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A study on role of preoperative nutritional status on post operative outcome in general surgical patients

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Abstract
Context: Pre-operative nutritional status in patients scheduled for elective or emergency surgery by measuring the MUST score and serum albumin, has influence on the post-operative outcome and recovery.
Aims: To find the predictability of MUST and Serum albumin on hospital stay, post op complication like seroma, SSI, wound dehiscence and mortality
Settings and Design: This is a prospective and observational study conducted in Narayana medical college and hospital between January 2017 and October 2018.
Methods and Material: 100 patients were included. Pre operatively assessed for their nutritional status using MUST and serum albumin. They are categorised into low, moderate and high-risk categories in both MUST and Sr. albumin
Statistical analysis used: Chi-square test, student's t-test, Pearson's correlation
Results: Mean age group of presentation was 45.72 years. 69% were male 31% were female. Elective surgeries were 80% and emergency surgeries were 20%. Seroma developed in 33.3% of medium risk, 9.8% in low risk group. SSI developed in 23.5% of high-risk group, 5.6% in low risk group. Wound dehiscence developed in 11.7% of high-risk, 2.8% in low risk group. The mean post-operative hospital stay was 8.24 days in high risk group, 7.67 in medium risk and 7.8 in low risk group according to MUST score. Mean Post-operative hospital stay was 11.5 days in high risk 9.46 days in medium risk 7.18 days in low risk group as per serum albumin categorization.
Conclusions: MUST was reliable in predicting post-op complications and serum albumin was reliable in predicting post-op hospital stay.

Keywords: MUST score, serum albumin, post-operative complications, nutritional assessment

Introduction
Numerous screening tools have been developed to identify patients at risk of malnutrition [1] like Nutritional risk index (NRI), Subjective global assessment (SGA), Mini nutritional assessment (MNA), & Malnutrition screening tool (MST), Nutritional risk screening (NRS 2002), Malnutrition universal screening tool (MUST), and Short nutritional assessment questionnaire (SNAQ).
These tools have been divided into comprehensive or quick and easy tools. Comprehensive screening tools, like MUST and NRS 2002, are more time demanding and need a better training of nurses. On the other hand, quick and easy screening tools, like MST and SNAQ, were not developed for diagnostic purposes and do not allow following patients in time.
In our study we measured nutritional status of individual with MUST score as it is easy to calculate without difficultly and does not involve any laboratory investigations and can easily be done by medical, paramedical staff.

Malnutrition universal screening tool (MUST): It was developed in 2003 by the malnutrition advisory group of the British association for parenteral and enteral nutrition (BAPEN) [2].
According to the intention of its developers, it eases the communication of nutritional status across different care settings, since it has been validated in primary care, home care, acute care, and long-term care, which has the benefit of allowing comparable nutritional screening data across care settings.
In hospitals, MUST predict length of hospital stay, type of discharge destination, and mortality. In community care, MUST predict rate of hospital admissions and general practitioner visits.
MUST uses unintentional weight loss, BMI, disease severity, and problems with food intake to classify malnutrition risk. A score ≥2 indicates malnutrition risk.

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As the serum albumin level increases complication rate decreases [3]. A serum albumin level >3.5 gm/dl suggests adequate protein stores and it confers protective effect through several biological mechanisms.

It predicts peri-operative morbidity and mortality [4]. Patients with low albumin had more number of complications as compared to patients with normal levels.

Thus, in the present study we tried to see the relation between pre operative nutritional status in patients scheduled for elective or emergency surgery by measuring the MUST score and serum albumin, on the post operative outcome and recovery by studying the rate of occurrence of complications and duration of hospital stay under each parameter.

Aims and objectives of the study
To find the predictability of MUST and Serum albumin on
- The length of hospital stay.
- Post operative wound complication like seroma formation, surgical site infection, wound dehiscence and
- Post-operative mortality

Methodology
This is a prospective and observational study conducted in Narayana medical college and hospital between January 2017 and October 2018.

