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Status and nutritional therapy in elective and emergency neurosurgery patients

Estado e terapia nutricional em pacientes de neurocirurgia eletiva e urgência

Estado y terapia nutricional en pacientes de neurocirugía electiva y urgencia

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ABSTRACT

Objevect: To evaluate the Nutritional Status (NS) and follow the Enteral Nutritional Therapy (ENT) of patients in neurosurgical intervention. **Method:** Cohort study in emergency or elective surgery patients with exclusive ENT. Anthropometric measurements (Arm Circumference (AC and Triceps Skinfold (TSF)) were measured on the first, seventh and 14th day. For the ENT monitoring, caloric/protein adequacy, fasting, inadvertent output of the enteral probe and residual gastric volume were used. **Results:** 80 patients, 78.7% in emergency surgery and 21.3% in elective surgery. There was a reduction in AC and Body Mass Index (BMI) (p>0.01), especially for the emergency group. The caloric/protein adequacy was higher in the emergency group (86.7% and 81.8%). **Conclusion:** The EN change was greater in the emergency group, even with better ENT adequacy. Changes in body composition are frequent in neurosurgical patients, regardless of the type of procedure.

Descriptors: Enteral Nutrition; Neurosurgery; Nutritional Evaluation; Malnutrition; Status.

RESUMO

Objetivo: Avaliar o Estado Nutricional (EN) e acompanhar a Terapia Nutricional Enteral (TNE) de pacientes em intervenção neurocirúrgica. **Método:** Estudo tipo coorte em pacientes de cirurgia de urgência ou eletiva, com TNE exclusiva. Foram aferidas medidas antropométricas (Circunferência do Braço (CB) e Dobra Cutânea Tricipital (DCT)) no primeiro, sétimo e 14º dia. Para o monitoramento da TNE, utilizou-se: adequação calórico/proteica, jejum, saída inadvertida da sonda enteral e volume residual gástrico. **Resultados:** 80 pacientes, 78,7% em cirurgia de urgência e 21,3% em eletiva. Houve redução da CB e do Índice de Massa Corporal (IMC) (p>0,01), em especial para o grupo de urgência. A adequação calórica/proteica foi superior no grupo de urgência (86,7% e 81,8%). **Conclusão:** A alteração do EN foi maior no grupo de urgência mesmo com melhor adequação da TNE. A alteração da composição corporal é frequente em pacientes neurocirúrgicos, independentemente do tipo de procedimento.

Descritores: Nutrição Enteral; Neurocirurgia; Avaliação Nutricional; Desnutrição; Estado.

RESUMEN

Objetivo: Evaluar el Estado Nutricional (EN) y acompañar la Terapia Nutricional Enteral (TNE) de pacientes en intervención neuroquirúrgica. **Método:** Estudio tipo cohorte en pacientes de cirugía de urgencia o electiva, con TNE exclusiva. Se midieron medidas antropométricas (Circunferencia del Brazo (CB) y Pliegue Cutáneo Tricipital (PCT)) en el primer, séptimo y decimocuarto días. Para el monitoreo de la TNE: adecuación calórica/proteica, desayuno, salida inadvertida de la sonda enteral y volumen residual gástrico. **Resultados:** 80 pacientes, 78,7% en cirugía de urgencia y 21,3% en electiva. Hubo reducción de la CB y del Índice Masa Corporal (IMC) (p> 0,01), en especial para el grupo de urgencia. La adecuación calórica/proteica fue superior en el grupo de urgencia (86,7% y 81,8%). **Conclusión:** La alteración del EN fue más alta en el grupo de urgencia mismo con mejor adecuación de la TNE. La alteración de la composición corporal es frecuente en pacientes neuroquirúrgicos independientemente del tipo de procedimiento.

Descriptores: Nutrición Enteral; Neurocirugía; Evaluación Nutricional; Desnutrición; Estado.

INTRODUCTION

Early Enteral Nutritional Therapy (ENT) is essential for the treatment of neurological diseases and is associated with length of hospital stay[1]. According to guidelines for surgical patients, the recommendation is to achieve the energy needs until the seventh day to reduce mortality. In order to achieve the goal, it is recommended to initiate ENT between 24 and 48 hours post-injury for those with hemodynamic stability and Gastrointestinal Tract (GIT) functioning[1-3].

