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A Literature Review: The Relationship between Decreased Hemoglobin Levels or Anemia and Acute Myocardial Infarction

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Abstract

Coronary heart disease (CHD) remains the leading cause of cardiovascular disease, with an estimated contribution to 36% of global mortality by 2020. Acute myocardial infarction (AMI) arises due to an imbalance between myocardial oxygen supply and demand. Anemia exacerbates myocardial ischemia by reducing blood oxygen levels and increasing myocardial oxygen consumption. This study aims to examine the relationship between decreased hemoglobin levels or anemia and AMI patients. This literature review employed a systematic search strategy using the keywords Relationship, Hemoglobin Levels, Anemia, and Acute Myocardial Infarction in both Indonesian and English. Searches were conducted across accredited electronic databases indexed in SINTA, such as Biomed Central, Garuda Portal, Google Scholar, Elsevier/Clinical Key, PubMed, and other relevant academic sources. Findings indicate that anemia influences the prognosis of AMI, although differing perspectives persist within the literature. Further research is required to comprehensively evaluate the impact of anemia on AMI patients and to determine the optimal management strategies for improving clinical outcomes.

Introduction

The leading cause of death worldwide is cardiovascular disease. Cardiovascular disease causes 17.7 million deaths or about 31% of all deaths in the world, 7.4 million due to coronary heart disease. Coronary heart disease (CHD) is the largest cause of cardiovascular disease, estimated in 2020 to be the leading cause of all deaths, which is 36% (Amaliah et al., 2019).

Acute myocardial infarction (IMA) is one of the five major manifestations of coronary heart disease, namely stable angina pectoris, unstable angina pectoris, acute myocardial infarction, heart failure, and sudden death. One million people in the United States are estimated to die from acute myocardial infarction each year and 300,000 before reaching the . In Indonesia, the results of household health surveys show the same thing (Amaliah et al., 2019; Jumalang et al., 2015). Indonesia is a developing country where the prevalence of heart disease is increasing from year to year, especially Acute Myocardial Infarction. There are approximately 32.4 million cases of IMA worldwide each year. Patients who survive IMA have an increased risk of recurrent infarction and have an annual mortality rate of 5% or as much as six times that of people of the same age who do not suffer from coronary heart disease (Amaliah et al., 2019).

Myocardial infarction results from an imbalance between oxygen supply and demand of the threatened myocardium. Anemia has been reported to occur in 15% of patients presenting with

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acute myocardial infarction (IMA) and in 43% of elderly patients with IMA. Anemia has the potential to exacerbate myocardial ischemic injury in IMA, both by reducing the oxygen content of blood supplied to the threatened myocardium and by increasing myocardial oxygen demand through the need for higher cardiac output to maintain adequate systemic oxygen delivery (Feng et al., 2011; Frangogiannis, 2015; Fathima, 2021; Ouweneel & Henriques, 2012; Naeije, 2010).

Based on WHO (1968) criteria, a person is considered anemic if the Hb value is <13 g/dl for men and <12 g/dl for women. Anemia was found in one-third of patients with acute coronary syndrome (SCS). 12.8% had IMA, 43% were diagnosed with NSTEMI and 5-10% with STEMI. Anemia is a common finding in patients with IMA and has the effect of worsening the patient's condition. Anemia is also a risk factor for cardiovascular disease and an independent predictor of complications suffered by patients with SCA. Anemia is often found in patients with cardiovascular disease and is considered the fifth risk factor for cardiovascular disease. Anemia is found in one third of patients with SCA, especially 12.8% of patients with IMA. However, the effect of hemoglobin concentration in the general population is still unclear because there are also some studies that say that there is no relationship between blood hemoglobin concentration and the incidence of acute myocardial infarction (Namli, 2021; Arkam et al., 2025; Thygesen et al., 2007). Based on the description above, the researcher is interested in conducting this study with the aim of knowing the relationship between a decrease in blood hemoglobin levels or anemia in patients with acute myocardial infarction (IMA) based on research that has been done before.

