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Original

Nutritional status influences the length of stay and clinical outcomes in hospitalized patients in internal medicine wards

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Abstract

Objective: **The aim of this study was to investigate the relationship between the nutritional status (NS) and clinical outcome and length of stay (LOS) among patients admitted to the internal medicine ward.**

Methods: **This is a retrospective observational study performed with the data of clinical patients collected during a one year period. The NS was assessed using: subjective global assessment (SGA), body mass index (BMI), triceps skinfold thickness (TST), muscle arm circumference (MAC) and combined tools. Statistical analysis was performed with a confidence interval of 95% ($p < 0.05$). For categories comparison the chi-square test was used. To examine the association between length of stay and variables related to the NS Mann-Whitney and Kruskal-Wallis tests was used with multiple comparisons.**

Results: **396 patients were included in the study, 42.2% were over 60 years of age, what was associated with the presence of hypertension ($p < 0.001$), diabetes mellitus ($p = 0.003$) and required diet with modifications consistency ($p = 0.003$). According to combined diagnostic tools, 45.7% of patients were malnourished. Decreased food intake ($p = 0.01$), malnutrition according to SGA ($p = 0.02$) and MAC ($p = 0.03$) were associated with increased mortality. Patients with tertiary level of care ($p = 0.01$), decreased food intake ($p = 0.001$), who died ($p = 0.004$) and diagnosed with malnutrition by SGA ($p = 0.001$) and by the combined tools ($p = 0.001$) had a longer LOS.**

Conclusions: **Patients who were malnourished by SGA and who presented decrease food intake at admission had longer LOS and poorer clinical outcomes (highest number of deaths). The diagnosis of malnutrition by MAC was also related to higher mortality.**

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Key words: *Nutritional status. Length of stay. Clinical outcome.*

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EL ESTADO NUTRICIONAL INFLUYE EN LA DURACIÓN DE LA ESTANCIA Y LOS RESULTADOS CLÍNICOS EN PACIENTES HOSPITALIZADOS EN LAS CLÍNICAS MÉDICAS

Resumen

Objetivo: **Vincular el estado nutricional (EN) con la evolución clínica y la duración de la estancia de los pacientes ingresados en las clínicas médicas de un hospital universitario.**

Métodos: **Estudio observacional retrospectivo en el que los datos analíticos se obtuvieron de los pacientes ingresados durante el período de un año. Para la evaluación del EN se utilizaron: la valoración global subjetiva (VGS), el índice de masa corporal (IMC), el pliegue cutáneo tricipital (PCT), la circunferencia muscular del brazo (CMB) y el diagnostico del estado nutricional por la combinación de métodos (VGS, medidas de antropometría y bioquímicas). El análisis estadístico se realizó con el poder de confianza del 95% ($p < 0,05$). Para las categorías de comparación se utilizó chi-cuadrado. Para examinar la asociación entre la duración de la estancia y variables relacionadas con el EN se utilizaron Mann-Whitney y Kruskal-Wallis con comparaciones múltiples.**

Resultados: **De los 396 sujetos estudiados 57,8% eran adultos. Ser mayor se asoció con la presencia de hipertensión arterial ($p <0,001$), diabetes mellitus ($p = 0,003$) y requerir cambios en la consistencia de la dieta ($p = 0,003$). Al final de la evaluación el 45,7% eran desnutridos. Presentar disminución de la ingesta de alimentos ($p = 0,01$), malnutrición según el SGA ($p = 0,02$) y la CMB ($p = 0,03$) se asoció con mortalidad. Estuvieron más tiempo hospitalizados los pacientes con nivel terciario de atención ($p = 0,01$), disminución de la ingestión de alimentos ($p = 0,001$), que murieron ($p = 0,004$), con un diagnóstico de desnutrición por VGS ($p = 0,001$) y por la combinación de métodos ($p = 0,001$).**

