

# The Influence of Preoperative Hematocrit Levels on Early Outcomes in Patients undergoing Cardiac Surgery

AJWAD FAROGH<sup>1</sup>, ASMA HASSAN<sup>2</sup>, SAIRA GULL<sup>3</sup>, MUHAMMAD IRFAN KHAN<sup>4</sup>, GOHAR BASHIR<sup>5</sup>, HAMID MAHMOOD<sup>6</sup>, SHAMILA AFSHAN<sup>7</sup>

<sup>1</sup>Associate Professor, Cardiac Surgery, Cardiac Center, Bahawalpur

<sup>2</sup>Consultant Pulmonologist, Cardiac Center, Bahawalpur

<sup>3</sup>Assistant Professor, Punjab Institute of Cardiology, Lahore

<sup>4</sup>Associate Professor of Hematology BVH, Bahawalpur

<sup>5</sup>Postgraduate Resident Cardiac Surgery, Cardiac Center, Bahawalpur

<sup>6</sup>Assistant Professor of Community Medicine, Sahara Medical, College, Narowal

<sup>7</sup>Biostatistician, Punjab Institute of Cardiology, Lahore

Correspondence to: Ajwad Farogh, Email: [ajwaad@yahoo.com](mailto:ajwaad@yahoo.com), Cell: 0344-4255534

## ABSTRACT

**Background:** Anemia is a common risk factor for cardiovascular disease. The impact of preoperative anaemia is unclear in cardiac surgery. Preoperative anaemia affects early findings in patients undergoing cardiac surgery.

**Aim and Objective:** The main objective of current research was to investigate the impact of preoperative anaemia on early outcomes in heart surgery patients.

**Material and Methods:** A prospective randomized clinical research was undertaken after obtaining written informed consent from patients for cardiac surgery at the PIC, Lahore between Apr 2020 and Feb 2021. A total of 120 individuals between the ages of 20 and 60 were chosen for the research. Preoperative anaemia was described as Hb levels of <13 g/dl for males and <12 g/dl in female patients undergoing cardiac surgery.

**Results:** Total 120 patients were enrolled and stratified into two groups (60 patients each) with average age  $5 \pm 5.75$  years. Early outcomes after surgery such as postoperative stroke (6.67 % versus 1.6 %), AF (37 % versus 32 %), and duration of hospital stay > 7 days (50 % vs 41.67 %) were found to be different between anaemic and normal Hb groups.

**Conclusion:** Preoperative anaemia can be increased risk of morbidity and mortality in patients after surgery. Low preoperative Hb found as advanced risk factor for death, renal impairment, stroke, AF and long hospital stay in our research.

**Keywords:** Anemia, CABG, AF, MI, IABP, CPB

## INTRODUCTION

Anemia is a clinically significant and widespread condition in surgical patients. Because of many co morbid disorders, the perioperative risk is naturally high in many of these patients, and it is enhanced when significant coronary artery disease is present. <sup>(1)</sup> Anemia has been related to a higher risk of perioperative disease and death in a variety of situations, including both cardiac and noncardiac surgery. <sup>(2-4)</sup> Patients underwent for CABG have a very limited coronary reserve, making them especially undefended to the impacts of low Hb levels. <sup>(5)</sup>

Mostly patients underwent for cardiac surgery, but the relationships between preoperative anaemia and outcomes after CABG are unexplored. However, the current data could not provide details the correlation between the degree of anaemia and various CABG patient poor outcomes, nor do they quantify the influence of previous comorbidities on this association. <sup>(6)</sup> Furthermore, it is uncertain whether low Hb levels alone or in conjunction with other risk factors that are frequent in anaemic people because negative effects on outcomes. Finally, there is a scarcity of data on the prevalence, severity, and primary causes of preoperative anaemia, particularly in patients undergoing heart surgery. <sup>(7)</sup>

A thorough international multicenter research in a well controlled broad group of patients has not addressed these concerns in detail. Because of the absence of accurate data, it's impossible to say which patient categories are at most risk based on their Hb levels and complications.

Detailed risk stratification might give clinicians with useful information to help them to better treat anaemic CABG patients after surgery.

