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Nutrition impact symptoms, sarcopenia, and malnutrition in hospitalized patients

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ABSTRACT

Introduction: Nutrition Impact Symptoms (NIS) are common in hospitalized patients and can be aggravated in the presence of malnutrition. **Objective:** To verify the presence of NIS and its association with sociodemographic and clinical variables, sarcopenia phenotype, and nutritional status of individuals hospitalized. Methods: This is a cross-sectional study with hospitalized patients, of both sexes and ≥50 years old. Patient-Generated Subjective Global Assessment (PG-SGA), handgrip strength (HGS), gait speed GS), and anthropometric measurements were performed up to 48 hours after admission. NIS was obtained through PG-SGA and stratified into two groups: <3 and ≥3 symptoms. The chi-square test (χ^2) was performed, and a 5% significance level was adopted. **Results:** A total of 90 patients (65.4±9.67 years) were studied, with the majority of men (56.7%), older people (70.0%), married (68.9%), low economic class (72.2%), without work activity (70.5%), with two previous diseases (60.0%), overweight by body mass index (46.7%) and adequate adductor pollicis muscle thickness (83.3%). The most prevalent NIS were "dry mouth", "anorexia", and "smells sick" respectively 31.1%, 30.0%, and 16.7%. There was an association between NIS and SARC-F score (p=0.002), handgrip strength (p=0.016), the status of sarcopenia (p=0.020), PG-SGA (p<0.001), and economic status (p=0.020). **Conclusion:** The identification of NIS is common, and may infer negative nutritional status and functional performance of patients. The use of protocols to identify NIS during hospitalization should be considered to minimize the negative impact on nutritional status.

Keywords: signs and symptoms; impact factor; nutritional status; malnutrition; sarcopenia; aged.

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INTRODUCTION

Patients admitted to public hospitals, for clinical or surgical reasons, who are in a preserved nutritional state benefit from a shorter hospital stay, earlier discharge, lower consumption of medications, and even a reduction of possible complications inherent to the treatments[1].

However, screening and assessment of the nutritional status of hospitalized patients are indispensable procedures within the first 48 hours of hospital admission, recommended by consensus and experts in the field of clinical nutrition worldwide[2,3]. Even with all

these initiatives and recommendations, malnutrition and sarcopenia are often unknown and neglected in this environment and still stand out in high prevalence, reaching up to 60%[4] and 76%[5] at hospital admission of older adult patients, respectively.

Most hospitalized adults and older people have common chronic diseases and major organ dysfunctions that require greater nutritional demands and expose them to greater risk of deterioration in nutritional status, such as loss of weight, muscle strength, and mass as well as physical performance[6].

The new European Consensus (European Working Group on Sarcopenia in Older People - EWGSOP2)[7] defined sarcopenia as a progressive and generalized musculoskeletal disorder that is associated with an increased likelihood of adverse outcomes, including falls[8], fractures[8] and mortality[9]. It deserves even greater attention and cares when associated with other comorbidities in hospitalized patients.

Besides these conditions, one of the main determinant aspects for the compromising of the nutritional status of these individuals is the lack of appetite, especially in older people, since nutrition impacts symptoms (NIS) which alterations that the hospitalized patient may present since it limits and/or prevents from eating, may be accentuated during the clinical and pharmacological process received, compromising food intake and contributing to a worse prognosis and longer hospital stay[10] and these can be aggravated with the presence of malnutrition[11].

Therefore, every hospitalized patient must undergo nutritional screening, using diversified and validated tools to identify the risk of malnutrition. For patients, at nutritional risk, a more detailed nutritional evaluation is suggested for the implementation of therapeutic conducts[2].

The Patient-Generated Subjective Global Assessment (PG-SGA) is an example of a more detailed nutritional status assessment method, as it covers various information pertinent to the patient's clinical and nutritional status, such as weight loss, changes in food intake, NIS that may impair food intake, and subjective physical examination, being able to identify malnutrition early and nutritional risk and thus indicate the necessary interventions[12].

The main NIS associated with malnutrition is stomach pain, taste changes, lack of appetite, early satiety, nausea, and bad-tasting food. Symptoms such as taste alterations, lack of appetite, and early satiety are related to the low amount of muscle mass[13].

