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Resolution of control and monitoring instrument of nutritional therapy in the intensive care unit of a university hospital

Resolución del instrumento de control y monitorización de la terapia nutricional en la unidad de cuidados intensivos de un hospital universitario

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ABSTRACT

Introduction: Patients in intensive care status are in nutritional threat and frequently present innutrition, therefore monitoring the nutritional offer becomes indispensable.

Aim: To purpose a control and monitoring form of enteral nutritional therapy and to evaluate its resoluteness.

Methods: Observational, analytical and retrospective study performed in intensive care patients receiving an enteral diet exclusively and/or associated with the oral/parenteral route, from January to April 2015 and from January to April 2016. An enteral nutritional

therapy control form was purposed and applied in 2016 and the results were compared to those of the previous year. In both of these years, five quality indicators proposed by the task force of clinical nutrition from the International Life Sciences Institute (Brazil, 2008) were applied.

Results: Ninety-four patients, mostly aged, were included (47 per year) in the study. There was an increase in the number of patients that presented diarrhea (p = 0.007) and hyperglycemia (p = 0.013) as well as an increase in the occurrence of these episodes among patients (p = 0.018, p = 0.032, respectively). The frequency of diarrhea, fasting of more than 24 hours and hypoglycemia did not correspond to the goal established by the indicators. Energy and protein estimations were reported, as well as their compliance with the literature.

Conclusion: After using the form, a greater report of clinical intercurrences and information on caloric and protein estimates was observed, thus demonstrating its effectiveness with respect to data recording.

Key words: Quality of health care. Critical care. Enteral nutrition. Indicators of quality in health care.

RESUMEN

Introducción: los pacientes en terapia intensiva presentan riesgo nutricional y frecuentemente se encuentran en estado de malnutrición, por lo que es fundamental la monitorización de la oferta nutricional.

Objetivo: proponer una forma de control y seguimiento de la terapia nutricional enteral y evaluar su efectividad.

Métodos: estudio de observación, analítico y retrospectivo, realizado en pacientes ingresados en una unidad de cuidados intensivos que reciben dieta por vía enteral exclusiva y/o asociada a vía oral/parenteral, en el periodo de enero a abril de 2015 y de enero a abril de 2016. En 2016 se propuso y aplicó un instrumento de control y monitorización de la terapia nutricional enteral en la unidad de cuidados intensivos y los resultados fueron comparados con los del año anterior. En ambos periodos se aplicaron cinco indicadores de calidad propuestos por el grupo especial de nutrición clínica del International Life Sciences Institute, de Brasil (2008).

Resultados: fueron incluidos 94 pacientes y se estudiaron 47 en cada año, la mayoría de ellos ancianos. Hubo un aumento del número de pacientes que desarrollaron diarrea (p = 0,007) e hiperglucemia (p = 0,013) y también de la cantidad de episodios de estas complicaciones (p = 0,018 y p = 0,032, respectivamente). La frecuencia de diarrea, ayuno superior a 24h e hipoglucemia no correspondía a la meta fijada por los indicadores. Se comenzó a relatar la estimación de energía y proteínas, así como su correspondencia con la literatura existente.

Conclusión: después de la utilización del instrumento hubo un aumento en el relato de complicaciones clínicas y la información referente a la estimación calórica y proteica, lo que demuestra su efectividad en el registro de datos para el cual fue desarrollado.

Palabras clave: Calidad de la asistencia sanitaria. Cuidados intensivos. Nutrición enteral. Indicadores de calidad en asistencia sanitaria.

INTRODUCTION

Special attention must be paid to the nutritional status of critical patients, who due to the specific characteristics of several metabolic conditions are in nutritional threat and frequently present with caloric-protein innutrition (1). Among the hospitalized in Brazil, 48% present some degree of malnutrition and 12% of them are severely malnourished (2).

Hospital nutrition is associated with an increased rate of morbidity and mortality, length of hospital stay, hospitalization, and increased health costs (3). These patients are usually hypermetabolic, and present hyperglycemia, insulin resistance and marked lipolysis, as well as intense protein catabolism, which, together with immobilism and the difficulty of achieving nutritional goals, interfere with nutritional support, leading to an important muscular depletion and increased nutritional needs (4).

