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ORIGINAL ARTICLE

Indices of malnutrition in patients admitted to general medical and chest medicine wards of an Iranian teaching hospital on admission and discharge

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Abstract The nutritional status of hospitalised patients is generally poor on admission and in some cases declines during their stay in hospital. The aim of this study was to assess the nutritional status of a group of hospitalised patients on admission and at discharge from a large teaching hospital in Northwestern Iran. Male and female patients, who were anticipated to stay in hospital for more than 1 week on the general medical or chest medicine ward, gave informed consent to take part in the study. One hundred and fourteen patients (53.6 ± 17.2 years, body mass index (BMI) 21.0 ± 5.7 kg/m^2 (mean ± standard error of the mean) were recruited to evaluate the nutritional status. Changes in bioimpedance and anthropometric markers of nutritional status were recorded. The NRS 2002 (nutritional risk screening) method was used to assess nutritional status in patients on admission and prior to discharge. Malnutrition, as assessed using NRS 2002 method, decreased during the stay of patients in hospital (2.8 ± 1.0 versus 1.8 ± 1.0, $p < 0.001$). This study showed that prevalence of malnutrition was as high as 63.1 % on admission to the general medical and chest wards. The nutritional status of patients was significantly changed over the period of their stay in hospital, as assessed using the NRS 2002 method, although patients lost weight due to the acute care situation.

Keywords Malnutrition · NRS 2002 · Nutritional status · Bioimpedance analyser

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Introduction

Malnutrition of hospitalized patients probably reflects a greater problem of malnourished people in the general community. Malnutrition in patients admitted to hospital has been investigated in the USA and UK for several years, although it is often unrecognized [1]. McWhirter and Pennington in 1994 showed that 40 % of patients admitted to five different specialties at Ninewells hospital in Dundee were malnourished [2]. The prevalence of malnutrition in patients admitted to two district general hospitals and two teaching hospitals in four geographic areas of England has been estimated to be 19.8 % in 2000 [3]. Elia et al. have indicated that in over 3 million individuals at risk of malnutrition in UK, about 93 % occurred outside the hospital environment, 5 % in care homes and the remainder in the community [4]. In spite of prevalence of only about 2 % of malnutrition in hospitals, a great deal of effort has been focused on the hospital environment [5], because policies in such relatively small areas are generally easier to establish, monitor and inspect. However, several studies

have been performed to assess the prevalence of malnutrition including the Council of Europe Resolution on malnutrition in 2003 [6], the report from Quality Improvement Scotland on Food, Fluid and Nutritional Care [7], and the report from Republic of Ireland in 2009 [8]. A recent study stated that government statistics underestimate the prevalence of malnutrition on admission and discharge from hospital (1,000–3,000 annually between 1998 and 2008), which is less than 1 % of the prevalence (about 3 million in 2007–2008) [1]. The incidence of malnutrition-related deaths in hospitals, according to government statistics (242 deaths in England in 2007), was also <1 % of an independent estimate, which was as high as 100,000 every year [1]. The British Association for Parenteral and Enteral Nutrition, using criteria based on the 'Malnutrition Universal Screening Tool' ('MUST') showed that 28 % of individuals admitted to hospital and 30–40 % of those admitted to care homes were malnourished [9]. Outpatient studies using 'MUST' showed that 16–20 % patients were malnourished and this was associated with more hospital admissions and longer length of stay. Research has suggested that 10–40 % of patients admitted to hospital exhibited some level of malnutrition [10], with further weight loss, occurring over the period of hospitalisation [2]. In a study of 156 patients, the prevalence of malnutrition increased from 12.9 % on admission to 23.1 % on discharge in Iran [11].

A recent study using the Nutritional Risk Screening 2002 method showed that the overall prevalence of nutritional risk changed from 27.3 to 31.9 %, and the prevalence of under-nutrition changed from 9.2 to 11.7 % during hospitalization in Beijing Teaching Hospitals, China [12].

Research also showed that despite more than 20 years of intense awareness, malnutrition was still highly prevalent in hospitalised patients and this continues to affect patients' outcomes. Malnutrition has serious consequences for recovery and increases the risk of complications in hospitalised patients [13] and in case of identifying the problem, treatment which could be initiated in the hospital may continue in the community.

