

Original Research Article

Evaluation of the role of pre-operative albumin and its post-operative drop in the prediction of outcomes of emergency laparotomy

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ABSTRACT

Background: Laparotomies are commonly performed surgeries in an emergency setting. The complications associated with these are a result of the activation of the surgical stress response, the magnitude and duration of which are proportional to the surgical injury. Albumin is an important negative phase reactant. This study was an attempt to evaluate the effectiveness of measurement of pre-operative albumin and the post-operative drop in albumin levels in the prediction of post-operative morbidity and mortality following laparotomy.

Methods: Albumin levels of 50 patients undergoing emergency exploratory laparotomy in Victoria Hospital were measured pre and post operatively. The percentage drop in albumin levels was noted. The outcomes were noted and classified according to Clavein Dindo Classification. Unpaired t-test and ANOVA test was used for statistical analysis. A p value of <0.05 was considered statistically significant.

Results: 62% of the patients had hypoalbuminemia preoperatively. 58% of patients had post-operative complications. The mean preoperative albumin levels for patients without complications was 3.83 while that for patients with complications was 2.78 (p<0.05). The mean percentage drop in albumin values was 9.66% for patients without complications while it ranged from 14.79 (Clavein Dindo 1) - 24.27 (Clavein Dindo 5) for patients with complications (p=0.047). A negative correlation was noted between the preoperative albumin values and the duration of hospital stay while the drop in albumin levels showed a positive correlation with the duration of hospital stay.

Conclusions: Measurement of albumin levels pre-operatively and in the immediate post-operative period following laparotomy can prove as a useful tool and an early indicator of morbidity and mortality following laparotomy.

Keywords: Drop in albumin, Outcome of laparotomy, Pre-operative albumin, Prognostic indicator

INTRODUCTION

Laparotomies are among the most commonly performed surgeries in an emergency setting. Complications following laparotomy vary from pain, wound infection and dehiscence, bleeding, bowel complications such as anastomotic leaks to systemic complications such as acute respiratory distress syndrome (ARDS), acute kidney injury (AKI), pulmonary thromboembolism and death.¹ These are a result of the activation of the surgical stress response which follows all surgeries, more so the major abdominal surgeries, the magnitude and duration of

which are proportional to the surgical injury. These ultimately result in catabolic changes.²

The surgical stress response is associated with alterations in the plasma levels of the positive and negative acute phase reactants. These include positive acute phase reactants such as C-reactive proteins, haptoglobin, serum amyloid A, lactoferrin, ceruloplasmin, fibrinogen, and negative acute phase reactants such as albumin, transferrin and transthyretin. Changes in the levels of these reactants following surgery, though non-specific can predict the extent of the stress response and thus can

serve as prognostic markers for prediction of complications.³

Hypoalbuminemia has been established indicator of nutritional status. Hubner et al noted that post-operative albumin drops strongly correlated with the rise in C-reactive protein (CRP), and also that albumin could be measured 4-6 hours post operatively. The albumin response was also related to clinical outcomes.⁴

This study was an attempt to evaluate the effectiveness of measurement of pre-operative albumin and the post-operative drop in albumin levels in the prediction of post-operative morbidity and mortality following laparotomy.

METHODS

The prospective observational study was done from May to August 2019 at Victoria hospital. Total 50 patients were included in the study.

Inclusion criteria

Patients undergoing emergency exploratory laparotomy for various abdominal conditions were included.

Exclusion criteria

Patients below age 18 were excluded.

50 patients undergoing emergency exploratory laparotomy at Victoria hospital in the months of May-August 2019 were included in the study. The details of these patients such as age, sex, indication for surgery, procedure performed were noted. The pre-operative albumin values were measured. Albumin level of less than 3.5 g/dl was considered as hypoalbuminemia.

Albumin levels were repeated at 4-6 hours post operatively. The change in albumin was expressed as a percentage of the initial albumin levels.

The patients were followed up until discharge or death, watching for complications such as superficial surgical site infection (SSI), wound dehiscence, burst abdomen, ARDS, AKI, multiple organ dysfunction syndrome (MODS), sepsis, leak, prolonged ileus. These were classified according to Clavein-Dindo classification. The treatment given for the complications were recorded as conservative, interventional or ICU care. The duration of hospital stay was noted.

The data was tabulated and analysed in SPSS v23. Descriptive statistics was such as mean and standard deviation was used to describe the data. Pearson's coefficient was used to calculate the correlation between the variables. ANOVA test was used for the analysis of multiple variables, p value of <0.05 was considered statistically significant.

