Original Article

Enteral nutritional support in non-ICU hospitalized patients: current practice in Mexico

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Background and Objectives: Patients receiving ≥80% of their energy requirements by enteral nutrition (EN) have better clinical outcomes; unfortunately, there are discrepancies between the amount prescribed and amount received. The aim of this study was to explore the nutritional clinical practice, determine the adequacy and identify reasons for underfeeding. **Methods and Study Design:** A retrospective study was conducted in hospitalized, non-intensive care unit, adult patients receiving EN for ≥72 h. The following data were recorded: the prescribed target of energy and protein per day, daily energy intake, and the percentage of adequacy of the energy and protein requirement up to hospital day seven. Complications during administration or reasons for interruption and the proportion of patients who received ≥80% of the energy goals on days four and seven were also recorded. **Results:** In total, 52 patients were included (61.5% women), with a median age of 57.5 years; 20.4% and 6.1% of the patients received ≥80% of their energy and protein goals, respectively, on day four, which improved to 28% (p<0.005) and 19% (p<0.001), respectively, on day seven. During the first seven days, a statistically significant (p<0.001) difference was observed between the amount of prescribed and administered energy over 24 h. The patients who received <80% of their total energy requirement remained hospitalized for 29 days (IQR 16.5-45.5), while those who received ≥80% were hospitalized for 18 days (IQR 13.3-28.8) (p<0.05). **Conclusions:** Significant energy and protein deficits were documented. Furthermore, it is necessary to use strategies such as the implementation of an algorithm to optimize EN.

Key Words: enteral nutrition, malnutrition, nutritional support, energy deficit, complications

INTRODUCTION

Enteral nutrition (EN) is the preferred method of artificially administering nutrients to patients in whom it is not possible to manage their requirements via the oral route because it is impractical, inadequate, or unsafe.[1-6] Although EN was previously only considered a means of nutritional support, currently, the type of intervention, quality, and content are as important as the quantity administered.[7]

The inability to meet the protein and energy requirement of patients leads to a deficit, which increases over time; this status has been associated with a deterioration of nutritional status, increased nosocomial infections, poor wound healing, dysfunction of respiratory muscles, and respiratory failure, leading to increased hospital stay, costs, and mortality.[8-10] The improved effects of EN support are achieved by providing an optimal amount (≥80%) of the total energy requirement.[8]

Deficits often occur because of EN interruptions related to operational logistics, gastrointestinal intolerance (diarrhoea, vomiting, pain, and abdominal bloating), accidental release of the enteral probe, medical and nursing procedures, and routine tests; 26-65% of these problems are preventable.[11] These problems occur in addition to traditional heterogeneous prescription and management (initiation of the infusion at low rates, with progressive increases), which extend the time required for patients to reach their goal delivery rate.[3,11,12] Studies evaluating EN intake in the intensive care unit (ICU) have shown that patients receive an average of only 61.2% of their energy target and 57.6% of their protein target during the first 12 days of EN; in addition, 74% of patients do not receive an optimal amount of their energy requirement.[13] In Mexico, the patients in non-critical areas with EN are underfed, receiving (on average) 61% of their energy goals.[14]

The aim of this study was to explore the clinical nutritional support practice of EN in hospitalized adult medical and surgical patients to determine the adequacy and factors involved in its administration.

METHODS

A retrospective study of EN support was conducted at Instituto Nacional de Ciencias Médicas y Nutrición

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Salvador Zubirán (INCMNSZ). The protocol for the research project was approved by the ethics committee (1557) at the institution and conformed to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). Adult hospitalized non-ICU medical and surgical patients receiving EN (via nasogastric, nasoenteric, gastrostomy, or jejunostomy) for ≥72 h, who had complete data during the first seven days of EN administration and were managed by the Clinical Nutrition Service during the period of May 2014 - April 2015, were eligible for inclusion. Patients in whom feeding was initiated by another route (oral, parenteral, or mixed) or for ≤72 h were excluded.

