Section: Cardiothoracic Surgery

Original Research Article

EVALUATION OF ALBUMIN LEVEL ON THE OUTCOME OF CARDIAC SURGERY

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Abstract

Background: The influence of postoperative albumin levels on outcomes after cardiac surgery remains unclear. Our aim was to evaluate the influence of albumin levels on the outcome of cardiac surgery. **Material and Methods:** This prospective observational study was carried out in Department of Cardiothoracic and Vascular Surgery, IMS, BHU. Patients undergoing cardiac surgery with normal preoperative albumin level and nutritional status were included and classified into two groups. We assessed outcomes and results were analyzed among the survived and expired patients. **Results:** The study includes 68 patients. Mean age was 58.32 ± 9.88 years (range 48-66 years). Mean BMI was lower in survivor group (20.24 ± 3.75 kg/m^2) than in non-survivor group (22.26 ± 1.67 kg/m^2), which was found statistically significant. Preoperative, intraoperative and postoperative data comparing survivors and non-survivors showed that non-survivors were older, higher in-hospital mortality, sepsis, hemorrhage related complications, and ICU stay. **Conclusion:** This study demonstrated that preoperative low serum albumin level is associated with increased morbidity and mortality after cardiac surgery.

INTRODUCTION

The influence of albumin levels on the outcome of cardiac surgery patients has been a subject of research. Studies have shown that higher postoperative serum albumin levels are associated with reduced in-hospital and long-term mortality rates in patients undergoing cardiac surgery.[1] Additionally, observational studies have indicated that higher postoperative plasma albumin concentrations are linked to lower myocardial injury and fewer cardiac complications in on-pump cardiac surgery patients.[2,3] However, there are gaps in the knowledge regarding the efficacy and safety of albumin use in adult cardiac surgery, with limited high-quality evidence supporting its benefits.[4] Overall, while there is evidence suggesting a positive correlation between postoperative albumin levels and better outcomes in cardiac surgery patients, further research is needed to clarify the role of albumin in improving patient recovery and to address the existing gaps in knowledge surrounding its use in this context.

MATERIALS AND METHODS

This prospective observational study was conducted in a surgical intensive care unit (ICU) of a University Hospital, Banaras Hindu University, Varanasi. Study eligibility was determined by looking at all consecutive patients with normal albumin levels prior to undergoing various forms of heart surgery. For analysis, information was gathered in a local database using data that had been prospectively taken from each patient's medical record. Operational data, postoperative factors, and preoperative data (comorbidities, treatment prior to surgery) were consistently gathered. The same team of surgeons followed standard operating procedures when performing the procedures throughout the research period. Arterial lactate levels and venous oxygen saturation, two metabolic indicators of tissue perfusion, were used to guide the treatment of the patients.

The statistical program 23.0 (SPSS Inc., Chicago, Illinois, USA) was used for the analysis. When applicable, data are presented as mean ± standard deviation or median (interquartile range). To assess the correlation between postoperative albumin level and mortality following heart surgery, we conducted univariate analyses comparing survivors and non-

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survivors; for group comparisons, we employed the Mann-Whitney U test or, if suitable, the two-sample t-test; for categorical prognostic factors, we utilized the $\chi 2$-test to determine the significance of postoperative albumin level as a factor associated with mortality.

RESULTS

Total 68 patients were enrolled in the study out of which 12 (17.64%) were expired. Baseline characteristics of patients are given in Table 1. Preoperative, intraoperative and postoperative data comparing survivors and non-survivors showed (Table 2, 3 and 4).

Male sex, incidence of hypertension, peripheral vascular disease, chronic renal insufficiency, COPD, patients on diuretics, and mean PAP (mmHg) were significantly high in non-survivor group (Table 2).

On comparing intraoperative findings, only mean CPB time (min) was significantly high in non-survivor group (p=0.040). On comparing surgical procedures, Isolated CABG, CABG + valve surgery and other cardiac surgery were comparable in both the groups (Table 3).

On comparing postoperative findings, the mean APACHE II, ventilation time (hours), PaO2/FiO2 ratio on admission, PaO2/FiO2 ratio 24 h after admission, need of vasoactive drugs (hours), albumin 24 h after surgery, AL peak after surgery, drainage loss first 12 h, need for blood products first 24 h, mean ICU stay (hours) and mean hospital stay (days) were significantly high in non-survivor group. Incidence of septicemia was also significantly high in non-survivor group (Table 4).

