



Original Article

Investigation of the effect of perioperative nutritional risk index on quality of life, wound healing, and well-being of patients

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Abstract

Objective: To investigate the effect of the perioperative nutritional risk index on the quality of life, wound healing, and well-being of patients.

Methods: Patients diagnosed with gynecological conditions and gynecologic oncology malignancies and who underwent surgery were included in this prospective study. The study groups were categorized as low-risk and high-risk according to Nutrition Risk Screening (NRS 2002). Demographic, clinical, and preoperative laboratory data of the patients were recorded. Patients were asked to complete the Hospital Anxiety and Depression Scale (HAD), EORTC QLQ-C30, and NRS 2002 forms.

Results: A total of 262 patients—205 categorized as low-risk and 57 as high-risk—were included. The low-risk group had thicker triceps skinfold ($p=0.044$), shorter wound healing time ($p=0.001$), greater upper arm circumference ($p=0.021$), fewer wound complications ($p=0.001$), higher hemoglobin ($p=0.001$), ferritin ($p=0.028$), and albumin ($p=0.001$) levels, as well as lower HAD scores ($p=0.001$), and better EORTC QLQ-C30 scores ($p<0.05$) than the high-risk group. A positive correlation was found between NRS 2002 and wound complications, wound healing time, and HAD scores, while a negative correlation was found with triceps skinfold thickness, hemoglobin levels, upper arm circumference, albumin, and ferritin levels ($p<0.05$).

Conclusion: The low-risk nutritional status of patients in the preoperative period positively affects their well-being, wound healing, and quality of life in the perioperative period.

Keywords: Hospital anxiety and depression scale, nutrition risk screening, perioperative nutrition, quality of life, well-being, wound healing.

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INTRODUCTION

The nutritional status of patients is an important parameter of quality of life in patients diagnosed with cancer (1). A loss of more than 2% of body weight within the first month, 5% within three months, or 10% within six months suggests nutritional deficiency (2). Disease-related malnutrition in hospitalized patients is a syndrome associated with significant disability, short- and long-term mortality, increased care costs, impaired recovery from illness, and increased morbidity (3). In surgical patients, the incidence of malnutrition varies between 11-77% (4). Inflammation and stress reactions during surgery, pathological processes underlying the disease, delayed recovery of bowel functions, and inadequate intake caused by perioperative fasting are considered nutritional risks or indicators of malnutrition in perioperative patients (5). Systemic inflammatory syndrome is mostly active in patients diagnosed with cancer. The systemic inflammatory response is associated with loss of muscle and fat mass, altered protein turnover, increased levels of acute phase proteins, impaired glucose tolerance, and often insulin resistance. Weight loss, systemic inflammation, and deterioration of physical performance interact with each other, leading to a persistent deterioration of the patient's well-being and general condition (6). Perioperative adverse events related to nutrition frequently include infection, wound healing disorders, repeat surgical procedures, venous thrombosis, perioperative neurocognitive dysfunction, prolonged hospital stay, unplanned readmission, and mortality (4). Biochemical markers of malnutrition include hemoglobin level, lymphocyte count, albumin, and C-reactive protein (CRP) levels (7). Evaluation of nutritional status in the perioperative period using laboratory parameters remains controversial and limited due to factors such as infusion, inflammation, acute and chronic blood loss, and stress response (4). While anthropometric measurements such as triceps skinfold thickness, abdominal circumference, and arm circumference are sometimes used in clinical practice, the use of body mass index (BMI) is common. However, severe protein-calorie deficiency is associated with definitive changes in body composition, and basing decisions solely on anthropometric measurements may not be appropriate (8). The most frequently studied nutritional scoring indices in surgical patients are the Geriatric Nutritional Risk Index (GNRI) (9), The Controlling Nutritional Status score (CONUT) (10), and the Prognostic Nutritional Index (PNI) (11). However, the NRS 2002 (12) remains the most widely used screening method for nutritional risk assessment. The NRS 2002 can identify patients at risk of malnutrition who have undergone major abdominal surgery. It may be appropriate to evaluate the preoperative nutritional status of patients and initiate treatment to optimize the patient's physical function and nutritional status. In nutritional counseling, it is recommended to first evaluate nutritional risk with anthropometric measurements and risk screening scales (13). For these reasons, this study aimed to investigate the effects of perioperative nutritional risk screening on quality of life, wound healing, and well-being of patients undergoing surgery for gynecological conditions and gynecologic malignancies.

