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The use of the ERAS protocol in malnourished and properly nourished patients undergoing elective surgery: a questionnaire study

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Abstract

Background: Enhanced recovery after surgery (ERAS) is a modern approach to perioperative management. This study aimed to evaluate compliance with certain aspects of the ERAS protocol in malnourished and properly nourished patients undergoing elective surgery.

Methods: A questionnaire study was conducted among 197 patients undergoing elective surgery at the university hospital. We divided patients into two groups according to nutritional status.

Results: The study's results showed that 67 patients (34%) lost weight before admission (the weight-loss group). Twenty-five participants (37%) in the weight-loss group and 15 patients (12%) in the preserved-weight group underwent surgery due to cancer ($P < 0.001$). More patients in the weight loss group (45 of 67) than in the preserved-weight group (40 of 129, $P < 0.001$) limited their food intake a week before the surgery. The preserved-weight group participants were mobilized earlier than the weight-loss group ($P = 0.04$). The median number of hours since drinking their last fluids and eating their last meals before the surgery were 12.2 hours and 25.4 hours for both groups, respectively. Only eight patients received preoperative carbohydrate loading. We found higher serum protein concentrations in the preserved-weight group (7.10 [0.5] vs. 6.92 [0.71], $P = 0.023$); however, white blood cell count was higher in the weight-loss group (7.85 (2.28) vs.7.10 (0.50), $P = 0.04$). Both groups were highly satisfied with their hospital treatments.

Conclusions: Our study revealed relatively high malnutrition in patients undergoing elective surgery. As a standard of perioperative care in the studied centre, the ERAS protocol implementation level is low.

Key words: cancer, malnutrition, elective surgery, enhanced recovery after surgery (ERAS).

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The enhanced recovery after surgery (ERAS) protocol is a modern, multistage pathway of perioperative management aimed at improving quality of treatment [1, 2], accelerating the recovery process [3], and reducing the costs associated with the treatment itself [4, 5]. Many studies have shown that the ERAS protocol is a valuable tool in caring for surgical patients [6]. The protocol changes traditional surgical procedures and standardises them to create a clear pathway based on the available scientific evidence.

The critical problem in the introduction and development of the ERAS protocol in each hospital is compliance. Results presented in many studies have shown that improvements in compliance with the ERAS protocol reduced postoperative complications and improved patient outcomes [2, 3]. Moreover, a patient's nutritional status plays a vital role in potential complications following surgery [7].

This study aimed to evaluate compliance with certain aspects of the ERAS protocol in malnour-

ished and properly nourished patients undergoing elective surgery.

METHODS

The Medical University of Lublin Ethics Committee provided ethical approval for this study (number KE-0254/281/2018 on November 29, 2018). This was a prospective, observational study involving a group of adult patients following elective surgery. Patients answered the questions included in the questionnaire 1 to 4 days after undergoing their respective surgical procedures (a minimum of 24 hours following the procedure). For the study, we included adults (≥ 18 years), undergoing elective surgery in the gynaecological and surgical departments of our hospital, anesthetised with general and/or regional techniques. Patients who could not give informed consent, after procedures in local anaesthesia, and/or not involving anaesthesiologists, admitted to the intensive care unit were excluded. The patients spent at least two postoperative nights in the hospital. The data were collected by medical students after obtaining written consent from the participants. The medical students obtained consent from the patients on the day of the survey collection after informing them about the aims of our trial and ensuring the anonymity of their identities.

Survey

The questionnaire form consisted of 14 questions reflecting alterations in food and fluids intake in the perioperative period, complications, and satisfaction with perioperative treatment. The questionnaire form is presented in Appendix 1.

Outcomes

The primary outcome was the proportion of patients who lost weight in the last six months before the surgery (Question 1 in the survey). According to the patients' answers to this question, we divided participants into two groups: the weight-loss group and the preserved-weight group. The other outcomes included in the survey were limited food and fluids intake due to illness and surgery, medication compliance, specific preoperative preparations, and patient satisfaction concerning the perioperative period. Moreover, we also evaluated several of the patients' complications, such as postoperative bleeding, infections, deaths, re-surgery, and readmissions connected with the previous hospitalisation up to a year following the surgery.

Statistical analysis

We analysed continuous variables with the *t*-test or Mann-Whitney *U* test and categorical parameters with Fisher's exact test. We used means (standard deviations) for normally distributed variables, medians (interquartile ranges [IQR]) for non-normally distributed parameters, and numbers (percentages) to present categorical data. All measurements were performed using the Statistica 13.1 software (Stat Soft. Inc., Tulsa, OK, United States).

