

## PREOPERATIVE ANEMIA AS A NEGATIVE RISK FACTOR FOR CORONARY ARTERY BYPASS GRAFTING SURGERY: A RETROSPECTIVE STUDY

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### ABSTRACT

#### OBJECTIVES

The objective of this study is to check the effects of Anemia on mortality and morbidity in patients having ischemic heart disease and undergoing coronary artery bypass graft surgery (CABG).

#### METHODOLOGY

The study involved all the patients who underwent isolated coronary artery bypass graft surgery from July 2019 to December 2022. The clinical data of patients was retrospectively collected from the departmental data pool and was then analyzed using the chi-square test and t-test. A p-value of less than 0.05 was considered significant.

#### RESULTS

The study included 2570 patients who underwent isolated CABG; 78.2% of patients were males with a mean age of 57.87±9.20. Hypertension was the most common comorbidity (68.9%), followed by dyslipidemia (53.7%) & Diabetes mellitus (49.9%). The preoperative mean hematocrit was 30.05±17.85. Of these 2570 patients, 52.37% were anaemic with a mean age of 58.69±9.05. Anemic patients had a significantly higher rate of IABP insertion (P 0.02) and intra-operative blood product transfusion (P <0.001). Anemic patients had a significantly higher incidence of in-hospital mortality (P 0.04) and a higher rate of postoperative blood product transfusion (P <0.001). There is no significant difference in terms of prolonged ventilation, reintubation, or readmission to ICU; however, nonanemic patients have a significantly higher rate of re-opening for bleeding/ tamponade (P 0.01).

#### CONCLUSION

Preoperative anaemia increases the mortality and morbidity in ischemic heart disease patients undergoing coronary artery bypass grafting. To improve the outcomes in CABG surgery, preoperative anaemia should be thoroughly investigated and treated to improve the outcomes of surgery.

**KEYWORDS:** Ischemic Heart Disease, Coronary Artery Bypass Grafting, Anaemia

## INTRODUCTION

Worldwide, there is an estimated 25% prevalence of Anemia.<sup>1</sup> Anemia in patients with ischemic heart disease has established worse results on outcomes and has been proven to be a significant predictor of early and late mortality.<sup>2</sup> Preoperative anaemia is a strong risk factor for adverse postoperative clinical outcomes in cardiac surgery.<sup>3</sup> Cardiac patients are more sensitive to the negative impact of low haemoglobin because of their limited myocardial reserves. Moreover, these patients have increased chances of blood loss and transfusions perioperatively. When looking into causes of Anemia, 3 main factors need to be checked. Adequate erythropoiesis shows bone marrow generation of specific growth factors. Erythropoietin is renal function and preserved red blood cell mass to

plasma volume ratio called hemodilution.<sup>4</sup> All or one of these factors may be deranged in patients having ischemic heart disease, causing Anemia and its consequences. Iron deficiency is the most common cause of Anemia, irrespective of age, gender and comorbidities. Iron deficiency, with or without anaemia, results in lower haemoglobin levels throughout the perioperative period, with more significant transfusions than in nonanemic groups.<sup>5</sup> Among cardiac patients, chronic disease Anemia is most prevalent. It occurs due to conditions resulting in acute or chronic immune activation, which affects cardiovascular progression and results in adverse outcomes. That is why it's also labelled as "anaemia of inflammation".<sup>6</sup> Patients should be pre-operatively diagnosed and treated for Anemia to decrease perioperative and postoperative complications like

longer hospital stays, multiple blood transfusions and mortality.<sup>7</sup> In our study, Anemia was defined as a hematocrit of 33% or less and haemoglobin of <12 g/dl in women and < 13g/dl in men, according to the anaemia classification of the World Health Organization. The occurrence of Anemia depends on multiple factors, especially the underlying pathology, age and the patient's physiological state.<sup>8</sup> The objective of this study is to check the effects of Anemia on mortality and morbidity in patients having ischemic heart disease and undergoing coronary artery bypass graft surgery.

