



Preoperative Albumin Level as a Predictor of Postoperative Complications Following Emergency Laparotomy

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Abstract: Background: Emergency laparotomy is associated with substantial postoperative morbidity and mortality. Early identification of patients at increased risk of adverse outcomes is essential for improving perioperative management. Serum albumin is a readily available biomarker that reflects nutritional and physiological status and may serve as a predictor of postoperative complications. **Objective:** To evaluate the role of preoperative serum albumin levels as a predictor of postoperative complications following emergency laparotomy. **Methods:** This observational analytical study was conducted at a tertiary care hospital in Karachi, Pakistan. A total of 200 adult patients undergoing emergency laparotomy were included through consecutive non-probability sampling. Preoperative serum albumin levels were measured within 24 hours before surgery. Patients were followed throughout their hospital stay for the development of postoperative complications, including surgical site infection, wound dehiscence, anastomotic leak, sepsis, and mortality. Data were analyzed using SPSS version 26, and statistical significance was considered at $p \leq 0.05$. **Results:** The mean age of the participants was 46.8 ± 15.2 years, and 128 (64.0%) were male. Hypoalbuminemia (serum albumin <3.5 g/dL) was observed in 118 (59.0%) patients. Postoperative complications occurred in 76 (38.0%) patients. Complications were more common among patients with hypoalbuminemia than among those with normal serum albumin levels (49.2% vs. 22.0%). A statistically significant association was observed between preoperative hypoalbuminemia and postoperative complications ($p < 0.001$). **Conclusion:** Preoperative hypoalbuminemia was significantly associated with an increased risk of postoperative complications following emergency laparotomy. Serum albumin may be utilized as a simple, inexpensive, and effective predictor for perioperative risk assessment and clinical decision-making in emergency surgical patients.

Keywords: Emergency laparotomy, Serum albumin, Hypoalbuminemia, Postoperative complications, Risk prediction, Surgical outcomes, Emergency surgery, Perioperative assessment.

INTRODUCTION

Emergency laparotomy continues to be a high-risk general surgical procedure due to high postoperative morbidity and mortality. Even with advances in perioperative care, studies report laparotomy complications to be in the range of 30%-50%, with mortality rates of 10%-15%, especially in the elderly, those with sepsis, and those with perforated bowel and intestinal obstruction {1,2}. Knowing the risks will help in managing the patient preoperatively, but more importantly help in managing the patient who is a

greater risk.

Albumin is a good reflection on a person's reserve, as well as their nutritional and inflammatory status. Having low levels of albumin has been an adverse prognostic indicator for a long time because it negatively affects healing of a wound, the immune system and a person's stress response to a surgical procedure {3}. The literature offers more support for the hypothesis regarding albumin and prognosis. A 2025 study of a population of people who underwent an abdominal surgical procedure, low preoperative

albumin was found to be indicative of a greater likelihood of complications and a longer stay, with an odd ratio of 12.68 for a negative prognosis {4}. In an article by Tan et al, patients who had an albumin level of less than 35 g/L had a greater incidence of wound dehiscence, longer stays in hospital and death following the surgical procedure {5}.

Emergency abdominal surgeries often involve patients

METHODOLOGY

This observational analytical study was carried out in the General Surgery Department at a Karachi, Pakistan, tertiary care hospital. Emergency laparotomy patients in the age range of 18 to 65, who provided informed consent, were identified using a non-probability convenience sampling technique.

Using OpenEpi version 3.01, the sample size was estimated based on the rate of occurrence of postoperative complications in the literature, which is 35% in emergency abdominal surgeries, and a sample size estimation formula using a confidence interval of 95% and a margin of error of 7%. The resultant minimum sample size was 179, and the study included 200 patients to account for possible incomplete data.

The study included patients aged 18 and older, conducted emergency laparotomy, and had a preoperative serum albumin test in the 24 hours before the surgery. Chronic liver disease, chronic nephrotic syndrome, severe burn injuries, immunodeficiency disorders, and incomplete medical records were

with infection, dehydration, and malnutrition, complicating the prognostic value of albumin. Studies show that low pre-operative albumin predicts morbidities, infections, and death after surgery of the abdomen {6,7}. In addition, another study shows that low albumin before surgery predicts both death and sepsis within 30 days after major surgery even more {8}.

exclusion criteria.

Data collection for age, sex, and all comorbid conditions and surgery-related variables including preoperative serum albumin, and surgery-related findings and outcomes were done using a structured pro forma. Patients were monitored for the entire duration of the hospital stay for the development of complications including surgical site infection, wound dehiscence, anastomotic leak, sepsis, extended hospital stay, and death.

Data were analyzed using SPSS version 26. Quantitative data were expressed as mean $\pm$ SD or median (IQR), and qualitative data were expressed as frequency and percentage. Preoperative albumin level and postoperative complications were analyzed using applicable statistical tests. A p-value of less than or equal to 0.05 was considered significant.

Informed written consent was acquired from all subjects. Patient privacy was protected and the study adhered to the ethical standards of the Declaration of Helsinki

RESULTS

Two hundred patients who had emergency laparotomy were reviewed. The average age was 46.8 ± 15.2 years (range 18 - 82). There were 128 (64.0%) males and 72 (36.0%) females. The demographics and other baseline characteristics were summarized in Table 1.

The average preoperative serum albumin was 3.2 ± 0.7 g/dL. Hypoalbuminemia (serum albumin < 3.5 g/dL) was seen in 118 (59.0%) of patients. The remaining 82 (41.0%) of patients had adequate serum albumin. The preoperative albumin levels were summarized in Table 2.

