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NUTRITIONAL ASSESSMENT IN CRITICALLY ILL SURGICAL PATIENTS

General Surgery

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ABSTRACT

BACKGROUND AND OBJECTIVES: Nutritional assessment of the critically ill is an accepted principle in managing patients in the surgical intensive care units. Although various procedures are available to assess the nutritional requirements of the individual patients, there is no set protocol available to determine or predict the nutritional support of critically ill patients. This study addresses this issue of nutritional assessment in the critically ill patients.

METHODS: A prospective cohort study including patients who were admitted to the surgical intensive care unit. Nutritional assessment done for these patients using Subjective Global Assessment and anthropometry and those who received nutritional support were compared with those who have not received nutritional support.

RESULTS: Subjective Global Assessment is a more reliable as compared to Anthropometry in assessing nutritional support of critically ill surgical patients. Malnourished patients who received nutritional support have a better outcome as compared to those who did not with a trend towards normalization of biochemical parameters (Serum albumin).

CONCLUSION: Nutritional assessment is important especially in the critically ill patient. Sensitivity to nutritional risk on the part of the surgeon may lead to identification of patients at risk for developing nutrition related morbidity and mortality. Using tools patient can be identified who would benefit from nutritional assessment. It is also evident that moderate to severely malnourished patients are more likely to benefit from nutritional support.

KEYWORDS

Nutrition, Nutritional assessment, Critically ill patients, Subjective Global Assessment, anthropometry, nutritional support.

INTRODUCTION

Malnutrition is a common entity seen in hospitalized patients which is largely unrecognized and untreated. To combat the state of malnutrition in critically ill patients, measures to identify the malnourished patients on admission and measures to provide prompt nutritional support is required to prevent or minimize development of malnutrition in hospital (Error! Bookmark not defined., 2). In critically ill patients nutritional support is important because depleted lean body mass is associated with a poor outcome and further impaired organ function and these patients also tend to lose approx 5-10% of skeletal muscle mass per week during their stay (3,4). There is also an increased incidence of nosocomial infections, longer hospital stay and increased mortality in patients with significant unintentional weight loss (>10%) prior to their illness. Nutritional assessment is a comprehensive approach to define nutritional status that uses nutritional history, physical examination, anthropometric measurements, laboratory data and professional judgment. The ideal set of nutritional assessment that correlates with patient outcomes has not been identified.

AIM

- To record baseline nutritional state of critically ill surgical patient and to assess correlation of Subjective Global Assessment (SGA) with other parameters of nutritional assessment.
- Prediction of survival using severity of illness scoring system (APACHE II)
- To monitor the outcome of peri-operative nutritional support in critically ill surgical patients.

Study Design and Settings

The study is a prospective cohort study done at an Armed Forces Tertiary Care Hospital. The study population consists of 100 consequent critically ill patients admitted in acute surgical wards. Nutritional assessment was done and correlation of SGA and other parameters were assessed. Nutritional supplementation was provided to a minimum of 1000 kcal and minimum of 05 days. The nutritional supplementation included Enteral nutrition/ Parenteral nutrition with strict glycemic control or combination of both, tailored as per patient need and clinical scenario. Outcome measured included morbidity, mortality and length of ICU stay. The control group for the study comprised of critically ill patients assessed as mild or moderately malnourished not getting admitted as inpatient for any reasons and kept on regular follow up and admitted prior to surgery or getting admitted in other unit of same hospitals

Inclusion criteria : All critically ill surgical patients requiring admission in acute surgical ward or ICU

Exclusion criteria : Children or patients below the age of 13 years. Patient discharged or transferred out of ICU before 5 days and patients who didn't give consent

Collection of data

1. Collection of basic data was done.
2. Questionnaire survey of illness, nutritional intake, co morbid conditions, socioeconomic status of the study population (subjective global assessment). Done at the time of ICU admission.
3. Serial nutritional assessment done at Day 1 and beyond Day 5 or a day prior to surgery of admission using following parameters.

a. Clinically by recording Body Mass Index
b. Biochemical parameters like albumin and transferrin
c. Estimation of severity of illness scoring system (APACHEII) in case of trauma, injury severity scoring
d. Estimation of daily calorie needs by Harris Benedict equation