RESULTS

The data of 50 patients undergoing emergency exploratory laparotomy in Victoria Hospital was tabulated and analysed. The mean age of the patients ranged from 18-82 years with a mean of 46.67±18.03 years, with maximum number of patients belonging to the age group of 41-50 years. Of the 50 patients, 32 (64%) of patients were males and 18 (36%) were females.

The most common indication for laparotomy was gastric perforation (12 patients- 24%) followed by ileal perforation and intestinal obstruction (8 patients each- 16%) (Table 1).

Table 1: Indications for laparotomy.

| Indication | Number of patients | Percentage (%) |
|--------------------------------------|--------------------|----------------|
| Appendicular abscess and perforation | 5 | 10 |
| Carcinoma colon | 3 | 6 |
| Gastric perforation | 12 | 24 |
| Ileal perforation | 8 | 16 |
| Obstruction | 8 | 16 |
| Sigmoid volvulus | 2 | 4 |
| Splenic injury | 4 | 8 |
| Stab injury | 3 | 6 |
| TB abdomen | 5 | 10 |

The most common procedure performed was resection anastomosis, performed in 16 (32%) of patients followed by modified Graham's omental patch repair in 12 patients (24%) (Table 2).

Table 2: Procedures performed.

| Procedure performed | Number of patients | Percentage (%) |
|--|--------------------|----------------|
| Resection anastomosis | 16 | 32 |
| Modified Graham's omental patch repair | 12 | 24 |
| Appendicectomy | 5 | 10 |
| Right hemicolectomy | 4 | 8 |
| Splenectomy | 4 | 8 |
| Primary closure of perforation | 3 | 6 |
| Peritoneal lavage | 2 | 4 |
| Negative laparotomy | 2 | 4 |
| Stoma creation | 1 | 2 |

The pre-operative albumin of patients was in the range of 1.8-4.5 g/dl, with a mean value of 3.23±0.74 g/dl. Of these, 31 (62%) of patients had hypoalbuminemia, while 19 (38%) of patients had normal levels of albumin. The postoperative albumin levels as repeated after 4-6 hours after surgery ranged from 1.4-4.1 g/dl and the mean was 2.75±0.79 g/dl. The mean reduction in absolute levels of

albumin was 0.48g/dl. The percentage of change in albumin levels ranged from 4.76 to 26.67%, with a mean of 15.71±6.54%.

29 of the 50 patients (58%) had complications. Of these, the most commonly observed complication was wound dehiscence and sepsis, each observed in 7 (14%) of patients followed by anastomotic leak observed in 6 (12%) of patients. The other complications are as listed in Table 3. 10 patients had more than one complications. Death occurred in 5 patients (10%). The management of these complications is depicted in Figure 1.

Table 3: List of complications observed.

| Complications | Number of patients | Percentage (%) |
|------------------|--------------------|----------------|
| Seroma formation | 5 | 10 |
| Wound dehiscence | 7 | 14 |
| Burst abdomen | 1 | 2 |
| ARDS | 5 | 10 |
| AKI | 4 | 8 |
| MODS | 3 | 6 |
| Sepsis | 6 | 12 |
| Leak | 7 | 14 |
| Prolonged ileus | 3 | 6 |

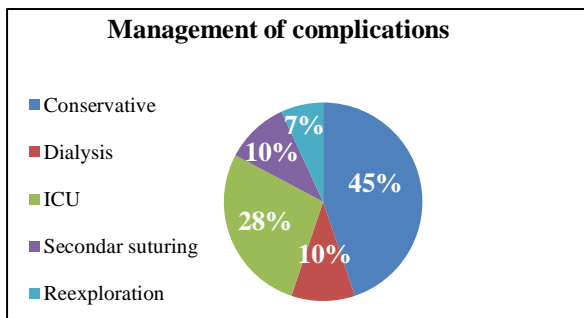


Figure 1: Management of complications of laparotomy.

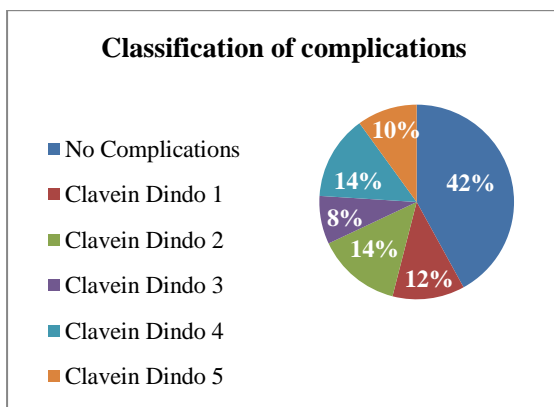


Figure 2: Classification of complications observed.