Source of data collection: The study group comprises of 100 patients admitted in Narayana Medical College and Hospital, Nellore, scheduled for surgery in the department of general surgery.

Inclusion criteria
- Patients aged between 15-75 years.
- Patients scheduled for surgeries under the department of general surgery
- Both elective and emergency surgeries were included.
- Patients who have given consent to be part of this study.

Exclusion Criteria
- Patients who have refused to be part of the study.
- Age of the patient <15 years and >75years.
- Patients with chronic liver disease.
- Patients who are pregnant.
- Patients who had recent blood or blood component transfusions or albumin transfusion.

Institute Ethical Committee clearance has been taken before starting the study**.**

Methodology
Every patient admitted in Narayana medical college and hospital under the department of general surgery, who are scheduled for surgical procedures, are pre operatively assessed for their nutritional status using MUST and serum albumin.
Patients whose height and weight cannot be assessed preoperatively; their indirect BMI is calculated based on mid arm circumference using standard nutritional charts.
Based on their pre operative nutritional assessment they are categorised into low, moderate and high-risk categories in both MUST and Sr. albumin.

MUST comprise 3 parameters
- Un-intentional pre-operative weight loss in the past 3-6 months.

- Acute illness leading to no nutrition for > 5days in peri operative period and
- BMI

Step 1
BMI kg/m^2 Score
>20	0
18.5 - 20	1
<18.5	2

BMI score
Patients height, weight were measured and BMI was calculated. Based on the values grade 0, 1, 2 was assigned.

Step 2
Unplanned Weight loss score: Percentage of weight loss in the past 6months
< 5%	0
5 – 10%	1
> 10%	2

In the study cases were not having any significant weight loss in the past 6 months and few had < 5% of weight loss and hence everyone had a score of 0 in this step.

Step 3
Acute disease effect score: If patient is acutely ill and there has been or is likely to be no nutritional intake for >5 days in the perioperative period. Score 2 is given.
In our study cases posted for ileostomy, colostomy closure, hallow viscus perforation, sigmoid volvulus were kept on nill by mouth for around 5- 6 days and a score of 2 was given for all such cases. Cases of appendicular perforation were kept on nil by mouth for 1-2 days. And the remaining cases orals were allowed in the evening on the day of surgery.

Step 4
Overall risk of malnutrition. Add Scores together to calculate overall risk of malnutrition.
Score 0	-	Low Risk
Score 1	-	Moderate Risk
Score 2 or more	-	High Risk

In the last step for calculating MUST score all the above three step scores are added and final cumulative score was calculated. Patients were categorised in to three risk groups low, moderate and high risk based on the scores.
On admission and before scheduled for surgery patients blood was taken to know serum total proteins and serum albumin levels. From the values obtained patients were categorized in to three risk groups low, moderate, high risk based on the serum albumin levels, as seen with MUST scores.

Step 5: Serum albumin levels (g/dl)
>3.5 (g/dl)	-	Low risk
2.8-3.5(g/dl)	-	Moderate risk
<2.8 (g/dl)	-	High risk

The course of the patients in the hospital was recorded. Complications encountered, duration of hospital stay and outcomes like mortality or morbidity were recorded with respect to their risk grades of MUST and serum albumin levels and the results were analyzed.

Observations & Results

Table 1: Age Distribution among study population

Age in years	No of cases	Percentage
15-20	5	5
21-30	13	13
31-40	22	22
41-50	27	27
51-60	15	15
>61	18	18

Mean age group of presentation was 45.72 years. 69 were male 31 were female accounting for 69 percent and 31 percent respectively. 80 underwent elective procedures while 20 patients had undergone an emergency surgery.

