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Study to Evaluate Post Operative Drop in Serum Albumin as a Marker for Surgical Stress and Predictor for Clinical Outcome in Laparotomy Patients

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ABSTRACT

Introduction: A simple and reliable parameter representing surgical stress would be clinically important to identify patients at risk and to tailor peri operative care. Albumin is the most abundant protein in humans and widely used as a nutritional marker and predictor for outcomes. Albumin shows an immediate response to surgical stress and could therefore qualify to measure surgical stress and to predict a complicated post operative course.

Aim: To assess serum albumin levels as response marker for surgical stress and as a predictor of adverse outcomes.

Material And Methods: This observational study was carried out on 50 patients in the department of Surgery, RNT Medical College, Udaipur.Preoperative and postoperative albumin levels were measured for the patients and association between the post-op fall in albumin level was compared with the incidence of post-op complications as determined by Dindo-Clavien scoring.

Results: The level of albumin was measured on the day of surgery (before), after the surgery on day 0 and subsequently on day 1, day 2, day 3, day 4 and day 5. It was found out that the serum albumin showed significant results right after 4 to 6 hours of surgery.

Conclusion : The serum albumin measurement is simple, easy and cost- effective. It is also easy to perform anywhere unlike like 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.

Keywords: S. Albumin, Dindo-Clavien scoring, Nutritional Marker, Surgical Stress.

I. INTRODUCTION

Surgical interventions trigger a metabolic stress response ofvarying magnitude which contributes to complications, delayedrecovery and prolonged hospital stay. Primarily,the term "major abdominal surgery'' remains poorly defined and includes procedure related factors, like the type of surgical approach(laparoscopy versus laparotomy), type and extent of organ resection, operative time, and blood loss;but secondarily also patient related factors, for example, underlying disease (benign versus malignant), nutritional status, and pre-existing co-morbidities[1].

A simple and reliable parameter representing surgical stress would be clinically important to identify patients at risk and to tailor peri operative care.

Albumin is the most abundant protein in humans and widely used as a nutritional marker and predictor for outcomes. Albumin shows an immediate response to surgical stress and could therefore qualify to measure surgical stress and to predict a complicated post operative course.

CRP levels correlate closely with the magnitude of surgery andare routinely assessed to monitor postoperative systemicinflammatory response. However, the dynamics are rathersluggish, and plasma peak are only attained between POD 2 andPOD 3.

Albumin also shows an instantaneous response to surgical tension and could,therefore, meet the criteria to determine surgical stress and topredict a complicated postoperative course. The present studyaims to assess serum albumin levels as response marker for surgical stress and as a predictor of adverse outcomes.

II. AIMS AND OBJECTIVES

To assess serum albumin levels as a marker for surgical stress and To assess serum albumin levels as a potential predictor ofadverse outcomes like delayed wound healing, increasedhospital stay and organ dysfunction.

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III. MATERIAL AND METHODS

This prospective observational study was carried out in the department of General Surgery, RNT Medical College,Udaipur, during the study period 2017to 2019.

Fifty cases undergoing laparotomy both electively and inemergency fulfilling Inclusion criteria of age group 16-70 years undergoing laparotomies both elective and emergencies.HIV patients with CD count <200 and patients with known decompensated liver disease were excluded.

Preoperative and postoperative albumin levels weremeasured for the patients and correlation between thepost-op fall in albumin level was compared with theincidence of post-op complications as determined byDindo-Clavien scoring.

Method

Serum albumin (g/L) levels were measured in preoperativeperiod in a homogeneous manner as per the hospitaltechnical guidelines. Samples on Post Operative Day 0were taken 4–6 hours postoperatively. Subsequently, dailyalbumin level was monitored up to POD – 5.Complications after surgery were graded by severity byDindo-Clavien system.Grades I-II were measured as minor and III-IV were measured asmajor complications. Mortality wasdocumented as grade V. Hospital stay was counted fromthe day of surgery.Operation duration was measured by the anaesthetist from incision to skin closure.

Intra operative blood loss was estimated as joint decision (anaesthetist, surgeon)by measuring aspiration fluid and soaked gauze materials.

