Original Article

Postoperative Drop in Serum Albumin levels as an Indicator for Surgical stress and Clinical Outcome in Laparotomy Patients: A Prospective Observational Clinical Study

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ABSTRACT

Background and Aim: Surgical interventions trigger a metabolic stress response of varying magnitude which contributes to complications, delayed recovery and prolonged hospital stay. The present study aims to assess serum albumin levels as a response indicator for surgical stress and as a predictor of adverse outcomes.

Materials and Methods: The study design was prospective observational clinical study, total 50 patients were included in this study. Preoperative and postoperative albumin levels were measured for the patients and correlation between the post-op fall in albumin level was compared with the incidence of post-op complications as determined by Dindo-Clavien scoring.

Results: A prospective study was done for eighteen months of cases undergoing laparotomy both elective and in an emergency between the age group of 16 to 70 years. A repetitive measures ANOVA with a Greenhouse-Geisser correction determined that mean serum albumin differed statistically significantly between time points (F $(2.321, 113.750)$ $=69.895$, P< 0.0005).

Conclusion: Our study results showed that the values of albumin dropped post operatively by 10 g/L which correlated with the length of operation, complications and clinical outcomes. In this study, the fall in serum albumin levels was related to the magnitude of surgery and the surgical stress associated with it. Clinical outcomes were also related to the postoperative albumin levels.

Keywords: Serum albumin, Postoperative drop, dindo-clavien scoring, laparotomy Patients

INTRODUCTION

Surgical interventions trigger a metabolic stress response of varying magnitude which contributes to complications, delayed recovery and prolonged hospital stay. The information of the major surgeries and their outcome is scarce in India. Publicly available data on post operative complications, their predictors and outcomes are scanty which has hindered in deciding the parameters to follow or observe in a patient undergoing major surgeries. [1]

The ideal marker has to be easy to measure, available early in the perioperative course, and economical. It should be robustly correlated with the extent of surgical trauma and be a reliable predictor of complications and prolonged hospital stay. So far, no such parameter is available. [2]

Stress response subsequent to surgery and trauma has been widely studied, and it involves vital electrolytic, hormonal, and metabolic changes and liberation of cytokines. While IL-6, a pro-inflammatory cytokine correlates with postoperative inflammation and the magnitude of (surgical) trauma, its sophisticated and expensive measuring precludes its routine use. CRP levels correlate closely with the magnitude of surgery and are routinely assessed to monitor postoperative systemic inflammatory response. However, the dynamics are

rather sluggish, and plasma peaks are only attained between POD 2 and POD 3.

This is an important limitation, as potential therapeutic interventions should be launched as early as possible. Albumin, the most abundant protein in humans, is widely used as a nutritional marker and an outcome predictor.

Albumin also shows an instantaneous response to surgical tension and could, therefore, meet the criteria to determine surgical stress and to predict a complicated postoperative course. [3]

The present study aims was to assess serum albumin levels as a response indicator for surgical stress and as a predictor of adverse outcomes.

MATERIALS AND METHODS

Study Design
- Prospective observational clinical study

Selection of Cases
- From cases undergoing laparotomy both electively and in emergency

Sample Size
- Total no samplings was 50 patients

Study centre
- Department of General Surgery, CAIMS, Karimnagar

Inclusion Criteria
- Age group 16-70 years
- Laparotomies both elective and emergencies

Exclusion criteria
- Age <16 years or >70 years.

- HIV patients with CD count < 200
- Patients with known decompensated liver disease 12

Outcome measure

Preoperative and postoperative albumin levels were measured for the patients and correlation between the post-op fall in albumin level was compared with the incidence of post-op complications as determined by Dindo-Clavien scoring.

Study Duration

The study duration was from December 2019 and June 2021 among 50 patients, consecutively chosen (ten of them) during seven abdominal surgical procedures of differing magnitude.

The following surgeries were performed;
- Radical cholecystectomy
- Whipple's procedure
- EEL+perforation closure
- Open colectomy
- EEL+resection anastomosis
- Gastrectomy
- EEL+ ileostomy/colostomy 13

STATISTICAL ANALYSIS

All demographic and preoperative data were tabulated with appropriate charts, where needed. All continuous variables were summarized as Mean±SD. Proportions were used for summary where required.

Dindo-Clavien Scoring:

Grade	Description
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions. Allowed therapeutic regimens are; drugs as antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside.
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications Blood transfusions and total parenteral nutrition are also included.
Grade III	Requiring surgical, endoscopic or radiological intervention
III a	Intervention not under general anesthesia
III b	Intervention under general anesthesia
Grade IV	Life threatening complication (including CNS complications) requiring IC/ICU management
IV a	Single organ dysfunction
IV b	Multiple organ dysfunction
Grade V	Death of a patient

Pre and Post operative albumin levels were recorded and means±SD were used to summarize. The statistical significance was evaluated using SPSS software v.16 for analysis of repeated measures ANOVA.

RESULTS

A prospective study was done for eighteen months of cases undergoing laparotomy both elective and in an emergency between the age group of 16 to 70 years.

Serum albumin (g/L) levels were measured in the preoperative period in a homogeneous manner as per the hospital technical guidelines. Blood samples on the day of the operation were taken 4–6 hours postoperatively and labeled Postoperative Day - 0. Subsequently, daily albumin level was monitored up to POD-5.

Complications after surgery were graded by use of the validated Dindo-Clavien system; grades I-II were documented minor and III-IV were documented as major complications, respectively. Mortality was documented as grade V. Hospital stay was counted from the day of surgery. Preoperative and postoperative albumin levels were measured for the patients and correlation between the post-op fall in albumin level was compared with the incidence of post-op complications as determined by Dindo Clavien scoring. Following results were obtained.

