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Original Research Article

Clinical and Hematological Profile of Anaemia in Patients Attending a Hospital: A Cross-Sectional Study

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Abstract:

Background: Anaemia remains one of the most common global public health challenges, particularly in developing countries like India. It affects individuals across all age groups and genders, leading to significant morbidity, impaired quality of life, and increased risk of mortality, especially in vulnerable populations.

Objectives:

- To determine the clinical and hematological profile of patients presenting with anaemia at a tertiary care hospital.
- To categorize anaemia based on morphological classification and etiological factors.

Methods: A cross-sectional study was conducted at the Department of General Medicine, AIIMS, Patna, Bihar, India from November 2020 to October 2022. A total of 150 patients diagnosed with anaemia (hemoglobin <12 g/dL in females, <13 g/dL in males) were enrolled. Detailed clinical evaluation, complete blood counts, peripheral smear examination, reticulocyte count, serum ferritin, vitamin B12, and folate assays were performed. Anaemia was classified morphologically and etiologically.

Results: Microcytic hypochromic anaemia was the most common morphological pattern observed, predominantly associated with iron deficiency. Nutritional deficiency remained the leading cause across all age groups, followed by anaemia of chronic disease. Female preponderance was noted. A substantial proportion of patients presented with moderate to severe anaemia requiring specific therapeutic interventions.

Conclusion: Anaemia continues to impose a substantial health burden, predominantly due to preventable and treatable causes like nutritional deficiencies. Early diagnosis through detailed clinical and hematological evaluation can facilitate timely management and reduce the morbidity associated with anaemia. Targeted public health measures focusing on nutrition, infection control, and chronic disease management are necessary.

Keywords: Anaemia, Hematological Profile, Iron Deficiency, Morphological Classification, Nutritional Deficiency, Tertiary Care.

Introduction

Anaemia, defined as a reduction in the oxygen-carrying capacity of blood due to low hemoglobin concentration, is a widespread health problem with far-reaching clinical consequences [1]. It affects nearly one-third of the world's population, with the highest prevalence recorded in South Asia and sub-Saharan Africa. In India, despite multiple public health interventions, anaemia remains a leading cause of morbidity across all age groups, impacting productivity, cognitive function, immunity, and maternal and child health outcomes [2].

The etiologies of anaemia are multifactorial, ranging from nutritional deficiencies (iron, vitamin B12, folate) to chronic infections, chronic kidney disease, bone marrow disorders, and malignancies. Socioeconomic factors, dietary practices, parasitic infections, and chronic illnesses contribute to the complex interplay that results in the high burden of anaemia in developing countries [3].

Clinically, patients with anaemia may present with a wide range of symptoms, from mild fatigue and pallor to severe breathlessness, syncope, and cardiac decompensation depending on the severity and rapidity of onset. Hematological evaluation, including complete blood counts, peripheral smear examination, and specific investigations like serum ferritin, vitamin B12, and folate levels, is crucial for

classifying anaemia and identifying the underlying cause [4,5].

Morphologically, anaemia can be classified into microcytic, normocytic, or macrocytic types based on mean corpuscular volume (MCV). This morphological categorization provides important clues toward etiological diagnosis and guides subsequent management. Identifying the pattern and cause of anaemia is essential not only for clinical management but also for formulating effective public health strategies aimed at prevention and control [6,7].

Despite the high burden, few studies have comprehensively evaluated the clinical and hematological profile of anaemia in the general adult population at tertiary care centers in Eastern India. Understanding local patterns of anaemia can assist healthcare providers in tailoring diagnosis and management protocols more effectively [8].

In this context, the present cross-sectional study was conducted at the Department of General Medicine, AIIMS, Patna, Bihar, India from November 2020 to October 2022. The study aimed to evaluate the clinical presentation, morphological pattern, and etiological factors associated with anaemia among patients attending a tertiary care hospital.

Methodology

This cross-sectional study was conducted in the Department of General Medicine at AIIMS, Patna, Bihar, India from November 2020 to October 2022, with the objective of evaluating the clinical and hematological profile of patients diagnosed with anaemia attending the hospital.

Study Population: The study population included adult patients aged 18 years and above who presented to the outpatient department or were admitted to the inpatient wards with anaemia. Anaemia was defined according to World Health Organization (WHO) criteria:

- Hemoglobin <13 g/dL in males,
- Hemoglobin <12 g/dL in females.

Inclusion Criteria:

- Adults aged ≥18 years.
- Newly diagnosed or known cases of anaemia undergoing evaluation.
- Willingness to provide informed written consent.

