



PREOPERATIVE SERUM ALBUMIN LEVEL AS A PREDICTOR OF ABDOMINAL WOUND-RELATED COMPLICATIONS AFTER EMERGENCY EXPLORATORY LAPAROTOMY

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ABSTRACT **Introduction:** A plethora of factors are involved in the process of wound healing; amongst them nutritional status of the patient is highly considered for fast recovery in the postoperative period. Literature shows that preoperative serum albumin levels can determine & impact postoperative complications in patients undergoing emergency laparotomy. Therefore, early detection & intervention is highly recommended. **Methods:** A retrospective study data consisting of 69 patients collected over 8 months amongst those who underwent emergency exploratory laparotomy due to perforation and small and large bowel obstruction was collected. Preoperative serum albumin levels & postoperative complications such as delayed wound healing (>7 days), surgical site infections on 5th day, anastomotic leak, enterocutaneous fistula (>7 days), wound dehiscence and prolonged hospital stay (>5 days) were noted & analysed statistically. ($P < 0.001$) **Results:** Majority of the subjects were in the age group of 18-29 years accounting for 30.4% with 63.8% being males. Also, 68.1% patients had albumin levels >3.5 g/dl. The mean duration of hospital stay & duration of surgery was found to be 14.11 days & 175.51 mins respectively. The most common procedures performed were primary closure (32%) & resection anastomosis (52.2%). Patients with <3.5 g/dl reported complications such as death (4), surgical site infection (21), anastomotic leak (2), enterocutaneous fistula (2), and increased hospital stay (1). **Conclusion:** Preoperative serum albumin levels can be used to determine & reduce complications in the postoperative period while reducing the morbidity and mortality levels by early intervention.

KEYWORDS : Albumin, laparotomy, complications, leakage, infections.

INTRODUCTION

Pre-surgical patient assessment is the normal protocol which is carried out by each and every physician/surgeon in order to counteract any deficiencies or findings which may impact the treatment outcome as well as its prognosis, whilst limiting/reducing the complications.

Even though we have had enormous strides of development, still we face high rates of postoperative mortality which has to be addressed with utmost importance until it becomes zero.¹

Amidst maintaining all the vital parameters, it is also important to maintain the nutritional health to recuperate at a faster rate while limiting the associated complications with a better prognosis.^{2,3}

Nonetheless, emergency exploratory laparotomy is a critical surgical intervention which is castoff to treat acute abdominal emergencies. Even though the procedure is fast, more efficacious and reduces the postoperative complications in comparison to a full surgery. Still, postoperative complications such as infection, wound dehiscence, delayed wound healing & recovery time as well as death have been recorded, particularly those related to wound healing, are a significant concern.^{2,3}

A review of available literature shows that there exists a definite relationship between low preoperative serum albumin levels with treatment outcome as there is an exponential increase in the number of postoperative complications which can be avoided if they have been addressed at an early stage.^{2,3}

According to research published in the literature, preoperative blood albumin levels can predict postoperative problems, including SSI, extended hospital stays, anastomotic leaks, enterocutaneous fistulas, and wound dehiscence, in patients having emergency laparotomies.^{2,5}

Therefore, this study was designed to assess the levels of preoperative serum albumin levels and predict abdominal wound-related complications in patients undergoing emergency exploratory laparotomy. Understanding this relationship could help stratify risk, manage perioperative care, and develop targeted interventions to improve surgical outcomes.

Aims & Objectives Of The Study

- To investigate the value of preoperative serum albumin level as a

predictor of postoperative wound-related complications after emergency abdominal surgery.

- To estimate the preoperative serum albumin levels as a predictor of abdominal wound-related complications after emergency exploratory laparotomy.
- To correlate preoperative serum albumin level with postoperative complications such as duration of hospital stay, prolonged ileus, the incidence of entero-cutaneous fistula, the incidence of anastomotic leak, and 30-day mortality.

MATERIALS & METHODS

We carried out a retrospective study wherein 8 month's data consisting of 80 patients who underwent emergency exploratory laparotomies for perforations and obstructions of the small and large bowels at the Bangalore's Raja Rajeswari Medical College was retrieved.

Inclusion And Exclusion Criteria

Inclusion Criteria

- Patients aged 16 years and above with abdominal pain
- Patients requiring immediate intervention as in abdominal surgery.
- Patients admitted for emergency abdominal surgery with an Acute Physiology and Chronic Health Evaluation II (APACHE II) score less than or equal to 10 were included in the study.

