Assessment of nutritional support in an intensive care unit

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Abstract

The objective of this paper has been to evaluate the appropriateness and implementation of an enteral feeding protocol, designed for a specialized intensive care unit. Over a 3 months period 34 records, with an admission period, over 48 hours were evaluated. Current simple clinical or laboratory parameters of nutritional assessment are not yet into practice. The records of nutritional support provided are inadequate, though enteral or parenteral regimens are regarded with great concern. Polymeric diets are adequate; a semi-elemental diet is seldom necessary. The protocol was appropriate but there is a need for close supervision regarding proficiency of care. A new protocol with individualized record sheet and guidelines for nutritional needs is proposed.

Key words: nutrition, enteral nutrition, oral nutrition, nutritional assessment, intensive care.

Introduction

In the last 20 years, it has been observed that about 40% to 50% of hospitalized patients suffer from malnutrition.[1,2,3] Despite the rapid growth of techniques for malnutrition therapy, these statistics have not changed,[4] and today, the existence of a Nutrition Team is seen as essential for optimizing the nutritional therapeutic approach.[5] This team has several roles, such as: informing people of the importance of nutritional support due to the underlying pathology, establishing therapeutic guidelines and techniques and, consequently, auditing their execution, with the aim of improving the care provided.[5,6]

Intensive care patients, who are particularly sensitive to metabolic and nutritional alterations,[7,8] are a priority in setting up protocols. The Nutrition Team of Santa Maria Hospital established a protocol for enteral nutrition (EN), to be implemented in the Intensive Care Unit (ICU) of the Cardiothoracic Surgery department of the same Hospital. The purposes of this study were to assess the adequacy and rigor of execution of the protocol, including evaluation of the state of nutrition, through to the nutritional therapeutic approach used, and also, to identify any changes necessary.

Material and methods

The protocol (*Appendix 1*) was only restricted to patients that could not feed by oral route. Based on the pathologies commonly seen, they were divided into two groups: 1) without chronic disease and in a good state of nutrition, and 2) with heart disease. In the first 24 to 48 hours, group 1 received saline solutions and administration via nasogastric tube was begun, of an isosmolar, polymeric diet, with 1 Kcal/mL, at 50cc/h in a drip, for 16 hours, with monitoring of gastric residue. From day 2 of EN, the volume and/or concentration (isosmolar, polymeric diet, with 1.5 Kcal/ml) was progressively increased up to the necessary and/or tolerated limit, maintaining a nocturnal pause. In the second group, the patients in a good state of nutrition followed the previous regimen. Those that showed a poor state of nutrition were started on an identical regimen, but with change of product to isosmolar, semi-elemental diet with 1 Kcal/ml, and slight reduction of debit. Once they showed tolerance on day 5, they were put on the regimen proposed for

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APPENDIX 1

ENTERAL NUTRITION (EN) PROTOCOL

Evaluate the following parameters in the clinical history:

1. Recent food intake
2. Nutritional state: global clinical assessment; body mass index (BMI)* presence of edemas; albuminemia
3. Parameters suggestive of severe malnutrition: BMI < 16; lymphocytes < 1200/mm^3; recent weight loss (3 months) > 10% of habitual weight; albuminemia < 3g/L (especially if with hypoproteinemia)

1. Patients without heart disease, without chronic disease, in a good state of nutrition and on mechanical ventilation:

In the first 24 to 48h: zero diet and possible nasogastric tube insertion (NTI) with passive drainage. Saline solutions: 10% glucose - 1500cc/day or 5% glucose - 3000cc/day (approximately 600 Kcal/day); assessment and replacement of K, Mg, P, Ca and Na.

After the first 24 to 48h: maintain saline solutions and check gastric residue, after NTI clamping for 1h. If gastric residue < 200cc, start PreciteneÒ 50cc/h drip for 4 hs. Re-clamp the tube for 1h, then if the residue is < 200cc, maintain EN for another 12hs (day 1 of EN). If tolerated, day 2: 60cc/h in 16h (nocturnal pause of 8h); day 3 to 6: increase 30cc/h per day (w/ nocturnal pause) up to 160cc/h and then maintain this dose. If hypercatabolism (e.g.: sepsis, severe multiple fractures), change from day 4 to Nutrison AEÒ. If intolerance arises, return to previous tolerated scheme. If intolerance continues, contact the Nutrition Team for reassessment.