The Clinical Nutrition Service (composed of physicians and dietitians) provides nutritional assessments, recommendations, and consultations for in-patients who require nutritional support during their hospital stay. The current clinical EN practice is prescribed during the morning rounds each 24h, and the type of EN formulas prescribed depends on the clinical status of the patient. When the patients require protein supplements, modular protein supplements are added.

Demographics: Subjective Global Assessment (SGA), an integrated tool to identify patients at risk of or with malnutrition;[15] clinical and EN practice data (administration route, infusion method, energy and protein requirements calculation method, prescription, type of enteral formula, energy and protein target, millilitres administered, and nutritional adequacy); gastrointestinal complications; and causes of interruption of EN were obtained from the clinical-nutritional record and nursing reports.

Continuous quantitative variables are expressed as medians and interquartile ranges, and nominal qualitative variables are expressed as percentages. The Wilcoxon ranks test was used to compare the energy prescribed with the amount administered on day four. A value of $p<0.05$ was considered statistically significant. Data were recorded with Excel 2013 and analysed using the SPSS (version 20) statistical program.

RESULTS

In total, 345 patients who had some indication of nutritional support during the course of their illness in the hospitalization area of the INCMNSZ were considered eligible; the data from 52 were analysed (Figure 1).

Table 1. Characteristics and clinical outcomes of study patients (n=52)

	Medians (p25-p75) or n (%)
Age, years	57.5 (39.0-62.0)
Sex, women (%)	32 (61.5)
Height, meters	1.67 (1.53-1.69)
Basal weight, kg	57.9 (45.6-74.9)
Final weight, kg	51.0 (44.6-61.5)
BMI, kg/m2	20.6 (18.1-26.5)
SGA, n (%)	
B	29 (55.8)
C	23 (44.2)
Admission type, n (%)	
Medical	31 (59.6)
Surgical	21 (40.4)
Admission diagnosis, n (%)	
Respiratory	2 (3.8)
Gastrointestinal	19 (36.5)
Neurologic	9 (17.3)
Oncologic	6 (11.5)
Infection	12 (23.1)
Others	4 (7.7)
Discharged alive, n (%)	48 (92.3)
Length of hospital stay, days	20 (13-43)

SGA: subjective global assessment.

The demographic and clinical characteristics of the included patients are listed in Table 1. The median age was 57.5 years; 61.5% of the individuals studied were female; the average body mass index (BMI) was 20.6 kg/m^2; 44.2% were classified as having severe malnutrition according to the SGA.

To estimate the daily energy requirement, prediction formulas (Harris-Benedict, Mifflin, and Ireton-Jones prediction formulas with the ideal or actual weight) were used (94.2%). In total, 69.2% of patients received gastric EN (48% by nasogastric tube); 19.2% received EN by jejunostomy, and 11.6% received EN by nasoenteric tubes. On average, an initial rate of 13.8±8.6 mL/h was

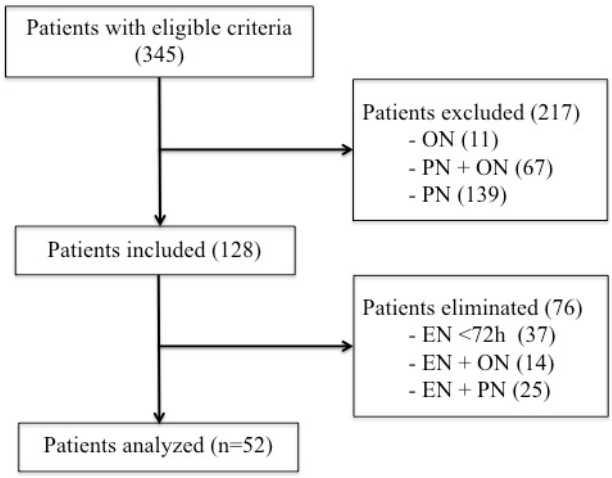

Figure 1. Nutritional support flow chart. Eligible criteria were non-ICU hospitalized patients with nutrition support (n=345). Patients without exclusive enteral nutrition (EN) were excluded (n=217): oral (ON, n=11), parenteral (PN, n=139), or mixed (PN+ON, n=67). Patients in whom feeding was initiated by another route: EN+ON (n=14), EN+PN (n=25), or ≤72 h (n=37). Patients with exclusive EN for >72 h were analysed (n=52).