On the other hand, poor appetite is a common feature of illness. In the recent years, nutritional supplements have been used in hospitals but their effectiveness, probably due to the effects of poor appetite, varies. Recent findings suggested that peptide hormones released from the gut, such as ghrelin and peptide YY (PYY), which stimulate and inhibit the appetite, respectively [14, 15], might play a role in the altered eating behaviour of sick patients [13, 16, 17].

The nutritional status of hospitalised patients in Razavi Khorasan province is not known. The aim of this study was to evaluate the prevalence of malnutrition in an Iranian teaching hospital, on admission and discharge.

Methods

Nutritional and medical data were collected from patients, charts, medical notes, dieticians and medical teams. Patients were followed clinically until discharge from hospital or death.

This was a prospective observational study undertaken in internal wards in a teaching hospital, Mashhad, Iran. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Research Ethics Committee of Mashad University of Medical Sciences (approval number 85372). Written informed consent was obtained from all subjects. Patient refusal at any time to continue with the study resulted in their withdrawal from the study. The inclusion criteria were: male and female patients between the ages of 20 and 85 years who were anticipated to stay in the hospital for longer than 1 week in the opinion of the consultant. Exclusion criteria were: patients who were anticipated to die, or stayed less than 1 week in the hospital; those who were known to be HIV or hepatitis B surface antigen positive.

Food record

All patients were on oral nutrition and a 24 h food intake was recorded at ward level at the nearest time on admission and discharge. The nutritional content of the patients' food record charts was calculated using computerised food tables.

Anthropometrics

Anthropometric indices, including weight, height and triceps skin fold thickness were performed on admission and at the nearest point to discharge from the hospital by a researcher for all patients [18]. Height was measured to the nearest 0.5 cm in those patients who were able to stand using a stadiometer. Patients were measured without shoes and standing up straight so that Frankfort plane (a line from the lower border of the left orbit to the upper margin of the canal) was parallel to the floor. Demi-span was measured using a flexible metal tape measure to calculate the height in order to compute body mass index (BMI) in those who were not able to stand [19]. Subjects were weighed using stand on digital scales. For those who were not able to stand, digital chair scales were used to the nearest 0.1 kg to record the weight. Patient's weight was measured by bed-scale (Seca 984, Germany), by connecting four leads to their bed when they lay on the bed for few cases who were not able to sit down. BMI, the most commonly used index of weight and height is calculated using the following equation: Weight (kg)/Height (m^2) [18].

Bioimpedance analysis

Body composition analysis was performed by portable bioimpedance analyzer (Body stat 1500 MDD) on admission and discharge. Body fat, lean body mass and body water indices were used for analysis.

Nutritional risk screening (NRS 2002)

The NRS 2002 method, a system for screening of nutritional risk, was used to assess malnutrition [20]. It is based on the concept that nutritional support is indicated in patients who are severely ill with increased nutritional requirements, or who are severely undernourished, or who have certain degrees of severity of disease in combination with certain degrees of under nutrition. Patients were scored in each of the two components, under nutrition and disease severity, based on whether they were absent, mild, moderate or severe, giving a total score 0–6. Patients with a total score of ≥ 3 were classified as nutritionally at-risk [20]. The NRS 2002 is the best validated screening tool, in terms of predictive validity, i.e. the clinical outcome improves when patients identified to be at risk are treated [21].

Statistical analysis

All data were checked for normality and presented as mean $\pm$ standard error of the mean (SEM). The data were analyzed using SPSS 13.5 for windows (SPSS Science, Apache Software Foundation, Chicago, IL, USA). Descriptive statistics and compare means (one sample *T* test and paired sample *T* test) were used to compare the variables between admission and discharge.

Results

One hundred and fourteen patients were recruited to evaluate the nutritional status on admission (73 patients in medical ward and 41 patients in chest medicine ward). To limit the budget, 26 patients among the total of medical ward patients were followed during their stay in hospital for second measurement.

The type of disease and length of stay of the patients in hospital is shown in Table 1. Nutritional status was assessed on discharge for patients in medical ward. The sample size attrition in the chest medicine ward group was due to their transfer to another hospital. Table 2 shows change in anthropometrics, BMI, bioimpedance analysis variables and food intakes between admission and discharge in medical ward and Table 3 shows them in chest medicine ward.