Table 1: Baseline characteristics

	All patients (*n* = 68)
Age (years)	58.32 ± 9.88
Sex (male)	79.41% (54)
BMI (Kg/m^2)	20.24 ± 3.75
Albumin before surgery	41.0 ± 3.8
Hypertension	75% (51)
Diabetes Mellitus	32.35% (22)
Dyslipidemia	47.06% (32)
Peripheral vascular disease	11.76% (8)
Chronic renal insufficiency	4.41% (3)
Renal failure (on Dialysis)	1.47% (1)
Previous stroke	25.0% (17)
COPD	10.29% (7)
Active smokers	8.82% (6)
On B-Blockers	42.65% (29)
On statins	44.12% (30)
On Aspirin	45.59% (31)
On diuretics	32.35% (22)
LVEF (%)	61 ± 11
PAP (mmHg)	44 ± 13
Isolated CABG	23.53% (16)
CABG + valve surgery	11.76% (8)
Other cardiac surgery	10.29% (7)
CPB time (min)	110 ± 42
APACHE II	12.38 ± 4.2
Ventilation time (hours)	55 ± 111
PaO2/FiO2 ratio on admission	323 ± 92
PaO2/FiO2 ratio 24 h after admission	312 ± 72
Reintubation	2.94% (2)
Tracheostomy	2.94% (2)
Need of vasoactive drugs (hours)	101 ± 1132
Albumin 24 h after surgery (g ·L $^{-1}$)	27 ± 4.6
AL peak after surgery (mmol·l $^{-1}$)	3.5 ± 1.5
Acute Renal Failure	5.88% (4)
Need for RRT	1.47% (1)
Haemorrhage-related reexploration	2.94% (2)
Pericardial tamponade	1.47% (1)
Drainage loss first 12 h (ml)	396 ± 291
Re-exploration	1.47% (1)
Need for blood products first 24 h (Units)	1.22 ± 1.5
Stroke	2.94% (2)

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Septicaemia	5.88% (4)
Mean ICU stay (hours)	121 ± 151
Mean hospital stay (days)	22.0 ± 18.0

Table 2: Comparison of Preoperative data between survivors and non-survivors

	Survivors (n = 56)	Non-survivors (n = 12)	P
Age (years)	52.54 ± 10.5	57.23 ±8.88	0.156
Sex (male)	48 (85.7)	6 (50.0)	0.005
BMI	27.2 ± 4.1	28.0 ± 4.6	0.550
Albumin before surgery	38.9 ± 2.2	39.9 ± 1.5	0.139
Hypertension	39 (69.6)	12 (100)	0.027
Diabetes Mellitus	14 (25.0)	8 (66.7)	0.005
Dyslipidemia	26 (46.4)	6 (50.0)	0.822
Peripheral vascular disease	2 (3.6)	6 (50.0)	< 0.001
Chronic renal insufficiency	0	3 (25.0)	< 0.001
Previous stroke	12 (21.4)	5 (41.7)	0.141
COPD	3 (5.4)	4 (33.3)	0.003
Active smokers	4 (7.1)	2 (16.7)	0.292
On B-Blockers	23 (41.1)	6 (50.0)	0.570
On statins	26 (46.4)	4 (33.3)	0.74
On Aspirin	27 (48.2)	4 (33.3)	0.34
On diuretics	15 (26.8)	7 (58.3)	0.034
LVEF (%)	56 ± 12	59 ± 14	0.448
PAP (mmHg)	42 ± 11	50 ± 15	0.036

Table 3: Comparison of intraoperative data between survivors and non-survivors

	All patients (n = 68)	Survivors (n = 56)	Non-survivors (n = 12)	P
Isolated CABG	23.53% (16)	13 (23.2)	3 (25.0)	0.894
CABG + valve surgery	11.76% (8)	6 (10.7)	2 (16.7)	0.561
Other cardiac surgery	10.29% (7)	5 (8.9)	2 (16.7)	0.423
CPB time (min)	110 ± 42	111 ± 39	140 ± 62	0.040