Table 2: Distribution of cases among study population

Diagnosis	No of cases	Percentage
Hernia	44	44
Cholelithiasis	6	6
Varicose veins	15	15
MNG	6	6
Stoma revision	3	3
Intestinal obstruction	1	1
Appendicitis	8	8
Limb pathology	5	5
Peritonitis	3	3
Others	9	9

Table 3: Distribution of cases based on BMI among study population

BMI in kg/m²	No of cases	Percentage
<18.5	13	13
18.5- 24.9	56	56
25-29.9	21	21
30-34.9	7	7
35- 39.9	1	1
>40	2	2

Table 4: Post operative Complications among study population

Complications	No of cases	Percentage
Seroma	12	50
Surgical Site Infections	8	33
Wound dehiscence	4	17

Table 5: MUST score among study population

MUST score	No of cases	Percentage
Low Risk – 0	71	71
Medium Risk – 1	12	12
High Risk – 2	17	17

Table 6: Division of study population based on Serum Albumin Levels

Albumin levels	No of cases	Percentage
Low Risk – >3.5g/dl	72	72
Medium Risk – 2.8 – 3.5g/dl	26	26
High Risk < 2.8 g/dl	2	2

Table 7: Complications in relation to timing of surgery

Timing of surgery	No of cases	Seroma	SSI	Wound dehiscence/ wound gaping	Total
Elective	80	10 (12.5%)	4 (5%)	2 (2.5%)	16 (20%)
Emergency	20	2 (10%)	4 (20%)	2 (10%)	8 (40%)

Table 8: Complications with respect to BMI

BMI in kg/m²	Seroma	SSI	WD	Total
<18.5	0	3(23.1%)	2(15.4%)	5 (38.6%)
18.5- 24.9	9(16%)	2(3.6%)	0	11 (19.6%)
25 – 29.9	2(9.5%)	0	0	2(9.5%)
>30	1 (74.5%)	3 (73.3%)	2 (84.6%)	6 (60%)

Table 9: Complications in relation to Serum Albumin levels

Complications		Seroma	SSI	Wound Dehiscence	Total
Serum Albumin Levels	Low Risk	8(11.1%)	3(4.16%)	2(2.7%)	13(18%)
	Medium Risk	4(15.4%)	4(15.4%)	1(3.8%)	9(34.6%)
	High Risk	0	1(50%)	1(50%)	2(100%)

Chi-Square Value = 3.825, P Value = 0.430 (Not Sig.)

Table 10: Complications in relation to MUST levels

Complications		Seroma	SSI	Wound Dehiscence	Total
MUST score	Low Risk	7(9.8%)	4(5.6%)	2(2.8%)	13(18.3%)
	Medium Risk	4(33.3%)	0	0	4(33.3%)
	High Risk	1(5.9%)	4(23.5%)	2(11.7%)	7(41.17%)

Chi-Square Value = 10.33, P Value = 0.035 (Sig.)

Table 11: Post-operative Hospital stay along with MUST score and serum albumin levels

MUST score	Post-operative Hospital stay in days	Mean	SD	t-Value	P Value
	Low Risk (n=71)	7.8	4.82	0.076	0.926 (Not Sig.)
	Medium Risk (n=12)	7.67	3.02		
	High Risk (n=17)	8.24	4.12		
Serum Albumin Levels	Low Risk (n=72)	7.18	4.51	3.27	0.042 (Sig.)
	Medium Risk (n=26)	9.46	4.03		
	High Risk (n=2)	11.5	4.95		

Table 12: Seroma in MUST group and Serum Albumin group

Seroma	Serum Albumin		
MUST	Low risk	Medium risk	Total
Low risk	4	3	7
Medium risk	3	1	4
High risk	1	0	1
Total	8	4	12

Chi-Square Value = 0.911, P Value = 0.634 (Not Sig.)

Table 13: SSI in MUST group and Serum Albumin group

SSI	Serum Albumin			
MUST	Low risk	Medium risk	High risk	Total
Low risk	2	1	1	4
High risk	1	3	0	4
Total	3	4	1	8

Chi-Square Value = 2.33, P Value = 0.311 (Not Sig.)

