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Original Research Article

PREOPERATIVE SERUM ALBUMIN AS A PREDICTOR OF POST OPERATIVE OUTCOMES IN EMERGENCY EXPLORATORY LAPAROTOMY: A DESCRIPTIVE LONGITUDINAL STUDY

Sachin Kashyap[1], Major Gen (Dr) CK Jakhmola[2], Anukriti Gupta[3]

[1]Junior Resident-3, Department of General Surgery, Teerthanker Mahaveer Medical College and Research Center, Moradabad, Uttar Pradesh, India.
[2]Professor, Department of General Surgery, Teerthanker Mahaveer Medical College and Research Center, Moradabad, Uttar Pradesh, India.
[3]Junior Resident -3, Department of General Surgery, Teerthanker Mahaveer Medical College and Research Center, Moradabad, Uttar Pradesh, India.

ABSTRACT

Background: Emergency exploratory laparotomy remains a crucial procedure for severe abdominal conditions but still shows high morbidity and mortality despite medical advances. Preoperative nutritional status, especially serum albumin levels, may predict postoperative outcomes. **Materials and Methods:** A descriptive longitudinal study was conducted at Teerthanker Mahaveer Medical College on 69 patients undergoing emergency exploratory laparotomy. Patients were grouped based on preoperative serum albumin levels and assessed for postoperative complications using Clavien-Dindo classification and Southampton wound scoring. **Result:** Hypoalbuminemia (<3.5 g/dl) was strongly associated with increased rates of surgical site infections, wound dehiscence, longer hospital stays, and mortality. Patients with serum albumin levels below 2 g/dl had the worst outcomes. **Conclusion:** Preoperative serum albumin is an effective, affordable marker for risk stratification in emergency laparotomy patients. Monitoring and optimizing albumin levels can help reduce complications, improve recovery, and enhance surgical outcomes.

INTRODUCTION

Emergency exploratory laparotomy (EEL) is one of the most frequently performed emergency abdominal procedures in general surgery worldwide, especially in developing countries like India where patients often present late with complicated intra-abdominal conditions.[1] Despite significant advancements in anaesthesia, perioperative care, and surgical techniques over recent decades, the procedure continues to be associated with high rates of postoperative complications and significant mortality.[2,3] Common adverse outcomes include wound dehiscence, surgical site infections (SSI), anastomotic leaks, sepsis, paralytic ileus, and multi-organ dysfunction, all of which contribute to longer hospital stays, re-operations, and increased treatment costs.[4,5]

The pathogenesis of postoperative complications is strongly linked to the patient's nutritional and inflammatory status at the time of surgery. Albumin, the most abundant plasma protein, plays a crucial role in maintaining plasma oncotic pressure and serves as a carrier for hormones, drugs, and fatty acids.[6] Importantly, it is a well-recognised negative acute-phase reactant, with its levels falling sharply in response to surgical stress, inflammation, or systemic infection.[7,8] Hubner et al,[9] highlighted that the immediate postoperative decline in serum albumin correlates strongly with the magnitude of surgical trauma and the systemic inflammatory response. Low preoperative albumin levels reflect both chronic nutritional depletion and the presence of acute catabolic processes both of which compromise wound healing and immune function.[10]

Gibbs et al,[10] demonstrated that even a modest decline in serum albumin can significantly increase postoperative morbidity and mortality. Hubner et al,[11] further observed that early postoperative falls in albumin levels strongly correlate with the magnitude of surgical trauma and the severity of the inflammatory response. Sharath Kumar et al,[12] highlighted similar findings in the Indian setting, showing that patients undergoing emergency abdominal surgeries with preoperative hypoalbuminemia have higher rates of surgical site infections, wound breakdown, and longer hospital stays. Despite such evidence, the role of serum albumin as a simple, cost-effective predictive marker in emergency exploratory laparotomy remains underutilised, particularly in low-resource hospitals. Recognising this gap, this study was conducted to

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evaluate the correlation between preoperative serum albumin levels and postoperative morbidity and mortality in patients undergoing EEL at a tertiary care hospital. By establishing serum albumin as a reliable prognostic tool, this study aims to highlight the need for routine nutritional assessment and timely intervention to improve surgical outcomes in emergency abdominal surgeries.

