FRAILTY SCORE AS A RISK PREDICTOR OF POSTOPERATIVE COMPLICATIONS AFTER COLORECTAL CANCER SURGERY IN GERIATRIC PATIENTS AND MONITORING OF ALBUMIN LEVELS

Frailty score ako jeden z prediktorov rizika vzniku pooperačných komplikácií po operácii kolorektálneho karcinómu u geriatrických pacientov a sledovanie hladín albumínu

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Abstract
Introduction: The aim of the study was to analyze frailty grades of geriatric patients and their impact on the incidence of postoperative complications. It focused on investigating the relationships between frailty, nutritional status, morbidity, and serum albumin levels.
Methods: The study included 80 geriatric patients who underwent colorectal cancer extraction. Patients were monitored for preoperative and postoperative serum albumin levels, Clinical Frailty Score, Charlson Comorbidity Index, and nutritional status based on the Mini Nutritional Assessment.
Results: The analysis of available data demonstrated a statistically significant relationship (p=0.003) between frailty and the prediction of 10-year survival. The patient's frailty grade affects the prediction of 10-year survival by 13%. Malnutrition was shown to be associated with increased frailty, affecting the frailty grade by 45%. Hypoalbuminemia was confirmed to correlate with nutritional status, increased frailty, and decreased prediction of 10-year survival.
Conclusion: Frailty is a geriatric syndrome with a multicausal etiology, chronic course, and varying degrees of functional impairment. The results of our study demonstrate that routine clinical implementation of preoperative assessment of frailty grade, nutritional status, and serum albumin levels has the potential to establish standardized management aimed at reducing postoperative morbidity and mortality in geriatric patients *(Tab. 1, Fig. 3, Ref. 33). Text in PDF www.lekarskyobzor.sk.*
KEY WORDS: frailty score, geriatric patients, postoperative complications, colorectal carcinoma, nutrition, serum albumin.
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Abstrakt
Úvod: Cieľom štúdie bolo analyzovať stupeň krehkosti geriatrických pacientov a jeho vplyv na výskyt pooperačných komplikácií. Bola zameraná na zisťovanie vzťahov medzi krehkosťou, nutričným stavom, morbiditou a hladinou sérového albumínu.
Metódy: Štúdia zahŕňala 80 geriatrických pacientov, ktorí podstúpili extrakciu kolorektálneho karcinómu. U pacientov bola sledovaná predoperačná a pooperačná hladina sérového albumínu, Clinical Frailty Score, Charlson Comorbidity Index a nutričný stav na základe Malého vyšetrenia výživového stavu.
Výsledky: Analýza dostupných dát dokázala štatisticky významný vzťah (p = 0,003) medzi krehkosťou a predikciou 10-ročného dožitia. Stupeň krehkosti pacienta ovplyvňuje v 13 % predikciu 10-ročného dožitia. Dokázalo sa, že malnutrícia súvisí s vyššou krehkosťou. Malnutrícia ovplyvňuje stupeň krehkosti v 45 %. Potvrdilo sa, že hypoalbuminémia koreluje so stavom výživy, zvyšuje krehkosť a znižuje predikciu 10-ročného dožitia.
Záver: Krehkosť je geriatrický syndróm s multikauzálnou etiológiou, chronickým priebehom a funkčným postihnutím rôzneho stupňa. Výsledky našej štúdie ukazujú, že rutinná klinická implementácia predoperačného stanovenia stupňa krehkosti, stavu výživy a hladín sérového albumínu má potenciál vytvorenia štandardizovaného manažmentu pre zníženie pooperačnej morbidity a mortality geriatrických pacientov *(tab. 1, obr. 3, lit. 33). Text v PDF www.lekarskyobzor.sk.*
KĽÚČOVÉ SLOVÁ: skóre krehkosti, geriatrickí pacienti, pooperačné komplikácie, kolorektálny karcinóm, výživa, sérový albumín.
Lek Obz 2026, 75 (2): 44-49