After Traumatic Brain Injury (TBI), more than half of the patients present intolerance to ENT. There is a relationship between the intracranial pressure levels and the Glasgow Coma Scale (GCS) with the time of tolerance of ENT at stipulated concentration and volume[1]. From the relationships established between the brain and the gastrointestinal system, intracranial pressure and gastric contractility are described. With increased intracranial pressure, there is a reduction of up to 80% in gastric contractility[1,4]. It is not uncommon for patients to present with gastrointestinal dysmotility, with the occurrence of diarrhea, constipation, nausea, vomiting and abdominal bloating[5]. ENT monitoring is of utmost importance for the effectiveness of treatment. Changing the Nutritional Status may be aggravated when ENT is not effective to meet nutritional needs. Severe patients undergo procedures that require fasting and interruption of ENT, situations that make it difficult to reach the programmed goals[6]. There is a shortage of information on the adequacy of calories and proteins, on the reasons for the cessation or delay of ENT in ICU patients and its relationship with changes in body composition[6].

The pathophysiological mechanism of body alteration is multifactorial. The intensity of the metabolic changes in the acute phase depends on the severity of the brain injury, a situation aggravated by the coexistence of injuries from other systems[7]. The anthropometric evaluation aims to identify changes in body composition and measure the effects of nutritional therapy on the Nutritional Status of surgical patients[8].

OBJECTIVE

This study aims to follow up ENT and evaluate the Nutritional Status of patients submitted to elective or emergency neurosurgery.

METHOD

Ethical aspects

The study was submitted and approved by the Ethics and Research Committee of the *Universidade Federal de São Paulo* (UNIFESP). Patients' representatives signed the Informed Consent Form (ICF) at the beginning of this study, accepting that patients were included.

Design, place of study and period

A quantitative, cohort and prospective study in a General and Neurological Intensive Care Unit (ICU) of a tertiary level hospital in São Paulo State (SP), in the city of São Paulo, during the years 2014 to 2016.

Sample and criteria of exclusion and inclusion

The sample size was determined considering the number of neurological surgeries performed in the year 2013, having as characteristics non-probabilistic and convenience. Inclusion criteria were patients older than 18 years, submitted to elective or emergency neurosurgery, with indication of exclusive ENT. The patients who received ENT prior to the surgical procedure and indication of oral diet were excluded.

Study protocol

The evaluated patients were divided according to the surgical classification in elective or emergency. For all patients, data were collected: age, gender, comorbidities, medical diagnosis, type of surgery (elective/emergency), Sequential Organ Failure Assessment (SOFA), Glasgow Coma Scale (GCS), anthropometric measurements, surgical procedure time and total volume of infused liquid[9]. Weight and height were considered for the classification of the Body Mass Index (BMI) according to age and anthropometric measures of Arm Circumference (AC) and Triceps Skinfold (TSF)[10].

The follow-up time was 14 days, with anthropometric measurements on the first, seventh and 14th days. The data collection was performed by the nutritionist, in the first 24 hours of the introduction of ENT with daily monitoring. For the estimation of nutritional needs, the values of 25 to 30 calories/kg/day and 1.2 to 2.0 g protein/kg/day, also known as "Pocket Formula" and referenced in the literature[7]. For the monitoring of ENT, the adequacy of the caloric and protein supply, fasting, inadvertent exit of the enteral catheter and gastric residue were considered. The data collection was interrupted when the patient started oral diet, at the hospital discharge or death.

All patients received ENT by means of a catheter located in the gastric position. After radiological confirmation, the initiation of the diet's infusion in the open system was released, following validated procedures of production of enteral diets, according to current legislation[11]. The enteral formulas offered were polymeric and/or oligomeric, with fractionation of 3/3 hours, with or without night break. The nutritionist was responsible for the evolution of the diets of the patients of this study. It started with normocaloric and normoproteic formula without addition of fibers, evolving to hypercaloric and hyperproteic formula with addition of fibers. In view of the frequency of the sedatives used based on lipid emulsion, nonprotein calories were also considered for the calculation of total calories. For the cases in which it was not possible to reach the protein target only with the prescribed enteral formula, the additional protein module was used.

