Analysis of NRS-2002 and SNAQ results of patients in selected wards of a clinical hospital

Analiza wyników NRS-2002 i SNAQ pacjentów wybranych oddziałów szpitala klinicznego

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ABSTRACT

Background: Malnutrition is a common problem in patients admitted to and staying in hospital wards, occurring in 30–50% of patients. Malnutrition is also often associated with longer hospital stays, more complications and higher treatment costs. The purpose of the study is to assess the effectiveness of the NRS-2002 (*Nutrition Risk Screening*) and SNAQ (*Simplified Nutritional Appetite Questionnaire*) in checking the risk of malnutrition and significant weight loss in patients in selected hospital wards.

Methods: The analysis included 100 patients from hospital wards (nephrology and geriatric). The differences between the NRS-2002 carried out at admission to the hospital and the repeated NRS-2002 during hospitalisation, the prevalence of malnutrition and the risk of losing 5% of body weight over 6 months depending on the ward were assessed.

Results: Out of all participants in the study, 51 patients (51%) had the NRS 2002 result indicating malnutrition. Also, 51 patients had a SNAQ score ≤ 14 indicating a significant risk of losing at least 5% of their body weight within the next 6 months. The analysis of the correlation between the NRS-2002 and the SNAQ showed a negative relationship (R = (–0.2425); p = 0.017). Malnourished patients are older (p < 0.0001), have a lower body weight (p = 0.002) and lower body mass index (BMI) (p = 0.05), patients with risk of malnutrition occurred almost equally in both wards (25 patients in geriatric *vs.* 26 patients in nephrology). Malnourished patients may also be more likely to have lower food intake (p = 0.005).

Conclusion: Malnutrition is very common in hospitalized patients with an emphasis on geriatric and nephrology patients. Correlation analysis showed a correlation of NRS with age and a negative correlation of SNAQ with CRP level. Unfortunately, on admission to hospital, the nutritional status is underestimated and fewer patients than expected are at risk of malnutrition. Correct identification of malnourished patients and those at risk of significant weight loss is the basis for appropriate treatment and should be carried out by a member of the nutrition team.

Key words: malnutrition, NRS-2002, SNAQ, nutritional status, appetite

STRESZCZENIE

Wstęp: Niedożywienie jest powszechnym problemem pacjentów szpitalnych, występującym wśród 30–50% hospitalizowanych. Niedożywienie wydłuża pobyt w szpitalu, zwiększa liczbę powikłań i koszty leczenia. Celem pracy jest ocena skuteczności kwestionariusza NRS-2002 (*Nutrition Risk Screening*) oraz SNAQ (*Simplified Nutritional Appetite Questionnaire*) w ocenie ryzyka wystąpienia niedożywienia i znacznej utraty masy ciała u pacjentów wybranych oddziałów szpitalnych.

Metody: Analizą objęto 100 pacjentów oddziałów szpitalnych (nefrologii i geriatrii). Oceniano różnice pomiędzy kwestionariuszem NRS-2002 wypełnianym przy przyjęciu do szpitala a badaniem NRS-2002 powtarzanym w trakcie hospitalizacji, a także częstość występowania niedożywienia oraz ryzyko utraty 5% masy ciała w ciągu 6 miesięcy w zależności od oddziału.

Wyniki: Spośród wszystkich uczestników badania u 51 pacjentów (51%) wynik NRS 2002 wskazywał na niedożywienie. Ponadto u 51 pacjentów wynik SNAQ ≤ 14 wskazywał na istotne ryzyko utraty co najmniej 5% masy ciała w ciągu najbliższych 6 miesięcy. Analiza korelacji NRS-2002 i SNAQ wykazała korelację ujemną [r = (–0,2425); p = 0,017]. Pacjenci niedożywieni są starsi (p < 0,0001), mają niższe masę ciała (p = 0,002) i BMI (p = 0,05). Pacjenci z ryzykiem niedożywienia występują niemal jednakowo na obu oddziałach (25 pacjentów na oddziale geriatrii, 26 pacjentów na oddziale nefrologii). Pacjenci niedożywieni częściej spożywają mniejszą porcję posiłków (p = 0,005).

