Original Article

Perioperative nutritional care in patients undergoing cytorreduction

Cuidados nutricionais perioperatórios em pacientes submetidas à citorredução

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ABSTRACT

Introduction: In ovarian neoplasms, one of the therapeutic measures is cytoreduction, a major surgical procedure for the removal of tissue affected by the disease. Malnutrition is a common condition in the perioperative context, due to inflammatory and immunological alterations associated with the disease, which makes nutritional care even more crucial. Thus, the European ERAS protocol and the Brazilian ACERTO project implement multimodal approaches in various surgical sites aimed at maintaining patients' nutritional status. This study aimed to associate perioperative nutritional care in patients undergoing cytoreduction at an oncological hospital with clinical outcomes and nutritional status. **Methods:** Retrospective study, analyzing electronic medical records and collecting information on perioperative nutritional care and clinical outcomes, as well as data on nutritional status. **Results:** The study included 35 patients, with a mean age of 58 years. The most common BMI category was overweight/obesity (62.9%). Regarding nutritional interventions, 31.4% received immunonutrition in the preoperative period, 8.6% underwent fasting reduction, and 54.3% received diet within 24 hours post-surgery. **Conclusion:** Adherence to perioperative nutritional care was lower than expected. However, patients who underwent fasting reduction had a shorter hospital stay, and those who received diet earlier had a lower incidence of complications.

RESUMO

Introdução: Em neoplasias de ovário, uma das medidas terapêuticas é a realização de citorredução, um procedimento cirúrgico de grande porte para a remoção do tecido acometido com a doença. A desnutrição é uma condição comum no contexto perioperatório, em razão das alterações inflamatórias e imunológicas associadas à doença, o que torna o cuidado nutricional ainda mais crucial. Dessa forma, o protocolo europeu ERAS e o projeto brasileiro ACERTO aplicam condutas multimodais em diversos sítios cirúrgicos, visando manutenção do estado nutricional das pacientes. Assim, esse estudo buscou associar os cuidados nutricionais perioperatórios em pacientes submetidas à citorredução, em hospital oncológico, com os desfechos clínicos e o estado nutricional. **Método:** Este foi um estudo retrospectivo, com análise de prontuário eletrônico, coleta de informações sobre os cuidados nutricionais perioperatórios e desfechos clínicos e análise do estado nutricional. **Resultados:** O estudo foi composto por 35 pacientes, com idade média de 58 anos. O IMC mais frequente foi de sobrepeso/obesidade (62,9%). Em relação às condutas nutricionais, 31,4% realizaram imunonutrição no pré-operatório, 8,6% realizaram abreviação de jejum e 54,3% receberam dieta em até 24h. **Conclusão:** A adesão aos cuidados nutricionais perioperatórios foi inferior ao esperado. Porém, pacientes que realizaram abreviação de jejum tiveram um período de internação mais curto, enquanto as que receberam dieta mais precocemente apresentaram menor incidência de complicações.

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INTRODUCTION

Gynecological tumors affect the female reproductive organs, such as the cervix, uterus, ovaries, vagina, and vulva. When diagnosed at advanced stages, patient care becomes challenging due to the complexity of the disease, as well as the higher likelihood of a negative prognosis and lack of quality care[1,2].

Among gynecological tumors, ovarian cancer is the third most common, being more prevalent in postmenopausal women. In general, there are few modifiable risk factors for ovarian cancer, which complicates its prevention[3]. In 2020, the number of new cases surpassed 300,000 worldwide, and in Brazil, there were 40,000 cases between 2000 and 2017[4].

Primary cytoreductive surgery followed by chemotherapy with taxane and platinum is the main therapeutic approach for the treatment of advanced-stage ovarian cancer, and it has shown favorable prognoses. The indication for neoadjuvant treatment results in better control of tumor growth prior to surgery and may reduce the extent of the surgery[1].

The late diagnosis of the disease is strongly associated with a decrease in food intake, which, combined with the pathophysiological factors of cancer, can lead to malnutrition. Postoperative complications, negative prognoses, and reduced survival and quality of life for patients are conditions with increased risk due to malnutrition. Regarding gynecological cancers, nutritional risk is present in approximately 88% of patients[5,6].

Thus, the need for intensified care for malnourished patients or those at risk of malnutrition is evident, as the presence of chronic inflammation, the disease itself, and the treatments often make it difficult to meet nutritional goals, requiring enhanced nutritional support. This results in higher hospital demands and, consequently, generates higher costs for the services involved[7].

