CHARACTERISTICS OF ANEMIA AND ASSOCIATED FACTORS AMONG INPATIENTS IN THE GENERAL INTERNAL MEDICINE DEPARTMENT - TRA VINH GENERAL HOSPITAL

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ABSTRACT

Background: Anemia is common among hospitalized patients, particularly adults and older people, and may reduce quality of life and exacerbate underlying diseases. Describing anemia characteristics and related factors is important to guide appropriate screening and management in clinical practice. **Objectives:** (1) To describe anemia characteristics and (2) to investigate factors associated with anemia severity among inpatients in the General Internal Medicine Department, Tra Vinh General Hospital. **Materials and Methods:** This prospective cross-sectional descriptive study included 196 inpatients aged ≥ 18 years who were diagnosed with anemia according to World Health Organization (WHO) criteria and admitted from June to August 2023. Data collected included demographic characteristics, medical history, habits, related comorbidities, and laboratory indices. Anemia severity was classified according to WHO standards. Data were analyzed using Stata 14.0, and $p<0.05$ was considered statistically significant. **Results:** The mean age was 58.1 ± 16.2 years, with patients aged ≥ 60 years accounting for 50.5%. Females comprised 54.1% of the study population. Most patients resided in rural areas (86.2%). Regarding ethnicity, 70.9% were Kinh and 29.1% were Khmer. Normocytic normochromic anemia was the most common morphology (78.0%), followed by microcytic hypochromic anemia (17.9%) and macrocytic anemia (4.0%). Moderate anemia accounted for 60.2% of cases, severe anemia for 24.0%, and mild anemia for 15.8%. Factors significantly associated with anemia severity included a history of anemia, chronic kidney disease (CKD), iron deficiency anemia, aplastic anemia, thalassemia, alcohol use, and anemia morphology (all $p < 0.05$). **Conclusions:** Among medical inpatients, moderate anemia and normocytic normochromic morphology predominated. Several chronic and hematologic conditions were associated with anemia severity, indicating the need for enhanced screening and appropriate anemia management in these patient groups.

Keywords: *anemia, anemia severity, anemia morphology, CKD, iron deficiency anemia.*

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I. INTRODUCTION

Anemia is defined as a reduction in hemoglobin (Hb) concentration or red blood cell (RBC) count, which impairs the oxygen-carrying capacity and consequently has a substantial impact on quality of life, increasing morbidity and mortality rates [6,9]. According to the World Health Organization (WHO), anemia occurs when Hb falls below the normal threshold for healthy individuals of the same sex and age living in the same environment [6].

Globally, anemia remains a significant public health concern. It was estimated that approximately 32.9% of the population was affected in 2010, with a higher burden in high-risk groups such as children under five years of age, women of reproductive age, older adults, and individuals with chronic diseases [6]. In a study by Ruan et al. (2019) involving 13,175 adults aged ≥50 years, the prevalence of anemia was 31% and was associated with frailty among older adults [9]. In Vietnam, the Global Burden of Disease 2021 report indicates that anemia continues to be a concern, with the burden concentrated in middle-aged and older populations, particularly among women. Although the overall prevalence of anemia from all causes decreased from 23.9% to 16.2% between 1990 and 2021, mild anemia remained predominant (58%), while severe anemia accounted for a small proportion (4%) [5].

Similarly, Vietnamese studies have reported substantial variations in anemia characteristics across different populations [1-4]. Previous research has shown that mild anemia predominates in diverse clinical and community settings, including patients receiving maintenance hemodialysis, individuals with chronic inflammatory conditions, and children under five years of age [1,2,4].

Among hospitalized patients, anemia is not only a consequence of underlying diseases but is often multifactorial and may further exacerbate disease severity and clinical outcomes [6,8]. However, in Tra Vinh city, data on anemia

severity and RBC morphology among inpatients remain limited, primarily derived from disease-specific cohorts, while clinical manifestations are often nonspecific. Therefore, identifying anemia characteristics and factors associated with anemia severity among hospitalized patients is essential to support effective clinical management, prevention strategies, and improved patient care. Based on these considerations, the present study was conducted.

Study objectives:

1.To describe the characteristics of anemia among inpatients in the General Internal Medicine Department of Tra Vinh General Hospital.

