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Prevalence of Anemia in Patients of Acute Coronary Syndrome: A Descriptive Cross-Sectional Study from Tertiary Care Centre of Eastern Nepal

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ABSTRACT

Background: Anemia in the setting of acute coronary syndrome (ACS) has been linked with increased severity of the disease and poor clinical outcomes, due to its reduced ability to carry oxygen, impaired vascular healing and inflammation, heightened risk of thrombosis and need for blood transfusions. This study aims to determine the prevalence of anemia in ACS and describe its association with clinical characteristics, severity and outcomes among patients of ACS presented to tertiary hospital of Nepal.

Methods: This was a descriptive cross-sectional study where clinical and angiographic profile of patients presenting with ACS, between November 2023 and October 2024 were evaluated and analysed in relation to anemia. Statistical analysis was done using SPSS 23.

Results: A total of 200 patients with ACS admitted in the study period were included in the study. Prevalence of anemia was 48.5%. It showed significant association with age (p=0.001). Among risk factors, only dyslipidaemia was significantly associated with anemia. Its association with severity of coronary artery disease in terms of vessels involved (p=0.002) and Gensini Score (p=0.006) were significant. Similarly, it was significantly associated with longer intensive care stay (p=0.005). Mortality was higher in anemic (12.37%) compared to non-anemic patients (4.85%), but the difference was not significant (p=0.127).

Conclusion: Anemia is considerably prevalent in our population and is associated with higher severity of disease mortality. Identification of anemia can be an important tool in treatment and prognostication of the disease.

Keywords: Anemia; Acute coronary syndrome; Outcomes; Prevalence; Severity

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INTRODUCTION

Coronary artery disease (CAD) is one of the major causes of morbidity and mortality worldwide.[1] Acute Coronary Syndrome (ACS) is a clinical spectrum of acute presentations in symptomatic CAD, and encompasses ST elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI) and unstable angina (UA).[2] Anemia in the setting of ACS has an established adverse prognostic value. Reduced ability to carry oxygen to an already under-perfused myocardium, impaired vascular healing, increased inflammatory influx, heightened risk of thrombosis and need for blood transfusions, can all contribute to adverse outcomes in patients of ACS with anemia.[3,4] The scoring systems for severity and complications following ACS are based on either clinical features or ECG changes, and do not include anemia which can be possible independent and additive prognosticator.[5,6] This study aims to determine the prevalence of anemia and its association with risk factors, severity of disease and clinical outcomes in patients of ACS.

METHODS

This is a single centre, hospital based, descriptive cross-sectional study from tertiary care centre of eastern Nepal. A total of 200 patients admitted for ACS between November 2023 to October 2024, fulfilling the following inclusion and exclusion criteria, were included in the study. All patients of age more than 18 years with diagnosis of ACS were included in the study. Patients with conditions known to cause anemia and having poor prognosis of the disease itself or preventing standard medical treatment for ACS: including chronic heart failure, chronic Kidney disease, Liver cirrhosis, malignancy, acute stroke and sepsis and chronic inflammatory diseases, were excluded from the study.

Haemoglobin (Hb) >12 mg/dl for female and > 13 g/dl for male were considered normal. Anemia was categorised in three categories as mild (Hb-11-11.9 g/dl for female and 11-12.9 g/dl for male), moderate (Hb 8 -10.9 g/dl) and severe (<8 g/dl). All participants underwent detailed medical history, clinical evaluation and relevant investigations. Variables including age, gender, hypertension, diabetes, smoking status, alcohol consumption, dyslipidemia, serum hemoglobin level and anemia status, iron profile, Killip Class, angiographic findings including number of vessels involved and Gensini Score, length of hospital stay, and outcome were extracted into data collection sheet. The study was conducted after ethical approval from the Institutional Review Committee (IRC) of BPKIHS (IRC 232/080/081).

