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Trabajo Original

Paciente crítico

Quality indicators for enteral and parenteral nutrition therapy: application in critically ill patients "at nutritional risk"

Indicadores de calidad para terapia nutricional enteral y parenteral: aplicación en pacientes críticamente enfermos "con riesgo nutricional"

Ronaldo Sousa Oliveira-Filho[1], Lia Mara Kauchi Ribeiro[1], Lucia Caruso[2], Patricia Azevedo de Lima[3], Nágila Raquel Teixeira Damasceno[4] and Francisco Garcia Soriano[5]

[1]Intensive Care Unit. Professional Improvement Program. Hospital Nutrition. University Hospital. University of São Paulo. São Paulo, Brazil. [2]Intensive Care Unit. Nutrition and Dietetics Division. University Hospital. University of São Paulo. São Paulo, Brazil. [3]School of Public Health. University of São Paulo. São Paulo, Brazil. [4]Nutrition and Dietetics Division. University Hospital. University of São Paulo. School of Public Health. University of São Paulo. São Paulo, Brazil. [5]Adult Intensive Care Unit. University Hospital. University of São Paulo. São Paulo, Medical School. Brazil

Abstract

Introduction: Quality Indicators for Nutritional Therapy (QINT) allow a practical assessment of nutritional therapy (NT) quality.

Objective: To apply and monitor QINT for critically ill patients at nutritional risk.

Methods: Cross sectional study including critically ill patients > 18 years old, at nutritional risk, on exclusive enteral (ENT) or parenteral nutritional therapy (PNT) for > 72 hours. After three consecutive years, 9 QINT were applied and monitored. Statistical analysis was performed with SPSS version 17.0.

Results: A total of 145 patients were included, 93 patients were receiving ENT, among then 65% were male and the mean age was 55.7 years (± 17.4); 52 patients were receiving PNT, 67% were male and the mean age was 58.1 years (± 17.4). All patients (ENT and PNT) were nutritionally screened at admission and their energy and protein needs were individually estimated. Only ENT was early initiated, more than 70% of the prescribed ENT volume was infused and there was a reduced withdrawal of enteral feeding tube. The frequency of diarrhea episodes and digestive fasting were not adequate in ENT patients. The proper supply of energy was contemplated only for PNT patients and there was an expressive rate of oral intake recovery in ENT patients.

Conclusion: After three years of research, the percentage of QINT adequacy varied between 55%-77% for ENT and 60%-80% for PNT. The results were only made possible by the efforts of a multidisciplinary team and the continuous re-evaluation of the procedures in order to maintain the nutritional assistance for patients at nutritional risk.

Key words:

Quality indicators. Enteral nutrition. Parenteral nutrition. Critically ill patient. Malnutrition.

Resumen

Introducción: los indicadores de calidad en terapia nutricional (ICTN) permiten evaluar la calidad de la terapia nutricional (TN) de forma práctica.

Objetivo: implementar y monitorizar los ICTN en pacientes críticos con riesgo nutricional.

Métodos: estudio transversal con pacientes críticos > 18 años en riesgo nutricional, en terapia nutricional enteral (TNE) o parenteral (TNP) exclusiva a > 72 horas. Después de 3 años consecutivos, 9 ICTN fueron implementados y monitorizados. El análisis estadístico fue realizado con el *software* SPSS, versión 17.0.

Resultados: fueron incluidos 145 pacientes, siendo 93 en TNE, 65% eran de sexo masculino, con edad promedio de 55,7 años (± 17,4); 52 pacientes que estaban en TNP, 67% eran de sexo masculino, con edad promedio de 58,1 años (± 17,4). Todos los pacientes (TNE y TNP) fueron cribados en la admisión, los cálculos de las necesidades calóricas y proteínicas fueron individualizados. Apenas la TNE fue precoz, > 70% del volumen prescrito fue administrado y fue visto una reducida pérdida de la sonda nasoenteral. Las frecuencias de diarrea y ayuno digestivo no fueron adecuadas en TNE. La administración adecuada de energía fue contemplada apenas en TNP y hubo una significativa tendencia de recuperación en la vía oral en TNE.

Conclusión: después de 3 años de estudio, el porcentaje de adecuación de los ICTN varió entre 55%-77% para TNE y 60%-80% para TNP. Los resultados reflejan los esfuerzos del equipo multiprofesional de TN en mantener la calidad de la asistencia nutricional en los pacientes críticos con riesgo nutricional.

Palabras clave:

Indicadores de calidad. Nutrición enteral. Nutrición parenteral. Paciente crítico. Malnutrición.

