

Assessment of Anemia Cases Presented at OPD in a Tertiary Care Hospital in Bihar Region

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Abstract:

Background: Anemia remains a significant public health problem in India, with a substantial burden observed in both rural and urban populations. Despite numerous national programs, the prevalence of anemia continues to be high, particularly in resource-limited regions like Bihar. Clinicopathological evaluation of anemia in outpatient settings is essential to understand its patterns, severity, underlying causes, and demographic distribution to guide timely diagnosis and management.

Aim: To assess the clinicopathological profile of anemia cases presenting to the outpatient department of a tertiary care hospital in Bihar and to analyze the distribution based on age, gender, clinical presentation, and hematological parameters.

Materials and Methods: This cross-sectional observational study was conducted over a period of 12 months in the Department of Pathology, Government Medical College, and Hospital, Purnea, Bihar. A total of 150 patients presenting with clinical signs and symptoms suggestive of anemia and attending the OPD were included. Detailed clinical history and examination were recorded. Hematological investigations including complete blood count, peripheral smear examination, and relevant biochemical tests were performed. Data were analyzed to determine the prevalence, morphological patterns, and likely etiology of anemia.

Results: The majority of patients were females, with the highest incidence observed in the reproductive age group. Nutritional anemia, predominantly iron deficiency anemia, was the most common type identified. Microcytic hypochromic anemia was the predominant morphological pattern on peripheral smear. Moderate anemia constituted the largest proportion, followed by mild and severe cases. The study highlights the role of simple hematological tests in early detection and categorization of anemia, which can help tailor appropriate interventions.

Conclusion: Anemia remains highly prevalent in the OPD population, with young females being most affected. Iron deficiency continues to be the leading cause. Strengthening screening at the primary care level, improving nutritional status, and creating awareness are crucial to reduce the burden of anemia, especially in resource-constrained regions like Bihar.

Keywords: Anemia, Iron deficiency anemia, Peripheral smear, Morphological pattern, OPD patients, Bihar, Cross-sectional study.

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Introduction

Anemia is one of the most widespread and preventable hematological conditions affecting individuals worldwide, yet it remains a significant public health challenge, especially in low- and middle-income countries. By definition, anemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiological needs, which varies by age, sex, altitude, smoking, and pregnancy status. It can arise due to multiple causes ranging from nutritional deficiencies to chronic infections, genetic disorders, and systemic diseases [1].

Globally, anemia affects nearly a quarter of the population. In India, the burden is even more concerning, with studies consistently showing a prevalence ranging from 40% to 70% in various demographic groups. Women of reproductive age, young children, and adolescents are the most vulnerable groups due to factors such as menstrual blood loss, increased nutritional demands during pregnancy and lactation, inadequate dietary intake, and poor absorption of essential nutrients. In men and elderly populations, anemia often goes unnoticed and untreated, leading to fatigue, reduced work productivity, and diminished quality of life [2].

The problem of anemia is especially critical in regions like Bihar, where socio-economic disparities, lack of awareness, poverty, poor sanitation, high incidence of parasitic infestations, and dietary inadequacies contribute significantly to its prevalence. Cultural practices such as early marriage, repeated pregnancies without adequate spacing, and gender-based nutritional neglect further aggravate the situation for women and adolescent girls. In children, nutritional anemia adversely impacts growth, cognitive development, and school performance, perpetuating a cycle of poor health and poverty [3].

Despite numerous national programs like the National Iron Plus Initiative, Weekly Iron and Folic Acid Supplementation, and various maternal and child health schemes, the overall impact has not matched expectations in many states. This gap can often be attributed to underdiagnosis, poor follow-up, lack of compliance, and limited data on local patterns and contributing factors of anemia at the primary and secondary care levels [4].

The role of the pathology department becomes crucial in this scenario. A simple yet systematic clinicopathological assessment can provide vital insights into the prevalence, severity, and morphological types of anemia prevalent in a given population. Hematological investigations such as hemoglobin estimation, red blood cell indices, reticulocyte count, peripheral blood smear examination, and additional biochemical markers like serum iron, ferritin, and vitamin B12 levels, when possible, help in identifying the type and probable etiology of anemia [5].

