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CLINICAL STUDY

Nutritional status and risk of malnutrition

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ABSTRACT
Malnutrition is a global health problem that is not limited to developing countries. So far, it is one of the underdiagnosed and curative medical problems.
THE AIM of our observation was to evaluate the nutritional status of patients at risk of malnutrition.
METHODS AND PATIENTS: We retrospectively evaluated 140 patients from the Gastroenterology Clinic and the Center for Home Parenteral Nutrition (HPN) at the University Hospital Bratislava, Slovakia. Patients were indicated for examination as part of the entry screening for malnutrition or consultation examination in patients presenting with signs of malnutrition. Based on the determination of the body mass index (BMI), the completed questionnaire of nutritional risk screening (NRS) and the determination of the state of performance, we evaluated the nutritional status of the patient and subsequently started enteral, or parenteral nutrition.
RESULTS: We recorded a statistically significant negative correlation between BMI and malnutrition risk ($p<0.001$), ie. the lower the BMI, the higher the risk of malnutrition. We did not observe a relationship between age, diagnoses and the incidence of BMI-related malnutrition in the study group of patients.
CONCLUSION: Properly applied clinical nutrition, whether enteral, parenteral, or a combination thereof, can significantly affect morbidity and mortality in patients with malnutrition or the risk of its development. Unfortunately, Slovakia is still lagging behind developed countries in its implementation as part of a comprehensive treatment of patients *(Tab. 2, Fig. 4, Ref. 28)*. Text in PDF www.elis.sk
KEY WORDS: malnutrition, nutritional risk screening, clinical nutrition, body mass index.

Introduction

Undernutrition (malnutrition) is a serious health problem that affects both developing and developed countries. In developed European countries, up to a third of patients suffer from various forms of malnutrition.

Malnutrition is a pathological condition caused by inadequate or insufficient intake of energy or other nutrients necessary for the proper functioning of the body. It can be conditioned by insufficient food intake, however, malnutrition caused by inflammatory and other mechanisms associated with disease states keeps increasing (1). In addition, it accompanies several diseases, and its presence is associated with an increase not only in mortality but also in morbidity in all groups of patients, with emphasis in the critically ill (2). In addition, it is associated with significant financial costs (1).

The aim of our observation was to evaluate the nutritional status of patients at risk of malnutrition.

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Methods and patients

We retrospectively evaluated 140 patients from the Gastroenterology Clinic and the Center for Home Parenteral Nutrition (HPN) at the University Hospital Bratislava, Slovakia. Patients were indicated for examination as part of the entry screening for malnutrition or consultation examination in patients presenting with signs of malnutrition.

Based on the determination of the body mass index (BMI), the completed nutritional risk screening (NRS) questionnaire and the determination of the performance status, we evaluated the patient's nutritional status and subsequently introduced enteral or parenteral nutrition.

To obtain relevant data on monitored parameters, we used a NRS questionnaire, the aim of which was to determine the occurrence of malnutrition in both hospital and outpatient settings. To fill it in, we used anthropometric and laboratory data obtained during the entrance examination.

The questionnaire was focused on basic identification data concerning the parameters of malnutrition, which served as an input NRS when the patient was admitted to the ward, or at the time of a basic examination in the nutrition clinic.

We evaluated the state of the risk of developing malnutrition according to the questionnaire used and the state of performance based on scoring according to the World Health Organization

Tab. 1. Diagnoses of examined patients of malnutrition.

The most common diagnoses	n/% (140/100%)
Diseases of digestive tract:	58/41%, of which:
– non-specific diseases of digestive tract	20/14%
– postoperative condition of digestive tract	16/11%
– malabsortive syndrome	13/9%
– dysmotility conditions of digestive tract	7/5%
Oncological diseases (digestive tract, hematooncological)	48/34%
Perioperative nutritional care	25/18%
Catabolic conditions of different etiology (septic conditions, MODS, SIRS)	9/6%

MODS – syndrome of multiorgan dysfunctions, SIRS – syndrome of systemic inflammatory respons,

(WHO). The score according to the WHO categorizes patients according to mobility, performance and self-sufficiency into categories 0–4. Category 0 indicates a fully active patient, performing all activities as prior to the disease, and category 4 indicates a patient completely incapable of self-care, fully confined to a bed or chair (3).

