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Nutrición Hospitalaria

Trabajo Original

Paciente crítico

Validation of the nutritrauma concept for the detection of potential harmful effects of medical nutritional treatment in critically ill patients in real life

Validación del concepto de nutritrauma para la detección de posibles efectos adversos del tratamiento nutricional médico en pacientes críticos en la vida real

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Abstract

Introduction: medical nutritional treatment (MNT) can be complex and may be associated with potential metabolic complications, which has been recently described as nutritrauma.

Objective: the aim of our work is to describe whether the application of the nutritrauma concept in real life is feasible and useful to detect the metabolic complications associated with the prescription of MNT.

Material and methods: in this descriptive, prospective study at a single center we enrolled 30 consecutive critically ill patients in a 14-bed medical-surgical intensive care unit. The nutritrauma strategy implementation was based in four "M" steps: Metabolic screening, MNT prescription, biochemical Monitoring, and nutritional Management.

Results: we analyzed 28 patients (mean age, 69.7 ± 11.3 years; APACHE II, 18.1 ± 8.1; SOFA, 7.5 ± 3.7; Nutric Score, modified, 4.3 ± 2.01, and mean BMI, 27.2 ± 3.8). The main cause of admission was sepsis (46.4 %). Length of ICU stay was 20.6 ± 15.1 days; 39.3 % of subjects died during their ICU stay. Enteral nutrition (82.1 %) was more frequent than parenteral nutrition (17.9 %). During nutritional monitoring, 54 specific laboratory determinations were made. Hyperglycemia was the most frequent metabolic alteration (83.3 % of measurements). Electrolyte disturbances included hypocalcemia (50 %), hypophosphatemia (29.6 %) and hypokalemia (27.8 %). The most frequent lipid profile abnormalities were hypocholesterolemia (64.8 %) and hypertriglyceridemia (27.8 %). Furthermore, nutritional prescription was modified for 53.6 % of patients: increased protein dosage (25 %), increased calorie dosage (21.4 %) and change to organ-specific diet (17.8 %).

Conclusions: in conclusion, the application of the nutritrauma approach facilitates detection of metabolic complications and an evaluation of the appropriate prescription of MNT.

Keywords:

Metabolic complications. Critically ill. Nutritrauma. Medical nutrition therapy. Enteral nutrition. Parenteral nutrition.

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Resumen

Introducción: el tratamiento médico nutricional (TMN) puede ser complejo y asociarse a potenciales complicaciones metabólicas, lo que se ha descrito recientemente como "nutritrauma".

Objetivo: el objetivo de nuestro trabajo es describir si la aplicación del concepto de nutritrauma en la vida real es factible y útil para detectar las complicaciones metabólicas asociadas a la prescripción del TMN.

Materiales y métodos: en este estudio unicéntrico y prospectivo describimos el seguimiento de 30 pacientes críticos consecutivos en una unidad de cuidados intensivos médico-quirúrgica de 14 camas. La implementación de la estrategia nutritrauma se basó en cuatro pasos "M": valoración Metabólica, prescripción del TMN, Monitorización bioquímica y Manejo nutricional.

Resultados: se analizaron 28 pacientes (edad media: 69,7 ± 11,3 años; APACHE II: 18,1 ± 8,1; SOFA: 7,5 ± 3,7; Nutric Score modificada: 4,3 ± 2,01, e IMC medio: 27,2 ± 3,8). La principal causa de ingreso fue la sepsis (46,4 %). La duración de la estancia en UCI fue de 20,6 ± 15,1 días y el 39,3 % fallecieron durante la estancia en UCI. La nutrición enteral (82,1 %) fue más frecuente que la parenteral (17,9 %). Durante el seguimiento nutricional se realizaron 54 determinaciones analíticas específicas. La hiperglucemia fue la alteración metabólica más frecuente (83,3 % de las determinaciones). Las alteraciones electrolíticas fueron: hipocalcemia (50 %), hipofosfatemia (29,6 %) e hipopotasemia (27,8 %). Las alteraciones del perfil lipídico más frecuentes fueron la hipocolesterolemia (64,8 %) y la hipertrigliceridemia (27,8 %). Además, se modificó la prescripción nutricional en el 53,6 % de los pacientes: aumentar la dosis proteica (25 %), aumentar la dosis calórica (21,4 %) y cambiar a una dieta específica de órgano (17,8 %).