2.To investigate factors associated with anemia severity in this population.

II. MATERIALS AND METHODS

2.1.Study population

Inclusion criteria: Patients aged ≥18 years who were admitted to the General Internal Medicine Department between June and August 2023, were diagnosed with anemia according to WHO criteria, and provided written informed consent to participate in the study.

Exclusion criteria: Patients with severe organ failure (including heart failure, liver failure, or respiratory failure) or psychiatric disorders that precluded cooperation.

2.2.**Study setting:** General Internal Medicine Department, Tra Vinh General Hospital.

2.3.Methods

2.3.1.Study design

A cross-sectional descriptive study with prospective data collection.

2.3.2.Sample size

Patients were consecutively recruited during the study period using a convenience sampling approach. A total of 196 anemic patients met the inclusion criteria.

2.3.3.Study variables and definitions

General characteristics: age, sex, ethnicity, place of residence, and body mass index (BMI).

Medical history and habits: history of anemia, chronic kidney disease (CKD), gastrointestinal diseases, *Helicobacter pylori* infection, routine deworming, and alcohol use.

Current anemia-related comorbidities: CKD, iron deficiency anemia, gastrointestinal bleeding, aplastic anemia, myelodysplastic syndrome, thalassemia, and other conditions.

Laboratory indices: Hb, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), reticulocyte count, serum iron, ferritin, creatinine, and stool examination for parasites.

Anemia severity: classified according to WHO criteria [6] (Table 1).

Table 1. Classification of anemia severity based on hemoglobin according to WHO

Population/age group	Anemia severity (g/L)			
	No anemia	Mild	Moderate	Severe
Non-pregnant women (≥15 years)	≥ 120	110 - 119	80 - 109	< 80
Men (≥15 years)	≥ 130	110 - 129	80 - 109	< 80

Anemia morphology classification: based on RBC indices (MCV, MCH, MCHC) into microcytic hypochromic anemia, normocytic normochromic anemia, and macrocytic anemia. **Iron deficiency anemia:** diagnosed using clinical criteria and routine laboratory findings, including low Hb or hematocrit accompanied by low MCV and MCH with a reduced RBC count. Measurement of ferritin and serum iron supports the diagnosis of iron deficiency [6,7].

2.4.Data collection and statistical analysis

Data were collected from medical records and direct interviews using a standardized questionnaire. Analyses were performed using Stata 14.0. Descriptive statistics included frequencies, percentages, and mean ± standard deviation. Associations between anemia severity and related factors were assessed using the Chi-square test or Fisher's exact test. A p-value < 0.05 was considered statistically significant.

2.5.Ethical considerations

The study was approved by the Biomedical Research Ethics Committee of Tra Vinh University (Decision No. 229/GCT-HĐĐĐ dated June 18, 2023) and was conducted with permission from Tra Vinh General Hospital in accordance with institutional procedures.

III. RESULTS

During the study period, we enrolled 196 patients with anemia for analysis. Females accounted for 54.1% and males for 45.9%. The mean age of the study population was 58.1 ± 16.1 years.

3.1. General characteristics, medical history, and current comorbidities

Table 2. General characteristics, medical history, and current comorbidities (n = 196)

Characteristics		Frequency (n)	Percentage (%)
Mean age (years)		58.1 ± 16.2	
Sex	Male	90	45.9
	Female	106	54.1
Age group (years)	18 – 40	29	14.8
	41 – 59	68	34.7
	≥ *60*	99	50.5
Ethnicity	Kinh	139	70.9
	Khmer	57	29.1
Residence	Rural	169	86.2
	Urban	27	13.8
BMI category	Underweight	18	9.2
	Normal	157	80.1
	Overweight/obesity	21	10.7
Medical history	History of anemia	75	38.3
	CKD	77	39.3
	Gastrointestinal diseases	45	23.0
	Helicobacter pylori infection	6	3.1
	Routine deworming	7	3.6
	Alcohol use	21	10.7
Current anemia-related comorbidities	CKD	78	39.8
	Iron deficiency anemia	75	38.3
	Gastrointestinal bleeding	32	16.3
	Aplastic anemia	9	4.6
	Myelodysplastic syndrome	2	1.0
	Thalassemia	6	3.1

