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Role of serum albumin and BMI in elective major abdominal surgeries

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Abstract
This study was conducted on 60 patients who underwent major elective abdominal surgery at JSSH, Mysore between October 2013 to September 2015. Sr. albumin and BMI were estimated preoperatively and postoperative complications were noted. Statistical analysis was done accordingly, p value < 0.05 was considered statistically significant. Z- test and Fischer exact t- test were used for analysis. Increased post-operative morbidity is seen in patients with Sr. albumin < 3.0g/dl. There is no mortality in our study. There was no significant correlation between BMI and postoperative outcome in these patients.

Keywords: serum albumin, malnutrition, surgical site infection, BMI, sepsis.

Introduction
The prevalence of protein-energy malnutrition in surgical patients is high, ranging from 10% to 54%. The correct assessment of the nutritional status of such patients is crucial since malnourishment is a risk factor for morbidity and mortality. The identification of patients with a high surgical risk is essential in the operative indications and decisions, often limited by the potential morbidities and mortality related to the procedure. Hence, the clinical and laboratory parameters which may point out higher risk for postoperative complications are important the different major surgeries.

Most patients with severe protein depletion will have low serum albumin levels. Patients with abnormal parameter have a markedly increased risk of poor clinical outcomes.

PEM affects every organ system. The most obvious results are loss of body weight, adipose stores and skeletal muscle mass. Due to changes in immunological function, poor wound healing.

Aims and Objectives
1. To study serum albumin and BMI (Nutritional status) in patients undergoing major elective abdominal surgeries.
2. To study the correlation of the nutritional status and postoperative morbidity and mortality.

Methodology
Source of data
Patients admitted in JSS hospital for any major abdominal elective surgery between October 2013 and September 2015
Calculated sample size n = 60

Inclusion criteria
Major elective abdominal surgery

Exclusion Criteria
- Patients With diabetes mellitus
- Severe anemia (<7gm %)
- Chronic renal failure
- Chronic liver disease
- Immunosuppressive patients (ie tuberculosis, hiv, pts on steroids),
- Patient's undergone chemotherapy and radiotherapy.
- Patients undergoing laparoscopic surgeries.

Method of collection of data

- Details of cases was recorded including history and clinical examination
- Anthropometry– Height and weight recorded
- Investigation –Serum albumin was estimated
- Follow up was done till patient was discharged from hospital

Results

The study was conducted on 60 patients, aged between15 -75 yrs, who underwent any major surgery elective surgery in Among 60 patients, 26 patients developed complications and 34 had uneventful recovery

Table 1: Sex Distribution

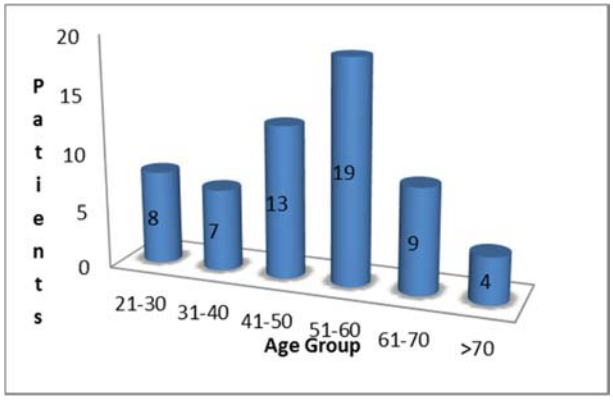
Sex		Complication		Total
		Yes	No	
Female	Count	15	14	29
	%With Complications	57.70%	44.10%	49.00%
Male	Count	11	20	31
	%With Complications	42.30%	55.90%	51.00%
Total	Count	26	34	60

Of the 60 patients studied, 51% were male and 49% were female. 42.30% of male patients had complications and 57.70% of females had complications with p value 0.277NS Above chart represents 42.3% of males in the study developed complications and 57.7% of the females had complications.