Conclusión: en conclusión, la aplicación de la estrategia nutritrauma facilitó la detección de complicaciones metabólicas y la evaluación de la adecuada prescripción del TMN.

Palabras clave:

Complicaciones metabólicas. Paciente crítico. Nutritrauma. Tratamiento médico nutricional. Nutrición enteral. Nutrición parenteral.

INTRODUCTION

Treatments for organ failure can present deleterious effects on critically ill patients, so adherence to institutional protocols is essential. However, despite the fact that having protocols is a basic step to improve healthcare practice, their existence does not guarantee their application (1), so in certain contexts some tools can be useful to facilitate the dissemination and implementation of protocols. Simplifying and grouping key elements of complex processes has been proven useful for implementing safety and/or quality strategies (2-4). Unequivocally, identifying the project facilitates the engagement, education, execution and evaluation of the protocol objectives. These 4 steps have been considered a useful methodology for the development of these strategies (5).

One of the resources to facilitate the implementation of protocols or strategies is to designate the process to be monitored unequivocally, if possible by associating it with a key concept through a specific name. To create a concept to group different events related with a cause or procedure can be useful to increase awareness and spread its existence. This is the case of barotrauma (6), to prevent injuries associated with mechanical ventilation, dialytrauma (7), to avoid injuries associated with renal replacement techniques in critically ill patients, or the bacteremia zero concept (8), to reduce catheter-related bacteremia.

Medical nutritional treatments (MNT) in critically ill patients can be complex, mainly during the first days of illness. The ideal prescription of calories, proteins, fiber or electrolytes is difficult because it can be affected by several factors such as basal patient conditions, impact of acute illness, endogenous production or route of administration, so a special monitoring is suggested (9,10). Over- and under-prescription of macronutrients is associated with worse prognosis. Moreover, critically ill patients can present comorbid conditions predisposing to refeeding syndrome (11,12).

Recently, with the idea to facilitate the monitoring of the metabolic effects of initial nutrition the concept nutritrauma was introduced to group together the potential metabolic complications associated with an inadequate medical nutritional treatment prescription (10). The idea was that by creating this concept, awareness about this kind of complications and their active detection, treatment and monitoring would be facilitated. However, while only conceptualization can be insufficient, it can facilitate the engagement and education of practitioners. Therefore, our idea was to implement a structured strategy based on engagement, education, execution and evaluation of the prevention of nutritrauma. The aim of this work was to describe the nutritrauma strategy implementation in real life, and analyze if it allows to detect metabolic complications and inappropriate prescription of MNT in critically ill patients.

MATERIALS AND METHODS

SUBJECTS AND STUDY DESIGN

A unicenter prospective study was developed in a medical-surgical intensive care unit with 14 beds at a university hospital. We included 30 consecutive critically ill patients that received MNT during the first trimester of 2020. Patients were monitored from admission to ICU discharge.

Inclusion criteria were patients admitted to intensive care unit, aged 18 or older, with at least 2 organ failures, who needed enteral or parenteral nutrition for at least 48 hours. Exclusion criteria were patients with a high subjective probability of receiving oral nutrition or dying during the first 72 h. The present study was approved by the Ethics Committee of the Consorci Sanitari del Maresme (Ref. 52/2019).

THE "NUTRITRAUMA STRATEGY" IMPLEMENTATION

The nutritrauma strategy was based on consecutive actions (Fig. 1) following the 4E strategy:

– *Engage and Educate:* A preliminary multidisciplinary formative session was conducted, in which the incidence of meta-

bolic complications and their incidence on the clinical evolution of critically ill patients was presented. We emphasized the concept that most of those complications can be easily detected and treated if a structured protocol is applied. A structured and validated protocol was redacted and diffused through the hospital's Nutritional Commission.

