Protein-calorie adequacy of enteral nutrition therapy in surgical patients

Marília Freire Isidro[1], Denise Sandrelly Cavalcanti de Lima[2]

[1] MSc Student in Nutrition, Universidade Federal de Pernambuco (UFPE); Postgraduate in Clinical Nutrition, Nutrition Internship Program, Hospital das Clínicas, UFPE, Recife, PE, Brazil
[2] Nutricionist, General Surgery Clinic, Hospital das Clínicas, UFPE; PhD Sutdent in Nutrition, UFPE; MSc in Nutrition, UFPE; Postgraduate in Clinical Nutrition, Hospital das Clínicas, UFPE, Recife, PE, Brazil

Summary

Objective: To evaluate the protein-calorie adequacy of enteral nutrition therapy (ENT) in surgical patients. **Methods:** A prospective study was performed in surgical patients who received ENT from March to October 2011. Patients were evaluated anthropometrically and by subjective global assessment (SGA). The amount of calories and protein prescribed and administered were recorded daily, as well as the causes of discontinuation of the diet. A 90% value was used as the adequacy reference. The difference between the prescribed and administered amount was verified by Student's *t*-test. **Results:** A sample of 32 patients, aged 55.8 ± 14.9 years, showed a malnutrition rate of 40.6% to 71.9%, depending on the assessment tool used. Gastric cancer and gastrectomy were the most common diagnosis and surgery, respectively. Of the patients, 50% were able to meet their caloric and protein needs. The adequacy of the received diet in relation to the prescribed one was 88.9 ± 12.1% and 87.9 ± 12.2% for calories and proteins, respectively, with a significant difference ($p < 0.0001$) of 105.9 kcal/day and 5.5 g protein/day. 59.4% of the patients had adequate caloric intake and 56.2% had adequate protein intake. Causes of diet suspension occurred in 81.3%, with fasting for procedures (84.6%) and nausea/vomiting (38.5%) being the most frequently observed causes in pre- and postoperative periods, respectively. **Conclusion:** Inadequate caloric and protein intake was common, which can be attributed to complications and diet suspensions during ENT, which may have hampered the sample reached their nutritional needs. This may contribute to the decline in the nutritional status of surgical patients, who often have impaired nutrition, as observed in this study.

Keywords: Enteral nutritional therapy; surgical patients; enteral nutrition; adequacy; malnutrition.

Study conducted by the Nutrition and Dietetic Unit, Hospital das Clínicas, General Surgery Clinic, Universidade Federal de Pernambuco, Recife, PE, Brazil

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Correspondence to:
Marília Freire Isidro
Rua Mamanguape, 303/602
Boa Viagem – Recife, PE, Brazil
CEP: 51020-250
isidro.marilia@gmail.com

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Introduction

Malnutrition is a statistically substantial problem in surgical patients, affecting 22% to 58% of cases[1-3], and is related to higher hospital costs; longer hospitalization periods, which predisposes to a range of complications; and higher incidence of infections and mortality[4,5].

The nutritional status directly affects the perioperative evolution of patients, which may significantly affect the surgical outcome[6]. Nutritional care should be initiated in the preoperative period, in order to prevent malnutrition or minimize its effects[7]. The response to surgical trauma can trigger the onset or worsening of malnutrition, with a consequent decrease in the quality of immune response, inefficient wound healing, and the appearance of infections[8].

Enteral nutritional therapy (ENT) is the most commonly used strategy to prevent or treat malnutrition due to inadequate oral intake and/or increased caloric and protein needs[9]. It has been used in patients with partial or total incapacity to maintain the oral feeding route, and should be used whenever the gastrointestinal tract (GIT) is functioning[10].

During ENT, conditions that interfere with the planned nutritional support may occur, causing temporary and/or permanent suspension[11,12], which may contribute to a decline in nutritional status[13]. These conditions include fasting for procedures and examinations, and diet intolerance, such as vomiting, diarrhea, and abdominal distension[14-16]. In recent years, studies have verified the protein-calorie adequacy of ENT; however, almost all of the evidence on this subject is limited to critically ill patients[17-19], whereas few[9,13,20,21] have investigated other clinical situations, which included surgery.