Comment: Patients aged ≥60 years accounted for the largest proportion (50.5%), whereas those aged 18–40 years accounted for the smallest (14.8%). The majority were of Kinh ethnicity (70.9%) and lived in rural areas (86.2%). Most participants had a normal BMI (80.1%). The proportions of patients with a history of CKD, anemia, gastrointestinal diseases, and *H. pylori* infection were 39.3%, 38.3%, 23.0%, and 3.1%, respectively. Routine deworming and alcohol use were reported in 3.6% and 10.7% of patients, respectively. Current comorbidities included CKD (39.8%), iron deficiency anemia (38.3%), gastrointestinal bleeding (16.3%), aplastic anemia (4.6%), thalassemia (3.1%), myelodysplastic syndrome (1.0%), and other conditions (43.4%).

1.2. Anemia severity and red blood cell morphology

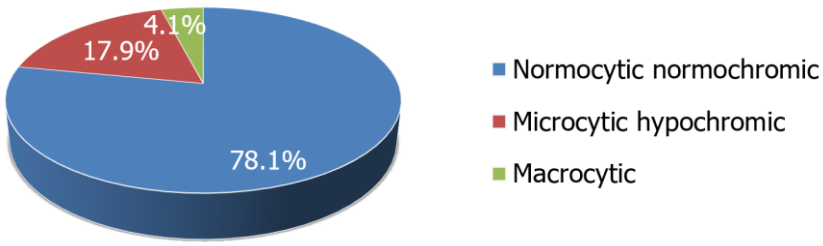

Figure 1. Red blood cell morphology patterns of anemia in the study population

Comment: Normocytic normochromic anemia accounted for 78.0%, microcytic hypochromic 11.1

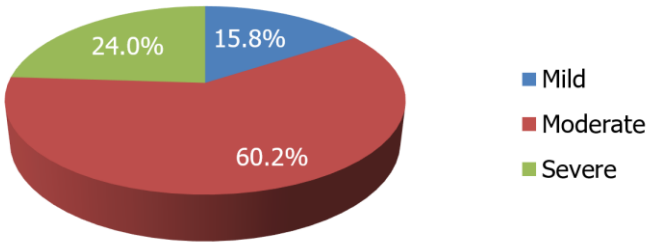

Figure 2. Distribution of anemia severity in the study population

Comment: Moderate anemia was the most common (60.2%), followed by severe anemia (24.0%), while mild anemia accounted for the smallest proportion (15.8%).

1.3. Factors associated with anemia severity

An analysis of the associations between anemia severity and general characteristics, medical history, current comorbidities, and anemia morphology showed that several factors were significantly related to anemia severity. The results are presented in Table 3.

Table 3. Factors associated with anemia severity in the study population

Independent variables		**Anemia severity**			**p**
		Mild n (%)	**Moderate n (%)**	**Severe n(%)**	
Medical history					
History of anemia	No	30 (24.8)	74 (61.2)	17 (14.1)	**<0.001**
	Yes	1 (1.3)	44 (58.7)	30 (40.0)	
History of CKD	No	27 (22.7)	63 (52.9)	29 (24.4)	**0.003**
	Yes	4 (5.2)	55 (71.4)	18 (23.4)	
Alcohol use	No	23 (13.1)	109 (62.3)	43 (24.6)	**0.012**
	Yes	8 (38.1)	9 (42.9)	4 (19.0)	
Current comorbidities					
CKD	No	26 (22.0)	59 (50.0)	33 (28.0)	**0.001**
	Yes	5 (6.4)	59 (75.6)	14 (18.0)	
Iron deficiency anemia	No	30 (24.8)	70 (57.9)	21 (17.4)	**<0.001**
	Yes	1 (1.3)	48 (64.0)	26 (34.7)	
Aplastic anemia	No	31 (16.6)	117 (62.6)	39 (20.9)	**<0.001**
	Yes	0 (0)	1 (11.1)	8 (88.9)	
Thalassemia	No	31 (16.3)	118 (62.1)	41 (21.6)	**<0.001**
	Yes	0 (0)	0 (0)	6 (100.0)	
Anemia morphology					
Microcytic hypochromic		1 (3.3)	13 (41.9)	17 (54.8)	**<0.001**
Normocytic normochromic		27 (17.9)	96 (63.6)	28 (18.5)	
Macrocytic		3 (21.4)	9 (64.3)	2 (14.3)	
Fisher's exact test					