Wnioski: Niedożywienie bardzo często występuje u pacjentów hospitalizowanych, ze szczególnym uwzględnieniem pacjentów geriatrycznych i nefrologicznych. Analiza korelacji wykazała korelację NRS z wiekiem oraz ujemną korelację SNAQ z poziomem CRP. Podczas przyjęcia do szpitala stan odżywienia pacjentów często jest oceniany nieprawidłowo, w wyniku czego mniej pacjentów, niż powinno, jest klasyfikowanych jako zagrożeni niedożywieniem. Prawidłowa identyfikacja pacjentów niedożywionych i zagrożonych znaczną utratą masy ciała jest podstawą odpowiedniego leczenia i powinna być przeprowadzona przez członka zespołu żywieniowego.

Słowa kluczowe: niedożywienie, NRS-2002, SNAQ, stan odżywienia, apetyt

INTRODUCTION

Malnutrition is an imbalance at the cellular level between the demand for nutrients and energy and the supply that allows certain life functions to be performed, such as growth or maintenance of vital functions.

Malnutrition affects the length of hospitalization of the patient and is associated with a worse prognosis and even death, additionally contributing to the increase in hospitalization costs [1]. Patients in nephrological and geriatric wards are particularly at risk of malnutrition [2]. It is associated with age, high comorbidity and usually chronic or acute inflammation. In nephrological patients, during hospitalisation increased concentration of uremic toxins causes loss of appetite [3], improper diet and nutritional deficiencies are observed. In turn, geriatric patients, and therefore older, are also more exposed to malnutrition due to reduced physical activity, loss of appetite with age, impaired perception of the taste of food or the feeling of being unwanted and the associated depression [4].

Therefore, the main aim of the present work was to assess the risk of malnutrition (using the NRS-2002) and the risk of losing 5% of body weight in 6 months (using the SNAQ [*Simplified Nutritional Appetite Questionnaire*] questionnaire) in selected non-surgical departments of a university hospital and assessing the relationship between malnutrition and laboratory results and clinical condition of patients.

METHODS

The group of the examined patients consisted of 100 people (M = 51, F = 49) aged 60.3 ± 18.8 years. All subjects were provided with information about the study and all questions were answered prior to consent and inclusion in the study. NRS 2002 and SNAQ were carried out at the patient's bedside, laboratory parameters were taken from medical records. Patients were classified as at risk of malnutrition (NRS-2002 ≥ 3) (n = 51) and not at risk (NRS-2002 < 3) (n = 49). The caloric requirement was calculated using the formula 30 kcal × body weight in kilograms [5].

Nutritional status

The risk of malnutrition was assessed using the NRS-2002 twice. The first time, during admission to the ward - by a doctor, and then after 7 days in the ward by a dietitian. NRS-2002 consists of two parts. The first contained four questions: is the patient's BMI < 20.5; whether you have lost weight in the last 3 months; whether food intake has been restricted in the last week, and whether the patient is seriously ill. Answering "yes" to any of the questions allowed to go to the second part of the questionnaire, which evaluated the patient's nutritional status, BMI and food intake restriction from 0 to 3, and then also the severity of the disease or injury on a scale of 0 to 3. Patients received an additional 1 point for age greater than 70 years. In total, patients could receive 7 points, the higher the score, the higher the risk of malnutrition.

The risk of weight loss over the next 6 months was assessed by SNAQ. This quick method includes questions about appetite, how much the patient eats during the day, changes in the taste of food, and how full the patient feels after a meal. This questionnaire contains only four questions with five answer options from A to E. All answers are scored on the same scale: A = 1, B = 2, C = 3, D = 4, E = 5. When added together, they give a total SNAQ score ranging from 4 to 20. The lower the total score, the greater the risk of losing weight. A score of 14 or less predisposes you to lose 5% of your body weight in the next 6 months [6].

In addition, information on the ordered hospital diet was collected from, the documentation available at the ward. The caloric status of the hospital diet was calculated as the average of five consecutive days.