Methods

Research was carried out through literature review to thoroughly review scientific articles that investigate the relationship between reduced hemoglobin levels and acute myocardial infarction events along with their patient outcomes. I selected a literature review design because it allowed collection of knowledge from numerous studies that studied this clinical relationship across various research methods and healthcare environments. This methodology creates comprehensive knowledge of study patterns and controversial aspects across research with an aim to find studies that need future exploration.

The research process followed structured and comprehensive methods to include every latest study of importance. The research analyzed peer-reviewed books from journals spanning from 2015 to 2024. A combination of standings national and international scientific databases allowed for the expansion of source quality and quantity within the research process. The research data was gathered from PubMed as well as Biomed Central and Elsevier/Clinical Key and Google Scholar and the Garuda Portal. The databases met the criteria for accessibility in conjunction with their credibility and their medical and clinical scientific relevance to cardiology and hematology. The research method was adjusted according to database search engines and choosing preferences to deliver precise search results.

Both English and Indonesian keywords complemented each other through a structured method during the literature search. The research employed “hemoglobin level” as the main search term together with “anemia,” “acute myocardial infarction,” and “cardiovascular outcomes.” The search strategy employed Boolean operators including “AND” and “OR” for combining multiple terms which resulted in an extensive study collection regarding the hemoglobin-myroinfarction link. Research involved using controlled vocabulary and free-text keyword search approaches in PubMed because they allowed maximum article retrieval while maintaining specific and sensitive results.

The search query resulted in a total of 2,353 articles. Researchers subjected the broad collection of identified studies to a methodical screening process that separated relevant articles from those lacking methodological soundness. Title and abstract evaluation began the assessment

process for every article. The purpose of this initial screening was to find conducted studies about acute myocardial infarction and its connection to anemia or low hemoglobin levels. The screening process excluded reports which failed to study the link between anemia and acute myocardial infarction or studied anemia in other population types separate from cardiac patients.

A full-text assessment followed the initial title and abstract review of articles that qualified as potential candidates. The stage ensured every accepted study met requirements for analyzing the research question through its empirical data and appropriate methodological specifications for interpretation. The potenial candidate articles underwent thorough methodical analysis of their methods, results, and discussion sections. The review stage focused on analyzing the study's anemia measurement criteria along with population demographics, AMI diagnostic parameters and how various outcomes including death, complications, blood transfusions and patient healing were presented.

The research team evaluated 2,353 articles and then selected sixteen articles which had sufficient relevance for full-text examination. Four out of the research studies were eliminated because they provided basic anemia discussions whereas no direct correlations surfaced between acute myocardial infarction and specific measurable patient results. The studies provided useful information about hematological conditions but did not match the research aim of this review. Laboratory research on inflammatory bowel disease yielded only twelve relevant investigations for the synthesis analysis.

The twelve studies included in the evaluation employed various study methods and participant numbers with different approaches to the research topic. The available evidence stemmed from observational research as well as retrospective and prospective cohort comparisons and randomized clinical trials and review-based assessments. Special attention was paid to analyze each study to identify essential data about participant characteristics with their hemoglobin classifications and anemic status and myocardial infarction types (STEMI or NSTEMI) as well as the observed cardiovascular outcome measurements.

Result and Discussion

Based on the summary results after the search, 12 journals were obtained related to the relationship of decreased blood hemoglobin or anemia to Acute Myocardial Infarction (IMA):

