A Study on Prevalence, Management and Complications Associated with Anaemia in Patients with Coronary Artery Disease at a Tertiary Care Teaching Hospital

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Abstract:

Anaemia is a common comorbidity in patients with coronary artery disease (CAD), significantly impacting clinical outcomes and complicating the management of CAD. The interplay between anaemia and CAD can exacerbate the severity of ischemia and increase the risk of adverse cardiovascular events, making it crucial to understand the prevalence, management, and complications associated with anaemia in this patient population. This study aims to assess the prevalence of anaemia among patients with coronary artery disease in a tertiary care teaching hospital, and to study the management strategies employed, and the associated complications. This prospective observational cross-sectional study was conducted at Government Cuddalore Medical College over three months (May-July 2024) with 108 CAD patients aged 20-80 years. Data were collected from inpatient case sheets using a structured form (PROFORMA). The prevalence of anemia among CAD patients in this study was found to be 55.56%. Among the study population anemia is more prevalent among female CAD patients (71%) compared to males (47%). The study included 108 CAD patients out of which the largest group was aged 41 to 60 years (48%), followed by those aged 61 to 80 years (43%). A higher prevalence of CAD patients with anaemia were in the 61 to 80 years age group (45%). ACS-NSTEMI was more frequent among anaemic CAD patients (46%). The most common comorbidity was hypertension along with type 2 diabetes mellitus, affecting 35% of anaemic patients with CAD. Moderate anaemia (haemoglobin levels 7-9.9 g/dL) was prevalent in 70% of cases. Oral iron therapy was the most used treatment (70%), with intravenous iron in 21% and blood transfusions in 9%. Anaemic CAD patients showed higher rates of heart failure, both with reduced (43%) and preserved (14%) ejection fraction. The findings show the importance of regularly checking for anemia in patients with coronary artery disease (CAD) and treatment plans. Treating anemia in CAD patients can lead to better health outcomes, lower the risk of heart failure, and improve their quality of life.

Key words: Anaemia, Coronary artery disease, Prevalence, Heart failure, Management, Comorbidities

1. Introduction

Anemia is a prevalent condition characterized by a reduction in the oxygen-carrying capacity of the blood, often due to fewer red blood cells or insufficient hemoglobin levels. This condition can have significant implications, particularly in patients with coronary artery disease (CAD), where the heart's oxygen demand is already compromised. The coexistence of anemia and CAD can exacerbate the severity of ischemic episodes, leading to a higher risk of adverse cardiovascular events and complications. Coronary artery disease, a leading cause of morbidity and mortality worldwide, is characterized by the narrowing or blockage of the coronary arteries due to atherosclerosis. This condition restricts blood flow to the heart muscle, resulting in symptoms such as chest pain, shortness of breath, and in severe cases, myocardial infarction. The presence of anemia in these patients further complicates the clinical scenario, as the reduced oxygen-carrying capacity can worsen myocardial ischemia and lead to poorer outcomes. However, managing anemia in CAD patients is challenging due to the delicate balance required to avoid aggravating the underlying cardiac condition. The treatment strategies need to consider factors such as the severity of anemia, the presence of other comorbidities, and the risk of complications such as heart failure or arrhythmias. This study aims to explore the prevalence, management and complications of anemia among patients with coronary artery disease in a tertiary care setting, to provide insights for improving patient care.

2. Aim and Objectives

2.1 Aim

This study aims to assess the Prevalence, Management and Complications Associated with Anaemia in Patients with Coronary Artery Disease

2.2 Objectives

The objectives of the study are as follows,

- To assess the prevalence of anaemia among patients with coronary artery disease in a tertiary care teaching hospital,
- To study the management strategies employed among patients with coronary artery disease
- To study the associated complications among patients with coronary artery disease

3. Materials and Methods

3.1 Study design: This study is a *prospective observational cross-sectional study.*
3.2 Study site: Department of Medicine, Government Medical College and Hospital, 1250 bedded tertiary care teaching hospital, located in the rural part of South India.
3.3 Study period: 3 months (May 2024- July 2024).
3.4 Sample size: Data were obtained from 108 In-Patients in Department of Medicine, Government Medical College and Hospital.
3.5 Study tools: Data collection form (PROFORMA).
3.6 Sources of data: Case sheets of inpatients.
3.7 Study population:
Inclusion criteria:

- All Patients diagnosed with any type of CAD with or without anaemia.
- Adult patients 20 – 80 years of age.