– *Execute:* Informative posters were designed (Fig. 2) and a specific biochemical profile was created in the biochemical laboratory petitionary. All patients with medical nutritional treatment should be evaluated periodically for the presence of nutritrauma. The strategy was structured in four M steps: Metabolic screening, MNT design, Monitoring, and Management (Fig. 3).
– *Evaluate:* Even though a daily analysis of nutritional requirements is mandatory, we proposed a weekly feedback clinical session, that was scheduled to discuss nutritional strategies and favor learning and engagement.

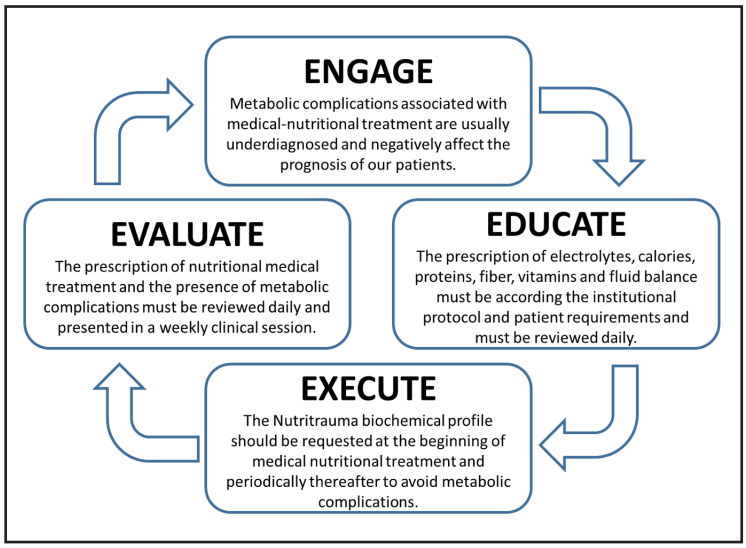

Figure 1.

The application of the 4E strategy (5) to translate knowledge to clinical practice.

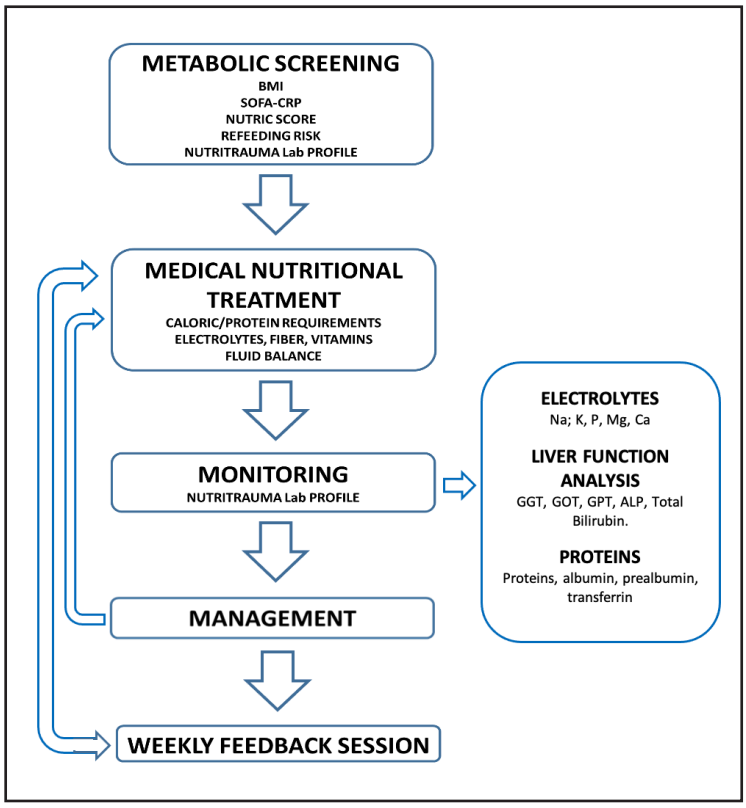

Figure 2.