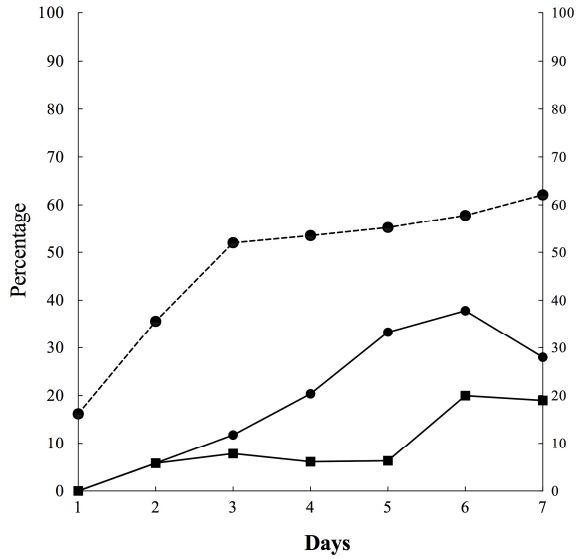

Figure 2. Percent adequacy of energy and protein from EN and proportion of patients who received the optimal energy (≥80%). The continuous line represents the percentage of energy (the median per day is represented by circles) and proteins (by squares) received during the first seven days exclusively through EN. The dotted line represents the proportion of patients who received the optimal number of energy (≥80% of their target) exclusively through EN.

prescribed, and 71.2% of patients received polymeric or standard formulas.

During the first seven days of receiving EN, the median daily prescribed and administered energy values were 27.1 (IQR 24.0-33.7) and 15.6 (IQR 9.1-26.5) kcal/kg (p<0.001), respectively; the median daily prescribed and administered protein values were 1.2 (IQR 1.0-1.5) and 0.9 (IQR 0.5-1.2) g/kg (p<0.001), respectively. The adequacy of the energy and protein requirements represented as a percentage (prescribed vs. administered) increased gradually during the first week, with a 53% median (IQR 24.6-76.8) on the fourth day, while on the seventh day, the median was 62.1% (IQR 41.1-91.7). The median time to reach ≥80% energy adequacy was five days (IQR 3.5-9) and eight days for ≥80% protein adequacy (IQR 4.5-10.5).

Patients were administered <62% of their energy target and <50% of their protein target during the first seven days, as shown in Figure 2. During the first seven days, a statistically significant (p<0.001) difference was observed between the number of prescribed and administered energy over 24 h.

Of the 52 patients studied on day four, three patients did not continue with EN, 39 (75%) received <80% of their total energy requirement, and 10 (19.2%) patients received ≥80% of their total energy requirement. The proportions of patients who received ≥80% of their estimated energy and protein values on the fourth day were 20.4% and 6.1%, respectively; this proportion of patients improved on the seventh day to 28% (p<0.005) and 19% (p<0.001), respectively, as shown in Figure 2. The accumulative energy deficit on the seventh day was 6,204 kcal (IQR 3713.5-8126.5), and the accumulative protein deficit was 401 g (IQR 265.1-555.0).

Among the gastrointestinal complications, diarrhea was reported most frequently (26.9% of subjects), followed by vomiting (19.2%) and bloating (15.4%). Patients who received <80% and ≥80% of their total energy requirement were compared, and it was found that patients who received<80% of their total energy requirement remained hospitalized for 29 days (IQR 16.5-45.5), while those who received ≥80% of their total energy requirement were hospitalized for 18 days (IQR 13.3-28.8), resulting in a statistically significant difference (p<0.05).