All examined patients were informed about their health status, diagnostic and therapeutic procedures and signed an informed consent. The implementation of the research was approved by the Ethics Committee of the University Hospital and Polyclinic Bratislava, St. Cyril and Methodius Hospital, Antolská.

We used standard statistical methods such as the two-sample t-test or Mann–Whitney U test, and simple analysis of variance or Kruskal–Wallis test. To determine the closeness of the relationship between two continuous random variables, we used Pearson's or Spearman's correlations. To determine the relationship between two discrete variables, we used the chi-squared test in contingency tables and, in the case of low expected frequencies, Fisher's exact test.

We worked with the IBM SPSS 21 statistical software. We performed all tests at the level of significance α=0.05.

Results

We retrospectively evaluated a group of 140 patients (78/56% men and 62/44% women, average age 54 years; average age of men was 56 years and average age of women was 52 years) from the Gastroenterology Clinic and the HPN Center at the University Hospital Bratislava, whose indication for examination was either an entry screening for malnutrition or a consultation examination of patients monitored for diagnosed signs of malnutrition.

Tab. 2. Characteristics of patients.

	n=140 patients (mean±SD)
Age	54±17 (15–85 years)
Gender	female 62/44% male 78/56%
BMI (kg/m^2)	16.5±2 (range 7–22)
performance status	3
NRS (n/ %)	Low degree – 14/10% Medium degree – 68 48.57% High degree – 58/41.43%

SD – standard deviation, NRS – nutritional risk screening, BMI – body mass index

The most common diagnoses leading to malnutrition were non-specific inflammatory diseases of the intestine (penetrating or stenotic form of Crohn's disease or ulcerative pancolitis) with failure of conservative treatment, with the need for surgical intervention and subsequent postoperative development of intestinal failure (of functional or organic origin) and subsequent development of short bowel syndrome with deficiency syndrome. Others were malabsorption syndrome (primary – celiac disease, conditions without organic cause, secondary – Whipple's disease, postradiation enteritis and colitis, pancreatic maldigestion and malabsorption, sclerosing vasculitis), dysmotility conditions (diabetic gastropathy, gastrectomy). Also, frequent diagnoses included oncological diseases (colorectal carcinoma, adenocarcinoma of the pancreas, stomach tumor) as well as hematooncological diseases (acute lymphoblastic leukemia, myeloid leukemia).

In patients with oncological diseases, it is necessary to monitor the rate of utilization of basic nutrients with regard to futile cycles and to put the patient on nutritional support according to the prognosis of the disease (Karnofsky score, score according to WHO). Perioperative nutritional intervention plays an important role in optimizing the nutritional status of malnourished patients and in the prevention of postoperative complications (e.g., anastomosis leak, impaired healing of surgical wounds, formation of bedsores, development of bronchopneumonia) and makes it possible to shorten overall postoperative recovery and reduce financial costs (Tab. 1).

On the basis of determining BMI, filling out the NRS questionnaire and determining the performance status, we evaluated the patient's nutritional status and then started enteral nutrition (EN) or parenteral nutrition (PN). Average BMI values were 16.5 kg/m^2, ranging from 7 to 22 kg/m^2 (average BMI in men was 17 kg/m^2 and in women 16 kg/m^2). We recorded a low degree of risk of malnutrition in 9 (6.42%) patients, a medium degree in 31 (22.14%) and a high degree in 100 (71.40%). The characteristics of the file are in Table 2.

After completing an anthropometric examination with determination of BMI and laboratory evaluation of nutritional status, patients were classified in the category of risk of developing malnutrition and nutritional treatment (EN or PN) was indicated for them.