ENT may be a factor in health promotion, in physiological stress reduction, and in immunity maintenance[16]. Therefore, as important as prescribing an adequate diet for the patient is to ascertain that the patient will actually receive what has been prescribed[22]. In this context, the objective of this study was to evaluate the protein-calorie adequacy of ENT administered to surgical patients, comparing what was effectively administered with what was prescribed, and to identify the different causes of interruption and/or suspension of the diet pre- and postoperatively.

Methods

This was a prospective case series study of longitudinal design, conducted from March to October 2011 at the Hospital das Clinicas of the Universidade Federal de Pernambuco (HC/UFPE). Patients of both genders, aged 20 years and older, who received ENT alone or associated with other feeding routes (oral or parenteral) of non-significant protein-calorie supply for at least 72 hours in the pre- or postoperative periods were included in the study. Pregnant women, critically ill patients, and patients with abnormalities that prevented anthropometric measurements were excluded.

All data were recorded in a form that contained information on demographic data, diagnosis, surgery, ENT indications, location of tube, start and end of the ENT, formula used, anthropometric measurements, body mass index (BMI), percentage of weight loss (%WL), classification by subjective global assessment (SGA), nutritional needs, calories and proteins of the prescribed and received ENT, in addition to the causes of diet discontinuation.

In the first 72 hours of hospital admission, anthropometric measurements were taken by a single trained examiner. Data on weight, height, average weight, %WL in the last six months, arm circumference (AC), triceps skinfold (TSF), and arm muscle circumference (AMC) were collected.

Nutritional status according to the BMI was evaluated according to the recommendations of the World Health Organization (WHO)[23] for adults (< 60 years) and of Lipschitz[24] for the elderly. For the nutritional assessment according to AC, AMC, and TSF the classifications of Blackburn and Thornton were used[25]. The WL% in the last six months was classified according to Blackburn et al.[26].

Within the first 72 hours of ENT start, the SGA was applied by the researcher, using the model proposed by Detsky et al.[27]. and later, patients were divided into malnourished (SGA-B and SGA-C) and not malnourished (SGA-A).

The prescribed volume, protein, and calories were recorded from the dietary prescription made by the Department of Nutrition, and the data on what was effectively administered and the factors that caused the suspension of diet in the pre- and postoperative periods were obtained from medical records or through the staff, caregivers, patients, or by observation of the researcher. All these data were collected from the first day of ENT introduction to the time of its withdrawal, patient's death, or discharge.

The caloric (kcal) and protein (g of protein) values prescribed and administered were recorded daily for each patient. The adequacy of supply was calculated by the ratio between the mean values prescribed and administered. In this study, the adopted reference value to be reached was 90% of the adequacy, where a discrepancy of more than 10% can be considered clinically important[9,14].

All patients received open-system gravity ENT or pump infusion ENT, intermittently. The enteral diets that were offered were specific and polymeric formulas. The choice of formula was based on the value closest to the daily needs or according to specific needs of the patient.

Patients who met their needs were considered as those who at some point during ENT use received at least

30 Kcal/kg body weight/day and 1.2 g protein/kg body weight/day, which are the minimum recommendations proposed by the project "Accelerating Total Postoperative Recovery (Acelerando a Recuperação Total Pós-Operatória - ACERTO)" for surgical patients, both pre- and postoperatively[28].

At the dietary evaluation of patients who received ENT both pre- and postoperatively (n = 8), only the data from the preoperative period were considered, in order to avoid large variations due to postoperative diet reintroduction.

Data collection started after approval by the Ethics Research Committee of Centro de Ciências da Saúde da UFPE, Resolution #196/96, protocol number 398032 and after the consent form had been signed by the patient or guardian.

The data obtained were tabulated in Excel and processed using Epi Info 6.04. The descriptive and inferential analysis was performed with SPSS statistical software release 18.0. All continuous variables were tested for normality using the Shapiro-Wilks and Levene's tests. Student's *t*-test for paired data was used to verify the difference between energy and protein prescribed and administered. To test the association between the variables, the chi-squared test was used, and for the description of proportions, a 95% confidence interval was established. All differences were considered statistically significant when $p < 0.05$.

