CLINICAL SCIENCE OF NUTRITION

Original Article

Clin Sci Nutr 2019; 1(1): 50-6 • DOI: 10.5152/ClinSciNutr.2019.76

Enteral nutrition; uncomplicated? Can we achieve the target?

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ABSTRACT

Objective: Enteral nutrition (EN) is safe, well tolerated and efficient nutritional support for patients with functional gastrointestinal (GI) tract. The major problems of EN are intolerance of the nutrition products and problems of achieving the targeted dose. This is a prospective observational study investigating the nutrition related problems, solutions to those problems, and the time for achieving the targeted dose in patients who received EN in our inpatient clinic and intensive care unit.

Methods: This prospective study was made between 11/01/2015-11/01/2016. This study evaluated patients demographic findings, nutrition status, daily calculated calories (25 kcal/kg/day), daily calculated protein dose (1.5 gr/kg/day), daily delivered calories, daily delivered protein dose, whether or not additional parenteral nutrition applied, biochemical parameters (blood sugar, Na, K, Ca, Mg, cholesterol, liver function tests, urea, CRP, albumin, prealbumin), intolerance issues, complications and EN termination reasons.

Results: Considering 2258 patients hospitalized during this period, a total of 70 patients (3.1%) were applied EN (Female/Male: 30/40, The mean age of the patients was 60±16.5 years). The average application time is 11.5 (2-42) days. Among these patients, 26 had an NRS-2002 score ≥3, and only 6 had a BMI<18.8. The rate of calorie and protein application was lower than the calculated, respectively, 37.14% and 52.8% of the cases. It was observed that 40.54% of total malignant patients were subjected to immunonutrition. There were GI tract related problems in 20 patients. Diarrhea was the most important problem during enteral support. Oral supplementation intolerance problem was observed in 20% of the population. Hyperglycemia was detected in 35.7% of the patients, and more than half of them were between 200-300 mg/dL levels. Almost 53% of the patients had malignancy, however, only 5 of them had prescription for oral supplementation during discharge.

Conclusion: EN was performed less than required with inaccurate calories and protein intake, and immunonutrition protocols in malignant patients are not properly complied and oral supplement prescription for those patients is rarely given after hospital discharge. Additionally, product intolerance is seriously frequent, and product and dosage changes should be done more actively.

Keywords: Complication, enteral route, nutrition

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Submitted:
30.01.2019

Accepted:
25.02.2019

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Introduction

It has been known for many years that malnutrition resulting from the imbalance between food intake and requirements has led to an increase in morbidity and mortality, prolongation of hospital stay, and an increase in costs (1-3). Malnutrition is observed in 20%-40% of general surgery clinics, especially in oncologic surgery (4-6). Nutritional support (NS) plays an important role in pre- and postoperative care of these patients and decreases postoperative complications and hospitalization duration (7). In addition, it is known that in patients undergoing major oncologic surgery, postoperative immunonutrition reduces infectious complications (8). The preferred method for NS is enteral nutrition (EN) (8).

EN is a physiologic, safe, and effective NS method for patients with normal bowel function, and complications are less common than parenteral nutrition (PN) (9, 10). However, gastrointestinal complications, which are more common in EN, may make the products difficult to be tolerated, resulting in a failure to reach the desired target dose during NS or termination of EN. The most common complication of EN is diarrhea, and this problem is more severe in intensive care units (may exceed 50%) (11, 12). Nausea and vomiting are seen in 20%-30% of EN patients. Other gastrointestinal problems include constipation, abdominal distention, regurgitation due to gastric emptying problems, and aspiration. Displacement and clogging of the tube that may occur in patients fed via tube are the mechanical problems that may cause EN termination. These prob-

Cite this article as: Taşar P, Türkan H, Gezer Z, Kerimoğlu D, Koç A, Kılıçturgay S. Enteral nutrition; uncomplicated? Can we achieve the target? Clin Sci Nutr 2019; 1(1): 50-6.

lems, which are more frequently encountered in EN, especially in intensive care patients, raise the differences in patients' time to reach the targeted calorie and the implementation of additional PN (13). In addition, difficulties in toleration due to taste-odor, among others, encountered in patients with oral nutritional supplement are another important problem. Patients are unwilling to use these products (14). The most critical point is to implement the correct application to achieve the goal of EN, which is thought to be more physiological, cheaper, and associated with less complications compared with PN.

