University of Novi Sad, Faculty of Medicine Novi Sad[1]
University Clinical Center of Vojvodina, Novi Sad,
Clinic of Anesthesiology, Intesive Care and Pain Therapy[2]
Ferona Fertility Clnic, Novi Sad[3]
University Clinical Center of Vojvodina, Novi Sad, Clinic for Plastic and Reconstructive Surgery[4]

Original study
Originalni naučni rad
UDK 616.6-006:613.2
https://doi.org/10.2298/MPNS2308209T

ASSESSMENT OF THE NUTRITIONAL STATUS OF UROLOGY PATIENTS WITH MALIGNANCIES

PROCENA NUTRITIVNOG STATUSA UROLOŠKIH ONKOLOŠKIH BOLESNIKA

Teodora TUBIĆ[1, 2], Nina VICO KATANIĆ[1, 2], Vladimir DOLINAJ[1, 2], Filip KATANIĆ[1, 3], Jelena NIKOLIĆ[1, 4] and Jasenka MILOŠEVIĆ[1, 2]

Summary

Introduction. Identifying patients with nutritional risk, nutritive assessment, and individual nutritional support are essential factors for the quality of treatment. Showing the importance of nutritional and clinical parameters as the essential indicators of the need for perioperative nutritional support. Differences in albumin and protein concentrations in the preoperative and postoperative periods of urology patients are directly related to the patients' age. **Material and Methods.** In 130 urological patients with malignancies, nutritional status was evaluated based on preoperative appetite reduction, unintentional body mass loss in the preoperative period, body mass index, the thickness of skin folds, percentage of fat tissue, the difference between normal and measured body weight, the level of albumins and total serum proteins preoperatively and postoperatively and other clinical parameters such as the presence of cardiovascular diseases and according to the classification of the American Society of Anesthesiologists patients status. Interviews, medical history, and anthropometric measurements were used in the research. **Results.** Of the total number of respondents, 81.5% did not have a decreased appetite, and 69.2% did not lose body weight. According to the body mass index, the highest percentage (50.77%) was normally nourished, while the malnourished group only comprised of 0.77%. A decrease in albumin and protein concentration was proven throughout the perioperative period. Older patients had lower concentrations of albumin and protein in this period. **Conclusion.** It is necessary to use several parameters, including body mass index and percentage fat percentage measurement to assess the nutritional status. Adequate perioperative protein nutritional support should be primarily be administered to elderly patients.

Key words: Nutritional Status; Urologic Diseases; Urologic Neoplasms; Serum Albumin; Blood Proteins; Weight Loss; Malnutrition; Body Mass Index; Adipose Tissue

Sažetak

Uvod. Prepoznavanje bolesnika sa nutritivnim rizikom, nutritivna procena i individualna nutritivna potpora značajni su činioci kvaliteta bolničkog lečenja. Prikazivanje značaja nutritivnih i kliničkih parametra kao glavnih pokazatelja potrebe za adekvatnom perioperativnom nutritivnom potporom. Razlike u koncentraciji albumina i proteina u preoperativnom i postoperativnom periodu lečenja uroloških bolesnika direktno su povezane sa starošću bolesnika. **Materijal i metode.** Kod 130 uroloških onkoloških bolesnika procenjivan je nutritivni status na osnovu: preoperativnog smanjenja apetita, nenamernog gubitka telesne mase preoperativno, indeksa telesne mase, debljine kožnih nabora, procenta masnog tkiva, razlika između uobičajene i izmerene telesne mase, nivoa albumina i ukupnih proteina u serumu preoperativno i postoperativno, prisustva kardiovaskularnih oboljenja i procena statusa bolesnika prema klasifikaciji Američkog udruženja anesteziologa. U istraživanju su korišćeni intervju, podaci iz istorije bolesti i antropometrijska merenja. **Rezultati.** Od ukupnog broja ispitanika 81,5% nije imalo smanjenje apetita, gubitak u telesnoj masi nije imalo 69,2%. Prema indeksu telesne mase najveći procenat su činili normalno uhranjeni 50,77%, dok je grupa pothranjenih činila tek 0,77%. Dokazano je smanjenje koncentracije albumina i proteina u čitavom perioperativnom periodu. Stariji bolesnici su imali u ovom periodu niže koncentracije albumina i proteina. **Zaključak**. Za procenu nutritivnog statusa potrebno je koristiti više parametara uključujući indeks telesne mase i merenje procenta masnog tkiva. Starijim bolesnicima potrebno je prevashodno ordinirati adekvatnu perioperativnu proteinsku nutritivnu potporu.