Enteral nutritional therapy (ENT) is seen as a therapeutic tool within Intensive Care (5,6). The use of quality indicators associated with the implementation of protocols is recommended to guarantee the quality of ENT and reduce costs for both the patient and the institution (6). In this context, the present study aimed to propose a form for the control and monitoring of enteral nutritional therapy and to evaluate its resolution.

MATERIALS AND METHODS

An analytical and retrospective study was performed through the collection of secondary data in medical records of patients admitted to an intensive care unit (ICU) of the University Hospital de Campo Grande (Mato Grosso do Sul, Brazil), previously approved by the Ethics in Research with Humans CEP/UFMS under the protocol number 1.328.152, with the consent of the responsible for the sector and signature of term of responsibility for use of medical records.

Individuals of both sexes, over 18 years of age, admitted to the ICU from January to April 2015 and from January to April 2016 and who received an enteral diet exclusively or associated with oral/parenteral administration were included in the sample. Children under 18 years of age and subjects whose nutrition was given orally and/or parenterally exclusively, indigenous, quilombolas and institutionalized were excluded from the study.

Data collection included the same period of 2015 and 2016. By 2015 there were no TN protocols validated in the industry. Patient records were the sources for data collection. In 2016, a form was proposed by the researcher, developed in partnership with the nutritionist of the sector, including dietary prescription control and notification of intercurrences related to ENT. The definitions of these intercurrences were standardized according to the European, American, Brazilian and Canadian guidelines (5,7-9). The data collection for 2016 was carried out in the proposed form.

In these two years, data were collected by the identification of individuals (date of birth, age and institution registration number), the main reason for hospitalization, comorbidities, length of staying in the ICU, nutritional diagnosis, dietary route of administration, type of diet, estimated time of needing of ENT after ICU admission, episodes and reasons for diet suspension, fasting time > 24 hours, clinical intercurrences, glycemia dysfunction, changes in physiological eliminations, and clinical outcome.

Five quality indicators of nutritional therapy (QINT) were applied. The indicators were chosen taking into account the characteristics of the sector. The analysis of the indicators was done according to the recommendations of the Clinical Nutrition Task Force - ILSI-Brazil (6).

The data were tabulated in spreadsheets of the program Microsoft Excel® 2013 and a statistical analysis was done using the Statistical Package for the Social Sciences (SPSS) software, version 24.0 for Windows. Descriptive statistics were used for the characterization of the sample, with absolute and relative frequencies, medium and standard deviation. In

order to compare proportions among the categorical variables, the Chi-squared test or Fisher's exact were used. The Mann-Whitney test was used for verification of the difference between the median values of the numerical variables, and the t test was used for the ranges after checking the distribution by the Shapiro Wilk normality test. The level of significance was 5%.

RESULTS

Among the patients admitted to the ICU during the study period, those who answered by the inclusion criteria were 47 in 2015 and 47 in 2016. In that last year, a specific form was adopted for the control of enteral and parenteral nutrition, what made it possible to record the calculation of energy needs for 93.6% of the patients.

There was no difference in the proportion of patients according to gender, age group, route of diet administration, ICU diet start time, ICU stay and patient outcome among the studied years. In 2015, the range age was 58.15 ± 19.30 years and in 2016, 58.87 ± 18.31 years (p = 0.853 t test). In 2015 and 2016, 97.9% and 95.7% of the patients, respectively, started the diet within 48 hours after admission. In 2015, the length of stay in the ICU was 14.87 ± 17.24 (range: 1-98) days, and in 2016 it was 18.11 ± 24.74 (range: 2-140) days (p = 0.380 Mann-Whitney test). The mortality rate during the period studied was 46.8% in 2015 and 29.8% in 2016 (Table 1).