Conclusión: **pacientes desnutridos según VGS y con disminución de la ingestión de alimentos al comienzo de la hospitalización se mantuvieron más tiempo en el hospital y tuvieron peores resultados clínicos (mayor número de muertes). El diagnóstico de la desnutrición por CMB también se relacionó con una mayor frecuencia de muertes.**

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Palabras clave: *Estado nutricional. Tiempo de internación. Evolución clínica.*

Abbreviations

NS: Nutritional status.
LOS: Length of Stay.
SGA: Subjective Global Assessment.
BMI: Body Mass Index.
TST: Triceps Skinfold Thickness.
MAC: Muscle Arm Circumference.
HTN: Hypertension.
DM: Diabetes Mellitus.

Introduction

According to studies from around the world malnutrition is a prevalent condition in hospitals, being present in about half of hospitalized patients. Malnourished patients have worse treatment response and increased rates of complication. This framework prolongs hospital stay and increases costs and mortality.[1,2,3,4,5,6]

However, there is not a gold standard tool for nutritional assessment. Due to the limitation of the different tools the Academy of Nutrition and Dietetics indicates the use of a large number of combine methods.[7] Despite the importance of hospitalized patients nutritional status, frequently the nutritional assessment is neglected. In the Brazilian National Survey on Hospital Nutritional Assessment (IBRANUTRI) study, only about 20% of patients had the nutritional status registered in personal health records.[6] The nutritional assessment enables early identification of patients at nutritional risk and predicts the probability of a better or worse outcome due to nutritional status. The nutritional support initiated at the proper time might improvement the outcome.[8]

Objectives

The aim of this study was to investigate the relationship of the nutritional status (NS) with clinical outcome and length of stay (LOS) among patients admitted to the internal medicine ward.

Patients and methods

This is a retrospective observational and analytical study using the data of hospitalized patients admitted at the male and female internal medicine wards of the Clinical Hospital of the Federal University of Paraná, Curitiba, Brazil, over a period of one year (between 2008-2009 years). The data were from nutritional records used by the Nutrition Service and were obtained at the time of admission. In the study, only records containing complete patient information were included. The information records used contained identification (gender, age), health (diagnosis, comorbidities, clinical outcome, LOS) and assessment of nutritional status by different tools.

The diagnosis was categorized into two categories according to reason of hospitalization (disease under treatment or disease still under investigation). The division was carried out because of the large number of different diseases assisted at internal medicine wards. The clinical outcome was classified as discharge or death.

The Subjective Global Assessment (SGA) used is adapted from Detsky.[9] Information about decreased food intake and consistency modified diet used in this study were from SGA.

Body weight was measure in a mechanical scale (Filizola®) with capacity of 150 kg and precision of 0,1 kg and height was assessing using stadiometer fixed at the same equipment. The weight loss during hospitalization was calculated as the difference between weight at admission and last weight before discharge or death. The body mass index (BMI) was calculated dividing the weight by the square of the height (kg/m^2) and was classified according to WHO[10] criteria for adults and Lipschitz[11] for elderly.

The triceps skinfold thickness (TST) was measure using a skinfold caliper (Cescorf®) with a range of 0-100 mm and precision of ± 1.0 mm. The measurement was performed on the right side of body and was used the mean of three times for the analyses. Mid-arm circumference was assessed at the measure midpoint of upper right arm to the nearest 0.1 cm. Mid-arm muscle circumference (MAC) was determined using the standard equation of Frisancho.[12] TST and MAC were standardized for gender and age: data was multiplied for 100 and divided by 50th percentile. After, both TST and MAC were classified according to Frisancho.[12]

The classification level of nutritional care in primary, secondary and tertiary considers the underlying disease and the nutritional status.[13] The nutritional diagnosis by the combined tools is defined subjectively using data from the SGA, BMI, TST, MAC and laboratory tests – albumin (normal range: 3,5-5,5 g/dL) and total lymphocyte count (> 1,600/ mL).