Informative poster (Na: sodium; K: potassium; P: phosphorus; Mg: magnesium, Ca: calcium; GGT: gamma-glutamyl transferase; GOT: glutamic oxaloacetic transaminase; GPT: glutamic pyruvic transaminase; ALP: alkaline phosphatase; CRP: C-reactive protein).

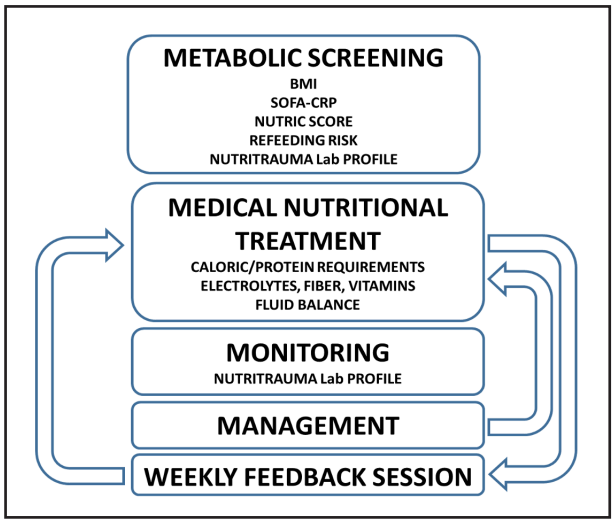

Figure 3.

Schema for "Execute" the nutritrauma strategy into clinical practice (BMI: body mass index; SOFA: Sequential Organ Failure Assesment; CRP: C-reactive protein; Lab: Laboratory).

THE EXECUTION OF THE NUTRITRAUMA STRATEGY

Metabolic screening

During the first 24 hours of admission, the severity of illness [Sequential Organ Failure Assessment (SOFA) (13), Acute Physiology and Chronic Health Evaluation II (APACHE II) (14)], nutritional risk evaluation (modified Nutric Score) (15), and risk of refeeding syndrome assessment (16) were performed.

Medical nutritional treatment prescription

Initial nutrition prescription was defined according to the institutional protocol. Caloric and protein requirements were estimated separately, using weight-based formulas (using adjusted weight if BMI was > 30). The initial calorie prescription was 10-15 kcal/kg/day if there was refeeding syndrome risk, and 20 kcal/kg/day if there was no risk. Calorie prescription was increased progressively according to clinical status. The enteral and/or parenteral route was used to achieve caloric objectives. Protein prescription was adjusted to clinical status (from 1.2 to 2 g/kg/day or 2 g/kg ideal weight/day if BMI was between 30 and 40) (17).

Biochemical monitoring

A specific blood profile was created (named Nutritrauma) that included:

- *Electrolytes:* sodium (Na); potassium (K), phosphorus (P), magnesium (Mg), calcium (Ca).
- *Liver function analysis:* gamma-glutamyl transferase (GGT), glutamic oxaloacetic transaminase (GOT), glutamic pyruvic transaminase (GPT), alkaline phosphatase (ALP), total bilirubin (and indirect and direct bilirubin if it was abnormal).
- *Proteins:* total proteins, albumin, prealbumin, transferrin.
- *Lipids:* total cholesterol, triglycerides.
- *Inflammation:* C-reactive protein (CRP), lymphocytes.

Nutritional management

Physicians must design their patients' treatments according to institutional protocols, based on SEMICyUC Guidelines (17). The Nutritrauma blood analysis was performed at nutrition initiation (day 0), at clinical criteria in the presence of abnormal values or nutritional risk, on days 2 and 5, and weekly. Every Wednesday a one-hour multidisciplinary clinical session was performed, attended by the medical ICU staff, a nutritionist, a pharmacist, a rehabilitation physician, and a physiotherapist.