Table 1 Type of disease and length of stay of patients in hospital

Number of patients	Type of disease	Length of stay
Medical ward patients ($n = 26$)	Gastrointestinal Bleeding ($n = 4$)	7–10 days
	Gastritis ($n = 2$)	
	Pancreatitis ($n = 2$)	
	Nephrotic syndrome ($n = 2$)	
	Ulcerative colitis	
	Icter ($n = 3$)	
	Epigastric pain	
	Diarrhea and vomiting	
	Blooding diarrhoea	
	Cirrhosis ($n = 3$)	
	Cancer cachexia	
	Abdominal pain	
	Melena	
	Gall bladder cancer	
	Chronic constipation	
	Rectorrhagia	
Chest medicine ward patients ($n = 9$)	Dysphagia	
	COPD ($n = 3$)	
	Hemoptysis ($n = 2$)	
	Hydrothorax	
	Lung cancer	
	Pneumonia	

Markers of nutritional status consisting of weight, triceps skin fold thickness, and BMI decreased during stay (from admission until discharge) (Table 4). Mean daily energy intake at the nearest time to discharge from the hospital was significantly higher in patients compared to the admission (Table 4).

NRS 2002

Malnutrition risk decreased during stay in hospital using NRS 2002 method.

Discussion

Results showed 63.1 % of admitted patients were at risk of malnutrition using NRS 2002 method. It is much higher than the study by Russell which showed 28 % of individuals on admission to hospital in UK were malnourished (using 'MUST') [9]. A study by Hosseini in nine different wards in Tehran showed that undernutrition (BMI < 18.5 kg/m^2) was present in 5.7 % and severe undernutrition (BMI < 16 kg/m^2) existed in 0.6 % on admission;

Table 2 Markers of nutritional status of medical ward patients ($n = 26$)

	Admission	Discharge	p value
Age (years)		52.7 ± 18.1	
Gender			
Female	48 % (12)[a]		
Male	52 % (14)[a]		
Ethnic group			
Asian	100 % (26/26)[a]		
Anthropometric			
TSF (mm)^2	17.3 ± 9.8	16.9 ± 9.8	0.67
Weight (kg)	52.1 ± 11.3	50.7 ± 10.6	0.08
Waist circumference (cm)	76.6 ± 13.9	75.7 ± 13.2	0.54
Hip circumference (cm)	87.5 ± 8.6	85.7 ± 9.7	0.18
Midarm circumference (cm)	23.4 ± 4.3	23.2 ± 3.7	0.81
Midcalf circumference (cm)	28.7 ± 3.4	28.3 ± 3.3	0.54
BMI (kg/m^2)	20.4 ± 4.4	19.7 ± 4.3	0.06
Fat percent (%)	34.4 ± 23.2	21.3 ± 17.2	0.12
Fat mass (kg)	14.4 ± 7.4	10.1 ± 8.1	0.24
Lean mass (kg)	34.7 ± 16.9	40.0 ± 13.6	0.16
Total body water (%)	59.1 ± 15.2	69.0 ± 15.5	0.14
Food intake (kcal/day)	809.3 ± 654.7	1,387.2 ± 491.2	<0.001
NRS 2002	70.8%	24%	
NRS 2002 score[b]	2.9 ± 1.0	1.8 ± 1.0	<0.001

Values are mean ± SEM

[a] Values are percentage (n)

[b] Patients with score ≥3 nutritionally at risk

Table 3 Markers of nutritional status of chest medicine ward patients ($n = 9$)