Ključne reči: nutritivni status; urološka oboljenja; urološke neoplazme; serumski albumin; serumski proteini; gubitak telesne težine; malnutricija; indeks telesne mase; masno tkivo

Introduction

The patients' nutritional status significantly affects and improves the outcome of treatment and the recovery of patients after surgery, whether accompanied by malnutrition, overweight, or obesity. Inadequate nutritional support could lead to malnutrition in the perioperative period, adversely affecting the course of surgical treatment, even in patients who were adequately nourished [1]. Malnutrition is a severe condition when your diet does not contain the right amount of nutrients. It can refer to undernutrition – not getting enough nutrients or overnutrition – getting more nutrients than needed [2].

Corresponding Author: Dr Nina Vico Katanić, Medicinski fakultet Novi Sad, UKCV - Klinika za anesteziju, intenzivnu terapiju i terapiju bola, 21000 Novi Sad, Hajduk Veljkova 1-7, E-mail: nina.vico@mf.uns.ac.rs, teodora.tubic@mf.uns.ac.rs

Abbreviations
BMI – body mass index
ASA – American Society of Anesthesiologists
CVD – cardiovascular disease

Another definition describes malnutrition as a deficiency, excess, or imbalance of a wide range of nutrients, resulting in a measurable adverse effect on body composition and function and a worse clinical outcome, the outcome of the disease [3].

Patients admitted to a health care facility with nutritional status are a challenge to dieticians in providing adequate nutritional care, especially the malnourished ones [4]. Obesity leads to numerous different disorders, both functional and inflammatory [5]. Obese patients undergoing surgery are at greater risk for surgical site infection and slower healing because of reduced blood flow in fat tissue. Extensive cohort studies have shown the association of malnutrition with worse clinical outcomes, slower wound healing, higher incidence of infections, and higher mortality [6]. Assessment of nutritional status in hospital conditions has been examined in different studies, but no specific interest has been devoted to urology patients. Proper evaluation of nutritional status is critical, and it becomes a necessary part of treatment of patients undergoing major surgical interventions. It has been observed that after 12 hours of fasting, there is a reduction of glycogen due to glycogenolysis, that fats and proteins are decomposed, and that endogenous glucose production is enhanced [7]. The stress metabolic response to a stressful situation for the organism, such as a surgical procedure, leads to consumption of the body's energy reserves, protein decomposition, increased inflammation protein synthesis, increased urea formation, and others. Insulin resistance, manifested by glucose intolerance during starvation, is well documented [8]. Malnourished patients or patients with a high risk of developing malnutrition benefit from preoperative nutritional support, which is administered 7 to 14 days before surgery. The best method to improve or maintain nutritional status is oral intake. Nutritional support should be implemented before arrival to the hospital. It must contain all the necessary nutrients and satisfy energy and the body's protein needs [9]. Preoperative nutrition optimization before surgery and maintenance of adequate nutritional status after surgery are the main goals in perioperative nutrition, especially during prolonged starvation or severe catabolism. A short-term period of preoperative fasting (6 hours) is enough to deplete carbohydrate stores, change the patient's metabolic and nutritional status, and increase the risk of dehydration, thus increasing the stress caused by the operation. Similar things and problems are also common in postoperative recovery. The guidelines suggest that early postoperative nutrition should start 6-24 hours after surgery. High-energy concentrated preparations should be used orally as patients cannot take large amounts of food in the early postoperative period. The main benefit of these drinks is that their use satisfies energy and protein needs and shortens the time from the last food consumption to the induction of anesthesia. Early recognition of patients with nutritional risk, adequate nutritional assessment, and individual nutritional support are significant factors in the overall quality of hospital treatment of patients [10].