Table 1. Characteristics of patients depending on nutritional risk (NRS-2002 < 3 without risk of malnutrition; NRS-2002 ≥ 3 patients with risk of malnutrition)

Parameters	Whole group n = 100	Without the risk of malnutrition n = 49 (49%)	With the risk of malnutrition n = 51 (51%)
Gender	M 51 (51%)/F 49 (49%)	M 32 (65.3%)/F 17 (34.7%)	M 19 (37.3%)/F 32 (62.7%)
Age [years]	66 (44.5–72)	54 (37–67)***	71 (52–80)
Body weight [kg]	74.0 (62.0–89.0)	81.0 (70–91)**	67.5 (57–81)
Albumin [g/L]	29.0 (23.0–33.0)	30.0 (24.0–34.0)	28.0 (23.0–32.0)
BMI [kg/m²]	25.5 (21.7–29.3)	26.4 (22.7–30.2)*	24.0 (19.8–28.2)
CRP [mg/L]	11.4 (3.0–50.9)	6.2 (2.5–31.7)*	18.2 (7.5–61.8)
Potassium [mmol/L]	4.3 (4.0–4.7)	4.4 (4.2–4.8)**	4.2 (3.7–4.6)
Sodium [mmol/L]	139.0 (137.0–141.0)	139.0 (137.0–139.0)*	140.0 (138.0–142.0)
Caloric needs [kcal/d]	2100.0 (1920.0–2340.0)	2250.0 (1995.0–2400.0)**	2010.0 (1770.0–2280.0)

*p = 0.05; **p = 0.002; ***p < 0.0001; BMI — body mass index, CRP — C-reactive protein; F — female; M — male

Data presented as median + IQR

Statistical analysis

Results are shown as percentage (for categorical variables), mean and standard deviation (for normally distributed variables), or median and interquartile range (for non-normally distributed variables). The assumption of normality was verified using the Shapiro-Wilk test. A p-value < 0.05 was considered statistically significant. Comparisons between the two groups were assessed using the Student's t-test or the Mann-Whitney U test. Statistical processing was carried out using the statistical program STATISCICA PL v 13.0 (Statsoft, Krakow, Poland).

RESULTS

Nutritional status

Considering the NRS-2002 conducted during the study, 51 patients (51%) showed a risk of malnutrition (NRS-2002 ≥ 3). The characteristic of patients depending on the NRS-2002 result is presented in Table 1. Patients with NRS-2002 score ≥ 3 had a lower body mass index (BMI; 24.8 ± 6.2 vs. 27.0 ± 5.1; p = 0.05), lower body weight (69.8 ± 19.4 vs. 82.0 ± 16.5 kg; p = 0.001) and older age (71 years (52–80) vs. 54 years (37–67) p < 0.0001). Patients at risk of malnutrition had a lower median serum albumin concentration, but this was not statistically significant (p = 0.22).

The second assessment by NRS-2002 was significantly higher than the NRS-2002 score at admission (2.5 ± 1.2 vs. 0.6 ± 1.0; p < 0.0001). In addition, the risk of malnutrition is most often observed in the geriatric ward (66% of all geriatric patients) then in the nephrology ward 42.0% (n = 26) of patients showed a risk of malnutrition. The NRS 2002 was positively correlated with age (r = 0.3446; p < 0.0001).