Exclusion criteria:

- CAD patients who were pregnant.
- CAD patients who had recently undergone major cardiac surgeries.
- CAD patient with CKD.

Data like Demographic details, CAD type, complication and anaemia status, types of management were collected from the case sheets of patients admitted in the Medicine department.

4. Observation and Results

In this study, 108 patients diagnosed with coronary artery disease were included. Among them, 60(56%) had anaemia, while the remaining 48(44%) did not have anaemia.

Prevalence of Anaemia in CAD

Prevalence = [Number of CAD patients with anaemia at a given period/Total number of CAD patients at given period] * 100

[60/108] *100 = 55.6%

The prevalence of anaemia among patients with coronary artery disease in this study is 55.56%

Table 1.1: Distribution of CAD patients with or without anemia based on gender, age, type and comorbidities

Category	Total number of CAD patients	CAD patients with Anaemia	CAD patients without Anaemia
GENDER			
Male	62 (57%)	28(47%)	34(53%)
Female	46(43%)	32(71%)	14(29%)
AGE			
20-40years	10(9%)	8(13%)	2(4%)
41-60years	52(48%)	26(42%)	26(57%)
61-80years	46(43%)	28(45%)	18(39%)
TYPE OF CAD			
ACS-Unstable Angina	14(23%)	6(23%)	8(24%)
ACS-NSTEMI	18(30%)	12(46%)	6(18%)
ACS-STEMI	16(27%)	6(23%)	10(29%)
Others	12(20%)	2 (8%)	10(29%)
CO MORBIDITIES			
SHTN	26(24%)	14(23%)	10(23%)
T2DM	24(22%)	16(26%)	8(18%)
SHTN AND T2DM	28(29%)	22(35%)	8(18%)
Others	10(7%)	5(6%)	5(9%)
No	20(18%)	6(20%)	14(32%)

Gender Distribution of CAD Patients with and without Anaemia

Out of the entire study group of 108 CAD patients, 62 patients (57%) were male, while 46 patients (43%) were female. Among the CAD patients diagnosed with anaemia, 28 (47%) were male, and 32 (71%) were female. Among the CAD patients who did not have anaemia, 34 (53%) were male, and 14 (29%) were female. This highlights that a higher percentage of female CAD patients had anaemia compared to males, while more males were found in the group without anaemia *(Table 1.1)*.

Age Distribution of CAD Patients with and without Anaemia

Among the 108 CAD patients in the study, 10 patients (9%) were aged 20 to 40 years, 52 patients (48%) were aged 41 to 60 years, and 46 patients (43%) were between 61 and 80 years old.

Among the coronary artery disease (CAD) patients with anaemia, 8 patients (13%) were between 20 and 40 years old, 26 patients (42%) were between 41 and 60 years old, and 28 patients (45%) were aged 61 to 80 years. In CAD patients without anaemia, 2 patients (4%) were aged 20 to 40 years, 26 patients (57%) were between 41 and 60 years old, and 18 patients (39%) were in the 61 to 80 years age group *(Table 1.1)*.

Duration of coronary artery disease (CAD) among patients

Among the study population, 82 patients (76%) had diagnosed with CAD for a period ranging from 1 to 10 years. Whereas 16 patients (15%) with a CAD history of 11 to 20 years, and 10 patients (9%) with a CAD history of 11 to 20 years for 21 to 30 years. This distribution suggests that most participants have a relatively recent onset of CAD, with the largest group falling within the 1 to 10 year duration.

Distribution of Anemia among CAD Patients

This study categorizes coronary artery disease (CAD) patients based on the type of acute coronary syndrome (ACS) they have, along with their anemia status *(Table 1.1)*. Among the patients with ACS-Unstable Angina, 14 individuals (23%) were identified, with 6 of them (23%) having anemia, while 8 patients (24%) did not have anemia. For those with ACS-NSTEMI, 18 patients (30%) were observed, of which 12 (46%) were diagnosed with anemia, and 6 (18%) were without anemia.