In addition to insufficient education of general practitioners, there is also the absence of protocols that would introduce screening and assessment of nutritional status as a standard procedure when admitting patients to the hospital.

This research aimed to demonstrate the importance of nutritional and clinical parameters as the leading indicators of the need for a proper perioperative nutritional support. We also evaluated if there was any difference in albumin and protein concentration in preoperative and postoperative period of treatment of urological patients that was directly related to the age of the patients.

Material and Methods

The study included 130 patients hospitalized at the Department of Urology in the University Clinical Center of Vojvodina who underwent surgery due to urologic malignancies. Data were prospectively collected in the period from October 2018 to January 2019.

Patients aged 21 to 85 years. Looking at gender, there were 98 male patients, and 32 female patients.

Nutritional status was assessed based on the nutritional status assessment parameters: preoperative decrease in appetite, unintentional preoperative weight loss, difference between normal and measured body weight, body mass index (BMI), skinfold thickness, percentage of adipose tissue, level of serum albumin preoperatively and postoperatively, level of total protein in serum preoperatively and postoperatively, and clinical parameters such as the presence of cardiovascular diseases (CVD) and the classification of the American Society of Anesthesiologists (ASA) patient status **(Table 1)** [11]. The exclusion criteria were patients classified as ASA grade 5 and the ones who did not speak Serbian language.

Data on preoperative appetite reduction and unintentional weight loss before admission were obtained by interviewing the patients in the preoperative period of surgical treatment, who answered the questionnaire **(Table 2).** The presence of cardiovascular diseases, the patient's ASA, albumin serum level, and total protein serum level preoperative status were obtained from medical history.

Body weight was measured with a calibrated weigh chair, height was measured with a stadiometer attached to the weighing chair, and the BMI was calculated as the body mass/height ratio (kg/m^2). Skinfold thickness was measured on the right side of the patient's body at four standard points (biceps, triceps, lower angle of the scapula, and anterior superior iliac spine) with a Lange-type skin caliper with a standard pressure of 10 g/mm^2. The measurement was repeated three times at each point, and the mean value was calculated from the obtained values. Based on the sum

Table 1. American Society of Anesthesiologists (ASA) classification
Tebela 1. *Klasifikacija Američkog anesteziološkog društva – ASA klasifikacija*

ASA I *ASA I*	Healthy patient without organ disease with a localized pathological process *Zdrav pacijent bez organskog oboljenja sa lokalizovanim patološkim procesom*
ASA II *ASA II*	Patient with mild systemic disease without functional limitations *Pacijent sa blagom sistemskom bolešću bez funkcionalnih ograničenja*
ASA III *ASA III*	Patient with moderate to severe systemic disease causing functional limitations *Pacijent sa umerenom do teškom sistemskom bolešću koja dovodi do funkcionalnih ograničenja*
ASA IV *ASA IV*	Patient with severe systemic disease which is a constant threat to life making life functions difficult- *Pacijent sa teškom sistemskom bolešću koja ugrožava život i otežava životne funkcije*
ASA V *ASA V*	Moribund patient with little possibility for survival with or without surgery *Moribundni pacijent sa malom verovatnoćom za preživljavanje sa operacijom i bez nje*

Table 2. Questionnaire on perioperative appetite reduction and unintentional weight loss
Tabela 2. *Upitnik na koji su ispitanici davali odgovore prilikom intervjua*

Has food intake decreased in recent months due to decreased appetite? *1. Da li se unos hrane tokom poslednjih meseci smanjio zbog smanjenog apetita?* a) Yes/*Da* b) No/*Ne*
Has the patient unintentionally lost weight in the last 3 months? *Da li je bolesnik nenamerno izgubio na telesnoj masi u poslednja tri meseca:* a) No/*Ne* d) Yes, more than 3 kg*/Da, više od 3 kg* g) Yes, more than 15 k g/*Da, više od 15 kg* b) I do not know/*Ne znam* e) Yes, 6 to 10 kg/*Da, 6-10 kg* h) Yes, but I do not know how much*/Da, ne znam koliko* c) Yes, less than 3 kg*/Da, do 3 kg* f) Yes, 11 to 15 kg/D*a, 11-15 kg*

of four skinfolds and using the Durnin and Womersley formula, D = 1.1715 - (0.0779 x log (sum of skinfolds)) for men and D = 1.1339 - (0.0645 x log (sum of skinfolds) folds)) for women, where D is the predicted body density (g/ml), the percentage of fat tissue in the body was calculated based on the formula: percentage of fat tissue = (495/D) - 450.