SNAQ

Simplified Nutritional Appetite Questionnaire showed that 51 (51%) patients had a score of ≤14, indicating that they were at significant risk of losing at least 5% of their total weight within 6 months. There were 28 patients in the group at risk of malnutrition, and 23 patients in the group without risk (54% vs. 46%). Additionally, SNAQ negatively correlated with C-reactive protein (CRP) (r = (–0.3561); p < 0.0001). In the question concerning the amount of food consumed, a significant difference was observed (p = 0.05), the malnourished group much more often consumed almost nothing or less than 1/3 of the portion than the group not at risk of malnutrition (43.1% vs. 22.4%). Patients in the geriatric ward have a similar risk of weight loss compared to patients in other wards (50% vs. 53.3%). Total SNAQ scores varied between groups and were borderline statistically significant (13.5 ± 3.0 vs. 14.6 ± 2.4; p = 0.07). In all parts of SNAQ, the score was on a scale of 1–5 and the points in the parts marked sequentially: "my appetite is" 1 — meant very poor appetite and 5 — very good, in the part with a question about eating "when I eat" 1 — meant feeling full after eating a few bites, in turn 5 — I rarely feel full after eating a meal next, part "food tastes" 1 — was very bad and 5 was very good, the last question "normally I eat" where 1 means less than one meal a day and 5 more than three meals a day. for each question, a score of 1 was the worst possible answer and 5 was the best answer. Depending on the group, patients most often assessed their appetite as moderate (3 points) or good (4 points). Both groups felt full most often after eating more than half of the meal (3 points). Interestingly, the group at risk of malnutrition more often assessed the perceived taste of food better than the group not at risk of malnutrition (4 points meant good and 3 was moderate). Both groups most often ate 3 meals a day (4 points). Scores for all questions of SNAQ are presented in Figure 1.

BMI

Patients at risk of malnutrition had significantly lower BMI than patients not at risk of malnutrition. Figure 2 shows the percentage distribution of BMI among patients at risk of malnutrition.

Comorbidities

The majority, as much as 67% (n = 67) of patients had been diagnosed with arterial hypertension. Subsequently, 28% (n = 28) of patients were diagnosed with diabetes and the
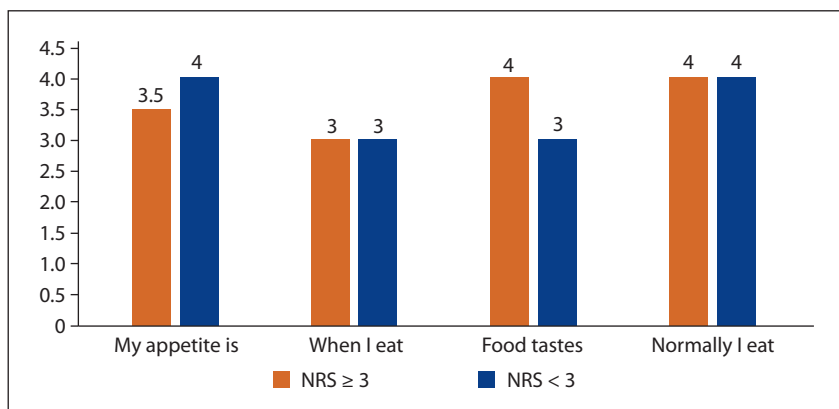
Figure 1. SNAQ responses broken down into groups depending on the NRS-2002 result (median)
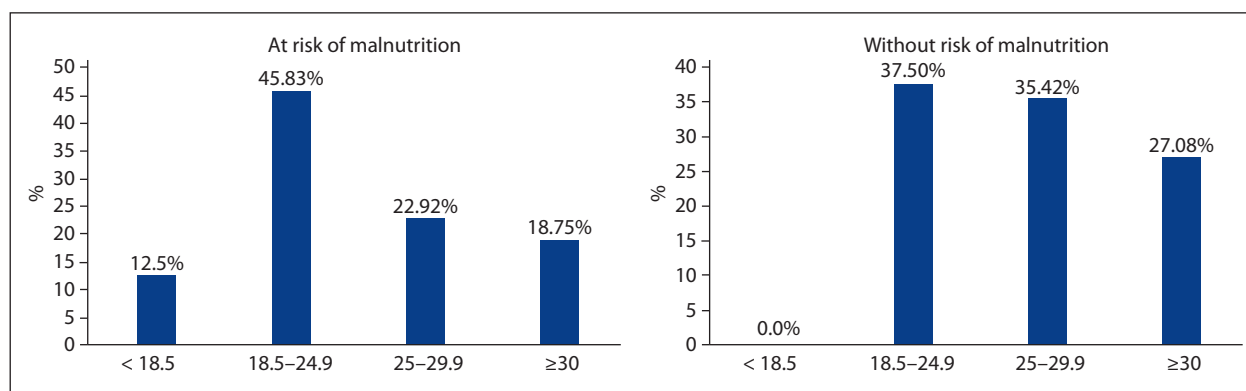

