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Factors leading to discrepancies between prescription and intake of enteral nutrition therapy in hospitalized patients

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ABSTRACT

Objective: We investigated factors leading to a reduction in enteral nutrition (EN) prescribed by a nutritional support team (NST) at a general hospital in Brazil.
Methods: In this prospective, observational study, hospitalized adults receiving only EN therapy via tube feeding were followed for up to 21 d from July to October 2008.
Results: The 152 subjects analyzed included 38 (23.5%) ward patients and 124 (76.5%) intensive care unit (ICU) patients. Eighty percent of the targeted feeding volume was achieved on day 4 by 80% of the patients. Reasons for not receiving the total amount of EN prescribed included delay in EN administration (3.1%), abdominal distention (5.6%), patient refusal of treatment (6.8%), feeding tube obstruction (8.6%), vomiting (10.5%), diarrhea (17.9%), unknown causes (17.9%), interference by a non-NST physician (25.9%), accidental feeding tube loss (34%), presence of high gastric residual (34%), and operational logistics at the hospital's Nutrition and Dietetics Service (99.4%). There was a significant association between patients who received <60% of the prescribed EN and external physician interference ($P < 0.016$). ICU patients also received inadequate EN ($P < 0.025$). Neurologic patients had a greater chance of receiving >81% of the prescribed EN amount than cardiac patients (odds ratio 3.75, $P < 0.01$).
Conclusion: Major reasons for inadequate EN intake are (in decreasing order) operational logistical problems, gastric stasis, accidental loss of enteral feeding tube, and interference by an external physician (not an NST member). Cardiologic patients and ICU patients are at a higher risk for inadequacy than neurologic patients.

Introduction

Hospital malnutrition is a highly prevalent independent risk factor for increased morbidity and mortality [1–3]. In Brazil, approximately 48% of hospitalized patients experience some degree of malnutrition; 12% are severely malnourished [4], and 28% of patients may be at nutritional risk at the time of admission [5]. Among the various strategies intended to prevent and treat malnutrition, enteral nutrition therapy (ENT) has a strong physiologic basis and is cost-effective.

ENT, usually administered on the basis of accepted guidelines [6,7], is preceded by nutritional planning to estimate the amounts of macro- and micronutrients to be administered to each patient according to their clinical condition. However, the prescribed amount of ENT to be provided via feeding tube or stoma is not always actually delivered to the patient. Daily caloric and protein deficits have a cumulative effect, leading to a substantial decrease in energy and protein availability for patients and potential clinical implications such as increases in morbidity and length of hospitalization [8–10]. A Dutch study revealed a discrepancy between the prescription and administration of ENT in 40% of hospitalized patients [11], whereas in France the frequency of ENT inadequacy in critical patients was reported to be as high as 29% [12]. A possible explanation for these discrepancies may be misinformation possessed by health professionals regarding good practices in nutrition therapy (NT) [13–15].

The past 20 y have seen the dissemination of books, journals, and many educational initiatives providing virtual and actual courses, seminars, conferences, and symposia about clinical nutrition. Thus, health professionals should be aware of recent guidelines regarding oral, enteral, and parenteral therapies [16,17]. In Brazil, ENT has been regulated by the health department since

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1998, when a multidisciplinary team specializing in NT passed Resolution 63 (2000) to establish criteria for ENT administration and control [18].

There are specialized NT groups in many Brazilian cities. As of 2007, these groups were present in 35 of 84 hospitals in São Paulo, the largest city in South America [19]. Recently, the Clinical Nutrition Task Force of the International Life Sciences Institute Brazil published two books describing indicators that would allow evaluation of the quality of ENT and parenteral nutritional therapy [20,21].

Discrepancies between the amount of prescribed enteral nutrition (EN) and what is actually received by the hospitalized patient may contribute to a decline in nutritional status. Overall, up to 70% of this population loses body weight during hospitalization, resulting in extended hospitalization time, increased costs, and decreased quality of life [1–3,17]. The American and European Societies for Parenteral and Enteral Nutrition are particularly concerned about this problem and have mentioned it in recently published guidelines [6,7].