Similarities and differences were obtained between individual nutritional status assessment parameters that relate to the overall nutritional status assessment results. Data were analyzed with the Statistical Package for Social Sciences, version 23. Descriptive and inferential statistics methods were used for data analysis. Data are presented via arithmetic mean, and standard deviation and categorical variables via frequencies and percentages. Student's t-test was used to assess differences between variables between study groups. Pearson's correlation was used to examine the correlation between the subject's age, serum protein concentration, and serum albumin concentration (preoperatively and postoperatively). A p-value < 0.05 was considered statistically significant. Sampling weights were used (except for the sample description) during the statistical analysis of the data. The results are presented tabularly and graphically.

Results

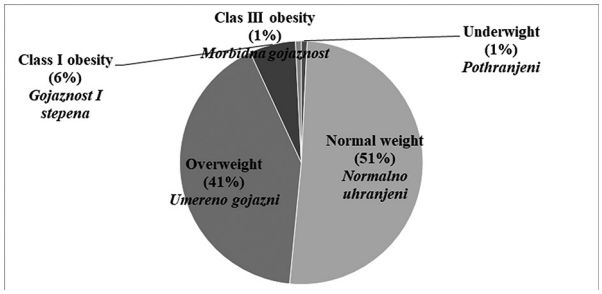
Of the total number of patients, 81.5% did not have a preoperative decrease in appetite, and less than 1/4 (18.5%) had an appetite decrease. Among 130 patients, 47.7% respondents had CVD. According to gender, there is a higher percentage of women (25%) than men (16.3%) who had a preoperative decrease in appetite. In comparison, male respondents (53.1%) had a higher percentage of CVD compared to female respondents (31.3%).

More than 2/3 of the patients (69.2%) had no unintentional weight loss in the preoperative period. 8.5% respondents lost up to 3 kg, 1.5% lost more than 3 kg, 8.5% respondents lost 6-10 kilograms, 5.4% respondents lost body weight but did not know how many kilos, while 4.6% respondents did not know if they had had unintentional weight loss.

Of the total number of women who had unintentional weight loss, the largest number of patients lost between 6-10 kg (15.6%), while the most significant percentage of men lost up to 3 kg (7.1%).

Out of the total number of patients, the largest number (66.2%) had ASA status 3, followed by ASA status 2 (29.2%), while the smallest number of respondents (2.3%) had ASA status 1 or ASA status 4. Observed according to gender, the largest number of both female (50%) and male patients (71.4%) had ASA status 3. No female subjects had ASA status 1. The smallest number of both women (6.3%) and men (1%) had ASA status 4.

The body mass index ranged from 18.8 kg/m^2 to 49.86 kg/m^2, and the average value was 25.07 ± 3.97 kg/m^2. According to the BMI, the patients' nutrition



Graph 1. Percentage of patients' nutrition according to body mass index (BMI) values
Grafikon 1. *Procenat uhranjenosti bolesnika prema vrednostima indeksa telesne mase (ITM)*
BMI categories: BMI< 18.5 – underweight, BMI 18.5-25 – normal weight, BMI 25-30 – overweight, BMI 30-35 – Class I obesity, BMI 35-40 – Class II obesity, BMI > 40 – Class III obesity.
Stepen gojaznosti spram indeksa telesne mase (ITM): ITM < 18,5 – pothranjeni, ITM 18,5 – 25 – normalno uhranjenin, ITM 25-30 - umereno gojazni, ITM 30-35 – gojaznost I stepena, ITM 35 – 40 – gojaznost II stepena, ITM > 40 morbidna gojaznost.

level was distributed so that 0.77% were malnourished and obese (Class 3). The normally nourished made up 50.77%. The pre-obese group made up 41.54%, while the obese (Class 1) made up 6.15% **(Graph 1)**.

