Summary

Background: Wound healing is a physiologically continuous and complex process that begins as soon as the injury occurs. Nutritional status determines the ongoing regenerative processes. Malnutrition may affect the prolongation of the inflammatory phase, reduced collagen production as well as the risk of new wounds. The problem of malnutrition is increasingly common and remains prevalent in the elderly population with coexisting chronic diseases. From the economic perspective, it poses a burden on national health care systems. Multimorbidity, including the presence of chronic wounds, disrupts the functioning of the body as a whole, leading to reduced quality of life or social isolation. Knowing that improving nutritional status can have a significant impact on wound healing, scientific societies recommend that clinicians' efforts should be directed toward performing routine screening for nutritional assessment, and even more so, that patients who are found to have wounds that are difficult to heal, and chronic wounds, should undergo such assessment. In-depth diagnostics should be based on available scales, biochemical tests and body composition assessment (bioelectrical impedance)

Aim of the study: The purpose of this study was to evaluate the nutritional status and body composition of patients with coexisting chronic wounds.

Material and methods: The study was carried out at the Wound Healing Clinic, Subcarpathian Oncology Center Specialized Hospital, from December 31, 2022 to December 31, 2023, on a group of 106 patients with chronic wounds. The controls included 50 subjects ≥ 60 years of age without coexisting chronic wounds. An AKERN BIA 101 Anniversary Sport Edition bioelectrical impedance analyzer (Akern SRL, Pontassieve, Florence, Italy) was used to assess body composition. A tetrapolar (8-electrode) system in a counterbalanced arrangement (measuring current amplitude 800 uA, sine wave, 50 kHz) was used. Based on the author's questionnaire, the sociodemographic data of the study group or the Barthel scale score were further analyzed. The wound itself was further evaluated on the basis of NPIAP/EPUAP, Wagner and RYB scales. Evaluation of morphological and biochemical blood parameters included analysis of albumin, hemoglobin and CRP levels. Then, the individual score of the NRI malnutrition risk index was calculated, and anthropometric assessment and analysis of nutritional status with the MNA scale constituted the final element of the study design.

The study was approved by the Director of the Podkarpackie Oncology Center Specialized Hospital and the Bioethics Committee at the University of Rzeszow (RESOLUTION no. 2023/03/0013). In addition, the guidelines of the Declaration of Helsinki were followed in the course of the study.

Results: Our study showed differences between the values of fat-free mass in kg (FFM) in subjects with chronic venous insufficiency (61.01 kg) and those with diabetic foot disease (66.38 kg) (p=0.0114). The amount of total body water (TBW) was significantly higher in the subjects with diabetic foot disease (DFD-50.39 l) than in the subjects with chronic venous insufficiency (CVI-46.98 l)(p=0.0227). In addition, it was shown that the study patients with DFD had higher values of such parameters as fat-free mass (FFM%) - 71.03%, muscle mass (MM kg) - 32.51 kg, skeletal muscle mass (SMM kg) - 32.51 kg, appendicular skeletal muscle mass (ASMM kg) - 25.68 kg. In subjects with chronic venous insufficiency, higher values of hip circumference measurement (119.63 cm), thigh circumference (57.32 cm) were confirmed, while subjects with diabetic foot disease had higher values of WHR index (1.00) and wrist circumference (19.10 cm). There were no differences in the values of biochemical parameters in subjects with CVI and DFD, in particular, measurements of albumin (CVI: 3.99 g/dl vs. DFD: 3.93 g/dl; p=0.5556), hemoglobin (CVI: 12.42 g/dl vs. DFD: 12.49 g/dl; p=0.7928), CRP (CVI: 23.44 mg/dl vs. DFD: 28.45 mg/dl; p=0.4903) or malnutrition risk index (CVI: 101.76 points vs. DFD: 100.66 points; p=0.5041). Assessing nutritional status based on the MNA questionnaire, on a quantitative scale (0-30 points), the differences between CVI and DFD were confirmed. Higher scores were obtained by CVI patients (22.35 points) than by DFD patients (20.63 points) (p=0.0062). Married DFD patients had higher values of reactance (43.66 ohm vs. 37.69 ohm; p=0.0079), and PhA (5.64˚ vs. 5.03˚ ; p=0.0229) than unmarried status subjects. On the other hand, single subjects had higher ECW values in L (26.18 L vs. 23.57 L p=0.0412) or ECW % (21.16% vs. 47.84%; p=0.0236). Respondents with diabetic foot disease who had primary education had reduced BCM kg (29.91 kg vs. 33.41 kg; p=0.0368), PhA˚ (4.99˚ vs. 5.42 ˚;p=0.0494), Mbasale kcal (1617.53 kcal vs. 1719.02 kcal; p=0.0374), relative to respondents with higher education. Respondents in relations who had a DFD had a higher nutritional status score (21.77 points vs. 18.61 points; p=0.0007) compared to those in unmarried status, and a reduced nutritional status score was confirmed in respondents with a DFD (18.97 points; p=0.0165) who had primary education. In the group of subjects with chronic venous insufficiency and diabetic foot disease, better functional status on the Barthel scale correlated positively with body composition components, NRI and some biochemical parameters. Regarding pain, exudate, wound area and biochemical values, a correlation was evident, suggesting a proportional increase in pain induction to the size/extent of the wound area. In terms of the relationship between body composition components, phase angle (PhA). There was a strong correlation between the assessment scales and morphological and biochemical blood tests. Patients who scored higher on the NPIAP/EPUAP scale had

concomitantly lower albumin, hemoglobin, NRI, and a lower value on the MNA scale, with an increase in CRP levels. In terms of comparison between the study and control groups, it was shown that those without coexisting wounds had better nutritional status as assessed by the MNA scale (25.83 points vs. 22.35 and 20.63 points) and BMI, while body composition differed in FM, FFM, TBW, BCM, BCMI.

Conclusions: Respondents with coexisting chronic wounds show significant differences in anthropometric assessment, body composition and overall nutritional status assessment, and the results indicate malnutrition or its risk. It was shown that marital status, education, and the level of performance on the Barthel scale, have a significant effect on the parameters of nutritional status (as the value on the Barthel scale increased, the level of albumin, hemoglobin, NRI, in subjects with DFD, and MNA in subjects with CVI increased). The larger wound area in DFD subjects corresponded with lower body composition component scores for PhA, FFM, BCM, ICW, BCMI, SPA, Mbasale. Both groups had lower albumin, hemoglobin, and NRI scores, and DFD subjects additionally had lower MNA scores. Wound exudate, and amount, was also associated with lower hemoglobin, albumin, and NRI values. There is a positive and strong correlation between bioelectrical impedance (phase angle) values and albumin, NRI and MNA scale scores. Wound bed expressed in the RYB classification, (as red), and the level of destruction at a lower level in the NPIAP/EPUAP scale was closely related to nutritional status in the MNA scale, NRI, biochemical tests, with lower CRP. Respondents with chronic wounds also achieved lower scores in the assessment of nutritional status by basic as well as extended methods compared to a control group of healthy subjects without comorbid wounds.

Keywords: chronic wounds, nutritional status, bioelectrical impedance