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Research Article

Malnutrition in hospitalised patients; a real concern in surgical outcomes

Chandrashekhar C. Mahakalkar[1]*, Suchita Modi[1], Meenakshi Yeola[1], Meghali N. Kaple[2], Maneesha A. Patwardhan[1], Pratik Laddha[1]

[1]Department of Surgery, Jawaharlal Nehru Medical College, Sawangi (Meghe), Maharashtra, India
[2]Department of Biochemistry, Jawaharlal Nehru Medical College, Sawangi (Meghe), Maharashtra, India

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***Correspondence:**
Dr. Chandrashekhar C. Mahakalkar,
E-mail: cmahakalkar@rediffmail.com

ABSTRACT

Background: Lack of appropriate nutritional support during hospitalization may worsen patients' nutritional status and increases risk for infection, organ failure, decreased wound healing and suboptimal response to regular medical treatment. The prevalence and intensity of hospital malnutrition have been recognized as an important parameter in the outcome of disease. The study aimed at to determine incidence of malnutrition in hospitalized patients, the change in nutrition status during hospital stay and its effects on outcome of disease.
Methods: It was a prospective study and conducted at a tertiary care hospital. Total 70 patients were studied. Each patient's nutritional status was determined from anthropometric data - body mass index, triceps skinfold thickness, mid-arm circumference, mid arm muscle circumference, MNA scoring, serum protein level changes during hospital stay. The next recording was done at 15 days and 30 days after discharge. Student's t is test used for statistical analysis.
Results: The statistical difference for various parameters of nutritional status was found significant at admission and discharge.
Conclusions: The change in various parameter of nutritional status was observed in hospitalized patients. The treatment should be aimed at treating specific disorders along with nutritional correction. It is recommended to have dietary plans at the time of admission in consultation with the dietician.

Keywords: Malnutrition, Hospitalized patients, Nutritional status

INTRODUCTION

Nutritional status has been shown to have important effects on health in recovery from illness or injury. Experimental semi starvation of normal volunteers that caused a 25% loss of body weight was associated with apathy, depression, fatigue, and loss of will to recover.[1] Malnutrition is associated with negative outcomes for patients, including higher infection and complication rates,[2-5] increased muscle loss,[5-7] impaired wound healing,[3,8] increasing susceptibility to chest infection,[9] and reduces cardiac function,[10] longer length of hospital stay[11-13] and increased morbidity and mortality.[14-18] Numerous studies have identified strong correlations between the severity of nutritional deficits and an increased risk of subsequent morbid events among the hospitalized elderly and shown the incidence of malnutrition in hospitalized population to be approximately 30-50 %.[11,14,19-22] The frequency of this problem is relatively constant despite the population differences in the types of hospitals.[23] In this

study we sought to determine the changes in nutritional status during hospitalization and to assess the effect of malnutrition on the outcome of disease.

METHODS

It was a prospective study and conducted at Jawaharlal Nehru Medical College and Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe), Wardha, Maharashtra, India. The patients admitted to the surgical wards of the hospital were included in the study. Duration of the study was three months from May 2012 till the end of July 2012. A total 70 patients were studied over this duration. All the patients included in the study signed the informed consent form before enrolment. The details of all the patients were recorded on the proforma including the demographic profile, medical history and examination.

All the patients who admitted to surgical wards except paediatric population will be involved in the study that will require the hospital stay of at least ten days were enrolled in the study. Pediatric population, patients who require acute surgical interventions known patients of renal or hepatic dysfunction and cancer cachexia were excluded.

Each patient's nutritional status was determined from anthropometric data - body mass index, triceps skinfold thickness, mid-arm circumference, mid arm muscle circumference, MNA scoring, serum protein level changes during hospital stay. The next recording was done at 15 days and 30 days after discharge. The biochemical tests were performed at all these four instances.

Triceps skinfold thickness (TSF) - Measurement of triceps skinfold thickness provides an estimate of body fat reserves. Triceps skinfold thickness (mm) was measured by the accepted method with Harpenden skinfold callipers.

Mid-arm circumference (MUAC) - is a useful measure of muscle protein stores Mid-arm circumference (cm) was measured with a tape measure. Follow up measurement was obtained on the same arm.

Mid upper arm muscle circumference (MUAMC) - The mid-upper arm muscle circumference is an estimation of the circumference of the bone and muscle portions of the upper arm. It is derived from the MUAC and the TSF by accounting for the thickness of the subcutaneous fat that surrounds the muscle, using the following formula, (mid arm muscle circumference = mid arm circumference - triceps skin fold thickness x 0.314).