2. Patients with valvular and/or coronary or myocardial heart disease:

a) In good nutritional state and requiring EN, start as in group 1
b) In poor nutritional state: start EN with Nutricomp Pepti FÒ with the same scheme as group 1 until day 4; on day 5 change to PreciteneÒ 130cc/h for 16hs and evolve to scheme 1

Contact the Nutrition Team in the case of: 1) patient with multiple organ failure 2) diarrhea > 600cc/day in volume on 2 consecutive days 3) severe malnutrition.

*BMI = weight (Kg)/height2 (m): (normal > 21; malnutrition < 19; severe malnutrition < 16; obesity > 26)

the other patients.

During the months of May, June and July 1993, 107 patients were hospitalized. The exclusion criterion for the analysis was hospitalization for less than 48 hours, whereby we excluded 63 patients (58.9%). Another 10 patients were excluded because the respective clinical processes were not available. Thus, we analyzed 34 processes, according to the assessment sheet (*Appendix 2*), which included 27 men (79.4%) and 7 women (20.6%). The mean age was 57.7 years, with a cut-off age range of 17 to 77 years, and similar distribution between the group of patients who only received oral feeding (58.2 years) and those who also received EN (56.2 years).

In the statistical evaluation, the Mann-Whitney and Student's t-tests were used for unpaired samples.

Results

The mean hospitalization time was 8.1 days, with limits between 3 and 90 days. In the ICU discharge diagnoses (*Table 1*) myocardial ischemia with coronary revascularization and valvular disease treated by conservative or valve replacement surgery was prevalent. Thirty-one patients (91.2%) underwent elective surgery. The coexistence of pathologies in the same patient precluded global percentile data. As regards comorbidity situations (*Table 2*), the most frequent were heart failure in 47.1%, respiratory failure in 23.5% and fever in 23.5%, four of which had sepsis.

The subjective assessment of the patients' nutritional state was reported in two cases (1 obese and 1 in a good state of nutrition); there was no record of objective assessment.

The laboratory assessment lacked any parameters that would indicate nutritional state. Before the start of nutritional support, serum albumin was determined in just 70.6% (24/34) of the patients. The mean value was 33.6 $\pm$ 5.04 g/l; (below 35 g/L in 17.6% of the patients). Of the 9 patients that received EN, 7 had this assessment. Post-nutrition albumin was recorded in 61.8% (21/34) of the patients, with mean value of 33.9 $\pm$ 6.01 g/L, having been evaluated in all the patients submitted to EN. The serum values prior to calcium, phosphorus and magnesium nutrition were only determined in 5/34 patients; one of them received EN. The same measurements were performed in 7 patients after nutrition, 6 with EN.

The feeding of the operated patients was started between 24 and 48 hours after surgery, according to the protocol (*Table 3*). This included, in most cases, a diet produced on a basis of normal food. After 48 hours of hospitalization, 26 of the 34 patients (76.5%) were being fed orally. In this group, 1 patient required EN, due to gastric stasis on day 3 postoperative, and parenteral nutrition (PN) due to upper gastrointestinal bleeding 14 days later. The remainder did not have any complications up to the date of discharge from the ICU.

EN by nasogastric tube was used in 9 of the 34

APPENDIX 2

EVALUATION OF EN PROTOCOL APPLICATION

Name of patient: _____ Process no.: _____
Age: _____ Diagnosis _____ Date of Admission: ____/ ____/ ____
Type of surgery _____ Date: ____/ ____/ ____
Coexistence of: 1) Cardiac insufficiency ..... yes ..... NYHA 1,2,3,4 ..... no
2) Renal failure ..... yes ..... acute ..... chronic..... no
3) Gastrointestinal bleeding ..... yes ..... H2 blocker ..... no
4) Antibiotic therapy ..... yes ..... 1,2,3,>3 ..... no
5) Fever ..... yes ..... no
6) Diuretics ..... yes ..... no
7) Mechanical ventilation ..... yes ..... no
Information on nutritional state _____ subjective _____ objective _____

Laboratory assessment	ADMISSION	CORRECTION (yes/no)	DATE OF DISCHARGE
Blood glucose (mmol/L)			
Urea (mmol/L)			
Total protein (g/L)			
Albumin (g/L)			
TIBC* (mmol/L)			
Sodium (mmol/L)			
Potassium (mmol/L)			
Phosphorus (mmol/L)			
Magnesium (mmol/L)			
* Total iron-binding capacity			

