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Original Article

Role of Serum Albumin as a Prognostic Indicator

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ABSTRACT

Background: The serum albumin level is a readily available and clinically useful parameter. A serum albumin level greater than 3.5g/dl offers a protective effect through several biological mechanisms. Serum albumin predicts morbidity and mortality. Patients with abnormal serum albumin levels have a markedly increased risk of poor clinical outcomes. This study evaluates the correlation of serum albumin to postoperative morbidity and mortality in elective surgeries.

Methods: This study was conducted in MKCG Medical College & Hospital, Brahmapur, Odisha from September 2013 to August 2015. Out of all surgical admissions for elective surgery during study period in our hospital, 50 cases of different age group were selected randomly. Details of cases were recorded and pre-operative serum albumin investigation performed. Post-operative complications were noted and follow up was done till patient was discharged from hospital.

Results: Among 50 patients studied, 18 patients developed complications and 32 had uneventful recovery. Wound infection was the most common complication. Rate of complication was more when serum albumin was less than 3.0 gm/dl which was statistically significant. Serum albumin level >3.5 gm/dl was associated with statistically significant lower complications.

Conclusion: Serum albumin is a good prognostic indicator as levels < 3.0 g/dl of serum albumin were associated with increased post-operative morbidity.

KEYWORDS: Prognostic indicator, Serum albumin.

INTRODUCTION

Protein calorie malnutrition leads to many adverse effects in surgical patients. Protein depletion results in delayed wound healing. Protein-calorie malnutrition produces a reduction in lean muscle mass, alteration in respiratory mechanics, impaired immune function and intestinal atrophy. Serum hepatic protein (albumin, transferrin, and prealbumin) levels have historically been linked in clinical practice to nutritional status. Compelling evidence suggests that serum hepatic protein levels correlate with morbidity and mortality.[1] Albumin is a major protein of human plasma and its normal serum value is between 3.5-5.5 gm/dl. Albumin (69 kDa) makes up approximately 60% of the total plasma protein. About 40% of albumin is present in the plasma, and the other 60% is present in the extracellular space. The liver produces about 12 g of albumin per day, representing about 25% of total hepatic protein synthesis and half its secreted protein.[2] Albumin synthesis is decreased during fasting and in malnutrition. Albumin is an acute phase protein, the concentration of which is decreased by at least 25% following injury. Causes of hyperalbuminemia (>5.5g/dl) include dehydration and albumin infusion. Hypoalbuminemia (<3.5g/dl) occurs in cases with increase in plasma water like excessive infusion of iv fluids, diminished synthesis eg. in malnutrition or in a hypercatabolic state eg. fever, trauma, major surgery. Hypoalbuminemia is associated with poor tissue healing, decreased collagen synthesis in surgical wounds or at the anastomosis and impairment of immune response such as macrophage activation and granuloma formation.

Pre-operative hypoalbuminemia is an independent risk factor for postoperative complications and low serum albumin may be used as a simple and low-cost prognostic tool to predict the risk of adverse surgical outcomes.[3]

AIMS

This study evaluates the correlation of serum albumin to postoperative morbidity and mortality in elective surgeries.

MATERIALS AND METHODS

The study was done at Department Of General Surgery, Maharaja Krushna Chandra Gajapati Medical College, Berhampur. The period of study was from September 2013 to August 2015. This is a prospective study. Study population has been selected after applying the necessary exclusion criteria. The study was approved by Institutional ethics committee. Informed consent was taken from all the patients.

A random selection of 50 patients from the patients admitted in surgical wards has been done.

Method of Collection of Data

After admission to the hospital, data was collected from the patient regarding the clinical features and pre-operative investigation of serum albumin performed. Postoperatively, patients' condition was assessed and complications were documented. Patients were followed up till discharged from the hospital.

Inclusion Criteria

Patients admitted for any elective surgery under the Dept. of General Surgery, MKCG Medical College, Berhampur, Odisha, INDIA.

Exclusion Criteria

- Children < 15 yrs
- Patients with icterus, severe anaemia <8 gm/dl, diabetes mellitus, chronic renal disease.

RESULTS

Of the 50 patients studied, the age varied from 18-72 yrs. The number of patients in the 51-60 age group was highest (24%).The highest number of complications were also noted in the 51-60 yrs age group (23.8%)

Out of the 50 patients, 30(60%) were males and 20(40%) were females. Out of the total 21 complications males comprised 57% and females 43%.