MATERIALS AND METHODS

Study Design and Setting
A descriptive longitudinal observational study was conducted in the Department of General Surgery at Teerthanker Mahaveer Medical College & Research Centre (TMMC&RC), Moradabad, Uttar Pradesh, India. The study included all eligible patients admitted for emergency exploratory laparotomy during the approved study period. Study Duration The study was carried out from the date of institutional ethical committee approval to the completion of data collection within the study timeline (2022–2025).

Sample Size
A total of 69 patients undergoing emergency exploratory laparotomy were enrolled.

Inclusion Criteria
- Patients aged 18–70 years.
- All cases undergoing emergency exploratory laparotomy.
- BMI between 17 and 28.5 kg/m².
- Haemoglobin level >8 g/dL.
- ASA Grade II or lower.

Exclusion Criteria
- Patients with diabetes mellitus.
- Chronic liver disease, cirrhosis, or liver failure.
- Chronic renal failure patients.
- Immunocompromised individuals.
- Patients with chronic obstructive pulmonary disease (COPD).
- Patients with coronary artery disease (CAD).

Data Collection and Variables
For each patient, detailed demographic and clinical data were recorded, including age, sex, diagnosis, procedure performed, and preoperative serum albumin levels. Patients were categorised into three groups based on their serum albumin levels:
• Group A: <2 g/dL
• Group B: 2-3 g/Dl
• Group C: 3-3.4 g/Dl
Postoperative outcomes were assessed using the Clavien-Dindo classification and the Southampton Wound Grading System at defined intervals.

RESULTS

Out of 69 cases, maximum 26% were aged 20-30yrs and 51-60yrs, with mean age being 41.45yrs. 59.4% cases were males, showing male predominance. Out of 69 cases, 10 cases had serum albumin levels

<2g/dl, 34 cases with 2-3g/dl and 25 cases with 3-3.4g/dl.
50% cases fall in Clavien dindo Grade V in group with serum albumin <2g/dl; 85.3% cases in group with serum albumin levels 2-3g/dl showed grade III, and 60% patients with serum albumin levels 3-3.4g/dl had grade 0. (Figure 1)
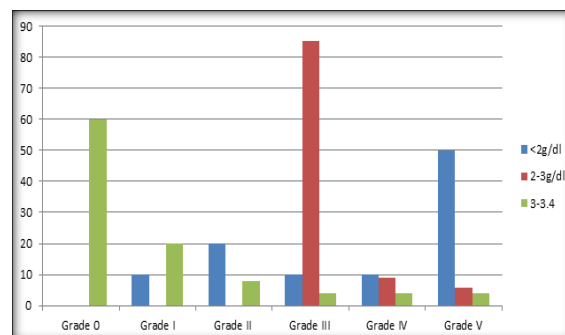

Figure 1: Clavien-Dindo grades vs. Albumin levels.

At 1st week, most patients with serum albumin 3.3–4 g/dl had grade 0, 68% with 2–3 g/dl had grade II, and 60% with <2 g/dl had grade V. By 4th week, 96% patients with 3.3–4 g/dl had grade 0, 50% showed grade 1 in <2 g/dl groups, and 58.8% in 2–3 g/dl group achieved grade 0. Wound scores decreased significantly over time (p < 0.05) across all albumin groups. (fig.2)
At week 1, 20% of patients with serum albumin <2 g/dl had anastomotic leaks, none in higher albumin groups; no leaks occurred in any group from week 2–4, with a significant decrease over time (p<0.05). (fig.3)
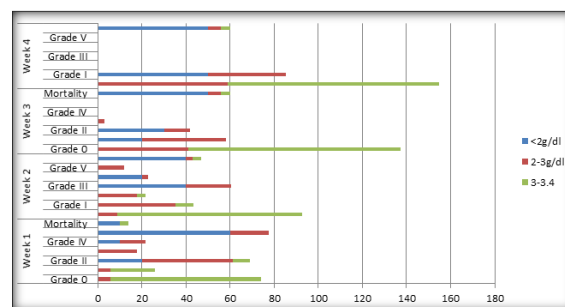

