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Research Article

Clinical Profile and Etiology of Anaemia in Tertiary Care Hospital

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Abstract: ***Background:*** Anaemia remains a major public health problem worldwide, particularly in developing countries, and is associated with significant morbidity and reduced quality of life. Understanding its clinical and etiological profile is essential for appropriate diagnosis and management. ***Objective:*** To evaluate the clinical profile, hematological characteristics, morphological patterns, and etiology of anaemia among patients attending a tertiary care hospital. ***Methods:*** This hospital-based cross-sectional study was conducted in the Department of Medicine, Private tertiary level hospital, Dhaka, Bangladesh, from January to December 2014. A total of 138 adult patients with anaemia were enrolled. Data on sociodemographic characteristics, clinical presentation, hematological parameters, morphological classification, and etiology were collected and analyzed using SPSS version 20. Associations between categorical variables were assessed using the Chi-square test. ***Results:*** The mean age of the participants was 42.8±17.6 years, and 57.2% were female. Generalized weakness (89.1%), fatigue (81.2%), and shortness of breath (62.3%) were the most common presenting symptoms. Moderate anaemia was the predominant severity category (47.1%), followed by severe (29.0%) and mild anaemia (23.9%). The mean hemoglobin level was 8.2±2.1 g/dL. Microcytic hypochromic anaemia was the most common morphological pattern (47.8%), followed by normocytic normochromic anaemia (31.2%). Iron deficiency anaemia was the leading etiology (42.0%), followed by anaemia of chronic disease (20.3%) and megaloblastic anaemia (14.5%). Significant associations were observed between morphological classification and etiology ($p<0.001$), and between severity and etiology of anaemia ($p=0.002$). ***Conclusion:*** Iron deficiency anaemia was the most common cause of anaemia, and microcytic hypochromic anaemia was the predominant morphological pattern. Morphological classification and severity were significantly associated with the underlying etiology, highlighting the importance of comprehensive evaluation for accurate diagnosis and management.
Keywords: Anaemia, Iron Deficiency Anaemia, Etiology, Clinical Profile, Morphological Pattern, Tertiary Care Hospital, Bangladesh.

INTRODUCTION

Anaemia is a major global public health problem affecting a large proportion of the world's population and remains a leading cause of morbidity, reduced productivity, and poor health outcomes [1,2]. The global burden of anaemia is substantial, affecting an estimated 293 million children under five years and 468 million non-pregnant women worldwide, with iron deficiency identified as the leading etiological factor. It often acts synergistically with folate and vitamin B12 deficiencies, as well as infectious diseases, further worsening the burden of disease [1]. In low- and middle-income countries, anaemia presents unique challenges due to its multifactorial etiology, involving complex interactions between nutritional deficiencies, infectious diseases, and socioeconomic determinants [1,3].

In South Asia, the burden of anaemia remains particularly severe, with pregnancy-related anaemia prevalence ranging from 18% to 80%, depending on age, education level, socioeconomic status, and compliance with iron supplementation [4-6]. This highlights the persistent nutritional and healthcare disparities in the region. Anaemia in these populations is largely driven by iron deficiency, poor dietary diversity, and recurrent infections, often compounded by limited access to preventive and therapeutic interventions [3,6].

In Bangladesh, anaemia remains a longstanding public health concern affecting millions of individuals across different age and sex groups [7]. National and regional studies have consistently demonstrated a high

prevalence of anaemia over several decades [8]. The major etiological factors include iron deficiency, poor dietary iron bioavailability due to phytate-rich diets, parasitic infestations, and haemoglobinopathies such as β-thalassaemia and Hb-E disease [8,9]. Rural populations and socioeconomically disadvantaged groups are particularly affected, reflecting ongoing nutritional and structural inequalities [7,8].

Although the community burden of anaemia in Bangladesh is well documented, there remains limited evidence regarding its clinical profile, morphological patterns, and etiological spectrum in tertiary care hospital settings, where more severe and complicated cases are usually managed. Hospital-based studies from the region suggest that anaemia presents with diverse clinical and haematological profiles depending on underlying diseases and patient characteristics [10].

Therefore, this study was undertaken to evaluate the clinical profile and etiology of anaemia among patients attending a tertiary care hospital in Bangladesh, which may provide important insights for improved diagnosis, classification, and management of anaemic patients.

METHODOLOGY

This was a hospital-based cross-sectional descriptive study conducted in the Department of Medicine, Private tertiary level hospital, Dhaka, Bangladesh, over a period of one year from January 2014 to December 2014. A total of 138 adult patients diagnosed with anaemia were included in the study. Anaemia was defined according to WHO criteria as hemoglobin concentration <13 g/dL in males and <12 g/dL in females. Patients aged 18 years and above with confirmed anaemia were eligible for inclusion. Patients with acute blood loss anaemia, recent blood transfusion within the last three months, and those with incomplete clinical or laboratory data were excluded from the study.