Figure 2. Percentage of BMI (kg/m²) in the group of patients at risk of malnutrition and without risk of malnutrition
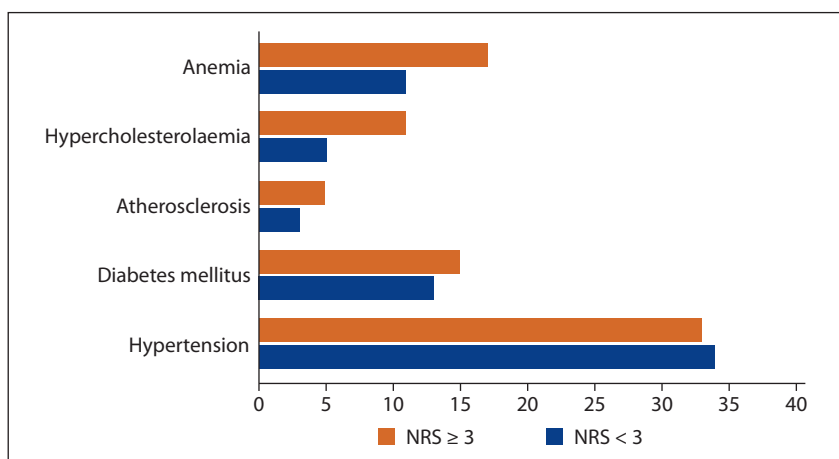

Figure 3. Accompanying diseases in the group at risk of malnutrition and not at risk of malnutrition (number of patients)

same number of patients were diagnosed with anaemia. All above comorbidities were more common in the group at risk of malnutrition, except for hypertension, which was more common in the group not at risk of malnutrition (33 *vs.* 34 people) see Figure 3.

Diet
Patients hospitalized in the geriatric ward consumed mainly a basic diet (44.7% n = 17), none of the patients in this ward had a high-protein diet ordered on the other hand 23.7% took a low-protein diet dedicated to patients with kidney

problems and 15.8% was eating diet dedicated to patients with diabetes mellitus. In all wards, the most frequently consumed diet was the basic diet (26%), 16 patients (16%), were on a renal and the same number of people were on an easily digestible diet. 12% of all was on a renal-diabetic diet. Other diets consumed by patients include, among others, a mixed, vegetarian or gluten-free diet. The median calorific value of all diets was 1867.2 (1735.3–2056.4) kcal. This combined with low consumption declared as more than half of the serving, gives an intake of 952.3–1475.1 kcal. Compared to the caloric requirement of 2100 kcal (1920.0–2340.0), it

Table 2. Characteristics of patients depending on the ward

Parameters	Whole group n = 100	Geriatrics patients n = 38	Nephrology patients n = 62
Age	66.0 (64.5–72.0)	69.0 (64.0–81.0)***	55.5 (40.0–70.0)
Gender	M 51 (51%)/F 49 (49%)	M 17 (45%)/F 21 (55%)	M 34 (55%)/F 28 (45%)
Body weight [kg]	74.0 (62.0–89.0)	72 (60.0–88.0)	76 (66.0–90.0)
Albumin [g/L]	29.0 (23.0–33.0)	28.0 (23.0–32.0)	29.0 (24.0–33.0)
BMI [kg/m^2]	25.5 (21.7–29.3)	25.7 (20.5–29.1)	25.5 (21.8–29.7)
CRP [mg/L]	11.4 (3.0–50.1)	22.3 (7.5–61.8)**	9.1 (2.5–28.6)
eGFR ml/min/1,73 m^2	55.0 (22.0–85.0)	75.0 (52.0–85.0)*	36.0 (12.0–82.0)

*p= 0.002; **p = 0.02; ***p < 0.0001; BMI — body mass index; CRP — C-reactive protein; eGFR — estimated glomerular filtration rate; F — female; M — male

Data presented as median + IQR

gives an intake of only 45–70% of the energy requirement, 33% of all patients eat 1/3 or less, resulting in a caloric intake of 616.2 kcal or less, which gives 29.8% of caloric needs.