Introduction

Population ageing remains a current and important issue. Life expectancy continues to increase due to implementing new scientific knowledge into clinical practice (1). With the rising number of surgical interventions in this age group, the issue of caring for geriatric patients is becoming increasingly significant. These patients have a higher incidence of complications during treatment, highlighting the need for more accurate methods to assess their health (2). Therefore, healthcare management for geriatric patients should be comprehensive, considering their vulnerability, caused by a combination of biological, psychological, and social factors. Reduced adaptability, comorbidity, polypharmacy, poor nutritional status, and exhausted compensatory mechanisms contribute to the overall picture of patient frailty (3). One effective but still underutilized tool for identifying frail patients in the perioperative period is the determination of the overall Frailty Score. The Frailty Index and determination of Frailty Score improve the effectiveness of perioperative care by helping to identify vulnerable patients who require enhanced preoperative preparation (4).

The aim of the study is to focus on geriatric patients who underwent elective surgery for colorectal cancer and to examine their postoperative outcomes based on preoperative assesment of frailty, nutritional status, and serum albumin levels. Our assumption was that determining the frailty score in geriatric patients would be one of the strongest predictors of postoperative complications following abdominal surgeries.

Materials and methods

A retrospective cohort study was conducted at the 1st Department of Surgery, University Hospital Bratislava, Staré Mesto, Slovakia. Data for the study were collected from January 1, 2020 to December 2023. Inclusion criteria for the study were the age 65 > years at the time of surgery, pathologically confirmed adenocarcinoma of colon or rectum, undergone primary surgical resection with curative intent. Exclusion criteria were the palliative resection only, emergency surgery due to obstruction/ perforation without prior histological confirmation and history of previous surgical resection. The final cohort consisted of 80 patients (males: n=37; 46.25% and females: n=43; 53.75%) with a median age of 76,8 years. The age distribution was: 65–74 years (n=34, 42,50 %), 75–84 years (n=37, 46,25 %), and 85–92 years (n=9, 11,25%). Male patients were slightly younger (mean age 74,49 years) compared to females (mean age 78,79 years). The distribution of primary tumor sites were: proximal colon (7 patients 8,75%) distal colon (28 patients, 35%) and the rectum (45 patients 56,25%). Regarding pathological stage, the majority of patients presented Stage II (39 patients, 48,75%). All data for the study were obtained from patient's medical records during hospitalization.

Methodology

Preoperative serum albumin levels were determined for patients in the preoperative period. Based on anamnestic data and patient input data, the following parameters were determined: frailty score, nutritional status, and prediction of 10-year survival. The *CFS (Clinical Frailty Scale)* was used to determine the *Frailty Score*. Individual patients were assigned a frailty score based on their overall condition, ranging from 1 to 9: 1- very fit, 2 - fit, 3 - managing well, 4 - living with very mild frailty, 5 - living with mild frailty, 6 - living with moderate frailty, 7 - living with severe frailty, 8 - living with very severe frailty, and 9 - terminally ill (5). The secondary parameter was nutritional status, assessed using the *MNA-SF (Mini Nutritional Assessment- Short Form)* questionnaire, with a scoring range of 0-14, where patients were divided into three categories according to their nutritional status. Patients with the score range of 0-7 - malnourished, 8-11 - at risk of malnutrition, 12-14 - normal nutritional status (6). The third monitored parameter was the *CCI (Charlson Comorbidity Index)*, which was used to predict the 10-year survival of patients. In geriatric patients, CCI values ranged from 2 points, corresponding to a 90% likelihood of 10-year survival to 37 points, corresponding to a 0% likelihood of survival (7).

After the surgical procedure was completed (extraction of colorectal cancer under general anesthesia), patients were monitored postoperatively in the intensive care unit of the 1st Clinic of Surgery. The protocol recorded four measured values (preoperative level, and postoperative Days 1, 3, and 5).

Statistical analysis

The statistical analysis was performed using the SPSS (Statistical Package for Social Sciences) software, version 25.0, and MS Excel. Frequency tables, cross-tabulations, and summary tables were created to present the research findings. A scatter plot and a bar chart were used for graphical representation. The data obtained were analyzed using the **Spearman rho** correlation coefficient, **Pearson's r,** and **t-test**. Calculations for determining the mean and median of the obtained values were also included.