Results

Table 1 : Age distribution of the patients

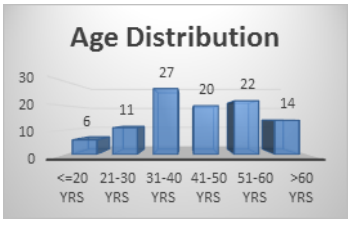


Table 2 : Gender distribution

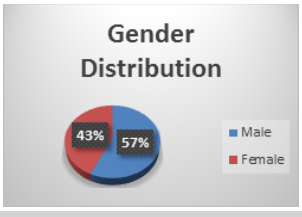


Table 3 : Frequency distribution of diagnosis

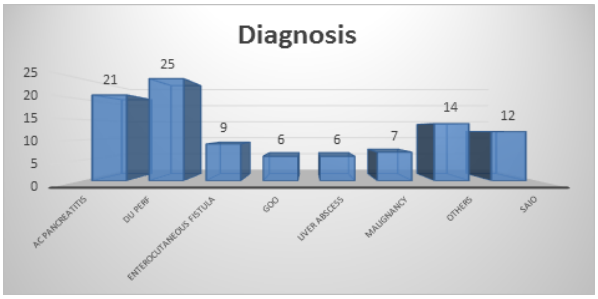


Table 4 : Frequency of duration of stay

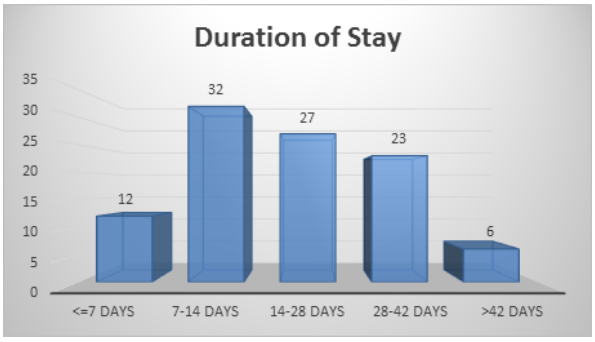
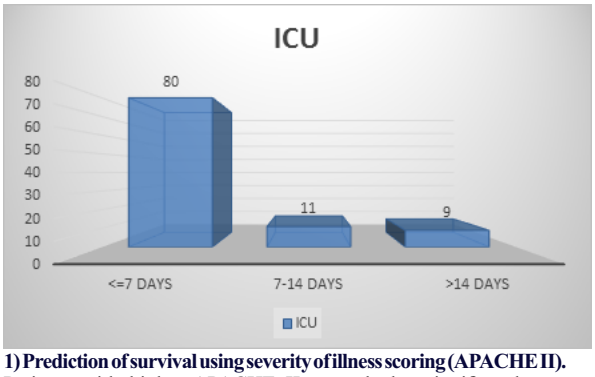


Table 5 : Frequency of duration of ICU stay



1) Prediction of survival using severity of illness scoring (APACHE II).
Patients with higher APACHE II score had a significantly worse outcome when compared to those with lower score. Patients with APACHE II score >15 are 32.2 times more likely to have a worse prognosis as compared to patients with score of <15 (p= 0.001). This compares well with study done by Edwards et al (5) who reported 100% mortality in patients with APACHE II score of >22. Similarly Borlase et al (6) reported 50% mortality in patients with score >18 and 100% mortality in patients with a score >24.

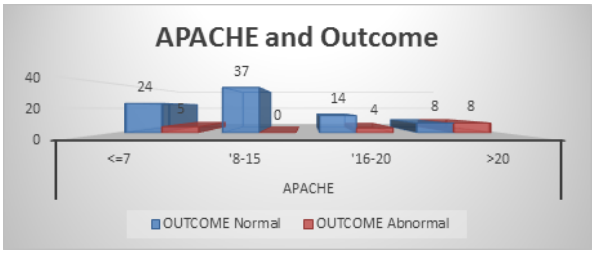


Table 6 : APACHE score and outcome

2) Record of base-line nutritional state of critically ill surgical patients:
This was done using SGA, BMI, MAC and Serum Albumin levels.

Using SGA, 22.2% of the patients were of normal nutritional status, 27.8% were moderately malnourished and 50% were severely malnourished at presentation. When this was compared to Serum Albumin, levels it was found that patients with normal SGA rating are significantly associated with normal albumin values (p<0.05), patients with moderate malnutrition had a higher incidence of hypoalbuminemia, while those with severe malnutrition had significantly increased hypoalbuminemia (p<0.05)**(Table 7)**. On comparing SGA with BMI, it was found that only 30.5% of the total patients had similar ratings by both assessment tools. Around 64% of the total patients rated by SGA as moderate to severe malnutrition were significantly under rated by BMI, and 5.6% were over rated. **(Table 8)**.

