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A Prospective Observational Study on Prevalence of Anemia, Associated Risk Factors and Outcome

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Abstract

Background: Admitted patients with anemia are at increased morbidity and mortality risk, as well as length of hospital stay. It affects more than 2 billion people worldwide and is causing significant morbidity and mortality. Its etiology is variable, with many predisposing factors including nutritional deficiencies, infections, malignancies, chronic inflammations, and other chronic diseases like autoimmune diseases, chronic liver disease, and chronic kidney disease. *Methods*: We performed a non-randomized, prospective observational study of 143 patients admitted to internal medicine between March and April 2021 and assessed their hemoglobin level in order to determine the prevalence of anemia. The demographic and clinical data were collected using a specially designed questionnaire. All patients found to have anemia were followed for outcome assessment (either discharge or death). *Results*: The prevalence of anemia was high (52.4%) among the 143 admitted patients in internal medicine at CHUK. Patients with HIV, cancer, and chronic kidney disease had a 5.84-, 4.11-, and 3.79-times higher risk of having anemia, respectively. In 75 patients who had anemia, 10 patients died; among them, 5 patients had severe anemia; 25 patients were 60 years old and above; 60 patients had normocytic anemia, and they had an average length of hospital stay of 20.6 days; for patients with severe anemia, the length of hospital stay was 28 days. *Conclusion*: This study demonstrated a high prevalence of anemia, which is associated with a high mortality rate among admitted patients in CHUK. Priority should be given to preventive medicine, optimal management of chronic disease, and geriatric medicine.

Keywords: Hospitalized Patients; Anemia in CHUK; Prevalence of Anemia; Rwanda.

1. Introduction

Anemia is defined as a decreased level of hemoglobin below the normal limit of less than 13g/dl and 12g/dl in men and women, respectively [1, 2]. WHO categorizes anemia as mild when hemoglobin is from 10 to 11.9g/dl and 10 to 12.9 g/dl in women and men, respectively; moderate when hemoglobin level is from 7 to 9.9 g/dl in both genders; and severe when hemoglobin is less than 7 g/dl in both men and women [3–5]. Anemia remains a big concern worldwide,

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affecting all genders and all age categories across all countries, but lower and middle-income countries with fewer resources, a deficiency in diet, and many comorbidities are more affected [2, 6–8]. Anemia tops all known blood abnormalities worldwide, with around 28.4% of the world's population affected [6, 9]. The most affected populations worldwide include women, young children, and people with chronic diseases [9]. It is more prevalent among preschool children (47.4%) and less prevalent among men (12.7%) [6, 7]. It affects more than 2 billion people worldwide and is causing significant morbidity and mortality among anemic subjects [10–12]. Its etiology is multifactorial in most cases, with many predisposing factors including nutritional deficiencies, infections, malignancies, chronic inflammations, and other chronic diseases like autoimmune diseases, chronic liver disease, and chronic kidney disease [2, 10, 13]. Admitted patients with concurrent anemia are at increased risk of morbidity and mortality [9]. There is evidence that co-existing anemia prolongs hospital stay and increases re-admission rates, and the outcomes in hospitalized patients can be improved by managing anemia along with the primary cause of admission [2, 9, 14]. From the WHO data, most cases of anemia are in Africa [4]. In Ghana, it was found that anemia was the leading cause of admission and the second most common contributing factor to death [6].

In Rwanda, we don't have enough data regarding anemia in the general population. The Rwanda Demography and Health Survey (DHS) 2015 report showed a prevalence of anemia of 36.5% in children and 19.2% in females [15]. This study evaluated the prevalence of anemia among admitted patients in CHUK, associated risk factors, and outcomes in terms of mortality and hospital stay.

2. Methods

2.1. Study Design and Methodology

Kigali University Teaching Hospital (CHUK) is a public tertiary hospital in Rwanda, located in Kigali, the capital city of Rwanda. It is the biggest hospital among the three major referral hospitals located in Kigali, with a capacity of 560 beds. Internal medicine is among the departments based on the types of specialties. We performed a non-randomized, prospective observational study. Between March and April 2021, 143 patients aged ≥ 15 years old who were admitted to internal medicine had their hemoglobin assessed to determine if they had anemia or not. The anemia was classified as normocytic anemia (means with normal mean corpuscular volume of 80–100), microcytic anemia (means low mean corpuscular volume), macrocytic anemia (means high mean corpuscular volume), mild anemia (hemoglobin >/=10 g/dl), moderate anemia (hemoglobin 7-10 g/dl), and severe anemia (hemoglobin </= 7g/dl).

