ORIGINAL ARTICLE

OPERATIVE MORTALITY OF CORONARY ARTERY BYPASS GRAFTING IN PATIENTS WITH LOW SERUM ALBUMIN AFTER NUTRITIONAL SUPPORT

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Objectives: The aim of this study was to determine the frequency of operative mortality in patients who had low serum albumin on admission and were undergoing coronary artery bypass grafting (CABG) after nutritional support at a tertiary care cardiac center in Karachi, Pakistan.

Methodology: A retrospective study was conducted at an adult cardiac surgery department of the largest tertiary care cardiac center in Karachi, Pakistan. Patients who had undergone isolated CABG during January to December 2019 admitted with low serum albumin (less than 3.5mg/dl) and received nutritional treatment before surgery were included in the study. Patients were monitored for a month to measure the 30 day mortality.

Results: There were 82.4% male patients and the mean age was 55.49±8.52 years. Preoperative mean serum haemoglobin, serum creatinine, and serum albumin levels were 12.225±1.19 mg/dl, 1.05±0.21 mg/dl, and 2.825±0.39 mg/dl respectively. Postoperative mortality was recorded in 1.7% of the total patients.

Conclusion: In patients with low serum albumin levels and had undergone isolated CABG after nutritional pre-treatment, mortality was mainly associated with peri-operative myocardial infarction. While, the incidence of delayed wound healing and atrial fibrillation were found to be high in these patients.

Keywords: post-operative mortality, low serum albumin, coronary artery bypass grafting, nutritional support, pre-treatment

INTRODUCTION

Coronary artery bypass grafting (CABG) is the most widely performed surgery worldwide,[1-3] with a reported mortality rate of 1.7%.[4] Due to an increased number of elderly and frail patients undergoing CABG who have minimal cardiac reserves; they end up in poor short term outcomes. This ageing surgical population has a higher prevalence of having or developing cerebrovascular disease, diabetes with systemic manifestation, chronic pulmonary disorders, renal impairment and peripheral vascular disease.[2] Therefore, an individualized risk–benefit profile must be constructed carefully, not just taking age into account but also a number of other multiple factors that may affect the outcome.[2]

It is well known that the early identification of patients at risk for poor outcome after CS may be helpful in modifying patient care strategy in the Intensive Care Unit (ICU) in order to improve outcomes.[5] It is reported that a decrease in albumin levels from 46 g/L to less than 21 g/L was associated with an exponential increase in mortality rates from 1% to 29%.[6]

Those patients undergoing cardiac surgery with low serum albumin levels showed a trend towards having greater postoperative complications and mortality rates in comparison to those patients who had higher serum albumin levels.[5-7]

A recent study showed a mortality rate of 12.7% for patients who had low serum albumin levels when undergoing surgery.[8] Results from another study reported a 5.4% post-operative mortality rate within 30 days in patients undergoing CABG having low levels of serum albumin.[9] The purpose of this study was to estimate the frequency of post-operative mortality in patients who had low levels of serum albumin at the time of admission and who planned to undergo CABG after oral and intravenous (IV) nutritional treatment at a tertiary care hospital in Karachi, Pakistan.

METHODOLOGY

A retrospective study of one year starting from January 2019 and ending in December 2019 was performed at the adult cardiac surgery department of

the National Institute of Cardiovascular Disease (NICVD), Karachi comprising a total of 233 patients. Inclusion criterion were set as all patients undergoing isolated CABG with age ranging from 30 to 75 years of either gender, pre-operative left ventricular ejection fraction (LVEF) > 40%, and low serum albumin levels at the time of admission. Serum albumin level less than 3.5mg/dl (normal range: 3.5 mg/dl to 4.5 mg/dl) before surgery was labeled as low pre-operative serum albumin. All the patients received oral and intravenous (IV) nutritional treatment daily for five days before planned elective surgery. All the patients received high protein diet three times a day, IV injection Aminovel 500 ml once a day, and injection human albumin 20% 50 ml on alternate days. This the normal criteria for all the under nourished patients on list for coronary artery by-pass grafting.No any intervention other than this done for the patients in order to get results.