RESULTS

A hundred and ninety-seven patients after general, oncological and gynaecological surgery procedures took part in the study. Medical students collected questionnaire forms from January to March 2020. Participant demographics and laboratory results at hospital admission are presented in Table 1. More patients in the weight-loss group had cancer surgery than participants in the preserved-weight group (37% vs. 12%, $P < 0.001$). Furthermore, we found that serum protein concentration was higher in the preserved-weight group (7.19 [0.5] vs. 6.92 [0.71]; $P = 0.023$); however, white blood cell counts

TABLE 1. Patient demographics and laboratory results at admission

Factor	Overall ($N = 197$)	Weight-loss group ($n = 68$)	Preserved-weight group ($n = 129$)	*P*-value
Female (%)	140 (71)	42 (62)	98 (76)	0.047
Age (SD)	53.53	56.24 (14.4)	52.11 (13.7)	0.62
Weight in kg (SD)	78.31	80.25 (20.5)	77.29 (17.7)	0.16
Height in cm (SD)	166.40	167.47 (7.2)	165.84 (7.1)	0.83
Cancer (%)	40 (20)	25 (37)	15 (12)	<0.001
Laparoscopy (%)	62 (31)	20 (29)	42 (33)	0.87
WBC 10^3 μL^{-1} (SD)	7.35 (2.30)	7.85 (2.28)	7.10 (0.50)	0.04
Protein g dL^{-1} (SD)	7.11 (0.59)	6.92 (0.71)	7.19 (0.50)	0.023
Albumin g dL^{-1} (SD)	4.28 (0.64)	4.11 (0.75)	4.41 (0.51)	0.07
Haemoglobin g dL^{-1} (SD)	12.95 (1.63)	12.62 (1.8)	13.12 (1.5)	0.052

All data are presented as numbers (%) and means (SD).
SD – standard deviation, WBC – white blood cell count

were higher in the weight-loss group (7.85 [2.28] vs. 7.10 [0.50]; $P = 0.04$).

Outcomes

Patients in the weight-loss group lost a median (IQR) of 6 (4–10) kg in 6 months before the surgery (Question 3). We found a significant difference between the studied groups in terms of the limitation of their food intake during the week prior to the surgery due to illness (Question 3). Forty-five of 68 participants in the weight-loss group limited food intake; however, only 40 of 129 patients in the preserved-weight group confirmed food reduction a week before the surgery ($P < 0.001$). The preserved-weight group participants were mobilised earlier than the weight-loss group ($P = 0.04$, question 9). The results of the survey are presented in Table 2.

We noted 22 postoperative complications in our patients. There were 11 complications per group, $P = 0.15$. Seven patients in the weight-loss group underwent re-surgery, in contrast to 11 in the preserved-weight group, $P = 0.8$. Six patients in the weight-loss group required readmission in comparison to three participants in the other group, $P = 0.06$. Five patients eventually died; four belonged to the preserved-weight group while one belonged in the weight-loss group, $P = 0.66$.

DISCUSSION

In our cohort, 35% of patients had lost a relevant amount of weight due to illness before the surgery (Table 1). The prevalence of weight loss was slightly lower in our research than in other studies assessing the risk of malnutrition in a surgical population (40–44%) [8, 9]. Portuondo *et al*. found that 44% of patients were malnourished before elective surgery. Moreover, the study's authors also found an association between low albumin concentration and malnutrition. We did not observe a significant difference in albumin concentration ($P = 0.07$); however, we found a significant difference in protein concentrations between the two studied groups ($P = 0.023$) (Table 1).

TABLE 2. Survey results

	Overall	Weight-loss group	Preserved-weight group ($n = 129$)	*P*-value
3. In the last week, have you limited your food intake (quantitatively/qualitatively) due to illness? YES/NO	85/111	45/23	40/89	< 0.001
4. Do you regularly take all the medications prescribed by your doctor? YES/NO	187/10	65/3	122/7	1.0
5. On the day of the surgery or the day before the surgery, did you take any carbohydrate supplements (e.g., Nutricia PreOp)? YES/NO	8/190	3/65	5/125	1.0
6. Were you given an enema before the surgery? YES/NO	44/153	20/48	24/105	0.11
7. Did you experience nausea or vomiting after the surgery? YES/NO	62/135	26/42	36/93	0.15
8. When were oral fluids started for you? Within six hours after surgery [1]/The Same day as surgery [2]/The next day [3]/After the next day [4]	3 [2–3]	3[2–3]	3 [2–3]	0.26
9. When did you start getting up and walking after the surgery? Within six hours after the surgery [1]/The same day as surgery [2]/The next day [3]/Later than the next day [4]	2.84 [2–3]	2.99 [2–4]	2.76 [2.5–3]	0.04
10. Before the operation, how many hours had it been since you last had a meal?	25.4 [18–20]	27.8 [14–22.5]	24.1 [18–19]	0.72
11. Before the operation, how many hours had it been since you last drank fluids?	12.2 [9–13]	11.2 [8–12]	12.8 [10–13]	0.06
12. How would you assess the quality of information regarding the preoperative and postoperative procedures that you received from the doctor? Very poor [1]/Poor [2]/Moderate [3]/Good [4]/Very good [5]	5 [4–5]	5 [4–5]	5 [4–5]	0.59
13. What is your assessment of the kindness of the medical staff? Very poor [1]/Poor [2]/Moderate [3]/Good [4]/Very good [5]	5 [5–5]	5 [5–5]	5 [5–5]	0.47
14. How do you assess your level of satisfaction with your hospitalisation? Very poor [1]/Poor [2]/Moderate [3]/Good [4]/Very good [5]	5 [4–5]	5 [4–5]	5 [4–5]	0.49