In the context of oncological surgeries, this information can be even more alarming, considering that these procedures are often extensive, generate a metabolic stress response, and require an adequate immune response due to the presence of uncontrolled inflammation, immune system suppression associated with tissue damage, and an increased risk of infections[8].

Thus, with the understanding of the negative impact of malnutrition in the context of surgery, the implementation of measures focused on the perioperative period aimed at improving the nutritional status of patients became necessary[9].

The implementation of certain nutritional management strategies, aimed at preserving or even recovering the nutritional status of patients undergoing surgery, should be prioritized. Offering nutritionally complete protein sources in adequate amounts, such as meats, fish, or eggs, prioritizing oral intake, supplementing nutrients if necessary, and conducting nutritional screening before and after the procedure are recommendations for effective nutritional care for patients, thereby minimizing negative outcomes[10].

The creation of the European ERAS (Enhanced Recovery After Surgery) protocol arose from the goal of providing better postoperative recovery through perioperative modulation, considering the metabolic and inflammatory responses that occur in the context of major surgeries[11]. In Brazil, the project named "Total Recovery Acceleration in the Post-Operative" (ACERTO) began in 2004, being based on the European protocol[12].

Both protocols share the main goal of promoting better outcomes for surgical patients, such as reduced rates of postoperative complications, shorter hospital stays, improved postoperative recovery, and reduced hospital costs[13].

Regarding nutrition, the ACERTO project and the ERAS protocol include practices such as prehabilitation, the use of nutritional therapy aimed at immune management, shortening preoperative fasting, and offering early feeding in the postoperative period. It should also be emphasized that the protocols are increasingly focused on the type of surgical procedure to be performed, individualizing interventions and improve clinical outcomes[11,14].

Shortening fasting involves offering 200 to 400 ml of clear, carbohydrate-rich liquids up to two hours before surgery, to reduce insulin resistance during the intraoperative period and, consequently, reduce postoperative complications, as well as promoting greater comfort for the patient[11].

Early refeeding, meaning the rapid introduction of diet post-surgery, provides benefits for patients such as reduced rates of infectious complications, faster recovery of intestinal function, and a shorter hospital stay[15].

Another nutritional measure implemented is the use of immunonutrition, which involves nutritional supplementation formulas enriched with nutrients like arginine, nucleotides, and omega-3, which help modulate the inflammatory response and the immune system in the postoperative period. Arginine and peptides are examples of nutrients that reduce the inflammatory response, while omega-3 maximizes the immune response[8].

The application of ERAS guidelines in gynecological surgeries has proven effective in reducing hospital readmissions, as demonstrated in a study conducted by Yoong et al.[16]. The study showed that the readmission rate due to postoperative complications was zero after the protocol was implemented for patients undergoing hysterectomy, a surgical procedure that may involve the removal of the uterus, fallopian tubes, and ovaries. Readmissions occurred only due to complications such as urinary retention or atrial fibrillation[16].

Although these measures are more established in the context of colorectal and abdominal surgeries, and considering they can have many benefits, exploring these measures into gynecological surgeries is highly relevant due to the extent of surgery patients undergo[17].

In the pursuit of better clinical outcomes for ovarian cancer patients, who undergo extensive surgeries, and considering the limited scientific production on this topic, it is crucial to deepen studies on perioperative nutritional care in this setting, evaluating surgical recovery, length of stay, return to daily activities, and quality of life.

Thus, this study aimed to associate perioperative nutritional care in patients undergoing cytoreduction in an oncology hospital with clinical outcomes, such as postoperative complications, length of stay, readmission within 30 days, and mortality after 30 days. Additionally, it sought to evaluate the nutritional status and correlate it with perioperative nutritional interventions and surgical outcomes.

METHODS

The study conducted is retrospective in nature, of a cross-sectional cohort type, which was carried out based on the recruitment through sampling of adult and elderly patients who underwent cytoreductive surgery after being diagnosed with ovarian cancer between April 2022 and June 2024. This study was approved by the Ethics and Research Committee under the number 3565/24.

Female patients over 19 years of age who were diagnosed with ovarian neoplasms and underwent cytoreductive surgery were included. In contrast, those who underwent emergency cytoreductive surgery, those without a computer tomography (CT) scan available in the electronic medical record, and those with CT scans performed more than 30 days before the surgery were excluded.

From this sample, patients included in the institutional protocol named Early Recovery, which begins with the referral from the medical team responsible for the surgical procedure to the outpatient care with the nutrition team, were enrolled.