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Correspondence:

Ronaldo Sousa Oliveira Filho. Av. Professor Lineu Prestes, 2565. Cidade Universitária, 1.º A.
05508-900 São Paulo (SP), Brazil
e-mail: ronaldonutrir@gmail.com

INTRODUCTION

The prevalence of nutritional risk in hospitalized patients is high. Approximately 48% of hospitalized patients in Brazil have some degree of malnutrition and among them 12% are severely malnourished (1). The prevalence of malnutrition in Intensive Care Unit (ICU) described in the literature varies between 43 and 88% (2,3).

This group of patients generally experience catabolic stress, which may be associated with Systemic Inflammatory Response Syndrome (SIRS). Under these conditions, there are increasing of Reactive Oxygen Species and Nitrogen productions, Multiple Organ Failure, Mechanical Ventilation (MV), length and hospital stay, thereby generating rising in morbidity and mortality rates (4).

In this way, Nutrition Therapy (NT) is an essential tool for the maintenance of immune function, for reducing metabolic complications and mainly in the deficit of muscle mass. Although Enteral Nutrition Therapy (ENT) is the preferred route of nourishment for critically ill patients, Parenteral Nutrition Therapy (PNT) is indicated when digestive tract cannot be safely used (5).

Gastrointestinal and/or metabolic dysfunctions such as refeeding syndrome, hyperglycemia, as well as pneumothorax and catheter infection, among other complications, are evident in patients on NT in ICU. These complications can negatively influence patient's clinical outcome (6). However, the prevention and minimization of these complications can be done by careful monitoring and the performance of Multidisciplinary Nutrition Therapy Team (MNTT). The MNTT in Brazil is defined by ordinances that regulate NT in order to provide effective and quality nutrition care (7,8).

Recently the task force of clinical nutrition of the International Life Sciences Institute - Brazil (ILSI) aiming at higher quality control in NT, proposes indicators for assessing the quality of ENT and PNT in hospitals. These Quality Indicators for Nutrition Therapy (QINT) allow the assessment of nutritional care in a healthcare service (9,10).

By this following up, the logistics of the service can be evaluated and the application of the recommendations proposed by NT guidelines in clinical practice can be verified. Despite the availability of these indicators, continuous and careful monitoring of patients in ICU on ENT or PNT is still modestly described in the literature. Regarding this background, the study had as an objective to apply and monitor QINT in critically ill patients at nutritional risk, on ENT or PNT admitted in a university hospital ICU in São Paulo - Brazil during three consecutive years.

METHODS

It was a cross-sectional study which considered the critically ill patients at nutritional risk, aged > 18 years old who entered in the ICU of a university hospital between August and December of 2010, 2011 and 2012 and also on exclusive ENT or PNT for more than 72 hours. Patients in palliative care, using ENT concomitantly with PNT and those that did not meet the criteria mentioned above were not included.

The research was approved by the Research Ethics Committee, being held prospectively in patients on ENT (CEP 603/05) and with retrospective analysis of data collected prospectively in patients on PNT (CEP 891/09). Data about sex, age, origin, destination, diagnosis, duration of NT, number of hours before starting NT, length of stay in the ICU, prescribed and infused volumes, and involuntary withdrawal of Enteral Feeding Tubes (EFT) were obtained from medical records.

The nutritional risk was assessed with the nutritional screening tool proposed by Kovacevichi et al. (11) (Fig. 1) and it was conducted by a dietitian. In order to detect nutritional risk, the reference method considered: involuntary weight loss, reduced food intake in the past weeks and the presence of gastrointestinal symptoms such as nausea, vomit, diarrhea and abdominal distension. Furthermore, other clinical data were considered for this evaluation, such as: previous diagnose of chronic diseases, malabsorption syndrome, abdominal surgery, cancer, sepsis and septic shock. This nutritional screening tool was accepted by the MNTT because of its simple implementation and compatibility with the resources available.

After identifying the nutritional risk, all patients were daily followed by the MNTT. The nutritional requirements were calculated from the body weight measured with a crane scale (Scale-Tronix brand, 2002) upon admission. The ideal body weight obtained from reference charts according to each age group (12,13) was used when patient mobilization was not possible due to limitations caused by medical condition. For obese patients (Body Mass Index - BMI $\geq$ 30 kg/m^2), the adjusted weight was calculated and used after obtaining the weight at admission. The formula used was: adjusted body weight = (current body weight - IBW) x 0.25 + IBW) (14).

The height measurement was based on those informed by patients or their relatives and in case this information was not available, the estimated height was calculated through equations using the knee height (15,16).