MATERIALS AND METHODS

Ethics committee approval for this prospective study was received from a tertiary center on 05.07.2022 with protocol number 2022/336. This study was performed in accordance with the ethical standards set forth in the 1964 Helsinki Declaration and its later amendments.

Patients who underwent surgery for gynecological conditions and gynecologic oncologic diagnoses between July 2022 and February 2024 were included in this study. All participants were informed about the study and informed consent was obtained. Inclusion criteria for this study were patients aged 18 years and older, patients who underwent surgery for a diagnosis of gynecological cancer (ovary, peritoneum, fallopian tube, uterus, cervix), and patients who underwent surgery for gynecological reasons (abnormal uterine bleeding resistant to treatment, myoma uteri, adnexal mass, and pelvic pain). Exclusion criteria included pregnant and breastfeeding women, those with a history of vaginal surgery, psychiatric disorders, chronic kidney and liver diseases, immunodeficiency, autoimmune, and hematological diseases.

Demographic data of the cases (age, parity number, gravida number, body mass index, marital status, family type, educational status, smoking and alcohol use, employment status), vital signs (fever, pulse, blood pressure, respiratory rate), concomitant diseases (Diabetes Mellitus and Hypertension), upper arm circumference, and triceps skinfold thickness were recorded. Patients were asked to complete questionnaires including the Hospital Anxiety and Depression Scale (14), the Quality of Life Form (EORTC QLQ-C30) (15), and the Nutritional Risk Screening Form (NRS 2002) (12). Patients were then categorized as low-risk and high-risk based on the results of the NRS-2002 form. Surgical incision type, suture material (prolene and other), subcutaneous closure type (single and multi-layer), postoperative wound healing status (incision healing time, wound complications), corset use, and preoperative laboratory test results were recorded.

The systemic inflammatory response index (SII) was calculated using the formula: $SII = \text{platelet count} \times \text{neutrophil count} / \text{lymphocyte count}$. SII, calculated from laboratory blood counts of neutrophils, platelets, and lymphocytes, can indicate different inflammatory conditions and immune pathways in the body and is more stable (16).

The sample size in the study was calculated with G*power version 3.1.9.2. The number of cases in the study was calculated as at least 84 cases in total, 42 cases in each group, based on Cohen's $d=0.8$, $\alpha=0.05$, and power 95%.

Statistical analysis

Statistical analyses were performed with SPSS 21.0 (IBM SPSS Statistics, IBM Corporation, Armonk, NY, USA). Descriptive characteristics (median, mean, and standard deviation) were calculated using descriptive statistical tests. For comparisons between two groups, the independent t-test was used for parameters with normal distribution, and the Mann-Whitney U test was used for parameters without normal distribution. Pearson Chi-Square and Fisher's Exact Test were used for comparisons of categorical parameters. Spearman's correlation test was used for the relationship between variables. A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age of cases in the low-risk and high-risk groups was 57.1 ± 10.7 and 57.8 ± 13.5 , respectively ($p=0.718$). A statistically significant difference was found between the two groups favoring the low-risk group in terms of demographic and clinical characteristics such as triceps skinfold thickness ($p=0.044$) and upper arm circumference ($p=0.021$) (Table 1).

In terms of surgical characteristics and pathology results, statistically significant shorter wound healing time ($p=0.001$) and fewer wound complications ($p=0.001$) were found in favor of the low-risk group (Table 2).

When the study groups were compared, the low-risk group demonstrated statistically significantly higher preoperative hemoglobin ($p=0.001$), ferritin ($p=0.028$), and albumin ($p=0.001$) levels compared to the high-risk group (Table 3).

