VIA MEDICA

Original article

NOWOTWORY Journal of Oncology
2017, volume 67, number 3, 174–179
DOI: 10.5603/NJO.2017.0029

ISSN 0029–540X
www.nowotwory.edu.pl

Utility of nutritional evaluation for the clinical risk assessment of postoperative complications. Does oncology need the NRS 2002 scale?

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Introduction. Malnutrition accompanies many cancers, especially those of the gastrointestinal tract, and significantly raises the risk of postoperative complications in cancer surgery. In Poland, hospitals are legally obliged to evaluate the nutritional status of their patients; one of the assessment tools used for this purpose is the NRS 2002 scale.

Aim. The primary objective of the study is to analyze the utility of the NRS 2002 scale in the risk assessment of postoperative complications in gastrointestinal cancers. In addition, the authors propose to determine whether the legal requirement to conduct nutritional assessments among hospitalized patients is complied with in clinical practice and to evaluate the risk of malnutrition in the study group.

Materials and methods. A detailed assessment was conducted on 226 patients who underwent surgery for upper (95 patients) and lower (131 patients) GI tract cancers in 2015. The risk of complications was analyzed based on the nutritional risk score (NRS 2002) and the levels of albumin and total proteins in the serum before surgery. Compliance with the obligation to carry out nutritional assessments was evaluated on breast and GI cancer patients treated with surgery at the Institute of Oncology in Warsaw in two successive years.

Results. An NRS 2002 score of ≥ 3 was shown to predict postoperative complications for both upper GI tract ($p < 0.001$) and colorectal cancers ($p < 0.001$). In upper GI cancers, complications were also more frequently observed at lower albumin ($p = 0.018$) and total protein ($p = 0.025$) levels in the serum.

Conclusion. The analysis shows that the NRS 2002 scale is useful in predicting the risk of postoperative complications in the treatment of upper and lower GI tract cancers.

NOWOTWORY J Oncol 2017; 67, 3: 174–179

Key words: malnutrition, postoperative complications, gastrointestinal cancers, NRS 2002

Introduction

Malnutrition accompanies many cancers, especially those of the gastrointestinal tract, and is not only one of the early symptoms of disease, but also the direct consequence of the condition and its treatment. Its causes include the loss of appetite, reduced food intake, metabolic changes due to the tumor and cancer-related chronic inflammation, as well as the side effects of cancer treatment, including surgery and chemo- and radiotherapy. In operated patients with GI cancers, malnutrition is an independent risk factor for an increased incidence of complications, nosocomial infections, and perioperative mortality [1–6].

As of 1 January 2012, in accordance with the Ordinance of the Minister of Health of 15 September 2011, amended on 22 November 2013, Polish hospitals are obliged to carry out an assessment of the nutritional status of patients admitted to all their wards, including emergency rooms. For this purpose, they can use either of the following tools: the

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Subjective Global Assessment scale (SGA) or the Nutritional Risk Screening scale (NRS 2002). The simpler of the two, NRS 2002 (Annex 1), evaluates the degree to which the patient's nutritional status has deteriorated, including indicators such as the loss of body mass over three months, the BMI, food intake as a proportion of the daily requirement over the previous week, as well as the severity of the disease, which tends to be accompanied by an increased demand for nutrients. An additional risk factor for malnutrition is age above 70 years. On a scale from 0 to 7, a score of ≥ 3 indicates that nutritional therapy should be introduced [7].

Purpose

The primary objective of the study was to analyze the utility of the NRS 2002 scale in the risk assessment of postoperative complications in gastrointestinal cancers. In addition, the authors proposed to determine whether the legal requirement to conduct nutritional assessments among hospitalized patients is complied with in clinical practice and to evaluate the risk of malnutrition in the study group.

Materials and methods

In order to determine how often the NRS 2002 scale is completed and assess the risk of malnutrition among cancer patients, the study evaluated surgical units and clinical oncology wards in two different clinics of the Marie Skłodowska-Curie Cancer Centre and Institute of Oncology in Warsaw: the Clinic of Breast Cancer and Reconstructive Surgery (KNPiChR) and the Clinic of Oncological Gastroenterology (KGO). The assessment was conducted in 2014 and 2015. Over the studied period, the KNPiCHR performed surgery on 3,420 patients and administered conservative treatment to 16,744, while the corresponding figures for the KGO were 1,888 and 4,054, respectively. The exact distribution of admissions to specific wards is shown in Table I. The choice of clinics was dictated by the difference in nutritional risk in breast and gastrointestinal cancers.