The average skinfold thickness in our group of subjects was 42.43 mm ± 12.46 mm, while the average percentage of fat tissue was 25.01 ± 5.52%. The average measured body weight was 76.71±16.08 kg. Men had a statistically significantly higher measured body weight than women (65.34±10.470 vs. 80.42±15.883; t= -5.020; p < 0.05).

The paired samples test evaluated the difference in albumin concentration in the preoperative and postoperative treatment periods. A statistically significant decrease in albumin concentration was found from the preoperative period (49.95±8.52) to the postoperative period (44.83±9.43); t = -9.352; p < 0.005. The average decrease in albumin concentration was 5.11, while the 95% confidence interval extends from -6.20 to -4.03 **(Table 3).**

The paired samples test was used to assess the difference in protein concentration in the preoperative and postoperative treatment periods. A statistically significant decrease in protein concentration was found from the preoperative period (70.30±6.17) to the postoperative period (62.60±8.09); t=-13,553; p < 0.005. The average decrease in protein concen-

Table 3. Preoperative and postoperative comparison of albumin and protein concentrations and comparison of normal and measured body weight
Tabela 3. *Preoperativno i postoperativno poređenje koncentracija albumina i proteina i poređenje uobičajene i izmerene telesne mase*

		N/*Br.*	$\overline{X}$±SD	$\overline{X}$±SD	95% confidence interval *95% Interval poverenja*		t/*t*	p/*p*
					Upper limit *Gornja granica*	Lower limit *Donja granica*		
Albumin concentration *Koncentracija albumina*	Preoperative *Preoperativno*	130	44.83±9.43	5.11±6.24	-6.20	-4.03	-9.352	0.000
	Postoperative *Postoperativno*	130	49.95±8.52					
Protein concentration *Koncentracija proteina*	Postoperative *Postoperativno*	130	62.60±8.09	7.69±6.47	-8.81	-6.57	-13.553	0.000
	Preoperative *Preoperativno*	130	70.30±6.17					
Body weight *Telesna masa*	Normal *Uobičajena*	130	84.35±55.77	7.64±55.5	-1.98	-71.27	1.571	0.119
	Measured *Izmerena*	130	76.71±16.08					

Table 4. Correlation of albumin/protein concentration with the age of subjects
Tabela 4. *Korelacija koncentracije albumina/proteina sa starošću ispitanika*

		Albumin concentration *Koncentracija albumina*		Protein concentration *Koncentracija proteina*	
		Preoperative *Preoperativno*	Postoperative *Postoperativno*	Preoperative *Preoperativno*	Postoperative *Postoperativno*
Patient age *Starost pacijenta*	Pearson Correlation Coefficient *Pirsonov koeficijent korelacije* (r)	-0.098	-0.103	-0.180	-0.201
	p/*p*	0.269	0.242	0.040	0.022
	N/*Br.*	130	130	130	130

tration was 7.69, while the 95% confidence interval extends from -8.8 to -6.57 **(Table 3).**

A paired samples test assessed the difference between normal and measured body weight. No statistically significant difference was found between the normal (84.35±55.77) and measured body weight (76.71±16.08) BMI; t=1.571; p=0.119. The usual body weight was greater than the measured body weight by 7.64 kg on average, while the 95% confidence interval extends from -1.98 to -71.27 **(Table 3).**

There was a weak negative correlation between the patient age and preoperative albumin concentration (r=-0.098; p=0.269) and a weak negative correlation between the patient age and postoperative albumin concentration (r=-0.103; p=0.242), but they were not statistically significant.

There was a statistically significant weak negative correlation between the patient age and the preoperative protein concentration (r=-0.180; p=0.040) and a statistically significant weak negative correlation between the subject's age and the postoperative protein concentration (r=-0.201; p=0.022), which means that younger patients had a statistically significantly higher concentration of both preoperative and postoperative protein values **(Table 4).**

Discussion

Decreased appetite and unintentional weight loss in the preoperative period are additional but not sufficiently sensitive parameters for differentiating malnutrition from normal nutrition [12]. Cardiovascular diseases were present in 47.7% of patients, with a higher percentage in men than women. The association of obesity as a risk factor for the occurrence of various cardiovascular diseases, especially in men, has been shown in various studies [13].