The low-risk group had statistically significantly lower depression and anxiety scores ($p=0.001$ for both) compared to the high-risk group on the HAD scale. In terms of the quality of life scale, the low-risk group had significantly higher functional and general well-being scores and lower symptom scale scores compared to the high-risk group ($p<0.05$, Table 4).

In the correlation analysis of significant factors between the two groups, a positive correlation was found between NRS 2002 scores and wound complications ($p=0.001$), wound healing time ($p=0.001$), depression level ($p=0.001$), and anxiety level ($p=0.001$). Conversely, triceps skinfold thickness ($p=0.032$), upper arm circumference ($p=0.034$), hemoglobin ($p=0.001$), ferritin ($p=0.001$), and albumin ($p=0.001$) levels were significantly negatively correlated with NRS 2002 scores (Table 5).

Table 1. Comparison of the cases according to their demographic and clinical characteristics

Variables	NRS 2002		p value
	Low risk (n= 205)	High risk (n=57)	
Age, year	57.1±10.7	57.8±13.5	0.718
Gravida	3 (0-8)	3 (0-7)	0.097
Parity	3 (0-8)	3 (0-7)	0.227
BMI, kg/m ²	31.1±7.0	31.0±6.5	0.917
Fever, degree	36.6±0.3	36.6±0.3	0.765
Heart rate, minute	83.1±9.1	82.8±11.3	0.545
Respiratory rate, minute	16.7±1.6	16.6±1.6	0.900
Systolic blood pressure, mmHg	120 (90-135)	120 (95-130)	0.756
Diastolic blood pressure, mmHg	70 (55-85)	70 (55-80)	0.269
Upper arm circumference, mm	31.6±4.8	30.0±4.7	0.021
Triceps skinfold, mm	20.0±4.8	18.4±4.6	0.044
Marital status			0.133
Single	7 (3.4)	6 (10.5)	
Married	194 (94.6)	50 (87.7)	
Widow	4 (2.0)	1 (1.8)	
Smoking			0.484
Yes	21 (10.2)	5 (8.8)	
No	184 (89.8)	52 (91.2)	
Education status			0.595
Illiterate	38 (18.5)	14 (24.6)	
Primary school	125 (61.0)	28 (49.1)	
Middle school	12 (5.9)	4 (7.0)	
High school	14 (6.8)	4 (7.0)	
University	16 (7.8)	7 (12.3)	
Coexisting disease			0.212
DM	49 (23.9)	13 (22.8)	
HT	40 (19.5)	6 (10.5)	
Other	20 (9.8)	10 (17.5)	
No	96 (46.8)	28 (49.1)	
Family type			0.074
Nuclear	168 (82.0)	40 (70.2)	
Extended	36 (17.6)	15 (26.3)	
Alone	1 (0.5)	2 (3.5)	
Work status			0.448
Yes	15 (7.3)	5 (8.8)	
No	190 (92.7)	52 (91.2)	

Abbreviations: BMI: Body Mass Index, DM: Diabetes Mellitus, HT: Hypertension

Data are reported as mean (SD) or median (IQR). Differences between two groups were analyzed using the Mann Whitney test or Student's t-test, categorical variables were analyzed with chi-square test and a p value of less than 0.05 was considered statistically significant.

Table 2. Comparison of the cases according to their surgical characteristics

Variables	NRS 2002		p value
	Low risk (n=205)	High risk (n=57)	
Pathology			0.115
Benign	58 (28.3)	11 (19.3)	
Malign	147 (71.7)	46 (80.7)	
Type of surgical incision			0.546
Vertical	65 (31.7)	22 (38.6)	
Transvers	102 (49.8)	27 (47.4)	
Laparoscopic	38 (18.5)	8 (14.0)	
Subcutaneous closure			0.429
One layer suture	77 (37.6)	20 (35.1)	
Multiple layers	128 (62.4)	37 (64.9)	
Suture material			0.183
Prolene	148 (72.2)	37 (64.9)	
Others	57 (27.8)	20 (35.1)	
Corset use			0.163
Yes	73 (35.6)	25 (43.9)	
No	132 (64.4)	32 (56.1)	
Wound healing, day	9.4±2.1	11.8±4.1	0.001
Wound complication			0.001
Infection	4 (2.0)	2 (3.5)	
Wound dehiscence	3 (1.5)	11 (19.3)	
No	198 (96.6)	44 (77.2)	

Abbreviations: BMI: Body Mass Index, DM: Diabetes Mellitus, HT: Hypertension

Data are reported as mean (SD) or median (IQR). Differences between two groups were analyzed using the Mann Whitney test or Student's t-test, categorical variables were analyzed with chi-square test and a p value of less than 0.05 was considered statistically significant.

