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Enteral nutrition: differences between volume, energy and protein prescribed and administered in adults

Nutrição enteral: diferenças entre volume, calorias e proteínas prescritos e administrados em adultos

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ABSTRACT

Objectives: Different conditions require that critically ill patients to receive lower than prescribed enteral nutrition volumes, energy and protein. This study objective was to evaluate the prescribed versus administered enteral nutrition difference in adults admitted to an intensive care unit.

Methods: In 2009, patients were followed for 30 days from the start of enteral nutrition to its discontinuation, or discharge from the intensive care unit. Parametric and nonparametric tests were used to evaluate prescribed versus administered differences.

Results: Eighty five patients were enrolled; mean age was 58.6±18.0 years and 40% were male. The patients remained in hospital for 29.5 days (IQ: 15.2 - 48.7) and were under enteral nutrition for 10 (IQ: 4.2 - 27.5) days. Lower than enteral nutrition

prescribed volume (-428±243ml/day), energy (-665±412 Kcal/day) and protein (-30±19 g protein/day) was received. Individual patients' evaluation demonstrated that about 40% of the prescribed volume was not actually given. The main reasons for enteral nutrition interruptions were nausea and vomiting, abdominal distension, constipation and clinical complications (52%); diagnostic procedures (41.6%); and transition to oral feeding (5.6%).

Conclusion: Patients admitted to intensive care unit receive less than the prescribed enteral nutrition. The routine care and gastrointestinal tract complications lead to enteral nutrition interruptions, contributing to less than prescribed calories administration.

Keywords: Intensive care units; Nursing care; Enteral nutrition; Electronic prescribing; Nutritional therapy; Gastrointestinal tract

INTRODUCTION

Enteral nutrition therapy (ENT) is a strategy for nutritional status maintenance or recovery in functional digestive system patients whose oral ingestion is total or partially impaired.⁽¹⁻³⁾ Early ENT may be an important contribution for promoting health, reducing physiological stress and preserving immunity.⁽⁴⁾ In this scenario, enteral nutrition (EN) election and prescription is complex, and requires both clinical and nutritional skills. Therefore, as important as the prescription of ENT appropriate for the patient's needs, is to ascertain that the patient effectively receives the prescribed diet.⁽¹⁾

Daily practice differences between prescribed versus given volume were shown,⁽¹⁻⁵⁾ contributing for many patients failure to have their nutritional

needs fulfilled, even with ENT. Campanella et al.⁽¹⁾, in a Brazilian trial, identified that only 31% of the patients received their planned energy-protein target. Similarly, McClave et al.,⁽⁶⁾ identified that patients received a mean daily volume corresponding to 51.6% of the prescribed, and that only 14% of them reached 90% or more of the prescribed within 72 hours from the ENT start. In a similar trial, intensive care patients only received enterally 76% of their daily energy needs.⁽⁷⁾

In the hospitalized patient, infusion of a lower than prescribed enteral diet volume contributes for malnutrition and its consequences: increased morbidity and mortality, prolonged hospital stay and increased healthcare costs.⁽⁸⁻¹⁰⁾ Additionally, in the critically ill patient malnutrition has been associated with poorer outcomes, including increased infection rates and longer hospital time of stay.^(6,7,10,11)

Different causes for interruptions and lower than prescribed volume administration were described: (a) gastrointestinal dysfunctions as nausea, vomiting, diarrhea and increased gastric residue; (b) clinically unstable patient; (c) prolonged fasting for medical, nursing or physiotherapeutic procedures; and (d) tube removal, either accidental or not, with delayed reinsertion.^(6,12-14) These factors, which are frequent in intensive care, place these patients under increased risk of receiving lower than prescribed volume and energy, i.e., less their actual needs.^(1,4)

In this context, this study evaluated how much the enteral diet prescribed for a high-complexity Brazilian hospital intensive care unit (ICU) patients was effectively given, and the main reasons for interruptions.

METHODS

During November 2009, exclusive EN adult patients staying in a high-complexity hospital clinical and surgical patients' ICU, were enrolled, independently of their admission diagnosis. Two of the authors (MCA and SMS) identified potentially eligible patients using the Hospital Management Computerized System. The authors searched daily the nursing records for the EN volumes actually given within the last 24 hours. The data were recorded by the assisting team after each diet bottle administration. All patients received their EN using open delivery systems, intermittent every 3 hours regimen, and were followed from the first prescribed EN until its discontinuation or discharge from the ICU. All diets prescriptions

were written by the ICU physicians. Other data were acquired from the patients' medical records (either electronic or hard copies), in addition to the authors observation.

The variables [EN prescribed and given volume, energy and protein, age, gender, Charlson index, Acute Physiological Chronic Health Evaluation (APACHE II) score, Glasgow coma scale, length of hospital stay, abdominal surgery, mechanical ventilation, vasoactive drug use, nosocomial infection, in-hospital death, and enteral nutrition time] were evaluated according to their characteristics and distribution, using either parametric or non-parametric tests to evaluate the absolute or percent dependent samples differences, as appropriate.