Table 1: Age distribution

Age (yrs)	15-20	21-30	31-40	41-50	51-60	61-70	>70
Total no.	2	9	10	8	12	5	4
No complications (29)	1	6	6	4	7	3	2
Complications (21)	1	3	4	4	5	2	2

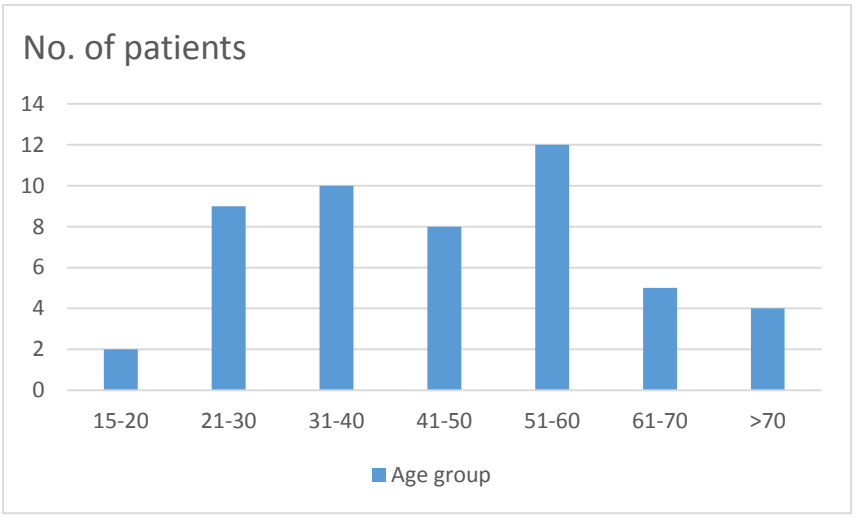
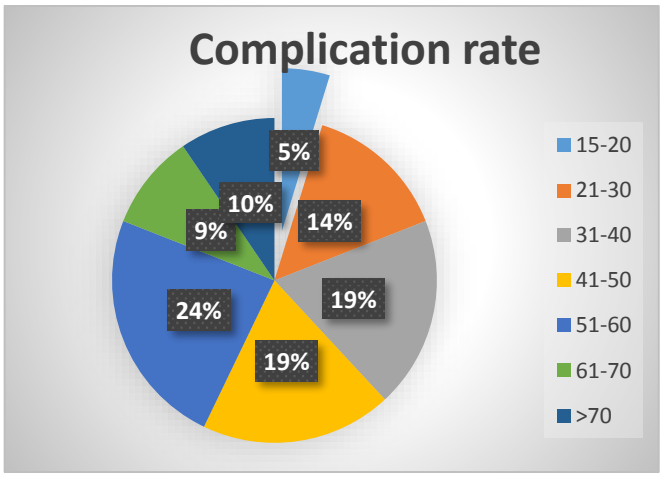
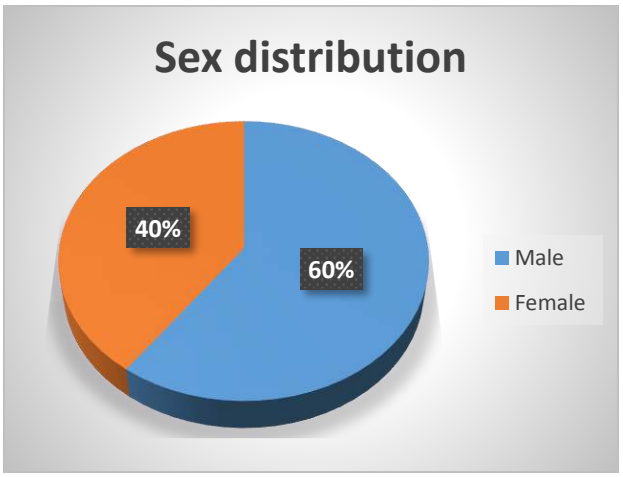
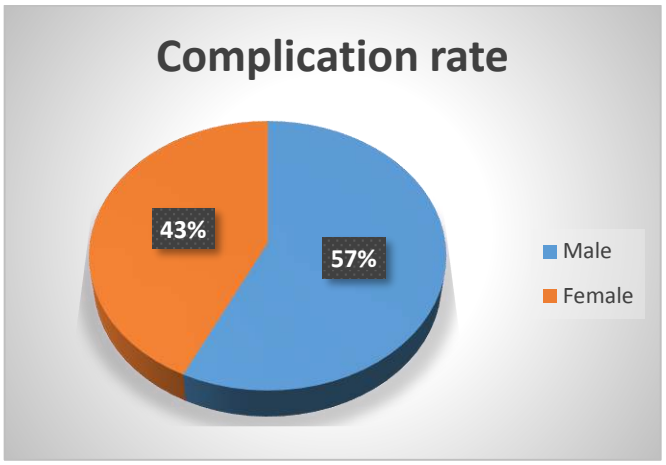