Still, it is important to say that unintentional weight loss, associated with the loss of lean body mass and inflammatory processes may increase the risk of developing sarcopenia and decreased physical performance in older people patients, as pointed out in a systematic review on the effects of nutritional intervention on markers of sarcopenia in hospitalized patients[14].

Given the above, this study aimed to verify the presence of nutrition impact symptoms (NIS) and its association with sociodemographic, clinical, sarcopenia phenotype, and nutritional status variables in hospitalized individuals.

METHODS

Sample and study design

A cross-sectional study with a non-probability sampling design and convenience sampling was conducted from June to December 2019 at a public university and tertiary level hospital.

Study participants were assessed within the first 48 hours of hospitalization, of which adults aged 50 years or older, of both genders, who were hospitalized for clinical or surgical reasons were included.

Exclusion criteria were: patients under respiratory precaution, with edema or impossibility of hand evaluation, individuals with the cognitive deficit, neurodegenerative diseases, or severe psychiatric dysfunctions confirmed in medical records that would preclude the execution of the research protocol, bedridden patients, and indigenous peoples.

This study was approved by the Ethics Committee of the Universidade Federal da Grande Dourados (CAAE 06426818.0.0000.5160). All participants agreed and signed the Informed Consent Form (ICF).

Sample Characterization

For sample characterization, sociodemographic and clinical characteristics were delineated.

The sociodemographic data were age (complete years), age group (adult/ older people), work activity (dichotomous: absent/ present), marital status (single, married, widowed, and divorced), and economic class determined according to economic classification criteria[15]. For this study, individuals from classes D and E were grouped in the same category.

As clinical characteristics, this study considered the presence of previous chronic diseases (none, 1-2, 3 or more) and corticoid use (dichotomous: absent/present). In addition to these variables, anthropometric aspects such as the body mass index (BMI) and the adductor pollicis muscle thickness (APMT) were incorporated into the clinical characteristics.

To calculate the BMI (kg/m^2), the patient's current weight (kg) and height (m) were obtained. Adults were classified according to World Health Organization criteria[16] and older people according to Lipschitz[17]. Subsequently, the patients were classified by the researchers as underweight, adequate, and overweight.

For the measurement of the APMT, both the measurement and the cut-off points were taken using the proposal by Lameu et al.[18], who assign adequate values for men and women equal to or greater than 12.5 mm and 10.5 mm, respectively.

Diagnostic Measures for Sarcopenia

Sarcopenia was defined using the diagnostic algorithm suggested by the EWGSOP2[7], which encompasses reduced muscle strength, associated with reduced muscle mass and low physical

performance. Based on this definition, individuals with low muscle strength were considered with probable sarcopenia, individuals with low muscle strength and low muscle mass were considered to have sarcopenia, and cases with low muscle strength, low muscle mass, and low physical performance were considered to have severe sarcopenia. Initially, the risk of sarcopenia was assessed using the SARC-F questionnaire[19], an instrument that assesses 5 items, being: strength, walking ability, rising from a chair, stair climbing, and experiences with falls. The items are noted on a 0 to 2-point response scale, where 0 represents the better functional ability and 2 represents the worse functional ability. However, patients with a SARC-F score ≥4 are classified at risk for sarcopenia.

The sarcopenia phenotype was established by applying the SARC-F questionnaire and assessments of muscle strength, muscle mass, and physical performance, according to the components and criteria detailed below.

Sarcopenia status was categorized as: no sarcopenia, probable sarcopenia, confirmed sarcopenia, and severe sarcopenia.

Muscle strength

Muscle strength was evaluated from the handgrip strength (HGS) test using a manual hydraulic dynamometer and following the criteria and cut-off points established by the EWGSOP2, men <27kg/f and women <16kg/f[7,20]. The patient was instructed to sit in a chair, with the assessed arm beside the body with the elbow forming a 90° angle, without supporting the body or receiving help from the evaluator. The measurement was performed on the right hand, in triplicate, with a 1-minute interval between measurements, and the highest value was considered[21].

Muscle mass

Muscle mass was evaluated using the measurement of calf circumference (CC), and the criteria used were those proposed by Barbosa-Silva et al.[22], The cut-off point for low muscle mass was 34 cm or less for men and 33 cm or less for women. An inelastic tape was used, positioned directly on the greatest prominence of the calf region[23].