Table 3. Comparison of the cases according to their laboratory results

Variables	NRS 2002		p value
	Low risk (n=205)	High risk (n=57)	
Preoperative			
Hb, g/dL	12.6±1.7	11.4±1.2	0.001
PLT, K/μL	312.3±95.8	309.8±73.1	0.856
SH	932.4 (39.7-14797.6)	1061.2 (302.2-11758.5)	0.360
WBC, K/μL	9.8±3.7	9.3±3.1	0.782
Neutrophyl, K/μL	7.1±4.0	7.0±3.4	0.920
Lymphocyte, K/μL	1.8±1.0	1.7±1.0	0.225
MPV, fl	10.1±1.0	10.2±1.0	0.496
CRP, mg/L	8.1 (1.5-127)	8.3 (3.3-47.9)	0.766
BUN, mg/dL	27.1±9.4	28.7±14.0	0.932
Cr, mg/dL	0.7±0.2	0.7±0.2	0.325
AST, U/L	19.3±8.5	18.0±7.5	0.314
ALT, U/L	16.1±7.8	15.0±7.3	0.300
Uric acid, mg/dL	4.8±1.2	4.8±1.4	0.994
Triglyceride, mg/dL	177.5±58.0	181.8±59.3	0.618

TSH, μ IU/L	2.8 $\pm$ 2.3	2.7 $\pm$ 2.4	0.726
Ferritin, mg/L	111.0 $\pm$ 90.1	74.8 $\pm$ 49.0	0.028
Albumin, g/dL	4.0 $\pm$ 0.6	3.6 $\pm$ 0.8	0.001
Total cholesterol, mg/dL	181.0 $\pm$ 31.8	173.6 $\pm$ 38.8	0.141

Abbreviations: Hb: Hemoglobin, PLT: Platelet, SII: Systemic Inflammatory Response Index, WBC: White Blood Cell, MPV: Mean Platelet Volume, CRP: C-Reactive Protein, BUN: Blood Urea Nitrogen, Cr: Creatinine, AST: Aspartate aminotransferase, ALT: Alanine Transaminase, TSH: Thyroid-stimulating hormone. Data are reported as mean (SD) or median (IQR)

Differences between two groups were analyzed using the Mann Whitney test or Student's *t*-test, categorical variables were analyzed with chi-square test and a *p* value of less than 0.05 was considered statistically significant.

Table 4. Comparison of cases according to HAD and EORTC QLQ-C30 quality of life scale

		NRS 2002		p value
		Low risk (n=205)	High risk (n=57)	
HAD scale form				
	Depression	8.7 $\pm$ 3.0	11.0 $\pm$ 3.3	0.001
	Anxiety	10.2 $\pm$ 3.6	12.0 $\pm$ 3.6	0.001
EORTC QLQ-C30 Quality of Life scale				
	Item			
Functional status 0-100				
Physical function	1-5	74.5 $\pm$ 16.4	61.5 $\pm$ 23.0	0.001
Role function	6-7	71.1 $\pm$ 23.6	36.8 $\pm$ 18.8	0.001
Emotional function	21-24	79.3 $\pm$ 19.4	50.4 $\pm$ 23.6	0.001
Cognitive function	20-25	77.0 $\pm$ 20.5	39.5 $\pm$ 18.0	0.001
Social function	26-27	77.4 $\pm$ 21.5	40.1 $\pm$ 20.3	0.001
General well-being 0-100	29-30	78.6 $\pm$ 12.1	75.7 $\pm$ 11.4	0.008
Symptom scale 0-100				
Weakness	10,12,18	36.7 $\pm$ 14.2	44.2 $\pm$ 20.0	0.004
Nausea and vomiting	14-15	30.8 $\pm$ 10.0	37.5 $\pm$ 17.5	0.003
Pain	9,19	35.0 $\pm$ 15.0	50.0 $\pm$ 28.8	0.001
Dyspnea	8	32.5 $\pm$ 15.0	37.5 $\pm$ 17.5	0.023
Insomnia	11	37.5 $\pm$ 20.0	52.5 $\pm$ 30.0	0.001
Loss of appetite	13	35.0 $\pm$ 15.0	42.5 $\pm$ 25.0	0.037
Constipation	16	32.5 $\pm$ 15.0	50.0 $\pm$ 27.5	0.001
Diarrhea	17	32.5 $\pm$ 15.0	45.0 $\pm$ 27.5	0.002
Financial difficulty	28	35.0 $\pm$ 20.0	32.5 $\pm$ 17.5	0.946