The patients in respiratory failure and/or on ventilator, who had undergone emergency cardiac surgery, myocardial infarction within 7 days, cardiogenic shock state, having body mass index (BMI)< 20 kg/m^2 or hemoglobin< 10 g/dl or serum albumin <1.5 mg/dl and billirubin> 2mg/dl, and alanine transaminase (ALT)> 40 iu/l were excluded from the study.

All the patients admitted in the state of hypoalbuminemia were medically optimized and were offered pre-operative measures based on directed guidelines to improve nutritional status in order to limit peri-operative complications.[10,11] To minimize operative risk, all the patients had to undergo a joint decision made in consultation with the operating surgeon, the cardiac anesthetist and the intensivist as per institutional policy.

After approval of the ethical review committee, data of the patients who met the inclusion criterion of the study was extracted from the institutional database and patients' file that is in the institution. Informed consent taken from the patients and attached in the files data base of institution. Albumin cutoff values vary between studies, and we attributed this difference to various study populations and types of surgery. Our study cut off value was less than 3.5 mg/dl.

Extracted data was entered and analyzed with the help of IBM SPSS Version-21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0). Descriptive summary, such as mean, standard Deviation (SD) and frequency proportion (%), of the variables are reported. Fisher's exact test and Mann-Whitney U test were applied to assess the association of postoperative survival status and demographic characteristics and preoperative clinical assessments. A p-value ≤ 0.05 was considered significant.

RESULTS

Out of 233 patients, 192 (82.4%) were male and the mean age of the patients was 55.49±8.52 years. The most common co morbidity among the selected patients was hypertension, which was observed in 56.7% (132) of the patients followed by diabetes which as observed in 36.5% (85) of the patients. Around two-fifth or 39.5% (92) of the patients were smokers while 19.7% (46) were obese. The mean level of preoperative serum albumin was 2.825±0.39 mg/dl. Patients' demographic and preoperative clinical assessments are presented in Table 1.

Table 1: Patients' demographic and preoperative clinical assessments

Number of patients	N = 233
Mean age	55.49±8.52 years
Females	41 (17.6%)
Body mass index (BMI)	25.59±5.41 kg/m^2
Comorbidities	
Obese (BMI>30 kg/m^2)	46 (19.7%)
Diabetic	85(36.5%)
Hypertensive	132(56.7%)
Smokers	92(39.5%)
Positive family history of IHD	38(16.3%)
Preoperative assessments	
Ejection fraction	53.44±8.22%
Serum hemoglobin	12.225±1.19 mg/dl
Serum creatinine	1.05±0.21 mg/dL
Serum albumin	2.825±0.39 mg/dl
EuroScore II	1.02±0.27

IHD = ischemic heart diseases

Postoperative outcomes are presented in Figure 1. The mortality rate was 1.7% or 4 patients, 39.5% or 92 patients developed postoperative atrial fibrillation, perioperative myocardial infarction was found in 7.3% or 15 of the patients, and 8.2% or 19 of the patients had postoperative renal failure. Delayed wound healing was observed in 25.3% or 59 of the patients while 5.6% or 13 of the patients required readmission or regular outpatient medical care due to surgical site infection.

The association between postoperative survival status and demographic characteristics and preoperative clinical assessments of patients are provided in Table 2. Preoperative ejection fraction (%) was found to be significantly lower among patients who passed away in comparison to those who survived with mean values of 41.3±9.5 vs. 53.7±8.1; the p-value was calculated to be 0.017.
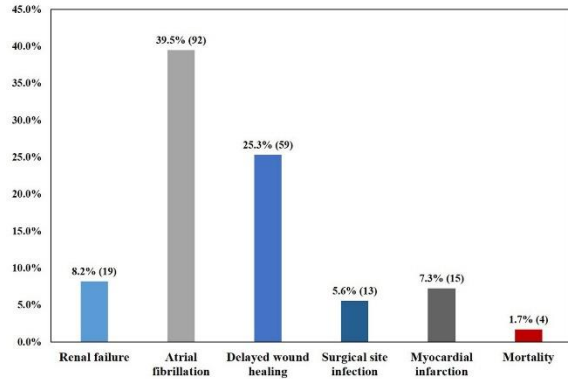
Figure 1: Perioperative and postoperative (30 days) outcomes