DISCUSSION

This study was conducted only on non-ICU hospitalized adult patients who received EN, and we found that the patients with this nutritional support were underfed, as in previous reports,[4] for several reasons. One reason was the under-prescription provided for 24h that was subsequently increased at low rates; this resulted in less energy and protein prescribed per day, which led to fewer patients reaching their total energy requirement by the fourth day and increased the accumulated protein-energy deficit each day. Additionally, interruptions for procedures occurred during the course of hospitalization for different reasons, which further increased the macronutrient deficits.

Gastrointestinal complications are a factor that is described worldwide, and our results were similar to those of other studies. While a frequency of diarrhoea <10% is a quality indicator of EN,[16] in our studied population, the definition of diarrhoea was not homogeneous, as has been described by other institutions.[17,18] In our study, diarrhoea was the main reason that EN was completely stopped; however, we did not identify whether diarrhoea was due to intolerance (access, type of enteral formula, rate, or safety), medication, or microorganisms (e.g., *Clostridium difficile*).[19]

Although our findings are inconsistent with a prospective observational study that found that patients received significantly more energy than prescribed through EN,[20] they are consistent with other authors who have found that EN-fed patients were malnourished.[2,9,12,21]

A study conducted by Leistra et al showed that certain predictors exist for reaching the energy and protein requirements in malnourished hospitalized patients.[22] Negative predictors include nausea, cancer, infections, and high BMI. Commonly, EN-fed patients meet their energy and protein requirement by the fourth day (OR=3.89; 95%CI 1.56-9.73; p<0.005); therefore, EN as well as having chronic pulmonary disease and advanced age are considered positive predictors. The authors considered the use of EN to be the most important positive predictor for reaching the protein and energy requirement by the fourth day; however, only 5% of patients were nourished using this method.[22]

In Mexico, for example, an observational study with the aim of obtaining the prevalence of underfeeding reported that 71% of patients were underfed (n=52) and that on average, they received only 61.3% of their total energy requirement,[14] although it is not clear on which hospital day this was evaluated. Our results indicated that a large proportion of patients, even while being fed enterally, were underfed on the fourth day. It is important to consider many factors, including training of the personnel involved in the EN prescription and administration, gastrointestinal complications, and interruptions in nutrition.

Avoidable interruptions must be taken into account to optimally feed our patients.[11]

Our study showed that administering macronutrients to stable hospitalized adult patients using EN was not consistent with international recommendations. This difference is related to the lack of a uniform guide for clinical practice in Mexico or the use of international guides. Our data indicate a similar gap between the prescription and administration of EN reported in patients with critical illness. Thus, we can conclude that a deficit in calories and protein exists during the first seven days of EN. Similarly, we observed that the protein requirements required a longer period to be satisfied than the energy requirements did; therefore, greater emphasis should be placed on protein intake in hospitalized patients.

In Canada, Heyland et al implemented an EN protocol (PEP uP protocol) designed to overcome the main barriers of administration in ICU patients, demonstrating that patients on the PEP uP protocol received more protein and energy than the control group.[23] Recent publications have proved that implementing algorithms for nutritional support improves the clinical practice of EN, reaching optimal values that reduce the complications associated with malnourishment.[24-28]

Most articles are focused on evaluating patients who are in critical areas, while our study evaluated patients who were in inpatient non-critical areas. Reviewing the literature related to patients in critical areas served as a guideline, although we did not expect such similar results. This study was also limited because it was retrospective. In future investigations, the follow-up period should be extended.

Our investigation has limitations that must be acknowledged. First, the results were based on a retrospective study and involved the loss of valuable information that may have the effect of reducing the sample size and power of a study; however, its strength was that the patients were unselected. Second, the subjects included were not a random sample. Third, the study was performed in a single centre, which might limit the generalizability of our findings. Finally, there was a small sample size. Consequently, the above limitations must be considered when interpreting our results.

This study documented significant energy and protein deficits during the first seven days of EN administration. Therefore, it is necessary to implement strategies such as management algorithms to optimize EN administration and to prevent or limit associated complications.

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AUTHOR DISCLOSURES

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