Artículo Original / Original Article

Associations between nutritional risk at hospital admission and incidence of complications, hospitalization time and mortality

Asociación entre nutricional en la admisión hospitalaria y la incidencia de complicaciones, tiempo de hospitalización y mortandad

ABSTRACT

The early identification of nutritional risk is essential for the earliest possible implementation of nutritional therapy. The aim of the present study was to evaluate the association between nutritional risk and the incidence of clinical complications. An observational study was conducted at the internal medicine infirmary of a Brazilian public hospital involving patients admitted between January 2016 and December 2017. The NRS-2002, anthropometrics and laboratory exams (initial and final) were used for the evaluation of nutritional risk. The prevalence of nutritional risk was 63.6%. Nutritional risk upon admission to hospital was associated with the occurrence of complications, a longer hospitalization time and death. In correlation analysis, considering anthropometrics and laboratory exams compared to hospitalization time and time elapsed prior to the onset of the diet, serum albumin was inversely correlated with both hospitalization time and nutritional risk. Based on the present findings, knowledge on the nutritional status of patients and adequate nutritional therapy can lead to fewer complications during hospitalization.

Keywords: Malnutrition; Nutritional assessment; Nutritional status; Length stay; Risk factors.

RESUMEN

La identificación del riesgo nutricional precoz es esencial para que un procedimiento nutricional sea implementado. El objetivo fue evaluar la asociación entre el riesgo nutricional con incidencia de complicaciones clínicas. Estudio observacional, realizado en la enfermería de una clínica médica de un hospital público brasileño, con pacientes admitidos entre enero de 2016 y diciembre de 2017. Para evaluación nutricional, se utilizaron la NRS-2002, antropometría y análisis laboratoriales inicial y final. La frecuencia de riesgo nutricional fue del 63,6%. El riesgo nutricional en la admisión se mostró asociado a incidencia de complicaciones, mayor tiempo de hospitalización y muerte. La albúmina sérica mostró una correlación inversa con el tiempo de internamiento y riesgo nutricional. Se concluye que el conocer el estado nutricional de los pacientes y el acompañamiento nutricional adecuado minimizará las complicaciones durante el internamiento.

Palabras clave: Desnutrición; Estado nutricional; Evaluación nutricional; Factores de riesgo; Tiempo de internación.

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INTRODUCTION

Malnutrition in the hospital setting is related to a greater incidence of complications, delayed recovery time, a longer hospital stay, an increase in hospital costs, readmission of the patient and mortality^{1,2}. When a patient's nutritional status is compromised, organic, cardiac, respiratory, intestinal, renal and immunological functions are affected, which could lead to the occurrence of infectious complications that have repercussions regarding clinical outcomes³. Undernourished hospitalized patients undergo a decline in functioning and are bedridden most of the time, which favors the occurrence of pressure ulcers; moreover, malnutrition hinders the healing process⁴.

According to Aquino and Phillippi⁵, the earliest possible identification of nutritional risk (NR) is an important care objective in the global treatment of hospitalized patients.

Adequate diagnosis is essential to the timely implementation of nutritional therapy.

The assessment of NR is of immense importance when performed upon admission to hospital. The present paper reinforces the importance of this assessment for better screening and a reduction in clinical complications. Therefore, considering the need for the assessment of NR for the earliest possible intervention, the aim of the present study was to evaluate the frequency of NR upon hospital admission and its association with the incidence of complications, hospitalization time and mortality at a public hospital located in northeast Brazil.

MATERIALS AND METHODS

An observational study was conducted, in which patients were evaluated upon hospital admission through the last day of hospitalization. Data collection involved the analysis of patient charts and nutritional follow-up charts of adults admitted to the internal medicine infirmary between January 2016 and December 2017 at the Miguel Arraes Hospital in the city of Paulista, which is located in the metropolitan region of Recife, Brazil.

The inclusion criteria were male and female adults with nutritional follow-up charts with complete information on diagnosis, admission date, date of discharge or death, nutritional screening, anthropometric nutritional assessment, biochemical analysis upon admission, subsequent analyses and dietary evolution. Individuals with amputations, those with edema (who have liver or kidney disease), those submitted to bariatric surgery and those undergoing corticoid therapy were excluded from the study.