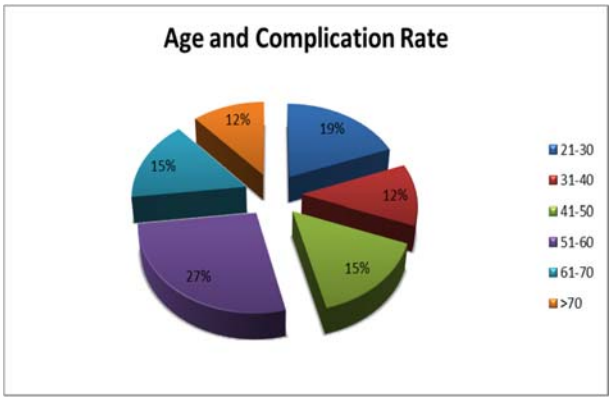
Table 2: Age Distribution

Age Group		Complication		Total
		Yes	No	
21-30	Count	5	3	8
	% With Complications	19.20%	8.80%	13.30%
31-40	Count	3	4	7
	% With Complications	11.50%	11.80%	11.70%
41-50	Count	4	9	13
	% With Complications	15.40%	26.50%	21.70%
51-60	Count	7	12	19
	% With Complications	26.90%	35.30%	31.70%
61-70	Count	4	5	9
	% With Complications	15.40%	14.70%	15.00%
>70	Count	3	1	4
	% With Complications	11.50%	2.90%	6.70%
	Total Count	26	34	60

Of the 60 patients, the age varied from 15-75 yrs having p value of 0.550NS for age distribution. The number of patients in the 51 – 60 years group was the highest (37.70%). And the highest no of complications were noted in the age group of 51-60 years (26.90%).



Graph 3: Age Distribution



Graph 4. Age and Complication Rate

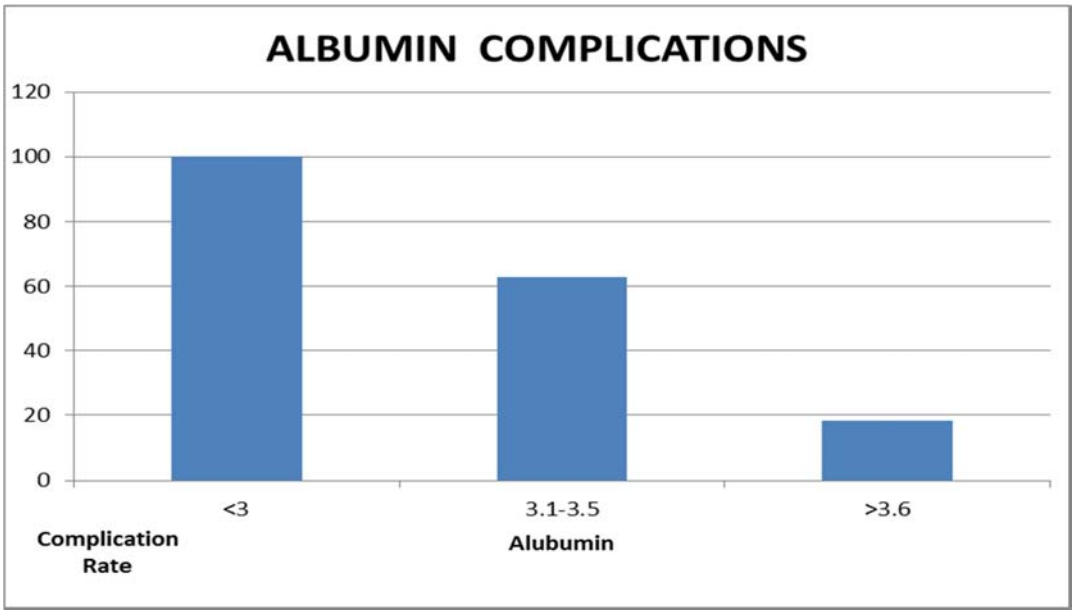
Among all the age group patients between 51-60 years have the highest complication rate 27%.