Fig 1: Age distribution







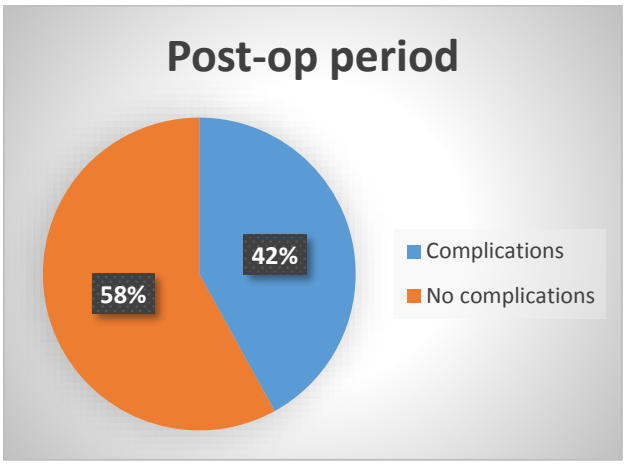


Table 2: Sex distribution

Sex	Number (%)	Complications	No complications
Male	30(60 %)	12	18
Female	20(40%)	9	11

Table 3: Different post-operative complications

	Surgical site infection	Wound dehiscence	Pleural effusion	Lower respiratory tract infection	Total
No. of patients	12	4	2	3	21
Percentage	57.14	19.04	11.12	14.28	100

Table 4: Serum albumin and post-operative outcomes

Serum album in g/dl	Total no. of patients	Complications	No complications	P value
<3	17	12	5	<0.05
3.1-3.5	16	6	10	>0.05
>3.5	17	3	14	<0.05

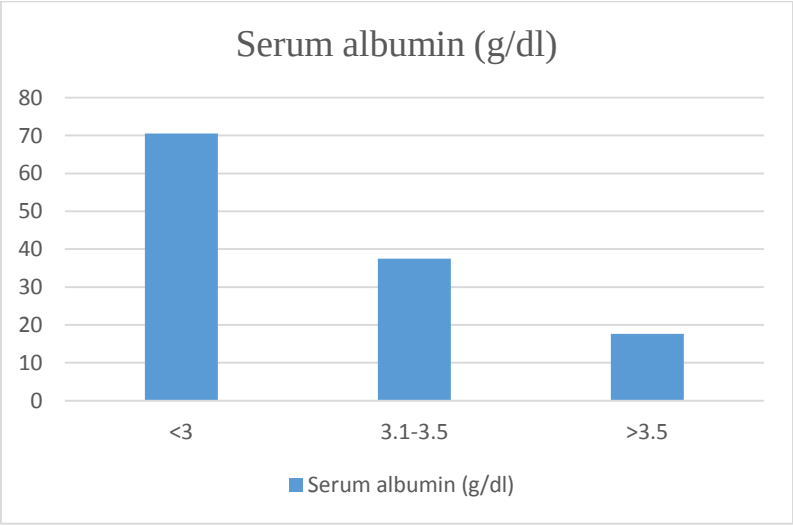


Fig 6: Level of serum albumin and post-operative outcomes

Table 5: Comparison of malignant and non-malignant diseases with post-operative complications

	Complications	No complications	Total
Malignant	7	13	20
Non-malignant	14	16	30

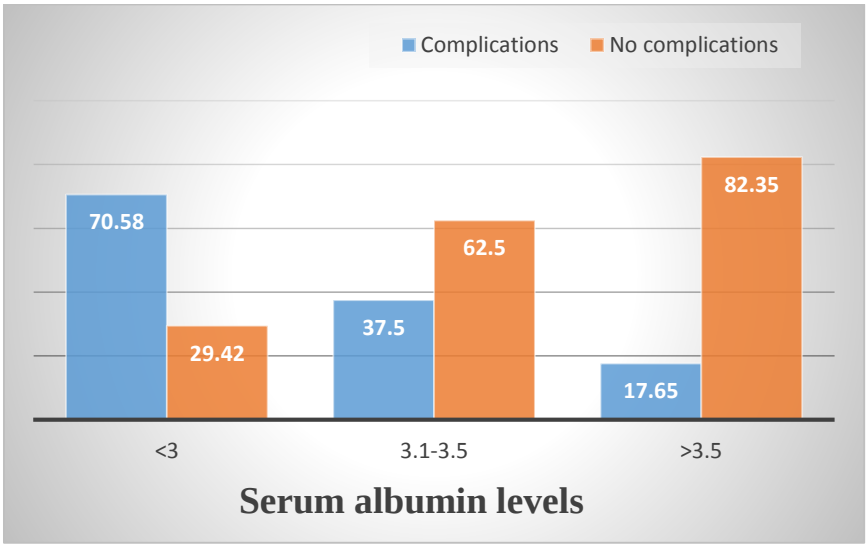


Fig 7: Comparison of complications and no complications with different levels of S.albumin

Table 6: Complication rates in malignant and non-malignant diseases with different S.albumin levels

	Serum albumin (gm/dl)	Complications	No complications
Malignant (20)	<3	4(66.67%)	2(33.33%)
	3.1-3.5	3(30%)	7(70%)
	>3.5	0	4(100%)
Non-malignant (30)	<3	8(72.73%)	3(27.27%)
	3.1-3.5	3(50%)	3(50%)
	>3.5	3(23.08%)	10(76.92%)

Patients with albumin <3g/dl had 70.58% complication rate. Patients with albumin levels between 3.1-3.5g/dl had 37.5% complication rate and those having >3.5g/dl had 17.65% complication rate.