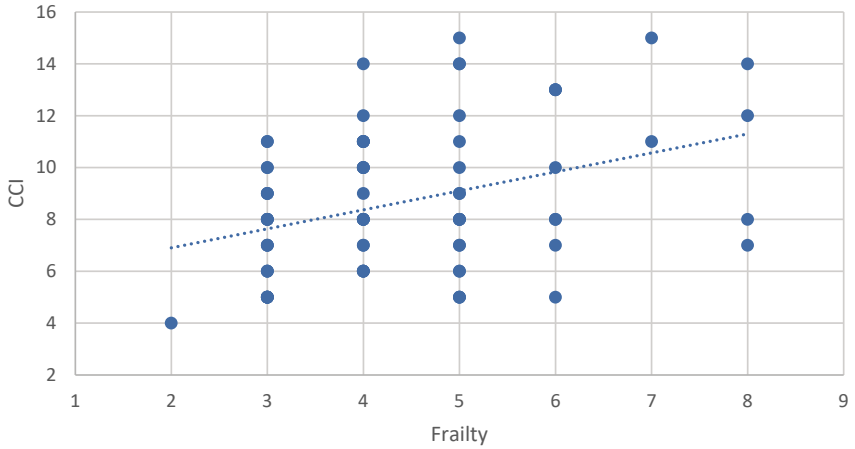
Results

The relationship between patient frailty and the prediction of 10-year survival according to the Charlson Comorbidity Score

The Spearman rho coefficient was used to determine the relationship between patient frailty, assessed using the Clinical Frailty Score, and the predicted 10-year survival based on the Charlson Comorbidity Index. The relationship between patient frailty and Charlson Comorbidity Index score is shown in Fig. 1.

A statistically significant relationship between the frailty of geriatric patients and the Comorbidity Index Score was shown.

Figure 1. Patient frailty according to the Charlson Comorbidity Index score.



Charlson Comorbidity Index - Spearman rho = 0.323 (p = 0.003).

As frailty increases, the Charlson Comorbidity Index Score also increases, and thus, the prediction of 10-year survival decreases. The analyses also revealed that 13% of the predicted 10-year survival of geriatric patients with multiple systemic diseases is explained by patient frailty.

The relationship between frailty and the nutritional status of the patient

The relationship between frailty and nutritional status of geriatric patients according to the results of the MNA-SF was confirmed by statistical significance - **Spearman rho = -0.641**, (<**0.001**). It was demonstrated that patients with a higher degree of malnutrition were associated with greater patient frailty. The relationship is shown in Fig 2.

Frailty in patients over 65 years of age can be explained in 45% of cases by inadequate nutrition.

The relationship between albumin levels, frailty, nutritional status and morbidity

Subsequently, we focused on selected statistically significant associations between the measured albumin levels (preoperative values, postoperative days 1, 3, and 5), the *Clinical Frailty Score, the Charlson Comorbidity Index, and the Mini Nutritional Assessment-Short Form.* The identified correlations are presented in Table 1.

We identified the following significant correlations:

- with higher albumin levels (preoperative, postoperative days 1 and 5), patient frailty decreases;
- the higher the albumin levels on day 5, the greater the likelihood of survival for geriatric patients (prediction of 10-year survival for geriatric patients);
- the higher the albumin levels (preoperative, postoperative days 1, 3, and 5), the more the nutritional status of geriatric patients approaches normal;

Figure 3 shows the statistically significant relationship between albumin levels (day 5) and Charlson Comobidity Index (CCI).

Table 1. Correlations between measured albumin levels and selected variables (Spearman rho)**.**

Variable	Albumin – preoperative value	Albumin – Day 1	Albumin – Day 3	Albumin – Day 5
CFS	S -0.236 p = 0.035	-0.239 p = 0.033	-0.178 p = 0.114	-0.280 p = 0.012
CCI	-0.206 p = 0.067	-0.198 p = 0.078	-0.057 p = 0.614	-0.286 p = 0.010
MNA-SF	0.333 p = 0.003	0.375 p = 0.001	0.251 p = 0.025	0.310 p = 0.005

The higher the albumin levels on day 5, the greater the prediction of 10-year survival for geriatric patients.

Figure 2. Patient frailty according to the Charlson Comorbidity Index score.

