Preoperative Serum Albumin and Body Mass Index as Predictors of Post-Operative Morbidity and Mortality in Elective Major General Surgeries

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ABSTRACT

BACKGROUND

Hippocrates recognized the side effects of malnutrition on the morbidity and mortality of patients. The most clinically useful parameter is serum albumin. It predicts perioperative morbidity and mortality. The main objective was to study the preoperative serum albumin and Body Mass Index as predictors of post-operative morbidity and mortality in elective major general surgeries.

METHODS

The study was conducted on 50 patients who underwent elective surgery at Calcutta National Medical College and Hospital, Kolkata between March 2013-Feb 2014. Z- Test and Fischer exact t-test were used for statistical analysis. Preoperative and post-operative parameters were taken. Preoperative parameters- serum albumin level and body mass index. Post-operative parameters- morbidity and mortality. Permission from institutional ethics committee was obtained.

RESULTS

Out of 50 patients studied 18 (36%) were malignant and 32 (64%) were non-malignant. 20 patients developed complications, 4 (20%) were malignant and 16 (80%) were non-malignant. Among the patients with malignancy (18) only 4 had complications, of which 2 (11%) were <3.0 g/dl and 2 (11%) between 3.1- 3.5 g/dl. Albumin less than 2.5 g/dl (p<0.001) and BMI less than 20 Kg/m^2 (p<0.005) and greater than 30 Kg/m^2 (p <0.005) was associated with increase in post-operative complications.

CONCLUSIONS

The correlation between the serum albumin and complication rate was statistically significant in the malignant diseases when considered separately. Serum albumin < 3.0 g/dl was associated with increased post-operative morbidity and mortality.

KEYWORDS

Preoperative, Serum Albumin, Body Mass Index, Postoperative

BACKGROUND

The adverse effects of malnutrition on the morbidity and mortality of patients was first recognized by Hippocrates (460 BC -370 BC) many centuries ago. It is common and occurs in about 30% of surgical patients with gastrointestinal diseases and in up to 60% of those in whom hospital stay has been prolonged because of postoperative complications.[1] Patients with a history of heavy smoking, patients maintained on home oxygen, patients who are unable to walk one flight of stairs without severe respiratory compromise, patients with a previous history of major lung resection, and elderly patients who are malnourished all must be carefully screened with pulmonary function tests.[2]
The total exchangeable pool of albumin is 4-5 gm/kg body weight, between 6-10% of the exchangeable pool is degraded per day. Albumin synthesis is decreased during fasting and in condition of protein malnutrition. The concentration of which is decreased by at least 25% following injury.[3] Both low and high BMI correlate with morbidity and mortality. Low levels of BMI are also associated with lethargy and diminished work productivity. The lowest survivable levels of BMI, as suggested by observation in starvation, famine and anorexia nervosa, or by theoretical models, have been estimated to be 12-13 Kg/m². Recent studies have indicated that independently living older individuals with a BMI less than 22 Kg/m² are at a much higher risk for all-cause mortality.[4]

METHODS

Total number of patients was 50 and are randomly selected by using simple random sampling who was admitted for elective major general surgery. Study was conducted at Department of General Surgery, Calcutta National Medical College and Hospital; Kolkata. Patients admitted in general surgical wards of Calcutta National Medical College and Hospital, Kolkata were studied. The study was carried out for a period of one year from between March 2013 - February 2014. Preoperative and post-operative parameters were taken. Preoperative parameter serum albumin level and body mass index. Post-operative parameter morbidity and mortality. Permission from institutional ethics committee was obtained. Under serum albumin level: Normal nutritional status, Mild, Moderate & Severe hypoalbuminemia were studied.

Under Body Mass Index: Underweight, Normal, and Overweight & Obesity. Study tool includes history, Clinical examination, investigations, operative note, Anthropometry. Preoperative clinical examination includes complete blood count, liver function tests, Fasting and post prandial blood sugar, Serum urea, creatinine. Ultrasonography of abdomen, Chest X-ray, Abdominal radiograph. Post-operative clinical examination includes complete blood count, Liver function tests, Fasting and postprandial blood sugar, serum urea, creatinine, Chest x- ray, Histopathological report of resected specimen if any, pus if found for culture and sensitivity.

Inclusion Criteria
Both male and female patients > 12 years age admitted for any major general elective surgery under department of surgery in Calcutta National Medical College and Hospital were included in the study.

Exclusion Criteria
Children <12 years, patients who have icterus, severe anaemia <7 gm/dl, diabetes mellitus, chronic renal diseases, chronic liver disease and patient on steroids, immunosuppressant, chemotherapy and anti-psychotic drugs, Road Traffic Accident cases and patients with inguinal and femoral hernia were excluded from the study.

Statistical Analysis
Statistical analysis was done accordingly, p value <0.05 was considered statistically. Z-test and Fischer exact t- test were used for analysis.

RESULTS

	Complications	No Complications	Total
Malignant	4	14	18
Non-Malignant	16	16	32

Table 1. Comparison of Malignant vs. Non-Malignant Diseases with Post-Operative Complications

Out of 50 patients studied Malignant with complications are 4 cases and malignant with no complications are 14 and non-malignant with complications are 16 cases and non-malignant with no complications are 16 cases. 18 (36%) were malignant and 32 (64%) were non-malignant (hernias, infective and others). 20 patients developed complications, 4(20%) were malignant and 16 (80%) were non-malignant.