Table 14: Wound Dehiscence in MUST group and Serum Albumin group

WD/WG	Serum Albumin			
MUST	Low risk	Medium risk	High risk	Total
Low risk	2	0	0	2
High risk	0	1	1	2
Total	2	1	1	4

Chi-Square Value = 4.00, P Value = 0.135 (Not Sig.)

Discussion

This is a prospective observational study done on cases scheduled for surgery in the department of general surgery in Narayana Medical College. In this study we included MUST scoring and serum albumin as tools of nutritional assessment.

MUST is a comprehensive screening tool that can be related to clinical outcome like seroma, SSI, wound dehiscence/ wound gaping and thus the hospital stay. Thus, it has prognostic value in screening for nutrition in at risk patients, undergoing surgery.

If the patient is defined as nutritional high risk according to MUST they have higher incidence of developing complications post operatively. Furthermore, moderate risk group has similar increased risk compared to low risk group.

Though higher risk group of malnutrition according to MUST have longer length of postoperative hospital stay compared to moderate and low risk group it did not reach statistical significance. Thus, in the present study MUST is not able to predict post operative length of hospital stay.

While nutritional risk is not the only factor responsible for the development of post operative complications, nutritional screening tools like MUST and serum albumin can be used to predict risk of development of post operative complications and length of hospital stay respectively.

Sex distribution comparison

In this study males comprised of 69% and 31% females. In the study done by Peri chum chao *et al*. [5] on MUST and a nutritional education programe for high risk cancer patients which comprised of 74.5% males and 25.5% females.

A study conducted by Vikrant M Bhagavat *et al*. [6] on role of serum albumin and BMI as predictors of post operative morbidity and mortality in major abdominal surgeries comprised of 54% males and 46% females.

A study conducted by Xuanhui Liu *et al*. [7] on role of pre-operative hypoalbuminemia association with an increased risk of intra abdominal septic complications after anastomosis in crohn's patients comprised of 79% males and 21% females.

Age comparison

The mean age group in this study group is 45.7 years. The highest percentage of patients were in the age group 41-50 years comprising of 27% compared to study conducted by Vikrant M Bhagavat *et al*. [6] on role of serum albumin and BMI as predictors of post operative morbidity and mortality in major abdominal surgeries where the highest percentage of patients were in the age group 51-60 comprising of 35%.

Serum albumin comparison

In this study group of 100 patients percentage of patients >3.5 gm/dl is 72% and 26% patients had serum albumin levels of 3.5 - 2.8gm/dl and 2% patients with <2.8gm/dl compared to 38% with >3.5 gm/dl and 62% with serum albumin <3.5 gm/dl

In a study conducted by Vikrant M Bhagavat *et al*. [6] on role of serum albumin and BMI as predictors of post operative morbidity and mortality in major abdominal surgeries.

In study conducted by Amir Akirov *et al*. [8] 65% patients had serum albumin level >3.5gm/dl, 29% patients had serum albumin level in between 2.5 -3.5 gm/dl and 5% patients with serum albumin level 2.5gm/dl and below.

In a study conducted by Peri Chun Chao *et al*. [5] 44.14% patients had serum albumin level > 3.5gm/dl, 34.46% patients had serum albumin level in between 2.8 -3.5 gm/dl and 21.30% patients with serum albumin level less than 2.8gm/dl.

In a study conducted by Adam Truong *et al*. [9] on hypoalbuminemia in colorectal surgeries 73.7% patients had serum albumin level >3gm/dl, 26.3% patients had serum albumin level in between<3 gm/dl.

BMI comparison

In the present study group 13% patients had BMI <18.5 kg/m^2, 56% with BMI between 18.5 -24.9 kg/m^2, 21% with BMI between 25 -29.9 kg/m^2 and 10% with BMI > 30 and above. In a study conducted by Peri Chun Chao *et al*. [5] 57.88% patients had BMI <18.5 kg/m^2, 8.55% with BMI between 18.5 -20 kg/m^2, 33.5% with BMI > 20 and above.