The main diagnoses on patient admission were pneumonia (40.4% in 2015 and 19.2% in 2016) and septic shock/sepsis (10.6% in 2015 and 29.8% in 2016). The frequency of cases of pneumonia was higher in 2015 (p = 0.024 Chi-squared test), and there was no difference in the proportion of septic shock/sepsis (p = 0.1188 Chi-squared test).

There was a greater percentage of patients with comorbidities in the year 2016 (93.6%) than in the year 2015 (78.7%) (p = 0.036 Chi-squared test). With respect to the type of comorbidities, there was no difference between the years studied (Chi-squared test). The most frequent were: systemic arterial hypertension (14.9% in 2015 and 25.5% in 2016, p = 0.199), acquired human immunodeficiency syndrome (21.3% in 2015 and 17.0% in 2016, p = 0.600) and chronic kidney disease (CKD) (12.8% in 2015 and 21.3% in 2016, p = 0.272).

In relation to clinical intercurrences (Table 2), there was a higher percentage of patients who had diarrhea (70.2%) and hyperglycemia (68.1%) in 2016. In 2015, 17% of the patients

presented anuria, whereas no case was observed in 2016. There was no difference in the proportion of patients who had constipation, hypoglycemia, stasis, melena and hematuria.

There was also a greater occurrence of diarrhea in 2016 (mean = 3.3 ± 4.1) compared to 2015 (mean = 1.8 ± 3.0). There were more episodes of hyperglycemia by one patient in 2016 (mean = 4.7 ± 5.5) compared to 2015 (mean = 3.5 ± 6.7). There was no difference in the number of episodes of hypoglycemia and stasis (Table 3).

In addition, there was a higher proportion of patients (57.4%) submitted to fasting in 2016 in comparison to 2015 (36.2%). However, there was no difference in the number of fasting episodes per patient (Mann-Whitney test p = 0.718), 1.2 ± 0.4 in 2015 (n = 17) and 1.1 ± 0.3 in 2016 (n = 27). The most frequent causes of fasting were hemodynamic instability, stasis and medical procedures. There was a statistical difference between both years for the following causes: stasis, which was more frequent in 2016 (40.7%), and hemodynamic instability, more frequent in 2015 (70.6%). There was no difference between both periods in relation to the fasting time (Table 4).

QINT were applied in the two periods studied in order to monitor ENT quality in subsequent years, besides verifying the applicability of the proposed instrument according to table 5.

DISCUSSION

Protocols for nutritional support provide greater control of nutrient receptions for patients and decrease the time to reach caloric and protein goals (10). Therefore, specific tools are necessary to facilitate the process of periodic evaluations, strategy establishment and assistance follow-up, using quality indicators to measure the effectiveness of the process. Furthermore, the use of protocols is cited as a differential framework in the care provided to patients in ENT when associated with continuing education and the participation of the multidisciplinary team (11,12).

The importance of the nutritionist in the ICU for the construction of these tools is emphasized, respecting the reality of the hospital to which they will be applied, as well as the human and material resources available for this purpose (13).

About the mean length of stay in the ICU, it was 14.87 ± 17.24 days in 2015 and 18.11 ± 24.74 days in 2016. A study conducted in the United States compared the clinical results of patients hospitalized in the ICU before and after the implementation of a nutritional protocol, finding an average time of intensive care hospitalization of 14.9 ± 18.0 days before

the protocol and 14.1 ± 18.8 days post-protocol, and there was no impact on the length of stay (14).

In relation to mortality, the rate was 46.8% in 2015, similar to that of a cohort study conducted in Brazil, with a rate of 45% when correlating the caloric deficit in critically ill patients with mortality (15). In the present study there was no statistical difference in the mortality rate between the years studied, but a decrease of 17.0% from one year to another can be observed.

In addition to advanced age, the patients admitted to the ICU presented a serious clinical condition, mainly related to the specialties of pneumology and infectology, which resulted in an average hospitalization period of approximately 15 days. These also had comorbidities related to chronic diseases or immune suppression. Advanced age, clinical severity and the presence of comorbidities, which result in longer hospitalization periods, are characteristic of patients admitted to the ICU and also reinforce the need for strict control of nutritional prescription (16).

