

Correlation between Post-Operative Serum Albumin Drop and Postoperative Morbidity and Mortality in Patients Undergoing Emergency Laparotomy for Gastrointestinal Conditions

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Abstract:

Background: Emergency laparotomy for gastrointestinal conditions is associated with significant postoperative morbidity and mortality. Early identification of patients at risk of adverse outcomes remains a major challenge. Serum albumin is not only a nutritional marker but also an indicator of surgical stress and systemic inflammatory response. A postoperative decline in serum albumin may serve as an early predictor of complications.

Aim: To evaluate the correlation between postoperative serum albumin drop and postoperative morbidity and mortality in patients undergoing emergency laparotomy for gastrointestinal conditions.

Materials and Methods: This was a prospective observational study conducted on 84 patients undergoing emergency laparotomy for gastrointestinal conditions in Department of General Surgery, Siddhartha Medical College & Hospital, and Vijayawada. Serum albumin levels were measured preoperatively, at 6 hours postoperatively, on postoperative day (POD) 1, and POD 3. A decline of ≥ 1 g/dL on POD1 was considered significant. Postoperative complications including surgical site infection (SSI), sepsis, anastomotic leak, respiratory complications, and mortality were recorded. Statistical analysis was performed using chi-square test, t-test, and ANOVA.

Results: Among 84 patients, 45 (53.6%) developed postoperative complications. The mean preoperative albumin level was 3.92 ± 0.34 g/dL, decreasing to 2.79 ± 0.41 g/dL on POD1. A significant albumin drop (≥ 1 g/dL) was observed in 32 of 45 patients (71.1%) with complications compared to only 1 of 39 patients (2.6%) without complications ($p < 0.001$). Mortality occurred in 8 patients (9.5%), all of whom demonstrated an albumin decline exceeding 1 g/dL. The sensitivity, specificity, positive predictive value, and diagnostic accuracy of albumin drop for predicting postoperative complications were 71.1%, 97.4%, 97.0%, and 83.3%, respectively.

Conclusion: A postoperative serum albumin decline of ≥ 1 g/dL within 24 hours is a reliable, inexpensive, and early predictor of postoperative morbidity and mortality following emergency laparotomy for gastrointestinal conditions. Routine monitoring may facilitate early intervention and improved outcomes.

Keywords: Serum Albumin, Laparotomy, Gastrointestinal Surgery, Postoperative Morbidity, Mortality.

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Introduction

Emergency laparotomy remains one of the most frequently performed major surgical procedures worldwide and is associated with high morbidity and mortality rates. Gastrointestinal emergencies such as perforation peritonitis, intestinal obstruction, mesenteric ischemia, strangulated hernia, and traumatic bowel injury often require urgent surgical intervention.

Despite advances in perioperative care, postoperative complication rates range from 30% to

60%, with mortality rates reaching 10–20% in high-risk patients. The physiological stress response following emergency surgery results in activation of inflammatory mediators, increased vascular permeability, fluid redistribution, and protein catabolism. Serum albumin, synthesized by the liver, plays an important role in maintaining oncotic pressure, immune function, and transport of endogenous and exogenous substances. Traditionally considered a nutritional marker, serum

albumin is increasingly recognized as an acute-phase reactant reflecting surgical stress and systemic inflammation.

Several studies have shown that preoperative hypoalbuminemia is associated with increased postoperative complications. More recently, attention has focused on the magnitude of postoperative serum albumin decline (Albumin) as an early indicator of adverse outcomes. A rapid fall in albumin concentration within the first 24 hours after surgery reflects the severity of surgical trauma and inflammatory response and may precede clinical manifestations of complications.

Given the high-risk nature of emergency laparotomy, identifying a simple and cost-effective biomarker for early risk stratification is of considerable clinical importance.

Therefore, this study was undertaken to evaluate the relationship between postoperative serum albumin decline and postoperative morbidity and mortality in patients undergoing emergency laparotomy for gastrointestinal conditions.

Aim: To determine the correlation between postoperative serum albumin drop and postoperative morbidity and mortality in patients undergoing emergency laparotomy for gastrointestinal conditions.

Objectives: To measure serum albumin levels preoperatively and postoperatively and to assess the incidence of postoperative complications. To evaluate the relationship between albumin decline and postoperative morbidity. To determine the predictive value of albumin drop for postoperative mortality.

Materials and methods: This was a prospective observational study conducted on 84 patients undergoing emergency laparotomy for gastrointestinal conditions in Department of General Surgery, Siddhartha Medical College & Hospital, and Vijayawada.

