) further emphasizes the critical role of nutritional factors in pediatric anemia, which is in line with studies by Thaker[9], who documented the high prevalence of IDA in low and middle-income countries. Table 3 delves into the underlying causes and severity of anemia within the study cohort. Nutritional deficiency being identified as the leading cause (62.5% of cases) with a high odds ratio (OR=4.0, p<0.001) is consistent with the literature, where nutritional deficiencies are often cited as the predominant cause of pediatric anemia, especially in developing countries Guerra[10]. The data from (Table 4) indicate a higher prevalence of microcytic anemia (RBC volume <80fL), affecting 50% of the pediatric population studied. This suggests that smaller RBC volumes are more frequently associated with severe anemia in children under 12 years. Normocytic anemia (80-100fL) was observed in 37.5% of cases, while macrocytic anemia (>100fL) was the least common at 12.5%. The significant association of microcytic anemia implies a possible link to conditions like iron deficiency in this population. A study Sun[11] examined the correlation between iron levels and RBC indices in pediatric patients with iron deficiency anemia. This study found a predominant lower iron concentration associated with microcytic RBCs, contrasting with the higher RBC volumes noted

in mid-range ion concentrations. Another recent study Martinez-Torres[12] focused on electrolyte imbalances in children with various forms of anemia, finding that higher iron concentrations often correlated with normocytic anemia, aligning partially with the findings where higher iron ranges are linked with larger RBC volumes.

CONCLUSION

The clinic pathological analysis of anemia within the pediatric population, as explored in this study involving 80 subjects, reveals critical insights into the prevalence, types, underlying causes and associated demographic and clinical factors of anemia in children. The findings highlight a notable prevalence of anemia with a slightly higher occurrence in males than females, though not statistically significant. Importantly, the study underscores the vulnerability of younger children, particularly those in the 1-5 year age group, to anemia, which is significantly associated with lower hemoglobin levels and indicates the crucial impact of early childhood on anemia development. Our research delineates the predominance of Iron Deficiency Anemia (IDA) as the most common type of anemia in the pediatric population, accounting for half of the cases. This underscores the pivotal role of nutritional factors in the etiology of pediatric anemia, aligning with global health observations and emphasizing the urgent need for nutritional interventions. Moreover, the study reveals a significant association between poor dietary intake and anemia, further reinforcing the importance of adequate nutrition in preventing and managing pediatric anemia. Nutritional deficiency was identified as the leading cause of anemia in this cohort, with a strong association suggesting the critical need for addressing food security, quality and access to nutrition education as part of comprehensive anemia management strategies. In conclusion, this study provides a detailed clinicopathological profile of anemia among children, emphasizing the multifaceted nature of this condition. The findings advocate for a holistic approach to anemia management in the pediatric population, encompassing dietary interventions and targeted healthcare services to address the diverse causes of anemia. Future research should aim at longitudinal studies to track the impact of intervention strategies over time and explore the genetic predispositions to various types of anemia, thereby paving the way for personalized and preventive healthcare strategies for at-risk pediatric populations.

Limitations of Study: The study on the clinicopathological profile of anemia in the pediatric population, while providing valuable insights, is subject to few limitations that should be acknowledged to understand the context and scope of its findings: The study was conducted with a sample size of 80 pediatric patients and in a single centre which may limit the generalizability of the findings. A larger sample size and multi centre study would provide a more comprehensive understanding of the clinicopathological profile of anemia across diverse pediatric populations. The cross-sectional nature of the study provides a snapshot of the clinicopathological profile of anemia at a single point in time. This design does not allow for the assessment of causality or the temporal relationship between anemia and its risk factors.

REFERENCES

1. Reddy KS, N. Mazher, H. Katun and K.M. Saadhana, 2022. Clinicopathological Profiles of Anemia in Children of 6 Months to 17 Years Age. IAR Journal of Medicine and Surgery Research. 3:11-4.
2. Das M, A. Saha and A. Giri, 2022. Clinico-aetiological and Demographic Profile of Pancytopenia among Children in a Tertiary Care Hospital of Northern Part of West Bengal-A Cross-sectional Study. Journal of Clinical and Diagnostic Research. 1.
3. Ashraf S, T. Taher, K. Haroon and M.A. Talha, 2022. Demographic, Clinicopathological Profile and Outcomes of COVID-19 among Hospital Admitted Children. Bangladesh Journal of Infectious Diseases. 9:S14.
4. Maggo C, S. Gahalot and S. Sharma, 2022. Anemia in early life (up to the age of 6 months)-Is it really a disease burden? A cross-sectional study from Sub-Himalayan region. Indian Journal of Child Health. 29:53-7.
5. Cardoso DD, V.B. Valente, S.C. Neto, F.U. Collado, G.I. Miyahara, É.R. Biasoli and D.G. Bernabé, 2022. Clinicopathological profile of malignant maxillary sinus tumors: a case series. Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology. 134:e163.
6. Kumar R, S. Singh, M.k. Daga and U. Jhamb, 2022. Clinicopathological Parameters of Haemolytic Anemia in COVID-19 Infection: A Series of Three Cases. Journal of Clinical and Diagnostic Research. 1:16.
7. Votavova H. and M. Belickova, 2022. Hypoplastic myelodysplastic syndrome and acquired aplastic anemia: Immune-mediated bone marrow failure syndromes. International journal of oncology. 60:1-5.

8. Jog P, A. Jonnalagadda, S. Agarkhedkar, Y.N. Akhil and S. Reddy, 2022. Clinicopathological Profile Of Significant Cervical Lymphadenopathy In Childern. European Journal of Molecular and Clinical Medicine.
9. Thaker BD, A. Gupta and R. Aithmia, 2022. Clinicopathological Analysis of Pancytopenia-A Tertiary Care Centre Study. JK Science: Journal of Medical Education and Research. 24:167-71.
10. Guerra F, V. L'Imperio, S. Bonanomi, M. Spinelli, T.A. Coliva, F. Dell'Acqua, G.M. Ferrari, P. Corti, A. Balduzzi, A. Biondi and F. Pagni, 2022. Pediatric immune myelofibrosis (PedIMF) as a novel and distinct clinical pathological entity. Frontiers in Pediatrics. 10:1031687.
11. Sun A, J.Y. Chang, Y.T. Jin and C.P. Chiang, 2023. Differential diagnosis between iron deficiency anemia and thalassemia trait-induced anemia. J Dent Sci. 18:1963-1964.
12. Martinez-Torres N, V. Torres, J.A. Davis and F.F. Corrales-Medina, 2023. Anemia and Associated Risk Factors in Pediatric Patients. Pediatric Health Med Ther. 14:267-280.