Analysis of results and statistics

The data were annotated in a collection tool through the EPIINFO v.3.5.1 program[12] and analyzed using Microsoft Excel software. The categorical variables were described in absolute value and relative frequency, while the continuous variables and submitted to the Kolmogorov-Smirnov Normality Test were described through measures of central tendency and dispersion. Initially, possible differences between basal and surgical characteristics were verified according

to the two study groups. Pearson's Chi-square test or Fisher's exact test was used to analyze categorical variables and Student's T-Test or Mann-Whitney U Test for continuous variables. To verify the evolution of the anthropometric indicators, the non-parametric Friedman test was used stratified according to the type of surgery performed. For the comparison of ENT characteristics between groups, Student's T-Test or Mann-Whitney U Test were performed. Results were considered as statistically significant with probability of type I error lower than 5%.

RESULTS

The initial casuistry was 83 patients, three patients were excluded due to lack of data. The sample consisted of 80 patients, 17 (21.3%) of elective surgery and 63 (78.7%) of the emergency surgery group. There was a predominance of males in both groups, with mean age of 55.4 years for the elective surgery group and 53.3 years for the emergency group. In general, the group submitted to emergency procedures had a higher frequency of comorbidities. No significant differences were observed in BMI, SOFA and baseline GCS between the groups. There was a greater frequency of cases of TBI and Stroke among patients submitted to emergency surgery, and in elective surgeries, neoplasias were predominant. The duration of surgery was higher among patients submitted to elective surgeries when compared to the emergency group (Table 1).

Table 2 shows the characteristics of ENT monitoring. Significant differences were observed regarding the time elapsed between surgery and the beginning of ENT. The percentage of caloric and protein adequacy indicators also did not show significant differences.

Nonprotein (parenteral) calories were present in 60% of the patients until the 3rd day of hospitalization with similar incidence between groups. From the 4th day, there was a higher frequency in the administration of calories among patients in the emergency surgery group. The contribution of calories to the daily Estimated Energy Requirement (EER) was decreasing in both groups during the first seven days. In general, there were no significant differences between the groups until the seventh day. As for the protein modulus, an increase in supply was observed during the first seven days. By the fourth day, the frequency of patients receiving protein modulus increased to approximately 72% in both groups, with superiority to the emergency group. From the fifth day, there is a reversal in the frequency of use of the protein module. Similar values were observed between groups on the fifth day, superiority among elective patients during the sixth day, and considerable superiority among patients in the elective group during the seventh day (90.9% vs 68.5%). The participation of the protein modulus on the Estimated Protein Need (EPN) during the first seven days presented a similarity between the surgical groups, showing no statistically significant difference during the first three days until the seventh day (p>0.05) (Table 3).

Table 4 shows the frequency of GIT changes, occurring between the second and seventh days of ENT. In general, it was not possible to observe significant differences between the surgical groups, although the need for fasting among elective surgery patients during the second day occurred at a frequency almost twice as high, when compared to the need of patients in the emergency group (p = 0.02). The GIT changes were more frequent in the emergency group, but with no statistically significant difference.

Table 1 - Demographics and clinical characteristics of patients, according to type of elective and emergency surgery

	Type of Surgery		*p* value
	Elective (n= 17)	Emergency (n= 63)	
Age			
Mean ±SD	55.4 ±14.8	53.3 ±17.9	0.66
Gender			
Male	9 (52.9%)	35 (55.6%)	0.84
Female	8 (47.1%)	28 (44.4%)	
Comorbidities			
Diabetes Mellitus	2 (11.8%)	10 (15.9%)	1.00
Hypertension	7 (41.2%)	38 (60.3%)	0.17
Chronic Kidney Disease	0 (0%)	1 (1.6%)	--
Surgical indication			
Trauma	1 (5.9%)	27 (42.9%)	**<0.01**
Stroke	1 (5.9%)	15 (23.8%)	0.17
AMF/Aneurysm	4 (23.5%)	16 (25.4%)	1.00
Neoplasm	10 (58.8%)	2 (3.2%)	**<0.01**
Others	1 (5.9%)	3 (4.7%)	---
SOFA *			
Median	10	9	0.65
Min - Max	0- 8	0 19	
GCS *			
Median	10	9	0.14
Min - Max	0-15	0–19	