Table 4: Level of Serum Albumin and complications

Albumin		Complication		Total
		Yes	No	
<3	Count	8	0	8
	%With Complications	30.8%	0.0%	13.3%
3.1-3.5	Count	12	7	19
	%With Complications	46.2%	20.6%	31.7%
>3.6	Count	6	27	33
	%With Complications	23.1%	79.4%	55.0%
Total	Count	26	34	60
	%With Complications	100.0%	100.0%	100.0%

X^2= 22.004; P < 0.001 * S

It was observed that the rate of complication was more when serum albumin level was less than 3.0 gm/dl which is statistically significant. There was no significant difference in rate of complication when serum albumin levels were <2, 2.1-2.5, 2.6-3.0, and 3.1- 3.5gm/dl. Sr. albumin level >3.5gm/dl were associated with statistically significant lower complications using the Z test and the Chi square test.



Graph 5: Serum Albumin-Complications Rate

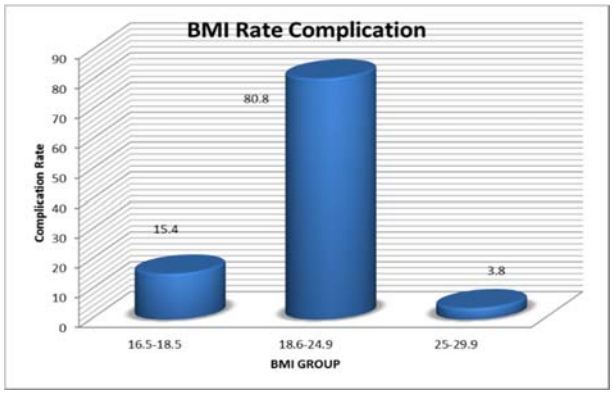
When comparing the sr. albumin to the complication rate, it was found that patients with alb<3.0g/dl had 100% complication. Patients with alb 3.1-3.5g/dl had 63%% complication rate, 22% complication rate for alb >3.5g/dl.

Table 5: BMI Group-Complications:

Bmi Group			Complication		Total
			Yes	No	
	16.5-18.5	Count	4	2	6
		%With Complications	15.4%	5.9%	10.0%
	18.6-24.9	Count	21	29	50
		%With Complications	80.8%	85.3%	83.3%
	25-29.9	Count	1	3	4
		%With Complications	3.8%	8.8%	6.7%
Total		Count	26	34	60
		%With Complications	100.0%	100.0%	100.0%

X^2= 1.914; P = 0.384 NS

The complication rate was found to be high with BMI group 18.6-24.9kg/m but not statistically significant



Graph 7: Bmi Complication Rate

The complication rate with BMI between 16.5-18.5 was 15%, 18.6-
24.9 was 85% and less complication was found in patients with BMI > 25kg/m2.

Table: Comparison of malignant Vs non-malignant diseases with postoperative complications

Table 5: Distribution of Cases According To Malignancy

Malignancy	Frequency	Percent
YES	37	61.7
NO	23	38.3
TOTAL	60	100.0

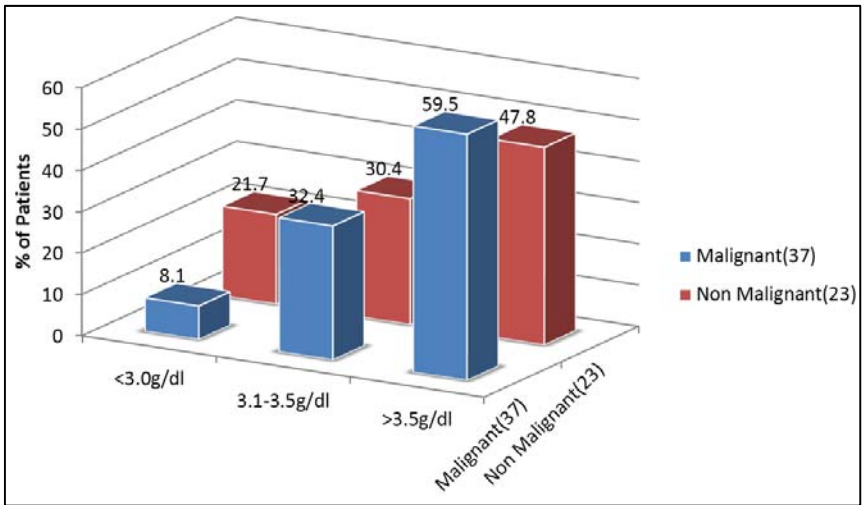
Among the 60 total patients studied 37 (61.7%) were malignant and 23 (38.3%) were non-malignant (hernias, infective and others).