In the ACS-STEMI category, 16 patients (27%) were noted, with 6 of them (23%) having anemia, and 10 patients (29%) being without anemia. The "Others" category [old CAD, microvascular disease] included 12 patients (20%), with 2 patients (8%) having anemia and 10 patients (29%) without anemia. This data suggests that ACS-NSTEMI is more prevalent among patients with anemia.

Distribution of Comorbidities among CAD Patients with and without Anaemia

An overview of the distribution of comorbidities among coronary artery disease (CAD) patients, comparing those with and without anemia *(Table 1.1).*

Among the 108 CAD patients, hypertension (SHTN) was present in 26 individuals (24%). Type 2 diabetes mellitus (T2DM) was observed in 24 patients (22%), while a combination of both hypertension and T2DM was found in 28 patients (29%). Other comorbidities were noted in 10 patients (7%), and 20 patients (18%) had no comorbidities.

In CAD patients with anaemia, 14 (23%) had hypertension, while 16 (26%) had diabetes mellitus. 22 patients (35%) had both hypertension and diabetes mellitus. Other comorbidities were present in 6% of the patients, and 6 patients (20%) had no comorbidities.

In CAD patients without anaemia, 10 (23%) had hypertension, 8 (18%) had diabetes mellitus, and another 8 (18%) had both hypertension and diabetes mellitus. Other comorbidities were present in 9% of the patients, while 14 patients (32%) had no comorbidities. The data indicates that the combination of hypertension and type 2 diabetes mellitus is the most prevalent comorbidity among CAD patients with anemia.

Distribution of Hemoglobin Levels among patients with anemia in CAD

Distribution of hemoglobin levels among patients, categorized into three levels of anemia severity: mild, moderate, and severe *(figure 1).*

Most patients, approximately 70%, fall into the moderate category, with hemoglobin levels ranging from 7 to 9.9 g/dL. Around 15% of patients have mild anemia, with hemoglobin levels at the lower limit of normal (approximately 10 g/dL).

The remaining 10% of patients have severe anemia, with hemoglobin levels below 7 g/dL. This indicates that moderate anemia is the most common condition among the patients studied.