*Note: *Absent data (n=2) ** Absent data (n = 22); *Kolmogorov-Smirnov Normality Test; AMF = Arteriovenous Malformation; BMI = Body Mass Index; AC = Arm Circumference; TSF = Triceps Skinfold, SOFA = Sequential Organ Failure Assessment; GCS = Glasgow Coma Scale.*

Table 2 – Relation between the medians, minimum and maximum of the time to the beginning, average percentage of caloric and protein adequacy of the Enteral Nutritional Therapy of the patients, according to the type of elective and emergency surgery

	Type of Surgery		*p* value
	Eletiva (n=17)	Urgência (n=63)	
Time of beginning of ENT *(days) n=80*			
Median	1.0	1.0	0.97
Min – Max	0 – 3	0 – 3	
Caloric adequacy (average percentage)			
1st- 3rd day ENT *(n=80)*	63.9 ±23.5	71.5 ±25.9	0.20
4th- 7th day ENT *(n=74)*	84.3 ±15.3	86.7 ±23.7	0.40
Up to the 14th day ENT *(n=80)*	76.5 ±16.4	79.4 ±22.0	0.29
Protein adequacy (average percentage)			
1st- 3rd day ENT *(n=80)*	44.4 ±20.4	50.6 ±22.4	0.37
4th- 7th day ENT *(n=74)*	81.4 ±17.9	81.8 ±38.1	0.97
Up to the 14th day ENT *(n=80)*	66.3 ±21.2	70.3 ±28.8	0.46

*Note: ENT= Enteral Nutritional Therapy; *Student's T-Test or Mann-Whitney U Test.*

In the assessment of Nutritional Status indicators, it was possible to observe a significant decline in BMI and AC values for patients in the emergency group. It can be observed that the patients presented reduction of AC, especially for patients in the emergency group (p<0.01). Among the patients in the emergency group, median BMI decreased from 26.6 kg/m^2 to approximately 25.0 kg/m^2 at

subsequent evaluations (p<0.01). In relation to the fat mass compartment, demonstrated by TSF initially for the elective group, larger values are observed in relation to the emergency group (Table 5).

Table 3 - Relative participation of nonprotein calories and protein modulus isolated during the first week of ENT, according to the type of elective and emergency surgery

	Type of Surgery		*p* value
	Elective (n=17)	Emergency (n=63)	
Calorias Não Dietéticas (parenterais) (percentual médio)			
1st- 3rd day ENT *(n=62)*	17.6 ±9.1	17.6 ±9.6	0.87
4th- 7th day ENT *(n=45)*	14.1 ±10.4	12.1 ±9.3	0.57
Up to the 7th day ENT *(n=64)*	17.0 ±9.6	15.2 ±8.1	0.67
Proteína Isolada (percentual médio)			
1st- 3rd day ENT *(n=12)*	26.0 ±6.1	25.6 ±7.9	0.95
4th- 7th day ENT *(n=34)*	24.2 ±12.3	28.6 ±11.5	0.40
Up to the 7th day ENT *(n=36)*	31.1 ±16.8	24.9 ±8.0	0.34

Table 4 - Association between the variables of Reflux or Gastrointestinal Residue, displacement of the probe and necessity of fasting in the first days of Enteral Nutritional Therapy, according to the type of elective and emergency surgery