The importance of ASA status as a clinical parameter of the patient's general condition should be considered. La Torre et al. showed that the ASA status alone cannot individually indicate the patient's malnutrition [14]. In our study, there were mainly elderly patients with ASA status III, which indicates adequate application of ASA status and other nutritional assessment parameters. Wolters et al. proved a significant correlation between the classification of ASA status and perioperative risk factors (intraoperative blood loss) and postoperative complications and mortality in a prospective study of 6301 surgical patients. It has been shown that the risk of complications was mainly influenced by ASA status III and IV and that ASA status is a predictor of postoperative outcome [15]. Farrow et al. reported absolute mortality rates of certain classes of ASA status with considerable variation from 0-0.3% for ASA I, 0.3-1.4% for ASA II, 1.8-4.5% for ASA III, 7.8-25.9% for ASA IV and 9.4-57.8% for ASA V. Differences in subjective assessment of physical status, patient population, sample size and duration of postoperative treatment may explain this variability [16].

The frequency of malnutrition at admission in the examined group of urology patients was 0.77% of the BMI. The obtained frequency does not fit in with the results of previous research, according to which malnutrition at admission was in the interval of 3.67–91% [17]. The lower frequency of malnutrition could be explained when BMI is used as an assessment parameter, especially for the elderly population, because of the increase in BMI due to physiological changes occurring in musculoskeletal function [18, 19]. Also, the percentage of customarily nourished patients on admission was 50.78%, and pre-obese 41.54%, which can also be explained by the fact that more than a half of the adult population of Serbia (54%) is overnourished, with 36.7% pre-obese and 17.3% obese [20, 21]. The highest overall prevalence of overweight in our country is recorded in Vojvodina [22]. The average percentage of adipose tissue was 25%, which corresponds to the facts, especially when we considered that the rate of pre-obese subjects in our examined group is 41.54%. Alberino et al. and Caregaro et al. recommend measuring the skin fold thickness above the triceps as the best method of assessing the nutritional status of surgical patients [23, 24]. Several studies have confirmed mutual deviations in fat mass and the degree of nutrition and obesity in normal body mass [25–27]. Marques-Vidal et al. showed the presence of obesity in normal body weight in less than 1% of men, while the frequency of this form of obesity in women was 27.8% and increased with age [25, 28]. Research conducted in our population reveals the presence of obesity in normal body mass in 25.71% of subjects [29]. In comparison, in the general population, 10% of normally nourished men and 13.33% women have borderline increased BMI, and 6.67% of normally fed women have increased fat mass [30]. Similar results of nutritional status assessment using skinfold thickness and percentage of fat tissue are also published by some other authors [31], although there is similarity between nutritional status assessment result using mid-upper arm circumference, on the one hand, and albumin level [32], a body index, loss of body mass [33] and skin folds thickness [34], on the other hand. From the laboratory parameters, a statistically significant decrease in albumin concentration was determined from the preoperative (49.95±8.52) to the postoperative (44.83±9.43) treatment period. Serum albumins are valid parameters of nutritional status because their level reflects the size of the visceral protein composition and is a strong predictor of hospitalization in urology patients. Reduced albumin production due to inflammation, hormonal deficit, redistribution of albumin from vascular to interstitial space during surgery, hyperhydration, and increased losses due to significant proteinuria may contribute to lower serum albumin levels.

A statistically significant decrease in protein concentration was also determined from the preoperative (70.30±6.17 g/l) to the postoperative (62.60±8.09 g/l) treatment period, which can be considered a physiological response of the body to a stressful situation, such as surgery when it comes to increased protein catabolism. There is no clear correlation between the preoperative level of serum proteins and their changes postoperatively [38]. Patients at risk of developing

complications during the postoperative period cannot be identified based on the measurement of preoperative serum protein concentrations. The results of our study show that the usual body mass is greater than the measured body mass of the subjects by 7.64 kg, which was not statistically significant.