The rate of complication was more when the serum albumin level was less than 3 g/dl which was statistically significant. There was no statistically significant difference in rate of complication when serum albumin levels were 3.1-3.5g/dl. Serum albumin level >3.5g/dl was associated with statistically significant lower complication rate.

Out of 50 patients, 20 (40%) were malignant and 30(60%) were non-malignant. 21 patients developed complications out of which 7(33.34%) were malignant and 14 (66.67%) were non-malignant. A comparison was done between the malignant and non-malignant diseases with serum albumin. Among the 20 patients with malignancy, 7 developed complications in which 4 patients had serum albumin <3g/dl and 3 patients had levels between 3.1-3.5g/dl.

The complication rate declined significantly in patients having serum albumin levels 3.1-3.5g/dl and none of the patients developed complications when albumin levels were >3.5g/dl. This was found to be significant and implies that in malignant cases as the serum albumin level increases the complication rate decreases.

Among the patients with non-malignant diseases (30), 11 patients had serum albumin levels <3 g / dl out of which, 8 developed complications. The rate of complications decreased as the serum albumin levels increased.

Table 7: Comparison of present study with previous studies

Previous studies	Levels of serum albumin (g/dl) associated with increased complications	P value
Gibbs et al[4]	<2.1	<0.001
Beghetto et al[6]	<3.5	<0.05
Brown et al[7]	<3	<0.05
Engelman et al[8]	<2.5	<0.005
Lin MY et al[10]	<3.2	<0.001
Present study	<3	<0.05

DISCUSSION

Several studies have been done on serum albumin as an indicator of post-operative morbidity and mortality worldwide, till date. This study was done in south Odisha. Many significant findings were observed in our study. Present study was compared with those of other authors. It has been summarized below:

Gibbs et al[4] observed that a decrease in serum albumin from concentration greater than 4.6g/dl to less than 2.1g/dl ($p<0.001$) was associated with exponential increase in mortality rates from less than 1% to 29% and in morbidity rates from 10% to 65%. In the regression models, albumin level was the strongest predictor of mortality and morbidity for surgery as a whole and within several subspecialties selected for further analysis.

Albumin level was a better predictor of some types of morbidity, particularly sepsis and major infections, than other types. .

Hennessey DB et al[5] observed that hypoalbuminemia (<3g/dl) was an independent risk factor for the development of surgical site infection following gastrointestinal surgery and was associated with deeper surgical site infection and prolonged hospital stay. Beghetto et al[6] concluded that serum albumin (<3.5g/dl) was the strongest predictive parameter for death and hospital infection. Brown et al[7] reported increased incidence of pneumonia and septicaemia with serum albumin levels <3g/dl. Engelman et al[8] observed that albumin less than 2.5g/dl was associated with increased mortality after cardiopulmonary bypass (P </=.0005). Operative mortality was highest among those with both low body mass index and low albumin level. They demonstrated that an albumin level of less than 2.5 g/dL was independently associated with increased risk of reoperation for bleeding, postoperative renal failure, and prolonged ventilatory support, intensive care unit stay, and total length of stay.

Foley et al[9] conducted a prospective, randomized trial of 25% albumin administration in 40 hypoalbuminemic (serum albumin, less than 25 g/L [2.5 g/dL]), critically ill patients. They found that the costly use of exogenous albumin as treatment for hypoalbuminemia in this patient population does not appear to be justified.

Lin MY et al[10] found that an albumin level below 3.2g/dl was a significant predictor of postoperative morbidity, infectious and non-infectious complications and mortality ($p<0.001$).

Lien YC et al[11] noted that among patients with adenocarcinoma of the gastric cardia, patients with higher preoperative serum albumin levels appeared to survive longer than patients with lower levels. They found that preoperative serum albumin level correlated highly with resectability and survival. Patients with abnormal serum albumin levels had worse survival than did those with normal serum albumin levels.

CONCLUSION

Wound infection (surgical site infection) was the most common complication occurring in 57.14% of patients. Complication rate was higher when serum albumin level was less than 3.0g/dl which was statistically significant. Patients with serum albumin >3.5g/dl have less postoperative complications which was also statistically significant.

Considering the malignant diseases separately also, as the serum albumin levels decrease there was an increase in complication rate. Thus, this study concludes that the correlation between albumin levels and complication rates is significant and albumin is a good prognostic indicator.

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