	Type of Surgery		*p* value
	Elective	Emergency	
Day 2 (n= 78)			
Reflux/GI Residue	7 (46.7%)	22 (34.9%)	0.95
Probe displacement	0 (0%)	3 (4.7%)	
Need for Fasting	10 (66.7%)	23 (34.9%)	0.02
Day 3 (n= 76)			
Reflux/GI Residue	6 (40.0%)	24 (39.3%)	0.96
Probe displacement	2 (13.3%)	1 (1.6%)	0.09
Need for Fasting	8 (53.3%)	25 (41.0%)	0.38
Day 4 (n= 73)			
Reflux/GI Residue	7 (50.0)	24 (40.7%)	0.52
Probe displacement	2 (14.3%)	0 (0%)	
Need for Fasting	6 (42.9%)	24 (40.7%)	0.88
Day 5 (n= 69)			
Reflux/GI Residue	4 (30.8%)	27 (48.2%)	0.25
Probe displacement	1 (7.7%)	4 (7.1%)	1.00
Need for Fasting	2 (15.4%)	18 (32.1%)	0.23
Day 6 (n= 68)			
Reflux/GI Residue	3 (25.0%)	21 (37.5%)	0.41
Probe displacement	0 (0%)	6 (10.7%)	
Need for Fasting	2 (16.7%)	18 (32.1%)	0.28
Day 7 (n= 64)			
Reflux/GI Residue	3 (27.3%)	20 (38.5%)	0.48
Probe displacement	2 (18.2%)	6 (11.3%)	0.53
Need for Fasting	4 (36.4%)	18 (34.0%)	0.87

*Note: GI = Gastrointestinal; *Kolmogorov-Smirnov Normality Test.*

It was possible to observe an equal frequency of hospital discharge and death in patients in the elective group (29.4%). For patients in the emergency group, 20.6% died and 15.9% were discharged from hospital, however, with no significant difference (p<0.29, p<0.51). When comparing the groups, patients submitted to elective surgery had a higher death rate, suggesting that patients in the emergency surgery group remained hospitalized for a period of more than 14 days.

Table 5 - Association between variables of the median, minimum and maximum values of the Body Mass Index, Arm Circumference and Triceps Skinfold at the initial time, seven days and 14 days of Enteral Nutritional Therapy, according to the type of elective and emergency surgery

	Inicial	7 dias	14 dias	*p* value
Elective	n=17	n=14	n=8	
BMI (kg/m²)	27.1 (19.0; 38.2)	28.5 (17.0; 38.4)	28.3 (17.3; 38.7)	0.79
AC (cm)	32.0 (25.3; 39.0)	31.9 (23.7; 39.2)	30.6 (24.0; 39.5)	0.74
TSF (mm)	21.0 (8.0; 45.0)	19.8 (7.5; 43.2)	22.5 (11.5; 42.8)	0.67
Urgência	n=63	n=52	n=33	
BMI (kg/m²)	26.6 (18.0; 41.8)	24.9 (13.2; 39.0)	25.0 (15.2; 39.5)	**<0.01**
AC (cm)	30.3 (24.0; 43.0)	29.5 (19.3; 42.0)	28.5 (21.4; 42.4)	**<0.01**
TSF (mm)	16.7 (1.7; 44.0)	15.6 (1.5; 39.0)	16.0 (1.8; 32.0)	0.14

*Note: *Friedman test (non-parametric ANOVA for repeated measures); BMI = Body Mass Index; AC= Arm Circumference; TSF= Triceps Skinfold.*

DISCUSSION

The sample of this study presented demographic and clinical characteristics comparable to another study performed in severe patients[9] in relation to the age distribution, gender, comorbidities and their respective surgical indications. There was a predominance in the adult male gender, data consistent with the literature, justified by the higher incidence of trauma[9,13-14]. The presence of comorbidities in ICU patients is common. In this study, Hypertension was found in 57% and Diabetes Mellitus (DM) in 15% of the patients studied, with a higher incidence in patients in the emergency group[15].

The moderate TBI was the main diagnosis found in the emergency surgery group, followed by Stroke. Surgical treatment can be performed depending on the expansion and/or location of the hematoma[16]. The profile of chronic diseases of the Brazilian population, the aging population and the increase in the incidence of cancer may justify the occurrence of brain neoplasm as the main cause found in elective surgeries. Although the literature describes different degrees of severity in neurosurgical patients in the ICU, the present study did not observe significant differences in the score of the SOFA and GCS scales, data consistent with the Jain study in 2007[17].