Statistical analysis was performed with power of 95% confidence ($p < 0.05$), using the R software, version 2.12.0, the software Statgraphics, Centurion version, and Excel spreadsheets to store data. The age variable had a normal distribution, but the same behavior was not observed with the other variables. In order to compare two categories chi-square test was used, whilst the chi-square test with Yates correction was used to compare three or more categories. The length of stay (LOS) was evaluated using Mann-Whitney and Kruskal-Wallis tests, the last one with multiple comparison test. Correlation tests were made between nutritional status and clinical outcomes.

The use of nutrition records data in this study was approved by the Research Ethics Committee of the Clinical Hospital of the Federal University of Paraná.

Table I
Characteristics of the study population

	N/%	*Adult n (%)*	*Elderly n (%)*	*p value*
Sample	396	229 (57.8)	167 (42.2)	
Gender				
Male	226/57	128 (32.3)	98 (24.7)	0.016[a]*
Female	170/43	101 (25.5)	69 (17.4)	
Hypertension	196/49.5	85 (37.1)	111 (66.5)	0.000[a]*
Diabetes mellitus	71/18	33 (14.4)	38 (22.7)	0.033[a]*
Reason of hospitalization				
Under treatment	204/51.5	124 (54.1)	80 (48)	0.622[a]
Under investigation	192/48.5	105 (45.8)	87 (52)	
Level of care				
Primary	5/1.3	4 (1.7)	1 (0.6)	
Secondary	105/26.5	69 (30.1)	36 (21.5)	0.840[b]
Tertiary	286/72.2	156 (68.1)	130 (77.8)	
Decreased food intake	245/61.9	145 (63.3)	100 (59.9)	0.487[a]
Diet consistency change	109/27.5	50 (21.8)	59 (35.3)	0.003[a]*
*Weight loss (kg)***	1,27 (0.1-9.9)	1,3 (0.1-7.5)	1,2 (0.1-9.9)	0.43[c]
*Length of stay (days)***	13,0 (1.0-76.0)	12,0 (2.0-76.0)	13,0 (1.0-66.0)	0.69[c]

[a]Comparison of variables between adults and elderly, Chi-square test with Yates correction.
[b]Comparison of variables between adults and elderly, Chi-square test.
[c]Comparison of variables between adults and elderly, Mann-Whitney test, $p > 0.05$
*Statistically significant values, $p < 0.05$.
**Numbers in format median (minimum-maximum).

Results

The study included data from 396 individuals. Elderly over 60 years of age represented a significant proportion of the study population (42%). Half of the patients (51.5%) were admitted for treatment of previously diagnosed disease and 72.2% of individuals had nutritional care classified as tertiary. Hypertension (HTN) and diabetes mellitus (DM) were associated with age and were present in 66.5% and 22.7% of the elderly population, respectively ($p < 0.05$) (table I).

Nutritional status

Decrease food intake prior to hospitalization was reported by 62% of participants and it was not associated with age. However, a significant proportion of the elderly needed consistency modified diets (35.3%; $p = 0.003$).

The method based on TST measurement identified the highest degree of malnutrition in patients (58.3%). The TST and SGA obtained the best results in order to identified severely malnourished individuals (37.4% and 35.6% respectively).