Aiming to know the possible factors associated with lower than 80% of the prescribed EN volume (this volume was arbitrarily chosen by the authors due to a possible negative impact on the patients' nutrition therapy), the patients group receiving < 80% of the prescribed volume was compared versus the patients group receiving ≥80% of the prescribed volume. $P < 0.05$ values (two sided) were considered statistically significant. The data were analyzed using the PASW Statistics 18.0 statistical package. The study was approved by the institution's Ethics Committee.

RESULTS

Eighty five exclusive EN patients were enrolled. Their age averaged 58.6 ± 18.0 years, and 40% were male; 2.0 (IQ: 1.0 – 4.0) co-morbidities, 23.5 ± 8.6 APACHE II score, and 10 ± 4.2 Glasgow coma score. The mean hospital stay time was 29.5 days (IQ: 15.2 – 48.7); 8% underwent abdominal surgery, and most of them were mechanically ventilated (95%) and used vasoactive drugs (78%). Forty one per cent had infection diagnosed by the time of hospital admission, and 44.7% eventually died. EN was used for 10 (IQ: 4.2 – 27.5) days. During this time, it was evidenced that patients received mean volume (-428 ± 243 mL/day), energy (-665 ± 412 Kcal/day) and protein (-30 ± 19 g/day) lower than prescribed, with a mean 40% reduction. Table 1 displays the median prescribed and given volumes, energy and proteins.

Except for EN time and in-hospital death rate, similar demographic and clinical characteristics were found for both the group receiving < 80% ($n=73$) and ≥ 80% ($n=12$) of the prescribed EN volume (Table 2).

Evaluating the volume (Figure 1A), energy (Figure 1B) and protein (Figure 1C) prescribed versus given

progression over the 30 days follow-up, excluding the first three days usually required to EN adaptation, we found that the prescription was not complied with in any of the follow-up days.

The most frequent reasons for EN interruptions

reported on the medical records were: nausea and vomiting (15.2%), abdominal distension (14.4%), constipation (8.8%), clinical complications (14.4%), diagnostic procedures (41.6%) and transition to oral feeding (5.6%).

Table 1 – Prescribed versus given daily enteral nutrition volume, energy and proteins

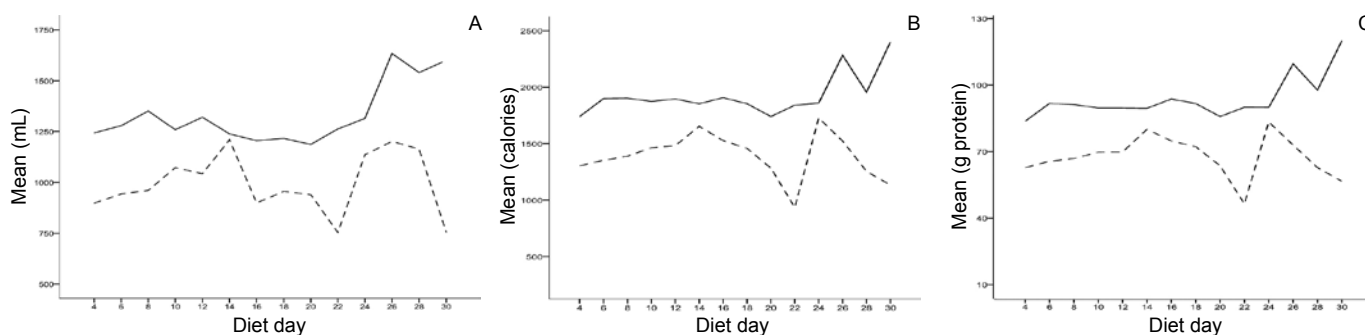
	Prescribed	Given
Volume (mL/day)	1126 (IQ: 960 - 1265)	729 (IQ: 472 – 949) ^ε
Energy/day	1645 (IQ: 1372-1938)	1046 (IQ: 598 – 1340) ^ε
Protein (g/day)	78 (IQ: 65 - 94)	49 (IQ: 27 – 65) ^ε

Values expressed as median (IQ: 25 percentile; 75 percentile); p value < 0.001 for all comparisons. ^εWilcoxon test.

Table 2 – Clinical and demographic patients characteristics according to the percent received

	Less than 80% of the prescribed volume (N=73)	More or equal to 80% of the prescribed volume (N=12)	p value
Age	58.4 ± 17.1	60.4 ± 23.3	0.7 *
Male	28 (38.3)	6 (50)	0.5 §
Charlson index	2.0 (1.0-4.0)	2.0 (0.25-5.5)	0.76 ‡
Charlson index ≥ 2	33 (45.2)	5 (41.7)	0.68 *
APACHE II	26 (18.5-35.5)	28 (17.25-35.75)	0.89 ‡
Glasgow coma scale	13 (8-15)	12 (5.5-14)	0.68 ‡
Hospital stay (days)	29 (15-49.5)	35 (22.75-64)	0.37 ‡
Abdominal surgery	6 (8.2)	1 (8.3)	0.9 §
Mechanical ventilation use	67 (94.4)	12 (100)	0.4 §
Vasoactive drug use	55 (75.3)	11 (91.7)	0.2 §
Nosocomial infection	31 (42.5)	4 (33.3)	0.7 §
In-hospital death	28 (38.3)	6 (50)	0.004 §
Diet time (days)	9.0 (3.2 – 22.7)	21 (16.5 – 33.7)	0.01 ‡

APACHE – Acute Physiological Chronic Health Evaluation. Values expressed as mean±sd; n(%) or median (IQ: 25 percentile; 75 percentile). * Student's t test, ‡ U Mann-Whitney test, § Chi-square Pearson's test.