Abbreviations: Data are reported as mean (SD)

Differences between two groups were analyzed using the Mann Whitney test or Student's *T*-test, and a *p* value of less than 0.05 was considered statistically significant.

Table 5. Correlation analysis of factors affecting NRS 2002 risk scoring

	NRS 2002	
	r value	p value
Wound complication	0.347	0.001
Wound healing time, days	0.359	0.001
Upper arm circumference, mm	-0.131	0.034
Triceps skinfold thickness, mm	-0.133	0.032
Hemoglobin, g/dL	-0.289	0.001
Albumin, g/dL	-0.250	0.001
Ferritin, g/dL	-0.177	0.001
Depression	0.279	0.001
Anxiety	0.196	0.001

Abbreviations: a p value of less than 0.05 was considered statistically significant.

NRS: Nutrition Risk Screening

DISCUSSION

In this study investigating the effect of the perioperative nutritional risk index on quality of life, wound healing, and well-being, statistically significantly better anthropometric measurements, shorter wound healing time, fewer wound complications, higher hemoglobin, higher ferritin, and higher albumin levels, lower HAD scale scores, and better quality of life scale scores were found in the low nutritional risk group compared to the high nutritional risk group. In the correlation analysis of the factors found to be statistically significant between the two groups, a positive correlation was found between wound complications, wound healing, depression, and anxiety scores and NRS 2002 scores, while a negative correlation was found between triceps skinfold thickness, upper arm circumference, hemoglobin, ferritin, and albumin levels and NRS 2002 scores. Malnutrition is quite common in hospitalized patients and is more likely to occur in surgical patients who need to recover. Untreated malnutrition is associated with longer hospital stays and postoperative complications that trigger catabolism, poor outcomes, major surgical stress, and trauma (17,18). Tan et al. found that postoperative infection-related complications were 2.2 times higher in patients undergoing abdominal surgery with a diagnosis of gastrointestinal cancer and had preoperative malnutrition (19). Similarly, in this study, longer hospital stays, and more complications were found in the high nutritional-risk group. Gunarsa et al. showed that a total lymphocyte count of less than 1,200 cells/mm³ was associated with low mid-upper arm circumference, albumin level, and malnutrition (20). Unlike this study, no difference was found between the study groups in terms of lymphocyte levels, and total lymphocyte counts were recorded as more than 1,200 cells/mm³. The designs and populations of the studies are different. Low levels of albumin, an acute phase protein and an important marker of systemic chronic inflammation, are indicative of poor nutritional status and are associated with poorer clinical outcomes (21). It has been reported that the risk of surgical site infection increases 3-fold in patients with preoperative serum albumin levels <3.3 g/L (22). In this study, a statistically significant difference was found between the two groups in terms of albumin levels, with both groups having albumin levels >3.3 g/L. Furthermore, the study groups differed in their characteristics. Calculation of the CONUT score, one of the most commonly used nutritional scoring indices in the literature, only requires data on lymphocyte counts, albumin, and serum total cholesterol levels. Bekos et al. showed that a high preoperative CONUT score was associated with a high rate of postoperative complications and serious complications (10). Another nutritional risk index, PNI, is calculated from serum albumin levels and total lymphocyte count. Ni et al reported that lower PNI scores were associated with poorer clinical outcomes, including increased risk of complications during and after treatment and lower