Estimates of energy and protein requirements, according to each clinical condition, were carried out conforming to existing protocol in the unit (17), so it was used 25-30 calories (kcal) per kilogram (kg) of weight based on recommendations of The European Society for Clinical Nutrition and Metabolism (18) (ESPEN) and 20 kcal/kg of adjusted weight for obese patients (14). For patients with acute-phase reaction it was used 1.25 to 1.5 g protein/kg of body weight (17-19).

The position of the EFT was according to the institution's protocol. Post-pyloric position was adopted and when it was not possible, the gastric position was used. All EFT placements were verified by X-ray and in all situations nasojejunal feeding tube was used. Enteral formulas were continuously administered using infusion pumps for approximately 22 hours and the remained two hours were reserved for procedures and administration of drugs (17). Five options of enteral formulas (polymeric normocaloric and normoproteic, polymeric hypercaloric and normoproteic with or without fibers, polymeric hypercaloric and hyperproteic and oligomeric) were available for ENT.

For PNT there were six types of formulations according to patient`s clinical condition (normocaloric with or without lipids, renal failure, hypercatabolic renal failure, hepatic failure, hypercaloric

A. Diagnosis:
If the patient has at least *one* of the following diagnoses, circle and proceed to section *E* to consider the patient *at nutritional risk* and stop here.
– Anorexia nervosa/bulimia nervosa.
– Malabsorption (celiac sprue, ulcerative colitis, Crohn's disease, short bowel syndrdrome).
– Multiple trauma (closed-head injury, penetrating trauma, multiple fractures).
– Decubitus ulcers.
– Major grastrointestinal surgery within the past year.
– Cachexia (temporal wasting muscle wasting, cancer, cardiac).
– Coma.
– Diabetes.
– End-stage liver disease.
– End-stage renal disease.
– Nonhealing wounds.

B. Nutrition intake history:
If the patient has at least *one* of the following symptoms, circle and proceed to section *E* to consider the patient *at nutritional risk* and stop here.
– Diarrhea (> 500 mL x 2 days).
– Vomiting (> 5 days).
– Reduced intake (< ½ normal intake for > 5 days).

C. Ideal body weight standars:
Compare the patient's weight for heigtht to the ideal body weigth chart on the back of this form.
– If at < 80% of ideal body weight, proceed to section *E* to considerer the patient *at nutritional risk* and stop here.

D. Weight history:
– Any recent unplanned weight loss? No ____ Yes ___ Amount (lbs or kg) ___
– If yes, within the past ___ weeks or ___ months.
– Current weight (lbs or kg)___
– Usual weight (lbs or kg) ___
– Height (ft, in or cm) ___
– Find percentage of weight lost: usual wt - current wt x 100 = ____% wt loss
usual wt
– Compare the % wt loss with the chart values and circle appropriate value:

Length of time	Significant (%)	Severe (%)
1 week	1-2	> 2
2-3 weeks	2-3	> 3
1 month	4-5	> 5
3 months	7-8	> 8
5 + months	10	> 10

If the patient has experienced a significant or severe weight loss, proceed to section *E* and considerer the patient *at nutritional risk.*

E. Nurse assessment:
Using the above criteria, what is this patient's nutritional risk? (circle one)
___ *Low nutritional risk.*
___ *At nutritional risk.*

Figure 1.
The nutritional screening tool proposed by Kovacevichi et al.

with lipids), with the option of supplementing with amino acids to achieve the previously estimated needs. All venous access were central with continuous administration for 24 hours. SAPS III Index (Simplified Acute Physiology Score) was used to assess the severity of patients' medical condition.

A total of 9 QINTs were selected, of which 4 were specific for patients on ENT. All indicators with formulas and goals were described in table I (9,8,20,21).

Statistical analyzes were carried out using SPSS version 17.0. Kolmogorov-Smirnov test ($p > 0.05$) was used to verify normal distribution of the sample. Mean and standard deviation were used when the variable was parametric and median values and interquartile range (p25-p75) for nonparametric variables. Chi-square test (χ^2) was used to compare qualitative variables and quantitative variables were compared using ANOVA and Student t tests for parametric variables and Kruskal-Wallis and Mann-Whit-

ney test for nonparametric variables. Statistical significant difference, $p < 0.05$ was considered for all tests.

RESULTS

Overall, the sample was composed of 145 patients, 93 on exclusive ENT, which 65% were male and the mean age was 55.7 years (± 17.4). Fifty-two patients on exclusive PNT were included in the sample, 67% were male and the mean age was 58.1 years (± 17.4). All patients presented nutritional risk, detected on ICU admission. On average, the patients remained 12.1 (± 9.4) days on ENT and 12.5 (± 8.8) days in PNT. Tables II and III show the demographic and clinical profile of patients respectively on ENT and PNT, and stratified according to the year of monitoring.