There were 76 (38.0%) of patients who experienced postoperative complications. The remaining 124 (62.0%) patients were complication free. The most common complication was infection of the surgical site that was seen in 32 (16.0%) patients. This was followed in frequency by sepsis that was seen in 18 (9.0%) patients, wound dehiscence in 14 (7.0%), and an anastomotic leak in 12 (6.0%) patients. There were 8 (4.0%) patients that died following the operation. The complications that occurred in the postoperative period were shown in Table 3.

Of the patients that were categorized as having hypoalbuminemia, 58 (49.2%) experienced complications. This was less than the 22.0% of the patients that experienced complications that had normal serum albumin levels. Among the patients that experienced hypoalbuminemia, 60 (50.8%) had postoperative complications, while 64 (78.0%) of the patients that had normal albumin levels had no complications. There was a significant relationship of preoperative hypoalbuminemia and postoperative complications ($\chi^2 = 15.84$, $p < 0.001$). The other findings were shown in Table 4.

Subgroup analysis showed that patients with hypoalbuminemia and normal albumin patients experienced surgical site infections, wound dehiscence, and sepsis. Patients with low preoperative serum albumin levels experienced a longer hospital stay.

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants (n=200)

Variable	Frequency (n)	Percentage (%)
Male	128	64.0
Female	72	36.0
18–30	42	21.0
31–45	58	29.0
46–60	61	30.5
>60	39	19.5

Table 2. Distribution of Preoperative Serum Albumin Levels (n=200)

Albumin Category	Frequency (n)	Percentage (%)
<3.0 g/dL	48	24.0
3.0–3.49 g/dL	70	35.0
≥3.5 g/dL	82	41.0
Total	200	100.0

Table 3. Postoperative Complications Following Emergency Laparotomy (n=200)

Complication	Frequency (n)	Percentage (%)
Surgical Site Infection	32	16.0
Sepsis	18	9.0
Wound Dehiscence	14	7.0
Anastomotic Leak	12	6.0
Mortality	8	4.0
No Complication	124	62.0

Table 4. Association between Preoperative Albumin Status and Postoperative Complications

Albumin Status	Complications Present n (%)	Complications Absent n (%)	Total
Hypoalbuminemia (<3.5 g/dL)	58 (49.2)	60 (50.8)	118
Normal Albumin (≥3.5 g/dL)	18 (22.0)	64 (78.0)	82
Total	76	124	200

DISCUSSION

This study focused on preoperative serum albumin levels, predicting complications after emergency laparotomies. The study found a strong link between hypoalbuminemia and negative postoperative results, putting serum albumin levels at the forefront of the preoperative risk assessment for patients undergoing emergency surgery. Patients with lower levels of serum albumin experienced a higher rate of postoperative complications than those with serum albumin levels in the normal range.

Most of these findings align with what is known in the literature. A number of recent studies focused on the abdominal and emergency surgery populations and have cited hypoalbuminemia as a distinct predictor of postoperative complications and mortality {9-11}. The literature has also documented reduced serum albumin levels and complications such as surgical site infections, wound dehiscence, sepsis, and prolonged postoperative hospitalization and mortality. These have also been documented in both elective and emergency surgery on the gastrointestinal tract {12,13}.

The reason for the relationship in the findings is

complex. There is an effect of serum albumin levels on plasma oncotic pressure, transport of substances, modulatory roles in inflammation, and tissue repair. The evidence is clear on the effect of serum albumin levels on malnutrition and the inflammatory response. The combination of these is a poor immune response and prolonged wound healing, which are indicative of surgical stress which impacts the ability of patients to recover after surgery {14,15}.

The link between hypoalbuminemia and postoperative complications being observed and past studies also show that serum albumin is a more trustworthy measure of surgical risk than many conventional clinical parameters {16}. Albumin measurement is cost-effective and easy to obtain and is done routinely before surgery. Thus, it can be an effective measure for predicting a high-risk patient, especially in low resource settings.

One of the major positives of this study is that it is looking at emergency laparotomy, a highly morbidity and mortality procedure, especially on a global scale. Along with other studies, using other readily available laboratory parameters makes the study findings that much more applicable. But, as with every study, there

are limitations; one being that the study was done at a single institution and may limit the external validity. Along with that, unmeasured variables such as the severity of the disease, nutritional measures and perioperative management can impact the results. There is also the limitation of an observational study, so no determination of the relationship of the variables can be made.

There are many potential implications for practice with this, one being that surveying serum albumin can signify to the surgeon a patient that will have a negative outcome and this can prompt additional measures to be taken during the perioperative period and may also define the focus of those measures. Further studies that provide more evidence, with larger samples and multiple institutions, can then show if the negative albumin measurements in the patients before surgery can positively impact the results of surgery on the patients after emergency laparotomy.

CONCLUSION

Preoperative serum albumin was one of the predictors of postoperative complications after emergency laparotomy. Patients with low albumin experienced a greater number of adverse postoperative outcomes when compared to patients with an albumin concentration within the normal range. Serum albumin can be a helpful parameter for identifying risk stratification of surgical patients. Serum albumin is a cost-effective parameter. The frequent measurement of serum albumin concentration prior to an emergency laparotomy can help facilitate optimization of the patient preoperatively, can help improve closeness of monitoring of a patient postoperatively, can help improve the clinical decisions that a clinician has to make, and can help use resources more effectively while at the same time improving the outcomes of patients.

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