In the present study, the sample basically consisted of patients with an enteral diet, since only one of them used concomitant parenteral nutrition in 2016, and none in 2015. There was no oral enteral diet in neither of the years.

The early enteral nutrition (EEN) at ICU, until to 48 h after admission (8), helps to maintain intestinal mucosal integrity, reduces bacterial translocation and infection risks, and is associated with decreased mortality derived from high risk of complications caused by undernourishment and/or non-feeding (5,17). In the two-year study, more than 95% of the patients received EEN, in line with the American, Brazilian, Canadian and European guidelines (5,7-9), however, there was no relationship between the early onset of the diet and the time of hospitalization and mortality, as well as in the study by Pasinato et al. (18). The occurrence of EEN may be associated to the routine of the sector and the presence of a multidisciplinary team offering adequate ENT. In addition, these patients come from other services of the hospital, and often arrive at the ICU with the diet already started.

After all the efforts to offer adequate caloric-protein intake, there are barriers that prevent reaching nutritional goals in less time. The main causes of interruption of the diet are complications of the gastrointestinal tract: abdominal distension, stasis and diarrhea. Other commonly found causes are fasting for exams and procedures, inadvertent feeding tube probe and hemodynamic instability (19,20). These factors contribute significantly to the

incidence of malnutrition in ICU patients and to their increased morbidity and mortality. Studies have also reported the lack of specific instruments and protocols as barriers impeding the success of ENT (5,11,21). The main clinical complications in the present study were gastrointestinal complications (diarrhea, constipation, stasis, melena) and glycemia dysfunctions (hyperglycemia and hypoglycemia).

Diarrhea was considered as the occurrence of three or more episodes of fluid evacuation in 24 hours; constipation, as absence for more than three days; stasis, as volume of gastric residue > 500 ml in 24 hours; hypoglycemia, < 70 mg/dl; and hyperglycemia, > 180 mg/dl (5,7,22).

In relation to the main intercurrences occurred in these two years, diarrhea and hyperglycemia are evident. The percentage of patients presenting these complications increased in this period, as well as the number of episodes per patient. In 2015, 42.6% of the patients presented diarrhea, and in 2016 this percentage increased to 70.2%. These values are above the desirable (< 10%) according to the indicators. Regarding hyperglycemia, even with the increase in patients presenting with this complication, the result of the indicator was satisfactory, taking into account the goal established for critical patients (70-80%). It may be explained by the greater report after the use of the instrument, and also the higher percentage of patients with comorbidities in 2016. However, hyperglycemia is not only related to ENT and is common in critically ill patients, being considered as a marker of severity of the disease (23).

There was a modest decrease in the number of patients presenting episodes of hypoglycemia, from 31.9% in 2015 to 29.8% in 2016. However, the result remains much higher than expected (5.1-6.9%). Hypoglycemia is associated with clinical complications and worse prognoses and should be avoided (7). In addition, Van Steen et al. (24) showed that insulin therapy continued in infusion pump is unnecessary due to lack of standardization of cut-off point of hyperglycemia in ICU patients increasing episodes of hypoglycemia, and the risk of mortality.

Other intercurrences in evidence in the study were anuria and hematuria, which did not appear in the reports of 2016 despite the hospitalization of patients with CKD, indicating a bias in the proposed tool, which has no specific field for this information.

Patients undergoing fasting for more than 24 hours totaled 36.2% in 2015, increasing to 57.4% in 2016. These percentages are not in line with the target (≤ 12%) established by

Waitzberg et al. (6). Hemodynamic instability, with 70.6%, was the main cause of fasting > 24 hours in 2015, reflecting the severity of patients admitted to the ICU. In 2016, it decreased to 37.0% (p = 0.030). Stasis, which represented 5.9% of the causes of fasting in 2015, rose to 40.7% in 2016 (p = 0.015). Another variable indicates, possibly, the greater registration of these occurrences after adoption of the study tool.