Results

The participants consisted of 32 surgical patients, mean age 55.8 ± 14.9 years (26-79 years), of which 18 were elderly (56.2%, 95% CI = 37.66-73.64) and 20 (62.5%, 95% CI = 43.69-78.9) were males. The period of ENT use was 6.9 ± 4.9 days (3-24 days), where 14 (43.8%, 95% CI = 26.36-62.34) used the therapy preoperatively and 18 (56.2%, 95% CI = 37.66-73.64) postoperatively.

Neoplasms were observed in 20 (62.5%, 95% CI = 43.69-78.9) patients, most often gastric (n = 13, 40.6%, 95% CI = 23.70-59.36), followed by periampullary (n = 5, 15.6%, 95% CI= 5.28 - 32.79). The other diagnoses were megaesophagus (n = 4, 12.5%, 95% CI= 3.51-28.99), pyloric syndrome and aneurysm with two cases each (6.3%, 95% CI = 0.77-20.81), and others, such as fistula, cholelithiasis, rectal cancer, and retroperitoneal neoplasia with one case each (3.1%, 95% CI= 0.08-16.22).

The most frequent surgeries were gastrectomies (n = 12, 37.5%, 95% CI = 21.10-56.31), followed by exploratory laparotomy (n = 4, 12.5%, 95% CI = 3.51-28.99), gastrojejunal anastomosis (n = 4, 12.5%, 95% CI = 3.51-28.99), Heller's cardiomyotomy (n = 3, 9.4%, 95% CI = 1.98–25.02), and esophagectomy (n = 3, 6.3%, 95% CI = 0.77-20.81). Other surgeries, with only one case each (3.1%, 95% CI = 0.08-16.22) were: vascular surgery, gastroduodenopancreatectomy, fistulectomy, cholecystectomy, and enterectomy.

Regarding the nutritional status, 13 patients (40.6%, 95% CI = 23.70-59.36) were malnourished according to BMI, 23 according to AC (71.9%, 95% CI = 53.25-86.25), 22 according to AMC (68.8%, 95% CI = 49.99-83.88), and 17 according to TSF (53.1%, 95% CI = 34.74-70.91). The weight loss of the sample in the last six months was 16.9 ± 7.5%, where the majority showed severe loss (n = 25, 78.1%, 95% CI = 60.72-90.72 *vs*. n = 7, 21.9%, 95% CI = 9.28-39.97). Regarding the SGA classification, 20 patients (62.5%, 95% CI = 43.69-78.9) were malnourished.

Table 1 shows the characteristics of the ENT used according to its indication, the period during which it was used, tube location, the formula used, and the use of other associated nutritional routes.

The mean time for caloric and protein needs to be met was 4.5 ± 1.4 days. Of the total sample, 16 patients (50%) met their caloric and protein needs, of which 11 received the ENT preoperatively and five postoperatively. These data refer only to the amount supplied by tube feeding, although some patients received oral or parenteral nutrition concomitantly.

Table 2 shows the mean calorie and protein amount prescribed and effectively administered, and the percentage of adequacy. The difference between what was prescribed and administered was significant, with a deficit of 105.9 kcal/day and 5.5 g protein/day ($p < 0.0001$). Of the total, 19 (59.4%, 95% CI = 40.64 - 76.30) were adequate (≥ 90%) with regard to the calories, and 18 (56.2%, 95% CI = 37.66 - 73.64) with regard to proteins. Comparing the patients pre- and postoperatively, there was no statistical difference between the caloric ($p = 0.610$) and protein ($p = 0.257$) adjustments.

Of the patients analyzed, 26 (81.3%, 95% CI = 60.72 - 90.72) had some complication that led to ENT suspension. Of these, 13 patients (50%) received the diet in the preoperative period, during which only one (7.1%) did not have any factors that interfered with the planned diet. Postoperatively, only five patients (27.8%) did not have any problems, showing no statistical difference ($p = 0.153$) regarding the occurrence of causes for diet suspension when comparing the period during which ENT was used. The main causes of diet discontinuation observed in this study, pre-and postoperatively, are shown in Table 3.

Discussion

ENT is strongly recommended for surgical patients, both due to its positive role in the preoperative period and the nutritional support it provides when it is not possible to maintain oral intake or when intake is insufficient in the perioperative period[29].