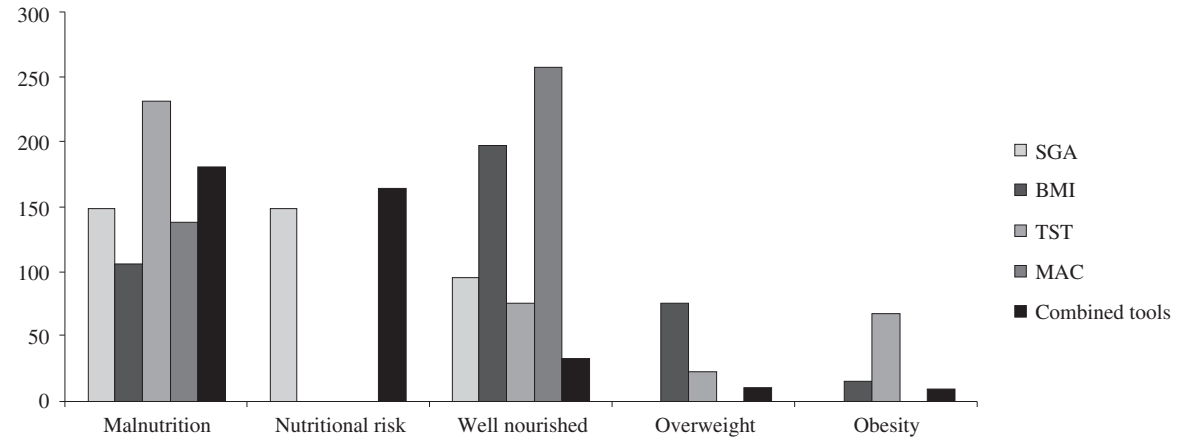
The majority of patients were classified as well nourished by the BMI and MAC (50% and 64.9%, respectively). Nevertheless, combined tools detected malnutrition in 45.7% and nutritional risk in 41.2% of patients. Few patients were diagnosed as well nourished or overweight/obesity, 8.3% and 4.8%, respectively (fig. 1 and table II). Combined diagnostic tools were correlated with some anthropometric measures, such as TST (weak correlation, $r_{TST} = 0.302$), BMI and MAC (moderate correlations, $r_{BMI} = 0.407$ and $r_{MAC} = 0.404$ respectively).

Clinical outcomes

Clinical outcome was not related to gender, age, HTN, DM, level of nutritional care and diet consistency modified ($p > 0.05$) in this study. Decreased food intake at admission was significantly associated with poorer clinical outcome. Most patients who died (87.5%) presented decreased in food intake ($p = 0.01$). Poorer outcome was significantly associated with malnutrition by SGA and MAC ($p = 0.02$ and $p = 0.03$ respectively). Most patients who died were classified as malnourished by SGA (62.5%) and by MAC (58.3%) (table III).

Length of hospital stay

The median length of stay was 13 days, ranging from 1 to 76 days (IC 95% = 5-29 days), without significant



Values of the graphics are in absolute frequency. SGA = Subjective global assessment; BMI = Body mass index; TST = Triceps skinfold thickness; MAC = Muscle arm circumference.

Fig. 1.—Nutritional diagnosis according to different assessment tools used.

Table II
Nutritional diagnosis according to different assessment tools used

Tools	*Nutritional diagnosis*	*Adults n (%)*	*Elderly n (%)*	*Total*
SGA	Severe malnutrition	83 (36.2)	65 (38.9)	148
	Nutritional risk	85 (37.1)	66 (39.5)	151
	Well nourished	61 (26.6)	36 (21.6)	97
	n	229 (100.0)	167 (100)	396
BMI	Malnutrition/Thinner	38 (16.6)	68 (40.7)	106
	Well nourished	119 (52.0)	79 (47.3)	198
	Overweight	55 (24.0)	20 (12.0)	75
	Obesity	17 (7.4)	0 (0.0)	17
	n	229 (100.0)	167 (100.0)	396
TST	Severe malnutrition	87 (38.0)	54 (32.3)	141
	Moderate malnutrition	31 (13.5)	15 (9.0)	46
	Mild malnutrition	28 (12.2)	16 (9.6)	44
	Well nourished	42 (18.3)	33 (19.8)	75
	Overweight	13 (5.7)	10 (6.0)	23
	Obesity	28 (12.2)	39 (23.4)	67
	n	229 (100.0)	167 (100.0)	396
MAC	Severe malnutrition	14 (6.1)	7 (4.2)	21
	Moderate malnutrition	41 (17.9)	13 (7.8)	54
	Mild malnutrition	45 (19.7)	19 (11.4)	64
	Well nourished	129 (56.3)	128 (76.6)	257
	n	229 (100.0)	167 (100.0)	396
Combined Tools	Severe malnutrition	27 (11.8)	13 (7.8)	40
	Moderate malnutrition	37 (16.2)	30 (18.0)	67
	Mild malnutrition	40 (17.5)	34 (20.4)	74
	Nutritional risk	93 (40.6)	70 (41.9)	163
	Well nourished	20 (8.7)	13 (7.8)	33
	Overweight	6 (2.6)	5 (3.0)	11
	Obesity	6 (2.6)	2 (1.2)	8
	n	229 (100.0)	167 (100.0)	396