DATA COLLECTION

The study data included age, sex, weight, height, body mass index (BMI), APACHE-II, and SOFA. Blood levels of total proteins, albumin, prealbumin, transferrin, triglycerides, total cholesterol, CRP, liver function (GGT, GOT, GPT, ALP), and electrolytes (Na, K, Ca, Mg, P] were recorded for each study participant.

During the Wednesday multidisciplinary clinical session, nutritional treatment changes were collected, such as increase of protein and/or caloric dosage, change to an "organ-specific diet" (L-arginine-enriched diets, specific diabetic diets, and diet for enteral nutrition-associated diarrhea) or change to a fiber-enriched diet.

STATISTICAL ANALYSIS

Data were collected in Excel® through individual questionnaires, which were anonymized and exported for analysis to the SPSS version 26.0 statistical package (IBM SPSS, Armonk, NY, USA) to perform a descriptive analysis of means or medians based on normality for quantitative variables, and of proportions for descriptive variables. Normality was analyzed using the Shapiro-Wilk test. No comparative statistical analyses were performed, according to the descriptive nature of the study.

RESULTS

PATIENTS CHARACTERISTICS

From January to March of 2020, 30 consecutives patients were included. Two of them died before initiation of MNT. Mean age was 69.7 ± 11.3 years, 50 % were female with an admission APACHE II

of 18.1 ± 8.1, admission SOFA of 7.5 ± 3.7, and modified Nutric Score of 4.3 ± 2.01. Four patients (14.4 %) had risk of refeeding syndrome. The most frequent disease on admission was sepsis (46.4 %), followed by cardiovascular disease (21.4 %) and respiratory failure (17.8 %). The main MNT route of administration was enteral nutrition (82.1 %). The adequacy of starting time of the nutritional treatment was 92.8 % [understood as early initiation (24-48 hours) of MNT after hemodynamic stabilization]. The patients stayed 20.6 ± 15.1 days in the ICU and 39.3 % died during their ICU stay. The main characteristics of the 28 patients are described in table I.

Table I. Main patient´s characteristics

Main patient's characteristics	*n* = 28
Age (years); mean (± SD)	69.7 ± 11.3
Male / Female	14 (50 %) / 14 (50 %)
Weigh (Kg); mean (± SD)	77.4 (± 12.9)
BMI; mean (± SD)	27.2 (± 3.8)
APACHE II; mean (± SD)	18.1 (± 8.1)
SOFA Score; mean (± SD)	7.5 (± 3.7)
Nutric Score; mean (± SD)	4.5 (± 1.9)
Risk of refeeding syndrome; *n* (%)	4 (14.4 %)
Disease on admission; n (%)	
Sepsis	13 (46.4 %)
Cardiovascular	6 (21.4 %)
Respiratory	5 (17.8 %)
Miscellanea	4 (14.4 %)
Enteral / Parenteral nutrition	23 (82.1 %) / 5 (17.9 %)
Adequacy of starting time; *n* (%)	26 (92.8 %)
Hiperglycaemia; *n* (%)	23 (83.3 %)
Fluid overload; *n* (%)	28 (100 %)
Length of ICU stay (days); mean (± SD)	20.6 (± 15.1)
Mortality; *n* (%)	11 (39.3 %)

Kg: kilograms; BMI: body mass index; APACHE II: Acute Physiology and Chronic Health Evaluation II; SOFA: Sequential Organ Failure Assessment; ICU: intensive care unit.