Table 6: Comparison of malignant Vs non-malignant diseases with sr. albumin.

			YES	NO	
Albumin	<3	Count	3	5	8
		% Within Malignant Group	8.1%	21.7%	13.3%
	3.1-3.5	Count	12	7	19
		% Within Malignant Group	32.4%	30.4%	31.7%
	>3.6	Count	22	11	33
		% Within Malignant Group	59.5%	47.8%	55.0%
Total		Count	37	23	60
		% Within Malignant Group	100.0%	100.0%	100.0%

X^2= 2.343; P = 0.310 NS

A comparison was done between the malignant and nonmalignant (hernias, infective and others) diseases with sr. albumin. It was found that among the 37 malginat patients 8.1 % (3) were malignant with alb <3.0g/dl, and albumin between 3.1-3.5g/dl 32.4%. Among the 60 patients with non-malignant diseases (23), which 5(22%) were <3.0g/dl; 7(30%) patients between 3.1-3.5g/dl and 11 (43%) patients > 3.5g/dl.



Graph 8: Comparision of Sr. Albumin in Malignant (M) and Non Malignant (Nm) Patients.

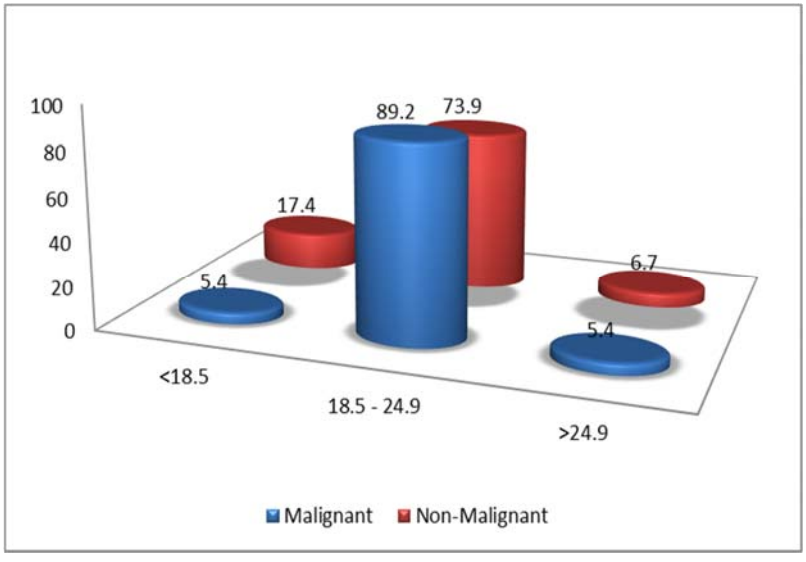
X-axis shows sr. albumin levels, and y-axis shows percentage of complications and no complications in both malignant and nonmalignant diseases. The graph shows comparison of complication and no complication of both malignant (M) and nonmalignant (NM) diseases at various levels of sr. albumin. The values are statistically significant only for malignant diseases.

Table 8: Comparison of malignant Vs non-malignant diseases with BMI.

			Malignant Group		Total
			Yes	No	
Bmi Group	16.5-18.5	Count	2	4	6
		% Within Malignant Group	5.4%	17.4%	10.0%
	18.6-24.9	Count	33	17	50
		% Within Malignant Group	89.2%	73.9%	83.3%
	25-29.9	Count	2	2	4
		% Within Malignant Group	5.4%	8.7%	6.7%
Total		Count	37	23	60
		% Within Malignant Group	100.0%	100.0%	100.0%

X^2= 2.665; P = 0.264 NS

A comparison was done between the malignant and non-malignant (hernias, infective and others) diseases with BMI. Among the malignant patients 2(5.4%) were with< 18.5 BMI and 33(11%) were between 18.5-24.9. Among the non-malignant patients 4(15.6%) were <18.5 and 17(34.3%) were between18.5-24.9. The values are not statistically significant.