Table 1. Literature Review study results

Author	Judgement	Methods	Results	Conclusions
Fitri Jumalang, Linda W. A. Rotty, Agnes L. Panda (2015)	Overview of Hematocrit and Hemoglobin Levels in the Incidence of Acute Myocardial Infarction (Ima) at Rsup Prof. Dr. R. D. Kandou Manado Period January - August	descriptive research	The results showed that of the 31 respondents, the majority were male (74.2%) with the highest age in the range of 46-55 years (38.7%). A total of 61.3% of respondents experienced hemodilution, while 38.7% had normal hematocrit levels. For hemoglobin levels, 83.9% of respondents had normal levels and 16.1% were anemic. The mean hematocrit level was 39.77 and hemoglobin level was 13.62.	In conclusion, acute myocardial infarction (IMA) patients at Prof. Dr. R. D. Kandou Hospital Manado in the period January - August 2014 mostly had low hematocrit and normal hemoglobin levels, with hemodilution being more common than normal hematocrit levels.
Sugiono Namli, Cut Aryfa Andra (2021)	The Relationship between Blood Hemoglobin Concentration and the Incidence of	This study used an analytical method with	The results of a study of 19 acute myocardial infarction (IMA) patients showed that the majority were 51-60 years old and predominantly male.	In conclusion, no significant association was found between blood hemoglobin levels and IMA at the

	Acute Myocardial Infarction at the University of North Sumatra Hospital for the Period	a *cross* design.	In terms of hemoglobin concentration, 9 patients were anemic and 10 had normal levels. Statistical analysis yielded a P value of 0.864, indicating no significant association between hemoglobin levels and the incidence of IMA.	University of North Sumatra Hospital during 2018-2019, and further research is recommended to consider other cardiovascular risk factors and increase the number of samples.
Jaskamal Padda, Khizer Khalid (2021)	Acute Anemia and Myocardial	Literature Research	This study found that anemia, both acute and chronic, negatively impacts the prognosis of myocardial infarction (MI) patients, increasing mortality and complications such as heart failure. Although there is an association between anemia and poor outcomes, it is unclear whether anemia directly increases mortality. Management of anemia in MI patients remains challenging, with a lack of consensus on the optimal treatment	This study emphasizes the need for a better understanding of the relationship between anemia and MI and the development of clear treatment guidelines to improve patient outcomes.
J.L. Carson et al (2023)	Restrictive or Liberal Transfusion Strategy in Myocardial Infarction and Anemia	Randomized Trial Research	This study highlights that anemia is a common condition that often occurs in patients with myocardial infarction. Anemia may affect the clinical outcome and recovery of patients who have had myocardial infarction This study aims to determine whether different transfusion strategies (restrictive vs. liberal) can affect the risk of death or recurrent myocardial infarction within 30 days in patients with myocardial infarction and anemia.	This study shows that although anemia is an important factor that can affect clinical outcomes in patients with myocardial infarction, a liberal transfusion strategy does not significantly reduce the risk of recurrent myocardial infarction or death within 30 days compared with a restrictive strategy. However, there are indications that a liberal strategy may have some benefit, although not statistically significant.
Muhamma d Ikhsan, Sally Aman Nasution, Andhika Rachman, Muhadi (2021)	Correlation of Haemoglobin Platelet Ratio (HPR) and Leukocyte Platelet Ratio (LPR) with SYNTAX-2 Score in STEMI Patients	Research analysis method	There were 114 subjects in this study, with a mean age of 53.87 years and most of them were male (86.8%). There was no significant correlation between RHP or RLP and SYNTAX-2 score. Sub-group analysis showed a moderate positive correlation between RHP and SYNTAX-2 score (r= 0.587; p = 0.005) and a strong positive correlation between RLP and SYNTAX-2 score (r= 0.606; p= 0.004) in subjects with normal body mass index BMI).	There was no correlation between RHP or RLP and SYNTAX-2 scores.