overall survival rates (11,23). Another nutritional scoring index, the Geriatric Nutritional Risk Index (GNRI), is calculated using ideal body weight and serum albumin levels. The Liu et al. study shows that patients with low GNRI scores have a higher risk of experiencing postoperative complications (9). In contrast to previous studies, the NRS 2002 scoring index was used in this study and similar lymphocyte counts, total cholesterol levels, and BMI were found between the study groups. Only the group with a low nutritional risk had a significant difference in terms of higher albumin levels. Longer hospital stays and more complications were found in the high-risk group. Low hemoglobin levels indicate anemia, which is often associated with malnutrition. This association is well documented in studies of gynecologic cancer, where anemia is often accompanied by malnutrition and inflammation, as reported by Zhang et al. (24). Similarly, in this study, hemoglobin levels were found to be lower in the high-risk group. Recently, PNI and preoperative SII have emerged as important parameters for the prognosis and diagnosis of gastric and cervical cancer (25). SII is used for the treatment and diagnosis of many malignant tumors and is associated with the prognosis of patients diagnosed with malignant tumors by reflecting the inflammatory level (26). In contrast to those studies, no significant difference was found between the two groups in terms of SII according to the NRS 2002 score. In addition, the design of this study included patients with gynecological conditions and gynecologic oncologic diagnoses who underwent surgery. These may be the reasons for the differences in the study results. Both the disease itself and the patient's nutritional status affect quality of life. Studies have shown that severe weight loss is associated with poor quality of life, and vice versa (27, 28). Another study showed that functional capacity worsened as the severity of malnutrition increased (29). In the Evangelou et al study, the well-nourished group reported significantly lower levels of depression and anxiety than those who were moderately and severely malnourished (30). However, clinically, symptoms such as pain, cachexia, fatigue, cognitive impairment, anxiety, and depression can be found alone or together in patients (31). Consistent with the literature, this study also found lower quality of life, less functional capacity, higher anxiety, and higher depression scores in patients with high nutritional risk scores. Loss of appetite resulting from systemic inflammation can be addressed alongside fatigue, weight loss, physical inactivity, reduced energy intake, and traditional nutritional support. Metabolic interventions and nutrition are aimed at alleviating metabolic disorders, maintaining or improving food intake, preserving skeletal muscle mass and physical performance, improving quality of life, and reducing the likelihood of reduction or interruption of planned anti-cancer treatment modalities (6). After malnutrition screening, every patient at risk for malnutrition should be evaluated with further tests. Perioperative nutritional management requires a multidisciplinary team that includes nutrition, nursing, anesthesia, and surgery (4). It has been reported that the implementation of the Enhanced Recovery After Surgery program reduces complications that may develop in individuals by 40% and re-hospitalizations by 30%, and its use is important in this context (32).

Limitations:

The limitations of the present study include being conducted at a single center, and the relatively small sample size. The strengths of this study include its prospective design, inclusion of patients with gynecological conditions and gynecologic oncologic diagnoses who underwent surgery, use of the NRS 2002 for nutritional assessment, and comprehensive evaluation of demographics, surgical procedures, preoperative laboratory characteristics, HAD, and EORTC QLQ-C30. This study is important because it provides detailed data on wound healing, quality of life, and well-being in gynecological and gynecologic oncology cases based on nutritional risk screening. By examining the nutritional status of patients, individualized interventions can be implemented based on nutritional risk, and appropriate nutritional support can be utilized to plan treatment strategies that may help reduce inflammatory marker levels and alleviate symptoms while improving clinical outcomes. This study contributes to literature and may inspire future research in this area.

CONCLUSION

The low-risk nutritional status of patients in the preoperative period positively affects their well-being, wound healing, and quality of life in the perioperative period. Nutritional support provided in the preoperative period can positively affect the perioperative recovery of patients and reduce operative morbidity.

Conflicts of interest: The authors declare no conflicts of interest.

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