The continued line represents the prescribed volume and the broken line the volume given.

Figure 1 – Enteral nutrition prescribed versus given volume, energy and proteins during 30 days follow-up. Figure 1A- volume progression. Figures 1B and 1C – energy and proteins, respectively.

DISCUSSION

An important gap between enteral nutrition prescribed versus administered volume, energy and protein was found in these critically ill adult patients; as a matter of fact, the patients failed to receive about 40% of their prescription. Pauses for diagnostic and therapeutic procedures were the main reasons mentioned for interrupting the enteral diet, likely contributing for the identified differences. While in the multi-center study by Kondrup et al.⁽¹⁵⁾ evaluating 167 either clinical or surgical nutrition risk patients without exclusive EN only 25% received more than 75% of their daily needs, and in a French prospective trial this percent was 30%,⁽¹⁶⁾ we evidenced that our patients failed to receive 40% of the prescription. As in this study, Binnekade et al.⁽¹⁷⁾ showed that for most of the enteral nutrition time, EN is not given. These last authors evaluated 403 EN patients and identified that in only 52% of the EN days the target was reached. Patients failure to receive their energy needs is not a new issue.⁽¹⁴⁾ The different reasons for withholding the diet, here shown, corroborate the common sense that patients' clinical status and therapeutics may difficult energy targets to be reached (prescription).^(1,4,6,7,14,16-19)

Although the medical teams are aware of the guidelines for critically ill patients' energy and proteins prescription,⁽²⁰⁾ and actually use them in their clinical practice, it was out of this study scope to evaluate how far the nutritional prescriptions contents were appropriate formulas according to the guidelines. But, even though the clinical impact of patients lower energy supply was not evaluated in this trial, studies^(21,22) have shown that failing to meet the energy requirements is correlated with worse clinical outcomes such as infections and complications.

Therefore, consideration should be given to minimize the discrepancy between the nutrition plan (prescription) and its execution (administration). If different clinical and therapeutic factors may render difficult to reach EN targets, would it be the case to add parenteral nutrition?^(20,23) The response to this question requires understanding if the same conditions that difficult EN would also impair the parenteral nu-

trition progression (e.g. vasoactive drugs). This is the intensive care teams' challenge.

CONCLUSION

Critically ill adults receive lower than prescribed enteral diet during their ICU stay. Nutrition interruptions, related to their care and gastrointestinal complications, may contribute to the total prescribed diet administration failure.

RESUMO

Objetivo: Diferentes condições determinam que pacientes críticos recebam volumes, aportes energéticos e protéicos de nutrição enteral menores que o prescrito. O objetivo do presente estudo foi avaliar a diferença entre a nutrição enteral prescrita e administrada a adultos internados em de centro de terapia intensiva.

Métodos: Durante 30 dias de 2009, pacientes foram acompanhados do início do uso de nutrição enteral até a sua suspensão, ou até a alta do centro de terapia intensiva. Foram usados testes paramétricos e não paramétricos para identificar diferenças entre o prescrito e administrado.

Resultados: Foram incluídos 85 pacientes, com 58,6±18,0 anos, sendo 40% do sexo masculino, que permaneceram internados por 29,5 dias (IQ: 15,2 - 48,7) e utilizaram nutrição enteral por 10 (IQ: 4,2 - 27,5) dias. Os pacientes receberam menos volume (-428±243 ml/dia), calorias (-665±412 Kcal/dia) e proteínas (-30±19 g de proteína/dia) do que prescrito. Quando avaliadas as diferenças diárias entre o prescrito e o administrado para cada paciente, observou-se que cerca de 40% do volume não foi administrado. Os principais motivos para interrupção da dieta foram: náuseas e vômitos, distensão abdominal, constipação e complicações clínicas (52%); realização de procedimentos diagnósticos (41,6%); e transição para via oral (5,6%).

Conclusão: Pacientes internados em centro de terapia intensiva recebem menos nutrição enteral que o prescrito. A rotina de cuidados e a ocorrência de complicações do trato gastrointestinal motivam interrupções da nutrição enteral, contribuindo para que pacientes de centro de terapia intensiva recebam menor aporte calórico do que prescrito.

Descritores: Unidades de terapia intensiva; Cuidados de enfermagem; Nutrição enteral; Prescrição eletrônica; Terapia nutricional; Trato gastrointestinal

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