Mini Nutritional Assessment (MNA) - Apart from this, Malnutrition Indicator Score was calculated by Mini Nutritional Assessment. it included questioner about dietary habits over the past three months, loss of weight during the last three month, any psychological stress or acute disease in the past three month and present dietary history. With the help of that score we classified the patient under malnourished, at risk of malnutrition, or normal status.

These values were compared with tables standardized for age and sex. Patients were considered to be at risk of malnutrition if their body mass index was <20 and, malnutrition indicating MNA score was between 17 and 23.5. Patients were considered malnourished if their body mass index was <18.5 and if their triceps skinfold thickness <15 for female and <11 mm for male, and mid-arm circumference <20 for female and upto 26 cm for male, malnutrition indicating MNA score <17 and mid upper arm muscle circumference between 14 to 20 for female and 16 to 23 cm for male, Serum albumin level below 3.5 gm/dl and serum total protein below 6.7 gm/dl.

RESULTS

Total 70 patients admitted in surgical wards were enrolled in the study from the age 18 to 80 years, 53 males and 17 females. Male to female ratio was 3.1:1. Most of the patients belonged to the age group of 36-50 yrs, accounting for 31% (24% male and 7% female) of all the patients, 27% (19) patients in the 26-35 yrs group, 25% (17) patients in the 51-65 yrs group and 10% (7) patient belong to18-25 yrs group. Least patients belong to 66- 80 yrs age group, accounting for only 7% (Table 1).

Table 1: Distribution of patients according to age.

Sr. No.	Age group	Males	Females	Total
1	18 – 25 years	5 (7%)	2 (3%)	7 (10%)
2	26 – 35 years	14(20%)	5(7%)	19 (27%)
3	36 – 50 years	17(24%)	5(7%)	22(31%)
5	51- 65 years	12(18%)	5(7%)	17(25%)
6	66 – 80 years	5 (7%)	0 (%)	5 (7%)
	Total	53	17	70

Malnutrition Indicator Score was calculated by Mini Nutritional Assessment. (MNA). This showed only (4) 6% patients had normal nutrition status i.e. between 24 to 30, (34) 49% patients had nutrition status between 17 to 23.5 while (32) 45% of patients were under malnourished having nutrition status less than 17 at the time of admission. This was constant during hospital stay for three consecutive weeks even at the time of discharge. Follow up after 15th day of discharge demonstrated (7) 10% patients with normal nutrition status, (43) 61% patients had score between 17 to 23.5 and malnourished patients reduced to (20) 29%. Similarly at 30 day follow up (12) 17% patients had normal nutrition status, (43) 61% patients had score between 17 to 23.5 and malnourished patients reduced to (15) 22% (Table 2).

When we compared the BMI, only (24) 34% patients had normal BMI i.e. >20, (17) 24% patients had BMI between 18.5 and 20, while (29) 42% were having BMI <18.5 at the time of admission and there was no change at the end of one week during their hospital stay. At the end of 2nd week, BMI of (21) 30% patient was more than 20 and (34) 49% patients had BMI <18.5. At the end of 3rd week, BMI of (20) 29% patient was >20 and (14) 20% had BMI between 18.5 and 20, while (36) 51% patients were having BMI <18.5 which was same at the time of discharge. At follow up at 15 day after discharge, (32) 46% patients had normal BMI i.e. >20, (12) 17% had between 18.5 to 20 and malnourished patients reduced to (26) 37% having BMI <18.5. Similarly at 30 day follow up (36) 51% patients had normal BMI, (10) 14% were between 18.5 to 20 and malnourished patients with BMI <18.5 reduced to (24) 35%.

The other indices of malnutrition like Triceps Skin Fold Thickness; Mid Arm muscle Circumference and biochemical parameters like Total serum proteins and serum Albumin were calculated and the mean of these indices are shown in Table 3.

Table 2: Patients nutrition according to MNA score.

Sr. No.	Malnutrition indicator score (points)	On Admission	End of 1st week	End of 2nd week	End of 3rd week	15 day follow up	30day follow up
1	24 - 30 (Normal)	4 (6%)	4 (6%)	4 (6%)	4 (6%)	7(10%)	12(17%)
2	17 - 23.5 (At risk)	34(49%)	34(49%)	34(49%)	34(49%)	43(61%)	43(61%)
3	<17 (Malnourished)	32(45%)	32(45%)	32(45%)	32(45%)	20(29%)	15(22%)
	Total	70	70	70	70	70	70

Table 3: The other indices of malnutrition in our study.