Type of nutrition (product) _____ Start date ___/ ___/ ___
Prescription (volume in mL) _____ Administered (volume in mL) _____ with /without dilution
Change of product: _____ yes cause _____ no
Complications of EN: ____ diarrhea ____ gastric stasis ____ hyperglycemia ____ electrolytic alt ____ others ____ no
Need for PN: ___ yes ___ Total PN _____ PN + EN ____ cause _____no
Complications of PN: ___ yes ___ mechanical _____ metabolic _____ sepsis _____no
Specification of complications: _____
Total no. of days of prescription _____ EN _____ EN + PN _____PN
Result: _____ transferred _____ discharge _____ death

patients assessed. In addition to the abovementioned patient, the other 8 were submitted to support with mechanical ventilator prosthesis in the immediate postoperative period. The use of EN was associated with greater severity of the underlying clinical situation, as in the 4 cases of infection, mechanical ventilation and even gastrointestinal bleeding. The chemical diet used in the majority of patients was a

TABLE I

Distribution by pathologies

Pathology	n (%)	Diet (n)	
		Oral	EN
Myocardial ischemia	18 (53.0)	16	2
Valvular disease	12 (35.3)	9	3
Ligation of patent ductus arteriosus	1 (2.9)	0	1
Multiple trauma with instability of the chest wall and ventilation support	3 (8.8)	0	3
Hemopneumothorax	1 (2.9)	0	1
Empyema caused by bronchial fistula	1 (2.9)	0	1
Valvular endocarditis	2 (5.9)	2	0
Myxoma of the left auricle	1 (2.9)	1	0
Pericardiectomy due to constrictive pericarditis	1 (2.9)	1	0
Aneurism of the left ventricle	1 (2.9)	1	0

TABLE II

Comorbidity factors

Pathology	n (%)	Diet (n)	
		Oral	EN
Heart failure	16 (47.1)	12	4
NYHA class I	2	2	0
class II	9	6	3
class III	4	3	1
class IV	1	1	0
Renal failure	5 (14.7)	2	3
Acute	1	0	1
Chronic	4	2	2
Gastrointestinal bleeding	3 (8.8)	0	3
Sepsis	4 (11.7)	0	4
Respiratory infection	1 (2.9)	1	0
Fever	8 (23.5)	3	5
Respiratory failure *	8 (23.5)	0	8

*With mechanical ventilation prosthesis

polymeric diet, following the established protocol, with intolerance occurring in 1 case due to gastric stasis, 1 due to diarrhea (without antibiotic therapy or H2 blockers) and 2 due to abdominal distention (1 with antibiotic therapy and H2 blockers). In 2 cases, as distension and/or diarrhea had been verified with the polymeric diet, it was necessary to use a semi-elemental predigested chemical diet on a temporary basis, with good tolerance. EN was maintained for 17.9 $\pm$ 11.9 days on average with limits between 7 and 42 days, not always consecutive. There was no consecutive period of EN above 3 weeks in any case. In the patients requiring EN, the mean hospitalization time increased to 20.0 days, more than 5 times higher than the 3.8 days for the patients submitted to oral diet ($p<0.001$). The mortality in the ICU was 11.8% (4/34), with all patients having been submitted to EN. Therefore, according to several indicators, the patients undergoing EN were more severe cases (*Table 2*).

No patient needed to receive PN in the first 48 hours. Later on, this type of feeding was required in 2 patients submitted to EN. One of these, due to upper gastrointestinal bleeding, received PN for 4 days, subsequently returning to EN, and another, due to ileus, was kept on PN for 3 days in association with a smaller volume of EN, before restarting oral feeding. According to standards of the Nutrition Team, the prescription and monitoring of PN was performed by one of its members.

TABLE III

Protocol of oral diet

Day	Diet	Macronutrients
1	Fractionated liquid (6 meals)	Calories – 600 Kcal Proteins – 30 gr
2 / 3	Fractionated pasty (6 meals)	Calories – 900 Kcal Proteins – 50 gr
3	Fractionated soft (6 meals)	Calories – 1500 Kcal Proteins – 70 gr
Subsequent	Fractionated light (6 meals)	Calories – 2000 Kcal Proteins – 80 gr

Discussion

Nutritional support should be viewed as essential and integrated in the prescription of the global therapeutic approach.[9] There are few publications analyzing how nutritional support is carried out.[10,11] This article, although limited to a small number of patients admitted to an Intensive Care Unit, is the first to be published in Portugal, and represents an attempt to carry out the internal evaluation of the nutritional care provided. The choice of this Unit arose from the interest expressed by its caregivers, nurses and physicians in the nutritional support training given by the Hospital's Nutrition Team. The participants decided jointly, and by consensus, on the program of a nutritional support protocol, studied for the type of patient habitually admitted to this ICU.