Anemia has long been known to be a high risk factor for heart disease. Low Hb levels are related to increased disease and death in patients with congestive HF and CAD, particularly in with ACS, according to various studies. <sup>(8-9)</sup> The impact of preoperative anaemia on heart surgery, on the other hand, is debatable. Preoperative anaemia has been demonstrated to be an independent risk factor for CABG-related mortality and morbidity in the hospital or valve surgery in earlier studies.

However, numerous studies have revealed no statistically considerable differences in bad outcomes between people with low Hb levels and those with normal Hb levels. <sup>(10-11)</sup> Furthermore, a recent research revealed that anaemia was only an independent predictor of non-cardiac events in CABG patients, but poor cardiac outcomes including mortality from cardiac events, MI, and HF were more connected to contemporaneous patients' problems than anemia per se. <sup>(12)</sup> The primary goal of this study was how preoperative hemoglobin influenced early clinical outcomes in patients undergoing heart surgery. To the best of knowledge, there is no evidence of a relationship between low preoperative Hb level and poor outcomes in CABG patients. In order to establish the predictive significance of low Hb in association with diseases for early and late complications, we analyzed the

data of patients undergoing CABG surgery in a single center.

**METHODS**

Total of 120 cases were registered after taking consent from the patients underwent surgery at the PIC, Lahore from the period of April 2020 to February 2021, prospective randomized clinical study was carried out. The participants of age group 20-60 years were included other than patients were using antibiotics, antidepressants, anticonvulsants, antiarrhythmics, ventricular tachycardia, preoperative inotropic support, IABP or diagnosed acute renal failure or emergency operations were excluded. Patients were stratified into two groups of sixty (n=60 each). Patients in Anemic Group (n=60) have low Hb levels, whereas patients in Normal Hb group (n=60) have a normal Hb levels. A complete CBC, urine test, CBC, RFTs, X-ray and ECG were performed as part of the basic laboratory tests (wherever applicable).

**RESULTS**

Total 120 patients equally divided into 2 groups (60 in each group), the mean age: 58 ± 7.6 years of anemic group compare with mean age: 56 ± 3.9 years of normal Hb group. The demographic and clinical characteristics are summarized, high BP, COPD, acute renal dysfunction and recent heart attack showed to be more common in anemic patients. (Table 1)

In Table 2 variables such as grafts implanted, XCP & cardiopulmonary bypass time, IABP and the development of AF were compared. The p-values were not significant in terms of grafts applied (p = 0.74), XCP time (p = 0.84), and cardiopulmonary bypass time (p = 0.60), AF development (p = 0.30) and IABP assistance (p = 0.23)(Table 2)

Table 1: Comparison of Clinical History of Patients

Variables	Anemic Group(n=60)	Normal Hb(n=60)	p-value
Age (years ± SD)	58 ± 7.6	56 ± 3.9	0.01
Hemoglobin level (g/dl ± SD)	10.5 ± 1.5	15.7 ± 1.3	0.01
NYHA class, n (%)	28 (46.7%)	22 (36.7%)	0.01
Diabetes, n (%)	24 (40%)	15 (25%)	0.01
Hypertension, n (%)	30 (50%)	29 (48.3)	0.02
Chronic Pulmonary disease, n (%)	29 (48.3%)	21 (35%)	0.01
Renal Failure, n (%)	5 (8.3%)	2 (3.3%)	0.01
Recent MI, n (%)	9 (15%)	7 (11.7%)	0.01

Table 2: Comparison of perioperative and post-operative outcomes and distribution of data between groups

Variables	Anemic Group(n=60)	Normal Hb(n=60)	p-value
Number of grafts Applied	4.13 ± 1.1	3.5 ± 0.9	0.74
Cross clamp time (min)	72.3 ± 24.5	66.1 ± 27	0.84
CPB time (min)	98.3 ± 32.5	90.1 ± 34.8	0.60
Peri-operative and Postoperative AF	12 (25%)	14 (30.4%)	0.30
Peri-operative and Postoperative IABP support needed	9 (18.8%)	11 (23.9%)	0.23