A detailed assessment of the prognostic utility of the NRS 2002 scale was conducted on 226 patients with esophagus, stomach, colon, and rectum cancers who were operated on in 2015. The study group consisted of 76 women (34%) and 150 men (66%); the median age was 59 (29–85) years. The exact distribution of diagnosis, gender, and age is shown in Table II. Alongside the NRS 2002 scale, the risk of malnutrition was also assessed based on albumin (ALB) and total protein (TP) levels in the serum, as measured a day before surgery. The threshold level for the NRS 2002 scale was defined as a score of 3 or more, and for ALB and TP — as 35 mg% and 66 mg%, respectively.

Table I. Admissions to the Clinic of Breast Cancer and Reconstructive Surgery (KNPChR) and the Clinic of Oncological Gastroenterology (KGO)

Clinic/Ward	Number of admissions per annum	
	2014	2015
KNPChR Surgical Ward	1.733	1.687
KNPChR Oncology Ward	11.722	5.022
KGO Surgical Ward	864	1.024
KGO Oncology Ward	1.681	2.372

All patients were prepared for surgery in the same manner, receiving special pre-operative nutritional treatment whenever their weight loss exceeded 10%/3 months, as well as undergoing anithrombotic prophylaxis and perioperative antibiotic therapy.

Data about surgical complications were gleaned from the prospective database of postoperative events kept at the Gastroenterology Clinic since 2010. These included the formation of abscesses at the surgical site, abdominal and scrotal wound infections, post-operative bleeding, anastomotic leaks, obstruction, UTIs, wound dehiscence, and other adverse symptoms, such as diarrhoea, rectovaginal fistulas, urinary retention, delayed peristalsis, urinary bladder dysfunctions, and sinus tachycardia.

The data were analyzed with the SPSS 15 statistical package; the Fisher's exact test was used whenever the number of cases was ≤ 10, while the chi-square Pearson test was employed when the number greater.

Results

The utility of the NRS 2002 scale in nutritional assessment and the risk prognosis of postoperative complications was studied on patients with esophagus, stomach, and intestinal cancers who underwent surgery in 2015. Due to significant differences in the invasiveness of the procedure, perioperative risk, and the predicted number of malnourished patients, upper (esophagus and stomach) and lower (colon and rectum) tract cases were analyzed separately. The evaluation relied on the NRS 2002 scale, as well as the serum levels of albumin and total protein before surgery.

Table II. Characteristics of the study group: patient diagnosis (ICD 10), age, and sex

Diagnosis	Number of patients (n)	Median age (range)	Sex	
			Women n (%)	Men n (%)
C15–16	95	58 (29–80)	30 (32%)	65 (68%)
C18–19	65	59 (41–85)	26 (40%)	39 (60%)
C 20	66	56 (39–79)	20 (30.3%)	46 (69.7%)

Table III. Surgery in stomach cancer patients

Parameter	Postoperative complications n (%)	p	RR	95% CI
ALB				
< 35 (n = 12)	8 (66.7)	0.018	2.35	1.38–3.98
≥ 35 (n = 81)	23 (28.4)			
TP				
< 66 (n = 33)	16 (48.5)	0.025	1.91	1.09–3.34
≥ 66 (n = 59)	15 (25.4)			
NRS 2002				
< 3 (n = 64)	7 (10.9)	< 0.001	7.57	3.69–15.52
≥ 3 (n = 29)	24 (82.8)			

n — number of patients in the group; ALB — albumins in the serum; TP — total protein in the serum; NRS 2002 — nutritional risk score

Table IV. Surgery in intestinal cancer patients (total)

Parameter	Postoperative complications n (%)	p	RR	95% CI
ALB				
< 35 (n = 20)	6 (30.0)	0.782	1.19	0.57–2.50
≥ 35 (n = 111)	28 (25.2)			
TP				
< 66 (n = 27)	6 (22.2)	0.805	1.18	0.54–2.58
≥ 66 (n = 99)	26 (26.3)			
NRS				
< 3 (n = 111)	18 (16.2)	< 0.001	4.93	3.06–7.94
≥ 3 (n = 20)	16 (80.0)			

n — number of patients in the group; ALB — albumins in the serum; TP — total protein in the serum; NRS 2002 — nutritional risk score

In the upper tract group, both the NRS 2002 score ($p < 0.001$) and albumin level ($p = 0.018$) were identified as a risk factor for postoperative complications; the latter were observed in 31 patients (33%), and mostly included septic symptoms — 10 (10%) and respiratory failure — 9 (9%). Detailed information can be found in Table III. In patients with lower tract cancers, only the NRS score ($p < 0.001$) was shown to have predictive utility. Postoperative complications, mostly septic (15 people, i.e. 11%), were observed in 34 patients (18%). Detailed data are shown in Table IV.