DETECTION OF METABOLIC COMPLICATIONS

During follow-up, 54 lab determinations were made (Table II). Hyperglycemia was the most frequent metabolic alteration during evolution (83.3 % of patients). Electrolyte disturbances were also frequent: hypocalcemia, adjusted for albumin (50 %), hypophosphatemia (29.6 %) and hypokalemia (27.8 %). After identifying ion deficit, supplementation was started in 100 % of the cases. Regarding liver function, 31.5 % of the patients had bilirubin elevated > 2 times above its baseline value, this not being associated with MNT. Similarly, 85.2 % of the patients presented cholestasis, none of them being treated with parenteral nutrition. Analyzing the lipid profile, hypocholesterolemia (64.8 %) was the most frequent laboratory abnormality followed by hypertriglyceridemia (27.8 %), and during serial tests both cholesterol and triglyceride levels normalized without specific treatment. All protein-related biochemical parameters were low during practically the entire follow-up: hypoproteinemia (90.7 %), hypoalbuminemia (88.8 %), low transferrin (87 %) and low prealbumin (72.2 %). Finally, 100 % of the patients presented anasarca in their evolution.

MEDICAL NUTRITIONAL TREATMENT MODIFICATIONS DURING MULTIDISCIPLINARY SESSIONS

During the multidisciplinary sessions inappropriate prescription was detected in 53.6 % of patients. All of them suffered at least one MNT modification, 3.6 % of the patients suffered two modifications, and another 3.6 % suffered three modifications during their evolution in the ICU. The most frequent modification made was increasing protein dosage (25 %), followed by increasing calorie dosage (21.4 %), and change to an organ-specific diet (17.8 %). A change to a fiber-enriched diet was made in 10.7 % of the patients (Table III).

Table II. Detected metabolic complications

Laboratory determinations		*n* = 54
Inflammation		
Lymphopenia; (*n* %)		31 (57.4 %)
C-reactive protein; mean (± SD)		16.5 ± 15.3
Glycaemia		
Hyperglycaemia; (*n* %)		48 (88.8 %)
Electrolytes		
Phosphorus	Hypophosphatemia	16 (29.6 %)
	Hyperphosphatemia	5 (9.2 %)
	Normal phosphorus	33 (61.1 %)

(Continues on next page)

Table II (cont.). Detected metabolic complications

Laboratory determinations		*n* = 54
Electrolytes		
Magnesium	Hypomagnesaemia	4 (7.4 %)
	Hypermagnesaemia	7 (12.9 %)
	Normal magnesium	28 (51.8 %)
Calcium	Hypocalcemia	27 (50 %)
	Hypercalcemia	3 (5.5 %)
	Normal calcium	24 (44.4 %)
Potassium	Hypokalaemia	15 (27.8 %)
	Hyperkalaemia	3 (5.5 %)
	Normal potassium	35 (64.8 %)
Lipids		
Cholesterol	Hypercholesterolaemia	3 (5.5 %)
	Hypocholesterolaemia	35 (64.8 %)
	Normal cholesterol	16 (35.2 %)
Triglycerides	Hypertriglyceridemia	15 (27.8 %)
	Low triglycerides	0 (0 %)
	Normal triglycerides	39 (72.2 %)
Liver function analysis		
Alteration of GGT and ALP		46 (85.2 %)
Alteration of bilirubin		17 (31.5 %)
Proteins		
Total proteins	Hypoproteinemia	49 (90.7 %)
	Normal proteins	5 (9.2 %)
Albumin	Hypoalbuminemia	48 (88.8 %)
	Normal albumin	6 (11.1 %)
Prealbumin	Low prealbumin	39 (72.2 %)
	High prealbumin	1 (1.8 %)
	Normal prealbumin	14 (25.9 %)
Transferrin	Low transferrin	47 (87 %)
	Normal transferrin	7 (12.9 %)

% expressed the number of described alterations with respect to lab determinations. GGT: gamma-glutamyl transferase; ALP: alkaline phosphatase.