2.2. Patient and Public Involvement

All patients admitted to internal medicine wards were recruited for the study. Prior to the recruitment of the study participants, by using the local language (Kinyarwanda), the patients were explained the purpose of the study as well as the potential benefits and risks of participating in the study. The investigator told them that they were free to withdraw from study at any time without having to give a reason for withdrawing and without affecting their future medical care. They had the opportunity to ask questions. By signing the informed consent, they knew that they authorized access to their medical records to the monitor(s) and the auditor(s), and possibly to the members of the ethical committees or health authorities, for verification of clinical study procedures and/or data. They have been given a copy of the informed consent form.

3. Analysis

Date entry was done using Epidata version 3.1 and exported to Excel and the statistical package for social science (IBM SPSS Statistics) version 28 for final data cleaning and analysis. We performed descriptive statistics to determine frequency and percentages, and later we did the chi-square test of independence and binary logistic regression to find out the relevant significance of association, where a p-value <0.05 under a confidence level of 95% the predictive variable(s) was considered to be significantly associated with the outcome variable. No confounding variables were identified in the literature review fitting for multinomial logistic regression testing for adjustment.

4. Results

Of 143 patients, more than half (52.4%) had anemia (Figure 1); 53.1% were male; the majority (64%) reported getting less than two meals per day; among the common comorbidities, 16.1% had cancer disease, followed by chronic liver disease (15.4%) and chronic kidney diseases (12.6%); and among 22 menstruating females, 11.8% had a normal menstruation period (Table 1). Among the classifications, 26 patients had mild anemia, and among them 4 patients died; 13 patients had severe anemia, and among them 5 patients died; the mortality was almost the same among anemic (10 patients) and non-anemic (9 patients) (Table 2). During the assessment of associated risk factors, chronic kidney disease (OR 3.79, p = 0.025), cancer (OR 4.11, p = 0.009), HIV (OR 5.84, p = 0.025), and other comorbidities (OR 5.9, p = 0.000) showed significant associations with anemia (Table 3). In assessment of severity; the majority had normocytic anemia (60 patients), followed by microcytic anemia (11 patients), and 4 patients had macrocytic anemia (Figure 2). In

terms of age group, among anemic patients, 25 patients were aged 60 years and above, followed by 16 patients who were aged 31 to 40 years old (Figure 3). In the assessment of hospital stay; the average was 20 days, and the severity of anemia was associated with prolonged hospital stay, where the patients who had severe anemia spent 28 days in hospital (Figure 4). In the assessment of the death rate, among anemic patients, there were 10 patients, and the severity of anemia was associated with a high mortality rate (Figure 5).

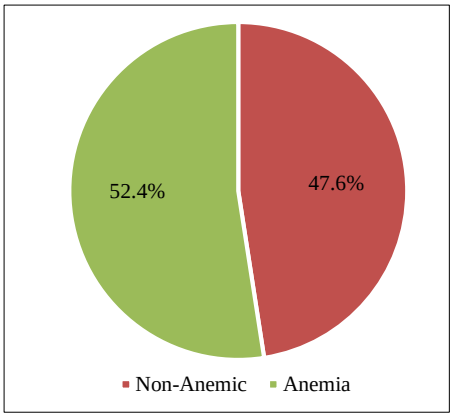

Figure 1. Anemia distribution

Table 1. Baseline characteristics of the enrolled participants

Characteristics	Number(n)	Percentage (%)
Age (Mean+/-SD) 51.6±19.6		
Gender		
Men	76	53.1
Women	67	46.9
Food Security		
Less than 2 meals per day	91	64
Greater than or equal 2 meals per day	52	36
Comorbidities		
Chronic Kidney Disease	18	12.6
Cancers	23	16.1
Chronic Liver disease	22	15.4
HIV/AIDS	13	9.1
Heart Failure	14	9.8
Chronic Lung disease	7	4.8
Peptic Ulcer disease	6	4.2
Other Diseases/comorbidities	40	28
Menstruating Female		
< 7 days per month	17	11.8
> 7 days per month	5	3.4

Table 2. Types of anemia and their prevalence with its effect on mortality (Bivariate analysis)