Nutritional treatment

Only 39.2% (n = 20) of malnourished patients received oral nutritional supplements, 1 patient was parenterally fed and also received oral nutritional supplements. and 2 patients were fed enterally (one by PEG; and one by nasogastric tube). In total, only 43.1% (n = 22) of malnourished patients received some kind of nutritional treatment (oral, enteral or parenteral).

Geriatric ward vs. nephrology ward

The present study included 62 patients from the nephrology ward and 38 patients from the geriatric ward. Regardless of the ward, the patients were at significantly different ages (69 y/o geriatric vs 55.5 y/o nephrology). Albumin level was performed only in 39 (62.9%) patients from nephrology and 20 (52.6%) patients from geriatric wards. The exact characteristics of patients by ward are given in Table 2.

DISCUSSION

The following study showed that despite the passage of time, widespread nutritional education of medical personnel and good screening tools, malnutrition is still common and misdiagnosed. The greatest differences in the NRS-2002 during admission to the NRS-2002 during the study were observed in the geriatric ward. Underestimating the risk of malnutrition among patients may carry serious risks such as prolongation of hospitalization time, worsening of the prognosis, more complications or even lead to the patient's death [1].

Patients in a geriatric ward presented a risk of malnutrition in 65%. Considering the work of Bellanti et. al. [4], which mentions the occurrence of malnutrition in up to 90% of geriatric patients, shows that the nutritional status in the study patients is better, but still, the risk of malnutrition is high [7]. The malnutrition in this group of patients should be diagnosed very carefully due to the multitude of complications associated with malnutrition, as proved by C. Mosquera et al. [8], malnutrition is associated with a longer postoperative stay, higher costs, higher in-ho-

spital mortality, more severe complications and higher readmission rates. Malnourished cancer patients also have a higher risk of infection, poorer pain control, and a greater need for anti-analgetic treatment in the form of opiates [9].

The NRS-2002 results of patients from Nephrology departments indicate the risk of malnutrition at 42%, respectively, which is consistent with the results from 2017 conducted by Borek et. al. [2] of 40.8%. Malnutrition in this group of patients is common due to dietary restrictions associated with chronic kidney disease. These include limiting the intake of protein or phosphorus, and these restrictions are higher the greater the stage of renal failure the patient is in [10].

In the study patients at risk of malnutrition were older (71 vs. 54 y/o.), which was consistent with the study, as proved by Borek et. al. [2] and Guenter et. al. [11], in which the characteristics of patients at risk of malnutrition also indicated their older age. 54% of all were in age greater or equal to 65 of which 35 (65%) of them got NRS-2002 result ≥ 3. The risk of malnutrition has a significant correlation with BMI. According to the ESPEN consensus a critical border of BMI status is age dependent, and it is accordingly < 20 BMI to patients aged < 70 y/o and < 22 BMI to patients aged ≥ 70 y/o and that's BMI status is the cut-off point for diagnosing malnutrition [12]. The study includes 33 patients in age ≥ 70 y/o and 4 of them (12%) had BMI < 22, but the study also includes 21 patients in age < 70 but higher or equal to 65 y/o and 4 of them (19%) had BMI < 22. As is known, lower BMI is a strong predictor of mortality in elderly patients [13] therefore, the assessment of the risk of malnutrition in this group of people should be carried out more reliably, and nutritional treatment should be offered more often and early.

The Appetite Questionnaire (SNAQ) was used in the study. His results indicated that 51 patients (51%) are at risk of losing at least 5% of their total weight within 6 months. Based on the SNAQ was observed decreased appetite in patients during hospitalisation. Appetite scoring is important because most malnutrition is due to insufficient food and therefore nutrient intake [1]. The question concerning the amount of food consumed was rated the worst, in which 33% of patients declared almost no food intake or consumption of less than 1/3 of the

portion. Significantly more patients at risk of malnutrition rate their intake as almost complete or consume less than 1/3 of a serving (43.1 *vs.* 22.5%). Food for special medical purposes (FSMP) was used in only 39.2% (n = 20) of malnourished patients, one patient was additionally fed parenterally, while two patients were fed enterally. FSMP should be used more often because the effect on older patients is not only in weight gain and muscle strength and function but also in quality of life, mental health and emotional function [14].