Alexander Dutsch, et al (2022)	Association of In-Hospital Hemoglobin Drop With Decreased Myocardial Salvage and Increased Long-Term Mortality in Patients With Acute ST-Segment-Elevation Myocardial Infarction	Prospective analysis method research	Of the 1204 patients analyzed, 1169 (97.1%) had decreased hemoglobin during treatment. The median myocardial salvage index for the no-reduction group was 0.70, while those for minimal, minor, and major reductions were 0.53, 0.40, and 0.40, respectively. A decrease in hemoglobin ≥3 g/dL was associated with lower left ventricular function at 6 months after STEMI, as well as increased 1-year and 5-year mortality.	Decreased hemoglobin during hospitalization in STEMI patients undergoing PPCI is associated with lower myocardial salvage and increased long-term mortality
Pei J, Wang X, Chen P, Zheng K and Hu X (2021)	Hb Levels and Sex Differences in Relation to Short-Term Outcomes in Patients With Acute Myocardial Infarction	This study is a analysis	Results showed that baseline hemoglobin levels were associated with major bleeding events, cardiovascular death, and adverse cardiovascular events (MACE), with specific threshold values for each outcome	Baseline hemoglobin level is an independent predictor of prognosis in AMI patients in South Asia, and its impact with low hemoglobin levels increases the risk of poor outcome, especially in men.
Nima Moghaddam (2018)	Association of Anemia with Outcomes Among ST-Segment-Elevation Myocardial Infarction Patients Receiving Primary Percutaneous Coronary Intervention	This study is a retrospective analysis	Of the 1919 patients, 322 (16.8%) were anemic, which was associated with a higher in-hospital mortality rate (8.1% vs 3.7%) and a higher risk of major bleeding (18.2% vs 9.4%). Anemia was associated with an increased risk of major bleeding (OR 1.78) but not with mortality (OR 0.99), and there was no significant difference in reperfusion time between anemic and nonanemic patients.	Anemia is common among STEMI patients receiving PPCI and is associated with greater bleeding risk, but does not affect in-hospital mortality, so prompt PPCI remains safe for anemic patients with attention to bleeding avoidance strategies.
Miriam Giovanna Colombo (2018)	Association between admission anemia and long-term mortality in patients with acute myocardial infarction: results from the MONICA/KORA myocardial infarction registry	This study is a retrospective analysis	Of the total patients, 283 (14.1%) were considered anemic, with 183 (9.1%) having mild anemia and 100 (5%) moderate to severe anemia. All-cause mortality after a median follow-up time of 4.2 years was 11.9%, with a significantly higher risk of death in patients with mild anemia (HR 1.74) and moderate to severe anemia (HR 2.05) compared to patients without anemia.	Anemia, whether mild or moderate to severe, is associated with an increased risk of long-term mortality after AMI. Although these results suggest a negative impact of anemia on .
Ming Gao, Xinying Zhang, Ling Qin, Yang Zheng, Zhiguo Zhang,	Discharge Hemoglobin Association with Long-Term Outcomes of ST-Elevation Myocardial Infarction Patients	This study is a retrospective analysis	Results showed that 16.4% of patients experienced bleeding events, and long-term mortality increased with decreasing Hb levels at discharge, with a significant hazard ratio (HR) for every 1 g/dL decrease in Hb. Patients	The study concluded that lower Hb levels at hospital discharge were a significant predictor of long-term mortality risk in patients treated for STEMI, and that decreased Hb during

Qian Tong, and Hang Li (2019)	Undergoing Primary Percutaneous Coronary Intervention		with Hb levels below the 20th percentile had a 3.529 times higher mortality risk.	treatment also contributed to worse outcomes.
Fatma Esin, Hu¨seyin Sefa Ince, Go€khun Akkan, Ugur Kocabas, Tuncay Kiris, Aykan Celik and Mustafa Karaca (2024)	Association between haemoglobin decline and long-term outcomes in ST-elevation myocardial infarction (STEMI) patients undergoing primary percutaneous coronary intervention	This study is a retrospective analysis	Of the 766 patients, the high group showed a significantly higher long-term mortality rate (65%) than the low group (28%). Propensity score matching also confirmed these results with higher rates of death and major adverse cardiovascular and cerebrovascular events (MACCE) in the high group.	A significant decrease in hemoglobin during hospitalization, even without visible bleeding, is associated with an increased risk of long-term mortality and MACCE in STEMI patients undergoing PCI.
Jesús Velásquez-Rodríguez, et al (2017)	Prognostic Impact of Age and Hemoglobin in Acute ST-Segment Elevation Myocardial Infarction Treated with Reperfusion Therapy	This research is an observational study	Results showed that advanced age and low hemoglobin levels were associated with poor prognosis. Patients in the highest age quartile (>76 years) had more risk factors, complications and higher mortality rates. Multivariate analysis identified age and hemoglobin levels as independent predictors of both in-hospital and long-term mortality.	The study concluded that hemoglobin levels are an independent predictor of in-hospital and long-term mortality in STEMI patients, especially in patients aged≥ 65 years, and that attention to hemoglobin levels should be part of the initial risk assessment in patients with STEMI.