Patients were divided into two groups anemic and non-anemic for comparison. Reporting of baseline characteristics was done as medians and interquartile ranges (IQRs) for continuous variables and as counts and percentages for categorical variables. Kruskal-Wallis test was used for continuous variable and Chi squared tests for categorical variables for comparison between the groups. p-values were tabulated with a level of significance set at <0.05. All data were analysed using IBM Statistical Packages for Social Sciences (SPSS), version 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). An analytical cross-sectional study was conducted to assess the prevalence and associations after explaining the study objectives and ensuring confidentiality and voluntary participation.

RESULTS

Over the period of one year from November 2023 to October 2024, 200 patients admitted for ACS and fulfilling our inclusion and exclusion criteria were included in the study. The prevalence of anemia was 48.5%. The male to female ratio was 1.59:1 and the median age was 70 and 62 years in anemic and non-anemic patients respectively. There was significant association of ACS with age distribution. The association was not significant with gender. Age wise distribution of patients in both the groups is shown in the Figure 1. Distribution of patients according to the grades of anemia is presented in Table 1. The demographic, clinical characteristics, severity of

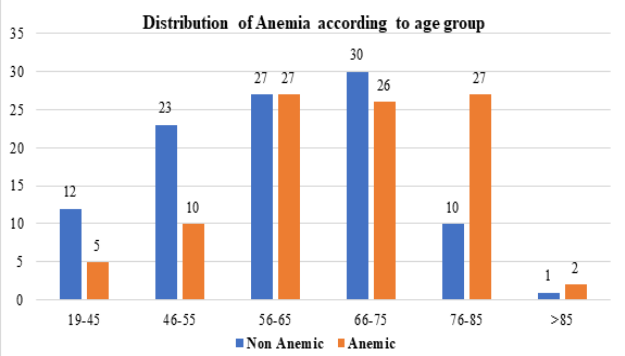

Figure 1. Distribution of anemia according to age

Table 1. Distribution of Patients according to anemia status in ACS

Level of anemia	Frequncy (%)
No anemia	103(51.50)
Mild	53(26.50)
Moderate	43(21.50)
Severe	1(0.50)

disease and outcomes of patients of both the groups, along with significance level (p-value), are tabulated in Table 2.

Among the risk factors studied, diabetes, hypertension, smoking and family history didn't show any significant association with presence of anemia. However, dyslipidemia was significantly associated with presence of anemia (p=0.002). Among 200 patients of ACS admitted during the study period, 19 (9.5%) patients had unstable Angina, 41(20.5%) had NSTEMI and 140 (70%) had STEMI. Type of ACS (non-STE or STE), however didn't show significant association with presence of anemia. There was significant association with increasing disease severity and presence of anemia. Almost 26 (27.95%) patients in anemic group were in Killip

Table 2. Demographic, clinical features, severity of disease and outcomes of patients.

Characteristics	Anemic (n=97) n (%)	Nonanemic(n=103) n (%)	Total (n=200)	p-Value
Age (median, IQR)	70 (60-77)	62 (53-70)		0.0001
Sex				0.1
Male	54 (55.67%)	69 (67%)	123 (61.5%)	
Female	43 (44.33%)	34 (33%)	77 (38.5%)	
Diabetes mellitus	29(29.89%)	35(33.98%)	64(32%)	0.536
Hypertension	48(49.48%)	45(43.69%)	93(46.5%)	0.412
Dyslipidemia	29(29.89%)	53(51.46%)	82(41%)	0.002
Smoking	75(77.32%)	78(75.73%)	153(76.5%)	0.791
Family History	21(21.65%)	19(18.45%)	40(20%)	0.571
Type of ACS				0.517
NSTEACS	27 (27.83%)	33 (32.03%)	60 (30%)	
STEACS	70 (72.16%)	70 (67.96%)	140 (70%)	
Killip class				0.037
Killip I	11(11.34%)	22 (21.36%)	33 (16.5%)	
Killip II	60 (61.85%)	68(66.02%)	128 (64%)	
Killip III	19 (19.59%)	11(10.68%)	30 (15%)	
Killip IV	7 (7.22%)	2 (1.94%)	9 (4.5%)	
CAD lesion				0.02
SVD	27 (31.76%)	57 (58.16%)	84 (45.90%)	
DVD	36 (42.35%)	24 (24.49%)	60 (32.79%)	
TVD	22 (25.88%)	17 (17.35%)	39 (21.31%)	
Outcome				0.127
Improved	83(85.57%)	97 (94.17%)	180 (90%)	
Died	12 (12.37)	5 (4.85%)	17 (8.5%)	
Not known	2 (2.06%)	1(0.97%)	3 (1.5%)	