All eligible participants were enrolled using a purposive consecutive sampling technique. Data were collected using a pre-designed structured data collection sheet through face-to-face interview, clinical examination, and review of laboratory and medical records. Information regarding sociodemographic characteristics, clinical features, and relevant hematological parameters including hemoglobin level, RBC count, hematocrit, MCV, MCH, MCHC, and RDW was recorded. Anaemia severity was classified as mild, moderate, and severe based on hemoglobin concentration. Morphological classification was done on the basis of peripheral blood film examination into microcytic hypochromic, normocytic normochromic, macrocytic, and dimorphic anaemia. Etiological classification included iron deficiency anaemia, anaemia of chronic disease, megaloblastic anaemia, chronic kidney disease-related anaemia, hemolytic anaemia, aplastic anaemia, hematological malignancy, and other miscellaneous causes.

Data were analyzed using SPSS software version 20 or later. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage. Associations between categorical variables were assessed using the Chi-square test, and a p-value <0.05 was considered statistically significant. Results were presented in tabular form accordingly.

RESULTS

A total of 138 patients with anaemia were enrolled in the study during the period from January 2014 to December 2014. The mean age of the participants was 42.8 ± 17.6 years (range: 18–85 years). Females constituted 57.2% (n=79) of the study population, while males accounted for 42.8% (n=59).

Sociodemographic Characteristics

The majority of patients belonged to the 31–50 years age group (39.1%), followed by 18–30 years (26.1%), 51–65 years (23.9%), and >65 years (10.9%). Most participants were female (57.2%) and from urban areas (61.6%) (Table I).

Table I: Sociodemographic characteristics of study participants (n=138)

Characteristics	Frequency (n)	Percentage (%)
Age group (years)		
18–30	36	26.1
31–50	54	39.1
51–65	33	23.9
>65	15	10.9
Gender		
Male	59	42.8
Female	79	57.2
Residence		
Urban	85	61.6
Rural	53	38.4

Clinical Presentation

The most common presenting symptom was generalized weakness (89.1%), followed by fatigue (81.2%), shortness of breath (62.3%), palpitation (42.8%), and dizziness (39.9%). Clinical pallor was present in almost all patients (95.7%) (Table II).

Table II: Clinical presentation of anaemic patients (n=138)

Clinical features*	Frequency (n)	Percentage (%)
Pallor	132	95.7
Generalized weakness	123	89.1
Fatigue	112	81.2
Shortness of breath	86	62.3
Palpitation	59	42.8
Dizziness	55	39.9
Weight loss	32	23.2
Fever	29	21.0
Pedal edema	21	15.2

*Multiple responses possible

Severity of Anaemia

Based on hemoglobin concentration, moderate anaemia was the most common category (47.1%), followed by severe anaemia (29.0%) and mild anaemia (23.9%) (Table III).

Table III: Severity of anaemia according to hemoglobin level (n=138)

Severity	Frequency (n)	Percentage (%)
Mild	33	23.9
Moderate	65	47.1
Severe	40	29.0

Hematological Profile

The hematological parameters of the study participants are presented in Table IV. The mean hemoglobin concentration was 8.2 ± 2.1 g/dL, indicating that most patients had moderate anaemia. The mean red blood cell count and hematocrit were 3.42 ± 0.88 $\times 10^6/\mu L$ and 27.6 ± 6.4%, respectively, both of which were lower than normal reference ranges, reflecting reduced erythrocyte mass. The mean MCV (75.6 ± 13.8 fL), MCH (24.8 ± 4.6 pg), and MCHC (30.2 ± 3.1 g/dL) suggested a predominance of microcytic hypochromic red cell morphology. The elevated RDW (17.9 ± 4.2%) reflected considerable variation in red blood cell size, indicating diverse underlying etiologies of anaemia (Table IV).

Table IV: Hematological parameters of study participants (n=138)

Parameter	Mean ± SD
Hemoglobin (g/dL)	8.2 ± 2.1
RBC count ($\times 10^6/\mu L$)	3.42 ± 0.88
Hematocrit (%)	27.6 ± 6.4
MCV (fL)	75.6 ± 13.8
MCH (pg)	24.8 ± 4.6
MCHC (g/dL)	30.2 ± 3.1
RDW (%)	17.9 ± 4.2

Morphological Classification of Anaemia

Peripheral blood film examination revealed that microcytic hypochromic anaemia was the predominant morphological type (47.8%), followed by normocytic normochromic anaemia (31.2%), macrocytic anaemia (13.0%), and dimorphic anaemia (8.0%) (Table V).