DINDO-CLAVIEN System of grading:-[2]

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 as follows: 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
Grade IIIa	Intervention not under general anesthesia
Grade IIIb	Intervention under general anesthesia
Grade IV	Life-threatening complication requiring IC/ICU management
Grade IVa	Single organ dysfunction (including dialysis)
Grade IVb	Multiorgan dysfunction
Grade V	Death of a patient

IV. RESULTS

AGE GROUP	NO. OF PATIENTS	%
0-10	0	0
10-20	4	8
20-30	7	14
30-40	7	14
40-50	19	38
50-60	10	20
60-70	3	6
Total	50	100

Table No. 1 Age group distribution

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In this study maximum patients were 19 in the age group of 40-50 years. Ranging from16 to 70 years. Minimum 3 patients were in the age group of 60-70 years. Mean age was 45 (S.D =15.90) years.In this study30 male (60%)and 20 female patients (40%) were included.

In 32% patients chief complains was pain abdomen, distention and vomiting. Other complains were not passing flatus and motion,pain RIF,trauma,swelling,lump,difficulty in swallowing etc.

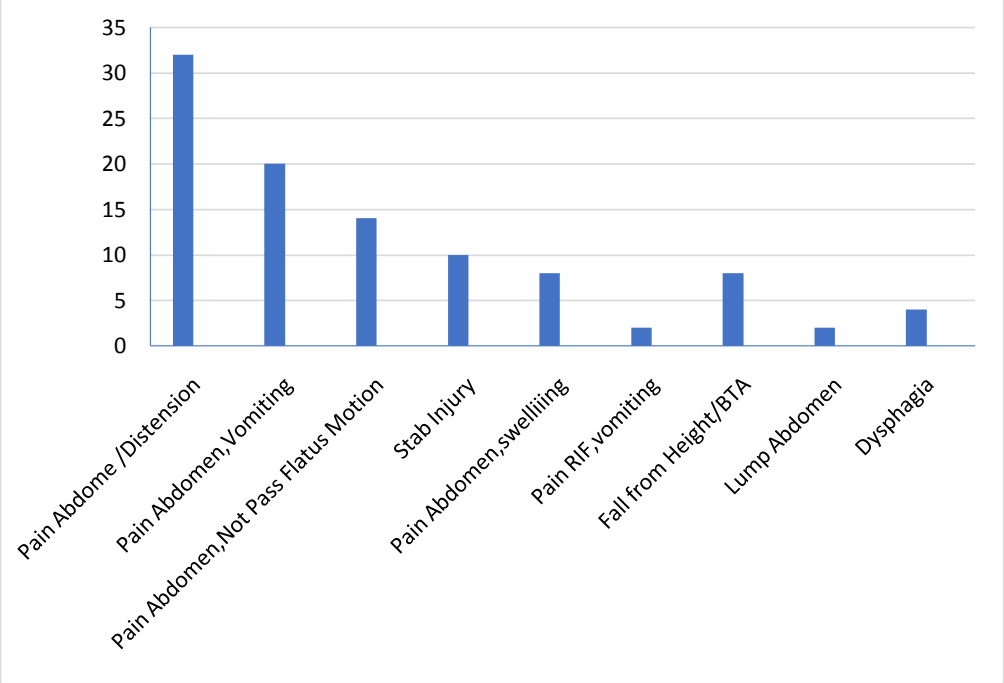

Figure no. 1:-Chief complaints of cases of surgery

Table 2: Indications for Surgery

DIAGNOSIS	FREQUENCY	%
Perforationperitonitis	22	44
Intestinal obstruction	4	8
RTA,BTA &perforation peritonitis	2	4
Stab injury perforation peritonitis	3	6
Stab injury&haemo-peritoneum	2	4
Haemo-peritoneum	1	2
Obstructed incisional hernia	1	2
Ca stomach	2	4
Ileal perforation& obstruction	1	2
Appendicular perforation	1	2
Ca colon	2	4
Acute abdomen	1	2
Gastricoutletobstruction	1	2
Ca ovary	2	4
Mesenteric cyst	1	2
Hydatid cyst of liver	1	2
Ca ileum&I-C junction	1	2

Most common indication of surgery was perforation peritonitis, followed by intestinal obstruction, stab injury of abdomen, malignancy, RTA/BTA and lump abdomen.