class III and IV compared to 13 (12.62%) patients in non-anemic group. Similarly, there was statistically significant association between angiographic disease severity and presence of anemia (p=0.02). Of the 183 patients who underwent CAG, 84 (45.9%) patients had Single Vessel Disease (SVD), 60 (32.8%) had DVD (double vessel disease) and 39 (21.3%) had TVD (triple vessel disease). Anemic group had more multivessel disease compared to non-anemic group (68.23% vs 41.83%). The median Gensini score for anemic and non-anemic patients 58 (IQR 40-88) and 46 (IQR 32-64) respectively. The difference in the score between the groups was significant, higher in anemic compared to non anemic patients (p=0.006). The median duration of hospital stay for anemic and non anemic groups were 4 (IQR 2-6) days and 3 (IQR 3-4) days respectively. The difference in duration of hospital stay was not significantly different in anemic compared to non-anemic patients (p=0.052). However, CCU stay was found to be significantly higher in anemic patients (p=0.005); 3 days (IQR 1-3) in anemic vs 2 days (IQR 1-3) in non-anemic. The proportion of patient who died due to ACS was higher in anemic (12.37%) compared to non-anemic (4.85%). However, the difference this outcome was not statistically significant (p=0.127).

DISCUSSION

Anemia is a common co-morbidity associated with ACS and is found to be associated with a considerably elevated rate of cardiovascular events in patients with ACS, heart failure, and in patients undergoing percutaneous coronary intervention and coronary artery bypass grafting.[7] Contributory mechanisms include potentiation of imbalance between myocardial oxygen supply and demand, both by reducing oxygen-carrying capacity and simultaneously increasing myocardial oxygen consumption via increased cardiac output, impaired vascular healing and inflammatory flux.[8] Further, the intrinsic fragility of anemic patients may limit aggressive medical and interventional therapy due to an increased risk of bleeding, and could independently contribute to worse outcome.[9]

The prevalence of anemia was found to be 48.5% in our study, comparable to prevalence reported from India by Bhavanadhar P et al., (51.5%) and Chiwhane et al (50.5%).[3,10] However, previous studies from middle east and Europe have reported lower prevalence of anemia in ACS, as 28% by Sulaiman et al from Middle east, 27% by Meneveau et la from France, 26% by Yazji et al., from UK.[11-16] Higher prevalence of anemia in our study may be because of higher overall prevalence of anemia in our country because of nutritional deficiency and other causes.[17]

In our study, anemia in ACS didn't show any significant association with gender. However, it was found to be significantly associated with age, with proportion of anemia increasing with increasing age. Previous studies have shown similar association of age with anemia. [10, 12, 15, 18-20] Anemia in elderly has been attributed to the potential contributions of inflammatory pathways, erythropoietin resistance, and changes in hematopoietic stem cells to the age-dependent decrease in red cell mass.[21]

In our study, only dyslipidemia was found to have significant association with anemia in ACS patients. In contrast to our findings, MINAP registry showed significant association of hypertension, diabetes and smoking with anemia.[15] The HORIZONS- AMI trial also showed significant association of anemia with hypertension, diabetes and age, in addition to smoking.[22] Discrepancies in the findings might be due to exclusion of patients with chronic kidney disease, which is related both to diabetes and anemia, and because of different population cohort and small size of our study.