Comment:

Patients with a history of anemia had a markedly higher proportion of severe anemia than those without such a history (40.0% vs. 14.1%; p < 0.001). Among patients with a history of CKD, anemia was mainly moderate (71.4%), while mild anemia was less frequent (5.2%) compared with those without a history of CKD (p = 0.003). Alcohol use was associated with a different distribution of anemia severity (p = 0.012), with a higher proportion of mild anemia (38.1%) and a lower proportion of severe anemia compared with non-users.

Among current comorbidities, CKD was significantly associated with anemia severity, showing a higher proportion of moderate anemia (75.6%) and a lower proportion of mild anemia (6.4%) than in patients without CKD (p = 0.001). Iron deficiency anemia was also significantly associated with anemia severity, with a higher proportion of severe anemia (34.7% vs. 17.4%) and a very low proportion of mild anemia (1.3%) (p < 0.001). Hematologic

disorders showed a strong association with anemia severity: most patients with aplastic anemia had severe anemia (88.9%) with no mild cases recorded, and all thalassemia cases were classified as severe anemia ($p < 0.001$).

Regarding morphology, microcytic hypochromic anemia was more often severe, whereas normocytic normochromic and macrocytic anemia were predominantly moderate; the difference was statistically significant ($p < 0.001$). Other factors such as sex, age group, ethnicity, residence, BMI, history of gastrointestinal diseases, *H. pylori* infection, and routine deworming were not significantly associated with anemia severity in this study.

IV. DISCUSSION

4.1. Patient characteristics

Our study showed a mean patient age of 58.1 ± 16.2 years, and anemia occurred in more than 50% of patients aged ≥60 years, consistent with previous studies [1,3,8]. The proportion of females was higher than that of males, similar to reports from both Vietnam and other countries [1,3,8,9]. This finding is in line with the Global Burden of Disease 2021 report, which indicates that anemia in Vietnam is currently concentrated among middle-aged and older adults, particularly women [5].

Most patients lived in rural areas, consistent with the studies by Nguyen Van Tuan [4] and Ruan et al. [9]. The Kinh ethnic group accounted for the largest proportion (70.92%), followed by the Khmer group (29.08%), which is comparable to the findings of Nguyen Le Thanh Truc [3]. These results reflect the local population structure and differences in access to healthcare services. Tra Vinh has a large Khmer community, mainly residing in rural areas. Socioeconomic conditions, nutritional status, and access to healthcare may influence anemia detection and management; however, these factors were not explored in depth in the present study. In addition, environmental and behavioral factors such as chronic gastrointestinal diseases, malabsorption, and parasitic infections in rural settings may also contribute to anemia. In our study, the proportions of routine deworming and alcohol use were low (3.6% and 10.7%, respectively).

The most common past medical histories in this study included CKD (39.3%), anemia (38.3%), and gastrointestinal disorders (23%). In contrast, current anemia-related comorbidities comprised CKD (39.8%), iron deficiency anemia (38.3%), gastrointestinal bleeding (16.3%), aplastic anemia (4.6%), thalassemia (3.1%), and myelodysplastic syndrome (1.0%). These findings are consistent with the mechanisms of anemia in chronic diseases, which involve disease-specific effects on blood loss, hemolysis, or erythropoiesis, as well as inflammation-mediated disturbances in iron metabolism [6]. Studies by Randi et al. [8] and Nguyen Chi Thanh et al. [1] reported that the two most common disease groups associated with anemia were CKD and chronic inflammatory conditions. These results are also consistent with epidemiological studies on anemia in older adults, in which advanced age and chronic diseases are recognized as important risk factors for anemia [6,8]. Overall, many cases of anemia appeared to be multifactorial, whereas iron deficiency anemia and other specific causes were less prevalent, a pattern similar to that reported by Migone et al. [8].