Figure 2: Southampton wound grading vs. serum albumin levels.
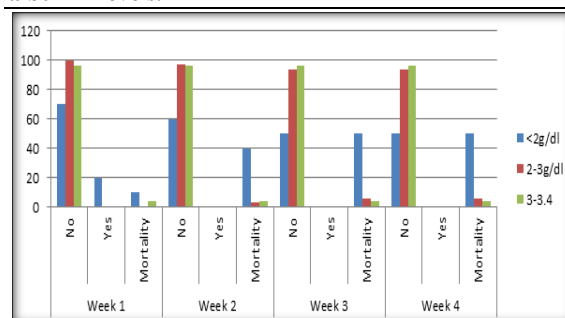

Figure 3: Anastamotic leak vs. Albumin levels.

At week 1, surgical site infection occurred in 90% of patients with serum albumin <2 g/dl, 55.9% with 2–

3 g/dl, and 8% with 3.3–4 g/dl. Rates decreased steadily, with no infections in any group by week 4. The <2 g/dl group showed a significant reduction over time (p<0.05) (figure 4)

At week 1, wound dehiscence occurred in 94.1% of patients with serum albumin <2 g/dl, 90% with 2–3 g/dl, and 16% with 3.3–4 g/dl. Rates fell steadily, reaching 0% in all groups by week 4. (figure 5)

Maximum 50% cases in group <2g/dl, followed by 5.9% in group with serum albumin 2-3g/dl; and 4% in group 3-3.4g/dl showed mortality. (figure 6)
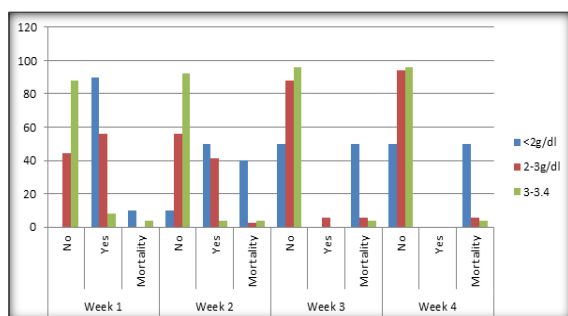

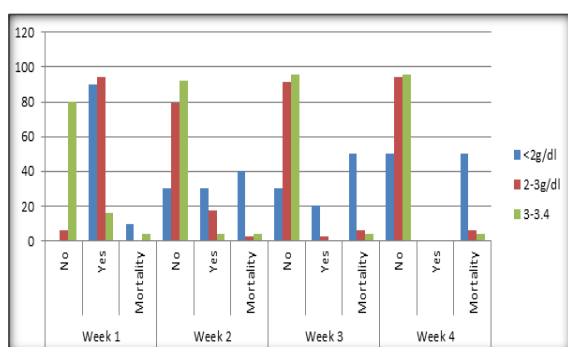**Figure 4: Surgical site infections(SSI) vs. Albumin levels**

Figure 5: Wound dehiscence vs. Albumin levels.
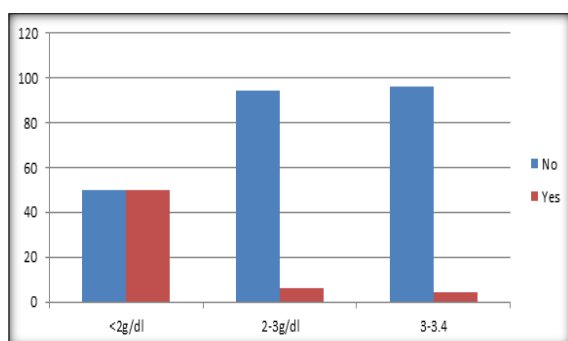

Figure 6: Mortality vs. Albumin levels.