Due to a lack of specific form, it was not possible to establish the frequency of calculation of energy and protein requirements, and it was not possible to assess the adequacy of the ENT indication in 2015. This measurement was possible after the use of the tool proposed in 2016, which evidenced the accomplishment of estimates of energy and protein requirements in 93.6% of the patients, taking into account the recommendations of the indicator. All these patients had ENT according to the main guidelines (5,7,9).

In view of the results obtained, the need to control the quality of patient care under ENT, which can be performed through QINT, was verified. Indicators are considered to be the most appropriate tool to assess nutritional assistance, besides being easy to apply, requiring only the training and commitment of the professionals involved (20).

In the first year of the study there were no forms or protocols of ENT validated in the sector dictating routines and nutritional processes, nor permanent multidisciplinary team working in the ICU. The sector counted on the care of residents from several areas, which characterized the high turnover of caregivers. Therefore, there was a lack of care standardization, since the behaviors diversify according to the professional and reference used, causing treatment disparity. In the intermission between the years of research there were changes in the composition and performance of the multidisciplinary team, in addition to training collegiate in the institution and in the sector that started to charge the use of checklists, protocols and quality indicators. These factors may have interfered in the result of this study, because with the systematized assistance, a greater number of intercurrences are identified.

Thus, the information collected may serve as a theoretical reference for the Multiprofessional Nutritional Therapy Team of the referred hospital, which is in the implementation phase, in order to establish ENT system's effectiveness, as well as the basis for new studies, which can standardize and suggest nutritional assessment and diagnosis protocols, ENT choice algorithms, specific diet therapy for the clinical conditions and treatment of ENT related complications.

The present study evidenced the need for an instrument to control infusion of ENT, since after its use clinical intercurrences and information relative to caloric and protein estimates were systematically notified. Therefore, the instrument was effective regarding the data record that was developed.

Although the use of the monitoring instrument proposed in the present study did not affect the reduction of hospitalization time, occurrence of clinical intercurrences and mortality in the ICU, possibly due to the patients' severe clinical situation, it was an effective control tool, since there was adequate nutritional status for almost all patients, who were better monitored by professionals that alternate in shifts in the sector. There was also an increase in the quantity and quality of registered nutritional information, making it possible to identify the occurrence of individual nutritional assessment, calculation of nutritional needs, calories and proteins prescribed and administered, interruptions of the diets, and clinical intercurrences, among others. In addition, the need to include information in the instrument to avoid under-registration, such as a specific field for diuresis, was evidenced because in 2016 there was no report of anuria even with a significant number of patients with CRI (21.3%).

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Table 1. Sample characterization according to study variables. Nutritional Therapy Unit, University Hospital Maria Aparecida Pedrossian, UFMS - 2015 and 2016

Variables	*2015 (n = 47)*		*2016 (n = 47)*		*p*
	No.	*%*	*No.*	*%*	
Sex					
Female	19	40.4	24	51.1	(1)0.301
Male	28	59.6	23	48.9	
Age					
18 to 30 years old	4	8.5	2	4.3	(1)0.628
31 to 60 years old	17	36.2	20	42.5	
> 60 years old	26	55.3	25	53.2	
Route of administration of the diet					
Enteral nutrition	47	100.0	46	97.9	(2)1.000
Parenteral and enteral nutrition	-	-	1	2.1	
Oral and enteral nutrition	-	-	-	-	
Beginning time of ENT(3)					
0 (in admittance)	36	76.6	38	80.8	(1)0.614
24 hours	6	12.8	5	10.6	(1)0.748
48 hours	4	8.5	2	4.3	(2)0.677
> 72 hours	1	2.1	2	4.3	(2)1.000
Permanence time at ICU(3)					
Until 3 days	9	19.1	4	8.5	(1)0.135
From 4 to 7 days	12	25.5	12	25.5	(1)1.000
From 8 to 15 days	11	23.4	14	29.8	(1)0.484
From 16 to 30 days	10	21.3	12	25.5	(1)0.626
Over 30 days	5	10.7	5	10.7	(1)1.000
Denouement					
Death	22	46.8	14	29.8	(1)0.237
Stay at ICU	3	6.4	4	8.5	
Transference	22	46.8	29	61.7	

[1]Chi-squared test. [2]Fisher's exact test. [3]The Chi-squared test was calculated in every category about this variable *versus* the most categories added.