Acute myocardial infarction (AMI) is one of the leading causes of morbidity and mortality worldwide. According to data from the World Health Organization (WHO), cardiovascular diseases, including myocardial infarction, account for approximately 31% of total global mortality. Various risk factors have been identified, including hypertension, diabetes, dyslipidemia, and unhealthy lifestyles. However, in recent years, attention has increasingly focused on the relationship between hemoglobin levels, anemia, and clinical outcomes in patients with myocardial infarction. Based on the literature review conducted by the researcher, the outline of the 12 journals taken will be discussed the results of these 12 journals which are to see the relationship between decreased Hemoglobin levels or Anemia in Acute Myocardial Infarction patients.

Hemoglobin Level and Incidence of Myocardial Infarction

Research conducted at Prof. Dr. R. D. Kandou Hospital Manado showed that most IMA patients had low hematocrit levels with normal hemoglobin levels, indicating hemodilution. This finding indicates that changes in hemoglobin levels can occur during the course of the disease, so monitoring hemoglobin levels is an important aspect in the management of IMA patients (Jumalang et al., 2015). Another study conducted by Padda et al. (2021) confirmed that acute anemia can worsen the condition of patients who have had myocardial infarction. This study showed that patients with low hemoglobin levels at the time of hospital admission had a higher risk of developing complications, including heart failure and death. This finding is in line with research showing that low hemoglobin levels can reduce tissue oxygenation, which in turn can worsen myocardial damage (Padda et al., 2021; Jenabi et al., 2022; Bajic et al., 2022; Mehri et al., 2023).

However, another study at the University Hospital of North Sumatra found no significant association between blood hemoglobin levels and the incidence of IMA. This suggests that other risk factors also have an important role in the pathogenesis of IMA, and hemoglobin levels alone may not be sufficient to predict the risk of this disease occurrence (Namli, 2021). Low hemoglobin levels can increase the heart's workload as it reduces the blood's ability to transport oxygen. A decrease in red blood cells will also decrease the concentration of hemoglobin in the blood and this in turn will interfere with oxygen delivery to tissues (Namli, 2021; Tsao et al., 2023; Gillespie & Doctor, 2021; Koury & Blanc, 2022).

Effect of Anemia on Prognosis of IMA Patients

Several other studies confirm that anemia, both acute and chronic, is associated with an increased risk of complications and mortality in IMA patients. A study by Padda et al. (2021) found that anemia in patients with IMA increases the risk of heart failure and death. , it is not entirely clear whether anemia directly increases mortality or is simply an indicator of poorer overall health (Padda et al., 2021).

Another study by Nima Moghaddam (2018) also found that anemia in STEMI patients undergoing Primary Percutaneous Coronary Intervention (PPCI) was associated with a greater risk of bleeding. However, anemia did not affect mortality in hospital care, so PPCI is still considered a safe procedure with special attention to bleeding avoidance strategies (Moghaddam et al., 2018). Some of the 12 studies that have been analyzed show that not only pre-existing anemia before IMA has a negative impact, but also a drop in hemoglobin levels during . Whereas, Studies according to Association of In-Hospital Hemoglobin Drop With Decreased Myocardial Salvage and Increased Long-Term Mortality found that a significant drop in hemoglobin levels, even in the absence of obvious bleeding, was associated with increased long-term mortality and major cardiovascular events (MACCE) (Esin et al., 2024; Li et al., 2024; Yoshii et al., 2023).