In a study conducted by Vikrant M Bhagavat *et al*. [6] on role of serum albumin and BMI as predictors of post operative morbidity and mortality in major abdominal surgeries 20% patients had BMI <18.5 kg/m^2, 76% with BMI between 18.5-25 kg/m^2 and 4% with BMI > 25 and above.

Overall complications and serum albumin

In this study there are a total of 24 complication events which comprise of 12 cases of seroma formation, 8 SSI and 4 had wound dehiscence / wound gaping.

13 cases of complication events accounting for 18% in low risk (serum albumin <3.5gm/dl) compared to 9 complication events in medium risk group (serum albumin 2.8-3.5gm/dl) accounting for 34.6% and 2 adverse complications post operatively in high risk group (serum albumin < 2.8) accounting for 100%.

In a study conducted by Adam Truong *et al*. [9] on hypoalbuminemia in colorectal surgeries 80% patients with deep wound infections had low serum albumin level <3 gm/dl (*p*<0.004), 46.4% having superficial infection had low serum albumin (*p*<0.001) and 83.03% having organ space infection had low serum albumin level (*p*<0.397).

In a study conducted by James Gibbs *et al*. [10] on hypoalbuminemia as a predictor of operative morbidity and mortality shown a systemic sepsis of 8% in high risk group (serum albumin <3.5gm/dl) compared to 1.3% in low risk group (serum albumin >3.5gm/dl), deep wound infection of 5.9% in high risk group compared to 2% in low risk group, superficial wound infection of 4.4% and 2.4% in high and low risk groups respectively, wound dehiscence of 2% and 0.8% in high and low risk group respectively.

In a study conducted by Vikrant M Bhagavat *et al*. [6] on role of serum albumin and BMI as predictors of post operative morbidity and mortality in major abdominal surgeries shown a 31% cases of wound infection 3% cases having wound gaping and 2% cases with mortality. 40% of cases who had complications had mean serum albumin of 2.98 gm/dl and 60% patients who had no complications had a mean serum albumin of 3.5gm/dl.

An analysis of preoperative albumin and major post operative complications in 2003 by Kudsk *et al*. [11] identified clinical hypoalbuminemia as an independent determinant of hospital stay, serious postoperative complications (albumin < 4.25 gm/dL), and mortality (albumin < 3.25 gm/dL)

Complications & MUST score

In this study there are a total of 24 complication events which comprise of 12 cases of seroma formation 8 SSI and 4 had wound dehiscence / wound gaping.

13 cases of complications accounting for 18.3% in low risk group, n=71 (MUST 0) compared to 4 complication events in medium risk group, n=12 (MUST 1) accounting for 33.3% and 7 complications post operatively in high risk group, n=17(MUST 2) accounting for 41.17%.

In a retrospective study conducted by Keerthi AR *et al*. [12] on pre operative nutrition screening as a predictor of post operative mortality in children undergoing major surgeries using modified MUST, MUST-1 had 6.3 times more risk of postoperative

complications with a p value of 0.002 and an odds ratio of 6.375, while children with MUST-2 or more had 16 times more risk of postoperative complications with a p value of 0.001 and an odds ratio of 16.056.

Among the 31 patients with postoperative complications, 24 (77.4%) developed surgical site infection (SSI) of which 12 belonged to MUST-2

The study conducted by Sarah Henderson [13] comparing MUST vs BNR has 51%, 14%, and 35% in low risk, moderate risk and high risk group.

Post operative stay

In this study the length of post operative stay as per serum albumin is 7.18, 9.46, 11.5 days in low, medium and high risk groups respectively.

In this study the length of post operative stay as per MUST is 7.8, 7.66, 8.23 days in low, medium and high risk groups respectively.

This in comparison to Garth *et al*. [14] study which has shown that pre operative serum albumin level was linear and inversely related to length of hospital stay (*p*<0.01). Median length of hospital stay after surgery was 2 days longer in serum albumin 3 - 3.4 gm/dl compared to serum albumin >3.4 gm/dl group.

