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Original Article

Role of Serum Albumin as Predictor of Postoperative Morbidity and Mortality in Gastrointestinal Surgeries

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ABSTRACT

Serum albumin, a key protein in human plasma, maintains oncotic pressure and transports various substances. In gastrointestinal surgeries, the impact of low preoperative serum albumin on postoperative morbidity and mortality is significant but not fully understood. **Objective:** To determine the role of serum albumin levels as a predictor of postoperative morbidity and mortality in patients undergoing gastrointestinal surgeries. **Methods:** This prospective cohort study was conducted at Department of Surgery – Jinnah Post Graduate Medical Centre, Karachi from January 01, 2021, to December 31, 2021. The study included 86 patients with age range 18 to 45 years and of either gender who had undergone elective gastrointestinal surgeries and had preoperative serum albumin levels measured within 7 days before the surgery. Patients having exploratory laparotomy involving organs other than GIT, those who lost to follow-up and patients with conditions that significantly affect serum albumin levels, such as chronic liver disease or nephrotic syndrome, were excluded from the study. **Results:** Hypoalbuminemia (<3.5 mg/dL) was observed in 61 patients (70.9%), while 25 patients (29.1%) had normal albumin levels (>3.5 mg/dL). All 30-day mortalities occurred in the hypoalbuminemia group ($p < 0.05$). Superficial surgical site infections were significantly higher in the hypoalbuminemia group as well (73.4% vs. 26.6%, $p < 0.05$). Other complications were more frequent in patients with hypoalbuminemia but were not statistically significant ($p > 0.05$). **Conclusions:** The study findings indicate that preoperative serum albumin levels were a significant predictor of postoperative complications in patients undergoing elective gastrointestinal surgeries.

INTRODUCTION

Gastrointestinal surgeries have been known to be linked with substantial morbidity and extended stay at the hospital, with studies reported up 35% of cases, having the complications [1-3]. Infectious complications account for a major proportion of the cumulative mortality and morbidity associated with colorectal surgery [4, 5]. Albumin is a single polypeptide responsible for hemostatic management of colloidal pressure, transport of nutrients in blood, scavenging of free radical for its autoxidizing properties. Moreover, it also serves as anticoagulant and antithrombotic agent through inhibition of platelet function. Albumin is believed to have favorable effects on vascular permeability during state of septicemia [6]. Low serum albumin (termed hypoalbuminemia) is also regarded as a marker for malnutrition [7]. In the early 1950's, it was first noted that poor post-operative outcomes (following colorectal surgery) were yielded among cases with low serum albumin [8]. Kang B *et al.*, reported a higher incidence of concurrent sepsis among patients with low serum albumin; while others drew similar associations of hypoalbuminemia with a higher rate of encountering malnutrition among hospitalized patients. [9, 10]. Though albumin status is often recognized as a useful predictor for outcome following most surgeries, however, the efficacy

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may vary depending on the type of surgery. One such surgery wherein the efficacy of albumin status to serve as a predictor of outcome may be challenged, is gastrointestinal (GI) surgery; owing to the fact that GI surgery patients are often malnourished resulting from restricted oral intake, blocked intestines (or intestines with fistulas), sub-par absorptive ability, and large losses of volume from the alimentary canal [11, 12]. Much of the previous research does not take this potential for bias into account; the predictive ability of hypoalbuminemia is cast into doubt [13]. It is important to generate evidence in this regard and determine whether preoperative hypoalbuminemia is of any predictive value in gastrointestinal surgery patients.

This study was designed to determine the role of serum albumin levels as a predictor of postoperative morbidity and mortality in patients undergoing gastrointestinal surgeries.

METHODS

A prospective cohort study was conducted at Department of Surgery – Jinnah Post Graduate Medical Centre, Karachi from January 01, 2021, to December 31, 2021, via non probability consecutive sampling. After obtaining IRB approval (No.F.2/81/2020-GENL/49066/JPMC), informed written consent was taken from every patient. A sample size of 86 was determined with a 95% confidence interval and a 5% margin of error, taking the incidence of postoperative bowel obstruction as 5.9% [14]. The study included patients with age range 18 to 45 years and of either gender who had undergone elective gastrointestinal surgeries including but not limited to Gastrectomy, Colectomy and Small bowel resection. Pancreaticoduodenectomy (Whipple procedure) and Hepatectomy and had preoperative serum albumin levels measured within last 7 days before the surgery. Patients having emergency gastrointestinal surgeries, requiring exploratory laparotomies and with major systematic illnesses like chronic liver diseases, chronic kidney diseases, sepsis, or patients with severe malnutrition or on albumin supplementation in last 30-days prior to surgery, were excluded from the study. The primary outcome was 30-day postoperative mortality while secondary outcomes included intra-abdominal or anastomotic bleeding, bowel obstruction, intra-abdominal sepsis, localized or generalized peritonitis, superficial surgical site infection, and wound dehiscence. These outcomes were recorded to assess the impact of preoperative serum albumin levels on postoperative complications in gastrointestinal surgeries. SPSS version 23.0 was used for data analysis. Descriptive statistics included mean and standard deviation for continuous variables (e.g., age, serum albumin levels) and frequencies/percentages for categorical variables (e.g., gender, postoperative surgical complications). Patients were divided into 2 groups based on their serum albumin levels (<3.5 mg/dL and >3.5 mg/dL). Chi-square test was used to compare postoperative mortality and morbidity in albumin groups.