The nutritional stages of the institutional protocol begin with preoperative outpatient nutritional care, which includes the assessment of nutritional status. Patients are advised to consume 400 to 600 ml per day of an oral nutritional supplement enriched with immunonutrients for a period of five to 14 days, depending on their nutritional status. Upon hospitalization for the surgical procedure, the preoperative fasting abbreviation involves the offering of a carbohydrate-rich oral nutritional supplement with added proteins, free of fats and fibers, containing 200 ml per unit. This is offered six and three hours before the surgical procedure to those patients authorized by the anesthesiology team during the pre-anesthesia assessment. After the surgical procedure, the release of diet for the patients is based on the extent of the surgery, with possible indications for a diet restricted in fermentable foods and/or laxatives. The time for the first meal release varies according to the surgical extent and occurs after evaluation by the responsible medical team. Depending on the patient's clinical condition, the diet may be released in the immediate postoperative period, or the patient may remain fasting until clinical stabilization.

Eligible patients for the study were contacted in person or by telephone for the signing of the Informed Consent Form (ICF), either in physical or digital format. Additionally, data was collected from the electronic medical records, including demographic and clinical information, anthropometric data, CT scan results, length of hospitalization, postoperative complications, readmission occurrences, and perioperative nutritional care, as well as information on the discharge instructions previously provided.

For the evaluation of nutritional status, data on weight and height were collected to calculate the body mass index (BMI). The cut-off points adopted followed the recommendations of the World Health Organization[18] and the Pan American Health Organization[19] for adults and elderly, respectively.

For the assessment of muscle mass, an analysis of the abdominal CT scan performed in the preoperative period was conducted, using the axial tomographic slice at the level of the lower portion of the body of the third lumbar vertebra (L3), with the Coreslicer® software. The muscle mass area was corrected for height, where muscle mass index (MMI) was calculated as muscle mass (cm^2)/height (m^2). For the classification of muscle mass depletion, an MMI value of <39 cm^2/m^2 was used for women.

For the descriptive analysis of continuous variables, central tendency measures (median, mean, and standard deviation) were considered. Absolute and relative frequencies were calculated for categorical variables. To compare quantitative variables, either Student's t-test or the Mann-Whitney test was used, depending on the normality distribution of the variables. To assess the existence of an association between body composition and other epidemiological, clinical, and anatomical-pathological variables, Fisher's exact test was used. A significance level of 5% was adopted.

RESULTS

The study included 35 women, with a mean age of 58 years. Of these, 20% were diagnosed with metastatic cancer. Regarding BMI, 62.9% were classified as overweight or obese. The sample characteristics are shown in Table 1.

Regarding the Early Recovery Protocol, 11 participants had it suspended, primarily due to prolonged fasting (20%) and the use of parenteral nutrition (8.6%). Concerning the

clinical outcomes assessed, 28.6% experienced postoperative complications, 14.3% were readmitted within 30 days after the procedure, and 2.9% progressed to death (Table 1).

Table 1 – Clinical and demographic characteristics of the study participants.

Variable	Category	N (%)
Age (years)	Min-Max	42-83
	Mean/ Median	58/58
Metastatic disease	Yes	7 (20)
	No	28 (80)
BMI	Eutrophy	13 (37.1)
	Overweight + obesity	22 (62.9)
Death	Yes	1 (2.9)
	No	34 (97.1)
Length of stay	Min-Max	2-31
	Mean/Median	8/7
Clinical complications	Shock	2 (5.7)
	Shock + metabolic ileus	1 (2.9)
	Hypotension	1 (2.9)
	Asymptomatic hypotension	1 (2.9)
	SIRS	3 (8.6)
	PE	1 (2.9)
	None	25 (71.4)
Hospital readminission	None	30 (85.7)
	Within 30 days	5 (14.3)

Min. = minimum; Max. = maximum; BMI = body mass index; SIRS = Systemic Inflammatory Response Syndrome; PE = pulmonary embolism.

When analyzing the perioperative nutritional care shown in Table 2, 31.4% of participants used immunomodulatory supplements, and regarding the quantity consumed, it ranged from one to 20 units within the recommended usage period. This variation occurred due to two different sets of guidelines used in practice, with supplementation offered for five to seven days or 10 to 14 days, depending on the patient's nutritional status.

Only 8.6% of participants were considered eligible for the abbreviated fasting protocol with the provision of an oral carbohydrate-based, clarified, and residue-free nutritional supplement. After surgery, 54.3% of participants received their first meal within 24 hours, while 17.1% received it after 48 hours (Table 2).

When statistically associating the relationship between perioperative care and postoperative complications, it was observed that among the patients who underwent abbreviated fasting, none presented complications. Regarding immunonutrition, 28% did not experience postoperative complications, but there was no statistically significant relationship ($p=0.542$ and $p=0.258$, respectively). The results can be seen in Table 3.