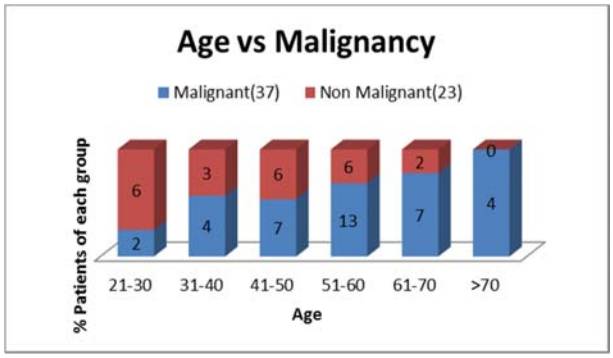
Graph 10: Comparision of BMI in Malignant

X-axis shows BMI levels, and y-axis shows percentage of complications and no complications in both malignant and nonmalignant diseases. The values are not statistically significant.

Table 9: Comparison of malignant Vs non-malignant diseases with Age.

			YES	NO	
Age Group	21-30	Count	2	6	8
		% Within Malignant Group	5.4%	26.1%	13.3%
	31-40	Count	4	3	7
		% Within Malignant Group	10.8%	13.0%	11.7%
	41-50	Count	7	6	13
		% Within Malignant Group	18.9%	26.1%	21.7%
	51-60	Count	13	6	19
		% Within Malignant Group	35.1%	26.1%	31.7%
	61-70	Count	7	2	9
		% Within Malignant Group	18.9%	8.7%	15.0%
	>70	Count	4	0	4
		% Within Malignant Group	10.8%	0.0%	6.7%
Total		Count	37	23	60
		% Within Malignant Group	100.0%	100.0%	100.0%

X^2= 8.788; P = 0.118 NS



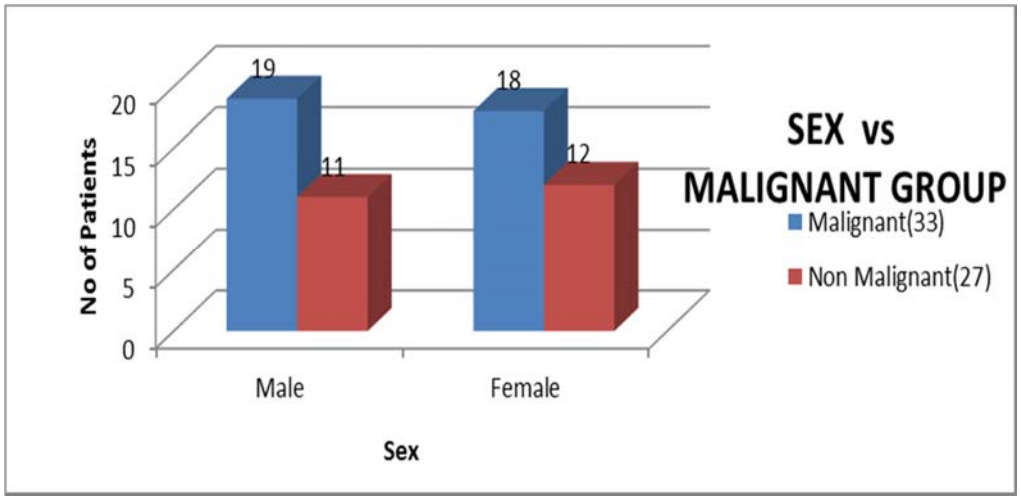
Graph 10: Comparision of Age in Malignant and Non Malignant Patients.

Of the 60 patients, the age varied from 20-75 yrs for age distribution and Malignance. The number of patients in the 51 – 60 years group was the highest (35.10%). And the highest no of malignant patients were noted in the age group of 51-60 years (31.70%).

Table 10: Comparison of malignant Vs non-malignant diseases with Sex.

