Research Article

Preoperative Serum Albumin and Body Mass Index as Predictors of Postoperative Complications in Elective Major Surgeries: A Prospective Observational Study

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Abstract

Background

Malnutrition is a well-recognised determinant of adverse surgical outcomes. Preoperative assessment of nutritional status using simple biochemical and anthropometric parameters may help predict postoperative complications and guide perioperative management.

Objectives

To evaluate the role of preoperative serum albumin and body mass index (BMI) as predictors of postoperative complications in patients undergoing elective major surgeries.

Methods

A prospective observational study was conducted among 100 patients aged more than 12 years undergoing elective major surgeries at a tertiary care centre between December 2019 and December 2021. Preoperative nutritional assessment included estimation of serum albumin and calculation of BMI. Patients with diabetes mellitus, chronic renal or liver disease, severe anaemia, malignancy on chemotherapy, or steroid therapy were excluded. Patients were followed postoperatively for complications such as surgical site infection, seroma, respiratory complications, wound dehiscence, and mortality. Statistical analysis was performed using SPSS software.

Results

Postoperative complications were observed in 38% of patients. Complications were significantly more common among patients with serum albumin levels between 2.5–3.0

g/dL. Patients with abnormal BMI, particularly those who were overweight, had a higher incidence of postoperative complications compared to those with normal BMI. Surgical site infection and seroma were the most frequently encountered complications.

Conclusion

Preoperative serum albumin and BMI are reliable, cost-effective predictors of postoperative complications. Routine nutritional assessment should be incorporated into preoperative evaluation to identify high-risk patients and improve surgical outcomes.

Keywords: Serum albumin; Body mass index; Postoperative complications; Malnutrition; Elective surgery

Introduction

Malnutrition continues to be a major yet underdiagnosed problem among surgical patients, particularly in developing countries. The association between nutritional status and surgical outcomes has been recognised since the time of Hippocrates, who first described the adverse effects of poor nutrition on wound healing and recovery[1]. Protein-energy malnutrition leads to impaired immune response, delayed wound healing, increased susceptibility to infections, prolonged hospital stay, and increased postoperative mortality[2].

The prevalence of malnutrition among hospitalised surgical patients ranges from 30% to 60%, depending on the population studied and the criteria used[3]. Patients undergoing major surgical procedures are particularly vulnerable due to increased metabolic demands, surgical stress, and catabolic hormonal responses[4]. Identifying malnutrition preoperatively provides an opportunity for early intervention and optimisation of outcomes.

Serum albumin is the most commonly used biochemical marker of nutritional status. It constitutes approximately 60% of total plasma protein and plays a crucial role in maintaining oncotic pressure, transport of endogenous and exogenous substances, and modulation of inflammatory responses[5]. Hypoalbuminemia has consistently been associated with increased postoperative morbidity and mortality across various surgical specialties[6]. Several large cohort studies have demonstrated that decreasing serum albumin levels correlate with exponential increases in postoperative complications and death[7].

Body mass index (BMI), also known as Quetelet's index, is a simple anthropometric measure that reflects nutritional reserves and body composition[8]. Both extremes of BMI—underweight and

obesity—have been associated with adverse surgical outcomes. Low BMI is linked to reduced muscle mass, impaired immunity, and poor wound healing, while obesity predisposes to wound complications, respiratory compromise, and infections due to impaired tissue perfusion and altered inflammatory responses[9].

Despite strong evidence supporting the role of nutritional assessment, routine preoperative evaluation often focuses primarily on cardiopulmonary risk stratification, with nutritional status receiving limited attention[10]. Simple, cost-effective tools such as serum albumin estimation and BMI calculation can be easily incorporated into routine practice, especially in resource-limited settings.

This study was undertaken to evaluate the predictive value of preoperative serum albumin and BMI in determining postoperative complications among patients undergoing elective major surgeries in a tertiary care centre.

Materials and Methods

Study Design

This was a prospective observational study.

Study Setting

The study was conducted in the Department of General Surgery, Government Villupuram Medical College and Hospital, Tamil Nadu, India.

Study Period

December 2019 to December 2021.

Study Population

Patients admitted for elective major surgical procedures under the Department of General Surgery.

Sample Size

A total of 100 patients were included in the study.

Inclusion Criteria

- Patients aged more than 12 years
- Patients undergoing elective major surgeries

Exclusion Criteria

- Age less than 12 years
- Severe anaemia (hemoglobin <7 g/dL)
- Diabetes mellitus
- Chronic renal disease
- Chronic liver disease
- Patients on long-term steroid therapy
- Patients receiving chemotherapy

Methodology

Eligible patients were enrolled after obtaining informed consent. A detailed clinical history and physical examination were performed. Anthropometric measurements including height and weight were recorded, and BMI was calculated as weight in kilograms divided by height in meters squared.