The aim of the present study was to determine the frequency of EN use in patients hospitalized in Uludag University Department of General Surgery Clinic and Intensive Care Unit, to determine whether the requirements were met correctly, to determine the duration of reaching the target dose, and to evaluate the problems encountered in this process.

Methods

This was a prospective observational study planned between 11/01/2015 and 11/01/2016 Ethical approval for the audit was obtained from the Uludag University Ethics Committee, and written informed consent was obtained from the study subjects [no.: 2015-21/15 (28.12.2015)]. All data were recorded by an experienced clinical dietician (Figure 1).

First, a follow-up form was created for all EN-treated patients. Nutritional status was assessed by Nutrition Risk Screening-2002 (NRS-2002 score ≥3), body mass index (BMI <18.5 kg/m^2), weight loss percentage in the last 3 months (>10%), and prealbumin (<13 mg/dL). The daily energy and protein targets of the patients were calculated as 20-25 kcal/kg/day and 1.2-1.5 g/kg/day (15, 16). The daily calories and protein content of the patients were calculated and recorded by the dietician. The type, dose, calorie, and protein contents of the enteral/oral nutritional product were recorded. In the patient follow-up, disruptions related to the consumption of the product (bad taste, excess amount, no appetite, increased blood sugar, very sweet, and nausea when used) were determined. Gastrointestinal complications [vomiting, diarrhea (aqueous/soft stool >200-250 g/day or >250 mL/day and fecal frequency ≥3-5 times/day), constipation (absence of excretion for >3 days), distension, and abdominal pain] and what was done against these problems (the dose was reduced, the product was changed, the fiber product was added, and EN was discontinued) were recorded. Mechanical complications related to the tube (obstruction, displacement, and removal) and procedures for the solution (opened with the guide, irrigation with pressurized water or soda, opened, and withdrawn) were determined. Laboratory parameters, total protein, albumin, prealbumin, urea, creatinine, aspartate aminotransferase, alanine aminotransferase, total cholesterol, sodium, potassium, calcium, zinc, magnesium, abnormal results in C-reactive protein values, and daily applied exogenous insulin amount, as well as blood sugar levels, were recorded. It was questioned whether residual control was performed in patients fed via gastric tube, whether the patient and/or relative were given near-tube maintenance training, and whether there was a compliance problem. The reason for termination of EN during the treatment period (patient rejected, patient could not tolerate, oral intake was adequate, complications, hemodynamic instability, operation, discharge, and died) and whether or not oral supplement was given during discharge were also recorded. As standard EN product, isosmolar products are used according to the hospital purchase policy. Oral impact was used as an immunization product (17).

Statistical analysis

Chi-square test was used to compare the groups. A p value <0.05 was considered statistically significant.

Results

A total of 70 patients were applied to the EN. The female-to-male ratio was 30/40. The mean age of the patients was 60±16.5 years. Considering 2258 patients hospitalized during this period, the rate of EN use was 3.1%. The average application time is 11.5 (2-42) days.

A total of 37 patients had malignant causes; 19 of them had periampullary region tumor, 5 had gastric malignant neoplasia, 6 had colorectal malignancy, 4 had intra-abdominal neoplasia, and 3 had malignant neoplasia. Among the patients admitted and hospitalized with benign causes, 18 had pancreatitis, 4 had trauma, 2 had liver hydatid cyst, and 9 had surgical site infection and biliary diseases.

Among these patients, 44 had an NRS-2002 score ≥3, and only 6 had a BMI <18.5 kg/m^2 (Table 1). The majority of the patients with an NRS-2002 <3 were those who used oral supplement because of inadequate oral intake. Eight patients were receiving support for immunonutrition. Of the 70 patients, 37 were malignant. Malnutrition was present in 78.3% (29 cases) of malignant patients, and hypocaloric support was applied in 33.3%. Of the 16 patients who underwent immunonutrition, 93.75% were malignant. It was observed that 40.54% of total malignant patients were subjected to immunonutrition.