## METHODOLOGY

A retrospective cohort study was conducted at a tertiary care hospital and included patient records from July 2017 to December 31, 2022. The study was completed, and approval was obtained from our hospital's ethical review committee (Rehman Medical Institute, Research Ethics Committee). This study includes all the patients who underwent isolated CABG. The patients were sub-classified as Anemic and Nonanemic groups. All patients with concomitant procedures along with CABG were excluded from the study. We compared the early outcomes in both anaemic and Nonanemic groups. Data was collected from the cardiothoracic surgery ward archives, which were gathered in data collection form, exported in Microsoft Excel sheet format and then converted into SPSS format. All the results were then represented in the form of tables. Data analysis was done using SPSS software, chi-square and t-tests were applied to data results, and the p-value <0.05 was set as significant.

## RESULTS

Our study included a total of 2570 patients who underwent isolated CABG. Amongst them, 78.2% were males with a mean age of 57.87±9.20. Hypertension was the most common comorbidity (68.9%), followed by dyslipidemia (53.7%) & Diabetes mellitus (49.9%). The preoperative mean hematocrit was 30.05±17.85. Of these 2570 patients, 52.37% were anaemic with a mean age of 58.69±9.05. The majority of them were male (76.4%). In terms of demographics, there was no statistical difference in age between the anaemic and nonanemic groups, whereas later, had significantly more male patients (80.1%) (P <0.001). In terms of comorbidity, anaemic patients were significantly more likely to have HTN (P <0.001) and DM (P <0.001). In comparison, nonanemic patients are more likely to have a significant history of dyslipidemia (P <0.001). Most anaemic patients had low EF, whereas most nonanemic patients had preserved EF, which was not statistically

significant. There is no statistical difference between the two groups in terms of the history of tobacco smoking, family history of CAD, and previous PCI.

**Table 1: Preoperative Parameters**

Parameter	Anemic Group (n=1346)	Nonanemic Group (n=1224)	P-Value
Age	58.6±9.0	59.9±9.2	0.5
Male	1029 (76.4)	981 (80.1)	<0.001
HTN	980 (72.8)	791 (64.6)	<0.001
DM	896 (66.6)	386 (31.5)	<0.001
TOBACCO SMOKING	221 (16.4)	219 (17.9)	0.32
FAMILY Hx of CAD	52 (3.9)	38 (3.1)	0.29
EF <35 %	124 (63.9)	70 (36.1)	<0.001
EF 35%-50%	538 (55.0)	440 (45.0)	
EF >50%	674 (49.5)	688 (50.5)	
Dyslipidemia	567 (54.6)	624 (79.9)	<0.001

Regarding intraoperative characteristics, the two groups have no statistically significant difference in perfusion cross-clamp time. Anemic patients have a significantly higher rate of Intra-aortic balloon pump (IABP) insertion (P 0.02) intra-operative blood/products transfusion (P <0.001).

**Table 2: Intra - Operative Parameters**

Parameter	Anemic Group (n=1346)	Nonanemic Group (n=1224)	P-Value
Cross clamp time	53.7±19.5	54.90±31.9	0.2
Perfusion time	95.88±30.1	98.57±21.1	0.8
Intra-aortic balloon pump	131 (9.7)	78 (6.4)	0.002
blood products transfusion	819 (60.8)	616 (50.3)	<0.001

**Table 3: Postoperative Parameters**

Parameter	Anemic Group (n=1346)	Nonanemic Group (n=1224)	P-Value
Prolong ventilation	44 (3.3)	28 (2.3)	0.1
Readmission to ICU	12 (0.9)	10 (0.8)	0.8
Re intubation	22 (1.6)	14 (1.1)	0.29
Re-opening	82 (6.1)	106 (8.7)	0.01
Blood products transfusion	652 (48.4)	476 (38.9)	<0.001
Stroke	07 (0.5)	13 (1.1)	0.1
Atrial fibrillation	33 (2.5)	26 (2.1)	0.5
In-hospital mortality	52 (3.9)	30 (2.5)	0.04

In terms of outcomes, anaemic patients have the worst outcome, with a significantly higher incidence of in-hospital mortality (P 0.04) and a higher rate of postoperative blood product transfusion (P <0.001). Amongst anaemic patients, 77.1% required RCC, 64.7% required FFP, and 64.1% required platelets transfusion. There is no statistical difference in RCC transfusion between the two groups, whereas anaemic

patients are more likely to have significantly higher FFP platelets transfusion than nonanemic patients (P 0.001) (P 0.01). There is no significant difference in terms of prolonged ventilation, reintubation, or readmission to ICU. However, nonanemic patients have a significantly higher rate of re-opening for bleeding/tamponade (P 0.01).