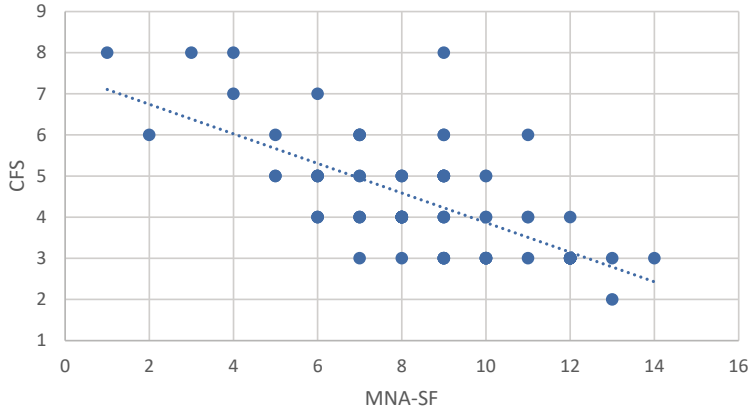
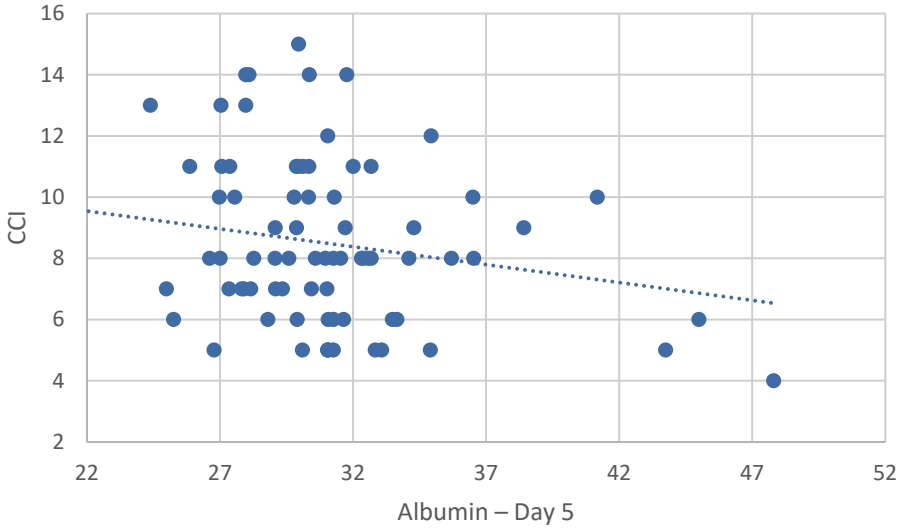


Figure 3. Albumin Day 5 and Charlson Comorbidity Index.



Discussion

Postoperative complications after abdominal surgery in individuals over 65 years of age occur due to several factors that significantly affect the health status of geriatric patients (8). Many of these complications are associated with biological ageing-related changes, such as malnutrition, weakness, and psychological problems in both the preoperative and postoperative periods (9).

The ageing process increases the risk of complications in the postoperative period, which can seriously impact the overall health and postoperative recovery of patients (10). Psychological factors, such as cognitive dysfunction and postoperative delirium, are common and need to be minimized (11).

In this study, we focused on predictive factors that may influence postoperative outcomes of geriatric patients after abdominal surgery. We investigated the frailty of geriatric patients with colorectal cancer in correlation with the Charlson Comorbidity Index Score, nutritional status according to the Mini Nutritional Assessment, and serum albumin levels in the perioperative period.

The definition of a clinical frailty score is essential for understanding and correctly assessing the overall health of geriatric patients (4). The clinical frailty score is a tool used to identify patient frailty and determine the risks associated with surgical and therapeutic interventions (12). Clinical studies have shown that frailty score is a direct predictor of increased postoperative morbidity and mortality (13). Its determination helps to tailor treatment to the individual needs of patients (14). Studies show that ineffective geriatric assessments can lead to deterioration in patient health (15). Failure to identify patient's risk in the preoperative period may prolong hospitalization and worsen the patient's prognosis (16). The importance of frailty is also related to the issue of comorbidities, where a higher score, according to the Charlson Comorbidity Index, may indicate not only an increasing risk of complications but also a higher mortality rate in elderly patients. (17). In our study, the Charlson Comorbidity Index appears to be a significant tool for assessing frailty in geriatric patients. The confirmed association between frailty in geriatric patients and CCI Score was shown to be statistically significant. As the degree of frailty increases, the Charlson Comorbidity Index Score also increases, thus significantly decreasing the prediction of 10-year survival of patients. The analysis further showed that 13% of the predicted 10-year survival in geriatric patients with multiple systemic diseases can be explained by patient frailty.