On comparing SGA with MAC, it was found that around 64% of the total patients were similarly rated by both the assessments while 36% of patients rated as malnourished by SGA were significantly (p<0.05) underrated by MAC. **(Table 9)**.

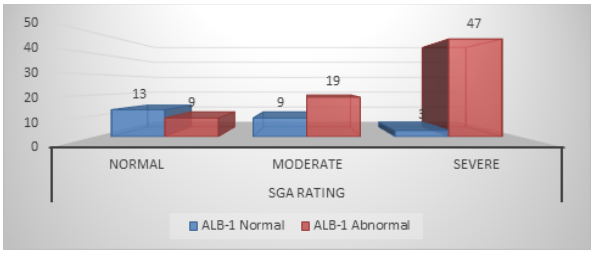


Table 7 : Association of SGA with Serum Albumin

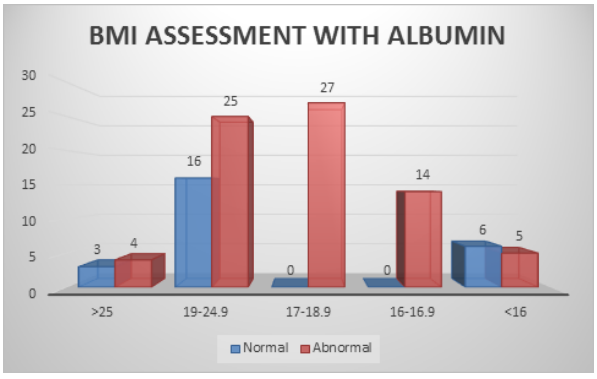


Table 8 : Association of BMI with Serum Albumin

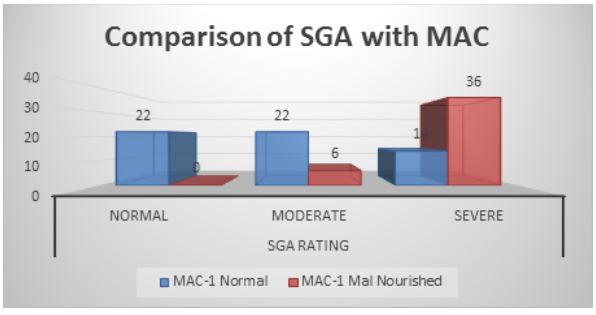


Table 9 : Association of SGA with MAC

Association of BMI with serum albumin.
As per Table 7, BMI assessment of nutritional status does not statistically correlate with serum albumin.

Association of MAC with serum albumin :
Patients rated as malnourished by MAC have increased proportion of hypo albuminemia (p= 0.252 and odds ratio =3.25) indicating that malnourished patients as per MAC are 3.25 times more likely to have low S. Albumin.

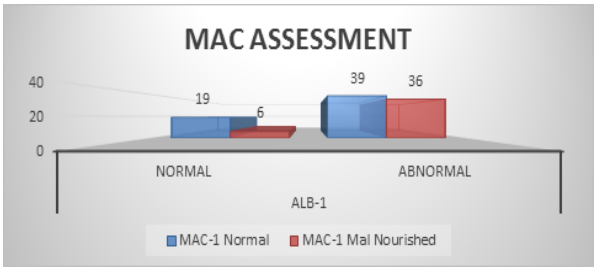


Table 10 : Association of MAC with serum albumin

Comparison of all the nutrition assessment tools with serum albumin (Table 11) showed that SGA has significant diagnostic value in assessing nutritional status when compared to BMI and MAC as for the diagnostic statistics and Kappa agreement coefficient. The second best was BMI while MAC has the least diagnostic values.

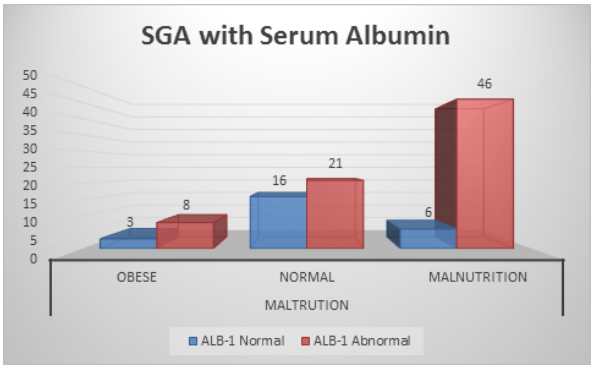


Table 11 comparison of SGA with Serum albumin

3. Outcome of providing nutritional support to the critically ill surgical patients:

Assessment of patients by SGA and comparing it with the outcome (**Table 12)** it was found that patients with severe malnourishment are 4 times more likely to have a bad outcome (Odds ratio of 4.0). On assessing the outcome of patients who received nutritional support and those who did not **(Table 13)** it was found that patients rated as moderate to severely malnourished by the SGA and who did not receive nutritional support had 3 times more bad outcome when compared to those who received nutritional support.