	Sr. Albumin (g/dl)	Complications	No Complications
Malignant (18)	<3.0	2(11.1%)	1(5.5%)
	3.1 -3.5	2(11.1%)	6(33.3%)
	>3.5	0	7(38.3%)
Non-Malignant (32)	< 3.0	9(28%)	4(12.5%)
	3.1 – 3.5	3(9.3%)	5(15.6%)
	>3.5	4(12.5%)	7(21.8%)

Table 2. Comparison of Malignant vs. Non-Malignant Diseases with Sr. Albumin

Among Malignant cases with complications were 4 and with no complications were 14. Among non-malignant cases with complications were 16 and with no complications were 16. A comparison was done between the malignant and non-malignant (hernias, infective and others) diseases with serum albumin. It was found that among the patients with malignancy (18) only 4 had complications, in which 2(11%) were <3.0 g/dl and 2(11%) between 3.1-3.5 g/dl, and 16 had no complications which was statistically significant according to Fischer exact t test. It implies that in malignant patients as the serum albumin increases the complication rate decreases.

Among the patients with non-malignant diseases (32), 16 developed complications in which 9(28%) were <3.0 g/dl; 3(9%) patients between 3.1-3.5 g/dl and 4(12.5%)

>3.5 g/dl, and 16 had no complications but this was not statistically significant.

	BMI (Kg/m²)	Complications	No Complications
Malignant (18)	<18.5	2(11.1%)	1(5.5%)
	18.5 -24.9	2(11.1%)	13(72.2%)
	>25	0	0
Non-Malignant (32)	< 18.5	5(15.6%)	3(9.3%)
	18.5 -24.9	11(34.3%)	10(31.2%)
	>25	0	3(9.3%)
Table 3. Comparison of Malignant vs. Non-Malignant Diseases			

A comparison was done between the malignant and non-malignant (hernias, infective and others) diseases with BMI. Among the malignant patients 2(11%) were with <18.5 BMI and 2(11%) were between 18.5-24.9. Among malignant with complication cases were 4 and non-complications were 14 cases. Among non-malignant with complication cases were 16 and with no complication cases were 16 cases. Among the non-malignant patients 5(15.6%) were <18.5 and 11(34.3%) were between 18.5 -24.9. The values are not statistically significant.

Study Name	Serum Albumin g/dl Associated with Increased Complications	p Value
Beghetto et al	<3.5	<0.05
Leite et al	< 3	<0.05
Brown et al	<3	<0.05
Engelman et al	<2.5	<0.001
Foley et al	<2.5	<0.001
Present study	<3	<0.05
Table 4. Significance of Serum Albumin Levels in Predicting Postoperative Outcomes		

Beghetto et al observed that albumin <3.5 g/dl (p<0.05). Leite et al observed albumin<3 g/dl (p<0.05). Brown et al reported that albumin <3 g/dl (p<0.05).Brown et al observed that albumin <3 g/dl (p<0.05). Foley et al observed that albumin <2.5 g/dl (p<0.001). In present study <3 g/dl albumin were observed with p value <0.05. Engelman et al observed that albumin less than 2.5 g/dl (p<0.001) and BMI less than 20 Kg/ m² (p<0.005) and greater than 30 Kg/m² (p <0.005) was associated with increase in post-operative complications.

DISCUSSION

Vincent et al shows that serum albumin level <2 gm/dl in critically ill patients has been shown to be associated with a mortality of 100%.[5] Hirsh et al in prospective study assessed the preoperative nutritional status of surgical patients and its relation to postoperative outcomes. Preoperative nutritional assessment included anthropometry and biochemical indices. The more useful parameters were preoperative weight loss and low serum albumin levels.[6] Jennifer et al reported the mature human albumin consists of one polypeptide chain of 585 amino acids and consists 17 disulfide bonds. It has ellipsoidal shape 75-80% of the osmotic pressure of the human plasma. To maintain adequate colloidal osmotic pressure of >2.5 gm. /dl and total protein >5 gm/dl is sufficient.[7]

According to Ian A.D et al Increase in plasma H_2O: This occurs as a part of physiological response in pregnancy. Other causes include excessive infusion of IV fluids, H_2O retention in SIADH, glucocorticoid deficiency. Diminished synthesis-any cause of generalized protein malnutrition will ultimately be reflected in low plasma albumin. Causes for this include deficient diet in protein nitrogen; protein malabsorption such as coeliac disease, tropical sprue, Crohn's disease, cystic fibrosis; decreased synthesis in chronic liver disease; in hereditary analbuminaemia there is a marked impairment of albumin biosynthesis with plasma levels which are typically low. Increased catabolism-This is a feature of hyper catabolic state. The important feature of hyper catabolic state is the stress related stimulation of glucocorticoid production. These hormones are known to stimulate protein catabolism. Condition such as fever, trauma, major surgery, severe sepsis, and malignant disease may all be associated with varying degrees of hypoalbuminemia. Losses of albumin from body-sites of excessive loss is GI tract, kidneys and skin.[8]

M.B. Badia et al of 158 patients on multivariate analysis, preoperative hypoalbuminemia was significantly associated with higher morbidity and lengthier hospital stay regardless of the type of surgery.[9] Woods et al done to identify the role of serum albumin concentration on length of postoperative illness.[10]

CONCLUSIONS

The correlation between the serum albumin and complication rate was statistically significant in the malignant diseases when considered separately. Serum albumin <3.0 g/dl was associated with increased post-operative morbidity and mortality. There is no significant correlation between BMI and post-operative outcome. Thus, serum albumin may not be clinically recognizable, but is associated with significant increased risk of morbidity and mortality. Comparison of complication and no complication of both malignant and non-malignant diseases at values of various levels of serum albumin are statistically significant only for malignant diseases. It shows that in patients with malignancy, as the serum albumin increases the complication rate decreases.

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