1. Age:	2. Height:	3. Weight:	4. Body mass index:	5. NRS:
6. Daily calorie need:…….kcal/day		7. Protein need:……..g/day		
8. Daily intake				
a. Caloric amount (24 h):…….kcal		b. Protein amount (24 days):……..g		
9. Blood sugar (highest value):				
10. Daily stool number:				
11. Daily stool character				
a. Fluid/soft		b. Solid		
12. Product consumption				
a. Bad taste	b. Excess amount	c. No appetite	d. Very sweet	e. Nausea when used
13. Complications				
a. Vomiting	b. Diarrhea	c. Constipation	d. Distention	e. Stomachache
14. Nutritional supplement given while being discharged				
a. Yes		b. No		

Figure 1. Follow-up form in patients receiving nutritional support

Table 1. General characteristics of the patients using enteral nutrition

	Patient number (n)
Gender (M/F)	30 (42.9%)/40 (57.1%)
Average age (mean±SD)	60±16.5
Day NS was taken (median/min-max)	11.5 (2-42)
NRS-2002 score ≥3	44 (62.8%)
NRS-2002 score <3	26 (37.2%)
Diagnosis	
Benign	33 (47.2%)
Malignant	37 (52.8%)

As summarized in Table 2, only 9 (12.85%) of the 70 patients were given support for daily calorie target, whereas 50% had a hypercaloric dose. Target calories were achieved in the patients at an average of 3.2 (1-12) days. While 12 of the 44 patients who had reached the target calories and above used EN alone, it was seen that a large proportion of the patients (32 patients) had additional PN support. A total of 32 patients underwent additional PN. When all patients were taken into consideration, 32 (76.1%) of 42 patients who had additional PN were found to have hypercaloric dose.

The calculated protein dose was met in 33 cases, whereas the protein dose given in 21 (30%) of these patients was above the calculated dose. In addition, insufficient protein was given in more than half of the cases (37 cases, 52.85%). Three-fourths of the patients who received low-dose protein (52.85%) and low-dose calories (37.14%) were patients with an NRS-2002 ≥3.

Twenty (28.5%) patients had problems during NS (Table 3). It was observed that 13 of these patients were hypercaloric, 4 were hypocaloric, and 3 received daily caloric support. In 8 of 13 patients who received hypercaloric NS, the dose was reduced due to gastrointestinal system complications, such as diarrhea, abdominal pain, distention, and swelling. Two patients had been discontinued due to the development of vomiting and diarrhea, whereas the formula of enteral supplement was changed in three patients due to hyperglycemia that was difficult to control. There were no changes in enteral product in three patients who developed abdominal pain and distention. Additional PN supplementation was performed in eight patients who were administered dose reduction. Half of these patients were seen to have sufficient caloric support by enteral route at the end of 3 days.

Among the four patients with gastrointestinal problems who received hypocaloric support, two had changes in the enteral product due to the development of diarrhea and vomiting; in one of the two patients with only vomiting, NS was terminated, and the dose was reduced in the

Table 2. Calorie and protein values			
	No. of cases (%)	NRS-2002<3 (n=26)	NRS-2002≥3 (n=40)
Energy requirement			
Hypercaloric (>25 kcal/kg/day)	35 (50)	17	18
Hypocaloric (<20 kcal/kg/day)	26 (37.14)	6	20
Isocaloric (20-25 kcal/kg/day)	9 (12.85)	3	6
Protein requirement			
High-dose protein (>1.5 g/kg/day)	21 (30)	13	8
Low-dose protein (<1.2 g/kg/day)	37 (52.85)	9	28
Normal dose protein (1.2-1.5 g/kg/day)	12 (17.15)	4	8

Table 3. Complications in patients with enteral nutrition	
Complications	**Case number (n=70)**
Gastrointestinal	
Distention	11 (15.7%)
Stomachache	5 (7.1%)
Vomiting	4 (5.7%)
Diarrhea	15 (20%)
Problem of tolerating oral supplements (taste-smell-discomfort)	15 (20%)
Metabolic	
Hyperglycemia	25 (35.7)
Hypopotassemia	3 (4.2%)
Hyperpotassemia	2 (2.8%)
Mechanic	
Tube clogging	5 (7.1%)

other case. EN was discontinued in one patient who was fed isocaloric due to vomiting and in two because of uncontrolled hyperglycemia even though diabetic product was given.