Exclusion Criteria

- Patients with comorbid illnesses - kidney disease, liver disease, hypertension, and diabetes mellitus
- Patients who underwent re-exploratory laparotomy within 30 days of the previous surgery were excluded from the study.

Sample Size

Sample size was estimated based on a study of the association between preoperative hypoalbuminemia and postoperative wound-site surgical complications in patients. The sample of 69 patients provided a 90% power for detecting a significant difference between the two groups at an alpha level of 0.05.⁶

We had obtained 80 patients data, out of which 11 patients did not meet our inclusion criteria or were part of some exclusion criteria. Our final sample size was 69 patients, which was in accordance with the estimated sample size.

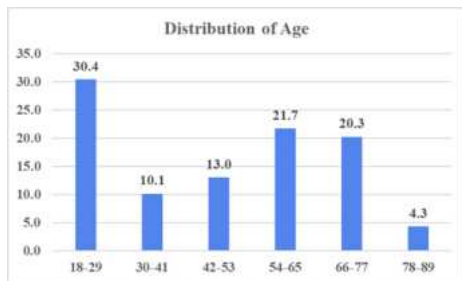
Methodology

Complete case history details were assessed to exclude any patients who did not fulfill our study criteria

- Serum albumin levels before surgery were noted
- Post-operative complications such as wound dehiscence, anastomotic leak, surgical site infections on the fifth day, wound delaying (>7 days), and extended hospital stays (>5) days were recorded.
- All the collected data was tabulated & analyzed using SPSS 20.0 version with P<0.001 considered being statistically significant.

RESULTS

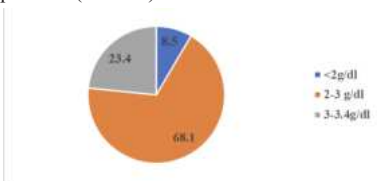
Results showed that the majority of the subjects were in the age group of 18-29 years accounting for 30.4%, followed by 54-65 years (21.7%), 66-77 years (20.3%), 42-53 years (13.0%), 30-41 years (10.1%) with the least being in the age group of 78-89 years (4.3%), with a mean age of 47.58 years. (Tabel.1)



Tabel. 1-Age distribution of patients

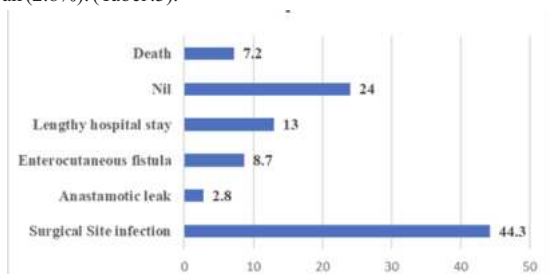
Majority of the subjects were males, accounting for 63.8% (44) subjects, with only 36.2% (25) subjects being females.

68.1% subjects had pre-operative albumin levels below <3.5g/dl, with remaining 31.9% being >3.5g/dl, with mean levels being 3.203g/dl. Pre-operative hypoalbuminemia patient's albumin levels <2g/dl was 8.5%, and the of albumin levels>2-3g/dl was 68.1%, 3-3.4g/dl were 23.4% in 69 patients. (Tabel.2)



Tabel. 2: Distribution of preoperative hypoalbuminemia

The most common complications in the study with patient's albumin <3.5g/dl were surgical site infection (44.3%), lengthy hospital stay (13%), enterocutaneous fistula (8.7%), death (7.2%), and anastomotic leak (2.8%). (Tabel.3).



Tabel.3- Distribution of complications in patients who underwent surgery with preoperative albumin <3.5g/dl

The average mean duration of surgery was 175.51 mins with a minimum of 120 mins to maximum of 240 mins. Further, the mean duration of hospital stay was 14.11 years with a minimum of 5 days to maximum of 35 days.

