Role of Serum Albumin as Predictor of Postoperative Morbidity and Mortality in Elective Gastrointestinal Surgeries

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Abstract:
Introduction: Serum albumin level is quantitative measure of patients' nutritional status which is the most readily available and clinically useful parameter. It predicts preoperative morbidity and mortality. A serum albumin level greater than 3.5g% suggest adequate protein stores and it confers protective effect through several biological mechanisms. Most patients with severe protein depletion will have low serum albumin levels. Patients with abnormal parameter have a markedly increased risk of poor clinical outcome. Objectives: To identify the patterns of complications among the patients with elective gastrointestinal surgeries. To study preoperative serum albumin and its effect on postoperative morbidity and mortality in elective gastrointestinal surgeries. Methodology: Hospital based prospective observational study performed on 100 patients undergoing GI surgery, presenting in Manipal College Teaching Hospital in 2 years (2014-10-01 to 2016-10-01). History and detailed clinical examination was performed which included demographic details, provisional diagnosis, final diagnosis, investigations and surgical procedure, morbidity and mortality. Data and all statistical analysis were done using SPSS 21. Ethical clearance was taken and written consent of all patients was taken. Result: Among 100 GI surgery cases 59% were female and 41% were male. Sixty-six percentage of patients had serum albumin more than or equal to 3.5g%. Out of 100 patients, 26 had malignant disease and 74 had benign condition. Sixteen patients with malignant disease had serum albumin less than 3.5gm% and ten had more than 3.5g% where significant association was seen between serum albumin and malignancy (p= 0.001). Postoperative complications were noted in 37% of patients with SSSI being the commonest one (19%). Lower the albumin level higher the complication was noted with Chi square (x^2) value 54.33 and p= 0.001.ConclusionLower the serum albumin level higher the complication noted. Superficial Surgical Site Infection was the commonest complication observed. Patients with malignant conditions had low serum albumin compared to patients with benign conditions. Cost effective test of doing serum albumin in patients undergoing elective GI surgery will help to predict postoperative morbidity and mortality so as to help the surgeons decide to select patients for nutritional buildup.
Keywords: Albumin, GI surgery, complications, SSSI, malignancy, malnutrition

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I.   Introduction:

Nutritional depletion has been demonstrated to be a major determinant of the development of post-operative complications. The prevalence of protein-energy malnutrition in surgical patients is high, ranging from 10% to 54%. Gastrointestinal surgery patients are at risk of nutritional depletion from inadequate nutritional intake, surgical stress and the subsequent increase in metabolic rate.[1,2]

There is substantial evidence to show that patients who have signs of malnutrition have higher risk of complications and increased risk of death in comparison to patients who have adequate nutritional reserve.[3]

Serum albumin provides a simple method of estimating visceral protein function.

Malnutrition and inflammation suppress albumin synthesis.[4]In an adult the normal range of serum albumin is defined as 3.5-5.0 g/dl and levels <3.5 g/dl is called hypoalbuminemia.[5,6]

Serum albumin concentration is a better predictor of surgical outcome than many other preoperative patient characteristics. It is a relatively low-cost test that should be used more frequently as a prognostic tool to detect malnutrition and risk of adverse surgical outcomes, particularly in populations in whom comorbid conditions are relatively frequent.[7]

Moreover, malnutrition leads to a significant increase in the operative death rate and three-fold increase in the postoperative infection rate. Current indications for nutritional support before elective surgery include a history of weight loss in excess of 10% of body weight or an anticipated prolonged postoperative recovery period during which the patient will not be fed orally.[8]

Our main purpose of this study is to determine preoperative serum albumin and its effect on postoperative morbidity and mortality in elective gastrointestinal surgeries.

II. Materials and Methods:

A hospital based prospective observational study was performed on 100patients presenting to Manipal Teaching hospital from 2014-10-01 to 2016-10--01 who were planned for elective GI surgeries except those patients whose serum albumin is <2.5g/dl, age < 12 years and who had icterus, anaemia< 7gm/dl, DM, chronic renal disease and patient on steroid. Sample size calculation was done following standard formula based on a study carried out by Garget al.[9]

After informed consent, full history and clinical examination was performed as per the working proforma, which included general demographic details (hospital number, name, sex, age and address), date of admission discharge, provisional diagnosis, final diagnosis investigation and outcome.

Post-operative complications were recorded in the form of wound infection, wound dehiscence, pulmonary complications like pneumonia, upper respiratory tract infection (URTI), reoperation and mortality. Total patients included for the study, were divided into two groups one with complications and the other without complications. Similarly, patient's serum albumin level was recorded and divided into two groups i.e; low serum albumin level (<3.5 gm/dl) and normal level (≥3.5 gm/dl). Further division was also made depending on benign condition and malignant disease. Observation was made about relation between serum albumin level and presence/absence of complications. Follow up was done till patient was discharged from the hospital.

After completion of data collection, collected data was checked, edited, organized, coded and entered in Statistical Package for Social Science (SPSS) 21 version. Demographic data and disease related characteristics were analyzed by using descriptive statistics like frequency, mean, maximum and minimum value whereas Chi square test was used to find out the association between serum albumin level & malignancy and Serum albumin level & outcome/ complication. The level of significance was considered at 5% with $p < 0.05$ and 95% confidence interval.