Indices	On admission		Discharge		15 days		30 days	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BMI n=70	19.55	3.46	18.930	3.48	19.72	3.32	21.08	3.25
Triceps skin fold thickness (Females) n=17	6.88	0.56	6.20	0.63	6.77	0.67	6.95	0.64
Triceps skin fold thickness (Male) n=53	6.95	0.56	6.02	0.74	6.55	0.73	6.77	0.75
Mid arm muscle circumference (Female) n=17	18.57	2.21	18.10	2.25	18.32	1.89	18.97	1.83
Mid arm muscle circumference (Male) n=53	19.92	2.72	19.52	2.76	19.90	2.76	20.58	2.76
Total serum protein level	6.93	0.56	6.06	0.72	6.60	0.72	6.82	0.72
Serum albumin level	3.66	0.57	3.09	0.52	3.42	0.51	3.80	0.56

On comparing various indices of malnutrition with status of post operative wounds i.e. recovery of the patients, 44 (63%) patients had complete recovery and 26 (37%) had delayed wound healing. The age wise outcome of disease is shown in Table 4. On further comparison of recovery with individual index of malnutrition Table 5 (A+B), the difference between complete recovery and delayed wound healing was not statistically significant. The comparison values of each index at admission, on discharge and at 30 day follow up, the results were alarming and suggestive of changes during their hospital stay. The statistical difference of BMI at admission and on discharge and at 30 day follow up was significant P-0.00 and P-0.00 respectively, Triceps skin fold thickness in female and male was P-0.01 and P-0.00 and P-0.00 and P-0.00 respectively. Mid arm muscle circumference in female and male was P-0.04 and P-0.00 and P-0.02 and P-0.00 respectively. Statistical significant difference was observed in BMI and Tricep skin fold thickness.

Table 4: Age wise outcome of patients in terms of complete recovery or delayed wound healing.

Sr. No.	Age group	Complete recovery	Delayed wound healing	Total
1	18 - 25 years	4 (6%)	3 (4%)	7 (10%)
2	26 - 35 years	12 (17%)	7 (10%)	19 (27%)
3	36 - 50 years	15 (21%)	7 (10%)	22 (31%)
5	51- 65 years	10 (14%)	7 (10%)	17 (25%)
6	66 - 80 years	3 (4%)	2 (3%)	5 (7%)
	Total	44 (63%)	26 (37%)	70

Incidence of malnutrition in our study, based on body mass index (BMI <18.5) was 36% on admission and 51% at discharge and subsequently decreased in follow up to 35%. The incidence of malnutrition as measured by Triceps Skin fold Thickness was 6% in females and 4% in males, mid arm circumference was 12% in females and 6% in males, mid arm muscle circumference 82% in females and 83% in males at the time of admission. The same parameters were again measured at the time of discharge. Triceps Skin fold Thickness was 6% in females and 15% in males, Mid arm circumference was 18% in females and 13% in males, Mid arm muscle circumference 88% in females and 85% in males.

Table 5A: Comparison of various parameters with outcome of disease.

Various parameters		Complete recovery	Delayed wound healing	Total
Malnutrition MNA indicator score	24 - 30	3 (4%)	1 (2%)	4 (6%)
	17 - 23.5	22 (32%)	12 (17%)	34 (49%)
	<17	22 (31%)	10 (14%)	32 (45%)
	Total	47	23	70
BMI	>20	12 (17%)	8 (12%)	20 (29%)
	18.5 - 20	9 (13%)	5 (7%)	14 (20%)
	<18.5	21 (30%)	15 (21%)	36 (51%)
	Total	42	28	70
Females - triceps skin fold thickness (mm)	<6.5	1 (6%)	0 (0%)	1 (6%)
	6.5 - 10	1 (6%)	1 (6%)	2 (12%)
	10 - 15	10 (59%)	3 (17%)	13 (76%)
	>15	1 (6%)	0 (0%)	1 (6%)
	Total	13	4	17
Males - triceps skin fold thickness in (mm)	<7.5	2 (4%)	4 (7%)	6 (11%)
	7.5 - 11	5 (9%)	12 (23%)	17 (32%)
	11 - 12.5	11 (21%)	6 (11%)	17 (32%)
	>12.5	8 (15%)	5 (10%)	13 (25%)
	Total	26	27	53

Table 5B: Comparison of various parameters with outcome of disease.

