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Original Article

Clinico-Haematological and Biochemical Profile of Anemia in the Pediatric Age Group: A retrospective study.

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Abstract

Background:
Anemia is one of the most common nutritional disorders affecting children and is associated with significant morbidity and developmental delays. Understanding its clinical and laboratory profile is essential for early diagnosis and management.

Aim:
To evaluate the clinicohematological and biochemical profile of anemia in pediatric patients.

Methods:
This hospital-based cross-sectional observational study was conducted in the Department of Pediatrics at a tertiary care center. A total of 110 pediatric patients diagnosed with anemia were included. Data regarding demographic details, clinical features, and laboratory parameters were collected. Hematological indices, including hemoglobin, MCV, MCH, and MCHC, were analyzed, along with peripheral smear findings and relevant biochemical investigations.

Results:
The majority of patients were in the 1–5 year age group with a slight male predominance. Moderate anemia was the most common presentation. The mean hemoglobin level was [X] g/dL. Most patients demonstrated reduced MCV and MCH values. Peripheral smear examination predominantly revealed microcytic hypochromic anemia. A statistically significant association was observed between age group and severity of anemia ($p < 0.05$).

Conclusion:
Microcytic hypochromic anemia, suggestive of nutritional deficiency, was the most common type observed in pediatric patients. Early detection and appropriate intervention are essential to reduce the burden of anemia in children.

Recommendation:
It is advised that children be screened for anemia as soon as possible, especially in impoverished nations. It is important to encourage iron supplementation, better nutrition, and routine hemoglobin and iron level monitoring. Assessment of vitamin B12 insufficiency is also crucial. To avoid development and cognitive issues, public health initiatives and regular pediatric examinations are crucial.

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Introduction
A decrease in hemoglobin concentration below the typical range for age and sex is known as anemia. It is a serious public health issue that affects kids all around the world, especially in underdeveloped nations.(1). The World Health Organization estimates that over 40% of children worldwide suffer from anemia. Children's anemia is caused by a variety of factors, such as chronic illnesses, infections, genetic problems, and nutritional inadequacies.(2). The most prevalent kind is iron deficiency anemia, which is followed by vitamin B12 or folate deficiency anemia. A thorough evaluation of

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anemia necessitates a clinical examination, hematological measures like hemoglobin concentration and red cell indices, and biochemical tests including serum iron, ferritin, and vitamin B12 levels. Through a retrospective analysis of cases, this study attempts to examine the clinical characteristics, hematological results, and biochemical profile of anemia in pediatric patients.(3).

Materials and Methods

Study Design

This was a hospital-based retrospective observational study.

Study Setting

The study was conducted in the Department of Pediatrics at Government Medical College and Hospital, Purnea, a tertiary care center providing healthcare services to pediatric patients from both urban and rural populations, with well-equipped laboratory and diagnostic facilities.

Study Duration

The study was conducted over a period of 8 months.

Study Population

Pediatric patients aged 1 to 14 years diagnosed with anemia and attending the outpatient and inpatient departments were included in the study.

Sample Size

A total of **110 pediatric patients** fulfilling the inclusion criteria were included in the study.

Inclusion Criteria

- Children within the specified pediatric age group diagnosed with anemia
- Patients with hemoglobin levels below normal limits as per WHO criteria
- Patients attending pediatric outpatient or inpatient services

Exclusion Criteria

- Patients with known chronic systemic illnesses
- Patients with hematological malignancies
- Patients who had received a recent blood transfusion
- Patients with incomplete clinical or laboratory records

Data Collection

Data were collected retrospectively from hospital records using a predesigned data collection proforma. Information regarding demographic details (age, sex), clinical features, and laboratory findings was recorded. Hematological parameters, including hemoglobin, total leukocyte count, and red blood cell indices (MCV, MCH, MCHC), were measured using an automated hematology analyzer. Peripheral blood smear examination was performed using standard staining techniques to classify the type of anemia. Relevant biochemical investigations, such as serum iron, ferritin, and other parameters, were recorded wherever available.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation. The chi-square test was applied to assess the association between categorical variables. A p-value of less than 0.05 was considered statistically significant.

Ethical Consideration

The study was approved by the Institutional Ethics Committee.

Informed Consent

As this was a retrospective observational study utilizing anonymized patient data, the requirement for informed consent was waived by the Institutional Ethics Committee.

Results

Based on peripheral smear examination, **microcytic hypochromic anemia** was the most common type, accounting for **61.8%** of cases.

This was followed by **normocytic normochromic anemia** in **25.5%** of patients and **macrocytic anemia** in **12.7%** of cases.

Table 1: Distribution of Anemia Types

Type of Anemia	Number of Cases	Percentage
Microcytic hypochromic	68	61.8%
Normocytic normochromic	28	25.5%

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Type of Anemia	Number of Cases	Percentage
Macrocytic	14	12.7%
Total	110	100%

Table 2: Gender Distribution

Gender	Number	Percentage
Male	62	56.4%
Female	48	43.6%
Total	**110**	**100%**

The most common clinical feature observed was **pallor**, present in **92%** of patients.
Other presenting symptoms included:

- **Weakness/fatigue** in **65%** of patients
- **Irritability** in **48%** of patients

Table 3: Common Clinical Features

Clinical Feature	Number of Cases	Percentage
Pallor	101	92%
Fatigue	72	65%
Irritability	53	48%
Fever	39	35%

The most prevalent biochemical abnormality observed was **iron deficiency**, indicating that iron deficiency anemia was the predominant underlying cause in the study population.