Preoperative blood samples were collected to estimate serum albumin and total protein levels. All patients underwent standard perioperative management as per institutional protocols. Patients were followed postoperatively until discharge and monitored for complications including surgical site infection, seroma, wound dehiscence, respiratory complications, fistula formation, and mortality.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using the Statistical Package for Social Sciences (SPSS). Results were expressed as frequencies and percentages.

Results

Baseline demographic and clinical characteristics

The study included 100 patients aged between 13 and 71 years. Among them, 72 were males and 28 were females. The majority of patients belonged to the 40–59-year age group. Thirteen patients had malignancy, with a higher proportion observed among females.

Table 1: Baseline demographic and clinical characteristics of the study population

Variable	Number	Percentage (%)
Sex		
Male	72	72.0
Female	28	28.0
Age group (years)		
<20	10	10.0
20–39	22	22.0
40–59	35	35.0
≥60	33	33.0
Malignancy		
Present	13	13.0
Absent	87	87.0

Figure 1: Gender distribution of the study population
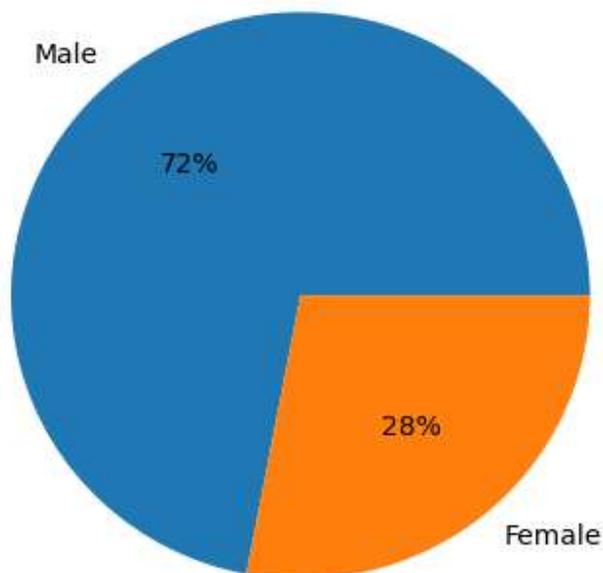
Pie chart showing sex distribution of the study participants. Male patients constituted 72% (n = 72) and female patients constituted 28% (n = 28) of the study population.

Prevalence of Malignancy

Out of the 100 cases studied, **13 patients (13%) were diagnosed with malignancy**, while **87 patients (87%) had non-malignant conditions**. Among the malignant cases, **9 patients were females** and **4 were males**. In contrast, males constituted the majority among non-malignant cases.

Table 2: Distribution of Malignancy According to Sex

Diagnosis	Male	Female	Total
Malignant	4	9	13
Non-malignant	68	19	87
Total	**72**	**28**	**100**

Distribution of Body Mass Index (BMI)
The majority of patients had BMI within the **normal range**. However, patients in the **overweight category** demonstrated a **higher incidence of postoperative complications** compared to patients with normal BMI.

Table 3: Distribution of BMI Among Study Participants

| BMI Category (kg/m²)	Number
<18.5	3
18.5–24.9	59
25.0–29.9	17
≥30.0	21
Total	**100**

When analysed according to BMI, most patients had a BMI within the normal range. However, patients in the overweight category demonstrated a higher rate of postoperative complications compared to those with normal BMI. Both underweight and obese patients also showed increased complication rates, though the number of such patients was relatively small.

Preoperative Serum albumin analysis
Preoperative Serum albumin analysis revealed that 62 patients had normal albumin levels, while the remaining patients had varying degrees of hypoalbuminemia.