The patients with hypercaloric feeding (13 of 35 patients) had more gastrointestinal system complications than hypoisocaloric patients (7 of 35 patients), but this difference was not statistically significant (p=0.11).

While 48.5% of the patients had aqueous/soft stool (9: aqueous), the number of defecation was >2/day in all cases. In 15 of these patients, the number of stools was >4 (21.4% of 70 patients). No constipation was detected in any of the cases.

Twenty percent of the patients had additional problems with oral supplement toleration. In 42% of these patients, the amount of oral supplements was high, 35.7% of them had poor taste, and 28% of them refused to use it because of mild nausea after ingestion. In one of these patients, while the product was changed, temporary dose reduction was performed in six of them.

A total of 42 patients were applied to the tube with EN. All of these patients were postoperatively enteral-fed patients. Thirty of them were given additional PN. There were 5 (11.9%) mechanical complications related to the tube. While the two blocked nasojejunal tubes were reopened, EN was discontinued in three patients. Although all of the relatives of the patients were given trainings related to tube maintenance, problems related to the change of the patients were observed. Five patients who had tube problems experienced the event during the night shift.

In nine patients (four patients had gastrointestinal intolerance despite of the precautions, two patients had metabolic problems (difficulty in glycemic control), and three patients had nasojejunal tube problems), EN had to be discontinued (12.8% of all patients). Hyperglycemia (>150 mg/dL) was observed in 35.7% of the cases (25 cases); among these, blood glucose in 2% was between 200 and 300 mg/dL. Intravenous insulin infusion was used in all hyperglycemic cases. In seven patients, 110-148 U was found to be regulated with insulin at a level of >300 mg/dl. Twenty-three of these patients were hypercaloric feeding cases and product change and dose reduction enabled glycemic control. No significant problems were found in liver function tests and electrolyte values during

the follow-up period. Only three cases showed hypopotassemia, and two hyperkalemia.

Although 52.85% (37 patients) of the patients were patients with cancer, only 5 patients were supplement prescribed while being discharged.

Discussion

Although EN is recommended for NS, it is noteworthy that the EN application rate was 3.1%. This rate is much less than expected because the need for NS patients in general surgery clinics is much higher. In this context, in a study published in 2009 and reflecting the situation in our country, it is seen that the rate of total malnutrition risk is 15% when data of 29,139 patients from 38 different centers (19 different cities) are taken into consideration. This rate increases to 40% in clinics dealing with cancer. Considering all standard surgical procedures in the general surgery clinics, the rate of malnutrition in the 8% level is approximately three times higher in the clinics applying only the gastrointestinal (6). In our study, malnutrition was present in 62.8% of the patients. This rate increased to 78.37% in malignant patients. The reason for administration of NS to other patients is not understood considering that only one-quarter of the patients without malnutrition uses immunonutrition. It is also noteworthy that only 40.54% of total malignant patients were immunonutritized.

It is interesting that only 12.85% of the patients were fed at the calculated caloric support dose, whereas 37.14% have hypocaloric, and 50% have hypercaloric support. The rate of hypocaloric patients varies in the literature. Reid stated that the calculated caloric dose is reached in 81% of the patients, and De Jonghe et al. showed that 63.5% of the total energy can be reached enterally (18, 19). In another study, this rate was found to be 51.6% (20). However, in 50% of the cases, hypercaloric support was provided, suggesting that the NS protocol was not adequately evaluated, and the follow-up was not effective. At this point, it is seen that the implementation of additional PN is an important factor. With regard to protein support, the condition is worse, and the rate of patients receiving low protein is 52.85%. This was observed in even 20% of the patients who were hypercaloric.