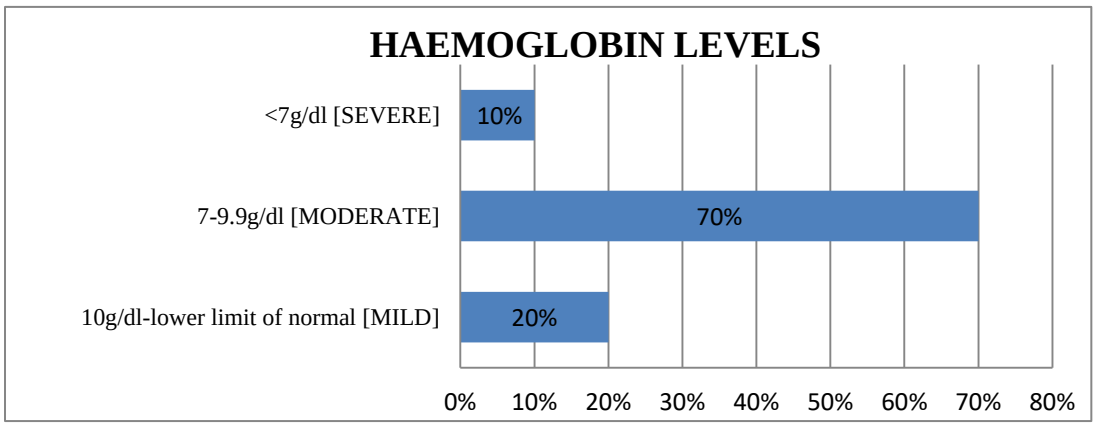

Figure 1: Distribution of Hemoglobin Levels among patients with anemia in CAD

Management Strategies for Anemia in Coronary Artery Disease (CAD) Patients

An overview of the treatments employed to manage anemia in patients with coronary artery disease (CAD) *(figure 2).* The most used approach is oral iron therapy, accounting for 70% of the cases, which indicates a strong preference for this non-invasive method (mostly given in mild and moderate anemia). Intravenous iron therapy is the next most frequently used treatment, applied in 21% of cases, suggesting that it is an alternative for patients who may not respond well to oral iron or who require more rapid replenishment of iron stores. Blood transfusion is the least common approach, used in only 9% of cases, likely reserved for more severe cases of anemia where immediate correction is necessary. Overall, the data reflects a tendency towards using iron supplementation, with oral iron as the first-line treatment, while more intensive methods like intravenous iron or blood transfusions are considered when necessary.

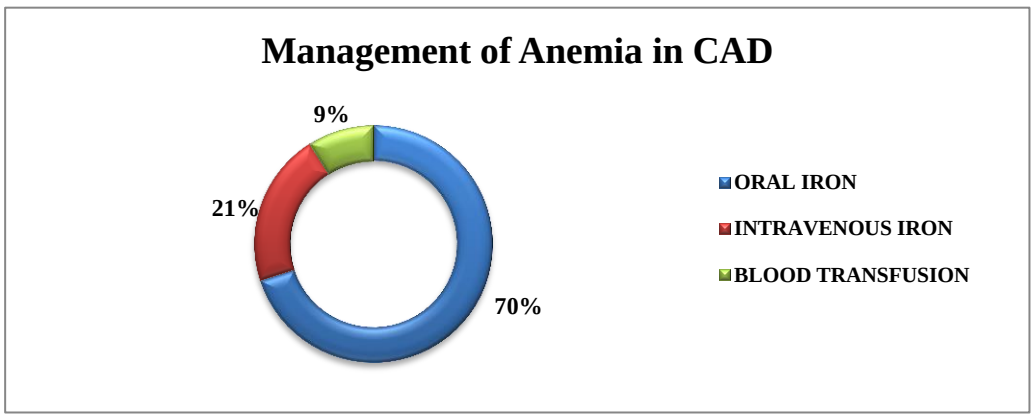

Figure 2: Management of Anemia in Coronary Artery Disease (CAD) Patients

Complications in Coronary Artery Disease (CAD) Patients with and without Anemia

The complications observed in coronary artery disease (CAD) patients with and without anemia, focusing on the occurrence of heart failure *(Table 1.2)*.

CAD patients with Anemia: Heart failure with reduced ejection fraction (rEF) 26 patients (43%). Heart failure with preserved ejection fraction (pEF) 8 patients (14%). Patients without heart failure is 26 (43%)

CAD patients without Anemia: Heart failure with reduced ejection fraction (rEF) 6 patients (13%). Heart failure with preserved ejection fraction (pEF) 2 patients (4%). Patients without heart failure 40 (83%).

This indicates that CAD patients with anemia have a higher prevalence of both types of heart failure compared to those without anemia. Among CAD patients with anaemia Heart failure with reduced ejection fraction was much more common than those with Heart failure with preserved ejection fraction.

Table 1.2: Complications in Coronary Artery Disease (CAD) Patients with and without Anemia

COMPLICATIONS	CAD PATIENTS WITH ANAEMIA	CAD PATIENTS WITHOUT ANAEMIA
Heart failure with reduced ejection fraction	26(43%)	6(13%)
Heart failure with preserved ejection fraction	8(14%)	2(4%)
Patients without Heart failure	26(43%)	40(83%)

5. Discussion

This study highlights the prevalence and impact of anemia in patients with coronary artery disease (CAD), offering insights into gender, age, duration of CAD, comorbidities, and management strategies. The findings have significant implications for the clinical management of CAD, particularly in patients with concurrent anemia.

The prevalence of anemia among CAD patients in this study was found to be 55.56%. This high prevalence underscores the importance of routine screening for anemia in CAD patients.