This study included only urology patients, while other studies were conducted on patients treated for other surgical diseases. Also, applying different nutritional status assessment parameters and various threshold values for the same parameters further complicates the proper comparison of our results and the results of other studies. In addition, there are no unique recommendations in the literature regarding selecting the optimal parameter for assessing nutritional status at hospital admission. Malnutrition as a nutritional imbalance in urology patients, mostly consisting of an older population with numerous other associated chronic diseases, is not a rare problem, and its frequency can be reduced by proper nutritional status assessment based on various examined parameters, primarily body mass index and skinfold thickness.

Conclusion

To date, there are no agreed positions on the optimal nutritional status assessment parameter for urology patients. However, several parameters should definitely be used, including the body mass index and the measurement of fat tissue percentage. Measuring the percentage of fat tissue with use of calipers is a relatively quick and inexpensive method and can be used for regular assessment of nutritional status. American Society of Anesthesiologists status should be used as a clinical parameter for the nutritional evaluation in elderly patients with American Society of Anesthesiologists status III, together with other parameters. Elderly patients should primarily be prescribed adequate perioperative protein nutritional support in order to prevent complications in the perioperative course of treatment as this study has found that they had significantly lower protein concentrations preoperatively and postoperatively.

References

1. Weimann A, Braga M, Carli F, Higashiguchi T, Huber M, Klek S, et al. ESPEN practical guideline: clinical nutrition in surgery. Clin Nutr. 2021;40(7):4745-61.

2. Saunders J, Smith T. Malnutrition: causes and consequences. Clin Med. 2010;10(6):624-7.

3. Allison S. Fluid, electrolytes and nutrition. Clin Med. 2004; 4(6):573-8.

4. Schuetz P, Fehr R, Baechli V, Geiser M, Deiss M, Gomes F, et al. Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial. Lancet. 2019:393 (10188):2312-21.

5. Planas Vila M, Perez-Portabella C. Malnutrition and evaluation of the nutritional status. Nutr Hosp. 1999;14(Suppl 2):4S-12.

6. Correia MI, Waitzberg DL. The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis. Clin Nutr. 2003;22(3):235-9.

7. Patel SY, Trona N, Alford B, Laborde JM, Kim Y, Li R, et al. Preoperative immunonutrition and carbohydrate loading associated with improved bowel function after radical cystectomy. Nutr Clin Pract. 2022;37(1):178-82.

8. Newman WP, Brodows RG. Insulin action during acute starvation: evidence for selective insulin resistance in normal man. Metabolism. 1983;32(6):590-6.

9. Nygren J. The metabolic effects of fasting and surgery. Best Pract Res Clin Anaesthesiol. 2006;20(3):429-38.

10. Pasechnik IN, Smeshnoy IA, Timashkov DA, Onegin MA, Cheparnov AV, Skobelev EI, et al. Elective surgery and oral carbohydrate loading. Khirurgiia (Mosk). 2020;(6):82-9.

11. Wolters U, Wolf T, Stützer H, Schröder T. ASA classification and perioperative variables as predictors of postoperative outcome. Br J Anaesth. 1996;77(2):217-22.

12. Roganović B, Perić S, Tarabar D. Optimalni parametri za procenu nutritivnog statusa gastroenteroloških bolesnika pri prijemu u bolnicu. Vojnosanit Pregl. 2007;64(8):549-53.

13. Koliaki C, Liatis S, Kokkinos A. Obesity and cardiovascular disease: revisiting an old relationship. Metabolism. 2019;92:98-107.

14. Cohendy R, Gros T, Arnaud-Battandier F, Tran G, Plaze JM, Eledjam J. Preoperative nutritional evaluation of elderly patients: the Mini Nutritional Assessment as a practical tool. Clin Nutr. 1999;18(6):345-8.

15. Li B, Lu Z, Wang S, Hou J, Xia G, Li H, et al. Pretreatment elevated prognostic nutritional index predicts a favorable prognosis in patients with prostate cancer. BMC Cancer. 2020;20(1):361.

16. Farrow SC, Fowkes FG, Lunn JN, Robertson IB, Samuel P. Epidemiology in anaesthesia. II: factors affecting mortality in hospital. Br J Anaesth. 1982;54(8):811-7.