The existence of NT multidisciplinary teams and groups specializing in NT does not guarantee good NT practice because factors outside the jurisdiction of these groups can interfere with NT quality. Therefore, we sought to evaluate the quality of ENT practice in hospitalized patients monitored by a specialized NT team. We focused on the serious nature of the health effects associated with discrepancies between prescription and administration of ENT, and we also investigated factors that were potentially responsible for the discrepancies in an attempt to reduce deficiencies in patient intake of protein and energy.

Materials and methods

Study design and patient population

This prospective, sequential, observational study took place at the Hospital São Joaquim da Real e Benemérita Associação Portuguesa de Beneficência in the city of São Paulo in the state of São Paulo, Brazil. The study design was approved by the Ethics Committee of Research of the Hospital São Joaquim da Beneficência Portuguesa de São Paulo and by the Ethics Commission for the Analysis of Research Projects of the Hospital das Clinicas da Faculdade de Medicina, University of São Paulo.

Between July and October 2008, a total of 640 patients older than 18 y were receiving exclusive ENT by enteral feeding tubes, gastrostomies, or jejunostomies in our hospital. Using a randomization table system, we enrolled 201 hospitalized adults (156 intensive care unit (ICU) and 45 ward patients) who provided informed consent (when the patient was not able, a legal representative did so). Patients were followed for 21 consecutive days; subjects were excluded from the study if they were discharged from the hospital, died, or had their therapy switched to oral or parenteral nutrition. All patients who were followed for at least 96 h were included in the database. We chose to not include the first 4 d of hospitalization in the evaluation because it takes an average of 4 d for patients to receive at least 80% of the EN necessary to meet their estimated energy and protein requirements.

ENT

A physician specializing in clinical nutrition was responsible for ENT indications and prescriptions in each case, in accordance with the NT good-practice guidelines [6,7]. We used powdered enteral diets in a gravitational drip system. The prescriptions were written in the patient's chart, and later a hospital dietitian noted the type and quantity of the prescribed enteral diet for the Nutrition and Dietetics Service. This procedure occurred twice daily, in the morning and early afternoon; at other times, the nursing staff was responsible for reporting the changes in prescription to the Nutrition and Dietetics Service. These notes were sent to the diet preparation sector, which required approximately 45 min to prepare and deliver each bottle to the nursing staff responsible for ENT administration.

Variables investigated in the study

Information for this study was collected daily directly from the patients' charts and stored in an electronic database in spreadsheet format (Microsoft Excel 2004 for Mac). Patient identification variables included patient initials, gender, age, place of hospitalization (ICU or ward), main diagnosis at the beginning of study, date of admission, and date of ENT start. Data collected for ENT included the initial type and position of enteral access (stomach or post-pyloric), daily energy and protein requirements, EN volume, energy, and protein quantity prescribed per day, and EN volume, energy, and protein quantity received per day. We also collected information on problems associated with ENT, including vomiting (at least one episode in 24 h), diarrhea (three or more liquid bowel movements in 24 h), gastric stasis (gastric residual exceeding 200 mL every 3 h), abdominal distension (diagnosed by clinical examination), and digestive bleeding of any amount. We also recorded the occurrence of fasting periods of more than 3 h for tests or procedures, obstruction or accidental loss of enteral access (accidental or deliberate patient removal of the feeding tube), operational logistical problems in ENT delivery (time delay between EN prescription and intake, including preparation of enteral diets and delivery to ward or ICU), delay of >1 h in ENT administration, interference by a non-nutritional support team (NST) physician, patient refusal to receive ENT, and unknown causes for not receiving ENT.

Statistical analysis

We performed descriptive data analysis, univariate analysis (the χ^2 test to verify the associations among variables), and logistic regression by Cox's regression model [22]. A P value <0.05 was considered to be statistically significant.