A nutritional risk screening (NRS-2002) was performed within the first 48 hours of admission to the hospital and patients were divided into two groups: with and without NR. The anthropometric evaluation was performed upon admission, with reevaluations on a weekly basis. Admission and follow-up routines included the determination of weight using a mechanical scale (FILIZOLA, model 31) with a capacity for 150 kg and height using a stadiometer. For bedridden individuals, weight was estimated using the formula proposed by Chumlea et al⁶. without the subscapular skin fold. Arm circumference (AC) was determined with a non-elastic tape measure with the elbow flexed at 90° and measured the midpoint between the acromion and olecranon. Weight and height were used to calculate the body mass index (BMI) considering the reference cutoff points established by the World Health Organization⁷. AC was evaluated based on Blackburn et al⁸.

Patients who received exclusive oral feeding and the use of supplementation, patients in enteral nutritional therapy and those in mixed nutritional therapy participated in the present study.

For the biochemical evaluation (albumin, C-reactive protein and leukocytes), we considered the values established by the outsourced laboratory that offers this service to the Miguel Arraes Hospital (CERPE Diagnostics), which used the following cutoff points: albumin: 3.5-5.0 mg/dl; CRP: ≤ 5 mg/dl; and leukocytes: 3500-11000/UL. The first and last exams of each patient during hospital stay were considered.

We evaluated the delay until the onset of the diet due

to hemodynamic instability or the need to undergo exams. For the evaluation of clinical complications, we investigated infectious conditions (analysis of leukocytes), inflammation (analysis of CRP), lowered level of consciousness and admission to the intensive care unit. The hospital outcome (discharge or death) was identified through information obtained from the nursing staff.

The databank was created and analyzed using the Statistical Package for the Social Sciences (SPSS, version 13.0, SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test was used to test the normality of the data distribution. Variables with normal distribution were expressed as mean and standard deviation values. Variables with non-Gaussian distributions were expressed as median and interquartile range. In the description of proportions, binomial distribution was approximated to normal distribution by the 95% confidence interval.

The paired t-test was used for the comparison of means of the anthropometric and biochemical variables at both evaluation times (admission and outcome). The paired Wilcoxon test was used for the comparisons of non-parametric data. Proportions were compared using Pearson chi-square test, the linear trend chi-square test or Fisher's exact test.

Either Pearson's or Spearman's correlation coefficients were calculated to determine the strength of correlations between the anthropometric/laboratory data and both hospitalization time and number of days elapsed until the onset of the diet adjusted for sex and the occurrence of NR upon admission to hospital.

This study received authorization from the administration of the Miguel Arraes Hospital. The study also received approval from the Human Research Ethics Committee of the Federal University of Pernambuco (certificate number: 81871717.1.0000.5208) in accordance with Resolution nº 466/2012 of the Brazilian National Board of Health and was conducted following the ethical precepts established in the Declaration of Helsinki. As the data were collected from patient follow-up charts, the ethics committee waived the need for a signed statement of informed consent.

RESULTS

Approximately 750 patients are admitted to the hospital per year. The present study was conducted between January 2016 and December 2017. Therefore, we started with 1500 patients, among whom 806 were eligible for the study after the application of the exclusion criteria. Mean age was 46.4 ± 12.5 years. Male sex accounted for 58.3% of the sample. The main causes of hospitalization were infectious-parasitic disease (28.6%), followed by chronic non-communicable disease (12.1%) (Table 1).

Nutritional risk upon admission was 63.6%. Median hospitalization time was 26.0 days (range: 17 to 41) and 54.6% of patients had no complications. Diet was administered mainly through the oral route and 80.0% of the patients were discharged from hospital (Table 1).

Tables 2 and 3 display the results of the analysis of the associations between NR and aspects of hospitalization. Among men (Table 2), NR upon admission was associated with

a longer time prior to the onset of the diet, greater number of days of zero diet for exams, the occurrence of complications, a longer hospitalization time, negative outcome (death) as well as leukopenia and high C-reactive protein (CRP) at the end of follow-up. Among women (Table 3), NR upon admission was associated with a larger number of days of zero diet for exams, the occurrence of complications, a longer hospitalization time, the occurrence of weight loss, the negative outcome (death)

and hypoalbuminemia at the end of follow-up.

In correlation analysis, considering anthropometrics and laboratory exams compared to hospitalization time and time elapsed prior to the onset of the diet adjusted by sex and the occurrence of NR upon admission, serum albumin was inversely correlated with both hospitalization time and time until the onset of the diet in men and women with NR (Table 4).

Table 1. Distribution of sample according to sex, cause of hospitalization, nutritional status and complications among patients admitted to the hospital in Paulista, Brazil, between January 2016 and December 2017.