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Dindo-ClavienScoring:-

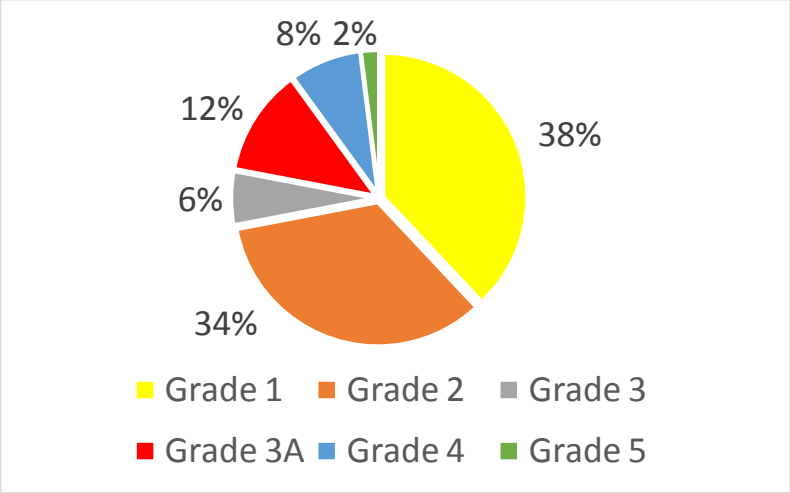

Figure no. 2: Dindo-clavien Scoring System

COMPLICATIONS	FREQUENCY	%
AKI dialysis	1	2
Aki underwent dialysis	1	2
Aki wound gapping	1	2
Aki wound infection	1	2
Blood transfusion	10	20
Burst abdomen sec. suturing	1	2
Elevated renal parameter	2	4
Fever	1	2
Mods	3	6
Mods(ventilator support)	1	2
NIL	13	26
Post op fever	4	8
Wound gapping sec. suturing	8	16
Wound infection	3	6
Total	**50**	**100**

Table no. 3: Demonstrates the complications.

Duration of Hospital Stay

Mean duration of hospital stay in 50% patients was 8.32 days and in other 50% mean stay was 10.06 days.

Table No. 4: Duration of stay in hospital after surgery

NO.OF DAYS	NO. OF PATIENTS
0-5	6
5-10	25
10-15	18
15-20	1

Table 5: Mean Albumin Levels

Time	Mean	Std. Deviation	N
PREOP ALBUMIN	3.874	0.4615	50
POD 0	3.466	0.5255	50
POD 1	3.324	0.6029	50
POD 2	3.376	0.6063	50
POD 3	3.368	0.6242	50
POD 4	3.344	0.6566	50

International Journal Dental and Medical Sciences Research
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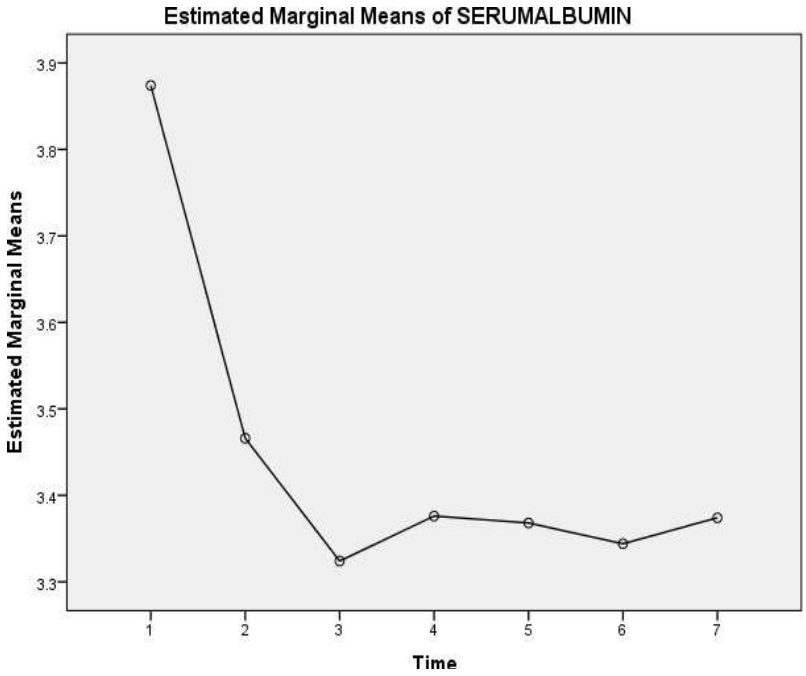
POD 5	3.374	0.6417	50



(1=Pre operative, 2-7= Post operative days 0 to 5)
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).

V. DISCUSSION

A prospective study was done for three year of cases undergoing laparotomy both electively and in an emergency between the age group of 16 to 70 years.Serum albumin(g/l) levels were measured in preoperative period in a homogenous manner as per the hospital technical guideline. Blood samples on POD 0 were taken 4-6 hours postoperatively. Subsequently, daily albumin level was monitored up to POD-5.