Table V: Morphological classification of anaemia (n=138)

Morphological type	Frequency (n)	Percentage (%)
Microcytic hypochromic	66	47.8
Normocytic normochromic	43	31.2
Macrocytic	18	13.0
Dimorphic	11	8.0

Etiology of Anaemia

Iron deficiency anaemia was the most common etiology, accounting for 42.0% of cases, followed by anaemia of chronic disease (20.3%), megaloblastic anaemia (14.5%), chronic kidney disease-associated anaemia (8.7%), hemolytic anaemia (5.8%), aplastic anaemia (3.6%), hematological malignancy (2.9%), and others (2.2%) (Table VI).

Table VI: Etiological distribution of anaemia (n=138)

Etiology	Frequency (n)	Percentage (%)
Iron deficiency anaemia	58	42.0
Anaemia of chronic disease	28	20.3
Megaloblastic anaemia	20	14.5
Chronic kidney disease-related anaemia	12	8.7
Hemolytic anaemia	8	5.8
Aplastic anaemia	5	3.6
Hematological malignancy	4	2.9
Others	3	2.2

Association Between Morphological Type and Etiology

A significant association was observed between the morphological pattern and etiology of anaemia ($\chi^2 = 89.4$, df = 9, $p < 0.001$). Microcytic hypochromic anaemia was predominantly associated with iron deficiency anaemia (84.8%), while macrocytic anaemia was mainly linked to megaloblastic anaemia (77.8%). Normocytic normochromic anaemia was most commonly observed among patients with anaemia of chronic disease (51.2%). These findings indicate that morphological classification is strongly associated with the underlying etiology of anaemia (Table VII).

Table VII: Association between morphological classification and etiology of anaemia (n=138)

Morphological Type	Iron Deficiency Anaemia n (%)	Anaemia of Chronic Disease n (%)	Megaloblastic Anaemia n (%)	Other Causes* n (%)	Total n (%)	p-value
Microcytic hypochromic	56 (84.8)	4 (6.1)	1 (1.5)	5 (7.6)	66 (47.8)	
Normocytic normochromic	2 (4.7)	22 (51.2)	3 (7.0)	16 (37.1)	43 (31.2)	
Macrocytic	0 (0.0)	1 (5.6)	14 (77.8)	3 (16.7)	18 (13.0)	
Dimorphic	0 (0.0)	1 (9.1)	2 (18.2)	8 (72.7)	11 (8.0)	
Total	**58 (42.0)**	**28 (20.3)**	**20 (14.5)**	**32 (23.2)**	**138 (100.0)**	**<0.001†**

*Other causes include chronic kidney disease-related anaemia, hemolytic anaemia, aplastic anaemia, hematological malignancy and miscellaneous causes
†Chi-square test, $\chi^2 = 89.4$, df = 9, $p < 0.001$. (Note: Fisher's exact test may also be appropriate due to small cell counts)
Note: Due to small expected cell counts in several cells, Fisher–Freeman–Halton exact test may also be considered appropriate; however, Pearson Chi-square test was applied for overall association.

Association Between Severity of Anaemia and Etiology

A statistically significant association was observed between the severity of anaemia and its underlying etiology ($\chi^2 = 15.8$, df = 6, $p = 0.002$). Moderate anaemia was the most common severity overall (47.1%), particularly among patients with anaemia of chronic disease (53.6%), megaloblastic anaemia (50.0%), and iron deficiency anaemia (48.3%). Severe anaemia was more frequent in patients with other causes of anaemia (46.9%), followed by megaloblastic anaemia (30.0%) and iron deficiency anaemia (27.6%). Mild anaemia was relatively more observed in anaemia of chronic disease (35.7%). These findings indicate a significant variation in anaemia severity according to underlying etiology (Table VIII).

Table VIII: Association between severity of anaemia and etiology (n=138)

Etiology	Mild n (%)	Moderate n (%)	Severe n (%)	Total n (%)	p-value
Iron deficiency anaemia	14 (24.1)	28 (48.3)	16 (27.6)	58 (42.0)	
Anaemia of chronic disease	10 (35.7)	15 (53.6)	3 (10.7)	28 (20.3)	
Megaloblastic anaemia	4 (20.0)	10 (50.0)	6 (30.0)	20 (14.5)	
Other causes*	5 (15.6)	12 (37.5)	15 (46.9)	32 (23.2)	
Total	**33 (23.9)**	**65 (47.1)**	**40 (29.0)**	**138 (100.0)**	**0.002†**

*Other causes include chronic kidney disease-related anaemia, hemolytic anaemia, aplastic anaemia, hematological malignancy, and miscellaneous causes.
† Chi-square test, $\chi^2 = 15.8$, df = 6, $p = 0.002$.