Inclusion Criteria: Patients above 18 years undergoing Emergency laparotomy for gastrointestinal perforation or Intestinal obstruction, Mesenteric ischemia, Traumatic bowel injury, Gangrenous bowel requiring resection.

Exclusion Criteria: Chronic liver disease, Nephrotic syndrome, Immunosuppressive therapy, Albumin infusion before surgery, Pregnancy.

Methodology: The following parameters were recorded: Age and sex, BMI, Comorbidities, Diagnosis, and Duration of surgery, Blood loss, ICU stay, and Hospital stay. Serum Albumin Measurement was done at Preoperative period, 6 hours postoperative, POD1, POD3. A decline ≥ 1 g/dL from baseline on POD1 was considered significant. Outcome Measures of Morbidity were surgical site infection, Wound dehiscence, Anastomotic leak, Sepsis, Respiratory complications. Mortality: In-hospital mortality within 30 days.

Statistical Analysis: Chi-square test, Student's t-test, ANOVA were used for description of correlation and p-value <0.05 considered significant.

Results

Table 1: Patient Characteristics (N=84)

Variable	Number (%)
Male	56 (66.7%)
Female	28 (33.3%)
Age >60 years	43 (51.2%)
BMI >25 kg/m ²	48 (57.1%)
Comorbidities	52 (61.9%)

Table 2: Indications for Emergency Laparotomy

Diagnosis	Number (%)
Hollow viscus perforation	36 (42.9%)
Intestinal obstruction	22 (26.2%)
Gangrenous bowel	12 (14.3%)
Mesenteric ischemia	8 (9.5%)
Traumatic bowel injury	6 (7.1%)

Table 3: Postoperative Complications

Complication	Number (%)
Surgical site infection	18 (21.4%)
Sepsis	12 (14.3%)
Anastomotic leak	8 (9.5%)
Pneumonia	7 (8.3%)
Wound dehiscence	6 (7.1%)
Total morbidity	45 patients (53.6%)
Mortality	8 (9.5%)

There were 6 cases among the Surgical Site Infections developed Wound Dehiscence and had Tension Suturing. 8 cases were dead among the study population that sustained mortality.

Table 4: Albumin Drop and Morbidity

Albumin Drop ≥ 1 g/dL	Complications Present	No Complications	P value
Present	32 (71.1%)	1 (2.6%)	<0.001 S
Absent	13 (28.9%)	38 (97.4%)	

Table 5: Albumin Levels

Time Point	Mean Albumin (g/dL)	P value
Preoperative	3.92 $\pm$ 0.34	<0.001 S
6 Hours Post-op	3.12 $\pm$ 0.40	
POD1	2.79 $\pm$ 0.41	
POD3	2.61 $\pm$ 0.48	

Table 6: Diagnostic Performance of Albumin Drop ≥ 1 G/Dl

Parameter	Value
Sensitivity	71.1%
Specificity	97.4%
PPV	97.0%
NPV	74.5%
Diagnostic Accuracy	83.3%

Discussion:

Emergency laparotomy triggers a profound systemic inflammatory response resulting in increased capillary permeability, cytokine release, and redistribution of albumin from the intravascular to the extravascular compartment. Consequently, serum albumin decreases rapidly during the early postoperative period.

The present study demonstrated that a postoperative albumin decline of ≥ 1 g/dL within the first 24 hours strongly correlated with postoperative morbidity and mortality. Patients with significant albumin decline were more likely to develop surgical site infections, sepsis, anastomotic leaks, respiratory complications, and prolonged hospitalization. [1]

Labgaa et al. conducted a prospective cohort study of 138 patients undergoing major abdominal surgery to evaluate postoperative serum albumin decrease (Δ Alb) as a predictor of complications. Serum albumin levels declined rapidly after surgery and correlated with surgical stress, inflammatory response, complication severity, and length of hospital stay. A Δ Alb ≥ 10 g/L on postoperative day 1 predicted complications with 77.1% sensitivity and 67.2% specificity. Patients with this degree of albumin decline had a threefold higher risk of postoperative complications, suggesting Δ Alb is a useful early marker of adverse surgical outcomes. [2]