			YES	NO	
Sex	Female	Count	19	11	30
		% Within Malignant Group	51.4%	47.8%	50.0%
	MALE	Count	18	12	30
		% Within Malignant Group	48.6%	52.2%	50.0%
Total		Count	37	23	60
		% Within Malignant Group	100.0%	100.0%	100.0%

X^2= 0.071; P = 0.791NS



Graph 11: Comparision of Age in Malignant and Non Malignant Patients.

Above chart represents 51.4% of females in the study are under malignant group with issues and 48.6% of the males are malignant.

Discussion

Preoperative serum albumin level has been well documented to have significant association with postoperative infectious and wound healing complications for a wide variety of surgical settings.

A variety of nutritional indices have been found to be valuable in predicting patient outcome. In one study preoperative serum albumin level and BMI were used for nutritional assessment.

Serum albumin level less than 3 g/dl was associated with increased post-operative morbidity and mortality according to studies done by Leite *et al.*, Golub *et al.*, Brown *et al.* and Mullen *et al*.

Gibbs *et al*. observed that a decrease in Serum Albumin from concentration less than 2.1 g/dl ($p<0.001$) was associated with exponential increase in morbidity and mortality and that it was a good prognostic indicator, whereas anthropometric markers could not predict postoperative outcome.

According to Beghetto *et al.* it was concluded that serum albumin level was the strongest predictive parameter for death and hospital infection (<3.5g/dl).

According to Foley *et al*. post-operative complication rate was higher when albumin was lower than 2.5 g/dl (p<0.001)

In our study albumin <3 g/dl associated with significant post-operative morbidity similar other study mentioned above

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

Mullen *et al*. reported that in the post-operative period being underweight was associated with increased mortality and obese individuals had more wound complication

Azodi concluded that a BMI of 27.5 kg/m2 or more was associated with more post-operative complication after open appendicectomy in patients with non perforated appendicitis (p<0.001)

Table 9: Significance of serum albumin levels in predicting postoperative outcomes.

Study name	Sr. Alb 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

Present study: Serum albumin less than 3g/dl has more postoperative complications and patients with serum albumin >3.5g/dl has less postoperative complications which was statistically significant. The study concludes that as the serum albumin level increases the complication rate decreases. Considering the malignant diseases, as the sr. albumin levels increase the complication rate decreases but was not statistically significant. The same was true with the nonmalignant diseases.

Our results revealed that the condition associated with low preoperative serum albumin level was a significant risk for postoperative infectious and wound complications, as would be expected. This risk was, as with the surgica1 risk study, higher when all infectious complications were included than when wound complications alone were considered. Also, it is perhaps not surprising that ASA class was significantly related to the same outcome since other major studies obtained similar results.

A common reason involved to explain the association between serum albumin level and postoperative septic: complications is that serum albumin is a marker for circulating visceral protein, a direct measure of nutritional and immunological status. Serum albumin itself may not be one of the essential components in the wound healing process, since analbuminemic patients can have normal wound healing.

We demonstrate that increasing age, female gender, tumor stage all independently conferred additional risk of increased mortality.

Considering the BMI the present study demonstrates that though the complication rate was high in group<18.5kg/m2 it was not statistically significant. Interestingly, BMI classification did not influence major complications or mortality following case-mix adjustment. However, decreasing levels of preoperative serum albumin was inversely related to the adjusted odds of the likelihood of having an adverse outcome

Conclusion

Our study shows that sr. albumin is a good indicator of postoperative complications. An abnormal BMI was associated with more complications but was not statistically significant. Obesity and elevated body mass index have long been considered to be independent risk factors for surgical operations.

Maximum no patients were noted with sr. albumin <2.5g/dl. The complication rate was almost similar with sr. albumin range of 2.5-3.0, and 3.0-3.5g/dl. The patients with sr. albumin <3.0g/dl had a higher complication rate which was statistically significant (p<0.05). Patients with sr. albumin >3.5g/dl had less complications which was statistically significant (p<0.05). The correlation between the serum albumin and complication rate was not statistically significant in the malignant diseases when considered separately.

Thus sr. 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 increased risk of morbidity and mortality.

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