Peripheral smear examination, in particular, remains a cornerstone for morphological classification into microcytic hypochromic, normocytic normochromic, macrocytic, and dimorphic anemia. This classification not only aids in identifying nutritional deficiencies like iron, folic acid, and vitamin B12 but also guides further evaluation for hemolytic anemias, bone marrow suppression, or underlying chronic diseases [6].

Tertiary care hospitals, especially in underserved regions like Bihar, often cater to a wide demographic range of patients coming from rural and semi-urban backgrounds. The outpatient department acts as the first point of contact for many symptomatic patients. Systematic documentation and analysis of anemia cases in such settings provide baseline data that is critical for understanding local trends, guiding clinicians in their diagnostic and therapeutic approach, and informing policymakers about the gaps in existing public health strategies [7].

Regular audit and research at the institutional level can help bridge the knowledge gap and strengthen community health outreach. Studies like the present

one, which aim to assess the burden, pattern, and likely causes of anemia among OPD patients in a tertiary care hospital in Bihar, are therefore not only relevant but essential. They highlight the need for sustained screening programs, community-based awareness campaigns, nutritional interventions, and appropriate referral systems to reduce the morbidity and mortality associated with anemia in vulnerable populations [8].

In this background, the present study was undertaken to assess the clinicopathological profile of anemia among patients attending the outpatient department of a tertiary care hospital in the Bihar region, with an objective to generate data that can contribute to better diagnosis, management, and prevention strategies tailored to the local population.

Aim: To assess the clinicopathological profile of anemia cases presenting to the outpatient department of a tertiary care hospital in Bihar, with an emphasis on demographic distribution, clinical features, hematological parameters, and morphological patterns.

Objectives

1. To determine the prevalence and demographic distribution (age, gender) of anemia among patients attending the OPD.
2. To evaluate the clinical presentation and severity of anemia in the study population.
3. To analyze hematological parameters including hemoglobin levels, red blood cell indices, and peripheral smear morphology.
4. To classify anemia into morphological types (microcytic hypochromic, normocytic normochromic, macrocytic, and dimorphic) based on peripheral smear examination.
5. To identify the probable etiological patterns of anemia, with special focus on nutritional causes such as iron deficiency.
6. To provide baseline data to aid in diagnosis, management, and prevention of anemia in the regional population.

Materials and Methods

Study Design: A hospital-based cross-sectional observational study.

Study Setting: This study was conducted in the Department of Pathology, Government Medical College, and Hospital, Purnea, Bihar, India, which caters to a large population from both rural and semi-urban areas.

Study Duration: The study was carried out over a period of 12 months.

Study Population: Patients attending the outpatient department (OPD) with clinical signs and symptoms suggestive of anemia.

Sample Size: A total of 150 patients were included in the study using convenience sampling.

Inclusion Criteria:

- Patients of all age groups and both sexes attending the OPD with clinical features suggestive of anemia (e.g., pallor, weakness, fatigue, breathlessness).
- Patients willing to give informed consent for participation.

Exclusion Criteria:

- Patients who had received blood transfusions within the last three months.
- Patients already diagnosed with anemia and undergoing treatment.
- Patients with known hematological malignancies or chronic renal failure.

Data Collection Procedure:

Each patient was evaluated through a structured proforma which included:

- Detailed demographic data (age, sex, socio-economic status).
- Detailed clinical history including dietary habits, menstrual history in females, and relevant past medical history.
- General physical examination and systemic examination findings were recorded.

Laboratory Investigations: Venous blood samples were collected under aseptic precautions. The following investigations were carried out:

- Complete Blood Count (CBC) including hemoglobin estimation, total and differential leukocyte count, RBC indices (MCV, MCH, MCHC), hematocrit, and platelet count using an automated hematology analyzer.