Table III. Treatment modifications

Variable		*n* = 28
Patients with treatment modifications; n (%)		15 (53.6 %)
Number of modifications	1	15 (53.6 %)
	2	1 (3.6 %)
	3	1 (3.6 %)
Type of modification	Increase protein dosage	7 (25 %)
	Increase calorie dosage	6 (21.4 %)
	Change to organ-specific diet	5 (17.8 %)
	Diabetic diet	4 (14.2 %)
	L-arginine-enriched diet	1 (3.6 %)
	Change to fiber-enriched diet	3 (10.7 %)

DISCUSSION

Our work is the first clinical report of the application of the nutritrauma concept. In our experience, the grouping of the different complications associated with MNT under the nutritrauma concept facilitated the spread of the notion that inappropriate nutritional prescription can be associated with deleterious metabolic effects. The strategy allowed the detection that nearly 30 % of patients presented hypophosphatemia, 50 % hypoalbuminemia, and 83 % hyperglycemia. Moreover, the combination of the lab screening with periodical clinical multidisciplinary sessions facilitated the systematic reevaluation of MNT, modifying MNT in 53 % of patients.

Our strategy was based on two actions: first, an individual approach (the 4 Ms) to the characteristics and metabolic requirements of patients, and second, a collective approach (a 1-hour weekly session) with different healthcare profiles, including all intensive care physicians, with presence of nurses, pharmacists, physiotherapists, and nutritionists. The individual approach was facilitated by the dissemination of the institutional protocol and the creation of a laboratory profile that includes all the analytical variables to assess nutritional risk and monitor electrolyte and metabolic complications. This laboratory profile was called "Nutritrauma".

Optimal prescription of MNT requires taking into account different aspects that may not be obvious. Scores, such as Nutric Score (15), which has been validated for critically ill patients, can facilitate the evaluation of different conditions that can modify the initial prescription, which is why we consider it essential prior to the administration of MNT. Age, acute disease severity, multiple organ failure, presence of comorbidities, and level of inflammation are factors that define a clinical scenario of nutritional risk and allow the identification of patients who must be specially treated and monitored. However, not only is nutritional risk detected but the approach also allows identification of patients with a higher general risk, thus indicating that these patients will need a greater nursing workload and a physiotherapist, will spend more days in the ICU, and have a greater probability of dying (18-20). So, in our opinion, the Nutric Score should be calculated at the beginning of MNT and can be also useful in general for the critically ill patient.

Glucose blood level alteration is quite common in critically ill patients. Its prevalence is difficult to know as it depends on the cut-off point we consider for hyperglycemia. In our sample, 83.3 % of patients presented glucose levels above 150 mg/dL, data that is consistent with what the actual literature describes. Hyperglycemia may be related to overfeeding, insulin resistance in the acute phase of metabolic response, or even insufficient insulin treatment (21). It is described that hyperglycemia is associated with poor clinical outcomes, increased morbidity and mortality (22), altered immune response causing increased risk of infection, reductions of vascular reactivity and nitric oxide, therefore compromising blood flow and increasing proteolysis, and, being associated with a greater risk of cardiac and renal complications (23). Although treatment of hyperglycemia is associated with better results, strict control is not recommended due to its association with higher mortality. Hence most scientific societies recommend glucose levels between 140 and 180 mg/dL (24). Avoiding hyperglycemia is not enough, it is increasingly important to control glycemic variability, which is also associated with mortality (23,24).

Electrolyte disorders, such as hypocalcemia (50 %) and hypophosphatemia (29.6 %) were very frequent. Calcium is the most plentiful mineral in the body. It has skeletal functions, such as bone tissue building, and non-skeletal ones. The latter are divided into structural, like organelle or cell membrane formation, and regulatory, such as enzymatic reactions to modify cell functions (25). Hypocalcemia may have severe consequences, such as seizures, laryngospasm, prolonged QT or cardiac dysfunction (26). In critically ill patients, abnormal calcium values can be a marker of severity, and is often corrected spontaneously when the primary disease is solved. There is not enough evidence on the management of hypocalcemia, although generalized administration is discouraged to normalize its values, and it is concluded that treatment should be guided by basic decision-making principles (27).