## DISCUSSION

A cohort study was conducted comprising a total sample size of 2570 patients who underwent isolated CABG, of which 52.37% were anaemic according to the definition. According to our study, preoperative Anemia profoundly increases the risk of mortality and morbidity in patients having ischemic heart disease undergoing coronary artery bypass grafting. Similar results were observed by Andreas Boening et al. According to the study of Jéssica Barbieri et al., Anemia is more prevalent in diabetic patients and contributes to the overall pathophysiology and an increased risk of possible cardiovascular disease development and progression in an individual, consistent with our findings.<sup>9,10</sup> According to another study by Jéssica Barbieri et al., haematological disorder and hypertension are significantly associated with Anemia of chronic disease, resulting in an increased risk of the development and progression of cardiovascular disease in such patients.<sup>11</sup> According to a study done by Marco Ranucci et al. and a study by Sarah Soh et al., preoperative Anemia with a poor left ventricular ejection fraction, advanced age, and a known diabetic and hypertensive disorder increases the adverse postoperative events in patients undergoing CABG surgery, similar findings were observed in our study.<sup>12,13</sup> Anaemic patients have a significantly higher rate of IABP insertion (P 0.02) and intra-operative blood product transfusion (P <0.001). Similar findings have been reported by Stephen D. Surgenor et al. In our study, amongst anaemic patients, 77.1% required RCC, 64.7% required FFP, and 64.1% required platelets transfusion.<sup>14</sup> According to this study, anaemic patients are more likely to have significantly higher FFP platelet transfusion than non-anaemic patients. According to Patrick R. Lawler et al., there is a strong association between preoperative Anemia and increased postoperative morbidity and mortality. The findings of this study were explained based on patients with many comorbidities and complicated cardiovascular problems that resulted in increased postoperative complications.<sup>15</sup> This decreased compensatory tolerance, mainly due to oxidative stress in cardiovascular patients, can cause tissue hypoxia, abnormal cellular physiology and death at the cellular level.<sup>16</sup> According to the study of Oprea, Adriana D et al., anaemia is a substantial risk factor in terms of long-term outcomes and mortality in patients

undergoing CABG.<sup>17</sup> In another study by Hari Padmanabhan, preoperative Anemia increases Mortality and Severe Morbidity in patients undergoing cardiac surgery.<sup>18</sup> According to another study, Anemia is a common observation in older adults that negatively affects cardiovascular disease development and progression.<sup>19</sup> All these findings are consistent with our results. According to Theodore Kapadohos, a low preoperative hb level, prolonged aortic cross-clamping, and a low PaO<sub>2</sub>/FiO<sub>2</sub> value increase the length of stay in the ICU.<sup>20</sup> We have observed similar findings. Based on our study results and discussion, it is suggested that anaemia should be thoroughly investigated and treated prior to CABG surgery in order to decrease the possible surgical risks and complications and improve overall surgical outcomes.

## LIMITATIONS

It was Single centered Observation retrospective study and only short-term outcomes was followed for patients (within index admission). Future studies should be planned to focus on anemia in CABG patients with multicenter studies, prospective/ randomized controlled study plan and including mid/long term outcomes of these patients.

## CONCLUSIONS

Preoperative Anemia increases the mortality and morbidity in ischemic heart disease patients undergoing coronary artery bypass grafting. To improve the outcomes in CABG surgery, preoperative Anemia should be thoroughly investigated and treated to improve the outcomes.

**CONFLICT OF INTEREST:** None

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