Our study didn't show significant association between type of ACS and anemia, similar to findings from the MINAP registry.[15] MONIKA/KORA Myocardial infarction registry and Shu DH et al shared findings in contrast to our study, where most patients with anemia had a non-ST elevation MI on admission whereas patients without anemia were more likely to have STEMI.[18, 23] This variation in our finding might be because of higher proportion of patients

with STEMI in our study. Further similar studies are needed to describe the impact of anemia on STEMI and non-ST elevation ACS.

Association of Killip Class with anemia was found to be significant in our study, with higher proportion of anemic patients in higher Killip class compared to non-anemic patients. Similar findings have been demonstrated in earlier studies with higher proportion of anemic patients presenting with heart failure compared to non-anemic patients.[10, 24, 25]

Our study showed significant association of vessels involved in CAD (single vessel or multi vessel) with anemia. Similarly, Gensini score was found to be significantly higher in anemic patients compared to non-anemic patients. Bhavanadhar P et al and Felker et al also showed significant association of anemia with number of vessels involved.[10, 26] The link between anemia and the Gensini score underscores the contribution of anemia on worsening coronary artery disease and severity of disease and lesions, since heart muscle may be under extra stress due to reduced oxygen delivery.

In our study the duration of ICU stay was significantly longer in anemic patients, however the total hospital stay did not reach the threshold for significance. Studies have found significant association of anemia with longer CCU and hospital stay in anemic patients. Lower haemoglobin was found to be an independent predictor of duration of hospital stay in the study by Bhavanadhar P et al.[10] In one retrospective cohort study, a higher degree of anaemia was associated with prolonged ICU stay and even patients with mild anaemia needed significantly more intensive treatment and suffered worse outcome.[27] Longer hospital or CCU stay correlates with the increased risk of complications associated with anemia, underlying conditions and treatment including blood and iron transfusions. Moreover, Anemia may delay the initiation and effectiveness of treatment and complicate the use of medications including anticoagulants and antiplatelets, and contribute to extended hospitalizations.

In our study, the in-hospital mortality was higher in anemic patients compared to non-anemic patients (12.37% vs 4.85%); however, it was not statistically significant. The Controlled Abciximab and Device Investigation to Lower Late Angioplasty Complications (CADILLAC) trial demonstrated that anemia was associated with a fourfold increased risk of in-hospital mortality and a more than twofold increased risk at one year after myocardial infarction.[25] Study by Shu DH et al., also reported anemia as independent predictor of mortality in patients with ACS.[23] Findings from MINAP study suggested that anemia is independently associated with mortality in ACS patients.[15] Similarly, Meneveau et al showed that anemia was an independent predictive factor of mortality and had incremental predictive value to the GRACE score system for early clinical outcomes.[12] In contrary, in hospital cardiac mortality was not influenced by hemoglobin in a study by Archbold RA et al.[11] Our study failed to establish significant association of anemia with mortality. It might be because of the small sample size and shorter follow up of the patients included in the study. Further studies including large number of patients and longer follow up studies are warranted to elaborate the impact of anemia in ACS.

CONCLUSIONS

The prevalence of anemia is substantial in our population and is associated with higher severity of ACS and in hospital adverse outcomes. Assessment of anemia is a valuable adjunct in assessing severity and prognosis in ACS. Further research should explore the potential therapeutic implications of targeting anemia in patients and to elucidate the mechanisms contributing to adverse outcomes in ACS.

Limitations

Our study should be interpreted considering following limitations. Since this was a single centered study, the results cannot be generalized. Secondly, long term follow up of patients were not analysed in this study. Despite these limitations, to the best of our knowledge, this is the first study from Nepal on

association of anemia with acute coronary syndrome.

Conflict of interest: None

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Availability of data and materials

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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