In a study conducted by Moghademyeghaneh *et al*. [15] in 108898 patients showed that hospital stay was 2 days longer even with moderate hypoalbunemia 3 - 3.4 gm/dl compared to >3.4 gm/dl group (*P*<0.01).

Two studies published in 2010 evaluated the association between albumin level and length of hospital stay.

Using a cohort of 95 patients admitted for either upper GI surgery or colorectal surgery over a 19-months period in Australia, Garth *et al*. [16] showed that preoperative albumin level was linear and inversely related to the length of hospital stay (R = -0.325; *P*<0.01).

Hennessey *et al*. [17] showed that an albumin level < 3.0 g/dL was associated with prolonged inpatient stay with a negative linear relationship (19.5 d vs 12 d; *P*<0.001; R2 = -0.319; *P*<0.001). A study from Thailand showed that an albumin level < 3.5 gm/dL increased the length of hospital stay from 6.8 ± 2.6 to 9.6 ± 4.7 d (P = 0.001)[72]

Mortality

In this prospective study group there was no mortality in any risk group.

In a study conducted by Amir Akirov *et al*. [8] had in hospital mortality of 0.3% patients in serum albumin level >3.5gm/dl, 12% patients in serum albumin level in between 2.5 -3.5 gm/dl and 33% patients with serum albumin level 2.5gm/dl and below. The overall follow-up mortality was 29%, 67%, 83% respectively.

In a study conducted by Adam Truong *et al*. [9] on hypoalbuminemia in colorectal surgeries 26% mortality in serum albumin < 2 gm/dl group, 6% mortality in serum albumin level < 3 gm/dl group compared to 1.7% in serum albumin > 3.5gm/dl group.

In a study conducted by Vikrant M Bhagavat *et al*. [6] on role of serum albumin and BMI as predictors of post operative morbidity and mortality in major abdominal surgeries mortality was noted in 2 patients.

The study conducted by Sarah Henderson [13] comparing MUST vs BNR concluded that mortality was best predicted with MUST compare to BNR.

In a study conducted by Dr R Subburathanam *et al*. [18] on pre operative serum albumin and BMI as predictors of morbidity

and mortality in elective major surgeries has shown a mortality of 1% in serum albumin group >3.5gm/dl compared to 28% for serum albumin group < 2.5gm/dl.

Moghadamyeghaneh *et al*. [15] emphasized the effect of modest hypoalbuminemia as defined by serum albumin levels between 3.0 and 3.4 g/dL. The mortality rate in patients with modest hypoalbuminemia and without hypoalbuminemia was 6% and 1.7% respectively

Conclusion

Good nutrition plays a positive and constructive role on the post operative outcome of patients undergoing surgery. Malnutrition is associated with immune dysfunction, anaemia; poor wound healing, and delayed recovering from surgery, higher morbidity and mortality. So Nutritional screening should be universal and mandatory for patients admitted to the hospital.

To assess nutrition several surrogate markers are used. However, it is not possible to establish a direct relationship between a determined marker and nutritional status. Numerous screening tools have been developed to identify patients at risk of malnutrition.

One among them is MUST score. It eases the communication of nutritional status across different care settings, since it has been validated in primary care, home care, acute care, and long-term care, which has the benefit of allowing comparable nutritional screening data across care settings.

However, it has been recently criticised because chronic conditions were not classified according to severity thereby leading to an overestimation of high nutritional risk and underestimation of those at intermediate nutritional risk.

Despite these flaws, the major advantages of the MUST tool are that it has been shown to have content and face validity, internal consistency and predictive validity.

Albumin also is a consistent marker of nutritional status and hypoalbuminemia significantly influences the length of hospital stay and complication rates.

In our study we noted that MUST was reliable in predicting post operative complications and serum albumin was reliable in predicting post operative hospital stay with statistical significance.

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