It is worth clarifying, that the EWGSOP2 mentions CC as an alternative diagnostic method for older adults in settings where no other diagnostic method for muscle mass is accessible[7].

The cut-off points proposed by Barbosa-Silva et al.[22] were adopted because they were determined based on a Brazilian population.

Physical Performance

The gait speed (GS) was used to assess the patient's physical performance. The patient was instructed to walk at his usual pace, the walk started one meter before the beginning of the four-meter course (marked on a flat surface corridor and the closest to his bed), and the stopwatch was started at the moment he reached the beginning of the course and ended when he completed it. When necessary, the use of canes, hand-hold walkers, or another aid was allowed. The cutoff point was ≤0.8 m/s as an indicator of low physical performance and severe sarcopenia[7].

Nutritional status

The nutritional status was assessed using the Patient-Generated Subjective Global Assessment (PG-SGA). Patients were classified according to the categories proposed by the instrument (A=well nourished; B=moderately malnourished and C= severely malnourished) and by the score (punctuation) (0-1 point: no intervention is required; 2-3 points: the patient and family members should be counseled by the team and receive pharmacological intervention according to the evaluation of symptoms and biochemical tests; 4-8: points intervention is required by the nutritionist in partnership with the nurse or physician to treat the presenting symptoms; ≥9 points: nutritional intervention and management are urgently indicated for the improvement of nutrition impact symptoms[12,24].

Nutrition impact symptoms (NIS)

The nutrition impact symptoms investigated came from the PG-SGA tool. NIS is part of box 3 and the frequency of appearance of symptoms was observed as anorexia, nausea (motion sickness), constipation (stuck bowel), mouth soreness, things tasting funny, smelling sick, early satiety, swallowing problems, pain, fatigue, and others (depression, dental or financial problems). The frequency of symptoms reported by patients was categorized by the researchers into none, <3 symptoms, and ≥3 symptoms.

Statistical Analysis

Initially, the data were organized in a spreadsheet and submitted manually and online in Google forms. Statistical analysis was performed using the IBM SPSS Statistics program (v.22, SPSS An IMB Company, Chicago, IL). The Kolmogorov-Smirnov test was used to verify the normality of quantitative variables.

A descriptive analysis of the data was performed, expressed as means and standard deviations to describe continuous variables and percentages for categorical variables. The chi-square test (χ^2) was applied for the associations of interest. The student's t-test was used to compare means. A significance level of 5% was adopted

RESULTS

A total of 122 patients hospitalized for clinical or surgical procedures were invited to participate. Of these, only 90 (73.8%) agreed to participate and signed the ICF. The most common reasons why patients refused to participate were dyspnea, abdominal discomfort, pain, anxiety and nervousness, weakness, sleepiness, and being close to the medication schedule.

The population had a mean age of 65.4±9.67, with a minimum of 50 and a maximum of 91 years of age, being mostly male (56.7%), older people (70.0%), married (68.9%), and without any work activity (70.5%). The majority belonged to economic class C (72.2%). The following table presents the detailed sample characterization of the patients as well as an evaluation of the proportions of nutrition impact symptoms (NIS) among the sociodemographic and clinical variables (Table 1).

The patients were recruited within the first 48 hours of hospitalization and most were hospitalized for surgical procedures (58.8%).

Regarding the clinical variables, it is noted that the patients were predominantly without a prescription for corticosteroids (93.3%), with the presence of one to two past disease conditions (60.0%), overweight to BMI (46.7%), and adequate adductor pollicis muscle thickness (83.3%).

The patients were mostly classified as non-sarcopenic (71.1%) and the variables economic status (p=0.020), HGS (p=0.016), SARC-F (p=0.002), and sarcopenia status (p=0.020) showed differences in the proportions of NIS (Tables 1 and 2). It can be noted that patients with risk of sarcopenia, reduced muscle strength and lower economic classes (C, D, and E) reported more NIS, while those classified as non-sarcopenic accounted for the highest prevalence among the asymptomatic. The diagnosis of sarcopenia (confirmed and severe) was present in 14 patients (15.5%) (Table 2).

Also in Table 2, nutritional status obtained by PG-SGA, malnourished patients (B and C), and those urgently in need of management for symptom improvement and/or nutritional intervention options (≥ 9 points) showed NIS in higher proportions (p<0.001).