Moreover, we also identified a higher WBC in the weight-loss group ($P = 0.04$), a finding that is consistent with studies showing a correlation between malnutrition and inflammation [10, 11]. Although albumins and proteins are no longer considered markers of malnutrition, they are often linked with body weight loss. Some new parameters are debated as potential laboratory tests in malnutrition screening [12]. Our previous study concerning the evolution of patients in a pre-anaesthetic clinic revealed a lower prevalence of weight loss among these individuals [13]. Only 20% of patients (93 of 467) experienced relevant weight loss in the pre-anaesthetic clinic. This difference between the two studies (35% vs. 20%) could be associated with the assessment of more surgical departments in the pre-anaesthetic clinic and not only general surgery and gynaecological wards, as in the current study. Patients with cancer experienced a higher risk of weight loss in our research (25 of 68 vs. 15 of 129 patients, $P < 0.001$) (Table 1). This result is consistent with a recent international study published in *The Lancet* [14]. In the abovementioned paper, 41.8% and 26.4% of patients in high- and upper-middle-income countries, respectively, were severely malnourished.

The study results reveal several differences between perioperative procedures in our hospital and the assumptions of the ERAS protocol. Eighty-five out of 197 (43%) patients in our study limited their food intake due to illness, with more doing so in the weight-loss group (66% vs. 31%, $P < 0.001$). Only eight patients in our study took carbohydrate supplements before the surgery. Although some authors have postulated that there are benefits associated with carbohydrate loading, a recent meta-analysis did not reveal any benefits relating to this intervention [15, 16]. Mechanical bowel preparation (enema) used to be a routinely performed procedure before many abdominal procedures. New evidence suggests that bowel preparation is not necessary [17]. In our study, an enema was conducted in 44 cases (22%) during the preoperative period.

According to the ERAS protocol, it is not recommended for patients to cease consumption of nutrition and fluids too early before the surgery [18]. Preoperative fasting guidelines of the American Society of Anesthesiologists (ASA) support the safety of allowing clear liquids up to 2 h and solid foods for up to 6 h (fatty foods for up to 8 h) [19] before elective procedures requiring general anaesthesia, regional anaesthesia or procedural sedation and analgesia. Moreover, in most cases, oral feeding should resume several hours following the procedure [20, 21]. In our study, the median time between cessation of fluids and the surgery was 12.2 hours, and the last meal was taken 25.4 hours before the procedure. We did not find a difference in these aspects between the studied groups. Most of our patients resumed fluid intake on the next day after the surgery (Question 9).

Early mobilisation is a crucial component of the ERAS pathway that shortens hospitalisation, helps preserve muscle function and reduces the risk of postoperative complications [22]. Early rehabilitation, which may include exercising in bed and sitting out of bed, should begin on the day of surgery. In our study, only approximately 25% of patients achieved early mobilisation.

Despite relatively low compliance with the ERAS protocol in our cohort, both groups were highly satisfied with the hospitalisation, the quality of information obtained in the perioperative period, and the kindness of the medical personnel (Table 2). Moreover, we did not identify differences in the long-term outcomes and postoperative complications between the two studied groups.

Our study showed low compliance with the ERAS protocol among surgical patients in our centre. The reasons for that fact included the habits of medical personnel and the lack of knowledge concerning new recommendations and guidelines. The potential improvement of this state can be achieved with better adherence to new recommendations and providing audits periodically in our centre.

Our study had several limitations. It was a single-centre study covering a relatively small cohort. The survey was conducted in two departments. The satisfaction of hospitalization was measured under relative pressure of investigators. Furthermore, only some aspects of the ERAS protocol were covered in our survey.

CONCLUSIONS

The results obtained in our study reveal a relatively high prevalence of malnourished patients undergoing elective surgery in our hospital. The ERAS protocol implementation level as a standard of perioperative care in the studied centre is low. Due to the possible benefits for the patient and the hospital, the current preoperative and postoperative procedures should be modified to better meet the ERAS assumptions.

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