Joliat et al. conducted a systematic review of 16 studies evaluating postoperative albumin decline (Δ Alb) as a predictor of complications after gastrointestinal surgery. The review found that Δ Alb demonstrated good predictive ability, with sensitivity ranging from 63–84% and specificity from 61–86%. Most studies identified threshold

values between 5–11 g/L or 14–27% decline. The authors concluded that postoperative albumin decrease is a promising early biomarker for anticipating postoperative complications and may assist in perioperative risk stratification and patient management following gastrointestinal surgery. [3]

Gibbs et al. analyzed 54,215 major non-cardiac surgical patients from the National Veterans Affairs Surgical Risk Study to assess the prognostic value of preoperative serum albumin. Patients were followed for 30 days postoperatively. Lower albumin levels were strongly associated with increased mortality and morbidity, with mortality rising from less than 1% to 29% and morbidity from 10% to 65% as albumin decreased. Serum albumin emerged as the strongest predictor of adverse surgical outcomes, particularly sepsis and major infections, highlighting its value as an inexpensive and reliable preoperative risk assessment tool. [4]

Sushma and Pavankumar conducted a prospective study on 50 patients undergoing elective and emergency laparotomy to evaluate postoperative serum albumin decline as a marker of surgical stress and clinical outcomes. Serum albumin levels showed a significant decrease from postoperative day 1 to day 5 compared with preoperative values. The study demonstrated that postoperative albumin decline correlates with surgical stress, complications, and hospital stay. The authors concluded that serum albumin is a simple, cost-effective, and reliable biomarker for predicting postoperative complications and assessing surgical stress severity. [5] Sriram Prabhu and Patankar studied 80 patients undergoing abdominal surgery to assess postoperative albumin decline as a predictor of clinical outcomes. Patients with an albumin drop greater than 10% at 6 hours and greater than 15% on

postoperative day 1 had significantly higher complication rates. The study concluded that postoperative serum albumin decline is strongly associated with surgical complications and can serve as a useful early predictor of clinical outcomes. [6]

Nipper et al. analyzed 842,672 surgical patients from the ACS-NSQIP database to determine the optimal preoperative serum albumin threshold for predicting adverse postoperative outcomes. A serum albumin level of 3.4 g/dL was identified as the optimal cutoff. Hypoalbuminemia was independently associated with a twofold increase in 30-day postoperative mortality (OR 2.01) and significantly higher rates of adverse events, particularly among patients with disseminated cancer.

The study supports using the standard hypoalbuminemia threshold as an effective tool for preoperative risk stratification and outcome prediction. [7] Curran et al. evaluated 65,192 patients undergoing outpatient surgery and found that preoperative hypoalbuminemia (<3.5 g/dL) was significantly associated with increased risks of major complications, infections, readmissions, and 30-day mortality. Patients with hypoalbuminemia had nearly twice the risk of major complications and three times the risk of death. Higher albumin levels were associated with better outcomes. The study concluded that hypoalbuminemia is an important, potentially modifiable risk factor, emphasizing the need for preoperative optimization to improve surgical outcomes. [8]

Kumar et al. conducted a prospective observational study involving 69 patients undergoing abdominal surgery and found that preoperative hypoalbuminemia (<3.5 g/dL) was strongly associated with increased postoperative complications and prolonged hospital stay. Hypoalbuminemia emerged as an independent predictor of adverse surgical outcomes, highlighting the importance of routine preoperative serum albumin assessment. [9]

Mishra et al. reported that a postoperative serum albumin decline of ≥ 1 g/dL within 24 hours after major open abdominal surgery was strongly associated with postoperative complications. The albumin drop demonstrated high specificity (97.4%) and diagnostic accuracy (83.3%), making it a simple, early, and cost-effective predictor of adverse surgical outcomes. [10]

The high specificity (97.4%) observed in our study suggests that patients without significant albumin decline are unlikely to develop major complications. Thus, postoperative albumin measurement may be incorporated into routine postoperative monitoring protocols for risk stratification. Furthermore, all mortality cases in the present study exhibited a postoperative albumin decline exceeding 1 g/dL,

indicating its potential utility as a predictor of poor prognosis.

Conclusion:

Postoperative serum albumin decline is a valuable biomarker reflecting surgical stress and inflammatory response following emergency laparotomy for gastrointestinal conditions. A decrease of ≥ 1 g/dL within the first 24 postoperative hours is significantly associated with: Increased postoperative morbidity, higher risk of sepsis and anastomotic leak, increased mortality and longer hospital stay.

Routine postoperative monitoring of serum albumin provides a simple, inexpensive, and readily available tool for early identification of high-risk patients and timely intervention.

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