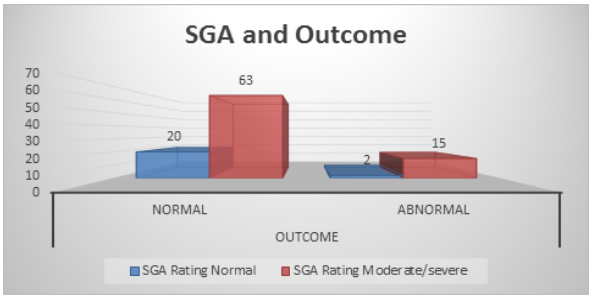


Table 12 : Assessment of SGA and outcome of patient

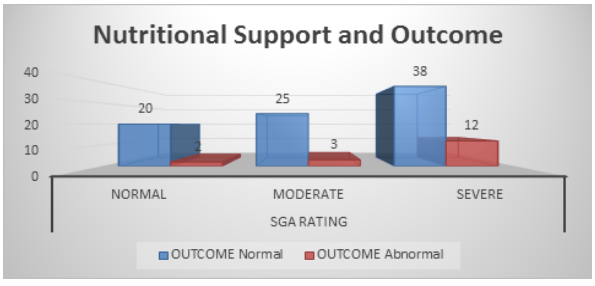


Table 13: Outcome of the patient who received nutritional support

Effect of providing Nutritional support on the parameters used for nutritional assessment

It was found that albumin levels significantly increased in patients with nutritional support with moderate Cohen's D effect= 0.61. The C-reactive protein levels also reduced considerably in patients with nutritional support. At the same time in patients who did not receive nutritional support there was a significant deterioration in the albumin. BMI, and MAC values with no change in C-reactive protein values. This shows that the anthropometric assessments are not reliable in assessing short term nutritional changes.

Discussion

Nutritional assessment

Nutritional assessment is a comprehensive approach to define nutritional status that uses nutritional history, physical examination, anthropometric measurements, laboratory data and professional judgment. The nutritional status is influenced by adequacy of food intake and by the physical health of the individual. A comprehensive nutritional assessment would include evaluation of the patients eating habits, dietary restrictions, weight changes and any influences on nutrient intake or absorption, physical assessment for body composition, fluid status and signs and symptoms of nutritional deficiencies, biochemical tests and analysis of body composition, grip strength and delayed cutaneous hypersensitivity. However many of these measurements are not reliable or practical after surgery. The ideal set of variables for nutritional assessment that may correlate with the patient outcomes has not been identified. The ones commonly used are enumerated below.

1. Clinical examination look for signs of muscle and fat wasting, poor wound healing, poor skin integrity and signs of nutrient deficiency
2. Anthropometry measurements such as Height, Weight, skin fold thickness and arm circumference (mid arm circumference, skin fold thickness- biceps, triceps, subscapular and suprailiac). Body mass index, Ponderal index, Broca's index, Lorentz formula and Corpulence index
3. Biochemical evaluation plasma proteins – Albumin, C reactive protein, transferrin, prothrombin time
4. Subjective Global Assessment (SGA) refers to overall evaluation of a patient by an experienced clinician that correlates the subjective and objective aspects of a medical history and physical examination. After evaluation patient will be classified as well nourished, mild to moderately malnourished and severely malnourished

1. **Clinical examination** : Clinicians should look for signs of muscle and fat wasting, poor wound healing, poor skin integrity, and other signs of deficiencies as objective data suggesting malnutrition. However clinical signs have drawbacks as there is lack of specificity.
2. **Anthropometry** : Anthropometry quantifies body mass, provides a semi quantitative estimate of the components of body mass, particularly the bone, muscle, and fat compartments and gives information concerning nutritional status. Anthropometric monitoring of the same patient longitudinally may provide valuable information concerning changes in nutritional status for that individual.(7-14)

I) Height / weight indices :

a) Body mass index (Quetlet's index) = weight in kg / height^2 (in meters)
b) Ponderal index = height (in cm) / cube root of weight (in kg)
c) Broca's indexIdeal body weight = height in cm – 100 kgs
d) Lorentz formula

Ideal body weight = height (cm) – 100 - height(cm) -150/2(women) or 4(men)

e) Corpulence index = actual index/desirable weight. This should not exceed 1.2.