- Peripheral blood smear examination stained with Leishman stain to assess morphological patterns of anemia.
- Reticulocyte count wherever indicated.
- Additional biochemical tests such as serum iron, ferritin, and vitamin B12 levels were performed when feasible and indicated clinically.

Classification of Anemia Severity: Anemia severity was categorized according to World Health Organization (WHO) criteria as mild, moderate, or severe based on hemoglobin levels.

Data Analysis: All collected data were compiled and analyzed using appropriate statistical software (such as Microsoft Excel and SPSS version 27). Descriptive statistics were applied to calculate frequencies, percentages, means, and standard deviations. Results were presented in the form of tables

Results

A total of 150 patients presenting with clinical features suggestive of anemia were included in the study. The study population comprised a broad age range, with a significant proportion of young adults and females. Most patients belonged to lower socio-economic groups and had nutritional indicators pointing towards under nutrition. Clinical symptoms were typical, with generalized weakness and pallor being predominant. Hematological investigations revealed that moderate anemia was the most common severity grade, with microcytic hypochromic morphology being the leading pattern. Nutritional anemia, especially iron deficiency, was the most common etiology identified. Additional analysis highlighted important associations between demographic variables, menstrual history in females, nutritional status, and morphological patterns of anemia.

Demographic Distribution

Table 1: Age-wise distribution of patients

Age Group (years)	Number of Patients	Percentage (%)
0–10	12	8.0
11–20	28	18.7
21–30	52	34.7
31–40	31	20.7
41–50	18	12.0
>50	9	6.0
Total	150	100

Table 2: Gender-wise distribution of patients

Gender	Number of Patients	Percentage (%)
Male	48	32.0
Female	102	68.0
Total	150	100

Socio-economic and Nutritional Profile

Table 3: Socio-economic status of patients

Socio-economic Class	Number of Patients	Percentage (%)
Upper	4	2.7
Upper Middle	12	8.0
Lower Middle	36	24.0
Upper Lower	64	42.7
Lower	34	22.6
Total	150	100

Table 4: BMI-wise distribution among adults (n=138)

BMI Category	Number of Patients	Percentage (%)
Underweight (<18.5)	68	49.3
Normal (18.5–24.9)	54	39.1
Overweight (25–29.9)	12	8.7
Obese (≥ 30)	4	2.9
Total	138	100

Female-Specific Variables**Table 5: Menstrual history among female patients (n=102)**

Menstrual History	Number of Patients	Percentage (%)
Normal Cycles	48	47.0
Heavy Menstrual Bleeding	34	33.3
Irregular Cycles	12	11.8
Post-menopausal	8	7.9
Total	102	100

Clinical Presentation**Table 6: Presenting symptoms of anemia patients**

Clinical Presentation	Number of Patients	Percentage (%)
Generalized Weakness	132	88.0
Pallor	115	76.7
Breathlessness	54	36.0
Palpitations	22	14.7
Dizziness	15	10.0

Severity of Anemia**Table 7: Severity-wise distribution based on WHO classification**

Severity	Hemoglobin Range (g/dL)	Number of Patients	Percentage (%)
Mild	10.0–10.9	38	25.3
Moderate	7.0–9.9	92	61.3
Severe	<7.0	20	13.4
Total		150	100

Hematological Parameters**Table 8: Mean RBC indices by severity group**

Severity	Mean MCV (fL)	Mean MCH (pg)	Mean MCHC (g/dL)
Mild	78.4 \pm 4.5	25.3 \pm 2.1	31.5 \pm 1.8
Moderate	72.2 \pm 5.1	22.4 \pm 2.7	30.1 \pm 2.0
Severe	68.6 \pm 6.0	20.1 \pm 3.0	29.0 \pm 2.4

Morphological Classification

Table 9: Morphological types of anemia on peripheral smear

Morphological Type	Number of Patients	Percentage (%)
Microcytic Hypochromic	104	69.3
Normocytic Normochromic	34	22.7
Macrocytic	8	5.3
Dimorphic	4	2.7
Total	150	100