4.2. Anemia severity and red blood cell morphology

Among the 196 patients included in this study, moderate anemia was the most prevalent category, accounting for 60.2% of cases, followed by severe anemia (24.0%). This distribution is consistent with findings from studies conducted in hospitalized populations, where moderate anemia frequently predominates and is commonly associated with a higher burden of underlying comorbidities [8]. In contrast, several studies performed in different clinical settings or disease-specific populations have reported mild anemia as the most common category [1,4]. These discrepancies may be attributed to differences in study populations, underlying disease profiles, treatment strategies, timing of hemoglobin assessment, and clinical settings.

With respect to RBC morphology, normocytic normochromic anemia was the predominant pattern in the present study (78.0%), followed by microcytic hypochromic anemia (17.9%) and macrocytic anemia (4.1%). This morphological distribution is comparable to those reported in previous Vietnamese studies [1,4], in which

normocytic normochromic anemia was the most frequent type, whereas macrocytic anemia was least commonly observed. Such a pattern likely reflects the high prevalence of chronic kidney disease and other chronic conditions in the study population, in which anemia typically presents as normocytic and normochromic due to reduced erythropoietin production and inflammation-related disturbances in iron metabolism. The proportion of microcytic hypochromic anemia observed in this study suggests a meaningful contribution of iron deficiency anemia and thalassemia, conditions that are known to remain prevalent in Vietnam [5]. In contrast, the relatively low prevalence of macrocytic anemia may be related to vitamin B12 or folate deficiency and alcohol use. However, these potential etiologies could not be fully characterized, as specialized laboratory assessments were not consistently performed in all patients.

4.3. Association between anemia severity and related factors

The study demonstrated significant associations between anemia severity and CKD, iron deficiency anemia, thalassemia, aplastic anemia, alcohol use, and RBC morphology. Severe anemia was more frequent among patients with a history of anemia, CKD, iron deficiency anemia, aplastic anemia, and thalassemia. In addition, anemia severity was strongly associated with RBC morphology ($p < 0.001$), with microcytic hypochromic anemia showing the highest proportion of severe cases. These findings are consistent with established mechanisms of anemia related to chronic blood loss and impaired erythropoiesis, particularly in CKD and hematologic disorders [6]. Alcohol use may further contribute to anemia severity through nutritional deficiencies and bone marrow toxicity. RBC morphology may provide etiologic orientation: microcytic hypochromic anemia suggests iron deficiency or thalassemia, normocytic normochromic anemia is commonly observed in CKD or chronic inflammation, and macrocytic anemia suggests vitamin B12/folate deficiency or alcohol misuse [6].

Other factors including sex, age group, ethnicity, residence, BMI, history of gastrointestinal diseases, prior *Helicobacter pylori* infection, deworming, and gastrointestinal bleeding were not significantly associated with anemia severity in this study. This finding is partly consistent with the study by Nguyen Van Tuan [4], indicating that not all potential risk factors show statistically significant associations in every specific study population.

This study had several limitations. Some tests (reticulocyte count, serum iron, ferritin, and stool examination) were not performed in all patients, limiting a comprehensive assessment of associations. The small sample sizes in certain specific disease groups (thalassemia, myelodysplastic syndrome, and aplastic anemia) restricted the generalizability of the findings. In addition, the cross-sectional design does not allow causal inference between related factors and anemia severity.

V. CONCLUSIONS

Patients with anemia admitted to the Internal Medicine Department were predominantly older adults, female, and mostly resided in rural areas. Moderate anemia was the most common severity category, and normocytic normochromic anemia was the predominant morphology. Anemia severity was significantly associated with a history of anemia, CKD, iron deficiency anemia, aplastic anemia, thalassemia, alcohol use, and RBC morphology ($p < 0.05$). These results suggest the need to enhance etiologic evaluation and anemia management among inpatients, particularly those with chronic comorbidities and hematologic disorders.

RECOMMENDATIONS

More comprehensive diagnostic testing (e.g., serum iron, ferritin, reticulocyte count, hemoglobin electrophoresis, and transferrin saturation) should be considered in cases of severe anemia or anemia of unclear etiology. Further studies with larger sample sizes and longer follow-up are needed to clarify the associations between anemia severity and underlying comorbidities.

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