Exclusion Criteria:

- Pregnant women.
- Patients with active major hemorrhage or recent major blood loss.
- Recent blood transfusion within the last one month.
- Patients with known hematological malignancies or on chemotherapy.

Sample Size: A total of 150 patients fulfilling the eligibility criteria were enrolled during the study period.

Data Collection Procedure: Detailed history including presenting symptoms (fatigue, pallor, breathlessness, syncope), dietary habits, menstrual history (for females), history of chronic illnesses, and drug history were recorded. Complete clinical examination was performed with emphasis on signs suggestive of nutritional deficiencies, organomegaly, or underlying chronic disease.

Investigations included:

- Complete blood count (CBC) including hemoglobin, red blood cell indices (MCV, MCH, MCHC), white blood cell and platelet counts.
- Peripheral blood smear examination for red cell morphology.
- Reticulocyte count.
- Serum ferritin for iron stores evaluation.
- Serum vitamin B12 and folate assays for macrocytic anaemia.
- Renal function tests, liver function tests, and tests for infections (e.g., HIV, tuberculosis) when clinically indicated.

Morphological classification of anaemia was based on mean corpuscular volume (MCV) and peripheral smear findings:

- Microcytic hypochromic anaemia (MCV <80 fL),
- Normocytic normochromic anaemia (MCV 80–100 fL),
- Macrocytic anaemia (MCV >100 fL).

Etiological classification was based on clinical assessment and laboratory parameters.

Outcome Measures:

The primary outcomes assessed were:

- Morphological types of anaemia in the study population.
- Etiological factors contributing to anaemia.
- Severity distribution of anaemia based on WHO criteria:
    - Mild Anaemia: Hb 10–12 g/dL (females), 10–13 g/dL (males),
    - Moderate Anaemia: Hb 7–9.9 g/dL,
    - Severe Anaemia: Hb <7 g/dL.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 21.0. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Chi-square test and

independent t-test were used to compare categorical and continuous variables, respectively. A p-value <0.05 was considered statistically significant.

Results

A total of 150 patients diagnosed with anaemia were included in the study. The majority of patients were females, and the highest prevalence was observed in the 18–40 years age group. Microcytic hypochromic anaemia emerged as the most common morphological type, predominantly due to iron deficiency. Nutritional deficiency, anaemia of chronic disease, and combined deficiencies were the major etiological categories identified. Moderate anaemia was the most frequently observed severity category. Early diagnosis based on clinical and hematological profiling was essential in directing appropriate therapeutic interventions.

Table 1: Demographic Profile of Anaemia Patients

Variable	Category	Number (n=150)	Percentage (%)
Age Group	18–30 years	48	32.0%
	31–40 years	42	28.0%
	41–50 years	26	17.3%
	51–60 years	18	12.0%
	>60 years	16	10.7%
Gender	Male	58	38.7%
	Female	92	61.3%

Table 2: Clinical Presentation of Anaemia

Symptom	Number (n=150)	Percentage (%)
Fatigue	122	81.3%
Pallor	114	76.0%
Breathlessness	86	57.3%
Dizziness/Syncope	34	22.7%
Palpitations	28	18.7%

Table 3: Morphological Classification of Anaemia

Morphological Type	Number (n=150)	Percentage (%)
Microcytic Hypochromic	78	52.0%
Normocytic Normochromic	54	36.0%
Macrocytic	18	12.0%

Table 4: Etiological Distribution of Anaemia

Etiology	Number (n=150)	Percentage (%)
Iron Deficiency	72	48.0%
Anaemia of Chronic Disease	38	25.3%
Vitamin B12/Folate Deficiency	22	14.7%
Combined Deficiencies	18	12.0%

Table 5: Severity of Anaemia

Severity Grade	Number (n=150)	Percentage (%)
Mild	34	22.7%
Moderate	78	52.0%
Severe	38	25.3%

Table 6: Mean Hemoglobin Levels by Gender

Gender	Mean Hb (g/dL) ± SD
Male	9.7 ± 1.6
Female	8.8 ± 1.8

Table 7: Mean Serum Ferritin Levels Across Etiological Groups

Etiology	Mean Ferritin (ng/mL) ± SD
Iron Deficiency	11.2 ± 4.5
Anaemia of Chronic Disease	98.4 ± 26.7
Vitamin B12/Folate Deficiency	134.7 ± 48.3

Table 8: MCV Distribution by Etiological Group

Etiology	Mean MCV (fL) ± SD
Iron Deficiency	71.5 ± 6.2
Anaemia of Chronic Disease	86.2 ± 5.7
Vitamin B12/Folate Deficiency	106.8 ± 8.4