The variable "primary diagnosis at the beginning of study" was categorized into five groups: cardiac diseases, neurologic diseases, cancer, vascular diseases, and infectious diseases. For the purposes of analysis, we compared groups as defined by variable categories; the most frequent primary diagnosis was cardiac disease, which was taken as the referent category. Therefore, all other diagnosis groups were compared to the cardiac disease group in terms of their ability to be associated with discrepancy between EN prescription and intake. The variable "prescription versus intake of EN" was divided into three groups: prescription/intake very inadequate (intake between 0% and 60% of prescribed volume), prescription/intake inadequate (intake between 61% and 80% of prescribed volume), and prescription/intake adequate (intake over 81% of prescribed volume, the referent category).

Results

In our descriptive analysis (Table 1), we verified that of the 201 enrolled patients, 45 patients did not complete 4 d of ENT and 4 patients were excluded from the analysis due to incomplete data records. Most individuals were over 60 y old and in the ICU with an enteral feeding tube located in the stomach. The most frequent causes of interruption of ENT administration included (in order of decreasing frequency) operational logistical problems, gastric stasis, accidental loss of enteral feeding tube, and interference by an external physician (not an NT specialist; Table 1). Patients with neurologic diseases had the greatest EN average intake (1649 ± 73 kcal/d) compared to patients with other diagnoses (Table 2). The average intake was lowest in patients with cardiac diseases (1220 ± 89 kcal/d; Table 2).

Univariate analysis revealed an association between the group "prescription/intake very inadequate" and external physician interference ($P < 0.016$). There was a linear association ($P < 0.025$) between the type of hospital unit (ICU or ward) and the percentage of diet intake agreement; ICU patients were subject to greater discrepancy between prescription and intake of EN than ward patients. There was no statistically relevant relationship between any of the other studied variables and the percentage of diet intake.

Logistic regression analysis detected an association between the primary diagnosis and the percentage of ENT intake ($P < 0.01$), as patients with neurologic diseases had a greater chance of receiving >81% of the prescribed diet compared to patients with cardiac diseases (odds ratio 3.75). We also uncovered a direct association between operational logistical problems and the diet intake percentage ($P < 0.01$). We did not observe significant relationships between any of the other studied variables and the percentage of EN intake.

Table 1
Patient characteristics and causes of enteral nutrition therapy (ENT) interruption in 152 patients

	Variables	*n*	%
Patient characteristics	Male	80	52.6
	Female	72	47.4
	Ward	36	23.5
	Intensive care unit	116	76.5
	Age > 60 y	121	80
	Age < 60 y	31	20
	Enteral feeding tube in gastric position at beginning of study	125	83
	Enteral feeding tube in postpyloric position at beginning of study	27	17
Causes of ENT interruption	Delay in ENT administration	5	3.1
	Abdominal distention	9	5.6
	Patient refusal	11	6.8
	Obstruction of enteral feeding tube	14	8.6
	Vomiting	17	10.5
	Diarrhea	29	17.9
	Unknown causes	29	17.9
	Interference by professional who is not a member of specialized NT team	42	25.9
	Accidental loss of enteral feeding tube	55	34
	Gastric stasis	55	34
	Logistical problems	161	99.4

Discussion

The results of the current study reflect how NT is performed in a large general hospital (1920 hospital beds) by a specialized, clinically experienced group with 30 y of clinical practice [23]. A recent study of 55 patients in one ICU and five wards investigated the differences between the volume of prescribed EN and what was actually received; patients received 87% of the prescribed diet on average, and the discrepancy was greatest in the internal medicine ward, where patients received only 68% of the prescribed amount of diet [11].

A study of ICU patients revealed an average discrepancy of 9.9% between prescribed and delivered EN, with patients failing to receive 90% of the prescribed volume during 26.6% of the study period [12]. Petros and Lothar reported similar rates in a study of critically ill participants who received, on average, 13.8% less EN than prescribed [24], whereas Faisy et al. described even greater discrepancies in a group of 38 ICU patients who received an average of 60–70% of the prescribed diet volume in the first 14 d of monitoring [25].