Severity-of-anemia	Admission Outcome, N (%)		Logistic regression			
	Survived	Died	OR	95% CI		P-value
Mild	22 (84.6)	4 (15.4)	1.192	0.333	4.268	0.787
Moderate	35 (97.2)	1 (2.8)	0.187	0.023	1.542	0.119
Severe	8 (61.5)	5 (38.5)	4.097	1.095	15.326	0.036**
No anemia	59 (86.8)	9 (13.2)	Ref.			
		Hemoglobin level				P-value
		Mean	SD	Minimum	Maximum	
Admission Outcome	Died	11.4	4.1	4.2	17.0	0.551
	Discharge	12.0	3.3	5.6	20.0	

Table 3. Bivariate analysis of factors associated with anemia

Variables		Overall, N (%)	Anemia, N (%)		OR (95%CI)	P-value
			Yes	No		
Age						
<65 years		96 (67.1)	50 (52.1)	46 (47.9)	0.96(0.477-1.929)	0.909
>=65		47 (32.9)	24 (51.1)	23 (48.9)	1	
Gender						
Male		76 (53.1)	40 (54.0)	36 (52.2)	0.822 (0.55-2.08)	0.822
Female		67 (46.9)	34 (45.9)	33 (47.8)	1	
Food Security						
<2 meals per day		91 (63.6)	44 (59.4)	47 (68)	1	
≥ 2 meals per day		52 (36.4)	30 (40.5)	22 (32)	1.45(0.73-2.81)	0.283
Comorbidities						
Chronic-kidney disease	Yes	18(12.6)	14(18.9)	4(5.8)	3.79(1.18-12.2)	0.025**
	No	125(87.4)	60(81.1)	65(94.2)	1	
Heart failure	Yes	14 (9.8)	8 (10.8)	6 (8.7)	1.27 (0.671-3.874)	0.671
	No	129(90.2)	66(89.2)	63(91.3)	1	
Cancer	Yes	23 (16.1)	18(24.3)	5 (7.3)	4.11(1.43-11.80)	0.009**
	No	120(83.9)	56(75.7)	64(92.7)	1	
HIV	Yes	13 (9.1)	11 (14.8)	2 (2.90)	5.84 (1.24-27.4)	0.025**
	No	130(90.1)	63(85.1)	67(97.1)	1	
PUD	Yes	6 (4.2)	3(4.05)	3 (4.35)	0.9 (0.18-4.768)	0.930
	No	137(95.8)	71(95.9)	66(95.6)	1	
Other Comorbidities		40 (27.9)	32 (80)	8 (20)	5.9 (2.43-13.849)	0.000**

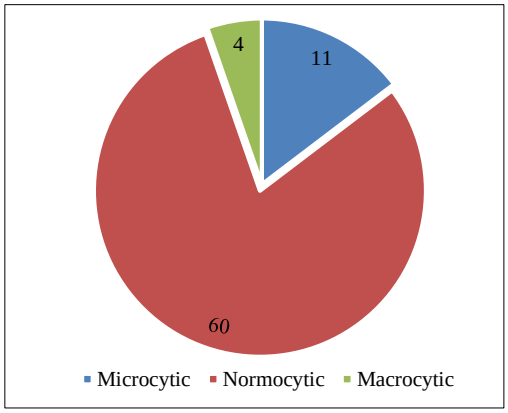

Figure 2. Anemia type distribution status (Absolute number)