Additionally, when examining the time of diet initiation and the occurrence of postoperative complications, it was found that 89.5% of the patients who received diet initiation within 24 hours did not experience complications. In contrast, only 10.5% of the patients whose diet was initiated after 48 hours did not develop complications ($p=0.015$) (Table 3).

Table 2 – Characterization of perioperative nutritional care.

Variable	Category	N (%)
Use of immunonutrition in the preoperative period	5-7 days	9 (25.7)
	7-14 days	2 (5.7)
	No use	24 (68.6)
Abbreviated fasting protocol	No	32 (91.4)
	Yes	3 (8.6)
Postoperative diet initiation time	Within 24 hours	19 (54.3)
	Within 48 hours	6 (17.1)

Table 3 – Perioperative care and association with postoperative complications.

Variable	Category	Complication N (%)		P-value
		Absent	Present	
Use of immunonutrition in the preoperative period	Yes	7 (28)	5 (50)	0.258[a]
	No	18 (72)	5 (50)	
Abbreviated fasting protocol	Yes	3 (12)	0 (-)	0.542[a]
	No	22 (88)	10 (100)	
Postoperative diet initiation time	Within 24 hours	17 (89.5)	2 (33.3)	0.015[b]
	Within 48 hours	2 (10.5)	4 (66.7)	

[a] = Fisher's exact test; [b] = Pearson's chi-square test.

The average length of stay for patients who underwent shortened fasting was lower than that of those who did not, and this result showed a statistically significant relationship (p=0.025). However, the use of immunonutrition before surgery was associated with a longer hospitalization period when compared to the absence of this nutritional management, but with no statistically significant association (p=0.862). Furthermore, the average length of stay was shorter for patients who had an earlier diet release, and the result did not show a statistically significant relationship (p=0.059). The results can be seen in Table 4.

When statistically analyzing the relationship between shortened fasting and hospital readmission, as well as the implementation of this nutritional strategy and the occurrence of death, no significant associations were identified (p=1.00 and p=1.00, respectively). The use of immunonutrition in the preoperative period was not statistically associated with the outcomes of hospital readmission or death (p=1.00 and p=0.343, respectively), nor was the time of diet release (p=0.240 and p=1.00, respectively).

Among the participants in this study, only 11 had available abdominal CT scans for analysis. The IMM values ranged from 26.6 cm^2/m^2 to 61.5 cm^2/m^2, with an average value of 44.9 cm^2/m^2. Approximately 82% of the patients had adequate muscle mass values.

The presence of postoperative complications was absent in 40% of eutrophic participants and in 60% of those who were overweight or obese (p=0.709), according to the data described in Table 5.

Regarding BMI, the average length of stay for eutrophic participants was longer than for those with overweight or obesity; however, the result was not statistically significant (p=0.139) (Table 6).

Furthermore, the occurrence of readmission within 30 days after hospital discharge was observed in 60% of eutrophic women and 40% of participants with overweight or obesity (p=0.337).

Table 4 – Perioperative care and its association with length of stay.

Variable	Category	Length of Stay		P-value
		Min-Max	Mean /Median	
Use of immunonutrition in the preoperative period	Yes	2-23	9/8.5	0.862[a]
	No	3-31	7.5/7	
Abbreviated fasting protocol	Yes	3-5	3.6/3	0.025[b]
	No	2-31	8.5/7.5	
Postoperative diet initiation time	Within 24 hours	2-10	5.5/5	0.059[a]
	Within 48 hours	5-12	8/8	

Min. = minimum; Max. = maximum; [a] = Mann-Whitney U test; [b] = Kruskal-Wallis test.

Table 5 – Body mass index and its association with the presence of postoperative complications.

Variable	Category	Complication N (%)		P-value
		Absent	Present	
BMI	Eutrophy	10 (40)	3 (30)	0.709[a]
	Overweight + obesity	15 (60)	7 (70)	

BMI = body mass index; [a] = Pearson's chi-square test.

Table 6 – Body mass index and its association with length of stay.

Variable	Category	Lenght of stay		P-value
		Min-Max	Mean /Median	
BMI	Eutrophy	3-31	10.7/9	0.139[a]
	Overweight + obesity	2-12	6.7/6.5	

BMI = body mass index; [a] = Mann-Whitney U test.

DISCUSSION

The study was conducted with patients who underwent cytoreduction following a diagnosis of ovarian cancer and found that most of them had overweight or obesity and did not follow all stages of the perioperative care established in the Enhanced Recovery Protocol. However, among the patients who underwent shortened fasting, the length of stay was shorter, and those who received diet earlier had a lower incidence of postoperative complications.