DISCUSSION

Emergency exploratory laparotomy remains a crucial, life-saving procedure in general surgery, particularly in resource-limited countries like India, where patients often present late with advanced intra-abdominal conditions requiring urgent intervention. Despite advancements in surgical technique, anaesthesia, and perioperative care, the procedure continues to carry significant morbidity and mortality risks, which are strongly influenced by the patient's nutritional and immunological status at the time of surgery.

In this study, preoperative serum albumin was evaluated as a marker to predict postoperative complications in patients undergoing emergency exploratory laparotomy. Our results clearly demonstrate that hypoalbuminemia (<3.5g/dl) is strongly associated with increased rates of surgical site infection, wound dehiscence, paralytic ileus, anastomotic leaks, longer hospital stay, and mortality. Patients with albumin levels below 2 g/dL had the worst outcomes, with a 100% incidence of wound complications and a mortality rate of 50% in this subgroup.

These findings are consistent with those reported in other studies. Gibbs et al,[10] highlighted that serum albumin is the single best predictor of surgical risk, with even modest reductions significantly increasing the risk of postoperative morbidity and mortality. Hubner et al,[9] also noted that the early postoperative drop in albumin closely reflects the degree of surgical trauma and the magnitude of the systemic inflammatory response. Sharath Kumar et al,[13] specifically studied emergency abdominal surgeries in India and found that patients with preoperative hypoalbuminemia had significantly higher rates of surgical site infection and delayed wound healing — findings directly mirrored in our results.

The underlying pathophysiology supports this correlation. Albumin acts not only as a nutritional marker but also as an indicator of the body's ability to withstand surgical stress and promote wound healing. Low albumin levels reflect poor nutritional reserves, impaired immunity, and an exaggerated inflammatory response, all of which adversely affect collagen synthesis, tissue repair, and resistance to infection.[6,7,12] This explains the higher rates of wound dehiscence, infections, and poor healing grades seen in the Southampton wound scoring in our study. International data further support these observations.

Labgaa et al,[11] and Paocharoen et al,[12] found a similar significant association between hypoalbuminemia and increased risk of postoperative wound complications in major abdominal surgeries.

Issangya et al,[8] emphasized that serum albumin is not only a static nutritional measure but also a dynamic marker of ongoing systemic inflammation and capillary leakage in critical surgical patients.

In our study, the Clavien-Dindo classification revealed that the majority of complications were Grade II and IV, indicating that patients often required significant medical intervention or ICU care postoperatively. This pattern aligns with earlier findings that hypoalbuminemia is a predictor of major complications rather than minor, self-limiting issues.[9,11]

Given that serum albumin estimation is simple, widely available, and cost-effective, its routine measurement should be emphasized in all emergency

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surgical settings, especially in low-resource hospitals. Early detection of hypoalbuminemia allows timely nutritional intervention, including albumin supplementation and tailored perioperative management, which may reduce the incidence of complications, shorten hospital stays, and improve overall outcomes.

Study Limitations

A relatively small sample size and its single-centre design, which may limit the generalisability of the findings. Larger multicentric studies would help strengthen the evidence and develop clear perioperative protocols for nutritional optimization in emergency surgeries.

CONCLUSION

Emergency exploratory laparotomy remains an essential but high-risk surgical procedure, particularly in resource limited settings where patients often present late with advanced intra-abdominal conditions. This study demonstrates that preoperative serum albumin is a reliable, simple, and economical biomarker for predicting postoperative morbidity and mortality in such patients. Patients with hypoalbuminemia, especially those with serum albumin levels below 3.5 g/dL, showed significantly higher rates of surgical site infections, wound dehiscence, paralytic ileus, prolonged hospital stay, and mortality. The worst outcomes were observed in patients with severe hypoalbuminemia (<2g/dl).

Routine measurement of serum albumin and timely correction of nutritional deficits before surgery can help improve wound healing, reduce complications, and optimize recovery in emergency laparotomy patients. Integrating this simple step into perioperative protocols can play a crucial role in improving overall surgical outcomes, especially in low-resource hospitals. Larger multicentric studies are recommended to validate these findings and to develop standardized perioperative nutritional strategies for emergency surgeries.

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