Table 2. Clinical intercorrences. Nutritional Therapy Unit. University Hospital Maria Aparecida Pedrossian, UFMS - 2015 and 2016

Clinical intercorrences[1]	*2015 (n = 47)*		*2016 (n = 47)*		[2]
	No.	*%*	*No.*	*%*	
Diarrhea	20	42.6	33	70.2	[3]*0.007*
Hyperglycemia	20	42.6	32	68.1	[3]*0.013*
Anuria	8	17.0	-	-	[4]*0.006*
Constipation	15	31.9	19	41.3	[3]0.347
Hypoglycemia	15	31.9	14	29.8	[3]0.823
Stasis	10	21.3	17	36.2	[3]0.111
Melena	4	8.5	5	10.9	[4]0.740
Hematuria	3	6.4	-	-	[4]0.242

[1]One or more fasting causes by one patient. [2]Values of *p* in bold indicate statistically significant difference. [3]Chi-squared test. [4]Fisher's exact test.

Table 3. Clinical intercorrences by one patient. Nutritional Therapy Unit, University Hospital Maria Aparecida Pedrossian, UFMS - 2015 and 2016

Clinical intercorrences	*2015 (n = 47)*		*2016 (n = 47)*		*p*
	Ranges	*DP*	*Ranges*	*DP*	
Diarrhea	1.8	3.0	3.3	4.1	[3]*0.018*
Hyperglycemia	3.5	6.7	4.7	5.5	[3]*0.032*
Hypoglycemia	1.3	2.5	1.0	2.1	[3]0.803
Stasis	0.4	0.9	0.9	1.4	[3] 0.185

Mann-Whitney test.

Table 4. Fasting occurrence over 24 hours. Nutritional Therapy Unit, University Hospital Maria Aparecida Pedrossian, UFMS - 2015 and 2016

Variables	*2015*			*2016*			*p*
	n	*No.*	*%*	*n*	*No.*	*%*	
Fasting	47			47			
Yes		17	36.2		27	57.4	[3]*0.039*
No		30	63.8		20	42.6	
Fasting causes[1]	17			27			
Stasis		1	5.9		11	40.7	[4]*0.015*
Exams		1	5.9		2	7.4	[4]1.000
Hemodynamic instability		12	70.6		10	37.0	[3]*0.030*
Abdominal distension		-	-		1	3.7	[4]1.000
Nursing procedures		-	-		1	3.7	[4]1.000
Medical procedures		6	35.3		5	18.5	[4]0.289
Sonda outlet		-	-		1	3.7	[4]1.000
Fasting time	17			27			
24 hours		5	29.4		12	44.4	
48 hours		5	29.4		8	29.6	[3]0.503
> 72 hours		7	41.2		7	26.0	

[1]One or more fasting causes by one patient. [2]Values of *p* in bold indicate statistically significant difference. [3]Chi-squared test. [4] Fisher's exact test.

Table 5. Quality indicators in nutrition therapy. Intensive Care, University Hospital Maria Aparecida Pedrossian, UFMS - 2015 and 2016

Quality indicators in nutrition therapy	*Meta**	*2015*	*2016*
I - Frequency of diarrhea in ENT patients	< 10%	42,6%	70,2%
II - Frequency of fasting > 24 h in patients in ENT	≤ 12%	34,0%	57,5%
III - Frequency of patients with glycemia dysfunction in ENT			
IIIa -Frequency of patients with hypoglycemia	5.1-6.9%	31.9%	29.8%
IIIb - Frequency of patients with hyperglycemia	70-80%	42.6%	68.1%
IV - Frequency of EP ** estimation in patients with ENT	> 80%	***	93.6%
V - Frequency of conformity of indication of ENT	< 13%	***	93.6%

*Clinical Nutrition Task Force - ILSI-Brazil (WAITZBERG, 2008). **Estimates of protein-energy expenditure. ***Data were not found.