Etiological Correlation

Table 10: Probable etiological diagnosis

Etiology	Number of Patients	Percentage (%)
Iron Deficiency Anemia	112	74.7
Anemia of Chronic Disease	24	16.0
Megaloblastic Anemia	8	5.3
Hemolytic Anemia	6	4.0
Total	150	100

Association Analyses

Table 11: Age group vs morphological pattern of anemia

Age Group	Microcytic Hypochromic	Normocytic Normochromic	Macrocytic	Dimorphic
0–10	10	2	0	0
11–20	20	6	2	0
21–30	40	10	2	0
31–40	24	6	0	1
41–50	7	8	3	0
>50	3	2	1	3

Table 12: Hemoglobin levels vs clinical symptoms

Symptom	Mean Hb (g/dL)
Generalized Weakness	8.5 ± 1.4
Pallor	8.2 ± 1.2
Breathlessness	7.8 ± 1.1
Palpitations	7.6 ± 1.0
Dizziness	7.4 ± 0.9

Table 1 highlights that the 21–30 years age group was most affected. Table 2 confirms a female predominance. Table 3 demonstrates the clear link with lower socio-economic status. Table 4 shows under nutrition as a significant contributor. Table 5 emphasizes menstrual irregularities as an important factor among females. Table 6 lists the common symptoms, while Table 7 indicates moderate anemia as most prevalent. Table 8 shows declining RBC indices with increasing severity. Table 9 confirms microcytic hypochromic pattern as predominant. Table 10 underscores iron deficiency as the major cause. Table 11 reveals a clear age-wise variation in morphological pattern. Table 12 shows the correlation between symptom severity and hemoglobin levels. Together, these findings underline the multifactorial nature of anemia in the study population and the need for targeted intervention strategies.

Discussion

The present cross-sectional study was undertaken to evaluate the clinicopathological profile of anemia

cases attending the outpatient department of a tertiary care hospital in Bihar. The findings reveal significant insights into the demographic patterns, clinical features, hematological characteristics, and probable etiologies of anemia in this regional population [9].

In the current study, anemia was most prevalent in the 21–30 years age group, which corresponds to the reproductive age for females and the most economically productive years for both sexes. This pattern reflects a dual burden: young women are particularly vulnerable due to menstrual blood loss, poor dietary practices, repeated pregnancies, and limited access to nutritional supplements [10]. The female preponderance observed in this study, with females constituting over two-thirds of the cases, reinforces the well-established fact that gender-specific factors contribute significantly to anemia in this population. Socio-cultural practices, gender-based nutritional neglect, and lack of awareness further exacerbate this trend [11].

The socio-economic analysis showed that a majority of patients belonged to the lower and upper-lower classes, highlighting the direct link between poverty, poor nutrition, and anemia prevalence. Malnutrition and poverty-driven food insecurity often limit access to iron-rich and nutrient-dense foods, while high rates of parasitic infestations in such communities may further worsen iron deficiency. Nearly half of the adult patients were underweight based on BMI assessment, supporting the fact that under nutrition is a major underlying factor contributing to anemia in this region [12,13].

Menstrual history analysis among females revealed that more than 40% reported heavy or irregular menstrual cycles, which likely contributed to chronic blood loss and subsequent iron depletion. This aspect underlines the importance of menstrual health education and timely gynecological evaluation to address menorrhagia and related disorders [14].

Clinically, generalized weakness and pallor were the most common presenting complaints, consistent with the physiological impact of decreased oxygen-carrying capacity of the blood. Breathlessness and palpitations were also noted, particularly in patients with severe anemia, emphasizing how reduced hemoglobin levels affect cardiovascular compensation mechanisms. The correlation between declining hemoglobin levels and the severity of symptoms reiterates the clinical relevance of early detection and categorization of anemia severity [15].

Regarding severity, moderate anemia was the most common category, comprising over 60% of cases. This suggests that while many patients experience significant symptoms, they may not seek timely medical care until their daily activities are noticeably impaired. It also reflects the need for proactive screening and community-level awareness to diagnose and treat mild anemia before it progresses [16].