In total, 9 QINT were applied. In ENT, the indicators that met the goals proposed in all years were the following: the screening of nutritional risk (QINT I); the estimation of energy and protein needs (QINT II); the patients with ENT infused volume above 70% of prescribed volume (QINT IV); involuntary withdrawal of feeding tubes (QINT VIII); the rate of oral intake recovery (QINT IX). Meanwhile, the indicator which verified the inappropriate fasting time before the starting of ENT (QINT III) met the goal in the years of 2011 (12.9%) and 2012 (19.4%) and the indicator which evaluated the frequency of diarrhea episodes in patients receiving ENT (QINT VII) reached the goal established only in 2011 (9.2%). In the other hand, indicators that evaluated the frequency of days with adequate supply of energy (QINT V) and digestive fasting > 24 hours (QINT VI) in patients under ENT did not contemplate the goal proposed by the literature during the years of study (Table IV).

In PNT, the indicator that verified the screening of nutritional risk (QINT I), the estimation of energy and protein needs (QINT II) and the frequency of days with adequate supply of energy (QINT IV) met the goal in all years evaluated. However, the indicator that evaluated the rate of oral intake recovery (QINT V) met the goal only in 2010 (42.8%) and 2012 (35.2%), and the indicator that evaluated the inappropriate fasting time before the starting of PNT (QINT III) never met the goal in all years evaluated (Table IV).

Therefore, in all of the indicators for ENT, the goal was achieved by 55% in 2010 (5 QINT), 77% in 2011 (7 QINT) and 66% in 2012 (6 QINT). For PNT, target was reached by 80% (4 QINT), 60% (3 QINT) and 80% (4 QINT), respectively in 2010, 2011 and 2012. All percentages of suitability for applied/contemplated QINT according to the years of study are showed in Table V.

DISCUSSION

Nutritional risk assessment is one of the most important aspects that integrate the procedure for the care of all hospitalized patients and it is essential for those who demand intensive care. Recently, the American guideline for NT in critically ill patients highlighted the importance of a careful monitoring on ENT and PNT for those who were diagnosed at high nutritional

Table I. Applied quality indicators in nutrition therapy. University Hospital of the University of São Paulo 2010-2012

Indicator	Formula	Goal
Frequency of caring out nutrition screening	No. of nutritional screening x 100 / No. of ICU admissions	≥ 80%
Frequency of estimated energy and protein needs in patients on NT	No. of patients with measurement of energy expenditure/protein x 100 / Nº of patients on NT	≥ 80%
Frequency of patients with inadequate fasting time before starting NT (> 48 h)	No. of patients on fasting > 48 h candidate to NT x 100 / total number of patients candidate to NT	< 20%
Frequency of patients with ENT infused volume above 70% of prescribed volume	No. of patients with NT infused volume > 70% x 100 / Total number of patients on NT	> 80%
Frequency of days of adequate supply of energy to patients on NT	No. of days with caloric offer between 25 a 35 kcal/kg x 100 / total number of days in the period evaluated	≥ 80%
Frequency of digestive fasting > 24 hours in patients on ENT	No. of patients in fasting > 24 h x 100 / No. of patients on ENT	≥ 10%
Frequency of diarrhea episodes in patients on ENT	No. of days with diarrhea x 100 / Total number of days on ENT	≥ 10%
Frequency of involuntary withdrawal of enteral feeding tubes in patients on ENT	No. of involuntary withdrawal of enteral feeding tube x 100 / Total number of patients on ENT x no. of days with enteral feeding tube	< 5%
Frequency of patients with oral intake recovery on NT	No. of patients which oral intake recovery x 100 / Total number of patients on NT	> 30%

ICU: Intensive Care Unit; NT: nutrition therapy; ENT: enteral nutrition therapy.

Table II. Demographic and clinical characteristics patients under enteral nutrition therapy in the period from 2010 to 2012. University Hospital of the University of São Paulo