Table 1: Sample characterization and proportions of nutrition impact symptoms among sociodemographic and clinical variables

Variables	Nutrition impact symptoms (n, %)			
	None	< 3 Symptoms	≥ 3 Symptoms	p-value
Sociodemographic				
Sex				0.946
Male	25 (27.8)	9 (10.0)	17 (18.9)	
Female	19 (21.1)	6 (6.7)	14 (15.6)	
Age Group				0.191
Adult	17 (18.9)	4 (4.4)	6 (6.7)	
Older Person	27 (30.0)	11 (12.2)	25 (27.8)	
Work activity #				0.655
Absent	29 (33.0)	10 (11.4)	23 (26.1)	
Present	14 (15.9)	5 (5.7)	7 (8.0)	
Marital status				0.263
Single	5 (5.6)	1 (1.1)	2 (2.2)	
Married	33 (36.7)	11 (12.2)	18 (20.0)	
Widower	2 (2.2)	2 (2.2)	8 (8.9)	
Separated/Divorced	4 (4.4)	1 (1.1)	3 (3.3)	
Economy Class *				0.020
A-Class	3 (3.3)	-	-	
B-Class	6 (6.7)	1 (1.1)	2 (2.2)	
C-Class	33 (36.7)	8 (8.9)	24 (26.7)	
Classes D and E	2 (2.2)	6 (6.7)	5 (5.6)	
Clinics				
Pre-existing chronic disease				0.533
None	15 (16.7)	2 (2.2)	9 (10.0)	
1 to 2 chronic diseases	25 (27.8)	10 (11.1)	19 (21.1)	
3 or more chronic diseases	4 (4.4)	3 (3.3)	3 (3.3)	
Use of corticoids				0.681
Absent	42 (46.7)	14 (15.6)	28 (31.1)	
Present	2 (2.2)	1 (1.1)	3 (3.3)	

* Average household income: A = R$ 25.554.33; B = R$ 5.64.64 a 11.279.14; C = R$ 1.748.59 a 3.085.48; D e E= R$ 719.81; # variable with 2 missing

Table 2: Evaluation of the proportions of nutrition impact symptoms among the variables that make up the sarcopenia phenotype and nutritional status

Variables	Nutrition impact symptoms (n, %)			
	None	<3 symptons	≥ 3 symptoms	p-value
Sarcopenia Phenotype				
SARC-F score				0.002
No risk	34 (37.8)	7 (7.8)	12 (13.3)	
With risk	10 (11.1)	8 (8.9)	19 (21.1)	
Handgrip strength (HGS)[#]				0.016
Adequate	31 (34.8)	9 (10.1)	12 (13.5)	
Reduced	12 (13.5)	6 (6.7)	19 (21.3)	
Calf circumference (CC)				0.178
Adequate	31 (34.4)	7 (7.8)	17 (18.9)	
Reduced	13 (14.4)	8 (8.9)	14 (15.6)	
Gait Speed (GS)[§]				0.204
Adequate	9 (10.5)	1 (1.2)	2 (2.3)	
Low gait speed (low physical performance)	35 (40.7)	12 (14.0)	27 (31.4)	
Sarcopenia Status				0.020
No sarcopenia	39 (43.3)	9 (10.0)	16 (17.8)	
Probable sarcopenia	3 (3.3)	2 (2.2)	7 (7.8)	
Confirmed Sarcopenia	-	-	1 (1.1)	
Severe Sarcopenia	2 (2.2)	4 (4.4)	7 (7.8)	
Nutritional status				
BMI				0.500
Low weight	5 (5.6)	4 (4.4)	7 (7.8)	
Adequate	17 (18.9)	6 (6.7)	9 (10.0)	
Overweight	22 (24.4)	5 (5.6)	15 (16,7)	
APMT[#]				0.623
Adequate	36 (40.9)	12 (13.6)	27 (30.7)	
Reduced	7 (8.0)	3 (3.4)	3 (3.4)	
PG-SGA *				<0.001
Well-nourished (A)	24 (27.0)	2 (2.2)	5 (5.6)	
Moderately malnourished (B)	18 (20.2)	7 (7.9)	13 (14.6)	
Severely malnourished (C)	1 (1.1)	6 (6.7)	13 (14.6)	
PG-SGA score				<0.001
0-1 point	11 (12.2)	-	-	
2-3 points	10 (11.1)	-	-	
4-8 points	20 (22.2)	5 (5.6)	3 (3.3)	
≥ 9 points	3 (3.3)	10 (11.1)	28 (31.1)	