Most of the patients were admitted for elective surgery for ischemic or valvular heart disease. In three quarters of the patients, the professionals maintained the physiological form of oral feeding, with normal food, commenced between 24 and 48 hours after surgery. Although there are no records of the patients' weight, or of the proportion of effective food intake, taking account the protocol (*Table 3*) and the age range in question, it is likely that the intake was sufficient to fulfill requirements, at least after day four.[12] To optimize oral feeding it is crucial to have a protocol supervised by nutrition professionals, of which there are still insufficient numbers in Portuguese hospitals.

As widely published,[12] patients that could not, would not or were unable to consume food, but had a functioning gastrointestinal tract, were fed through an enteral (nasogastric) tube. This form of artificial nutrition[13] was used with 9 patients (26.5%), 8 of whom were using ventilation prosthesis, preventing the use of the oral route.[14] The recorded decision to start EN at 48 hours stems from the evidence that early resumption of the digestive tract decreases morbidity, reducing the probability of nosocomial infections and multiple organ failure, by maintaining the integrity of the mucous barrier and gastrointestinal immune function.[7,14,15,16]

We used the nasogastric tube as a routine procedure due to its easy insertion. The advantage of administration beyond the pylorus has only been permanently demonstrated in specific pathologies (e.g.: severe acute pancreatitis).[16] Moreover, providing the protocol predicts a cautious administration rate, with progressive increases, as advocated, drip administration to the stomach allows the use of discontinuous regimes, in this study with nocturnal pause. This practice appears to reduce the risk of bacterial proliferation in the gastrointestinal tract,[16] as well as the possibility of bacterial contamination of the diet to be administered.[17] With the latter objective, we opted for commercially available chemical diets,[17] which also have the advantage that they have a known composition, complete in macro- and micronutrients, which enables easier management and evaluation of the nutrients administered.[12,14] As regards this point, the records were incomplete in 3/9 (33.3%), with the possibility of an insufficient nutrition intake.[18,19,20]

The chemical diet of first choice was a polymeric diet with calorie density of 1 Kcal/mL, which was well-tolerated in 88.9% of the cases (8/9). When intolerance occurred, as evidenced by distention and/or diarrhea or stasis, in 2 cases, or *ab initio* for patients with severe malnutrition, the protocol established the use of a semi-elemental diet, which was well tolerated in these circumstances. These results are consistent with the literature, in which there is an excellent efficacy/cost ratio with polymeric diets, although we should have an alternative with easier absorption, generally without gluten and without lactose,[21] characteristics of the alternative diet that we used.

Although some patients suffered from cardiac insufficiency and 74% were prescribed diuretics, we never resorted to a diet with greater density of nutrients (also established in the protocol) and never administered over 160 cc/h (2560cc/day). The EN records proved to be more accurate than those for oral feeding, allowing greater certainty of reaching

APPENDIX 3

PROTOCOL OF NUTRITION IN ICU: guidelines

Name: _____ Age: _____ Sex: _____ Proc. No.: _____
Diagn: _____ Date of admission: ___/ ____/ ____

1. Nutritional state:

- global subjective assessment (22): .....good.....regular.....poor.....obese
- BMI (body mass index) = weight (Kg) / height2 (m)
  Normal BMI >21; malnutrition <19; severe malnutrition <16; obesity > 26
- assess: edemas (Y/N); dehydration (Y/N); albuminemia _____;

Classification: 1. good; 2. regular; 3. slight malnutrition; 4. severe malnutrition; 5. obesity

2. Comorbidity factors (yes / no): state of consciousness (coma) _____; hemodynamic instability _____; mechanical ventilation _____. Associated disease: heart failure _____; respiratory failure _____; Cirrhosis of the liver _____; renal failure _____; diabetes mellitus _____; ileus _____; diarrhea _____; sepsis _____; surgery _____. Drugs: _____.

3. Laboratory assessment

	up to 48 hours	on day 8 or end	on day 15 or end
Hemoglobin/ MCV			
Leucocytes/lymphocytes			
Blood glucose			
Creatinine			
Total proteins/albumin			
Triglycerides			
Sodium/potassium/chloride			
Calcium/phosphorus/magnesium			
Transferrinemia			

4. Nutrition programs

Always opt for the oral route. If ineffective, use the enteral route through a nasogastric/nasojejunal tube. Parenteral nutrition is the last resort and should be transitory. Any route requires accurate records of the nutrition intake.