Various parameters		Complete recovery	Delayed wound healing	Total
Females - mid arm circumference (cm)	< 20	1 (6%)	2 (12%)	3 (18%)
	20-26	10 (58%)	3 (18%)	13 (76%)
	26-28.5	00	1 (6%)	1 (6%)
	Total	11	6	17
Males - mid arm circumference (cm)	<20	2 (4%)	5 (9%)	7 (13%)
	20-26	23 (44%)	15 (28%)	38 (72%)
	26-29	8 (15%)	0 (0%)	8 (15%)
	Total	33	20	53
Females - mid arm muscle circumference (cm)	20-23	00	2 (12%)	2 (12%)
	14-20	10 (58%)	5 (30%)	15 (88%)
	Total	10	7	17
Males - mid arm muscle circumference (cm)	23-25	8 (15%)	-00	8 (15%)
	16-23	25 (47%)	20 (38%)	45 (85%)
	Total	33	20	53
Albumin (gm/dl)	3.5-5.5	14 (20%)	8 (12%)	22 (31%)
	<3.5	28 (30%)	20 (28%)	48 (69%)
	Total	42	28	70
Total protein (gm/dl)	6.7-8.6 (normal)	5 (7%)	6 (9%)	11 (16%)
	<6.7	37 (53%)	22 (31%)	59 (84%)
	Total	42	28	70

DISCUSSION

The objective of nutritional assessment is to identify those patients who are already malnourished or who are at increased risk of protein-calorie malnutrition developing. Dozens of assessment techniques are currently available and in common use. Blackburn and colleagues[24] have recommended an extensive panel of clinical and laboratory measurements. These include anthropometric measurements of height, weight, triceps skin-fold thickness and arm muscle circumference; laboratory analysis of serum albumin and transferrin levels; quantitative and qualitative measurements of lymphocyte function; 24-hour measurements of creatinine excretion as a function of height, and measurements of protein and energy intake and expenditure. Other authors recommend the use of serum proteins with shorter half-lives,[25] measures of protein turnover,[26,27] sophisticated measures of body composition[28-31] dynamic measures of muscle function and quantitative indices that combine various measurements.[32,33] Recently, the definition of malnutrition has been clarified by the European Society of Parenteral and Enteral Nutrition (ESPEN) to highlight the differences between cachexia, sarcopenia (loss of muscle mass and function) and malnutrition.[34] Cachexia can be defined as a "multifactorial syndrome characterized by severe body weight, fat and muscle loss and increased protein catabolism due to underlying disease(s)".[34] Therefore, malnutrition seen in hospitalised patients is often a combination of cachexia (disease-related) and malnutrition (inadequate consumption of nutrients) as opposed to malnutrition alone.

The Mini Nutritional Assessment (MNA) was designed for use with older patients and includes anthropometric measurements including calf and arm circumferences, BMI, and weight loss. In addition, the MNA assesses lifestyle, mobility, and medication usage. The MNA

contains a dietary questionnaire to measure food and fluid intake and autonomy of feeding. The clinician has to make a subjective assessment of the patient's perception of his or her health and nutrition status. Once complete, the patients are categorized into one of three levels: satisfactory, risk of malnutrition, or PEM.[35,36] In our study 49% patients were at risk of malnutrition (MNA 17-23.5) and 45% were malnourished (MNA <17) on admission, these numbers were unchanged till discharge but at follow up there was a significant change in nutritional status.

Incidence of malnutrition in our study, based on body mass index (BMI <18.5) was 36% on admission and 51% at discharge and subsequently decreased in follow up to 35%. This incidence was more as compared to the studies done by Shum NC[37] which was around 16.5% and 31.5% by Kelly I E.[38] When BMI was combined with Serum Albumin (BMI <18.5 and Serum Albumin <6.7 gm/dl) the incidence increased to 84% at discharge. Bistrian B. R. et al.[39] reported prevalence of malnutrition according to BMI was up to 45%.

The other observable parameters of malnutrition like weight loss, loss of subcutaneous fat and muscle reveals the magnitude of the problem. The incidence of malnutrition as measured by Triceps Skin fold Thickness was 6% in females and 4% in males, mid arm circumference was 12% in females and 6% in males, mid arm muscle circumference 82% in females and 83% in males at the time of admission. The same parameters were again measured at the time of discharge. Triceps Skin fold Thickness was 6% in females and 15% in males, Mid arm circumference was 18% in females and 13% in males, Mid arm muscle circumference 88% in females and 85% in males.