* PG-SGA: Patient-Generated Subjective Global Assessment; IBMI: body mass index; APMT: adductor pollicis muscle thickness; [#] variables with 2 missing; [§] variable with 4 missing

The mean and standard deviation values of the continuous variables investigated are presented separately by sex (Table 3). It is noted that patients, on average, present with overweight, adequate calf circumference, no risk of sarcopenia (SARC-F<4), adequate grip strength, low physical performance (GS) (≤ 0.8m/s), and in urgent need of nutritional intervention and management for improvement of nutrition impact symptoms (≥9 points).

Gender differences were observed for the variables BMI (p=0.004), APMT (p=0.006), SARC-F (p=0.017), HGS (p<0.001) and GS (p=0.006) (Table 3).

Table 3: Mean and standard deviation of the continuous variables investigated according to sex

Variables	Average ± Standard Deviation			p-value*
	Total	Male	Female	
Age (years)	65.43±9.67	65.47±9.08	65.38±10.52	0.967
BMI (kg/m²)	27.39±6.25	25.75±5.68	25.54±6.37	0.004
APMT (mm)	16.16±4.92	17.35±5.17	14.59±4.12	0.006
SARC-F (score)	2.98±2.68	2.39±2.58	3.74±2.63	0.017
HGS (kg)	23.86±10.67	28.86±10.57	17.27±6.43	<0.001
CC (cm)	34.97±4.49	34.71±4.47	35.30±4.55	0.541
GS (m/s)	0.62±0.40	0.72±0.48	0.48±0.21	0.006
PG-SGA score	9.57±7.13	9.56±6.81	9.59±7.62	0.982

BMI: body mass index; APMT: adductor pollicis muscle thickness; SARC-F: sarcopenia risk questionnaire; HGS: handgrip strength; CC: calf circumference; GS: gait speed (meters/second); PG-SGA: Patient-Generated Subjective Global Assessment; *Independent samples t-test

The symptoms 'dry mouth', 'anorexia', and 'smells sick' were the most reported by patients, respectively with 31.1%, 30.0%, and 16.7% (Table 4).

DISCUSSION

This study was developed to alert nutritionists and healthcare professionals who work with hospitalized patients, regardless of whether admitted for clinical or surgical procedures, of the importance of investigating symptoms of nutrition impact symptoms within the first 48 hours of hospital admission. The importance of adopting validated tools in clinical practice to obtain reliable results should be emphasized.

It was found that NIS was in higher proportions in patients who presented the economic class in the lowest strata, risk of sarcopenia, reduced HGS, and malnutrition identified by the PG-SGA, classified categorically or by the score of the tool. Also, the absent sarcopenia status had the highest proportion of asymptomatic patients.

The causes of malnutrition in older adults are diverse and its prevalence can reach up to 65% of these when hospitalized[25]. It is known in the scientific literature that social factors, such as economic status, are important determinants of malnutrition[26]. Therefore, these individuals tend to present NIS more frequently, with the need for early recognition to reduce and/or minimize the negative consequences. Perhaps this may explain the higher proportion of patients with NIS in the lower economic classes, added to the fact that economic class C and malnutrition were predominant in this study.

Any further arguments regarding the economic condition would represent speculation, so further investigation of the social/economic factors could be relevant concerning NIS.

This study also invites professionals who are on the front line of care to reflect on strategies to assess and control these symptoms, as they can impact worsening nutritional status and reduction in both quantity and aspects of muscle function. Silva et al.[27], in cancer patients, verified that malnourished patients tend to present less muscle strength, even before the occurrence of muscle mass reduction.

The importance of detailed nutritional assessment in the hospital environment should be reinforced to identify early malnourished and/or sarcopenic patients, or those at risk for these conditions, during hospitalization and establish an appropriate nutritional plan.

The HGS is a measure used to assess muscle function (physical strength) and is directly correlated with nutritional status, besides being considered an important predictor of health status, being suggested to identify several unfavorable events, especially in older people[28]. In the present study, although most patients were classified with adequate HGS, the NIS presented in different proportions. This fact may indicate greater attention to this assessment in clinical practice.