Table 9: Reticulocyte Count Distribution

Reticulocyte Count (%)	Number (n=150)	Percentage (%)
<1%	94	62.7%
1–2%	40	26.7%
>2%	16	10.6%

Table 10: Requirement of Blood Transfusion by Severity

Severity of Anaemia	Transfusion Required (n)	Percentage (%)
Mild	0	0%
Moderate	18	23.1%
Severe	32	84.2%

Table 11: Association of Menorrhagia with Iron Deficiency Anaemia

History of Menorrhagia	Number of Female Patients (n=92)	Percentage (%)
Present	32	34.8%
Absent	60	65.2%

Table 12: Associated Factors in Anaemia Cases

Associated Condition	Number (n=150)	Percentage (%)
Nutritional Deficiency	94	62.7%
Chronic Infections (e.g., TB, HIV)	26	17.3%
Chronic Kidney Disease	18	12.0%
Malignancy	12	8.0%

Among the 150 patients enrolled, the demographic profile is detailed in Table 1, with clinical symptomatology summarized in Table 2. Morphological types of anaemia and etiological categories are shown in Tables 3 and 4. Severity distribution is highlighted in Table 5, with mean hemoglobin values by gender shown in Table 6. Serum ferritin and MCV distributions across etiological groups are presented in Tables 7 and 8. Reticulocyte counts, transfusion requirements, and associations like menorrhagia and chronic diseases are detailed in Tables 9 through 12.

Discussion

Anaemia continues to remain a major clinical and public health concern, particularly in developing countries like India. In this study involving 150 patients attending a tertiary care center, a detailed clinical and hematological profiling of anaemia cases was performed, offering insights into its prevalent patterns, etiologies, and severity distributions [9].

The majority of the patients belonged to the younger adult age group of 18–40 years, with a clear female predominance. This demographic pattern is consistent with prior studies, reflecting the compounded risk of anaemia among women due to menstrual blood loss, nutritional deficiencies, and increased physiological demands [10]. The clinical presentation was dominated by non-specific but classic symptoms of anaemia such as fatigue, pallor, and breathlessness, emphasizing the need for high clinical suspicion even in vague symptomatology [11].

Microcytic hypochromic anaemia was the most common morphological type, identified in over half of the patients, and was predominantly associated with iron deficiency. Normocytic normochromic anaemia was the second most common pattern, often linked to chronic diseases such as infections and chronic kidney disease. Macrocytic anaemia was less frequent but strongly correlated with vitamin B12 or folate deficiencies, indicating the ongoing burden of nutritional deficiencies even in the urban and semi-urban population [12,13].

Iron deficiency remained the leading etiological factor, accounting for nearly half of all anaemia cases, largely driven by nutritional insufficiencies and menstrual blood loss among females. Anaemia of chronic disease, commonly secondary to chronic infections like tuberculosis and chronic inflammatory conditions, was the next most frequent etiology. Combined nutritional deficiencies were also notable, reflecting multiple overlapping risk factors in many patients [14,15].

The severity distribution showed that moderate anaemia was the most common, followed by severe

anaemia, with a substantial proportion requiring blood transfusions, especially among severely anaemic patients. Reticulocyte count analysis provided additional diagnostic clues, with low counts suggesting hypo proliferative marrow response and elevated counts indicating marrow recovery or hemolysis [16].

The association between low serum ferritin levels and iron deficiency anaemia was strong, reinforcing the importance of biochemical evaluation in differentiating various causes of anaemia. Additionally, a significant number of female patients with iron deficiency anaemia reported menorrhagia, further emphasizing the need for integrated management approaches addressing both underlying causes and consequences [17].

This study highlights the critical need for early screening and detailed evaluation of anaemia, even among ambulatory patients presenting with subtle symptoms. Addressing nutritional deficits, managing chronic diseases effectively, and increasing public awareness regarding dietary practices are crucial steps toward reducing the burden of anaemia. Routine hematological workup including complete blood counts, peripheral smear, serum ferritin, and vitamin assays should be encouraged in clinical practice for appropriate diagnosis and management.

Conclusion

Anaemia remains highly prevalent among patients attending tertiary care hospitals, with nutritional deficiencies, particularly iron deficiency, being the leading cause. Microcytic hypochromic anaemia was the most common morphological pattern observed, and a significant proportion of cases were moderate to severe in intensity. Early diagnosis through detailed clinical evaluation and appropriate hematological investigations is critical for timely intervention. Public health initiatives focused on improving nutrition, addressing menstrual health, and managing chronic diseases are necessary to reduce the burden and long-term complications associated with anaemia.

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