Among geriatric patients, a basic hospital diet was dominant, which may result in insufficient protein intake in this group of patients. ESPEN recommendations for protein intake in the group of geriatric patients refer to the consumption of a minimum of ≥ 1 g of protein per kilogram of body weight, 1.0–1.2 g/kg of body weight for healthy elderly people, 1.2–1.5 for elderly people with acute or chronic diseases and up to 2.0 g/kg body weight in severe diseases, injuries or malnutrition [15]. Optimal protein intake in this group of patients is crucial for proper treatment. Increasing the supply of protein, even by using a high-protein diet, should be considered more often.

The patients often had diet-related comorbidities, in which arterial hypertension predominated. Therefore, it is important that each patient admitted to the hospital has the opportunity to have an individual dietary consultation to discuss personalized nutritional recommendations so that the patient knows how to eat properly after leaving the hospital. A proper diet in diseases such as the aforementioned arterial hypertension, diabetes or anaemia plays a key role in the prevention and treatment of given disease entities. For example, the low-sodium DASH diet has a positive effect on lowering blood pressure [16] while a diet low in sugars, red meat and simple fried foods helps improve the condition of diabetic patients. Patient nutrition education should be more widespread as diabetes awareness is poor in many developing countries [17].

There is a need not only for a proper assessment of the nutritional status on admission but also the need for repetition of nutritional status assessment during hospitalisation or global assessment of patients at risk.

The nutritional status of the patients during their stay in the hospital deteriorated significantly. This may have been caused by a lack of appetite, which effectively limited the patient's food intake, or by an inadequate diet, which did not ensure that the patient's dietary needs were covered, or by a combination of the two, which together may have had a greater effect on.

Patients in the nephrology ward and the geriatric ward did not differ significantly, except for the age difference. Pay special attention to inflammation and other ailments related to kidney diseases, which may result in an increased nutritional risk in the group of nephrological patients. Therefore, patients with kidney disease may be at higher risk of malnutrition while exhibiting similar characteristics to patients in other departments. In addition, patients with kidney disease may show a normal BMI or normal weight, which may be misleading, as it may result from overhydration.

CONCLUSIONS

The study showed that the risk of malnutrition assessed using the NRS-2002 among patients of various departments is a common problem.

The main usefulness of the SNAQ is risk assessment, as the method allows the identification of high nutritional risk patients (with a lack of appetite) who are likely to need or will need more nutritional support after discharge from the hospital.

Consumption of a hospital diet is not able to provide the energy necessary for the patient, therefore, diet fortification or nutritional treatment should be considered more often.

Patients of nephrology and geriatric wards are particularly vulnerable to malnutrition, and this may result in higher mortality in this group of patients, hence the conclusion that the assessment of nutritional status, not only with the use of questionnaires but also with the use of body composition analysis, should become a part of routine clinical assessment for prognostic assessment of patients.