RESULTS

The study included 86 patients with a mean age of 37 years (± 4 years) (Table 1). The mean preoperative serum albumin level was 3.62 gm/dL. Among the participants, 49 (57%) were male, and 37 (43%) were female. Hypoalbuminemia (serum albumin <3.5 mg/dL) was present in 61 patients (70.9%), while 25 patients (29.1%) had serum albumin levels >3.5 mg/dL.

Table 1: Descriptive Statistics

Variables	Mean ± SD/N (%)
Age (Years)	37 ± 04 Years
Preoperative Serum Albumin (mg/dL)	3.62 gm/dL
Gender	
Male	49 (57%)
Female	37 (43)
Hypoalbuminemia	
Present (<3.5 mg/dL)	61 (70.9%)
Absent (>3.5 mg/dL)	25 (29.1%)

In Table 2 the postoperative outcomes among patients with GI surgeries. Poor postoperative outcomes occurred in 26 patients (30.3%). The 30-day postoperative mortality rate was 2.3%, with 2 patients dying within 30 days after surgery. The complications included intra-abdominal or anastomotic bleeding in 3 patients (3.5%), bowel obstruction in 1 patient (1.2%), intra-abdominal sepsis in 1 patient (1.2%), and peritonitis (localized or generalized) in 1 patient (1.2%). Superficial surgical site infection was the most common complication, affecting 15 patients (17.4%), while wound dehiscence occurred in 3 patients (3.5%).

Table 2: Postoperative Outcomes

Outcomes	N (%)
30-day Postoperative Mortality	2 (2.3)
Postoperative Complications	
Intra-abdominal or Anastomotic Bleeding	3 (3.5)
Bowel Obstruction	1 (1.2)
Intra-Abdominal Sepsis	1 (1.2)
Peritonitis (Localized/Generalized)	1 (1.2)
Superficial Surgical Site Infection	15 (17.4)
Wound Dehiscence	3 (3.5)
Total	26 (30.3)

Comparison of postoperative complications by serum albumin levels was detailed in Table 3. Patients with serum albumin <3.5 mg/dL (hypoalbuminemia) had higher rates of complications. Specifically, 30-day postoperative mortality was 100% in the hypoalbuminemia group, with no deaths in the group with serum albumin >3.5 mg/dL ($p < 0.05$). Intra-abdominal or anastomotic bleeding occurred in 66.7% of patients with hypoalbuminemia compared to 33.3% in those with higher albumin levels ($p > 0.05$). Bowel

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obstruction, intra-abdominal sepsis, peritonitis, and wound dehiscence were all 100% in patients with hypoalbuminemia, with no occurrences in patients with serum albumin >3.5 mg/dL ($p > 0.05$ for each). Superficial surgical site infection was more frequent in the hypoalbuminemia group (73.4%) compared to those with higher albumin levels (26.6%), and this difference was statistically significant ($p < 0.05$).

Table 3: Comparison of Postoperative Complications by Serum Albumin Levels

Postoperative Complications	Serum Albumin <3.5 mg/Dl N (%)	Serum Albumin >3.5 mg/Dl N (%)	P-Value
30-day Postoperative Mortality	2 (100%)	0 (0%)	< 0.05*
Intra-abdominal or Anastomotic Bleeding	2 (66.7%)	1 (33.3%)	> 0.05
Bowel Obstruction	1 (100%)	0 (0%)	> 0.05
Intra-Abdominal Sepsis	1 (100%)	0 (0%)	> 0.05
Peritonitis (Localized/Generalized)	1 (100%)	0 (0%)	> 0.05
Superficial Surgical Site Infection	11 (73.4%)	4 (26.6%)	< 0.05*
Wound Dehiscence	3 (100%)	0 (0%)	> 0.05
Total	21	5	-