Variables	N	%	95% CI
Age			
20 – 59 years	417	51.7	42.4 – 44.6
> 60 years	389	48.3	72.4 – 74.2
Sex			
Male	470	58.3	54.9 – 61.7
Female	336	41.7	38.3 – 45.1
Reason for hospitalization			
Infectious/parasitic disease	231	28.6	25.6 – 31.9
Chronic noncommunicable disease	98	12.1	10.1 – 14.6
Respiratory tract disease	82	10.2	8.30 – 12.4
Chronic kidney disease	62	7.70	6.00 – 9.70
Chronic liver disease	61	7.60	5.90 – 9.60
Other ¹	272	33.8	30.5 – 37.1
Nutrition risk			
With risk	513	63.6	60.3 – 66.9
Without risk	293	36.4	33.1 – 39.7
Nutritional status (BMI)			
Undernourished	143	17.8	15.5 – 16.1
Ideal range	403	50.0	22.8 – 24.4
Excess weight	260	32.2	29.2 – 30.2
Arm circumference percentage (%AC)			
Undernourished	195	24.2	79.5 – 81.7
Ideal range	277	34.4	90.8 – 98.1
Excess weight	334	41.4	130.2 – 134.5
Complications during hospitalization			
No complications	440	54.5	51.1 – 58.0
Infection	177	21.9	19.2 – 24.9
Other complication	86	10.8	8.70 – 13.0
Pressure ulcer	52	6.50	4.90 – 8.40
Intensive care unit	51	63.0	4.80 – 8.20
Outcome			
Discharge	645	80.0	77.1 – 82.6
Transference	86	10.6	8.70 – 13.0
Death	75	7.30	7.50 – 11.5

Note: ¹Others: gastrointestinal tract, rheumatic, oncological, neurological diseases and minor surgery. Data expressed as absolute number and percent.

Table 2. Aspects of internment: diet, occurrence of complications, final laboratory findings and clinical outcome according to nutritional risk in male patients admitted to the hospital in Paulista, Brazil, between January 2016 and December 2017.

	Total		With risk		Without risk		p*
	N	%	n	%	n	%	
Total n° of patients	470		302		168		
Day of onset of diet							0.000
1 st day	343	72.9	201	66.6	142	84.5	
2 nd day or more	127	27.1	101	33.4	26	15.5	
Days of zero diet for exams							0.017**
None	265	56.4	159	52.1	106	64.2	
1 to 2 days	138	29.4	94	30.8	44	26.7	
3 days or more	67	14.2	52	17.1	15	9.10	
Complications							0.000
No	284	60.4	136	52.9	148	69.5	
Yes	186	39.6	121	47.1	65	30.5	
Hospital stay (days)							0.008**
≤15	94	20.0	52	17.2	42	25.0	
16 to 30	188	40.0	114	37.7	74	44.0	
>30	188	40.0	136	45.0	52	30.9	
Weight loss during hospitalization							0.155
No	255	54.3	156	51.7	99	58.9	
Yes	215	45.7	146	48.3	69	41.1	
Type of diet offered							0.030
Exclusive oral diet	315	67.0	168	55.6	147	87.5	
Oral + enteral diet	114	24.3	95	31.4	19	11.3	
Exclusive enteral diet	41	8.7	39	13.0	2	1.2	
Weight gain during hospitalization (kg)							0.476
0 to 0.5	302	64.3	190	62.9	112	66.7	
>0.5	168	35.7	112	37.1	56	33.3	
Leukocytes (UL)							0.022**
Low	35	7.40	30	9.90	05	3.00	
Adequate	276	58.7	173	57.3	103	61.3	
High	159	33.8	99	32.8	60	35.7	
Albumin (g/dl)							0.062
Low	391	83.2	259	85.8	132	78.6	
Adequate	79	16.8	43	14.2	36	21.4	
CRP (mg/dl)							0.014
High	423	90.0	280	92.7	143	85.1	
Adequate	47	10.0	22	7.30	25	14.9	
Outcome							0.000
Death	62	13.2	57	18.9	05	3.00	
Discharge	408	86.8	245	81.1	163	97.0	

* Pearson's chi-square test. **Linear trend chi-square test.

Table 3. Aspects of internment: diet, occurrence of complications, final laboratory findings and clinical outcome according to nutritional risk in female patients admitted to the hospital in Paulista, Brazil, between January 2016 and December 2017.