ENT was started in the first 24 hours (24-72h) for all patients, according to the international guidelines on intensive care[7]. Consistent with these results, in a multicenter study, mean values for the ENT onset of 42.1 hours[18]. O'Meara et al., In 2008, observed that the mean time to onset of ENT was 18.2 hours[19]. ENT, when started early, is associated with a lower occurrence of clinical complications, decreased mortality, and length of ICU stay[8,20]. The programmed caloric goal was reached in 96 hours, considering the contribution of non-dietary (parenteral) calories. The result corroborates the Brazilian study conducted by Martins et al.[21], where 80% of the goal was reached on the fourth day of ENT. Similarly, the authors included patients in the ICU and infirmary who received enteral nutrition in the open system, whose process

requires manipulation of the enteral formula, with packaging for administration in intermittent periods[21]. The energy deficit accumulated in the first week in the ICU is described as a strong predictor of clinical outcomes, and the delay to the start of ENT may expose the patients to the energy deficit, which probably will not be compensated during hospitalization[22]. Tsai and colleagues evaluated associations between calories and protein consumed in the first week of ICU admission and outcomes. They found that patients who received less than 60% of the prescribed calories had a higher mortality risk[23]. On the other hand, Arabi and colleagues evaluated the effect of permissive sub-offer (60 to 70%) versus adequate supply (90 to 100%) in clinical outcomes, the group that received an average of 59% hospital mortality rates when compared with the rates of the group receiving 71.4%[24]. Protein intake also deserves attention, although reaching the hyperproteic prescription with available enteral formulas is often a limiting factor. Protein adequacy was observed from the fourth day of ENT. An alternative found was the supplementation with isolated protein modulus diluted to 15%, by volume of 100 to 500 ml/day, according to the individual needs, which allowed the addition of up to 60g of proteins per day. The use of enteral formula with 1.2 to 1.5 calories/mL and protein values between 44 and 65 grams/liter, respectively, did not allow the caloric and protein adequacy, without the use of modular protein, in ICU patients[25-26].

It was observed that the caloric and protein adequacy in the first three days of ENT showed superiority in the emergency group. The adequacy indicators, when calculated from the fourth to the seventh day, in addition to the total adequacy indicator (up to the 14th day) showed very close values between the groups. Nonprotein calories had a caloric adequacy of 60%, with higher percentages for patients in the emergency group. This was due to the use of larger doses of sedatives to control intracranial pressure. Although sedation remained for both groups from the fourth day onwards, there was a decline in this treatment. The use of lipid emulsion-based sedative (Propofol) is a reality in the ICUs and has contributed to the early caloric adequacy in the validity of nutritional therapy. When administered in doses higher than 20 mL/hour, in combination with any type of nutritional therapy, it can lead to overnutrition, a situation associated with hyperglycemia, hepatic steatosis and hypertriglyceridemia[27]. The guidelines recommend that the nutritional intake administered be as close to the patient's needs as possible, to avoid nutritional deficiencies, to attenuate lean mass loss, to avoid complications, and to improve clinical outcomes[28].

In this study, the factors considered for the non-supply of ENT were: the need for fasting for any type of procedure, the presence of gastric residue higher than 200mL/hour and/or reflux and the inadvertent exit of the enteral tube only in the first seven days from ENT. The analysis was thus driven by the fact that, after this period, the events were sporadic and some patients were withdrawn from the study, following the criteria of censorship initially proposed. It can be observed that the events were more frequent in the elective group, especially the need for fasting. Elevated gastric residue in the first days of ENT may be related to an increase in intracranial pressure in the emergency group and also to the positioning of the probe at the gastric level and the infusion ENT method[19]. For the inadvertent output of the probe, the percentage was low, demonstrating the commitment of all the team with the effectiveness of the therapy. In another study, the gastric residue was also presented as one of the main occurrences, although in a smaller volume[19]. One possible explanation for this lower incidence would be the positioning of the post-pyloric probe, which seems to provide better tolerance to the diet. Severe patients may present with gastroparesis and increased gastric residue, with gastric stasis being one of the main measurable causes limiting ENT[28]. Changes in GIT were more frequent until the seventh day of follow-up, a fact that led to the non-presentation of the variable until the 14th day. For all patients in the emergency surgery group, the outcomes observed were: longer hospitalization, precocity in the introduction of oral diet and lower percentage of death. The mechanism of rehabilitation of adult patients with acute neurological disease seems better than in patients with acute or chronic acute illnesses[29].