Hematological analysis confirmed that microcytic hypochromic anemia was the predominant morphological pattern, accounting for nearly 70% of cases. This finding aligns with iron deficiency as the leading etiology. The mean RBC indices demonstrated a clear trend of progressively lower MCV, MCH, and MCHC values with increasing anemia severity, supporting the pathophysiological basis of microcytosis and hypochromia in iron-deficient states [17].

Nutritional anemia, predominantly iron deficiency anemia, accounted for nearly three-fourths of the total cases. This is in line with established data indicating that iron deficiency remains the single largest contributor to anemia in low-income regions like Bihar, where dietary iron intake is insufficient and bioavailability is low. Additional contributory factors include chronic infections, poor sanitation

leading to parasitic infestations, and limited health infrastructure to diagnose and treat nutritional deficiencies early [18].

The peripheral smear examination proved invaluable in identifying morphological patterns, which aided in distinguishing iron deficiency from other forms such as normocytic normochromic anemia seen in anemia of chronic disease, macrocytic anemia associated with folate or B12 deficiency, and dimorphic anemia which suggests mixed nutritional deficiencies or treatment response phases. The morphological variation across age groups indicates that while iron deficiency is dominant in young individuals, macrocytic and normocytic patterns appear more frequently in older patients, possibly reflecting underlying chronic diseases or nutritional malabsorption in the elderly [19].

The correlation between socio-demographic factors, nutritional status, menstrual history, and morphological patterns underscores the multifactorial nature of anemia in this population. This emphasizes the need for a holistic approach that combines nutritional interventions, deworming, menstrual health management, and robust screening programs at the primary care level [20].

In resource-limited settings like Bihar, strengthening simple hematological investigations at the OPD level, including complete blood counts and peripheral smear examination, remains a practical and cost-effective strategy for early diagnosis. Moreover, periodic audits of clinicopathological profiles can help track trends, identify emerging patterns, and inform policymakers about targeted interventions required for high-risk groups.

Overall, this study adds valuable local data highlighting that anemia in the OPD population is common, largely preventable, and amenable to early diagnosis with basic hematological tools. Addressing social determinants of health, improving dietary practices, ensuring availability of iron and folic acid supplements, and increasing community awareness are crucial steps to reduce the burden of anemia, particularly among women and children in rural and underserved areas.

Conclusion

The present study underscores that anemia continues to pose a significant public health challenge in the Bihar region, especially among young females of reproductive age and socio-economically disadvantaged groups. The highest burden was observed in the 21–30 years age group, with a striking female predominance and a strong link to poor nutritional status, low BMI, and heavy or irregular menstrual bleeding. These findings reiterate that nutritional iron deficiency remains the

leading cause of anemia in outpatient settings, as evidenced by the predominance of microcytic hypochromic morphological patterns on peripheral smear.

The study highlights the value of simple, cost-effective hematological investigations such as complete blood counts and peripheral smear examination for early detection and categorization of anemia. Identifying the severity and type of anemia at the initial point of contact in the OPD can significantly improve timely management and reduce progression to severe forms that affect work capacity and quality of life.

Furthermore, the results reflect the pressing need to address the underlying socio-economic and nutritional factors contributing to the high prevalence of anemia in this population. Strengthening community-based screening programs, promoting iron-rich dietary habits, ensuring routine deworming, and improving menstrual health education for adolescent girls and women are crucial steps forward. Institutional mechanisms to monitor anemia trends and provide accessible diagnostic services at the primary and secondary care levels can bridge the gap between national programs and their ground-level impact.

Regular clinicopathological audits and research, as demonstrated in this study, play an essential role in generating local data, which can inform targeted interventions and resource allocation. Overall, a multi-pronged approach involving healthcare providers, community stakeholders, and policymakers is vital to effectively reduce the burden of anemia and improve the health and well-being of vulnerable populations in resource-constrained regions like Bihar.

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