The mean pre-operative albumin levels of patients without complications was 3.83 g/dl while that for patients with complications was 2.78 g/dl. This difference

was found to be statistically significant (p<0.05). The complications were classified according to the Clavein Dindo classification. The distribution of patients according to this classification is shown in Figure 2.

The mean values of pre-operative albumin for these patients is shown in Table 4. This data was found to be statistically significant (p=0.047).

Table 4: Distribution of mean values of pre-operative albumin.

| Complications | Number of patients | Mean level of pre-op albumin | Standard deviation |
|------------------|--------------------|------------------------------|--------------------|
| No complications | 21 | 3.83 | 0.53 |
| Clavein Dindo 1 | 6 | 3.25 | 0.70 |
| Clavein Dindo 2 | 7 | 2.77 | 0.50 |
| Clavein Dindo 3 | 4 | 2.8 | 0.69 |
| Clavein Dindo 4 | 7 | 2.68 | 0.24 |
| Clavein Dindo 5 | 5 | 2.4 | 0.37 |

The mean percentage drop in albumin levels for these patients is shown in Table 5. This data was found to be statistically significant (p=0.047).

Table 5: Distribution of mean percentage drop in albumin levels.

| Complications | Number of patients | Mean percentage drop in albumin | Standard deviation |
|------------------|--------------------|---------------------------------|--------------------|
| No complications | 21 | 9.66 | 2.68 |
| Clavein Dindo 1 | 6 | 14.79 | 6.4 |
| Clavein Dindo 2 | 7 | 20.68 | 4.2 |
| Clavein Dindo 3 | 4 | 20.78 | 2.2 |
| Clavein Dindo 4 | 7 | 20.67 | 3.2 |
| Clavein Dindo 5 | 5 | 24.27 | 1.7 |

There was a negative correlation between the pre-operative albumin levels and the duration of hospital stay (Pearson coefficient=-0.452) (p=0.001). A positive correlation was noted between the percentage drop in albumin levels and the duration of hospital stay (Pearson coefficient=0.612) (p=0.00).

DISCUSSION

The study was conducted to evaluate the effectiveness of pre-operative albumin levels and the percentage drop in albumin levels post operatively in the prediction of morbidity and mortality following laparotomies. In our study a statistically significant difference was noted that in the pre-operative albumin levels among patients with and without post-operative complications. This is consistent with the study by Warriar et al who also

concluded that measurement of serum albumin is a simple yet effective predictor of post-operative complications following laparotomy.⁵ Similar results were also observed by Kumar et al who noted that the risk of post-operative morbidity and mortality following laparotomy increased in patients with pre-operative albumin levels less than 2.5-3 g/dl.⁶

The post-operative decrease in albumin levels relatable to the observed post-operative complications in present study. This is consistent with the findings of Labgaa et al who noted that early post-operative decrease in albumin levels correlated with the extent of surgery, its metabolic response and adverse outcomes, including duration of hospital stay.⁷ Similar results were observed by Muller in their study where they observed that delta albumin was a better prognostic marker for an eventful post-operative course as compared to albumin alone.⁸ Hubner et al recognised the role of albumin as negative phase reactant.⁴ They showed their study that the post-operative drop in albumin levels correlated with the post-operative rise in CRP levels.

Present study also compared the correlation between the albumin levels and the duration of hospital stay. We found a negative correlation between the pre-operative albumin values and the duration of hospital stay, and a positive correlation between the post-operative drop in albumin levels and the duration of hospital stay.

Albumin being a negative phase reactant, the drop in albumin levels following surgery is indicative of the extent of the stress response initiated in response to the surgery performed. A greater stress response would indicate higher drop in albumin levels and also more complications. The pre-operative albumin levels are indicative of the nutritional status of the patient, which, when poor, also adds to the post-operative morbidity. The advantage of albumin is that the changes in the albumin levels occur in the early post-operative period.

Thus, measurement of the albumin levels and its drop in the early post-operative period can serve as an early prognostic indicator for the outcome of emergency laparotomy. However, further studies are needed to determine whether corrective measures in the early post-operative period can alter the poor prognosis of such patients.

CONCLUSION

The measurement of albumin levels pre operatively and in the immediate post-operative period following

laparotomy can prove as a useful tool and an early indicator of morbidity and mortality following laparotomy.

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