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## Assessing post-operative morbidity with relation to pre-operative albumin status in patients admitted to emergency department for abdominal surgery: An observational study

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### Abstract

**Aim:** The aim of study was to assess the post-operative morbidity with relation to pre-operative albumin status, in patients undergoing emergency abdominal surgery.

**Material and Methods:** In this hospital-based observational study, 100 patients undergoing emergency abdominal surgery at Department of General Surgery were included. Hypoalbuminemia was diagnosed if serum albumin level was less than 3.5 gm/dl. Types of surgery and postoperative complications were included in the study. Any association between preoperative serum albumin level and postoperative morbidity was assessed. Study period was of 2 years. Pre-operatively, 50 patients had hypoalbuminemia (serum albumin <3.5 g/dl) and 50 patients had normal albumin levels ( $\geq 3.5$  g/dl).

**Results:** Of the 100 patients studied, 65% were male and 35% were female. Pre-operatively, 50 patients had hypoalbuminemia (serum albumin <3.5 g/dl) and 50 patients had normal albumin levels ( $\geq 3.5$  g/dl). Most of the patients belonged to 38-57 years in the present study. The most common indication for emergency abdominal surgery was peptic ulcer perforation 35 (35%), followed by acute intestinal obstruction 30 (30%). Surgical site infection was commonest complication found in 29 (29%) cases. Wound dehiscence was found in 11 (11 %) cases. Mean length of hospital stay was found to be higher i.e.  $8.72 \pm 5.60$  days in patients with hypoalbuminemia, compared to  $7.35 \pm 4.16$  days with those having albumin level  $\geq 3.5$  g/dl.

**Conclusion:** Preoperative albumin is a useful low-cost prognostic predictor for predicting surgery outcome.

**Keywords:** Serum albumin, emergency surgery, morbidity

### Introduction

Abdominal surgeries in the emergency are very commonly done across hospitals in India. Although surgical and perioperative improvements have reduced postoperative mortality over the last few decades, postoperative morbidity remains high. In addition to the morbidity patients are exposed to, postoperative complications pose a significant financial burden [1]. The magnitude of the metabolic stress response with the long duration of surgery may contribute to the development of postoperative complications. Early identification of patients with nutritional deficiencies and comorbidities and adequate initial resuscitation may help in reducing the postoperative mortality and morbidity of patients [2-4].

Albumin, a crucial protein, transports hormones, fatty acids, and exogenous medications while also regulating plasma oncotic pressure. Because albumin levels drop during injuries and infection, albumin is referred to as a negative acute-phase protein [5]. A maintenance protein called serum albumin is quickly downregulated by inflammatory signals. Low levels of serum albumin are mostly brought on by inflammatory conditions, specifically by high levels of cytokines interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-alpha). A common finding in both acute and chronic diseases is hypoalbuminemia. Although new data suggest that increased catabolism is a more frequent reason, hypoalbuminemia in chronic illness has traditionally been attributed to decreased albumin synthesis because of wasting and cachexia. The mechanisms causing hypoalbuminemia in acute conditions are different from those in chronic diseases because capillary leakage into the interstitial space as a result of inflammatory processes is the main source of hypoalbuminemia in acute conditions.

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Additionally, reduced synthesis, dilution of blood due to fluid administration, renal and intestinal losses due to congestion, and increased catabolism also play a role [6-8].

Albumin is the major protein of human plasma. It constitutes approximately 60% of the total plasma protein and its normal serum concentration is 3.5-5.0 g/dl. A serum level of less than 3.4 g/dl is considered hypoalbuminemia (citation). Plasma albumin has three primary functions: osmotic, transportation and nutritional and it accounts for more than 75-80% of total plasma osmotic pressure (25 mmHg). During physiological stress, decreases in serum albumin levels to hypoalbuminemia levels causes a fall in oncotic pressure, which in turn leads to interstitial oedema. Studies have shown that hypoalbuminemia contributes negatively to the process of wound healing, fracture union and severity of disease [9]. Hypoalbuminemia is linked to mortality and postoperative complications such as surgical site infections (SSI) and reoperations together with longer hospital stays [10, 11]. Additionally, one study reported that early decreases in serum albumin levels of  $\geq 10$  g/dl in postoperative day one presents a three-fold increased risk in postoperative adverse complications in major abdominal surgeries. In another study, a decrease of albumin of  $> 15\%$  from the mean value of 3.94 g/dl was associated with longer hospital stays, SSI and higher risk of reoperation. In an oesophagectomy study related to malignancy, patients with postoperative low albumin had higher chances of anastomotic leaks and mortality within 7 days of surgery [12].