Of these the Body mass index and Broca's index are widely used. But here again only an individual's height and weight are used and no indication of actual lean or fat mass can be determined.

ii) Skin fold measurements : Measurements may be taken at four sites: triceps, biceps, subscapular, and iliac crest. Measuring skinfold thickness may be considered a semi quantitative measure of the amount or rate of change in total body fat. (7-14)

Anthropometric measures of skeletal muscle mass are an indirect assessment of muscle protein. Approximately 60% of total body protein is located in skeletal muscle--the body's primary source of amino acids in response to poor nutritional intake. Estimates of muscle mass in an individual, for comparison with a reference population, is made by measuring the arm at the midpoint from the acromion to the olecranon. From measurements of both the mid-arm circumference (MAC) and the triceps skinfold (TSF), a calculated estimate of the mid-arm muscle circumference (MAMC) (that includes the bone) can be made using the following formula.(7-14)

iii) Biochemical evaluation:

Plasma proteins : Albumin has long been the indicator used to assess the status of nutrition of a patient. However it has been criticized due to its lack of specificity and long half life (20 days) .The normal range of

serum albumin is 3.5-5 gms / dl. Levels of this visceral protein may decline in the setting of acute injury and illness as the liver re-prioritizes protein synthesis from visceral proteins to acute phase reactant proteins(eg, C Reactive Protein) .(15-17)

Pre albumin : also referred to as trans-thyretin,is a transport protein for thyroid hormone. It is synthesized by the liver and partly catabolised by the kidneys. Normal serum pre albumin concentrations range from 16 - 40 mg/ dl. Values < 16 mg are associated with malnutrition. The half life of pre albumin (2 - 3 days) is much shorter than that of albumin making it a more favorable marker of acute change in nutritional status. A baseline pre albumin is useful as a part of the initial nutritional assessment if routine monitoring with nutritional support is planned. This test is more expensive than albumin and is not available in all institutions.(16)

C reactive protein : This is a acute phase reactant which is a non specific marker of inflammation and infection. It can increase up to a thousand fold early in the acute phase response. Elevated concentrations suggest physiological stress that requires continued hepatic synthesis of acute phase reactants and delays production of markers of nutritional rehabilitation (like pre albumin) (16)

Transferrin : It has been used as a marker of nutritional status. This acute phase reactant is a transport protein for iron; normal concentrations range from 200-360 mg/dl. Transferrin has relatively longer half life (8 -10 days) and is influenced by several factors including liver diseas, fluid status, stress, and illness. Levels decrease in the setting of severe malnutrition but this marker is unreliable in mild malnutrition.(16)

Subjective global assessment(SGA).

Detsky et al. defined the methodology for the clinical technique to assess nutritional status and named it Subjective Global Assessment (SGA). (17-29) SGA refers to the overall evaluation of a patient by an experienced clinician that correlates the subjective and objective aspects of a medical history and physical examination. Review of the medical history includes an assessment of weight and weight change, dietary intake, gastrointestinal symptoms, disease state, and the patient's functional status. SGA also includes a physical examination for negative changes in body composition such as loss of subcutaneous fat or muscle wasting, and signs of edema or ascites (nutrition-related). After evaluation, the patient is classified as well nourished (A), mild-to-moderately malnourished (B), or severely malnourished ©.

SGA predicts nutritionally mediated complications, but point out that it could actually be an index of "sickness" rather than nutrition. Proving that SGA is an index of nutrition will require demonstrating that nutrition support can reverse the higher complication rate in SGA "C" patients. SGA, presently, provides the best clinical way to define the manifestations of malnutrition in relation to clinical objectives. These findings support the use of SGA to determine nutritional status since the assessment of muscle function and muscle wasting are important parts of the SGA procedure.

As a screening tool, SGA can differentiate between the patients who need immediate and aggressive nutritional intervention and those who need minimal intervention. SGA can quickly identify those patients who are most at risk for malnutrition or whose status is declining, allowing patient care to be prioritized.

CONCLUSION:

APACHE II scoring is fairly accurate in predicting outcome in critically ill surgical patients with a worse outcome being associated with a higher score.

Subjective Global Assessment (SGA) is more reliable as compared to Anthropometry in assessing nutritional status of critically ill surgical patients.

Malnourished patients who received nutritional support have a better outcome as compared to those who did not, with a trend towards normalization of biochemical parameters (serum albumin).

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