The analysis showed that head physicians largely failed to comply with the obligation of nutritional assessment. Compliance rates were higher in surgical departments: at the surgical ward of the KNPiChR, 63% (1,087/1,733) of admitted patients underwent assessment in 2014, as compared to 94% (1,583/1,687) a year later. In the analyzed period, the clinical oncology ward of the clinic used the NRS scale to evaluate as few as 5% (913/17,722) and 22% (1,088/5,022) of patients, respectively (Fig. 1). The corresponding figures for the surgical ward of the KGO were 63% (541/864) and 83% (845/1,024). Nutritional assessment was also rare at the clinical oncology ward of the KGO: as few as 8.5% of hospitalized patients (144/1,681) were evaluated in 2014 and the figure further dropped to 8% (190/2,372) the following year (Fig. 2).

In order to evaluate the reliability of collected data, as compared to the proportion of malnourished patients predicted on the basis of available literature, the authors also performed an analysis of NRS scores obtained during the nutritional assessment conducted in the surgical wards of the two clinics in 2015. Due to the scarcity of data from clinical oncology units, a similar analysis could not be performed for patients undergoing conservative treatment. At the KNPiChR, 1,535 patients (94%) obtained a score of less than 3; 92 (6%) scored 3 or more. At the KGO, the corresponding values were 419 (49%) and 426 (51%), respectively (Fig. 3).

Discussion

With a significant impact on clinical outcome, malnutrition is now considered a major factor of poor prognosis

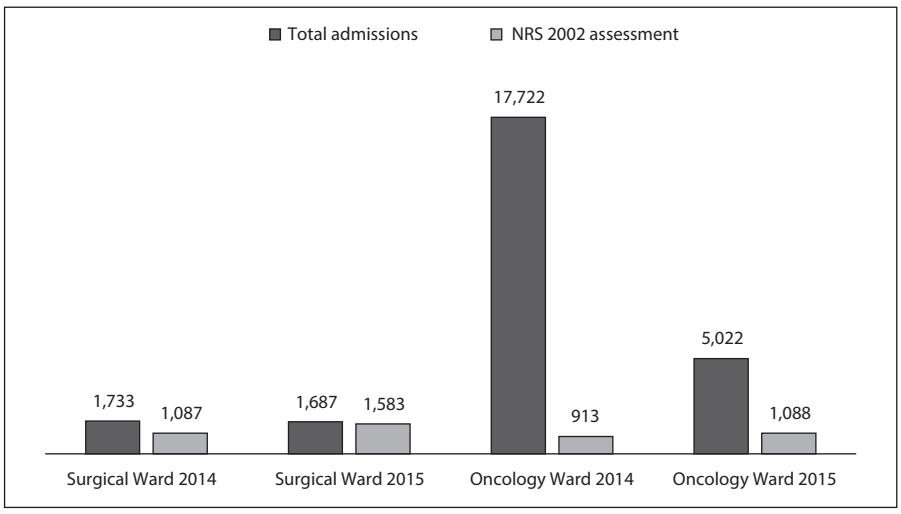

Figure 1. Nutritional assessment and the number of admissions to the Clinic of Breast Cancer and Reconstructive Surgery (KNPChR)