Most common procedures performed are primary closure in 22(32%); Resection anastomosis in 36(52.2%), Exploratory laparotomy with splenectomy in 3 (4.4%), Exploratory laparotomy with cholecystectomy in 1 (1.4%), Exploratory laparotomy with partial Gastrectomy in 1 (1.4%) Exploratory laparotomy with hernia repair in

1 (1.4%), Exploratory laparotomy with appendectomy in 5 (7.2%). (Tabel.4)

Tabel. 4-Type of procedure performed

Procedures Performed	Frequenc y (n=69)	Percenta ge (%)
Primary closure	22	32
Resection anastomosis	36	52.2
Exploratory laparotomy with splenectomy	3	4.4
Exploratory laparotomy with cholecystectomy	1	1.4
Exploratory laparotomy with partial Gastrectomy	1	1.4
Exploratory laparotomy with hernia repair	1	1.4
Exploratory laparotomy with appendectomy	5	7.2
Total	69	100

The most common diagnosis observed in our study were Hollow viscus perforation in 35.9% which includes gastric, prepyloric, duodenal, ileal, colonic and appendicular perforations, followed by small bowel obstruction in 30.6%, large bowel obstruction in 18.9% and blunt trauma to abdomen in 8.6% of patients. The rest of the diagnosis were not statistically significant and depicted in Tabel 5

Tabel. 5- Diagnosis of the patients who underwent laparotomy

Diagnosis (n=69)	Percentage (%)
Appendicular perforation	8.7
Blunt trauma abdomen	8.6
Bowel Ischemia	1.4
Gastric perforation	7.6
Prepyloric perforation	5.8
Duodenal perforation	6.1
Ileal perforation	4.9
Colonic perforation	2.8
Obstructed hernia	3.2
Small bowel obstruction	30.6
Large bowel obstruction	18.9
Perforated gallbladder	1.4
Total	100

Association between pre-operative albumin levels and complications post-operatively were found to be highly significant P<0.001)

DISCUSSION

Amongst all proteins, Albumin is deemed to be an essential protein which helps to transport hormones, fatty acids as well as exogenous medications admist regulating plasma oncotic pressure. A drop in serum albumin levels has been observed by various researchers and has gained intelligible importance in the recent years. Therefore, it is more commonly referred to as "maintenance protein".1

A definite relationship exists between injury and albumin levels as we observe a drop in albumin levels soon after injury, thereby referring it to as "a negative active-phase protein".8,9 The drop in the serum albumin levels due to high levels of inflammation has been well-acknowledged; as inflammatory conditions wherein there are high levels of cytokines interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF-alpha) is seen in acute as well as chronic diseases. In such a state, there us a drop in the serum albumin levels, which is termed as "hypoalbuminemia".8,9

Even after surgical procedures there is a drop in the serum albumin levels which are associated with postoperative complications which are difficult to eliminate but can be certainly minimized.10-13

Our study consisted of 69 patients across various age groups ranging from 16 to 77 years, wherein we recorded their mean age to be 47.58 years. Amongst them the majority of the patients in our study were in the age range of 25 to 44 years. Similar results were found by Bhandari et al.,10 who found the median age to be 50 years, which was almost close to our study. However, Gibbs et al.,14 found the median age of the patients to be 61 years.

Nevertheless, the most commonly affected individuals were in the age group of 25-44 years, which can be attributed to exclusion of comorbidities such as hypertension, diabetes mellitus, liver disease, and kidney disease which are common in the elderly age group.

The maximum number of patients in our study was males, accounting to 63.8%, whereas only 36.2% were females. Herein a correlation of gender with age showed the mean age of male & female patients to be 44 years & 25 years respectively.

Similar results were reported in a previous study by Sharath Kumar et al.,⁷ in which 61.5% were males and 38.5% were females. In another study by Bhandari et al.,¹⁰ 66% were males and 34% were females. Therefore, there was a definite agreement that most of the subjects were males in contrast to females who required abdominal surgery.

In a country like INDIA, even with enormous development, there still exists a male predominance in terms of field work. Further, there is a higher rate of own transport in comparison to the public transport along with speed as a factor, all of which increases the incidence of male population which may equate proportionally to them on road presence which can be one of the reasons for higher male incidence requiring surgery in case of road traffic accidents.

Apart from that, the higher incidence of deleterious habits such as alcoholism, smoking, and drug abuse which are predominantly found in males present with higher chances of increased trauma and conditions such as pre-pyloric perforation, hollow viscus perforation, and ruptured liver abscess

Amongst the 69 patients, we found the mean of the patients to be 47.55 with a standard deviation of 20.211, with the mean pre-operative albumin level to be 3.203 and standard deviation of 0.768.

Overall, 65% of the patients had hypoalbuminemia (serum albumin level <3.5 g/dL), and 32% of patients had normal serum albumin levels (>3.5 g/dL to 5.5 g/dL). Similar results were acknowledged in the study by Sharath Kumar et al.,⁷ wherein 63.1% of the patients had hypoalbuminemia with the remaining 36.9% of the patients having normal albumin levels.