Characteristics	2010 (n = 31)	2011 (n = 31)	2012 (n = 31)	*p*	Total (n = 93)
Genre, n (%)					
Female	10 (32.3)	10 (32.3)	12 (38.7)	0.791	32 (34.4)
Male	21 (67.7)	21 (67.7)	19 (61.3)		61 (65.6)
Age, years oucome (%)	60.6 (± 16.9)*	49.9 (±15.5)	56.5 (± 18.4)	0.05	55.7 (± 17.4)
Discharge from ICU	19 (61.3)	25 (80.7)	22 (74.2)	0.161	66 (72.0)
Death	12 (38.7)	6 (19.4)	9 (25.8)		27 (28.0)
Admitting diagnosis (%)					
Respiratory	9 (29.1)	11 (35.4)	8 (25.8)	0.779	28 (30.1)
SIRS	4 (12.9)	7 (22.6)	3 (9.7)	0.395	14 (15.1)
Neurological	5 (16.1)	7 (22.6)	5 (16.1)	0.790	17 (18.3)
Cardiovascular	7 (22.6)*	1 (3.2)	2 (6.5)	0.045	10 (10.7)
Hepatic	1 (3.2)	1 (3.2)	3 (9.7)	0.449	5 (5.4)
Surgery	1 (3.2)	2 (6.5)	8 (25.8)**	0.020	11 (11.8)
Others	4 (12.9)	2 (6.5)	2 (6.4)	0.607	8 (8.6)
SAPS III	60,9 (± 13.8)	59.2 (± 16.9)	60.7 (± 14)	0.888	60.3 (± 14.9)
CRP, mg/L	126.9 (+ 94.8)*	201.5 (± 123.9)	189.4 (± 130.7)	0.031	172.6 (± 120.5)

*Qualitative variables were analyzed by χ^2 test, and the results were expressed in absolute values followed by frequency. Quantitative variable were analyzed by t-Student test, and the results expressed in mean and standard deviation. Significance level $p < 0.05$. *2010 vs. 2011; **2012 vs. 2011. ICU:Intensive Care Unit; SIRS: Systemic Inflammatory Response Syndrome; SAPS: Simplified Acute Physiology Score; CRP: C-reactive protein.*

Table III. Demographic and clinical characteristics patients under parenteral nutrition therapy in the period from 2010 to 2012. University Hospital of the University of São Paulo

Characteristics	2010 (n = 14)	2011 (n = 21)	2012 (n = 17)	*p*	Total (n = 52)
Genre n (%)					
Female	5 (35.7)	5 (23.8)	7 (41.2)	0.307	17 (32.7)
Male	9 (64.3)	16 (76.2)	10 (58.8)		35 (67.3)
Age, years oucome (%)	54.7 (± 21.1)	55.9 (± 17)	63.8 (± 10.7)	0.259	58.1 (± 16.7)
Discharge from ICU	9 (64.3)	5 (23.8)*	6 (35.3)	0.033	20 (38.5)
Death	5 (35.7)	16 (76.2)	11 (64.7)		32 (61.5)
Adimitting diagnosis (%)					
Surgery	12 (85.8)	17 (81.0)	15 (88.2)	0.649	44 (84.6)
Hepatic	1 (7.1)	0 (0.0)	1 (5.9)	1.00	2 (3.9)
Others	1 (7.1)	4 (19.0)	1 (5.9)	0.223	6 (11.5)
SAPS III	57.4 (± 22.6)	57.5 (± 17.5)	62.6 (± 11.0)	0.683	59.0 (± 17.3)
CRP, mg/dL	203.4 (± 92.3)	215.3 (± 94.2)	243.7 (± 98.9)	0.443	221.4 (± 94.8)

*Qualitative variables were analyzed by χ^2 test, and the results were expressed in absolute values followed by frequency. Quantitative variable were analyzed by t-Student test, and the results expressed in mean and standard deviation. Significance level $p < 0.05$ *2010 vs. 2011; ICU: Intensive Care Unit; SIRS: Systemic Inflammatory Response Syndrome; SAPS: Simplified Acute Physiology Score; CRP: C-reactive protein.*

Table IV. Quality Indicators in Nutrition Therapy at Intensive Care Unit, according to the year studied. University Hospital of the University of São Paulo 2010-2012

Indicators applied on ENT	2010 (%)	2011 (%)	2012 (%)	Goal
I Frequency of caring out nutrition screening	100	100	100	≥ 80%
II Frequency of estimated of energy and protein needs in patients on ENT	100	100	100	≥ 80%
III Frequency of patients with inadequate fasting time before starting ENT (> 48 h)	22.6	12.9	19.4	< 20%
IV Frequency of patients with ENT infused volume above 70% of prescribed volume	83.8	87.1	87.1	> 80%
V Frequency of days of adequate supply of energy to patients on NT	75.6	73.6	72.3	≥ 80%
VI Frequency of digestive fasting > 24 hours	16.1	19.3	16.1	≤ 10%
VII Frequency of diarrhea episodes in patients on ENT	10.5	9.2	10.7	≤ 10%
VIII Frequency of involuntary withdrawal of enteral feeding tubes in patients on ENT	0.2	0.2	0.2	< 5%
IX Frequency of patients with oral intake recovery on enteral nutrition therapy	48.3	77.4	61.2	> 30%
Indicators applied on PNT	**2010 (%)**	**2011 (%)**	**2012 (%)**	**Goal**
I Frequency of caring out nutrition screening	100	100	100	≥ 80%
II Frequency of estimated of energy and protein needs in patients on PNT	100	100	100	≥ 80%
III Frequency of patients with inadequate fasting time before starting PNT (> 48 h)	71.4	61.9	82.3	< 20%
IV Frequency of days of adequate supply of energy to patients on NT	87.3	83.8	85.1	≥ 80%
V Frequency of patients with oral intake recovery on parenteral nutrition therapy	42.8	23.8	35.2	> 30%

NT: nutrition therapy; ENT: enteral nutrition therapy; PNT: parenteral nutrition therapy.

