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ORIGINAL ARTICLE

Clinical Benefits of Albumin Supplementation in Hypoalbuminemic Patients after Major Abdominal Surgery: A Retrospective Analysis

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ABSTRACT

Background: Hypoalbuminemia is prevalent in patients undergoing major abdominal surgeries and is associated with adverse postoperative outcomes, including prolonged hospital stays, higher infection rates, and increased mortality. The clinical impact of albumin supplementation in these patients remains under scrutiny.

Objective: This study evaluates whether albumin supplementation in hypoalbuminemic patients (≤3.0 g/dL) improves postoperative outcomes.

Methods: This retrospective study included patients who underwent major abdominal surgery between January 2021 and December 2024 at a tertiary care hospital. Patients with hypoalbuminemia were divided into two cohorts of 250 each: those who received postoperative albumin supplementation and those who did not. Outcomes measured included length of hospital stay (LOS), infection rates, ICU admission rates, and 30-day mortality.

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Results: The albumin supplementation group had a significantly shorter LOS (8.1 vs. 11.4 days, $p < 0.001$) and lower infection rates (10% vs. 17%, $p = 0.02$). There was no statistically significant difference in ICU admissions or 30-day mortality between the two groups ($p = 0.58$ and $p = 0.19$, respectively). Multivariate regression identified albumin supplementation as an independent predictor of reduced LOS and infection rates.

Conclusion: Albumin supplementation in hypoalbuminemic patients post-major abdominal surgery improves recovery metrics by reducing LOS and infection rates without influencing short-term mortality. Future randomized controlled trials are necessary to validate these findings.

KEYWORDS

• Hypoalbuminemia <3.5 g/dL • Length of hospital stay(LOS) • Post operative albumin levels • Albumin supplementation

INTRODUCTION

Background and Rationale

Hypoalbuminemia, defined as a serum albumin level below 3.5 g/dL, is a common condition among patients undergoing major abdominal surgeries.[1-3] Albumin serves as a critical protein in maintaining oncotic pressure, modulating immune responses, and binding essential substances.[4-7] Low albumin levels have been consistently associated with adverse clinical outcomes, such as increased susceptibility to infections, poor wound healing, and prolonged recovery.[8-12]

Major abdominal surgeries including resections for malignancies, gastrointestinal perforations, and organ transplants impose considerable physiological stress on patients. In hypoalbuminemic patients, these stresses are exacerbated, leading to an increased risk of complications.[13-15]

Despite the physiological rationale supporting albumin supplementation, its clinical benefits remain controversial. While some studies report improvements in outcomes, others suggest negligible benefits or potential risks associated with its use. This study aims to provide clarity by evaluating whether albumin supplementation offers tangible benefits in terms of recovery metrics, particularly LOS and postoperative complications.[16-17]

Study Objectives

The primary objective of this study was to determine if albumin supplementation in hypoalbuminemic patients undergoing major abdominal surgery reduces postoperative LOS. Secondary objectives included evaluating its effects on infection rates, ICU admissions, and 30-day mortality.

METHODS

Study Design

This retrospective cohort study was conducted at a tertiary care hospital and included patients who underwent major abdominal surgery between January 2019 and December 2023. Ethical approval was obtained from the institution's ethics committee.

Inclusion and Exclusion Criteria

- **Inclusion Criteria**: Patients aged ≥18 years with preoperative serum albumin levels ≤3.5 g/dL who underwent major abdominal surgery.
- **Exclusion Criteria:** Patients with chronic liver disease, nephrotic syndrome, or severe burns; those receiving preoperative albumin supplementation; and those who declined or were medically ineligible for albumin administration.

INTERVENTION

The intervention group received albumin supplementation (20% albumin solution, 50 mL/day for five days) starting immediately after surgery. The control group did not receive albumin supplementation but were managed with standard care, including crystalloid and colloid infusions as needed.

Outcomes Measured

- **Primary Outcome**: Hospital LOS (in days).