The mean \pm S.D duration of surgery was found to be 2.798 ± 0.4645 , whereas the duration was 13.09 ± 8.140 .

In patients with ALBUMIN <3.5g/dl it was surgical site infection (46.6), lengthy hospital stay (17.1), enterocutaneous fistula (12.8), death (6.4), and anastomotic leak (4.3). A definite difference in the postoperative complications was observed when the patients were suffering from hypoalbuminemia.

An analogous study carried out by Sharath Kumar et al.,⁷ showed the incidence of surgical site infections to be 59.1% in patients with preoperative hypoalbuminemia, which was also statistically significant. However, in another study conducted by Gibbs et al.,¹⁵ the incidence of deep wound infections was 5.9% and the incidence of superficial wound infections was 4.4%, with statistically significant p-values of <0.001.

Further, correlation in our study showed that all patients who had complete wound dehiscence reported with preoperative serum albumin levels to be less than 2 g/dL (68%). In terms of death, we found that 80% of the patients lost their lives who were having preoperative albumin levels <3.5g/dl, whereas it was only 20% when the preoperative albumin levels were >3.5g/dl.

A multicentric study of 54,215 patients following major non-cardiac surgery in 1999 highlighted that a decrease in serum albumin from concentrations greater than 46 g/L to less than 21 g/L was associated with an exponential increase in mortality rates from less than 1% to 29% and in morbidity rates from 10% to 65% following non-cardiac surgery.¹⁴ Recently, another retrospective study from Ireland in a review of 200 patients revealed decreased serum albumin concentration on the first postoperative day was also good predictor of poor surgical outcome following gastrointestinal cancer surgery.¹⁵

Common diagnosis observed in our study were Hollow viscus perforation in 35.9%, followed by small bowel obstruction in 30.6%, and large bowel obstruction in 18.9%. Similar results were noted in the study by Sharath Kumar et al.,⁷ wherein the most common indications for emergency surgery were due to hollow visceral perforation (45.8%), followed by intestinal obstruction (23.2%), however a detailed report was not found

Our patients were treated by primary closure 22(32%); Resection

anastomosis in 36(52.2%), Exploratory laparotomy with appendectomy 5(7.2%), Exploratory laparotomy with splenectomy in 3(4.4%), with other procedures such as exploratory laparotomy with cholecystectomy, exploratory laparotomy with partial Gastrectomy, exploratory laparotomy with hernia repair being Minuscule 1(1.4%).

Further analysis in terms of association between pre-operative albumin levels and complications post-operatively for Albumin Levels of Anastomotic leak, Death, Enterocutaneous fistula, Lengthy hospital stay, Nil, Surgical Site Infection between <3.5g/dl and >3.5g/dl and total were found to be highly statistically significant P-value <0.001. In a previous study by Amavizca et al.,¹⁶ low serum albumin level shortly after admission was used to predict prolonged hospital stay in younger burn patients. Their study also revealed that among burn patients aged less than or equal to 40 years, 16% sustained a prolonged hospital stay, i.e., more than three weeks. Moreover, using serum albumin as a sole predictor, 87.5% of patients with prolonged stay were correctly predicted, which was statistically significant

Albumin is associated with collagen production as well as immune response maintenance. Thus, low serum albumin leads to poor wound healing, compromised collagen synthesis, as well as compromised immune action, all of which may potentially increase the risk of post-operative complications.^{17,18}

During trauma or inflammation there is increased leakage of synthetic albumin into the extravascular spaces and/or inadequate albumin replenishment which may increase the associated postoperative complications.^{19,20}

Management of albumin levels in such patients is highly advocated. A Recent study highlighted that preoperative nutrition supplements may help the patient whilst improving surgical outcomes.^{19,20}

Even though our study evaluated all the requisite parameters to fulfil our aims & objectives of our study, still a larger sample size with a multi-centric institutional study is recommended to reduce the bias while obtaining the data. Further, we recommend the assessment of albumin levels in a staged manner to understand the relationship of albumin with the outcome of the procedure and the associated complications.

CONCLUSION

We found that there is a definite correlation between reduced pre-operative albumin levels and postoperative complications, which was found to be statistically significant. There is a plethora of literature which shows such a positive association between preoperative hypoalbuminemia and postoperative complications. These complications may be as simple as surgical site infection or even as severe as death. Therefore, we recommend early assessment of preoperative serum albumin levels to encounter the associated postoperative high-risk complications, in order to reduce the rates of morbidity and mortality, while equipping the patients with adequate requisites.

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