	Total		With risk		Without risk		p*
	N	%	N	%	N	%	
N° of patients	336		211		125		
Day of onset of diet							0.518°
1st day	324	96.4	203	96.2	121	99.6	
2nd day or more	12	3.60	08	3.80	04	3.20	
Days of zero diet for exams							0.000**
None	207	61.7	110	52.1	97	77.6	
1 to 2 days	82	24.4	61	28.9	21	16.8	
3 days or more	47	13.9	40	19.0	07	5.60	
Complications							0.000
No	181	53.9	86	40.8	95	76.0	
Yes	155	46.1	125	59.2	30	24.0	
Hospital stay (days)							0.000**
≤15	74	22.0	37	17.5	37	29.6	
16 to 30	123	36.6	69	32.7	54	43.2	
>30	139	41.4	105	49.8	34	27.2	
Weight loss during hospitalization							0.039
No	173	51.5	99	46.9	74	59.2	
Yes	163	48.5	112	53.1	51	40.8	
Type of diet offered							0.038
Exclusive oral diet	221	65.8	111	52.6	110	88.0	
Oral + enteral diet	74	22.0	61	28.9	13	10.4	
Exclusive enteral diet	41	12.2	39	18.5	2	1.6	
Weight gain during hospitalization (kg)							0.680
0 to 0.5	247	73.5	153	72.5	94	75.2	
>0.5	89	26.5	58	27.5	31	24.8	
Leukocytes (UL)							0.433**
Low	25	7.40	13	6.20	12	9.60	
Adequate	214	63.7	134	63.5	80	64.0	
High	97	28.9	64	30.3	33	26.4	
Albumin (g/dl)							0.001
Low	261	77.7	177	83.9	84	67.2	
Adequate	75	22.3	34	16.1	41	32.8	
CRP (mg/dl)							0.292
High	39	11.6	21	10.0	18	14.4	
Adequate	297	88.4	190	90.0	107	85.6	
Outcome							0.003
Death	47	13.9	39	18.5	08	6.40	
Discharge	289	86.1	172	81.5	117	93.6	

°Fisher's exact test. *Pearson's chi-square test. **Linear trend chi-square test.

Table 4. Correlation between anthropometric/laboratory variables and hospital stay/number of days until onset of diet adjusted for sex and nutritional risk in patients admitted to a hospital in Paulista, Brazil, between January 2016 and December 2017.

Variables	Hospitalization time ^b		Time until onset of diet ^a	
	r	p	R	p
Men without nutritional risk (n= 168)				
Age (years)	-0.051	0.514	0.052	0.502
Initial BMI (kg/m ²)	-0.200**	0.009	-0.026	0.737
Initial serum albumin (g/dl)	-0.110	0.156	-0.034	0.665
Initial CRP (mg/dl)	0.018	0.817	0.016	0.839
Men with nutritional risk (n= 302)				
Age (years)	0.023	0.686	0.001	0.988
Initial BMI (kg/m ²)	0.050	0.390	-0.012	0.831
Initial serum albumin (g/dl)	-0.195**	0.001	-0.149**	0.009
Initial CRP (mg/dl)	0.059	0.303	0.082	0.153
Women without nutritional risk (n= 125)				
Age (years)	0.056	0.538	-0.046	0.609
Initial BMI (kg/m ²)	0.027	0.765	-0.090	0.320
Initial serum albumin (g/dl)	-0.143	0.112	-0.067	0.458
Initial CRP (mg/dl)	-0.009	0.923	0.133	0.139
Women with nutritional risk (n= 211)				
Age (years)	0.026	0.709	0.086	0.211
Initial BMI (kg/m ²)	-0.024	0.725	0.012	0.866
Initial serum albumin (g/dl)	-0.182**	0.008	-0.055	0.425
Initial CRP (mg/dl)	0.023	0.735	-0.026	0.704

^aPearson's correlation. ^bSpearman's correlation. *level of significance: $p < 0.05$. ** level of significance: $p < 0.01$.

DISCUSSION

In the present study, 63.6% of patients were at NR upon admission to hospital. This high prevalence may be explained by the fact that the patients were at a public emergency hospital in the city of Paulista in the metropolitan region of Recife (northeast Brazil), the majority of whom had little access to basic healthcare services. Moreover, patients affected by conditions that require emergency care generally have a high hypercatabolic state, which contributes to the aggravation of poor nutritional status.