SGA = Subjective global assessment; BMI = Body mass index; TST = Triceps skinfold thickness; MAC = Muscle arm circumference.

difference between adults and elderly. Among the patients included in the study, 6% died (table I).

The LOS did not differ according to gender, age, need of diet consistency change and anthropometric measurements. Longer hospitalization periods were associated with poor clinical outcomes, decreased food intake, level of nutritional care, diagnosis by SGA and malnutrition diagnosis by combining tools. The LOS of

Table III
Relationship between clinical outcome and the variables involved in the assessment of nutritional status

Variables	*N*	*Clinical outcome*		*p value*
		Discharge n (%)	*Death n (%)*	
Gender				
Male	226	210 (92.9)	16 (7.1)	0.93[a]
Female	170	162 (95.3)	08 (4.7)	
Age				
Adult	229	216 (94.3)	13 (5.7)	0.87[a]
Elderly	167	156 (93.4)	11 (6.6)	
Hypertension	196	185 (94.4)	11 (5.6)	0.87[a]
Diabetes melitus	71	66 (93.0)	5 (7.0)	0.91[a]
Level of care				
Primary	5	5 (100.0)	–	
Secondary	105	103 (98.1)	02 (1.9)	0.08[b]
Tertiary	286	264 (92.3)	22 (7.7)	
Decreased food intake	245	224 (91.4)	21 (8.6)	0.01a*
Diet consistency change	109	102 (93.6)	7 (6.4)	0.96[a]
SGA				
Severe malnutrition	148	133 (89.9)	15 (10.1)	
Nutritional risk	151	144 (95.4)	07 (4.6)	0.02[b]*
Well nourished	97	95 (97.9)	02 (2.1)	
BMI				
Thinner	106	104 (98.1)	5 (4.7)	
Well nourished	198	187 (94.4)	11 (5.6)	0.85[b]
Overweight	75	68 (90.7)	7 (9.3)	
Obesity	17	16 (94.1)	1 (5.9)	
TST				
Severe malnutrition	141	132 (93.6)	9 (6.4)	
Moderate malnutrition	46	43 (93.5)	3 (6.5)	
Mild malnutrition	44	42 (95.5)	2 (4.5)	0.36[b]
Well nourished	75	72 (96.0)	3 (4.0)	
Overweight	23	20 (87.0)	3 (13.0)	
Obesity	67	63 (94.0)	4 (6.0)	
MAC				
Severe malnutrition	21	19 (90.5)	2 (9.5)	
Moderate malnutrition	54	46 (85.2)	8 (14.8)	0.03[b]*
Mild malnutrition	64	60 (93.8)	4 (6.3)	
Well nourished	257	247 (96.1)	10 (3.9)	
Combined tools				
Severe malnutrition	40	36 (90.0)	4 (10.0)	
Moderate malnutrition	67	59 (88.1)	8 (11.9)	
Mild malnutrition	74	68 (91.9)	6 (8.1)	0.09[b]
Nutritional risk	163	157 (96.3)	6 (3.7)	
Well nourished	33	33 (100.0)	–	
Overweight	11	11 (100.0)	–	
Obesity	8	8 (100.0)	–	