Table V. Quality Indicators in Nutrition Therapy at Intensive Care Unit, percentage of suitability according to the year studied. University Hospital of the University of São Paulo 2010-2012

Year / ENT	No. of applied indicators	No. of contemplated indicators	Percentage of suitability
2010	9	5	55%
2011	9	7	77%
2012	9	6	66%
Year / PNT	**No. of applied indicators**	**No. of contemplated indicators**	**Percentage of suitability**
2010	5	4	80%
2011	5	3	60%
2012	5	4	80%

ENT: enteral nutrition therapy; PNT: parenteral nutrition therapy.

risk (22). However, it appears that this specific group of patients is prone to the adverse effects of NT such as re-feeding syndrome, underfeeding/overfeeding, hypoglycemia/hyperglycemia, abdominal distension, nausea, vomiting, constipation, diarrhea and prolonged fasting; all which could result in a negative clinical outcome (5,6,18,19,22,23). These aforementioned complications that occur while applying NT could be gradually reduced or even avoided if specific protocols were implemented in NT as such as systematic application of QINT (9,10,19-22,24,25).

In our study, the QINT I that evaluated the frequency of nutritional screening for patients receiving ENT or PNT resulted in 100% of adequacy in all years considered for the study. After implementing this same QINT in 72 ICU patients, Bezerra et al. (26) also got similar results, reinforcing the importance of nutritional risk assessment in critically ill patients. A careful monitoring of the nutritional risk in critically ill patients conducted the MNTT to establish daily reviews of NT procedures in order to prevent eventual side effects of ENT and PNT during hospitalization. Therefore, the

nutritional screening guides the nutritional care, considering the presence of risk or not in the patient (22,23).

Recently the Nutrition Risk in Critically ill (NUTRIC) was considered the best tool for assessing nutritional risk in critically ill patients (22). However, before the completion of the protocols adopted by this research, the "modified NUTRIC" version without considering the IL-6 value was not available yet (23).

Besides nutritional screening, to estimate the energy and protein needs becomes the starting point for directing NT in the severely ill patient. Considering the obstacles that exist in nutritional assessment for those patients, such as sedation, intubation, anasarca, biochemical tests altered by the acute phase reactions, polytrauma and even the absence of close family or relatives. In this context, it is mandatory in ICU the use of formulas in order to estimate height, weight and energetic and proteic expenditure (22). Even when considering these obstacles, the QINT II that evaluated the frequency of estimated energetic and proteic expenditure for patients under NT met the goal established at $\geq$ 80% in all three years of study, which reiterates the MNTT efforts to individualize NT. Martins et al. (27), in a prospective study with 200 patients and Oliveira Filho et al. (28) in a retrospective study with 551 ward and ICU cancer patients, also found $\geq$ 80% of adequacy in the same QINT. With the intention of define the energy needs for the severely ill patients, the indirect calorimetry is the golden standard. However, in clinical practice, the predictive equations which estimate the energy expenditure still prevail due the availability of the calorimetric method (22).

The QINT III that evaluated the frequency of patients with inadequate fasting time (> 48 hours) before starting ENT presented values of 22% in 2010, 12.9% in 2011 and 19.4% in 2012. In 2010, this QINT was outside the established goal, which led the MNTT to reinforce the importance of early ENT commitment for critically ill patients and consequently achieved the established goal on the following years of the study.

Heyland et al. (29) in a multicentric and cohort study with 5497 patients found in those units with NT protocols that the average of hours to start ENT was 42.1 hours, while in units without protocols the mean time was 57.1 hours which was a significant difference between such units ($p = 0.0003$). Oliveira Filho et al. (30) evaluated the ENT quality at nutritional risk, critically ill and cancer patients (NUTRIC $\geq$ 6), which also highlighted the early start of this therapy. The early ENT (24-48 hours) is associated with least infectious complications, less intestinal permeability and proliferation of inflammatory cytokines, reduced mechanical ventilation time, better dietary tolerance, as well as a tendency for reduced mortality and ICU length of stay (19,22,29).