Table 1 – Characteristics of enteral nutritional therapy prescribed to surgical patients hospitalized in the HC/UFPE from March to October 2011

Variable	n	%	95% CI*
Indication			
Low oral ingestion	10	31.2	16.12-50.01
Impossibility to use oral route	22	68.8	49.99-83.88
Period			
Preoperative	14	43.8	26.36-62.34
Postoperative	18	56.2	37.66-73.64
Tube position			
Gastric	12	37.5	21.10-56.31
Post-pyloric	20	62.5	43.69-78.9
Formula used			
Immunomodulator	13	40.6	23.70-59.36
Hypercaloric and hyperproteic	11	34.4	18.57-53.19
Normocaloric and hyperproteic	3	9.4	1.98-25.02
Semi-elementary	2	6.3	0.77-20.81
Kidney disease on conservative treatment	2	6.3	0.77-20.81
Kidney disease on hemodialysis	1	3.1	0.08-16.22
Associated nutritional route			
Oral	10	31.3	16.12-50.01
Parenteral	2	6.2	0.77-20.81
Exclusive tube	20	62.5	43.69-78.9

*95% confidence interval

Table 2 – Mean (± SD) of the amount of energy and protein prescribed and administered, and the adequacy of enteral nutrition therapy used in surgical patients of HC/UFPE from March to October 2011

	Prescribed Mean ± SD	Administered Mean ± SD	Adequacy (%) Mean ± SD
Kcal/day	1119.57 ± 372.63*	1013.67 ± 402.41*	88.9 ± 12.11
Protein (g/day)	52.35 ± 17.06*	46.82 ± 18.52*	87.9 ± 12.18

*Student's t-test t: $p < 0.0001$; SD, standard deviation

Table 3 – Distribution of patients according to the causes that led to diet discontinuation in the pre- and postoperative periods in surgical patients from HC/UFPE from March to October 2011

Variable	Period			
	Pre		Post	
	n (%)	95% CI*	n (%)	95% CI*
Fasting before procedures	11 (84.6)	54.55-98.08	2 (15.4)	1.92-45.45
Abdominal pain and distension	4 (30.8)	9.09-61.43	3 (23.0)	5.04-53.81
Tube displacement	3 (23.0)	5.04-53.81	4 (30.8)	9.09-61.43
Nausea/vomiting	1 (7.69)	0.19-36.03	5 (38.5)	13.86-68.42
Diarrhea	1 (7.69)	0.19-36.03	1 (7.69)	0.19-36.03
Patient's refusal	1 (7.69)	0.19-36.03	1 (7.69)	0.19-36.03
Gastric return	–	–	2 (15.4)	1.92-45.45

*95% confidence interval

Considering the increased risk for the development of disease and malnutrition for the elderly, research involving patients receiving ENT have found similar mean age of 54.7 to 67.2 years[17,30,31].

Regarding gender and most frequent diagnosis, the higher percentage of males and neoplasias corroborate the study by Cook et al., which associated male gender to a higher propensity to cancer, probably due to their greater exposure to risk factors[32].

In Brazil, there is a prevalence of cancer with worse survival in men, notably the liver, esophagus, and stomach neoplasias[33]. In the present study, gastric cancer was the most frequent, showing the association between gender and the diagnosis. Total or subtotal gastrectomies were the most frequently performed surgeries, as the main curative and/or palliative treatment for gastric cancer.

This study showed a high rate of malnutrition, ranging from 40.6 to 71.9% depending on the evaluation tool used. The Brazilian Survey of Hospital Nutritional Assessment (Inquérito Brasileiro de Avaliação Nutricional Hospitalar – IBRANUTRI) diagnosed a malnutrition rate of 39% in surgical patients according to the SGA[5]. Bragagnolo et al., in turn, demonstrated a rate of 88.5% using the same tool in patients undergoing major GIT surgery[34]. The high prevalence of malnutrition in the study group is expected, considering that it is one of the criteria for ENT indication[7].

Besides surgical patients, those receiving ENT often have impaired nutritional status, with rates of 34.3% to 55.9%[21,35], confirming the high rates found in this study.

The severe weight loss observed is similar to the findings of Stratton et al., who observed a rate of approximately 70% in hospitalized patients[36]. As for the BMI, Dias and Burgos[37] observed a malnutrition rate of38% in surgical patients, and Dock-Nascimento et al.[1], 41%. The latter study indicates that BMI may underestimate malnutrition in this population, thus it is a poor sensitivity method.