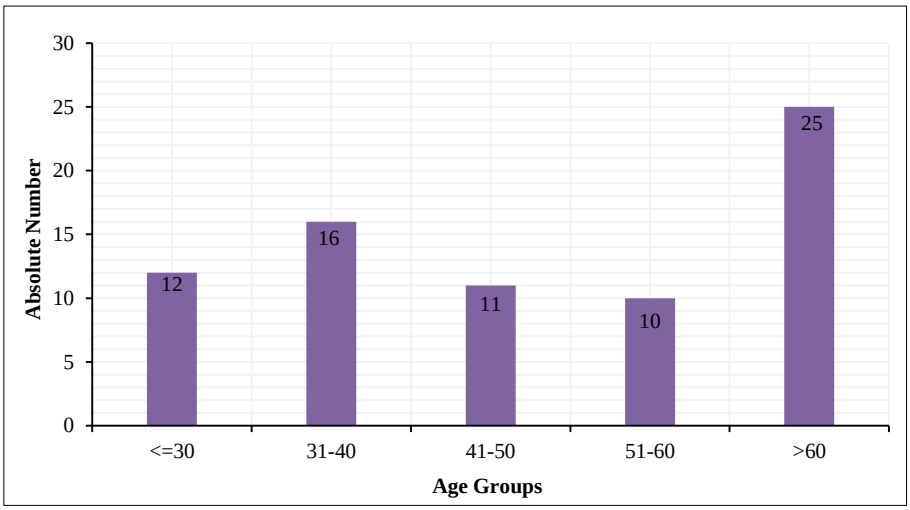

Figure 3. Age characteristics and Anemia

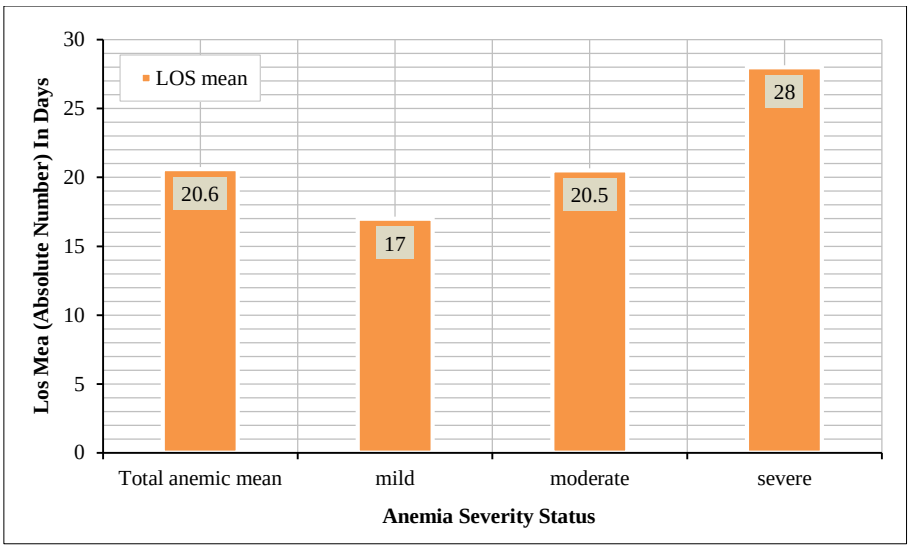

Figure 4. Distribution of length of hospital stay by anemia severity status (LOS: length of hospital stay)