We divided the evaluated 140 patients into 5-year intervals according to age. The largest group consisted of patients aged 50–54 (n=20), followed by 55–59 (n=17) and 70–74 (n=15) year-

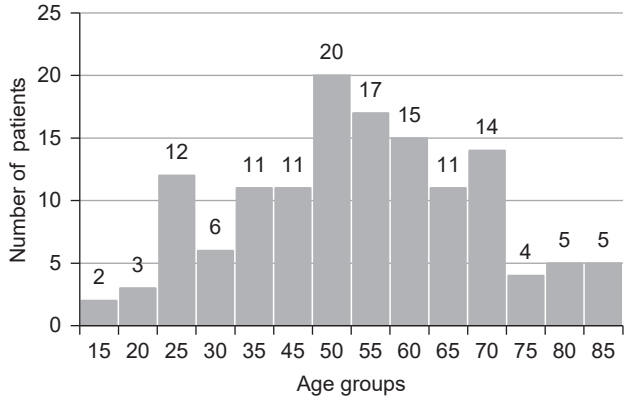

Fig. 1. Structures of patients accordig to 5-year intervals.

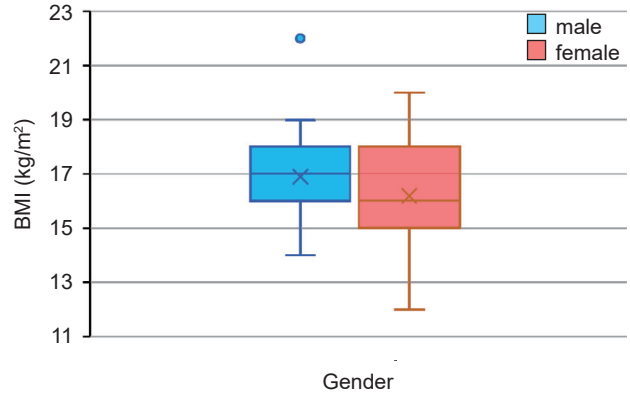

Fig. 3. Relationship between BMI and gender.

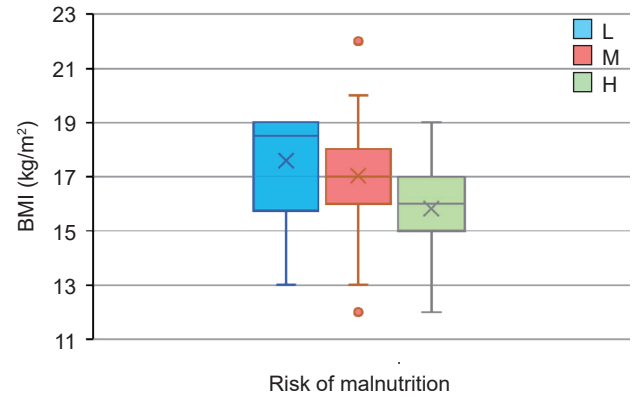

Fig. 2. Relationship between BMI and nutritional screening. L – low risk of malnutrition, M – medium risk of malnutrition, H – high risk of malnutrition.

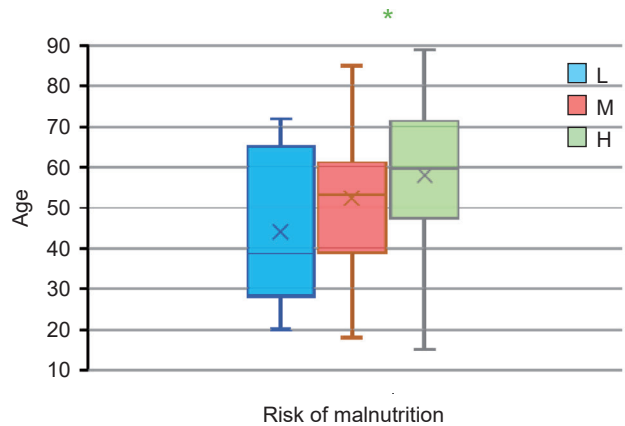

Fig. 4. Relationship between age and risk of malnutrition expressed by nutritional screening. L – low risk of malnutrition, M – medium risk of malnutrition, H – high risk of malnutrition.

old patients (Fig. 1). According to our experience, malnutrition occurs in inflammatory bowel diseases (IBD) mainly in early adulthood (from 18–25 years) and in middle productive age (from 35–55 years).