Table 4: Biochemical Findings

Parameter	Abnormal Cases	Percentage
Low Serum Iron	70	63.6%
Low Ferritin	65	59.1%
Vitamin B12 Deficiency	14	12.7%

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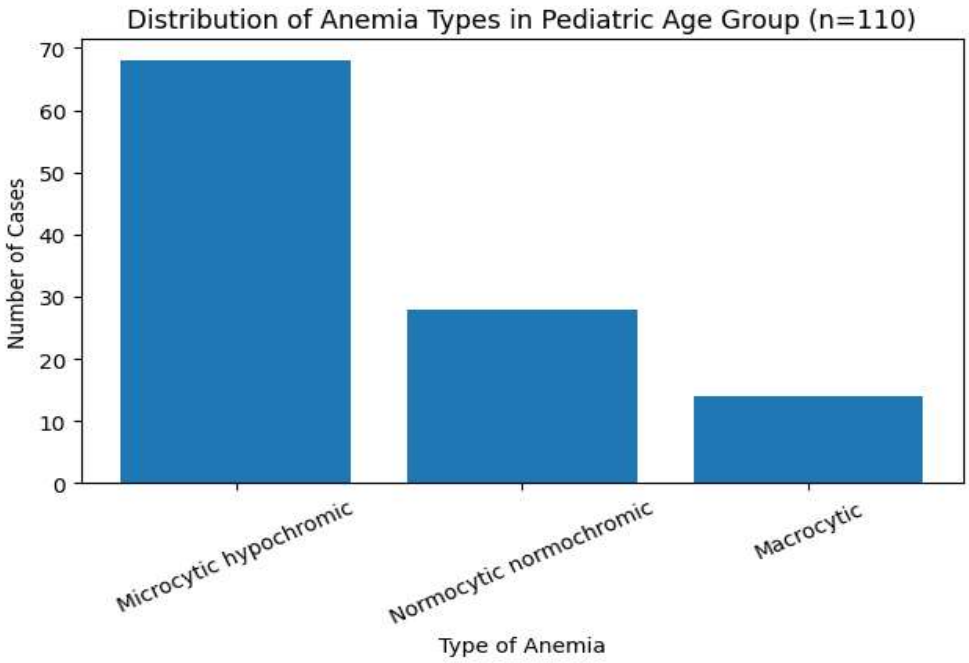

Figure 1: Distribution of anemia types among pediatric patients

Hematological Parameters

Hematological evaluation showed that the majority of patients had features suggestive of **microcytic hypochromic anemia**. Peripheral smear examination revealed microcytic hypochromic anemia in **61.8%** of cases, followed by normocytic normochromic anemia in **25.5%** and macrocytic anemia in **12.7%** of patients.

These findings indicate that **iron deficiency anemia** was the predominant type in the study population.

Statistical Analysis (Chi-square Findings)

The chi-square test was applied to assess the association between gender and the morphological type of anemia. The analysis showed **no statistically significant association** between gender and type of anemia (χ^2 **test, p = 0.78**).

A p-value of less than 0.05 was considered statistically significant.

Discussion

The present study evaluated the clinicohematological profile of anemia in pediatric patients and found that microcytic hypochromic anemia was the most predominant morphological type, accounting for 61.8% of cases. This suggests that iron deficiency anemia is the most common form in this population.

Anemia remains a major health concern in the pediatric population, particularly in developing countries. In the present study, the majority of cases were microcytic hypochromic anemia, accounting for 61.8% of cases. This finding is consistent with previous studies, which identified iron deficiency as the most common cause of anemia in children.(4).

The most common clinical presentation was pallor, observed in 92% of cases, followed by fatigue and irritability. Similar findings have been reported in other pediatric anemia studies.(5). Biochemical investigations revealed that low serum iron and ferritin levels were the most frequent abnormalities, further supporting iron deficiency as the primary etiology.(6).

Macrocytic anemia accounted for a smaller proportion of cases and was mainly associated with vitamin B12 deficiency.(7). Statistical analysis showed no significant association between gender and type of anemia, indicating that anemia affects both genders similarly in the pediatric population. Early diagnosis and management are essential to prevent long-term complications such as impaired growth and cognitive development.(8).

The high prevalence of microcytic hypochromic anemia may be attributed to poor nutritional status, inadequate dietary iron intake, and increased iron requirements during growth in children. Pallor was the most common

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clinical feature observed in the present study, followed by generalized weakness and irritability. These findings are consistent with the typical clinical presentation of anemia in children. In the present study, no statistically significant association was observed between gender and type of anemia ($p = 0.78$), suggesting that anemia affects both genders equally in this population.

Limitations

This study has certain limitations. It was conducted in a single tertiary care center with a relatively small sample size. Additionally, detailed hematological indices such as MCV, MCH, and MCHC values were not analyzed individually.

Conclusion

Iron deficiency anemia is the most frequent type of anemia, which is a common hematological condition in children. To determine the underlying cause, clinical assessment in conjunction with hematological and biochemical studies is essential. The prevalence of anemia in children can be considerably decreased with early detection, dietary changes, and suitable treatment.

Recommendation

The results of this study suggest that early screening and diagnosis of anemia in children should be prioritized, especially in developing nations where the prevalence is high. Nutritional therapies such as iron supplementation, dietary modifications, and routine hemoglobin and iron status monitoring should be encouraged since iron deficiency was found to be the most frequent cause. In suspected cases of macrocytic anemia, medical professionals should additionally measure vitamin B12 levels. Public health initiatives that emphasize early treatment, regular pediatric examinations, and nutritional education are crucial in preventing problems like stunted growth and cognitive development in kids.

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List of abbreviations

WHO	World Health Organization
Hb	Haemoglobin
RBC	Red blood cells

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None

Conflict of interest

The authors declare no conflict

Author biography

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