The results showed significant p-values in term of postoperative mortality (5% vs 1.6%, p=0.01), stroke (6.67% vs 1.6%, p = 0.04), AF (37% vs 32%, p = 0.03), renal impairment (20% vs 13.3%, p=0.01), MI (5% vs 0%, p = 0.01) and hospital stay > 7 days (50% vs 41.67%, p-value 0.01). (Table 3)

Table 3: Post-operative outcomes

Outcomes	Anemic Group(n=60)	Normal Hb(n=60)	p-value
Mortalityn (%)	3 (5)	1 (1.6)	0.01
AF % n (%)	22 (37)	19 (32)	0.03
Renal Impairmentn (%)	12 (20)	8(13.3)	0.01
Stroke n (%)	4 (6.67)	1 (1.6)	0.04
MI n (%)	3 (5)	0 (0)	0.01
Length of hospital stay >7 days n (%)	30 (50)	25 (41.67)	0.01

**DISCUSSION**

We investigated the impact of preoperative haemoglobin levels on early outcomes following CABG surgery in the current research. Total 120 patients enrolled for current study which were equally divided into 2 groups, the average age of Group-1 was 58 ± 7.6 years compare with Group- 2 as 56 ± 3.9 years with statistically significant p-value 0.01. There were 24(40%) diabetic patients, 30 (50%)hypertensive patients in anemic group, CPD patients were 29 (48.3%), 5 (8.3%) patients observed renal failure and 9 (15%) observed recent myocardial infarction among low hemoglobin patients with statistically significant p-values.

Another research conducted by Kumar (2021), they registered total 82 patients and divided into two groups, the mean age of group (1) as 62 ± 8 which compare group (2) 59 ± 9 which was statistically insignificant. Hypertensive patients were 82.5% compare with other group 85.7%. Both groups were similar in terms of age, gender distribution, and co-morbidities such as type 2 diabetes. (13)

In the current research variables such as grafts implanted, XCP, cardiopulmonary bypass time, IABP and the development of AF were compared. The p-values were not significant in terms of grafts applied (p = 0.74), XCP time (p = 0.84), and cardiopulmonary bypass time (p = 0.60), AF development (p = 0.30) and IABP assistance (p = 0.23)

In a previous research published by Van Straten (2009), various peri-operative factors were compared across the groups. There were no differences found in terms of the grafts utilized (p = 0.84), XCP time (p = 0.972), and CPB time (p = 0.597), AF (p = 0.214) and IABP support (p = 0.175) during peri-operative periods which supported our results. (14)

The current investigation discovered a substantial difference in the probability of postoperative stroke (6.67 % vs 1.6 %, p = 0.04), AF (37 % vs 32 %, p = 0.03), hospital stay > 7 days (50% vs 41.67 %, p=0.01), and MI (5% vs 0%, p = 0.01).

In a research conducted by Shteinshnaider (2012), they separated all patients into two study groups that were significantly different in terms of diseases, clinical characteristics, and laboratory analysis. As a result, when compared to patients in the normal Hb group, patients in

the anaemia group were statistically more likely to have diabetes, renal dysfunction, chronic lung disease, or a history of stroke, confirming previous findings that anaemia patients develop AF, renal disease, stroke, MI, death, and longer hospitalization.<sup>(15)</sup>

Our participant's data was evaluated in terms of early outcomes related with low Hb, therefore medium and long-term effects were not possible to estimate. Patients with chronic renal failure, history of CABG, and patients rushed for emergency surgery with preoperative hemodynamic instability were also excluded. On the other side, this situation prevented the study's conclusions from being influenced by the important preoperative conditions.

## CONCLUSION

In patients undergoing heart surgery, preoperative anaemia has been related to an increased risk of postoperative disease and death. In our study, low preoperative Hb level was discovered to be the major risk factor for disease i.e renal impairment, stroke, AF, prolonged hospital stay and death after operation.