Previous studies that also employed the NRS-2002, report much lower frequencies of NR compared to that found in the present study. Among patients at a public hospital in the city of Recife, 16.7% were at NR⁹. In a study conducted by Lisboa et al¹⁰ in a internal medicine infirmary at a university hospital in the state of Pernambuco

(PE), 39% of patients were diagnosed with NR in the first 48 hours after admission. At a general surgery infirmary of another university hospital, the frequency of NR among patients was 31.1%¹¹. Raslan et al¹² evaluated 705 patients and found that 27.9% were at NR. The high frequency of NR in the present study may have been due to the fact that infectious-parasitic diseases were the main cause of hospitalization, along with the high frequency of respiratory, kidney and liver diseases. Thus, admission to hospital was due to the exacerbation of these diseases, increasing the hypercatabolic state, with a consequent negative impact on nutritional status.

The higher number of male patients compared to females has also been reported in previous studies^{13,14}. This reflects the chronicity and disease complications due to the failure on the part of men to seek basic healthcare services, only doing so when conditions become so

serious that hospitalization is required. The age of the patients (46.4 ± 12.5 years) is also in agreement with data found in the previous studies, which describe a mean of 45 to 59 years^{9,12,15,16}.

The mean hospitalization time was 26 days, which may have been due to the most frequent type of adverse health condition and the occurrence of complications, along with the fact that the internal medicine infirmary is an investigational setting in which patients spend more time for the confirmation of the diagnosis. Previous studies report a shorter hospitalization time, with a mean of 15 days^{12,16,17,18}. Moreover, hospitalization time was longer among those with NR upon admission. According to Kyle and collaborators (2001)¹⁹, both the depletion of lean mass and an excess of fat mass exert a negative impact on hospitalization time.

In the analysis of the associations with the variables analyzed during hospitalization, NR upon admission was associated with a later onset of the diet among the men. It is possible that patients at NR have more serious conditions, with hemodynamic instability, digestive hemorrhages and the preparation for exams or surgical procedures. The literature reports that patients at NR and with a late onset of the diet have greater catabolism and a higher risk of weight loss, especially lean mass, leading to malnutrition and its probable complications⁴.

Among women, no association was found between NR and later onset of the diet. However, the greater need for nutritional support, complications and death were more probable among both men and women at NR. The most frequent complications were respiratory and urinary infections, which can be caused by an unfavorable nutritional status^{20,21}.

In a review of the literature published in 2005, authors concluded that patients at risk for the development of pressure ulcers can be identified early through the nutritional assessment, including a biochemical analysis, anthropometric measurements, clinical signs, dietary history and energy expenditure²². Pressure ulcers are more frequent in seniors, hospitalized patients and individuals with chronic diseases, such as stroke, cancer and spinal cord injuries.

Clinical outcome is an important aspect to consider. Patients at NR and those with malnutrition have worse outcomes, including an increased risk of mortality. In the present study, deaths were more frequent among the men and women with NR upon admission to hospital¹.

The prevalence of hypoalbuminemia was high at both evaluation times. Amaro and collaborators (2016)¹ also found albumin levels below the reference value in patients at two evaluation times. The association between NR and hypoalbuminemia was found in the women. Previous studies have also found hypoalbuminemia more frequently in malnourished patients and those at NR^{23,24,25}. In contrast, CRP was higher than the laboratory reference value. Previous studies report similar results, with mean CRP values of 3 mg/dL^{26,27,28}. These findings are due to inflammation caused by either the baseline disease or an associated condition, reflecting the clinical status and severity of the disease.

Albumin is a negative acute-phase protein, meaning that it is reduced in the inflammatory phase, whereas CRP is a positive acute-phase protein, meaning that it is increased during the inflammatory process of a disease²⁹.

The late onset of the diet and/or longer fasting time for the execution of exams was negatively correlated with albumin (patients with a longer fasting time had albumin below the reference range). Albumin was correlated with hospitalization time among the patients at NR upon admission.

In the present study, 13.2% of male and 13.9% of female patients at NR died. In the literature, this frequency is around 18.0% among patients at NR²⁹. In undernourished patients and those at NR, there is a greater possibility of the occurrence of clinical complications due to the greater susceptibility to infection and surgical complications and a greater risk of death.

Nutritional screening performed upon admission to the hospital is an important factor to ensure better outcomes, as preexisting NR together with clinical complications increase morbidity and mortality rates among patients.

CONCLUSION

Determining the nutritional status of patients upon admission and performing adequate nutritional follow-up improves patient status during hospitalization, thereby minimizing the occurrence of complications, lowering the risk of morbidity/mortality and shortening the hospital stay. However, being in the ideal range for BMI is not necessarily a protective factor against NR. The present findings underscore the need for the earliest possible screening for NR to ensure the wellbeing of hospitalized patients.

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