III. Result

The study was conducted on 100 patients, aged between 19-80yrs (mean age= 49.69 years), who underwent elective GI surgery in Manipal College Teaching Hospital, Pokhara from October 2014 to October 2016. Majority of them were female i.e 59. Total of 61 patients had serum albumin level ≥ 3.5 gm/dl and 39 had < 3.5 gm/dl. The mean serum albumin was 3.669gm/dl. Of 100 patients, 37% had postoperative complications, out of which commonest was superficial surgical site infection i.e; 19% followed by LRTI. Single mortality was observed.

Serum albumin and malignancy

Table 1: Relation between serum albumin and malignancy

Albumin		Malignancy		Total
		Present	Absent	
	<3.5	16	23	39
	>3.5	10	51	61
Total		26	74	100

Chi square: 11.87   df:1   p: 0.001

Among 100 cases, 26 patients was noted malignant. Considering albumin level amongst malignant cases 16 had low level of albumin (< 3.5 gm/dl). Statistically significant association was seen between serum albumin level and presence of malignancy with chi square value of 11.87 and p= 0.001. The mean serum albumin in patient with malignant disease was 3.4gm/dl and in those with benign condition was 3.76gm/dl.

Serum albumin and complications

Table 2: Serum albumin level and complication

Serum albumin	Complications		Total
	Present	Absent	
2.5-3	11	0	11
3-3.5	18	10	28
3.5-4	6	43	49
4-4.5	2	7	9
4.5-5	0	3	3
Total	37	63	100

Table 3: Relation between serum albumin level (in the normal and low range) and   complications

		Complications		Total
		Present	Absent	
Albumin	<3.5	29	10	39
	>3.5	8	53	61
Total		37	63	100

Chi square:54.33   df:1   P: 0.001

When patients were grouped with serum albumin in the normal and low range and complications were compared it was noticed that 29% of the complication was in the group with serum albumin of <3.5gm/dl. There was only 8% complications (where one is mortality) in the group with serum albumin >3.5gm/dl. This showed that patients with low serum albumin had more complications which was statistically significant (p=0.001).

IV. Discussion:

Serum albumin level, serum transferrin level and delayed hypersensitivity reactions were the only accurate prognostic indicators of postoperative morbidity and mortality.[10]Although serum albumin level may also be affected by acute factors such as trauma and surgical stress, it is predictive of operative outcome because it is a marker of disease and malnutrition as well as possibly conferring a direct protective effect through several biological mechanisms.[11]

In a study by Badia-Tahulletal[12] which included 158 patients undergoing elective gastrointestinal surgery over a period of 6 months. The mean age of the patient studied was 61(18-87yrs) and 64.6% were men. Our study included total of 100 patients over a time period of one and half year. The mean age of our patients was 49.69 years with 59% female. Among total 75.3% had neoplastic disease and the mean operative plasma albumin levels were 3.73+/-0.54gm/dl. This was different from our study which included less malignant conditions, 26% malignant cases and 74% benign condition. A total of 32.9 % presented with at least one complication with infection being the most common. The complication rate was 37% with infection being the most common in our study which was similar to observation being made in the above study.

A retrospective study by Kudsk et al[13] of 526 surgical patients who had preoperative serum albumin levels measured and were undergoing elective oesophageal, gastric, pancreaticoduodenal and colon surgery, a serum albumin level below 3.25gm/dl correlated immensely with complications, length of stay, postoperative stay and mortality. This was similar to what was observed in our study.

Hennessey et al conducted a study of 524 patients undergoing GI surgery of which 339 (64%) underwent colorectal surgery in 4 institutions in Ireland showed that patients who developed a surgical site infection had a lower median preoperative serum albumin than those who did not develop an infection, 3.0 g/dl and 3.6 g/dl respectively (P < 0.001). A total of 105 patients (20%) developed surgical site infection. Our study had 37% complication and surgical site infection was noted in 19% which was similar to that noted in the above study.

Johnson et al [14] conducted retrospective review of NSQIP 2005-2011 participant use data files, which included 1,085 patients who had undergone radical cystectomy at 315 United States medical centre from 2005-2011 where overall 30 days complication rate was 53%(n=575), out of these, 6%(n=32) had preoperative albumin level <3gm/dl. After controlling for age, resident involvement, operation year and prior operation only albumin at levels <3gm/dl remained as significant predictor of postoperative complications(p=0.4). Our study had complications of 37% though 30 days follow up wasn't done. Hypoalbuminemia taken as <3.5gm/dl in our study had statistically significant direct relation with postoperative complications (p=0.001).

V. Conclusion:

Preoperative serum albumin is a good indicator in predicting postoperative outcome in patients undergoing elective GI surgery. Pre-operative serum albumin < 3.5gm/dl has higher rate of complications than that of >3.5gm/dl serum albumin cases. SSSI is the commonest postoperative complication noted followed by LRTI and SSSI with LRTI. Patients with malignant condition had statistically significant relationship with low serum albumin than those with benign conditions.

Thus serum albumin is a good prognostic indicator because of its ability to detect PEM, which is not necessarily accompanied by lower body weight and may not be clinically recognizable but is associated with significant risk of morbidity and mortality.

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