- **Secondary Outcomes**: Postoperative infection rates, ICU admission rates, and 30-day mortality.

Data Collection

Clinical data, including demographics, surgical details, laboratory values, and outcomes, were collected from electronic medical records. Postoperative complications were classified according to the Clavien-Dindo grading system.

Statistical Analysis

Continuous variables were compared using the Student's *t*-test, and categorical variables were analyzed with the chi-square test. Multivariate regression was performed to identify predictors of LOS and postoperative complications. A p-value < 0.05 was considered statistically significant.

RESULTS

Patient Demographics and Baseline Characteristics

A total of 500 hypoalbuminemic patients met the inclusion criteria, with 250 in each cohort. The groups were comparable in terms of age, gender distribution, comorbidities, and surgical complexity:

Patient Demographics

Measure	Details
Median Age (years)	63 (range: 44–78)
Gender Distribution	54% Male, 46% Female
Mean Preoperative Albumin Level (g/dL)	2.6 (SD: 0.3)

- **Primary Outcomes**

Outcome Measure	Intervention Group	Control Group
Length of Hospital Stay (LOS)	8.1 days (SD: 1.9)	11.4 days (SD: 2.5)

- **Secondary Outcomes**

Outcome Measure	Intervention Group	Control Group
Infection Rates	10%	17%
ICU Admission Rates	8%	9%
30-Day Mortality	4%	6%

- **Difference: 3.3 days (p < 0.001)**

Secondary Outcomes

After adjusting for age, comorbidities, and surgical complexity, albumin supplementation emerged as an independent predictor of reduced LOS and infection rates:

Predictor	Adjusted OR (95% CI)	P-value
Reduced LOS	0.72 (0.60–0.85)	< 0.001
Reduced Infection Rates	0.68 (0.52–0.89)	0.01

DISCUSSION

Principal Findings

This study demonstrates that albumin supplementation in hypoalbuminemic patients undergoing major abdominal surgery is associated with significant improvements in recovery metrics, particularly LOS and infection rates. These findings support the hypothesis that correcting hypoalbuminemia addresses some of the systemic vulnerabilities that predispose patients to adverse outcomes.

Comparison with Existing Literature

The results align with prior studies that have reported similar benefits of albumin supplementation, including reduced LOS and lower infection rates. However, our findings differ from studies that found no effect on mortality, emphasizing the need for cautious interpretation of mortality outcomes in this population.

Physiological Mechanisms

The observed benefits may be attributed to several mechanisms:

1. **Enhanced Oncotic Pressure**: Albumin supplementation restores plasma oncotic wpressure, reducing tissue edema and improving microcirculatory perfusion.
2. **Immune Modulation**: Albumin's role in modulating inflammatory responses may contribute to reduced susceptibility to infections.
3. **Drug Binding and Transport**: Albumin's capacity to bind and transport endogenous and exogenous substances, including medications, enhances therapeutic efficacy.

Clinical Implications

Routine albumin supplementation in hypoalbuminemic patients after major abdominal surgery may be a cost-effective strategy to improve recovery and reduce healthcare burdens associated with prolonged hospital stays. However, clinicians should balance these benefits against potential risks, such as fluid overload or allergic reactions.

Limitations

- **Retrospective Design**: As a retrospective study, it is subject to selection bias and unmeasured confounders.
- **Single-Center Study**: Findings may not be generalizable to other settings.
- **Short-Term Outcomes**: The study focused on short-term outcomes, and long-term effects remain unexplored.

Future Research

Future randomized controlled trials are warranted to confirm these findings and to evaluate the long-term impact of albumin supplementation, including its effects on quality of life and functional recovery.

CONCLUSION

Albuminsupplementationinhypoalbuminemic patients undergoing major abdominal surgery significantly reduces LOS and infection rates, offering a tangible clinical benefit. However, it does not influence short-term mortality. These findings highlight the potential role of albumin supplementation as an adjunctive therapy in perioperative care.

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