In contrast, we observed that the higher the ENT administration discrepancy, the higher the number of patients in the ICU ($P < 0.025$). A possible explanation may be that ICU patients tend to be in a more critical situation than ward patients, and therefore, their tolerance of inadequate EN volumes may be compromised. Furthermore, we recorded frequent interruption of EN by non-NST health professionals (especially physicians), which certainly contributed to discrepancies in EN delivery. Our hospital recommends that changes in the delivery schedule or withdrawal of EN be carried out only after consulting the NST. Nevertheless, this did not happen, suggesting that physicians who are not specialists are not fully aware of the importance of ENT, or that the communication process is not sufficiently implemented. We are currently in the process of reinforcing internal protocols regulating the role of these professionals regarding NT. Other measures such as a detailed orientation session addressing ENT practices and continued education for health professionals who do not specialize in NT may aid in controlling these factors [26,27].

Although diarrhea was not a main reason for inadequacy between EN prescription and intake (17.9% of the cases) in our series, it deserves consideration as a contributing factor. It is difficult to determine whether the onset of diarrhea is related to the EN delivery system, the patient's gastrointestinal tolerance, or the use of diarrhea-inducing drugs such as antibiotics. ENT delivery by a dripping system such as the one in use in our hospital may have caused diarrhea in our population [28], and efforts should be made to change the ENT delivery system to a pump system.

We found that the main reason for discrepancies between ENT prescription and intake was operational logistical problems in delivering the enteral diet from the Nutrition and Dietetics Service to the patient. It is somewhat surprising that, in a hospital with a room devoted exclusively to ENT preparation and a multidisciplinary team of NT physicians and nutritionists, logistical matters should be the main reason for discrepancies between ENT prescription and delivery. Our large hospital usually (78% of cases) experienced a delay of at least 3 h between prescription issue and diet delivery to the nursing station; this delay was longer than 6 h in 22% of patients. In a personal interview with an author of the current study (JRM), the head of Nutrition and Dietetics Service suggested that logistical problems would be less frequent if all medical prescriptions were made in the morning, giving the dietitians sufficient time to adapt the enteral diet daily volume to the medical prescription. However, this change would entail additional human resources costs, because it would require hiring more physicians to examine the patients and write the prescriptions in a shorter period of time. Although online prescriptions could minimize this problem, because changes in the type and volume of diet would be quickly sent to the EN preparation sector, a substantial conceptual and financial investment would be required. Another possible solution is an ENT administration protocol defining the

Table 2
Average enteral nutrition (EN) intake for each group of patients based on primary diagnosis

Group of patients	Average EN intake (kcal/d/patient)
Cardiac diseases	1220 ± 89
Neurologic diseases	1649 ± 73
Cancer	1425 ± 45
Vascular diseases	1516 ± 41
Infectious diseases	1436 ± 67

daily EN volume for each patient, so that any interruption in ENT administration would be offset by dripping adjustments aimed at achieving the prescribed volume within 24 h [29]. However, implementation may be difficult in hospitals using liquefied enteral powder diets with an open system and gravitational dripping.

Logistic regression analysis verified that the risk factors for receiving <81% of the prescribed ENT were initial diagnosis (cardiac patients were more likely to receive <81% of the prescribed EN compared to patients with neurologic disorders) and operational logistical problems. Cardiac disability may be associated with changes in intestinal morphology, permeability, and absorption, which may explain why cardiac patients are more likely to have EN intolerance than neurologic patients [29,30]. Some ICU cardiac patients may undergo low splanchnic blood flow and fluid restriction after surgery, leading to partial intestinal ischemia and malabsorption, thus reducing EN tolerance [31,32]. These data may be relevant for ENT management in cardiac patients.

Conclusion

In our study, the major reasons for the discrepancy between EN prescription and intake in a general Brazilian hospital were operational logistical problems, gastric stasis, accidental loss of enteral feeding tube, and interference by an external physician. Cardiac patients and ICU patients are at special risk for EN inadequacy.

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