Age distribution of the sample

The following figure illustrates the age distribution of the participants with mean age of 55 (S.D= 12.56).

The following table shows the age distribution of fifty cases

Table 1: Age distribution interval

Age distribution interval	Frequency
0-20	2
20-40	5
40-60	22
60-80	21
80-100	0
Total	50

DISCUSSION

The age distribution of the participants was with a mean age of 55 (S.D=12.56). Majority of them were males (72%, n=36). The Dindo-Clavien Scoring of the patients showed that 19 of them were in grade I.

The duration of the stay was a mean of 8.32 days (S.D=4.468) for 47 patients while two of them died on 10th post-operative day and one of them on 12th post-operative day.

Dindo-Clavien Scoring

The following table illustrates the Dindo-Clavien Scoring of the patients

Dindo-Clavien Scoring	Frequency	Percentage
Grade I	18	36
Grade II	16	32
Grade III	3	6
Grade III a	6	12
Grade III b	2	4
Grade IV	1	2
Grade IV a	1	2
Grade IV b	2	4
Grade V	3	6
Total	50	100

Complications present

The following table demonstrates the complications present in the patients.

Complications if any	Frequency	Percentage
Wound infection		
	3	6
Wound gaping	8	16
Postoperative fever	4	8
MODS	3	6
MODS(Ventilator support)	1	2
NIL	17	34
Mild Fever	1	2
Elevated renal parameters, wound infection	2	4
Burst abdomen, secondary suturing done	1	2
Blood transfusions done	6	12
AKI , dialysis done	4	8
Total	50	100

A repetitive measures ANOVA with a Greenhouse-Geisser correction determined that mean serum albumin differed statistically significantly between time points (F (2.321, 113.750) =69.895, P< 0.0005).

In this study, the fall in serum albumin levels was related to the magnitude of surgery and the surgical stress associated with it. Clinical outcomes were also related to the postoperative albumin levels. Preoperative serum albumin doesn't influence the outcome of duration of stay in hospital or dindo-clavien score, but pod-2 albumin levels significantly correlate to the same. This correlates with most of the previous studies that used serum albumin as a marker for post-operative complications.

Human serum albumin (HSA), the most abundant protein in plasma, is a monomeric multi-domain macromolecule, representing the main determinant of plasma oncotic pressure and the main modulator of fluid distribution between body compartments.[4] HSA displays an extraordinary ligand binding capacity, providing a depot and carrier for many endogenous and exogenous compounds. Indeed, HSA represents the main carrier for fatty acids, affects pharmacokinetics of many drugs, provides the metabolic modification of some ligands, renders potential toxins harmless, accounts for most of the antioxidant capacity of human plasma, and displays (pseudo-)enzymatic properties.

HSA is a valuable biomarker of many diseases, including cancer, rheumatoid arthritis, ischemia, post-menopausal obesity, severe acute graft-versus-host disease, and diseases that need monitoring of the glycemic control. Moreover, HSA is widely used clinically to treat several diseases, including hypovolemia, shock, burns, surgical blood loss, trauma, hemorrhage, cardiopulmonary bypass, acute respiratory distress syndrome, hemodialysis, acute liver failure, chronic liver disease, nutrition support, resuscitation, and hypoalbuminemia.[5] Recently, biotechnological applications of HSA, including implantable biomaterials, surgical adhesives and sealants, biochromatography, ligand trapping, and fusion proteins, have been reported.[6]

Albumin is the most abundant plasmatic protein. It is only produced by the liver and the full extent of its metabolic functions is not known in detail. One of the main roles assigned to albumin is as an indicator of malnutrition. There are many factors, in addition to nutrition, that influence levels of albumin in plasma. Albumin is a good marker of nutritional status in clinically stable people. Significant loss of muscle mass has been observed in elderly people with low albumin levels.[7]

Not many studies are available that use serum albumin level to understand the response to surgical stress and related clinical outcomes. There are not many studies that focus on the postoperative albumin drop that can be used as a predictor or indicator of surgical stress and the outcome of surgery.[8] One study by Martin Hubner et al. (2016) has been referred for this study of 70 patients who underwent abdominal surgeries. Their albumin levels were measured from the day of surgery and followed up daily till five postoperative days.

Our study results showed that the values of albumin dropped post operatively by 10 g/L which correlated with the length of operation, complications and clinical outcomes.[8]

The serum albumin measurement is simple, easy and cost effective. It is also easy to perform anywhere unlike other methods that require state of the art care. Using the serum albumin as a marker, reliable predictions can be made regarding the surgical complications, duration of stay in the hospital, the severity of surgical stress, etc.[9] Early perioperative decreases in serum albumin levels may be a good, simple and cost effective tool to predict adverse outcomes in major abdominal surgeries.

LIMITATIONS

- One of the major limitations in this study was only a single set of surgical procedures evaluated, other surgical procedures were not considered as a part of this study.

- Testing in larger patients is required and also in other critically ill patients.

CONCLUSION

Serum Albumin an important type of serum proteins is known to react immediately to surgical stress and has been useful as an indicator to predict post operative course and clinical outcomes. Albumin levels were measured on the day of surgery and followed up daily till minimum five postoperative days. Our study results showed that the value of albumin dropped in the postoperative period by about 10 g/L, which correlated with length of operation, complications and clinical outcomes. How far these values can be used to decide therapeutic procedures remains to be seen based on more future studies.

CONFLICT OF INTEREST:

The authors declared no conflict of interest.

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