Phosphate has several functions in the body (28) including an energy function (it is part of adenosine triphosphate, ATP), structural function (it is a component of phospholipids in cell membranes and nucleic acids), activation of proteins through phosphorylation, intracellular buffering effect, and mineralization of the bone matrix. Hypophosphatemia produces a wide spectrum of symptoms when there is a depletion of intracellular phosphate. Its deficit produces an increase in the affinity of hemoglobin for oxygen, reducing its delivery at the tissues, and ATP deficit produces alterations in the cellular functions affecting neurological, cardiopulmonary, muscular and hematological systems. In critically ill patients, hypophosphatemia, in addition to the above-described symptoms, is a risk marker for refeeding syndrome, a syndrome associated with high morbidity and mortality (16). As reflected in the latest ASPEN consensus recommendations on refeeding syndrome (29), the identification of hypophosphatemia can help identify patients at risk of presenting with refeeding syndrome.

During the nutritrauma strategy MNT prescription was optimized in 53.6 % of patients. In our experience, one of the most frequent difficulties of MNT for nonexpert physicians, is to adapt its prescription to the metabolic situation (30) and syndromic characteristics (31-33). Many studies show that the number of calories and proteins that critically ill patients receive is lower than the calculated requirements (34,35). This is associated with worse evolution (36). However, an evaluation of daily nutritional requirements may minimize this concern. Despite the fact that our patients were in a non-blinded observational study, underfeeding remained the most frequent complication related to doses. Consequently, increases in protein (25 %) and calorie dosages (20 %) were the most frequently made modifications.

The qualitative characteristics of diets can also affect a patient's evolution. We introduced changes in the prescription of organ-specific diets in 17.8 % of patients (31). The SEMICYUC

recommendations for specialized nutritional-metabolic management of the critical patient includes soluble and insoluble fiber diets to prevent complications such as diarrhea, constipation, and tolerance to enteral nutrition (37). We detected a significant percentage of patients that were not receiving a fiber-enriched diet, so the prescription of a fiber-enriched diet was very common (10.7 %).

The weekly feedback session was an essential tool in the strategy. Despite the fact that general recommendations for the prescription of MNT and the management of gastrointestinal complications are included in the institutional protocol, some doubts or errors regarding MNT may be detected (34). The weekly feedback sessions were a very useful learning tool for training non-expert clinicians in MNT. In addition, the presence of a pharmacist, nutritionist and physiotherapist makes it possible to incorporate different points of view and facilitate the transition from parenteral to enteral and from enteral to oral nutrition, as well as the continuity of nutritional management outside the ICU, in the wards. Frailty after ICU discharge is common, therefore MNT in critically ill patients should not end with ICU discharge. A transfer from the ICU to a ward may be associated with changes in the healthcare personnel involved in the patient's recovery (doctors, nurses, nutritionists, physiotherapists...). Therefore, there is a risk that the transfer of a critically ill patient to a ward may cause changes in or the partial withdrawal of the nutritional and physiotherapy treatments. In our experience, the weekly feedback session facilitated the presence of the nutritionist and physiotherapist who will treat patients after discharge from the ICU. However, the positive effects of multidisciplinary meetings are difficult to measure. In our experience, sharing weekly doubts and interpretations of nutritional practice with experts not only allowed the identification of wrong dosages and metabolic disorders, but also led to an increase in MNT knowledge.

Our work has some limitations. This is a non-blinded observational study designed to evaluate the applicability of the nutritrauma strategy. In our opinion, the main limitation is that it was developed in a single center with a low number of patients. Moreover, we cannot evaluate whether MNT modifications impact positively patient prognosis, which is the final objective of any clinical intervention. However, it is clear that, by facilitating metabolic monitoring, we increase the detection of metabolic alterations correlated with complications and worse prognosis, and allow therapeutic modifications. Despite these limitations, this is the first clinical application reported of the nutritrauma concept, and the benefits observed encouraged us to present our protocol and results.

CONCLUSIONS

The nutritrauma concept has been useful to spread the notion that MNT must be carefully designed and monitored to avoid harmful effects. The application of the nutritrauma strategy facilitates the detection of metabolic complications and the evaluation of the appropriate prescription of MNT. A weekly multidisciplinary session represents a powerful clinical and educational strategy.

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