**Statistically Significant*

DISCUSSION

Published evidence hints at a high prevalence (up to 50%) of malnutrition in hospitalized patients and it is often hypothesized to influence patient outcome, affect length of hospital stay, cost, mortality, and morbidity [15]. It is important to note that, hypoalbuminemia is known to be most significantly associated with poor healing of tissues, decreased synthesis of collagen, and formation of granuloma in surgical wounds, eventually leading to delayed wound healing [16]. Traditionally, levels of serum albumin have been assessed prior to surgery for many of the reasons and deemed a reliable prognostic indicator (preoperatively) for a wide array of surgical interventions including (but not limited to) cardiac, general surgery and trauma [17-19]. Research has showcased that albumin < 3.5 g/dL is among the most reliable preoperative predictors of mortality and 30-day morbidity and mortality [20]. Additionally, low serum albumin levels were an independent predictor of acute renal failure, bleeding, coma, need for assisted ventilation, transfusions, systemic sepsis and more than two dozen other adverse outcomes ($P < 0.001$ for all the complications). Galata C *et al.*, claimed clinical hypoalbuminemia (albumin < 4.25 g/dL) to be independently associated with extended hospital stay, and other poor postoperative outcomes. Furthermore, severe hypoalbuminemia (albumin < 3.25 g/dL) was deemed to be associated with mortality by Roy N [21-23]. Studies suggest that in elective procedures, the decision to delay or cancel surgery due to low albumin levels must be weighed against the potential risks and benefits of corrective measures. While albumin supplementation may be effective in improving outcomes, it is not without risks, such as fluid overload and electrolyte imbalances. Moreover, the relationship between albumin levels and post-operative outcomes was complex, and other factors such as overall health status, nutritional state, and surgical technique also play a significant role [24, 25]. Our research yielded poor postoperative outcomes with only 2 30-days mortalities having occurred during the course of the research. The mean serum albumin level noted among patients encountering a poor outcome (morbidity or mortality) was significantly lower than patients with better outcomes; thereby supporting our hypothesis and strengthening the belief that serum albumin level, may be taken as a reliable indicator of disease prognosis (postoperative mortality and morbidity) [18]. Though acute factors, namely: surgical stress and trauma may affect the level of serum albumin, but stratified results published in literature show that even after accounting for such effect modifiers, the serum albumin levels remain a potent predictor of operative outcome [26]. The mean age of the sample stood at 37 years (SD ± 04) which is much lower than the samples of Liang WQ *et al.*, 61 (18-87 years) but similar to others such as Pradeep Ghimire MS that is recorded as 49.69 [27, 28]. The gender ratio was tilted slightly in favor of males in this research with 57% of the sample being male patients. This is similar to the aforementioned studies. The mean serum albumin value among patients encountering an infection fell in the hypoalbuminemia range and this is a strong indicator. Liang WQ, *et al.*, and Pradeep Ghimi et have reported similar findings [27, 28]. Savluk ÖF *et al.*, researched this phenomenon among patients undergoing elective colon, gastric, oesophageal and pancreaticoduodenal surgery and revealed that hypoalbuminemia (especially below 3.25gm/dl) was associated with adverse outcomes, extended hospital stays, and in-hospital mortality [29]. Out research yields similar findings and showcases a synonymous trend of adverse outcome among patients with low levels of serum albumin. In this research, the most common postoperative complication was found to be Surgical Site Infection i.e., 17.4%, among patients (15/86). Multi-institutional research by Hennessey DB *et al.*, on patients undergoing colorectal surgery revealed a similar pattern [30]. Hennessey also claimed that the probability of developing a surgical site infection was higher among patients with a lower median preoperative serum albumin, i.e., 3.0 g/dl or less ($P < 0.001$). The pre-operative mean serum albumin level among patients with postoperative surgical site infection was significantly lower in comparison to the patients without surgical site infection in this present study as well. This was seconded by the work of Udeh CI *et al.*, as well who claimed a 53% complication rate among patients with a preoperative albumin level <3gm/dl [31].

CONCLUSIONS

The study findings indicate that preoperative serum albumin levels were a significant predictor of postoperative complications in patients undergoing elective gastrointestinal surgeries. Patients with hypoalbuminemia (serum albumin <3.5 mg/dL) exhibited

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higher rates of complications, including a statistically significant increase in 30-day postoperative mortality and superficial surgical site infections. Although other complications such as intra-abdominal or anastomotic bleeding, bowel obstruction, intra-abdominal sepsis, peritonitis, and wound dehiscence were more frequent in patients with lower serum albumin levels, these differences were not statistically significant.

Authors Contribution

Conceptualization: AAAA
Methodology: AAAA, AA, SP
Formal analysis: AAAA
Writing, review and editing: MA, AA, MS, AN, SP

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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