On the other hand, after conducting the same QINT III for patients receiving PNT, all values found in the present study differed from the goal of 20%. It is worth noting that in three years of the study, more than 80% were surgery patients and 90% of those had previous abdominal surgeries. The EPaNIC study found that late parenteral nutrition, was associated with fewer infections, lower incidence of cholestasis, enhanced recovery, and lower health care costs, when compared with the early parenteral (31).

The recommendations of guidelines for nutrition support in critically ill patients differ from each other. ESPEN guidelines advocated early parenteral nutrition up to 48 hours after ICU admission for patients unable to be feeding by enteral route (18). In contrast, American (5) and Canadian guidelines (32) proposed that for patients without nutrition impairment the initiation of PNT can wait until 8 days (192 hours). However, the American guideline has recently complemented its recommendations in order to emphasize the care for malnourished patients in ICU. Therefore, PNT must be initiated as soon as possible for patients at high nutritional risk (22).

After applying the QINT VI that analyzed patients who received > 70% of prescribed ENT volume, the present study met the goal during all three years monitored. Oliveira Filho et al. (30), encountered an average of > 80% of adequacy in infused ENT volume in oncological patients with NUTRIC $\geq$ 6 and under MV, while Couto et al. (33) showed values < 80% in politrauma patients and also under MV. In intensive care, to manage that patients receive a proper amount of prescribed ENT is a daily struggle, considering gastrointestinal intolerance such as abdominal distension, diarrhea and vomit or even pauses for procedures such as extubation or surgeries (30,34). Discrepancies observed between prescribed and infused volume had been reported by several authors as one of the main factors for hypoalimentation (5,18,19,29). McClave et al. (5) found that those patients who received volume of EN close to 100%, progressed with lower infectious complication rates, reduced hospital length of stay and with a tendency to a lower mortality rate.

Regarding the QINT that assessed the frequency of days of adequate supply of energy in patients with ENT (QINT V), it was observed values from 72.3 to 75.6% of adequacy in the three years of study. Several studies reported the main barriers to achieve the prescribed energy in patients with ENT, such as non-compliance with protocols and logistic failure in nutritional service (5,29,35). The hemodynamic instability, hours to nutritional goal and extubation, for example, also were the main reasons that negatively impact the energy deficit in critical oncologic patients at high nutritional risk (30). Heyland et al. (36) after evaluating 3,390 critically ill patients, under MV and at high nutritional risk, found 61.2% of adequacy in supply of energy in ENT patients and 74% of them did not receive at least 80% of their nutritional needs. In this study, the majority of critically ill patients, including high nutritional risk patients, fail to receive adequate nutritional intake.

However, for patients receiving PNT (QINT IV), it was verified a range between 83.8 to 87.3% of adequacy in the years analyzed. Shiroma et al. (37) showed that the infusion of more than 80% of the caloric needs from PNT led to hospital discharge in ward and ICU patients. The great advantage in PNT, even without gastrointestinal use, is to optimize the supply of energy in the early days of ICU stay, while there is a good metabolic and organic tolerance which can be monitored through routine biochemical tests (38). Besides, PNT is independent of the digestive tract and therefore is not negative influenced by long fasting periods for tests or procedures (e.g. endoscopy, computed tomography and extubation) in comparison to ENT and so the caloric target can be fully achieved daily.

The QINT VI analyzed the frequency of digestive fasting for more than 24 hours in patients receiving ENT and, during all three

years, our results were outside the goal. Brandão and Rosa (39) have also not met the goal in this QINT after evaluating critically ill patients during 31 days. Many factors might contribute to the prolonged fasting in severely ill patients in ENT, such as subsequent attempts of extubation, especially in patients with worse respiratory function. Furthermore, gastrointestinal complications such as elevated gastric residue and uncontrollable diarrhea, fluids, electrolytes and acid-base imbalance (38), as well as hemodynamic instability (22) contribute to an increase in fasting time and consequently, can also increase the caloric and protein deficit, length of hospital stay and mortality in ICU (40).

It is still necessary to even consider logistic issues that might interfere, such as surgery centers being unavailable for tracheostomy, as well as full schedule when scheduling exams (*e.g.* computed tomography). This can lead to a prolonged fasting period and even might not successfully undergo the procedure or exams. These results point to the need of strategic planning and, since 2012, tracheostomy procedures were conducted inside the ICU as the computed tomography had a reserved time and date for all ICU patients as a way to ensure a better schedule for the patients.