DISCUSSION

The present study evaluated the clinical profile and etiology of anaemia among 138 patients attending a tertiary care hospital. The mean age of the study population was 42.8 ± 17.6 years, and females constituted a higher proportion of cases than males. This finding is consistent with the global epidemiology of anaemia, which demonstrates a greater burden among women due to nutritional deficiencies, menstrual blood loss, and reproductive factors [11].

Generalized weakness, fatigue, and shortness of breath were the most common presenting symptoms in the present study. Similar clinical manifestations have been reported by Vieth and Lane, who described weakness, fatigue, dyspnea, and reduced exercise tolerance as the predominant symptoms of anaemia across different etiologies. These symptoms reflect impaired tissue oxygen delivery resulting from reduced haemoglobin concentration.

In the current study, moderate anaemia was the most frequent category (47.1%), followed by severe anaemia (29.0%). This finding suggests that many patients seek tertiary-level care only after developing clinically significant disease. Stoltzfus emphasized that anaemia often remains under-recognized until symptoms become sufficiently severe to require medical attention, particularly in resource-limited settings [11].

Microcytic hypochromic anaemia was the predominant morphological pattern (47.8%), followed by normocytic normochromic anaemia (31.2%). Correspondingly, iron deficiency anaemia was identified as the most common etiology (42.0%). These findings are in agreement with Fielding, who reported iron deficiency as the leading cause of anaemia worldwide and noted that microcytic hypochromic morphology is strongly associated with iron deficiency states [12]. The predominance of iron deficiency in the present study may reflect inadequate dietary iron intake, chronic blood loss, and poor iron absorption, which remain common in developing countries.

Anaemia of chronic disease was the second most common etiology (20.3%). This observation is consistent with previous reports indicating that chronic inflammatory and systemic disorders constitute a major cause of anaemia among hospitalized patients [15,16]. Stouten et al. reported that chronic diseases account for a substantial proportion of anaemia cases encountered in clinical practice, particularly among older adults and patients with multiple comorbidities.

Megaloblastic anaemia accounted for 14.5% of cases in the present study. Similar findings were reported by Khanduri and Sharma, who identified nutritional deficiency of vitamin B12 and folate as major contributors to megaloblastic anaemia in South Asian populations [17]. The relatively high frequency of megaloblastic anaemia observed in this study may be attributable to dietary inadequacies and delayed diagnosis.

Chronic kidney disease-related anaemia represented 8.7% of all cases. This finding is supported by McClellan et al., who demonstrated a high prevalence of anaemia among patients with chronic kidney disease due to reduced erythropoietin production and associated metabolic abnormalities [18]. Furthermore, Metivier et al. highlighted the important cardiovascular consequences of renal anaemia, emphasizing the need for early recognition and treatment [15].

A significant association was observed between morphological classification and etiology of anaemia ($p < 0.001$). Iron deficiency anaemia was predominantly associated with microcytic hypochromic morphology, whereas megaloblastic anaemia was strongly associated with macrocytic morphology. These findings are biologically plausible and consistent with established hematological principles and previous literature [12,13]. In addition, a significant relationship was found between severity of anaemia and underlying etiology ($p = 0.002$), with severe anaemia being more frequent among patients with chronic systemic and other pathological causes. Similar observations have been reported among hospitalized patients where disease severity and chronicity influence the degree of haemoglobin reduction [16].

Overall, the findings of the present study indicate that iron deficiency anaemia remains the leading cause of anaemia in tertiary care settings, while chronic diseases and megaloblastic disorders contribute substantially to the overall burden. Recognition of the underlying etiology and morphological pattern is essential for timely diagnosis and appropriate management of anaemic patients.

CONCLUSION

Anaemia is a common clinical problem in tertiary care settings with a wide spectrum of clinical presentations and underlying etiologies. In this study, most patients presented with moderate anaemia, and generalized weakness and fatigue were the most frequent clinical features. Microcytic hypochromic anaemia was the predominant morphological pattern, with iron deficiency anaemia being the leading cause. A significant association was observed between morphological classification, severity, and underlying etiology of anaemia. The findings highlight that anaemia in hospitalized patients is often multifactorial and varies in severity according to its underlying cause. Early identification of clinical and haematological patterns can facilitate prompt diagnosis and appropriate management. Strengthening diagnostic evaluation and addressing preventable causes, particularly iron deficiency, may help reduce the burden of anaemia in tertiary care settings.

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