Figure 2: Distribution of preoperative serum albumin levels
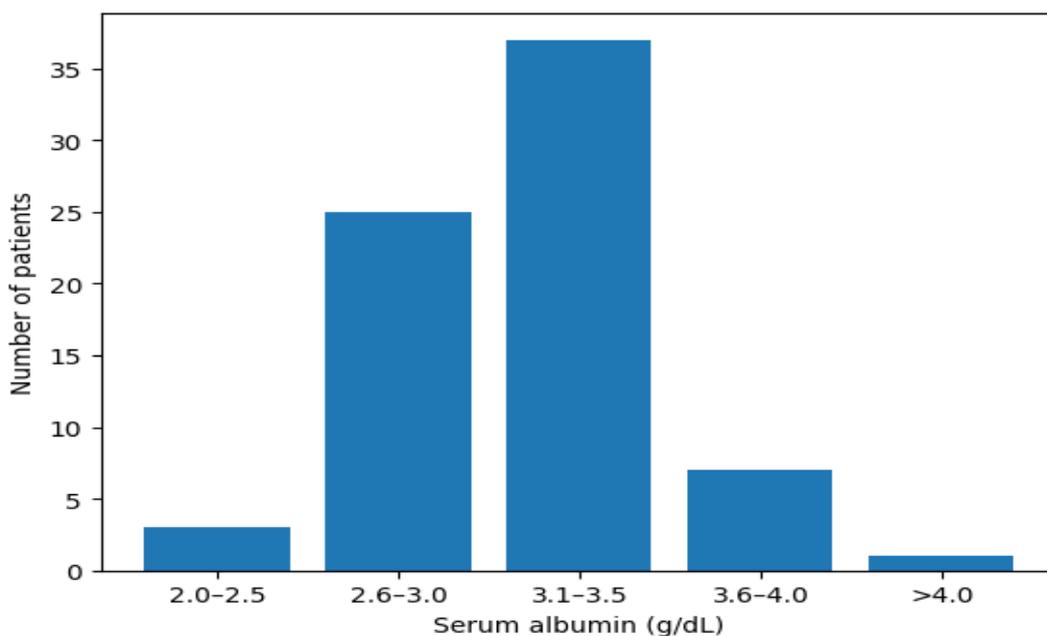
Bar diagram illustrating the distribution of serum albumin levels among the study population. The highest incidence of complications was observed among patients with serum albumin levels between 2.6 and 3.0 g/dL (25 cases). Surgical site infection and seroma were the most frequently encountered complications, followed by respiratory complications and wound dehiscence. One postoperative mortality was recorded.

Postoperative complications

Postoperative complications were observed in 38 patients, while 62 patients had an uncomplicated postoperative course. Complications were more common among male patients compared to females.

Table 4: Pattern of postoperative complications observed in the study

Type of Complication	Number
Wound infection	18
Seroma	16
LRTI with pleural effusion	2
Burst abdomen	1
Fistula	0
Mortality	1

Surgical site infection was the most frequently observed postoperative complication (18 cases), followed closely by seroma formation (16 cases). Less common complications included lower respiratory tract infection with pleural effusion (2 cases), burst abdomen (1 case), and mortality (1 case). No cases of postoperative fistula were recorded in the study population.

Discussion

The present study demonstrates a strong association between preoperative serum albumin levels, BMI, and postoperative complications in patients undergoing elective major surgeries. These findings reinforce the importance of nutritional assessment as an integral component of preoperative evaluation.

Gibbs et al. analysed over 54,000 surgical patients and reported that decreasing serum albumin levels were associated with a dramatic increase in postoperative morbidity and mortality[7]. Patients with

albumin levels below 2.5 g/dL had mortality rates approaching 30%. Similar findings were reported by Kudsk et al., who observed that serum albumin levels below 3.25 g/dL were strongly associated with increased complications and prolonged hospital stay[11].

Vincent et al., in a meta-analysis of cohort studies, concluded that hypoalbuminemia is an independent, dose-dependent predictor of poor outcomes in acutely ill patients[12]. Each 10 g/L decrease in serum albumin significantly increased mortality and morbidity. These findings are consistent with the results of the present study, where complications were most prevalent among patients with serum albumin levels between 2.5 and 3.0 g/dL.

BMI also emerged as a significant predictor of postoperative outcomes. Beghetto et al. reported that both low BMI (<18.5 kg/m²) and hypoalbuminemia were associated with increased postoperative infections and mortality[13]. Engelman et al. demonstrated that underweight and obese patients had higher complication rates following cardiac surgery[14]. The increased risk among overweight and obese patients may be attributed to impaired tissue perfusion, increased inflammatory response, and technical challenges during surgery.

Obesity is associated with decreased oxygenation of adipose tissue, leading to delayed wound healing and increased susceptibility to infection[15]. Conversely, undernutrition results in reduced collagen synthesis, impaired immune function, and delayed wound repair[16]. The present study supports the concept that both extremes of BMI adversely influence surgical outcomes.

Pulmonary complications are another important contributor to postoperative morbidity. Arozullah et al. demonstrated that low serum albumin was a significant predictor of postoperative respiratory failure[17]. Malnutrition leads to respiratory muscle weakness, reduced cough reflex, and impaired immune defence, predisposing patients to pulmonary infections.

The findings of this study highlight the importance of early identification of nutritionally at-risk patients. Preoperative nutritional optimisation, including dietary counselling and supplementation, may reduce postoperative complications and improve recovery. Serum albumin estimation and BMI calculation are simple, inexpensive tools that can be routinely implemented in surgical practice.

Conclusion

Preoperative serum albumin and body mass index are effective and reliable predictors of postoperative complications in patients

undergoing elective major surgeries. Hypoalbuminemia and abnormal BMI are associated with increased postoperative morbidity, particularly surgical site infections and wound-related complications. Routine nutritional assessment using these simple parameters should be incorporated into standard preoperative evaluation protocols. Early identification and correction of nutritional deficiencies may significantly improve surgical outcomes, reduce hospital stay, and decrease postoperative morbidity and mortality.

Conflict of Interest

The authors declare no conflict of interest.

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