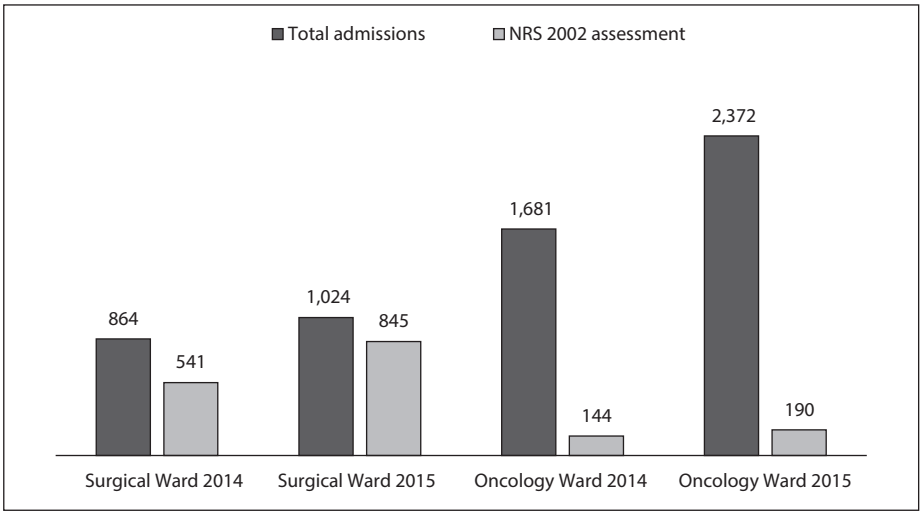

Figure 2. Nutritional assessment and the number of admissions to the Clinic of Oncological Gastroenterology (KGO)

in cancer therapy. Relatively frequent, the phenomenon occurs in 20–60% of cancer patients [1–3] and may considerably affect the quality of life and treatment results [8]; everyone, including those treated in highly developed countries of the European Union [9], is at risk. Importantly, malnutrition requires longer hospital stays, and, as a consequence, a more lengthy and expensive treatment process [4, 10–13], which may take up to twice as long as in properly nourished patients with the same diagnosis [2]. Its impact on postoperative events in digestive tract surgeries has been investigated by numerous clinical studies [3–6]. Associated complications may include slower, abnormal wound healing and often require the postponement of combined therapy, which negatively affects the final outcome of therapy [13]. The proper identification of high-risk patients and their nutritional treatment may improve clinical outcomes, shorten hospitalization time, reduce the frequency of complications, and lower perioperative mortality rates [2, 4, 8, 10, 11, 14].

The choice of an appropriate assessment method (i.e. one that would be easy to use and have a high predictive value) has been the subject of a plethora of studies and metaanalyses thus far [4, 5]. The abundance of available tools goes to show that no ideal one-size-fits-all solution has yet been found [4, 15]. The NRS 2002 scale, recommended for use in the mandatory nutritional assessment of Polish hospital patients, is one of such instruments. In their metaanalysis of 128 randomized clinical trials, Kondrup et al. [7] validated the patient- and treatment-related risk factors for malnutrition and proposed the NRS scale as a tool for their assessment. Its effectiveness has been confirmed by a number of studies [5, 7, 16–19]. Budzyński et al. [17], for instance, analyzed annual admissions to a selected full-profile

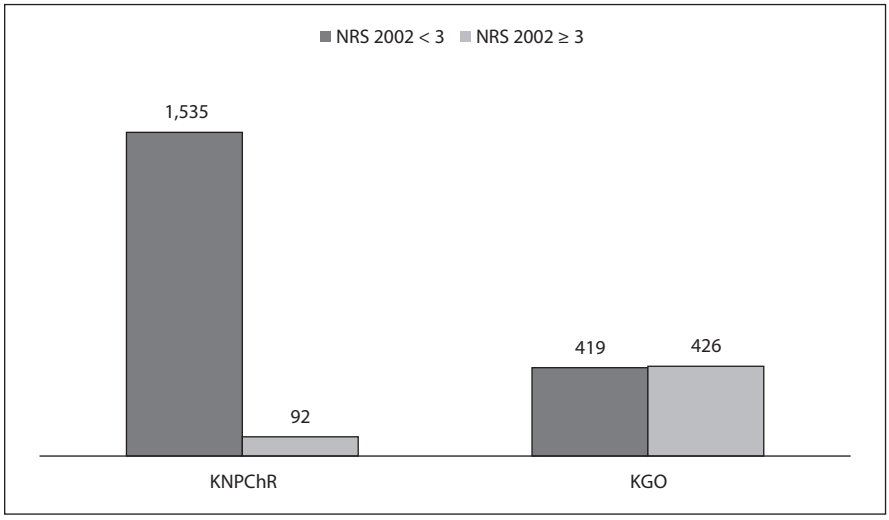

Figure 3. Nutritional assessment of surgical patients in the surgical wards of the Clinic of Breast Cancer and Reconstructive Surgery (KNPChR) and the Clinic of Oncological Gastroenterology (KGO) in 2015