Table 4: Comparison of Postoperative data between survivors and non-survivors

	All patients (n = 68)	Survivors (n = 56)	Non-survivors (n = 12)	P
APACHE II	12.38 ± 4.2	11.5 ± 4.5	19 ± 6.2	< 0.001
Ventilation time (hours)	55 ± 111	38 ± 92	244 ± 301	< 0.001
PaO2/FiO2 ratio on admission	323 ± 92	336 ± 92	288 ± 111	< 0.001
PaO2/FiO2 ratio 24 h after admission	312 ± 72	310 ± 70	242 ± 90	< 0.001
Reintubation	2.94% (2)	0	2 (16.7)	0.057
Tracheostomy	2.94% (2)	0	2 (16.7)	0.057
Need of vasoactive drugs (hours)	101 ± 1132	90 ± 112	256 ± 275	< 0.001
Albumin 24 h after surgery	27 ± 4.6	30 ±3.3	24 ± 3.2	< 0.001
AL peak after surgery	3.5 ± 1.5	3.3 ± 1.1	6.6 ± 3.3	< 0.001
Acute Renal Failure	5.88% (4)	1 (1.8)	3 (25.0)	< 0.001
Need for RRT	1.47% (1)	0	1 (8.3)	0.352
Haemorrhage-related reexploration	2.94% (2)	0	2 (16.7)	0.057
Pericardial tamponade	1.47% (1)	0	1 (8.3)	0.29
Drainage loss first 12 h	396 ± 291	381 ± 280	494 ± 395	< 0.001
Re-exploration	1.47% (1)	0	1 (8.3)	< 0.001
Need for blood products first 24 h	1.22 ± 1.5	1.11 ± 1.3	3.5 ± 3.2	0.01
Stroke	2.94% (2)	0	2 (16.7)	0.057
Septicaemia	5.88% (4)	1 (1.8)	3 (25.0)	< 0.001
Mean ICU stay (hours)	121 ± 151	118 ± 122	322 ± 305	0.003
Mean hospital stay (days)	22.0 ± 18.0	21.6 ± 16.4	39.1 ± 56.2	< 0.001

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DISCUSSION

The studies on serum albumin in the postoperative recovery of cardiac patients provide valuable insights into the impact of albumin levels on patient outcomes. Research has consistently shown that low postoperative serum albumin levels are associated with increased mortality rates, higher incidence of complications such as sepsis and hemorrhage-related issues, and longer ICU stays in patients undergoing cardiac surgery.[1,5] Patients with lower postoperative serum albumin levels are at a higher risk of adverse outcomes, emphasizing the importance of maintaining adequate albumin levels to improve recovery and survival rates in cardiac surgery patients.[1,5] Furthermore, these studies have highlighted that higher postoperative serum albumin levels are linked to reduced in-hospital and long-term mortality rates, indicating the significance of optimal albumin levels in enhancing patient outcomes post-surgery.[1,5] Subgroups of patients with lower postoperative serum albumin levels have been shown to have worse long-term survival rates, underlining the critical role of albumin in influencing patient recovery and prognosis.[1,5]

Multivariable analysis across these studies has consistently demonstrated a higher incidence of in-hospital mortality, sepsis, hemorrhage-related complications, and prolonged ICU stays in patients with lower postoperative serum albumin levels, further emphasizing the importance of albumin in postoperative care and outcomes in cardiac surgery patients.[1,5] Predictors of moderate and severe hypoalbuminemia, such as preoperative chronic kidney disease, previous cardiac surgery, and longer cardiopulmonary bypass time, have been identified as factors contributing to lower postoperative serum albumin levels and adverse outcomes.[1]

Higher postoperative serum albumin levels are associated with reduced in-hospital and long-term mortality rates in patients undergoing cardiac surgery.[1] Patients with lower postoperative serum albumin levels are at a higher risk of in-hospital mortality, sepsis, hemorrhage-related complications, and longer ICU stays.[1] Factors like preoperative chronic kidney disease, previous cardiac surgery, and longer cardiopulmonary bypass time are predictors of moderate and severe hypoalbuminemia.[1]

Observational studies have shown that higher postoperative plasma albumin concentrations are linked to lower myocardial injury and fewer cardiac complications in on-pump cardiac surgery patients.[3] However, there is a need for further research to clarify the efficacy and safety of albumin use in adult cardiac surgery, as limited high-quality evidence supports its benefits.[3]

Expert consensus suggests that low preoperative serum albumin levels in patients undergoing cardiac surgery are associated with increased mortality risk and a higher incidence of postoperative morbidity. While preoperative albumin levels have been shown to be useful in assessing post-cardiac surgery complications, defining a specific abnormal level of albumin remains a challenge due to variations in study findings and classifications of hypoalbuminemia.[6]

Postoperative serum albumin levels can serve as a predictive tool affected by factors related to fluid and metabolic status, with lower levels associated with higher rates of sepsis, bleeding complications, and mortality.[1] The association between chronic renal insufficiency, previous cardiac surgery, and longer cardiopulmonary bypass time with hypoalbuminemia highlights the multifactorial nature of albumin levels in postoperative cardiac patients.[1]

The research indicates that postoperative albumin levels play a crucial role in the recovery and outcomes of cardiac surgery patients. Understanding the impact of albumin levels on mortality, complications, and recovery can guide clinical decision-making and patient management strategies in the postoperative period.

CONCLUSION

The comparison between survivors and non-survivors on serum albumin levels underscores the importance of monitoring and maintaining adequate albumin levels in cardiac surgery patients to improve recovery, reduce complications, and enhance long-term survival rates. Adequate postoperative serum albumin levels are associated with better outcomes and lower mortality rates, emphasizing the significance of albumin in the postoperative care of cardiac patients.

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