This study was an attempt to analyze the correlation between preoperative hypoalbuminemia and surgical complications encountered in patients undergoing emergency abdominal surgery.

### Material and Methods

In this hospital-based observational study, 100 patients undergoing emergency abdominal surgery at Department of General Surgery were included. Hypoalbuminemia was diagnosed if serum albumin level was less than 3.5 gm/dl. Types of surgery and postoperative complications were included in the study. Any association between preoperative serum albumin level and postoperative morbidity was assessed. Study period was of 2 years. Pre-operatively, 50 patients had hypoalbuminemia (serum albumin  $< 3.5$  g/dl) and 50 patients had normal albumin levels ( $\geq 3.5$  g/dl).

A detailed history was taken, and a thorough clinical examination was performed. Relevant biochemical and radiological investigations were done. Data on type of surgery, and post-operative complications were collected. Patients with no significant comorbidity admitted and operated within 24 hours were included in the study. Serum albumin level of 3.5 g/dl was considered the standard baseline in the study. Serum albumin level was less than 3.5 gm/dl was considered as hypoalbuminemia. The association between preoperative serum albumin level and postoperative morbidity was assessed. Ethical clearance was obtained from the institutional ethics committee (human) prior to the conduction of the study.

#### Exclusion criteria

Patients with chronic debilitating disease like patients having anemia with hemoglobin  $< 7$  g/dl, liver failure, nephrotic syndrome, diabetic patients; immunocompromised patients; femoral hernias; perforation due to medical causes like typhoid ulcer perforation; patients with associated head injury, orthopedic injury, renal injury, chest trauma

### Statistical Analysis

Statistical testing was conducted using SPSS Statistics version

21.0 (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean  $\pm$  standard deviation (SD) or median (interquartile range, IQR) for non-uniformly distributed data. Categorical variables were expressed as frequencies and percentages. Uniformly distributed continuous variables between the groups were compared using Student's t-test. Nominal categorical data between the groups were compared using the chi-square test or Fisher's exact test as appropriate. Non-normally distributed continuous variables were compared using the Mann-Whitney U test. For all statistical tests, a p-value less than 0.05 indicated a statistically significant difference.

### Results

**Table 1:** Demographic details

| Variables                                    | N  |
|--|----|
| <b>Age (years)</b>                           |    |
| 18-27  | 12 |
| 28-37  | 25 |
| 38-47  | 25 |
| 48-57  | 15 |
| 58-67  | 10 |
| 68-77  | 9  |
| $\geq 78$                                    | 4  |
| <b>Gender</b>                                |    |
| Male   | 68 |
| Female                                       | 32 |
| <b>Patients with albumin</b>                 |    |
| Hypoalbuminemia (serum albumin $< 3.5$ g/dl) | 50 |
| Normal albumin levels ( $\geq 3.5$ g/dl).    | 50 |

Of the 100 patients studied, 68% were male and 32% were female. Pre-operatively, 50 patients had hypoalbuminemia (serum albumin  $< 3.5$  g/dl) and 50 patients had normal albumin levels ( $\geq 3.5$  g/dl). Most of the patients belonged to 38-57 years in the present study.

**Table 2:** Indications for emergency laparotomy

| Indications                 | Number of patients | Percentage |
|-----------------------------|--------------------|------------|
| Perforated peptic ulcer     | 35                 | 35         |
| Malignant                   | 25                 | 30         |
| Non-malignant               | 5                  |            |
| Appendiceal perforations    | 15                 | 15         |
| Incarcerated ventral hernia | 8                  | 8          |
| Strangulated hernia         | 12                 | 12         |

The most common indication for emergency abdominal surgery was peptic ulcer perforation 35 (35%), followed by acute intestinal obstruction 30 (30%).