centre (more than 15,000 patients, 20,000 hospitalizations) and confirmed the utility of the NRS 2002 in the prognosis of both 14- and 30-day readmission (OR, respectively: 2.44, $p < 0.0001$ and 2.37 $p < 0.001$) and in-hospital mortality (OR 13.95, $p < 0.001$). Schiesser et al. demonstrated that screening test scores can be shown to correlate with the frequency and severity of abdominal surgery complications, and it should be kept in mind that the risk of malnutrition in this patient group is particularly high [10]. In an EuroOOPS study conducted on 5,051 patients in 27 European broad-profile centres (surgery, internal medicine, oncology), Sorensen [18] confirmed the utility of NRS in the prognosis of postoperative complications. Gou [19], in turn, evaluated 337 patients who underwent stomach cancer surgery in a single center and found that complications were more frequently observed in the NRS ≥ 3 group ($p < 0.05$). A metaanalysis of 11 prospective studies performed by Sun et al. [5] likewise confirmed the effectiveness of the scale in the risk assessment of surgical complications ($p < 0.00001$) and postoperative mortality ($p < 0.00001$) among patients treated with digestive tract surgery; those with a score of < 3 were also shown to require shorter hospitalization times ($p = 0.009$) (Tab. V). Similar conclusions can be drawn from our analysis of 226 patients with upper and lower digestive tract malignancies. The lack of NRS 2002 scores for all patients (only 83% were studied) may undermine its validity, but a comparison with the Polish population [3] shows a similar distribution of malnutrition in the study group (51% NRS 2002 ≥ 3 points).

Like many other studies, the current analysis suggests that the NRS 2002 scale may be very useful in the risk assessment of postoperative complications and conservative cancer treatment [16–19]. It is an extremely simple tool with a high predictive value. Even though nutritional assessments are now mandated by law, however, the proportion of patients who do not undergo such evaluation, especially in cancer wards, remains high (more than 90%). This is bound to cause alarm, since cancer patients are at a particularly elevated risk of further malnutrition as a consequence of both the disease and its treatment [13]. The year-to-year increase in the number of completed NRS 2002 questionnaires, however, offers a glimmer of hope. Current ESPEN guidelines recommend that all cancer patients should be screened for malnutrition in order to prevent its adverse effects prior to cancer treatment [14].

Conclusion

The NRS 2002 scale is a useful tool for the prognosis of postoperative complications in the treatment of GI cancers. Even though nutritional assessment is now required by law, not all patients, especially among those receiving systemic therapy, undergo such evaluation. The proportion of malnourished patients in the study group corresponds to similar figures available for the Polish population in relevant literature, which confirms the reliability of the assessment. The utility of the NRS 2002 scale for individual cancers, types of surgical procedures, and in systemic therapy requires further research in the framework of prospective studies.

Table V. Utility of the NRS 2002 scale in predicting postoperative complications in GI tract surgery (according to Sun et al. [5])

Risk of postoperative complications	OR = 3.13 [2.51, 3.90], $p < 0.00001$
Risk of perioperative mortality	OR = 3.61 [1.38, 9.47], $p = 0.009$
Hospitalization time	WMD = 5.58 [4.21, 6.95], $p < 0.00001$

OR — odds ratio; WMD — weighted mean difference

Conflict of interest: none declared

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Received:13 Nov 2016
Accepted: 6 Feb 2017

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Annex 1. Nutritional Risk Screening (NRS 2002), final screening

Impaired nutritional status		**Severity of disease, increase in requirements**	
Score 0 — Absent	Normal nutritional status	Score 0 — Absent	Normal nutritional requirements
Score 1 — Mild	Weight loss > 5% in 3 months or food intake below 50–75% of normal requirement in preceding week	Score 1 — Mild	Hip fracture, chronic patients, in particular with acute complications: cirrhosis, COPD, chronic hemodialysis, diabetes, oncology
Score 2 — Moderate	Weight loss > 5% in 2 months or BMI 18.5–20.5 + impaired general condition or food intake 25–60% of normal requirement in preceding week	Score 2 — Moderate	Major abdominal surgery, stroke, severe pneumonia, hematologic malignancy
Score 3 — Severe	Weight loss > 5% in 1 month (> 15% in 3 months) or BMI < 18.5 + impaired general condition or food intake 0–25% of normal requirement in preceding week in preceding week	Score 3 — Severe	Head injury, bone marrow transplantation, intensive care patients (APACHE > 10)
Total score		Total score	
Age if ≥ 70 years: add 1 to total score above			
Total score:			

COPD — chronic obstructive pulmonary disease; BMI — body mass index