[a]Comparison between the studied variables and clinical outcome (discharge or death), Chi-square test with Yates correction.
[b]Comparison between the studied variables and clinical outcome (discharge or death), Chi-square test.
*Values considered significant with $p < 0.05$. (%)= percentage calculated in relation to the N of the respective class.
SGA = Subjective global assessment; BMI = Body mass index; TST = Triceps skinfold thickness; MAC = Muscle arm circumference.

patients who died, was 7 days longer than those who were discharged ($p = 0.004$). Patients that decreased food intake had LOS 3 days longer than patients without decreased food intake ($p = 0.001$). Tertiary patients remained hospitalized 4 days longer than secondary care patients ($p < 0.01$) (table IV). According to SGA, malnourished and patients at nutritional risk had longer LOS than well nourished

Tabla IV
Relationship between length of hospital stay and the variables involved in the assessment of nutritional status

Variables	*N*	*Length of hospital stay (days)***	*p value*
Gender			
Male	226	13.5 (2-76)	0.69[a]
Female	170	12.0 (1-63)	
Age			
Adult	229	13.0 (1-66)	0.07[a]
Elderly	167	12.0 (2-76)	
Hipertensão			
Present	196	11.0 (1-76)	0.11[a]
Absent	200	13.0 (2-70)	
Diabetes mellitus			
Present	71	15.0 (2-59)	0.09[a]
Absent	325	12.0 (1-76)	
Level of care			
Primary	5	8.0 (3-29)	0.01[b]
Secondary	105	10.0 (1-76)	
Tertiary	286	13.0 (2-70)	
Decreased food intake			
Present	245	15.0 (2-59)	0.001[a]*
Absent	151	12.0 (1-76)	
Diet consistency change			
Yes	109	12.0 (1-70)	0.63[a]
No	287	13.0 (2-76)	
Clinical outcome			
Death	24	19.0 (2-66)	0.004[a]*
Discharge	372	12.0 (1-76)	
SGA			
Severe malnutrition	148	14.5 (2-76)	0.001[b]*
Nutritional risk	151	13.0 (2-52)	
Well nourished	97	9.0 (1-30)	
BMI			
Thinner	106	14.5 (2-76)	0.09[b]
Well nourished	198	11.0 (2-66)	
Overweight/obesity	75	12.0 (1-63)	
TST			
Severe malnutrition	141	12.0 (2-62)	0.34[b]
Moderate malnutrition	46	13.0 (2-66)	
Mild malnutrition	44	16.0 (2-44)	
Well nourished	75	11.0 (2-43)	
Overweight	23	10.5 (1-76)	
Obesity	67	13.0 (2-44)	
MAC			
Severe malnutrition	21	15.0 (6-44)	0.12[b]
Moderate malnutrition	54	13.0 (2-70)	
Mild malnutrition	64	14.0 (2-66)	
Well nourished	257	11.0 (1-63)	
Combined tools			
Severe malnutrition	40	15.0 (8-70)	0.001[b]*
Moderate malnutrion	67	16.0 (4-66)	
Mild malnutrition	74	13.0 (2-63)	
Nutritional risk	163	10.0 (2-76)	
Well nourished	33	10.0 (2-41)	
Overweight	11	9.0 (3-30)	
Obesity	8	4.5 (1-18)	

**Numbers in median format (min-max) calculated with IC 95%.
[a]Comparison between the studied variables and length of stay, Mann-Whitney test.
[b]Comparison between the studied variables and length of stay, Kruskall-Wallis test and multiple comparisons among categories of variables.
*Values considered significant with $p < 0.05$.
SGA: Subjective global assessment; BMI: Body mass index; TST: Triceps skinfold thickness; MAC: Muscle arm circumference.

patients. The LOS of malnourished patients was 5 days longer than well nourished. The LOS of severe malnourished patients by combined tools was 5 days longer than well nourished ones and 10 days longer than obese patients (table IV). The correlation coefficients between weight loss during the hospitalization period and clinical outcome (r = 0.028) and LOS (r = 0.010) were not significant.