Within the sample, men 78/56% prevailed over women 62/44%. The average age of the examined patients was 54 years, and the average BMI was 16.5 kg/m^2. 12/9% of patients were at low risk of malnutrition, 70/50% were at medium risk, and 58/41% of patients were at hight risk of malnutrition.

The average age of the men was 56 years, and the average BMI was 17 kg/m^2. Low risk of malnutrition was found in 4/5%, medium risk in 43/55% and high risk in 31/40% of men. The women were younger with an average age of 52 years and an average BMI of 16 kg/m^2. Eight/13% were at low risk and 27/43.5% at medium and high risk of malnutrition.

Through statistical evaluation, we noted a statistically significant negative correlation between the BMI value and the risk of malnutrition ($p<0.001$), i.e., the lower the patients' BMI, the higher the risk of malnutrition (Fig. 2).

We did not observe a relationship between age, diagnoses and the occurrence of malnutrition expressed by BMI in the monitored group of patients.

We recorded a statistically significantly higher BMI in men compared to women ($p=0.0483$) (Fig. 3). We consider this finding to be accidental, as the occurrence of malnutrition is not associated with gender, but rather with the basic diagnosis and its comorbidities, the dependencies of which we did not record in our sample.

We noted a statistically significant relationship between age and the risk of malnutrition expressed by nutritional screening. The risk of malnutrition expressed by nutritional screening increased with age ($p<0.05$) (Fig. 4), while we did not note a dependence between age and BMI. Likewise, we did not observe a statistically significant dependence of the risk of malnutrition on the basis of gender.

Discussion

Undernutrition (malnutrition) is a serious global health problem. 20–60% of hospitalized patients are at risk of developing so-called iatrogenic malnutrition, while in acutely hospitalized patients this risk is up to 55% and several factors participate in it (4, 5). In up to 70% of patients with pre-existing malnutrition,

the degree of malnutrition worsens during hospitalization. The mortality rate of untreated severe malnutrition is 3–4%. If in a 1,000-bed hospital, 30–40 patients are not provided with artificial nutrition every day, there is a risk that patients will die from insufficient nutrition.

Despite the fact that it is a life-threatening condition, insufficient attention is paid to malnutrition and unfortunately many times it remains untreated or insufficiently treated. The most common causes of malnutrition include insufficient or impaired food intake, disorders of digestion, absorption and passages of the aboral part of the gastrointestinal tract (GIT), short-term or long-term changes in nutritional requirements, and disease states. At-risk patients include patients with oncological disease (85%), with intestinal inflammatory diseases (80%), in critical condition (65%), with chronic diseases of the respiratory system (45%) and geriatric patients (50%) (6, 7, 8, 9, 10, 11).

Among the gastrointestinal causes, malnutrition is most often associated with non-specific intestinal inflammations, GIT malignancies, chronic pancreatitis, malabsorption syndrome, celiac disease, post-operative conditions of the GIT, cystic fibrosis, various causes of dysphagia (6, 9, 10, 12, 13).

In our studies from 2009 and 2019, we noted mild hypoproteinemia in 17% and 13% of patients and severe hypoproteinemia in 21% and 23% and BMI below 19 kg/m^2 in 31% and 16% of evaluated patients (3). In the presented set of 140 patients, 62/44% women and 78/56% men, we recorded average BMI values of 16.5 kg/m^2. The average value for men was 16.8±1.9 kg/m^2 and for women 16.2±2.0 kg/m^2. At the borderline of significance ($p=0.48$), we noted a higher BMI in men compared to women, which is likely due to underlying diagnoses and comorbidities rather than gender differences.