## REFERENCE

1. Docherty AB, Walsh TS. Anemia and blood transfusion in the critically ill patient with cardiovascular disease. *Critical Care*. 2017 Dec;21(1):1-8.
2. Bunupuradah T, Kiertiburanakul S, Avihingsanon A, Chetchotisakd P, Techapornroong M, Leerattanapetch N, Kantipong P, Bowonwatanuwong C, Banchongkit S, Klinbuayaem V, Mekviwattanawong S. Low-dose versus standard-dose ritonavir-boosted atazanavir in virologically suppressed Thai adults with HIV (LASA): a randomised, open-label, non-inferiority trial. *The lancet HIV*. 2016 Aug 1;3(8):e343-50.
3. Muñoz M, Gómez-Ramírez S, Campos A, Ruiz J, Liunbruno GM. Pre-operative anaemia: prevalence, consequences and approaches to management. *Blood Transfusion*. 2015 Jul;13(3):370.
4. Miceli A, Romeo F, Glauber M, de Siena PM, Caputo M, Angelini GD. Preoperative anemia increases mortality and postoperative morbidity after cardiac surgery. *Journal of cardiothoracic surgery*. 2014 Dec;9(1):1-7.
5. Kinnunen EM, De Feo M, Reichart D, Tauriainen T, Gatti G, Onorati F, Maschietto L, Bancone C, Fiorentino F, Chocron S, Bounader K. Incidence and prognostic impact of bleeding and transfusion after coronary surgery in low-risk patients. *Transfusion*. 2017 Jan;57(1):178-86.
6. Chaparro CM, Suchdev PS. Anemia epidemiology, pathophysiology, and etiology in low-and middle-income countries. *Annals of the new York Academy of Sciences*. 2019 Aug;1450(1):15.
7. Quarterman C, Shaw M, Hughes S, Wallace V, Agarwal S. Anaemia in cardiac surgery—a retrospective review of a centre's experience with a pre-operative intravenous iron clinic. *Anaesthesia*. 2021 May;76(5):629-38.
8. Klein AA, Collier TJ, Brar MS, Evans C, Hallward G, Fletcher SN, Richards T, Association of Cardiothoracic Anaesthetists (ACTA), Alston RP, Pauli H, Vijayan A. The incidence and importance of anaemia in patients undergoing cardiac surgery in the UK—the first Association of Cardiothoracic Anaesthetists national audit. *Anaesthesia*. 2016 Jun;71(6):627-35.
9. Padmanabhan H, Brookes MJ, Nevill AM, Luckraz H. Association between anemia and blood transfusion with long-term mortality after cardiac surgery. *The Annals of thoracic surgery*. 2019 Sep 1;108(3):687-92.
10. Althoff FC, Neb H, Herrmann E, Trentino KM, Vernich L, Füllenbach C, Freedman J, Waters JH, Farmer S, Leahy MF, Zacharowski K. Multimodal patient blood management program based on a three-pillar strategy: a systematic review and meta-analysis. *Annals of surgery*. 2019 May 1;269(5):794-804.
11. Meybohm P, Straub N, Füllenbach C, Judd L, Kleinerüschkamp A, Taeuber I, Zacharowski K, Choorapoikayil S. Health economics of Patient Blood Management: a cost-benefit analysis based on a meta-analysis. *Voxsanguinis*. 2020 Feb;115(2):182-8.
12. Miceli A, Romeo F, Glauber M, de Siena PM, Caputo M, Angelini GD. Preoperative anemia increases mortality and postoperative morbidity after cardiac surgery. *Journal of cardiothoracic surgery*. 2014 Dec;9(1):1-7.
13. Kumar S, Khurana NK, Awan I, Memon S, Memon MK, Sohail H, Ali B, Kumar B. The Effect of Preoperative Hematocrit Levels on Early Outcomes After Coronary Artery Bypass Graft. *Cureus*. 2021 Jan;13(1).
14. Van Straten AH, SolimanHamad MA, Van Zundert AJ, Martens EJ, Schönberger JP, De Wolf AM. Preoperative hemoglobin level as a predictor of survival after coronary artery bypass grafting: a comparison with the matched general population. *Circulation*. 2009 Jul 14;120(2):118-25.
15. Shteinshnaider M, Almoznino-Sarafian D, Alon I, Tzur I, Berman S, Cohen N, Gorelik O. Atrial Fibrillation at an Internal Medicine Ward: Clinical and Prognostic Implications. *Journal of atrial fibrillation*. 2012 Jun;5(1).