In this study, the symptoms of "dry mouth", 'anorexia', and 'smell sickness' were the most reported by patients, and this NIS is the most associated with nutritional risk and/or malnutrition, limiting the individual to eat. The NIS most described in the literature, associated with malnutrition, are often stomach pain, taste alterations, lack of appetite, early satiety, nausea, and dysgeusia[13].

Changes in taste, lack of appetite, and early satiety are related to low muscle mass, which can promote changes in gait speed dynamics and reduced mobility[29].

In the study by Lindiqvist et al.[11], where the prevalence of NIS in patients with chronic liver disease was evaluated, more than 90% of their sample presented more than two NIS and 53% more than four NIS, most of them being dry mouth, abdominal pain, nausea, and diarrhea. This study also pointed out changes in taste, lack of appetite, and early satiety as predictors of malnutrition.

Although our findings do not indicate a relationship between the presence of chronic diseases and NIS since the proportions were similar, as well as between the older people and SIN, most patients with chronic diseases and older people reported the

Table 4: Prevalence of nutrition impacts symptoms of the participants

Nutrition impact symptoms	n	%
Anorexia		
Absent	63	70.0
Present	27	30.0
Nausea		
Absent	76	84.4
Present	14	15.6
Constipation		
Absent	76	84.4
Present	14	15.6
Mouth sores		
Absent	84	93.3
Present	6	6.7
Strange taste		
Absent	76	84.4
Present	14	15.6
Smells sickened		
Absent	75	83.3
Present	15	16.7
Early satiety		
Absent	79	87.8
Present	11	12.2
Vomit		
Absent	80	88.9
Present	10	11.1
Diarrhea		
Absent	81	90.0
Present	9	10.0
Dry mouth		
Absent	62	68.9
Present	28	31.1
Swallowing problems		
Absent	80	88.9
Present	10	11.1
Pain		
Absent	86	95.6
Present	4	4.4
Fatigue		
Absent	77	85.6
Present	13	14.4
Other		
Absent	90	100.0
Present	-	-

presence of NIS. Even so, it is necessary to give more attention to these groups, since the factor of advanced age and presence of previous diseases added to the presence of NIS are risk factors for unintentional weight loss and malnutrition during hospitalization[30].

In line with this, Knudsen et al.[31], evaluated the presence of NIS in hospitalized patients with chronic diseases and cancer in a sample of 122 individuals and more than 50% presented more than four NIS. Also, the presence of nutritional risk was verified in most individuals, concomitant with low HGS, with reports of difficulty swallowing, the rapid feeling of satiety when starting the meal, and lack of appetite.

This study has limitations because it is a research of transversal design, in which the measurements are taken only once, thus preventing us from inferring the causal effect. In addition, for the diagnosis of sarcopenia, the CC measurement to verify muscle mass loss was used because it is a practical and inexpensive method, with resources that are available at the research institution. Furthermore, CC is a useful estimate to evaluate muscle mass and is used in different studies[32-34], in addition, it offers health professionals an alternative for the diagnosis of sarcopenia in adults and older people[7].

While the gold standard considered for determining muscle mass loss are CT scans and DEXA[7], however, these are high-cost methods. As a selection bias, one can mention the pathophysiology of the diseases of the hospitalized individuals as well as their relationship with NIS.

As important positive points of the data obtained, the importance of using protocols that investigate the NIS of hospitalized patients is highlighted, thus corroborating the advances in hospital clinical practice, guiding health professionals on the main factors and variables that negatively and directly impact the nutritional status of this population and, in a way, predict subsequent interventions to improve the nutritional status and reduce the risk of malnutrition.

Conclusion

This study allows us to point out that the presence of NIS is very common in hospitalized patients and was associated with the components of the sarcopenia phenotype SARC-F, HGS and sarcopenia status, nutritional status obtained by PG-SGA as well as economic class.

Longitudinal studies should be conducted to investigate the causal relationship of the associations found.

In addition to the use of detailed nutritional screening protocols for early identification of patients at nutritional risk, it is essential to establish dietary protocols to prevent the progression of this nutritional condition and recovery of these individuals still during hospitalization. Furthermore, the need for the engagement of the multidisciplinary team in the early tracking and notification of NIS is emphasized.

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