The percentage of malnourished patients was higher when evaluated by AC, followed by AMC and TSF, indicating a greater depletion of lean mass in relation to fat mass, common in protein-energy malnutrition.

Among ENT indications, incapacity to use the oral route showed similar results to those of Van den Broek et al. who found 80%, of which 36% were surgical cases[9]. Regarding the time of ENT, the study by Luft et al., which included surgical patients, showed similar results, with a median of six days[20].

Placing the tube in a post-pylorus position was most frequently used in the study patients, as these are gastrointestinal surgery patients, where ENT indication was more common postoperatively. In intensive care unit (ICU) and ward patients, Martins et al. have shown another situation, in which the gastric position of the tube was used in 83% of patients[13].

The immunomodulatory formula was the most often used by patients in this study. Some authors have demonstrated the positive impact of this formula, decreasing morbidity and hospital length of stay postoperatively, being used as the protocol in the perioperative period, with the exception of contraindications or intolerance[38,39].

Of the patients studied, 50% had met their caloric and protein needs, while O'leary-Kelley et al.[14] and Campanella et al.[25] observed only 32% and 31% of the protein-calorie targets were met in ICU patients, respectively. Differences between the prescribed and administered volume have been demonstrated[17,25,30], which contributes to the fact that many patients do not reach their nutritional needs during ENT use[40].

Oliveira et al. analyzed 18 ICU patients receiving ENT exclusively, and found a mean energy deficit of 190 kcal/day, and an 88.2% energy adequacy[18]. Van den Broek et al. have found, in patients from several wards receiving ENT exclusively, a deficit of about 260 kcal/day and an adequacy of 87%[9]. These results corroborate the present study, where a decrease of more than 10% of the energy requirement a day for several days can have a detrimental effect on the nutritional status of patients, who often depend exclusively on ENT.

Similar data in this line of research are more frequent in ICU studies such as that by Reid[15], who observed 81% energy adequacy, and by Oliveira et al.[12] who found 89.7% protein adequacy.

Regarding the reasons that led to ENT suspension, fasting for procedures was the most frequent cause, corroborating the report by Assis et al., where fasting was responsible for 41.6% of interruptions of enteral feeding in ICU patients[40].

Other causes for this difference between the prescribed and administered diet have been described, such as digestive intolerances, among them diarrhea, vomiting and abdominal distension[17]. These causes were also observed in this study, both pre- and postoperatively, although Montejo et al. have reported that interruptions due to digestive intolerances are more common in critically-ill patients[31].

Martins et al., analyzing ICU patients from the different wards, including surgical, reported frequent ENT interruption due to lack of awareness of the importance of ENT by health professionals or due to lack of communication within the team[13]. In the present study, the main reasons for the discrepancy between the prescribed and administered ENT were also operational, such as fasting for a procedure, tube dislocation, whether accidental or not, and delay in reinsertion, or simply because the patient refused to receive the diet. This information was very often not observed in the medical and nursing reports, or there were discrepancies between the reports and information from professionals and patients.

The comparison of data obtained from studies in this field is also complex, due to differences in study design, types of observation, and follow-up periods[17,41,42].

The protein-calorie inadequacy of ENT observed in surgical patients demonstrates the need to establish measures to reduce the causes of diet discontinuation. The abbreviation of fasting in the perioperative period, as well as the monitoring of gastrointestinal complications during diet administration are measures that can reduce complications during ENT use. Therefore, raising awareness of health professionals on the importance of this therapy in the treatment and recovery of surgical patients is crucial.

Conclusion

There was a high prevalence of malnutrition in the studied surgical patients, where the ENT, in many cases, was the only source of food and nutrition. The presence of complications occurred during administration in most patients, with fasting for procedures and examinations, abdominal pain and distension, and tube dislocation, either accidental or not, being the main reasons for diet discontinuation. These causes were responsible for inadequate protein-calorie supply from ENT, which may have impaired the meeting of nutritional needs for half of the study sample.

The use of clinical surveillance mechanisms, with a multidisciplinary team approach, establishing protocols, and continuing education of health professionals can be important measures to ensure the proper administration of ENT and provide the greatest benefit to patients.

Ethical aspects

The research was approved by the Ethics Committee in Research of Centro de Ciências da Saúde of UFPE on March 02, 2011.

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