In the evaluated group, we confirmed a statistically significant negative correlation of the risk of malnutrition with BMI values ($p<0.001$), the lower the BMI value of the patients, the higher the risk of malnutrition. BMI is also an independent prognostic factor for length of hospitalization and survival time, especially in elderly patients (3). We did not record a statistically significant correlation between age, diagnoses and the occurrence of malnutrition expressed by BMI and its risk. We found that the occurrence of malnutrition in our group of patients was most frequent in IBD diseases in early adulthood (from 18–25 years, 25 patients) and in middle productive age (from 35–55 years, 20 patients).

As part of screening for malnutrition, 3 types of nutritional protocols are recommended (14, 15): Nutritional Risk Screening 2002 (NRS – 2002) – suitable for hospitalized patients; Malnutrition Universal Screening Tool (MUST) – used for both inpatients and outpatients and Mini Nutritional Assessment (MNA) used for seniors in social service facilities.

Based on the NRS, we diagnosed early signs of malnutrition in the monitored group, with the indication of nutritional support, which makes it possible to improve the prognosis as well as the overall development of the patient's condition. Out of all 140 patients, 68 (48.57%) were at moderate risk of malnutrition, followed by 58 (41.43%) at high risk of malnutrition. Only 14 (10%) patients were at low risk of malnutrition. We found a statistically significant relationship between age and the risk of malnutrition expressed by NRS, while this risk increased with age ($p=0.003$). Our results clearly confirm that patients with severe eating disorders are indicated for nutritional support, as they are at high risk of developing malnutrition, which is in agreement with published data (13, 16).

The published EN and PN guidelines clearly point to the necessary screening for malnutrition and the need for rapid nutritional intervention in both outpatient and hospitalized patients. It is also recommended to determine the initial risk of malnutrition during the patient's hospitalization, which is subsequently the basis for complex treatment, an integral part of which is adequate comprehensive nutritional support depending on the underlying disease and nutritional status (8, 17, 18, 19).

Although NRS does not replace the diagnosis of malnutrition, it can reveal predictors of short-term or long-term deficit nutrition, i.e., a disproportion between the intake of nutrients and the nutritional requirements of the body. While in Slovakia, unfortunately, the NRS assessment is not part of the assessment of the patient's state of health upon admission to a medical facility, in Great Britain, the USA, the Netherlands and Denmark, NRS is a mandatory part of the entrance examination of every patient and is a condition for issuing accreditation.

Malnutrition accompanies the most serious diseases of the GIT (17, 20, 21, 22, 23, 24), which represented 41% in our group with non-specific diseases, postoperative conditions and malabsorption syndromes. Nutritional disorders with the risk of developing malnutrition also occur in other diseases, such as kidney diseases, cancer, COVID-19 infection, as well as acute phases of critical illnesses, etc. (16, 25, 26) and in our group there were 34% of patients with a primary diagnosis of cancer, 18% with postoperative malnutrition and 9% with catabolic states of various etiologies.

Recently published studies have shown a positive effect of nutritional interventions on the decrease in the incidence of complications, the length of hospitalization, the number of rehospitalizations, as well as overall mortality (27). The correct management of malnutrition must be based on screening and diagnostic criteria, with the help of which it is possible to classify the severity of malnutrition and determine its subsequent influence – treatment. In order to set up the right nutritional intervention, the evaluation of malnutrition is of primary importance (1, 3, 28).

Conclusion

Malnutrition is a significant risk factor associated with morbidity and mortality. Correctly applied clinical nutrition, whether enteral, parenteral or a combination of them, can significantly influence morbidity and mortality in patients with malnutrition or the risk of developing it. Unfortunately, Slovakia still lags behind developed countries in its implementation as part of complex treatment of patients. In Slovakia, it is necessary to intensify the activity of all those involved in regular monitoring of the risk of developing malnutrition, which will result in benefits not only for patients but also for the health care system.

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