Anemia not only increases the risk of IMA events, but also contributes to poor clinical outcomes. Research shows that patients with anemia who experience myocardial infarction have higher mortality rates and slower recovery. For example, a study examining the relationship between decreased hemoglobin levels during hospitalization and long-term outcomes showed that decreased hemoglobin levels were associated with decreased myocardial salvage and increased long-term mortality. This suggests that monitoring hemoglobin levels should be an integral part of the management of patients with myocardial infarction (Colombo et al., 2018; Dutsch et al., 2022; Esin et al., 2024; Bolaji et al., 2025; Ruetzler et al., 2021; Goldsweig et al., 2025).

Anemia is a common finding in patients with IMA and has the effect of worsening the patient's condition. Anemia is also a risk factor for cardiovascular disease and an independent predictor of complications suffered by patients with SCA. A decrease in red blood cells will also reduce the concentration of hemoglobin in the blood and this will later interfere with oxygen delivery to the tissues (Namli, 2021; Obeagu et al., 2024; Nguyen et al., 2023; Mohanto et al., 2023). Another study that explored the relationship between hemoglobin-platelet ratio and leukocyte-platelet ratio with SYNTAX score showed that these ratios can help in assessing the risk and complexity of coronary artery disease. The SYNTAX score is a tool used to assess the prognosis of patients with coronary heart disease, and these findings suggest that hemoglobin levels may contribute to better risk assessment. This study emphasizes the importance of considering hematological factors in cardiovascular risk assessment (Ikhsan et al., 2021; Truslow et al., 2022; Bojan et al., 2021). This study concluded that there was no correlation between RHP or RLP and SYNTAX-2 score in patients with IMA-STE. However, patients with IMA-STE who have a normal body mass index are advised to have the RHP value calculated at the time of admission to the hospital to see the relationship with long-term

prognosis. Further research is still needed to find a causal relationship between RHP and prognosis of IMA-STE patients as a marker of acute inflammation, namely with prospective studies associated with mortality or major adverse cardiovascular events (Ikhsan et al., 2021).

The effect of anemia in patients with MI has long been a topic of interest. Anemia has been projected as a poor prognostic factor in both short- and long-term outcomes after MI (Lee et al., 2017; Zhu & Zhou, 2024). Anemic patients are more likely to have concomitant risk factors such as hypertension, hypothyroidism, rheumatologic diseases, chronic kidney disease, malignancy, and congestive heart failure, as previously mentioned (Gandhi et al., 2017). The presence of these comorbidities not only makes MI a more challenging condition to manage, but also increases the risk of complications in this subset of patients, thus affecting their short- and long-term outcomes (Padda et al., 2021).

Comparison of Transfusion Strategies in IMA Patients with Anemia

The debate regarding blood transfusion strategies in patients with myocardial infarction and anemia is also a focus in this literature. Some studies suggest that more liberal blood transfusion may improve clinical outcomes, especially in patients with severe anemia. However, other studies suggest that a more restrictive approach may be safer and not increase the risk of complications. For example, studies addressing transfusion strategies in patients with myocardial infarction suggest that more restrictive transfusions may reduce the risk of infection and other complications. This suggests the need for a more individualized approach in determining transfusion needs in patients with myocardial infarction (Carson et al., 2023). Therefore, decisions regarding blood transfusion in IMA patients with anemia need to be individualized, taking into account the severity of anemia, bleeding risk, as well as the patient's overall clinical condition.

Chronic anemia often occurs in patients on admission to the hospital due to comorbidities such as advanced age, occult bleeding, renal disease, cancer, nutritional deficiencies, and chronic inflammatory conditions. Alternatively, acute anemia may present at the time of admission when sudden blood loss triggers MI, or it may occur during hospital stay due to blood loss, acute inflammation, or hemodilution (Mahendiran et al., 2020). In patients with chronic anemia, compensatory mechanisms, such as increased levels of 2,3-diphosphoglycerate, cardiac output, and coronary and cerebral blood flow, may have been established, whereas this is less likely to occur in patients with acute anemia. The physiological differences that occur regarding the acuity of anemia may influence the effects of different RBC transfusion strategies on outcomes after acute myocardial infarction (Carrier et al., 2024).