Regarding evaluation of the frequency of diarrhea in patients on ENT (IQTN VII), in 2011 the target was achieved, as it was found frequency of 9.2% of days with diarrhea. One the other hand, the values in 2010 (10.5%) and 2012 (10.7%) were bordering the target established. Bittencourt et al. (41), in an observational study with 110 patients, applied the diarrhea indicator and found a prevalence of 13%, while Martins et al. (27) met 8%. In the literature, there are records with higher percentages of episodes of diarrhea, with values ranging from 14% to 41% of the days on ENT (41). Characteristics such as age, medical condition, hospital stay and type of EN are some factors that may compromise the bowel transit. Another important point to consider is the very frequent use of antibiotics in critically ill patients, leading to dysbiosis which can result in diarrhea. The contamination by *Clostridium difficile* should also be considered (5,6,22).

When the values related to involuntary withdrawal of enteral feeding tube in patients on ENT (IQTN VIII) were evaluated, the results of all years were according to the proposed target. In the study by Martins et al. (35), the values were 6% for patients admitted to wards and 26% for patients in ICU, while Cervo et al. (42) found 4.6% for patients in critical care. The results found in the present study reflected the efforts of the nursing crew in all procedures related to the EFT, as well as, the protocols that had been developed in order to standard professional actions.

The oral intake recovery was another important aspect in our investigation. The QINT showed an adequacy of 100% in all the years evaluated in the patients receiving ENT (QINT IX), while in PNT, only in the year of 2011 (23.8%), it was not possible to achieve the goal proposed. It is worth noting that in 2011, 72.6% of the patients who received PNT had died, and that outcome turns impossible to achieve the goal. Bezerra et al. (26) has also achieved a 100% rate of adequacy for this QINT after evaluating 72 patients under ENT and intensive care. In our study, even disregarding the patients under PNT in 2011, the results in this QINT were obtained only because of a rigorous monitoring conducted by the MNTT in partnership with the speech therapy team. In our team, the QINT of rate of oral intake recovery was considered as one of the most important aspects when evaluating the quality of NT within the ICU. Considering that the oral intake is the most physiological channel for nourishment (43), one must establish that oral intake might result in ample benefits for patients under ENT or PNT, both in psychosocial and family levels.

Marshall et al. (44) has highlighted in recent studies the importance of active family participation as a strategy to optimize nutritional support to critically ill patients. The constant presence of the family and relatives during ICU stay might contribute to an increase in oral intake, mainly for elderly patients, because those are the ones who probably display a smaller percentage of oral intake recovery when compared to adult patients (34).

Considering all the three evaluated years, the QINT percentage of adequacy varied from 55-77% for ENT and 60-80% for PNT which presented a concern about quality as well as it brought aspects that need to be managed. The assessment of nutritional assistance quality must ensure the best of what NT can provide to patients, achieving as a result the recovery/maintenance of the nutritional status at reduced costs, ensuring a long term quality of life as well (9,10).

The Joint Comission on Acreditation of Health Care Organization (JCAHCO) recognized over a decade ago the need of constantly evaluation and monitoring of patients who are subjected to NT (45). Hence, the application of QINT is considered now as an adequate tool to better evaluate the quality of nutritional assistance provided in medical services. These QINT can provide a plausible comparison between different health institutions, as well as a feasible guidance for future strategic actions and improvement of results (9,10,21).

It becomes an important detail that trained health professionals, comitted to specific NT protocols and who comply with a quality-oriented hospital management program and who keep themselves familiarized with these QINT results will provide feasible benefits to patients, to the hospital and the public health by ensuring the quality in all services (46). This is a continuous process of evaluation which tends to always apply NT guidelines to clinical practices, by constantly reviewing said processes in order to improve the assistance provided.

Currently, what poses as a challenge to professionals who are NT specialists is defining which QINT are needed and could possibly be considered as applicable at clinical nutrition services in order to improve the nutritional care for the hospitalized patient. There are no standardized rules in order to establish quality indicators as they will reveal themselves as a consequence of the needs and experiences developed at each health institution (46).

We emphasize that our study has some limitations because it was carried out in a single school hospital, which had only one adult ICU for medical and surgical patients, so that it resulted in a small study sample and presented a limited number of professionals.

CONCLUSION

After three years of research, the percentage of QINT adequacy varied between 55% and 77% for ENT and 60% and 80% for PNT. There is the establishment of individualized nutrition target, with

early introduction of ENT, but not PNT. The average volume of ENT administered is above 70% and administration of calories in PNT is more adequate. There was an expressive rate of oral intake recovery in ENT, which can contribute for a long term quality of life for those patients. The results were only made possible by the efforts of a multidisciplinary team and the continuous re-evaluation of the procedures in order to maintain the nutritional assistance for patients at nutritional risk.

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