Gender distribution data revealed that anemia is more prevalent among female CAD patients (71%) compared to males (47%). This is consistent with existing literature, which suggests that women, particularly postmenopausal women, are more susceptible to anemia due to various factors, including hormonal changes and nutritional deficiencies.

The study included 108 CAD patients with a broad age range. The largest group was aged 41 to 60 years (48%), followed by those aged 61 to 80 years (43%). A smaller proportion of patients (9%) were between 20 and 40 years old. Among CAD patients with anaemia, the age distribution shifted slightly. A higher percentage of patients with anaemia were in the 61 to 80 years age group (45%), compared to those without anaemia (39%). This suggests that anaemia is more common in older CAD patients, which may be due to age-related physiological changes, comorbidities, and a longer duration of the disease.

In the group of CAD patients without anaemia, a substantial proportion was aged 41 to 60 years (57%). The higher percentage of younger patients without anaemia may suggest that CAD in this age group tends to be less complicated or less frequently associated with anaemia. This could be due to a lower incidence of comorbid conditions or a shorter duration of CAD in these patients.

Based on type of ACS, it was observed that ACS-NSTEMI (46%) was more prevalent among patients with anemia, whereas ACS-STEMI (29%) and other types of CAD were more common among those without anemia. This could indicate that anemia may predispose patients to less severe, but more chronic forms of myocardial injury, such as NSTEMI, which are often associated with worse long-term outcomes compared to STEMI.

The study also highlights the significant burden of comorbidities among CAD patients with anemia. Notably, the combination of hypertension and type 2 diabetes mellitus (T2DM) was the most prevalent comorbidity, affecting 35% of anemic CAD patients. This finding is critical because the combination of these comorbidities is known to exacerbate the progression of both CAD and anemia, creating a vicious cycle that can lead to worse clinical outcomes.

The distribution of hemoglobin levels indicated that moderate anemia (hemoglobin levels between 7 and 9.9 g/dL) was the most common, affecting 70% of the anemic CAD patients. Low haemoglobin levels have been associated with adverse cardiac outcomes either by hypoxic injury, myocardial remodelling, perfusion mismatch, or impaired nitric oxide activity at lower Hgb levels [6, 7].

The study found that oral iron therapy was the most frequently used treatment, applied in 70% of cases, particularly in patients with mild to moderate anemia. Intravenous iron therapy and blood transfusions were less common, reflecting a more conservative approach to treatment unless the anemia was severe. The preference for non-invasive methods aligns with current clinical guidelines, which recommend correcting anemia with the least aggressive intervention necessary to improve patient outcomes.

The study observed a significantly higher prevalence of heart failure, both with reduced (43%) and preserved (14%) ejection fraction, among CAD patients with anemia compared to those without. This suggests that anemia may be a contributing factor to the development and progression of heart failure in CAD patients. Prior reports suggested improved clinical outcomes after correction of anaemia in patients with acute coronary syndrome and HF [8, 9].

The reduced oxygen-carrying capacity associated with anemia can exacerbate myocardial ischemia, leading to myocardial dysfunction and heart failure. In contrast, most CAD patients without anemia did not experience heart failure, indicating that the presence of anemia is a critical factor in the worsening of cardiac function. The findings confirm that anemia is related to an adverse outcome of patients with cardiovascular disease [1, 2].

6. Conclusion

This study highlights the significant prevalence of anemia (55.56%) among coronary artery disease (CAD) patients, with a notable gender disparity—71% of female patients were anemic compared to 47% of males. Age analysis revealed a higher prevalence of anemia in CAD patients aged 61-80 years. Anemia was more common in patients with non-ST-elevation myocardial infarction (NSTEMI), suggesting a link between anemia and less severe but chronic myocardial injury. Comorbidities, particularly the combination of hypertension and type 2 diabetes, were prevalent in 35% of anemic CAD patients, exacerbating disease progression. Moderate anemia was most common, with oral iron therapy as the primary treatment.

The findings show the importance of regularly checking for anemia in patients with coronary artery disease (CAD) and treatment plans, especially for those with moderate anemia and other health issues. Treating anemia in CAD patients can lead to better health outcomes, lower the risk of heart failure, and improve their quality of life.

7. References

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