Frailty and the Charlson Comorbidity Index are closely related assessment concepts that provide essential insights into the health of geriatric patients (18). Frailty, as a reduced resistance to stress, can significantly affect morbidity and mortality of these patients (19). According to a study that examined the impact of frailty on geriatric patients with traumatic injuries, patients classified as frail had up to three times the risk of hospitalization requiring a prolonged length of hospital stay (20). The Charlson Comorbidity Index considers various chronic diseases and their severity, highlighting factors that may worsen the patient's prognosis (21). These findings suggest that the combination of frailty and comorbidity can significantly influence clinical decision-making and therapeutic approaches in geriatric care (21-22).

In our study, we investigated the nutritional status of geriatric patients as a potential factor in developing postoperative complications. The results were obtained from a nutritional screening using the Mini Nutritional Assessment-Short Form questionnaire. We found statistically significant differences frailty grades of geriatric patients and their nutritional status. It was shown that higher levels of malnutrition in patients were also associated with higher rates of frailty. The results of our research show that frailty in patients over 65 years of age can be explained by malnutrition in 45% of cases.

In this context, the Mini Nutritional Assessment (MNA) proves to be an effective tool for identifying the risk of malnutrition. The combination of frailty assessment and evaluation of patient's nutritional status is a key factor in improving healthcare, especially in elderly individuals with cancer (23). In the discussion on frailty assessment and nutritional status of onco-geriatric patients, the link between malnutrition and the presence of syndromes such as malnutrition, sarcopenia and cachexia need to be emphasized (24). Salis et al. identify malnutrition as a common and often neglected problem in elderly patients (25). Considering the increasing number of older cancer patients and the growing need for their follow-up and treatment, it is important to include comprehensive geriatric assessment in preoperative care (26). This enables early detection of syndromes such as malnutrition and frailty, improves therapeutic procedures, and significantly affects the quality of life of these patients. The application of models based on frailty scores and nutritional assessments is expected to improve treatment outcomes and minimize the risk of complications (27-28). In the final part of the study, we analyzed the relationship between serum albumin levels, frailty, nutritional status, and morbidity. Serum albumin levels determined preoperatively and on Day 1, Day 3, and Day 5 after surgery in the intensive care unit were evaluated. We identified significant correlations that demonstrated considerable findings. Higher serum albumin levels during the monitored period were associated with normal nutritional status and a significant reduction in frailty in geriatric patients. Patient frailty decreases with higher albumin levels (preoperative, day 1 and 5). A significant correlation was associated with serum albumin values on postoperative day 5 and Charlson Comorbidity Index score. The higher the albumin levels were determined, the greater the probability of 10-year survival in geriatric patients. Albumin levels are crucial in assessing patient health, especially in the context of colorectal surgery (29). Abnormalities in albumin levels may indicate malnutrition, which is associated with complications in both the perioperative and postoperative periods (30). Research shows that lower albumin levels are associated with increased patient frailty and a higher incidence of postoperative complications following surgical procedures (31). Adding the assessment of serum albumin levels to traditional clinical predictors can improve risk stratification and the proper setting of a nutritional plan (32). An optimal nutritional plan improves recovery and reduces the risk of postoperative complications (33). The results of our study indicate that routine clinical implementation of preoperative assessment of frailty grade, nutritional status, and serum albumin levels in geriatric patients has potential to establish a standardized management approach that enhances patient safety, improves healthcare quality, and reduces postoperative morbidity and mortality. This approach improves care and emphasizes the importance of targeted preoperative assessment of the patient's overall functional status and identification of potential risk factors for postoperative complications.*

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