Determine nutritional needs, administration route and tolerance. The calculation of basal needs (BNs) can be obtained by the Schofield equation*. BNs should be adjusted to actual needs, e.g.: 1) major trauma victim: real BNs = BN + 20% BN; 2) ventilated patient: real BNs = BN - 15% BN. Monitor clinical situation, blood glucose levels, renal function values, ionogram and hydration status.

a) In multiple organ failure, with or without hemodynamic instability, provide 5% or 10% glucose hyposaline solutions for 12-48 hours, in a volume of 1500 to 3000cc/day; supervise ionic corrections (K, Mg, P, ionized Ca and Na) and gastric residue with nasogastric tube insertion. The administration of vasoactive amines for inotropic effect is an absolute contraindication for enteral nutrition that allows effective nutrition.

b) In the uncomplicated postoperative period, start oral feeding at 24 hs. On day 1, liquid to soft diet, fractionated with +800Kcal and 1.0<g/Kg of proteins. Proceed with daily increases of +200Kcal up to 2000Kcal and of proteins up to 1.5g/Kg. In patients under mechanical ventilation, EN with polymeric diet should be started at 24-48 h, where possible, elevating the bed head to 30°, with previous evaluation of the gastric residue after tube clamping for 1h. If gastric residue <200cc start EN via drip, at 30cc/h for 4h; re-clamp the tube for 1h and check residue; if <200cc maintain EN for 12hs (day 1 of EN). On day 2, pass on to 50cc/h with nocturnal pause of 8h. From days 3 to 6, increase 30cc/h on each day up to 160cc/h, maintaining nocturnal pause of 8h. If there is intolerance, resume previous dose, with slower progression and/or continuous administration in 24h; consider chemical diet or administration route alternatives. The jejunal tube requires smaller volumes and slower progression.

c) In severe malnutrition or hypercatabolism, correct micronutrient deficiencies in advance and schedule progressive nutrition, with the maximum objective of 4-5g of glucose/Kg/day, and 1.2 to 1.8g of proteins/Kg/day.

*** Schofield Equation**

Age	Women	Men
15 -18	13.3 x weight + 690	17.6 x weight + 656
18 – 30	14.8 x weight + 485	15.0 x weight + 690
30 – 60	8.10 x weight + 842	11.4 x weight + 870
> 60	9.00 x weight + 656	11.7 x weight + 585

the nutritional objectives.[18] Complications with contraindication for EN, caused by ileus and/or upper gastrointestinal bleeding,[7,12] led to the prescription of PN in 2 patients for a period of less than 5 days, in one of them in association with EN. Although mortality has been higher in the patients with EN, due to greater severity of the underlying disease, there was no increase in morbidity due to artificial nutrition.[13]

Nutritional assessment has not yet been included in current practice. No objective parameters of global nutrition have ever been recorded, and the state of nutrition by subjective assessment[22] was mentioned in only 2 cases (5.9%). In the pathologies in question, it may be that there were now significant changes in state of nutrition, for which reason they were not mentioned; nevertheless, it is important to record these changes, in order to evaluate the evolution of the patient's nutritional status, which, in intensive care, can deteriorate very quickly.[6,7,12] The absence of records relating to the global state of nutrition may be an additional factor of poor interpretation of the adequacy of the prescribed nutritional support. However, as in other countries, physicians continue to show little interest in nutritional indicators,[4,23,24] which in this study, is also evidenced by the low percentage of important laboratory measurements such as calcium, phosphorus and magnesium,[8,12] particularly in patients with potential heart disorders and therapeutic approach with diuretics.

Despite the consensus that nutrition is essential for the promotion of health, with inherent reduction in the average hospital delay and in costs, the individualized prescription is, as a rule, undervalued. Furthermore, nutritional assessment and records of substances administered are habitually insufficient, which prevents an accurate evaluation of the quality of care. The creation of protocols tends to stimulate the interest of health staff and their contribution to a study designed to improve the quality of life of patients, increasing survival. One of the roles of the Nutrition Teams at hospital level is setting up implementation and self-auditing standards. This article aims to perform a preliminary evaluation of such a procedure. The dynamics of nutritional care prompt us to modify the protocol and to suggest a new format. This format, which can be used in any ICU, has a practical focus on subjective, objective and even laboratory nutritional assessment, with the creation of a specific sheet tending to encourage individualized records in a prospective manner, as well as having generic guidance on the calculation of requirements (*Appendix 3*). ■

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