17. WHO. Obesity-preventing and managing the global epidemic: report of WHO consultations on obesity. Geneva: WHO; 1997. p. 7-17.

18. Jayanama K, Theou O, Godin J, Mayo A, Cahill L, Rockwood K. Relationship of body mass index with frailty and all-cause mortality among middle-aged and older adults. BMC Med. 2022;20(1):404.

19. Schneider SM, Al-Jaouni R, Pivot X, Braulio VB, Rampal P, Hebuterne X. Lack of adaptation to severe malnutrition in elderly patients. Clin Nutr. 2002;21(6):499-504.

20. Crnobrnja V, Srdić B, Stokić E, Dujmovic F, Andrejić B. Analiza učestalosti rizičnih oblika gojaznosti kod studenata novosadskog univerziteta. Med Pregl. 2012;65(3-4):133-7.

21. Michel C, Robertson HL, Camargo J, Hamilton-Reeves JM. Nutrition risk and assessment process in patients with bladder cancer undergoing radical cystectomy. Urol Oncol. 2020;38(9):719-24.

22. Grujić V, Martinov-Cvejin M, Ač-Nikolić E, Nićiforović Šurković O. Epidemiologija gojaznosti odraslog stanovništva Vojvodine. Med Pregl. 2005;58(5-6):292-5.

23. Alberino F, Gatta A, Amodio P, Merkel C, Di Pascoli L, Boffo G, et al. Nutrition and survival in patients with liver cirrhosis. Nutrition. 2001;17(6):445-50.

24. Caregaro L, Alberino F, Amodio P, Merkel C, Bolognesi M, Angeli P, et al. Malnutrition in alcoholic and virus-related cirrhosis. Am J Clin Nutr. 1996;63(4):602-9.

25. Marques-Vidal P, Pécoud A, Hayoz D, Paccaud F, Mooser V, Waeber G, et al. Prevalence of normal weight obesity in Switzerland: effect of various definitions. Eur J Nutr. 2008;47(5):251-7.

26. Yuan L, Chang M, Wang J. Abdominal obesity, body mass index and the risk of frailty in community-dwelling older adults: a systematic review and meta-analysis. Age Ageing. 2021;50(4):1118-28.

27. Zhai Z, Zheng Y, Li N, Deng Y, Zhou L, Tian T, et al. Incidence and disease burden of prostate cancer from 1990 to 2017: results from the Global Burden of Disease Study 2017. Cancer. 2020;126(9):1969-78.

28. Matsushita M, Fujita K, Nonomura N. Influence of diet and nutrition on prostate cancer. Int J Mol Sci. 2020;21(4):1447.

29. Stokić E, Srdić B, Peter A, Ivković-Lazar T. Masna masa tela u normalnoj uhranjenosti. Med Pregl. 2002;55(9-10):407-11.

30. Srdić B, Stokić E, Polzović A, Babović S. Odnos parametara koji definišu veličinu i raspored masnog tkiva. Med Pregl. 2003;56(5-6):232-6.

Rad je primljen 26. XI 2023.
Recenziran 1. I 2024.
Prihvaćen za štampu 8. I 2024.
BIBLID.0025-8105:(2023):LXXVI:7-8:209-215.

31. Silva DA, Pelegrini A, Silva JM, Petroski EL. Epidemiology of abdominal obesity among adolescents from a Brazilian State Capital. J Korean Med Sci. 2011;26(1):78-84.

32. Dormenval V, Budtz-Jorgensen E, Mojon P, Bruyere A, Rapin CH. Nutrition, general health status and oral health status in hospitalised elders. Gerodontology. 1995;12(12):73-80.

33. Hade AM, Shine AM, Kennedy NP, McCormick PA. Both under-nutrition and obesity increase morbidity following liver transplantation. Ir Med J. 2003;96(5):140-2.

34. Correia MI, Caiaffa WT, da Silva AL, Waitzberg DL. Risk factors for malnutrition in patients undergoing gastroenterological and hernia surgery: an analysis of 374 patients. Nutr Hosp. 2001;16(2):59-64.