The BMI, an anthropometric indicator used as an evaluation tool, can be considered a predictor of mortality, when values lower than 18.5 kg/m^2, while high values of this indicator seem to be associated with favorable results, independent of the conventional predictors. However, it is important to consider the limitations of the method, since severe patients have body weight modified by changes in intra- and extracellular compartments[30]. The initial Nutritional Status, in both groups, was overweight. Although overweight in the adult population is related to risk factors for cardiovascular disease, in neurological patients it seems to have a protective factor. Excess body fat protects the body against loss of muscle mass, a common situation in neurological patients and, more recently, also described for severe patients[31]. Due to the body changes presented, even for overweight patients, there was reduction of BMI in the emergency surgery group. In the severe patient, the evaluation of Nutritional Status is a great challenge, since the evaluated parameters can be influenced purely by the inflammation, and did not represent the nutritional questions, often reflecting the severity of the disease with its systemic repercussion. Drug therapy also interferes with its values, such as the need for volume expansion during hemodynamic balance[32].

Changes in body composition in ICU patients are directly related to the fluid supply and intensity of the injury, with the lean mass compartment more affected by proteolysis and decreased protein turnover. The reserves of body fat are consumed for the generation of energy by changing the body compartments. Objective nutritional assessment may not reflect the actual situation of reservations in a short period of time[32]. The main alterations in body composition, due to anthropometric measurements, were more frequent in patients in the emergency group, where the TBI was the diagnosis of higher prevalence.

The neuroendocrine response to acute injury occurs through an intense mobilization of nutritional stocks, due to the process of protein synthesis. Precisely at this point, ENT becomes essential to provide substrates. Both overnutrition and undernutrition carry with them the worsening of metabolic disorders, compromising the evolution of the severe patient, justifying the attention for the progression of ENT[33-34]. Severe patients receive nutritional support lower than their needs, compromising the Nutritional Status, due to factors intrinsic to the acute phase of the disease and also of iatrogenic factors, which act as a barrier to the administration

of ENT[34]. Although the BMI does not demonstrate the actual commitment of Nutritional Status in severe patients, and the use of the equations does not estimate the actual nutritional needs, these are mechanisms widely used in clinical practice. This study highlights the importance of monitoring and follow-up of ENT[35].

Study limitations

In the present research, some limitations were observed. Firstly, because it was developed in a single school hospital, and because of the fact that, during the study, there was a reduction in the performance of elective surgeries, determining the inequality among the participants. In view of the variety of factors that interfere in the monitoring of ENT, some measures could better ensure therapy in severe patients such as: institutional protocols, specific enteral formula and multidisciplinary team performance.

Contributions to the sector of Health

Although it is already a reality in most health institutions, ENT should be monitored routinely, since it can be adopted as an indicator of the quality of nutritional assistance provided by the nutritionist, along with the multidisciplinary team. This proposal assumes an important role when considering the difficulties to obtain viable nutritional parameters for patients in neurosurgery.

CONCLUSION

Regarding Nutritional Status, it was observed that patients in the emergency surgery group had a worse result regarding the BMI and AC values when compared to the elective surgery group. Regarding body fat mass, patients in the elective surgery group presented higher values than those in the emergency group. The nutritional monitoring of ENT in neurosurgical patients may allow the caloric/protein supply to be more quickly reached; in relation to the parameters evaluated, fasting was the most predominant variable for the interruption of ENT. The indication and the caloric/protein adequacy were completed by the fourth day for both groups. The indication of ENT was early and its follow-up proved to be effective, since with adequate ENT in terms of caloric and protein supply, it can be provided that the individualized nutritional need is more quickly achieved.

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