**Table 3:** Post-operative morbidity associated with hypoalbuminemia

| Complications                        | S. albumin $< 3.5$ g/dl (50) | S. albumin $> 3.5$ g/dl (50) | Total (100), p-value |
|--------------------------------------|------------------------------|------------------------------|----------------------|
| Surgical site infection (%)          | 19 (38)                      | 10 (20)                      | $p < 0.025$          |
| Wound dehiscence (%)                 | 8 (16)                       | 3 (3)                        | $p < 0.028$          |
| Mean length of hospital stays (days) | $8.72 \pm 5.60$              | $7.35 \pm 4.16$              | $p < 0.05$           |

Surgical site infection was commonest complication found in 29 (29%) cases. Wound dehiscence was found in 11 (11 %) cases. Mean length of hospital stay was found to be higher i.e.  $8.72 \pm 5.60$  days in patients with hypoalbuminemia, compared

to  $7.35 \pm 4.16$  days with those having albumin level  $\geq 3.5$  g/dl.

### Discussion

Malnutrition is prevalent in roughly 30% of surgical patients with gastrointestinal illnesses, and up to 60% of those whose hospital stay has been extended due to post-operative complications. There is substantial proof that patients with malnutrition have a higher risk of complications and death than individuals with adequate nutrition [13, 14]. Initially, serum albumin was misinterpreted, and the significance of serum albumin in assessing a person's nutritional makeup was overlooked. When there is acute illness or stress, a reduction in serum albumin occurs due to alterations in hepatic metabolism, and loss of albumin into the interstitium. It also shows an immediate response to surgical stress. As a result, it may meet the criteria for predicting a difficult post-operative course. Abdominal surgeries in the emergency are very commonly done across hospitals in India. Although surgical and perioperative improvements have reduced postoperative mortality over the last few decades, postoperative morbidity remains high. In addition to the morbidity patients are exposed to, postoperative complications pose a significant financial burden [15]. The magnitude of the metabolic stress response with the long duration of surgery may contribute to the development of postoperative complications. Early identification of patients with nutritional deficiencies and comorbidities and adequate initial resuscitation may help in reducing the postoperative mortality and morbidity of patients [16, 17].

Of the 100 patients studied, 68% were male and 32% were female. Pre-operatively, 50 patients had hypoalbuminemia (serum albumin  $< 3.5$  g/dl) and 50 patients had normal albumin levels ( $\geq 3.5$  g/dl). Most of the patients belonged to 38-57 years in the present study. Similar results were reported in a previous study by Sharath Kumar *et al* [18], in which 61.5% were males and 38.5% were females. In another study by Bhandari *et al* [19], 66% were males and 34% were females. Males were more commonly involved in road traffic accidents compared to females because males are at high risk while traveling compared to females who mostly stay at home in a developing country like India. This could be the reason for more male patients undergoing exploratory laparotomy in trauma cases. Another reason could be the presence of risk factors usually found in males rather than females, such as alcoholism, smoking, and drug abuse, which are usually responsible for increased trauma and conditions such as pre-pyloric perforation, hollow viscus perforation, and ruptured liver abscess.

The most common indication for emergency abdominal surgery was peptic ulcer perforation 35 (35%), followed by acute intestinal obstruction 30 (30%). The preoperative albumin values had an inverse relation with the length of hospital stay, whereas the reduction in albumin levels had a positive correlation with the length of hospital stay [20]. Truong *et al* performed a systematic literature review through an electronic search of MEDLINE from PubMed and the Cochrane library found that hypoalbuminemia has a major impact on the length of stay in the hospital, the rate of surgical site infections, the likelihood of enterocutaneous fistulas, and the development of deep vein thrombosis [21].

Surgical site infection was commonest complication found in 29 (29%) cases. Wound dehiscence was found in 11 (11 %) cases. Mean length of hospital stay was found to be higher i.e.  $8.72 \pm 5.60$  days in patients with hypoalbuminemia, compared

to  $7.35 \pm 4.16$  days with those having albumin level  $\geq 3.5$  g/dl. Hu *et al*, on 42,483 patients undergoing gastrointestinal surgery found that serum albumin  $< 3.5$  g/dl was associated with wound dehiscence ( $p < 0.0001$ ) [22]. Perioperative levels of serum albumin have been shown to be powerful predictors of morbidity and mortality [23]. Hypoalbuminemia was linked to poor tissue healing, reduced collagen production in surgical wounds or anastomoses, and impaired immunological response [24]. Preoperative serum albumin plays a critical role in determining a patient's postoperative outcome after major surgery [25].

### Conclusion

Preoperative albumin is a useful prognostic predictor for predicting surgical outcome, especially in emergency surgery. It is a simple-to use test. Post-operative morbidity in surgical patients could be decreased by assessing albumin levels in preoperative period, as hypoalbuminemia has adverse relation with surgical outcome. So, it is preferable to have normal albumin perioperatively.

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