Table 2: Demographic and preoperative clinical assessments of patients stratified by postoperative survival status

	Postoperative Mortality		P-value
	No	Yes	
Number of patients	N = 229	N = 4	-
Age (years)	55.5±8.6	56.5±5.1	0.819
Females	17.5% (40)	25% (1)	0.541
Body mass index (BMI)	25.6±5.4	26.9±5.8	0.495
Comorbidities			
Obese (BMI>30 kg/m^2)	19.7% (45)	25% (1)	0.588
Diabetic	35.8% (82)	75% (3)	0.139
Hypertensive	57.2% (131)	25% (1)	0.218
Smokers	39.7% (91)	25% (1)	0.483
Positive family history of IHD	16.2% (37)	25% (1)	0.512
Preoperative assessments			
Ejection fraction (%)	53.7±8.1	41.3±9.5	0.017*
Serum hemoglobin (mg/dl)	12.2±1.2	12.4±1.5	0.86
Serum creatinine (mg/dl)	1±0.2	1.1±0.2	0.672
Serum albumin (mg/dl)	2.8±0.4	2.7±0.3	0.48

significant at 5%

DISCUSSION

Hypo-albunemia plays a role as an independent predictor of in-hospital death.[12] However, a consensus has not been made and there is still a debate, since clinical trials have not yet reported the benefit of exogenous albumin supplementation in reducing morbidity and mortality.[14]

Albumin is the major contributor of plasma oncotic pressure. Albumin also has some protective properties such as free radical scavenging effect, toxins binding capacity, antithrombotic properties, capillary membrane permeability and nitric oxide pool.[15] Surgical site infection is a significant complication of cardiac surgery, delaying recovery and acting as a barrier to enhanced recovery after cardiac surgery and hypo-albunemia is a cause.[16]

Kim and colleagues demonstrated that hypoalbuminemia enhances the thrombocyte aggregation in patients on dialysis, and inverse correlation of serum albumin with C-reactive protein, D-dimer and von Willebrand factor levels.[17] Hypoalbuminaemia is a also marker of hepatorenal dysfunction, advanced cardiovascular disease, endothelial dysfunction and subclinical systemic inflammation.[18-19] The association of preoperative hypoalbuminemia with poor surgical outcomes has been well documented.[20-21]

Volume expansion is often necessary after cardiac surgery, and albumin is often administered.[22,23] As nutritional status is a potentially modifiable risk factor, .optimizing a pre-operative nutritional status could potentially lead to improved short- and long-term outcomes.[24] Hence, we have hypothesized that serum albumin is a better indicator than BMI for predicting short-term morbidity and mortality of patients undergoing CABG.[22] In our study, we found a higher incidence of post-op atrial fibrillation of around 39.5%, while another study reported it to be around 25.8% showing a clear association with BMI.[25]

Limitation of the study: The small sample size of our study does limit its applicability and generalization. The main limitations of the present study include a single-centre experience with a non-randomized design. Since the study was conducted using a small sample size in an urban environment, therefore, the results might not be generalized for larger populations.

CONCLUSION

In our study, the results showed that for the patients with low levels of serum albumin who were given nutritional support at the time of admission, post-operative mortality were similar to worldwide mortality rate after routine CABG procedure. Around 50% of deaths in our study were due to perioperative myocardial infarction.

AUTHORS' CONTRIBUTION

SMA, TA, and MK: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. ASM, MK, KFA, AA, and NAS: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

Conflict of interest: Authors declared no conflict of interest.

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