REFERENCES

1. Saunders J, Smith T. Malnutrition: causes and consequences. Clin Med (Lond). 2010; 10(6): 624–627, doi: 10.7861/clinmedicine.10-6-624, indexed in Pubmed: 21413492.
2. Borek P, Chmielewski M, Małgorzewicz S, et al. Analysis of outcomes of the NRS 2002 in patients hospitalized in nephrology wards. Nutrients. 2017; 9(3): 287, doi: 10.3390/nu9030287, indexed in Pubmed: 28300757.
3. Carrero J, González-Ortiz A. Anorexia and appetite stimulants in chronic kidney disease. Nutritional Management of Renal Disease. 2022: 893–906, doi: 10.1016/b978-0-12-818540-7.00012-4.
4. Bellanti F, Lo Buglio A, Quiete S, et al. Malnutrition in hospitalized old patients: screening and diagnosis, clinical outcomes, and management. Nutrients. 2022; 14(4): 910, doi: 10.3390/nu14040910, indexed in Pubmed: 35215559.
5. Thibault R, Abbasoglu O, Ioannou E, et al. ESPEN guideline on hospital nutrition. Clin Nutr. 2021; 40(12): 5684–5709, doi: 10.1016/j.clnu.2021.09.039, indexed in Pubmed: 34742138.
6. Wilson MMG, Thomas DR, Rubenstein LZ, et al. Appetite assessment: simple appetite questionnaire predicts weight loss in community-dwelling adults and nursing home residents. Am J Clin Nutr. 2005; 82(5): 1074–1081, doi: 10.1093/ajcn/82.5.1074, indexed in Pubmed: 16280441.
7. Buitrago G, Vargas J, Sulo S, et al. Targeting malnutrition: Nutrition programs yield cost savings for hospitalized patients. Clin Nutr. 2020; 39(9): 2896–2901, doi: 10.1016/j.clnu.2019.12.025, indexed in Pubmed: 31917050.
8. Mosquera C, Koutlas NJ, Edwards KC, et al. Impact of malnutrition on gastrointestinal surgical patients. J Surg Res. 2016; 205(1): 95–101, doi: 10.1016/j.jss.2016.05.030, indexed in Pubmed: 27621004.
9. Gascón-Ruiz M, Casas-Deza D, Marti-Pi M, et al. Diagnosis of malnutrition according to GLIM criteria predicts complications and 6-month survival in cancer outpatients. Biomedicines. 2022; 10(9), doi: 10.3390/biomedicines10092201, indexed in Pubmed: 36140301.

10. Małgorzewicz S, Ciechanowski K, Kozłowska L, et al. Zasady żywienia w przewlekłej chorobie nerek : stanowisko Grupy Roboczej Polskiego Towarzystwa Nefrologicznego. Forum Nefrologiczne. 2019; 12(4): 240–278.

11. Guenter P, Abdelhadi R, Anthony P, et al. Malnutrition diagnoses and associated outcomes in hospitalized patients: United States, 2018. Nutr Clin Pract. 2021; 36(5): 957–969, doi: 10.1002/ncp.10771, indexed in Pubmed: 34486169.

12. Cederholm T, Jensen GL, Correia MI, et al. GLIM Core Leadership Committee, GLIM Working Group. GLIM criteria for the diagnosis of malnutrition - a consensus report from the global clinical nutrition community. Clin Nutr. 2019; 38(1): 1–9, doi: 10.1016/j.clnu.2018.08.002, indexed in Pubmed: 30181091.

13. Kane RL, Shamliyan T, Talley K, et al. The association between geriatric syndromes and survival. J Am Geriatr Soc. 2012; 60(5): 896–904, doi: 10.1111/j.1532-5415.2012.03942.x, indexed in Pubmed: 22568483.

14. Zhang H, Qiu Y, Zhang J, et al. The effect of oral nutritional supplements on the nutritional status of community elderly people with malnutrition or risk of malnutrition. Asia Pac J Clin Nutr. 2021; 30(3): 415–423, doi: 10.6133/apjcn.202109_30(3).0008, indexed in Pubmed: 34587701.

15. Volkert D, Beck AM, Cederholm T, et al. ESPEN practical guideline: Clinical nutrition and hydration in geriatrics. Clin Nutr. 2022; 41(4): 958–989, doi: 10.1016/j.clnu.2022.01.024, indexed in Pubmed: 35306388.

16. Ozemek C, Laddu DR, Arena R, et al. The role of diet for prevention and management of hypertension. Curr Opin Cardiol. 2018; 33(4): 388–393, doi: 10.1097/HCO.0000000000000532, indexed in Pubmed: 29771736.

17. Sami W, Ansari T, Butt NS, et al. Effect of diet on type 2 diabetes mellitus: A review. Int J Health Sci (Qassim). ; 11(2): 65–71, indexed in Pubmed: 28539866.