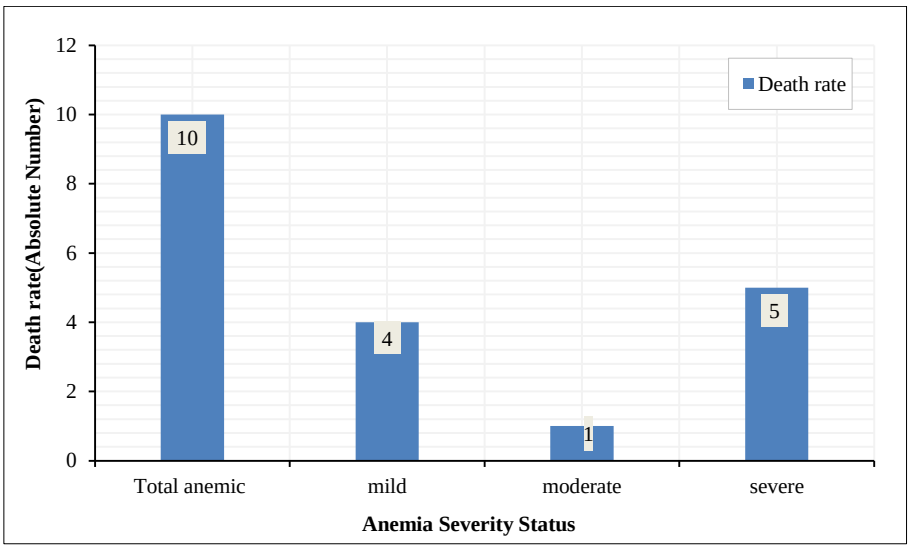

Figure 5. Anemia severity against death rate

5. Discussion

Anemia is a major problem among hospitalized patients worldwide, and it is associated with high mortality and morbidity [9]. In the study conducted at Cooper University Hospital, US, the findings were that anemic patients had an overall increased mortality risk (6.5% vs. 2.5%; OR 2.68 [2.51-2.86]) than patients without anemia, and anemia had an overall significant unique association with mortality (OR 4.5 [3.4-6]) after adjustment for demographic factors and comorbidities [16]; and in another study done by Culleton et al. in 2006 where there was a 5-fold increase in all-cause mortality risk at hemoglobin less than 11 g/dl in unadjusted analysis (HR 5.01; 95% CI, 4.43-5.66) [17]. In the study done by Zaninetti et al. (2017) in Italy, patients with anemia had a mean length of hospital stay of 11 days, longer compared to non-anemic patients, where the mean length of hospital stay was 10 days (P-value = 0.001). Participants with severe and moderate anemia had a mean length of hospital stay of 12 days, and the degree of anemia was an independent predictor of a long-term hospital stay (P-value 0.015) [18]. Another study done by Rachoin et al. supported the association of anemia and prolonged length of hospital stay with 9.8 ± 14.1 days versus 5.35 ± 8.7 days; P< 0.001) in non-anemic patients [16]. The length of hospital stay was inversely correlated with hemoglobin level in each patient, and all levels of anemia were independent risk factors for a longer hospitalization (P = 0.003, RR = 1.88, CI 95% = 1.3–2.85) [19].

The prevalence of anemia in Africa is diverse. There is a reported study in Uganda with a prevalence of 16.8 to 33.8% among adults of all genders. Another study reported a prevalence of 12.5% and 13.2% in older men and women, respectively, in South Africa and a prevalence of 23% in Zimbabwe for the general population. In Ghana, a study reported as much as 53.2% prevalence in pregnant women. In Ethiopia, studies have reported a prevalence of anemia ranging from 17 to 52.3%, and WHO data indicates that the prevalence of anemia among non-pregnant women in Ethiopia is around 23.3% as of 2016 [10].

Our findings in CHUK show that, compared to neighboring countries, there is a high prevalence of anemia among the admitted patients in the Internal Medicine Department, where, among 143 recruited patients, 52.4% had anemia (Figure 1). It is more common in senior citizens (Figure 3); normocytic anemia, which is known to be anemia of chronic disease [10], is more common, and this is supporting the significant association between anemia and HIV, cancer, and chronic kidney disease; those mentioned diseases are chronic diseases (Figure 2, Table 3). Among 75 patients who were found to have anemia, 10 (13.3%) patients died; this is a higher mortality rate compared to the 6.5% which was found in a study conducted in anemic patients at Cooper University Hospital, US, and half of the deaths were due to severe anemia (Figure 5). Our anemic patients had a prolonged length of hospital stay with a mean of 20.6 days (Figure 4), which is longer than the 11 days found in the study conducted by Zaninetti et al. [18] and other different studies. Also, our finding showed length of hospital stay inversely correlating with hemoglobin level.

6. Conclusion

Based on our findings, anemia is more prevalent among the patients admitted to the Internal Medicine Department of CHUK. It is more common in chronic senior citizens patients and they are having prolonged length of hospital stays. To the best of our knowledge, this is the first study assessing the prevalence of anemia, associated risk factors, and outcome in CHUK as well as in Rwanda. We are recommending the Ministry of Health, through the Rwanda Biomedical Centre, put enough effort into preventive medicine, optimize the management of chronic disease as anemia is among its complications, and introduce geriatric medicine as anemia is more prevalent in people with 60 years of age and above. All the measures mentioned will help to control anemia and limit its morbidity and mortality.

7. Declarations

7.1. Author Contributions

Conceptualization, E.N. and P.H.; methodology, E.U.; software, R.N.; validation, E.N., F.M., and F.B.; formal analysis, R.N.; investigation, D.M.; resources, P.N.; data curation, E.N.; writing—original draft preparation, P.H.; writing—review and editing, E.N.; visualization, F.B.; supervision, E.U.; project administration, F.M. All authors have read and agreed to the published version of the manuscript.

7.2. Data Availability Statement

The data presented in this study are available in the article.

7.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7.4. Ethical Approval

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Institutional Review Board of College of Medicine and Health Sciences (No 063/CMHS IRB/2021) and Ethics Committee of CHUK (Ref: EC/CHUK/045/2021).

7.5. Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. They were explained the objective of the study, and they were granted freedom of withdrawing from the study at any time, without giving a reason of withdrawing or affecting their future medical care.

7.6. Declaration of Competing Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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