Preoperative and postoperative albumin levels were measured for the patients and correlation between the post-op fall in albumin-was compared with the incidenceof post-op complications as determined by Dindo-clavien scoring[2].

The age distribution of the participants was with a mean age of 45(S.D.=15.905). majority of them were males (60%, n=30).

Dindo-clavien scoring of the patients showed that 19 of them were in grade 1st. The duration of the stay was a mean of 8.32 days (4.468) for 50 patients.

A repetitive measures ANOVA with a greenhouse-geisser correction determined that mean serum albumin differed statistically significantly between time points.

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 post-operative albumin levels.

This correlates with most of the previous studies that used serum albumin as a marker for post-operative complications. Manufactured by the liver, albumin is a protein that is essential for performing many functions in the body. One of the main functions is to maintain the osmotic pressure which prevents the leakage of fluid from the blood into the tissues.

The perioperative care has fairly advanced to address the ambiguity through the use of recovery pathways (eras) that has shown to reduce the surgical stress, complications, duration of hospital stay and overall cost of the management[3-5]. In addition to this, nutritional support and other formulas have shown to impact the clinical outcomes.

The real challenge lies in identifying an easy to monitor and reliable variable that can be used to find out the patients at risk and customize the perioperative care for them. Initially, insulin was proposed byThorell et al. (1999)[6]. But the cost of testsand the reliability factor has made it difficult to measureinsulin. Sometimes the peak values are observed only after the golden period is crossed.

This is why albumin is proposed as a reliable predictor as it is abundantly available and easy to measure. Albumin is known to react immediately to surgical stress and has been instrumental in predicting clinical course and outcome[7-9].

Not many studies are available that uses 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 orindicator of surgical stress and the outcome of surgery.

One study by Martin Hubner et al. (2016)[10] has been referred to 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 post operative days.

The results showed that the values of albumin dropped post operatively by 10g/dL which correlated with the length of operation, complications and clinical outcomes. The present study correlates with this quotedliterature.

Based on the surgery and the complications that developed after that, Dindo-Clavien method was used to assess and grade the severity of the complications. Minor complications were graded as one and two while major complications were graded as three and four. Grade five denoteddeath.

In this study, serum albumin was used as a marker for the surgical stress and the postoperative complications that developed after that. Seven different surgeries were takeninto account.

The level of albumin was measured on the day of surgery(before) ,after the surgery on day 0 and subsequently onday 1, day 2, day 3, day 4 and day 5. All of them were measured at 7 am in the morning to help standardize the tests. It was found out that the serum albumin showed significant results right after 4 to 6 hours of surgery.

Secondly, the level of serum albumin drop closely related to the duration of surgery, intraoperative complications, blood loss, the severity of the operation and with the clinical outcome.

All of them positively correlated while prognosis was negatively correlated. Since serum albumin could reliably predict the outcome and other relatedit was said to be a reliable indicator for assessing the severityofsurgery.

VI. CONCLUSION

In this study, serum albumin was used as a marker for the surgical stress and the postoperative complications that developed after that. Seven different surgeries were taken into account.

The level of albumin was measured on the day of surgery (before), after the surgery on day 0 and subsequently on day 1, day 2, day 3, day 4 and day 5. All of them were measured at 7 am in the morning to help standardise the tests. It was found out that the serum albumin showed significant results right after 4 to 6 hours of surgery.

Secondly, the level of serum albumin drop closely related to the duration of surgery, intraoperative complications, blood loss, the severity of the operation and with the clinical outcome. All ofthepositively correlated whileprognosis was negatively correlated. Since serum albumin could reliably predict the outcome and other related factors, it was said to be a reliable indicator for assessing the severity of surgery.

The serum albumin measurement is simple, easy and cost- effective. It is also easy to perform anywhere unlike like 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.

Postoperative hemodilution may act as a confounding factor which can be circumvented by using other parameters and correlation with the clinical for confirmation.

VII. LIMITATIONS

The other surgical procedures were not considered as a part of thisstudy.The smaller sample size leaves us with only ahypothesis.False positives and false negatives are yet to be addressed with more sensitivity, reliability, validity andspecificity.Testing in larger patients is required and also in other critically illpatients.How far these values can be used to decide therapeutic procedures remains aquery.

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