These parameters assessment by other authors as by Bistrian B. R. et al.[39] revelled the incidence of malnutrition calculated by arm muscle circumference was 55%, Mc whirter et al.[40] reported at the incidence at the time of admission was 40% and during hospital stay nearly 33% patient lost their weight. Xiaokum lianng et al.[41] reported prevalence of nutritional risk was 27.3%, the prevalence of under nutrition was 9.2% at admission. The overall prevalence of nutritional risk changed from 27.3% to 31.9% (p <0.05), and the prevalence of undernutrition changed from 9.2% to 11.7% (p <0.05), during hospitalization.

Various studies at different geographic locations and in different populations enlisted the risk of hospital malnutrition. Meijers et al.[42] found the hospital malnutrition almost 24%, Stratton et al.[43] in the United Kingdom found that malnutrition was common in 58% of patients and was associated with longer hospital stays and poor outcomes. Edington et al.[44] in 2000 reported malnutrition rates for the United Kingdom to be 20% - 40% upon hospital admission. In Vietnam hospitals during 2002 - 2004, Pham et al.[45] found admission malnutrition rates of almost 56% for patients admitted for elective abdominal surgery. Brazilian hospitals were found by Correia et al.[46] to have malnutrition rates at hospital admission of 34%.

Malnutrition has been shown to cause impairment at a cellular, physical and psychological level.[16-18] This impairment is dependent on many factors, including the patient's age, gender, type and duration of illness, and current nutritional intake. On a cellular level, malnutrition impairs the body's ability to mount an effective immune response in the face of infection, often making infection harder to detect and treat.[47] It also increases the risk of pressure ulcers, delays wound healing, increases infection risk, decreases nutrient intestinal absorption, alters thermoregulation and compromises renal function.[16,17]

On a physical level, malnutrition can cause a loss of muscle and fat mass, reduced respiratory muscle and cardiac function, and atrophy of visceral organs.[16,17] It has been shown that an unintentional 15% loss of body weight causes steep reductions in muscle strength and respiratory function, while a 23% loss of body weight is associated with a 70% decrease in physical fitness, 30% decrease in muscle strength and a 30% rise in depression.[18] At a psychological level, malnutrition is associated with fatigue and apathy, which in turn delays recovery, exacerbates anorexia and increases convalescence time.[17]

It is widely reported in the literature that malnutrition is associated with an increased length in hospital stay.[48,49] In addition to a longer length in hospital stay, malnourished patients are more prone to experiencing complications during their period of hospitalisation than patients who are in a well-nourished state. Complications can occur when an unexpected accident or disease adds to a pre-existing illness without being specifically related to the illness. For example, one study that assessed the nutritional status of patients preoperatively found that malnourished patients had significantly higher rates of both infectious and non-infectious complications.[50] Following on from a higher complication risk, as mentioned prior, malnutrition has also been shown to be associated with an increase in mortality rates.[18]

Despite the multitude of evidence indicating that patients who are nutritionally compromised suffer worse outcomes, it is difficult to control for disease severity in the clinical setting and thus definitively conclude that malnutrition alone is a cause of these outcomes. The fact that numerous studies internationally, in a wide variety of clinical settings and patient groups, all report similar findings lends strength to the premise that malnutrition is detrimental in terms of clinical outcome. The high prevalence rates of malnutrition in the hospital setting indicate that such negative outcomes as longer hospital stay, higher complication and infection rates, and mortality would be highly prevalent also. It is therefore not surprising that malnutrition has significant secondary

effects to health care facilities. Malnutrition places additional stress on acute health care facilities. All these issues combined indirectly increase hospital costs associated with treating the patient, secondary to the management of their primary medical reason for admission.

It is concluded from the study that the change in various parameter of nutritional status was observed not only for critically ill patients but also in patients getting admitted for elective surgeries. The treatment should be aimed at treating specific disorders along with nutritional correction. It is recommended from the study that every patient at the time of hospital admission should be evaluated for malnutrition; dietary supplementations in hospitals, in the form of enteral feeds should be based on their nutritional status, specific deficiencies should be evaluated in patients found to be malnourished at the time of hospital admission, role of dietician in formulating the supplementary feeds is important.

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