Other Independent Aggravating Factors

The results of a study analysis conducted by Carson et al. (2023) showed that baseline hemoglobin level is an independent predictor of clinical outcomes of IMA patients. This study found that patients with lower hemoglobin levels had a higher risk of complications, especially in the older age group (≥ 65 years), and also suggested that attention to hemoglobin levels should be part of the initial risk assessment in patients with STEMI (Velásquez-Rodríguez et al., 2017).

This is also in line with research conducted by Pei et al. (2021) showing that hemoglobin levels also have different effects based on gender, with men more likely to experience complications than women with similar hemoglobin levels. This suggests that demographic factors also need to be taken into account in assessing patient risk. The patient's baseline hemoglobin level is an independent predictor of prognosis in patients with acute myocardial infarction in South Asia. Besides that, its effect on prognosis is largely dependent on the patient's gender. Low hemoglobin levels may increase the risk of adverse outcomes in patients with acute myocardial infarction. Male patients with low hemoglobin levels are at high risk of bleeding and should consider conservative antiplatelet and anticoagulant strategies (Pei et al., 2021).

Anemia is associated with various comorbidities, such as diabetes, heart failure, chronic kidney disease, and other non-cardiovascular conditions. Although many studies confirm that anemia is an independent predictor of prognosis in patients with AMI, few studies have explored the impact of hemoglobin levels on the prognosis of patients with AMI (Kim et al., 2019; Numasawa et al., 2018; Pei et al., 2021; Velásquez-Rodríguez et al., 2017). Brener et al. only described a non-linear relationship between baseline hemoglobin levels and prognosis, but their study did not outline the independent effects of different hemoglobin levels on prognosis (Brener et al., 2017). Many studies have reported that low hemoglobin levels are associated with bleeding and women have a higher risk of bleeding in ACS. However, in the above study, the increased risk of bleeding caused by low hemoglobin levels was more pronounced in male patients. In female patients, hemoglobin levels were not significantly associated with bleeding risk. Differences in race, gender, and age in the population may lead to differences in the association between hemoglobin and adverse outcomes, as has been reported in previous studies (Stucchi et al., 2018).Based on the results of this study, we should be aware of the risk of bleeding when treating male patients with low hemoglobin levels and should consider a more conservative treatment strategy in antiplatelet therapy.

Conclusion

This review of medical evidence demonstrates the medical importance of both blood hemoglobin levels and anemia diagnosis as key risk factors for patients diagnosed with acute myocardial infarction (AMI). Numerous research studies across multiple populations demonstrate that AMI patients have worsened medical results when their hemoglobin decreases at hospital entry or develops while being hospitalized. Patients with AMI who experience these adverse outcomes tend to face an elevated risk of death both short-term and long-term while also developing an increased chance of heart failure and bleeding problems and experiencing reduced effectiveness of heart tissue protection during PCI procedures. Anemia studies indicate two approaches that link the condition either as an independent risk factor for patient prognosis or a marker that reflects advanced comorbidities like chronic kidney disease, inflammation and age-related complications.

Researchers have gathered substantial evidence yet remaining inconsistencies appear in understanding both causality and the relationships between blood hemoglobin levels and poor cardiovascular outcomes. Research shows an absence of meaningful statistical relationships between baseline hemoglobin measurements and AMI occurrences so healthcare providers should analyze anemia in the complete picture of various cardiovascular risk elements. The specific differences observed in patient groups between males and females as well as across age groups demonstrate the need for individualized treatment strategies because standard approaches fail to address the full range of implications related to anemia in myocardial infarction patients. This review evaluates the continuous conversation regarding the most appropriate blood transfusion practices for patients with myocardial infarction who suffer from anemia. Medical practices should use restrictive transfusion thresholds as their primary method to reduce risks but patients who have severe anemia or unstable blood pressure can benefit more from higher transfusion limits. The lack of consensus in existing research requires more studies to build evidence-based protocols that combine hemoglobin testing with anemia treatment approaches while involving risk assessment into acute myocardial infarction management strategies.

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