	Admission	Discharge	p value
Age (years)		55.3 ± 15.4	
Gender			
Female	53.7 % (5)[a]		
Male	46.3 % (4)[a]		
Ethnic group			
Asian	100 % (9/9)[a]		
Anthropometric			
TSF (mm)^2	19.9 ± 12.2	19.0 ± 12.4	0.15
Weight (kg)	56.9 ± 19.2	56.4 ± 20.9	0.62
Waist circumference (cm)	83.3 ± 21.5	81.8 ± 21.0	0.13
Hip circumference (cm)	91.8 ± 13.3	91.3 ± 14.3	0.77
Midarm circumference (cm)	24.6 ± 6.5	24.5 ± 7.0	0.85
Midcalf circumference (cm)	29.0 ± 5.8	28.2 ± 5.9	0.50
BMI (kg/m^2)	22.9 ± 8.4	22.7 ± 9.0	0.50
Fat percent (%)	28.3 ± 13.1	25.7 ± 14.3	0.50
Fat mass (kg)	17.4 ± 12.7	16.7 ± 16.6	0.77
Lean mass (kg)	40.8 ± 11.3	41.8 ± 7.9	0.68
Total body water (%)	61.3 ± 10.6	62.1 ± 18.4	0.84
Food intake (kcal/day)	891.6 ± 758.9	1,382.3 ± 621.6	0.27
NRS 2002	51 %	12.5 %	
NRS 2002 score	2.4 ± 1.1	1.7 ± 1.4	0.40

Values are mean ± SEM

[a] Values are percentage (n)

when discharged, 11 % of the patients were undernourished, and the prevalence of severe undernutrition increased to 1.3 % [11]. Results of this study showed that measures of nutritional status of patients deteriorated during their stay in hospital, with a decline in body weight, TSF and BMI. These data are consistent with the previous studies [13, 16, 17]. This is also consistent with a recent study in Iran which showed average body weight and BMI decreased significantly during hospitalisation ($p < 0.001$) [11].

In this study, portable BIA (Bioelectrical Impedance Analysis) was used to assess accurate weight loss in fat and lean body mass. Patients had lost considerable amount of fat and gained lean body mass during their stay. This discrepancy may be explained by presenting some degree of edema as percent of body water that was increased during stay. Edema may mask weight loss and indices of malnutrition.

This study had methodological limitations. The nature of the patients in hospital limited sample size as it is difficult to take consent on admission. Sample size was also reduced on discharge assessment as mentioned in "Methods". The main aim was to investigate malnutrition on admission and discharge in hospital and statistically significant results have been established in this report.

This study showed that prevalence of malnutrition was as high as 63.1 % on admission. The nutritional status of patients was slightly improved over the period of their stay in hospital using NRS 2002 method, although patients lost weight during their stay in the hospital due to acute care situation.

The results reinforce the need to research into potential preventive measures of malnutrition as malnourished people may be admitted to hospital more than not-at-risk people. Indeed, the results warrant research on the mechanisms of hospital malnutrition.

Table 4 Demographics, anthropometrics, food value records and NRS 2002 in an Iranian teaching hospital ($n = 35$)

	Admission	Discharge	p value
Age (years)		53.6 ± 17.2	
Gender			
Female	48.6 % (17)[a]		
Male	51.4 % (18)[a]		
Ethnic group			
Asian	100 % (35/35)[a]		
Anthropometric			
TSF $(mm)^2$	18.2 ± 10.5	17.6 ± 10.6	0.34
Weight (kg)	53.4 ± 13.7	52.2 ± 13.9	0.07
Waist circumference (cm)	78.4 ± 16.3	78.3 ± 15.8	0.92
Hip circumference (cm)	91.7 ± 12.7	87.2 ± 11.2	0.06
Midarm circumference (cm)	23.7 ± 4.9	23.6 ± 4.8	0.79
Midcalf circumference (cm)	28.8 ± 4.4	28.3 ± 4.4	0.20
BMI (kg/m^2)	21.0 ± 5.7	20.5 ± 5.9	<0.05
Fat percent (%)	31.9 ± 19.4	23.2 ± 15.8	0.09
Fat mass (kg)	15.7 ± 9.8	12.9 ± 12.4	0.22
Lean mass (kg)	37.3 ± 14.7	40.8 ± 11.3	0.14
Total body Water (%)	60.0 ± 13.1	66.1 ± 16.6	0.14
Food intake (kcal/day)	830.6 ± 670.9	1,386.5 ± 516.8	<0.001
NRS 2002	63.1 %	6.1 %	
NRS 2002 score	2.8 ± 1.0	1.8 ± 1.0	<0.001

Values are mean ± SEM

[a] Values are percentage (n)

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Conflict of interest None.

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