The treatment of gynecological neoplasms is predominantly surgical, aiming for total or near-total removal of the tumor and adjacent tissues. In general, surgeries increase catabolic demands, insulin resistance, and may increase morbidity associated with the procedure. The intensity of the intervention is directly related to the size of the lesions, which can result in hormonal, immune, and metabolic changes. Additionally, these factors increase the risk of postoperative complications, prolonging the length of hospital stay[13,20, 21].

When analyzing nutritional status and the risk of surgical complications, it is understood that the presence of obesity is an important factor as it can affect morbidity and surgical outcomes. A retrospective cohort study conducted with patients undergoing gynecological surgeries found a higher prevalence of overweight and obesity, accounting for 80.7% of the sample. Furthermore, it was observed that obese women had more postoperative complications compared to eutrophic women. The present study found a similar prevalence, with 62.9% of the sample having a BMI of 25 kg/m^2 or higher. However, no association was found with the development of postoperative complications.

Regarding the nutritional assessment of the patients in the present study, approximately 80% of those who had CT scans available for analysis showed adequate values, a result higher than the study by Kuroki et al.[23], where 50% of the women studied had adequate muscle mass values through CT analysis in the preoperative period. This difference between percentages may be associated with senescence and muscle mass loss, as there was a difference in the average age of patients in both studies. Kuroki et al.[23] found an average age of 65 years, whereas the present study had an average age of 58 years.

Although the present study did not obtain similar results, Bernard et al.[24] implemented some strategies established by the ERAS protocol, such as shortened fasting time and early postoperative diet initiation. The number of patients with postoperative complications was lower in the intervention group, and they had a shorter hospital stay. Furthermore, regarding postoperative complications, Zhu and Xu[25] demonstrated a lower prevalence in patients who underwent shortened fasting along with carbohydrate-rich supplementation.

In relation to shortened fasting, the administration of carbohydrate-enriched drinks was carried out in the present study and in the prospective study conducted by Reis et al.[26] focused on colorectal surgeries. Like the present study, the authors observed shorter hospital stays, lower costs, and better postoperative outcomes due to the physiological benefits.

When analyzing the timing of diet initiation, a systematic review revealed that early reintroduction, i.e., the initiation of diet within 24 hours, is associated with a reduction in the time to the first bowel movement, shorter hospital stays, and a lower frequency of infectious complications. Thus, it was concluded that there is no evidence indicating negative outcomes associated with early feeding in the postoperative period, as seen in the present study, where a reduction in postoperative complications was demonstrated in patients who had an early diet initiation[27].

Although the results of this study are divergent, Lambaudie et al.[28] implemented some perioperative strategies for patients undergoing gynecological surgeries, including reducing fasting time and early diet introduction. These interventions resulted in a decrease in hospital stay and reduced surgical complications, bringing significant benefits to the participants in the postoperative period.

Regarding the use of immunonutrition in gynecological surgeries, although this study did not show positive results like the retrospective cohort study by Chapman et al.[29], the provision of three units of immunomodulatory supplements during the five days before and after gynecological surgery demonstrated benefits to the patients. The occurrence of complications during surgery and in the postoperative period was lower in the intervention group, as well as surgical site infections.

A cohort study analyzed the situation in hospitals before and after the implementation of nutritional measures based on the ERAS protocol. The results showed a reduction in hospital stay, readmission rates within 30 days, and hospital costs. When comparing surgical patients who did not undergo the implementation of some ERAS protocol measures with those who did, an American cohort demonstrated a decrease in postoperative complications, but there was no significant difference in hospital stay between the intervention group[30,31].

Studies on the implementation of the ERAS protocol show significant benefits for both patients and healthcare services. However, there is still considerable resistance to its adoption. To overcome this challenge, it is essential to promote a multidisciplinary and integrated care approach, focusing on improving patient adherence to perioperative nutritional guidelines. This collaborative approach can optimize outcomes and provide a more efficient and safe recovery[11].

The presented study has limitations due to its retrospective nature, with data collection based on medical records. Additionally, the study faced challenges in contacting the participants and applying the ICF, resulting in a limited number of participants.

CONCLUSION

The present study concludes that the application of perioperative nutritional interventions may be beneficial for patients undergoing cytoreduction, particularly in reducing postoperative complications and length of stay. Although no impact was observed in hospital readmission and mortality rates in this study, it is important to emphasize the need to investigate other Brazilian cohorts with a larger number of participants.

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