Discussion

The elderly population is increasing over the past years[14] and added to this situation exists a progressive increase in the prevalence of chronic diseases among the general population. In this study elderly population represents almost half of the patients evaluated. Further, HTN and DM were associated with the elderly population increasing the risk of developing complications from chronic diseases, which affect the maintenance of a good nutritional status[15,16]. Elderly people are a risk group for nutritional alteration due to physical, cognitive and physiological limitations imposed by advancing age. In this study, the elderly required more dietary modifications and had higher median weight loss.

Fifty percent of the patients in the present study had some degree of weight loss during the hospitalization period, which is higher than the percentage published in another study in a university hospital, in which 31% of hospitalized patients showed decline in nutritional status during hospitalization[17]. Half of patients did not have a definitive diagnosis at admission, which involves performing several diagnostic tests. This may have contributed to increase the fasting times which can affect negatively the nutritional status. Most patients were classified as tertiary level care, *i.e.*, the underlying disease required nutritional care and it was already associated to nutritional risk factors (anorexia, decreased food intake, weight loss). This fact can be justified because this is a tertiary hospital, where the patients are admitted when the symptoms are already advanced in a process of underlying diseases investigation. These clinical symptoms can affect the food intake and interfere with the maintenance of a good nutritional status.

In this study nutritional status assessment was done using different tools. There is not a gold standard method for the diagnosis of nutritional status, which makes the use of different tools important in order to define the nutritional diagnosis, since each of these tools has limitations. Therefore, in this study a combination of different tools (here called combined tools) were used in order to make a better diagnosis of nutritional status[7].

Analyzing the tools used to diagnose undernutrition, TST and SGA were those more effective to detect some degree of malnutrition. In this study, more than half the cases of death were from patients diagnosed as malnourished by SGA. The SGA considers clinical characteristics and presents predictive capacity of nutritional status related complications[18]. These data indicate the importance of periodic nutritional status assessment, which improves the chances of early nutritional therapy and better prognosis[19].

BMI and MAC showed moderate correlation with the nutritional diagnosis by combining tools. Although it has been proposed that anthropometric measurements identify malnutrition mainly in advanced stages[20]. In the present study only MAC was related to increase mortality. This result might be explained by the fact that this anthropometric measure is able to detect mainly body lean mass changes as compared to other anthropometric measures. The relationship between body lean mass deterioration and mortality is well established[21].

When clinical, anthropometric and biochemical variables (combined tools) routinely used at the teaching hospital were considered to determine the nutritional status, 46% of patients were classified as malnourished. These results are similar to those reported in other studies, in which 30% to 50% of hospitalized patients were malnourished[6,22]. Thus, combined tools can improve the early detection of nutritional status, which allows minimize the negative impact of hospital malnutrition. Malnutrition is responsible for poor clinical responses to treatment, increased complications, LOS and costs of hospitalization what adversely affects clinical outcomes[22,23,24].

Tertiary care patients, with decreased food intake, diagnosed as malnourished by SGA at admission and by combined tools had longer LOS and poor clinical outcomes. These results have been found in other studies.[25,26,27,28]. Decreased food intake can be a consequence of advanced underlying disease and be related to poor response to medical treatment. The association between malnutrition detected by SGA at admission and negative clinical outcome has been described in other studies confirming the importance of SGA as a tool for early nutritional assessment at admission.[29,30]. This may also be associated with more severe underlying disease.

In this study longer LOS was associated with higher mortality. The relationship between malnutrition and LOS was also reported in other studies[17,31,32,33] and can be considered an independent risk factor for increased complications rates, mortality, and costs[34].

This study has some limitations, such as the wide variety of underlying diseases treated or investigated at the internal medicine department. Additionally a large number of patients are admitted for investigation without a definitive diagnosis. Thus, it was not possible to determine the impact of the underlying disease on the nutritional status.

Conclusion

Malnourished patients according to SGA and those with decreased food intake at admission have longer LOS and poorer clinical outcomes. Malnutrition diagnosed by MAC is also related to higher mortality.

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