Although EN is a recommended method, various causes may prevent the target dose from being reached. Nutrition intolerance due to motility and absorption disorders, especially in intensive care, trauma, and gastrointestinal patients undergoing surgery, were observed as high gastric residual volumes, distension, vomiting, and diarrhea. In the present study, gastrointestinal problems were observed in 28.5% of EN patients. Of these 20 patients, 13 were hypercaloric, and 4 were hypocaloric. The incidence of gastrointestinal complications increased to 37.1% in hypercaloric patients and decreased to 20% in hypoisocaloric patients. On the other hand, it is noteworthy that 33.3% of the patients who received isocaloric nutrition had problems. The lack of statistically significant difference could be related to the low number of cases (p=0.11).

For management of gastrointestinal complications emerging during the use of enteral products, methods, such as prokinetic agent use, dose reduction, elimination of other factors that may result in diarrhea, use of antiemetic, and gradual dose increment during administration, are widely used (21, 22). The studies in particular on the presence or absence of fibrils in the products did not differ with regard to gastrointestinal complications (23). In our study, our approach to gastrointestinal complications is generally in the form of dose adjustment. However, if the problem persists, the product has been changed. Mentec et al. (24) reported a 46% intolerance incidence in a study on 153 enteral-fed patients. In a 44 case study by McClave et al. (20), 51.6% of the targeted calorie was accessed enterally, and 52.3% of them developed diarrhea. Similarly, in another study consisting of 60 cases by Engel et al. (13), >80% of the calculated energy requirements were reached in only 35% of the patients. In the same study, the cause of >50% of the insufficient EN is shown as gastrointestinal causes. Low-dose EN is usually attributed to patient-related factors, especially in patients after trauma and surgery. Diarrhea is observed between 15% and 50% among gastrointestinal complications. Especially in the study by Jakob et al. (25) in 2017, high dose and hyperosmolar were found to be associated with EN diarrhea. Similarly, in their study, no significant effect of other features of enteral product on diarrhea and intolerance was found. In our study, diarrhea was found in 15 of 20 patients who developed gastrointestinal complications. In fact, in approximately half (48.5%) of the patients receiving EN, stool change was detected. Among the patients with diarrhea, 83.3% were hypercaloric patients, and the rate of administration was >70 ml/h. In all patients who developed diarrhea, the first step was to reduce the dose or stop enteral feeding. However, the time to reach the targeted daily calorie was prolonged in dose-reduced patients.

An important cause of EN cutting is the problems in the tube. The most effective method to prevent tube clogging is education (26, 27). Although it was understood from the records that this education was given to the relatives of all patients who applied EN in the study, the fact that five patients who had tube problems experienced the

event during the night shift suggested problems related to patient relative changes.

The most prominent metabolic complication in the study was hyperglycemia (35.7%) and was controlled by high-dose insulin infusion in 7 of these patients. Almost all of the cases were hypercaloric fed, and dose reduction and product change were applied. It is noteworthy that this problem is seen, especially in patients using immunonutrition products.

It is interesting to note that only 5 (7.3%) patients underwent oral NS after discharge. This rate was found to be 14% in the presence of 37 patients with ND. However, significant weight loss and reductions in muscle mass and muscle strength were defined even 180 days after major surgery (28). Gastrointestinal symptoms, such as dietary restrictions, anorexia and nausea, vomiting, abdominal pain, and diarrhea, may persist for a long time after a major surgery and endanger adequate nutrition. Beattie et al. (29) and Jensen et al. (30) showed that oral supplements performed after discharge at home make positive changes in weight and body composition. No approach strategy was observed to be followed in our clinic.

In conclusion, the EN application in the surgical clinic is much lower than expected. The measurements of protein and energy requirements are not calculated sufficiently sensitive enough in EN patients. The rate of patients undergoing hypercaloric nutrition was significantly higher. The number of hypoproteinemic patients is significant. In malignant patients, immunonutritional support is not adequately administered. Although the metabolic and catheter complications are low, symptoms affecting the quality of life due to product tolerance are severe, and product changes and dosing should be performed more actively. The use of supplement during discharge is also as low as to be neglected.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Uludag University (Date: 28.12.2015; Decision no.: 2015-21/15).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – S.K.; Design – S.K.; Supervision – S.K., P.T.; Resources – H.T., Z.G., A.K., D.K.; Materials – Z.G., A.K., H.T.; Data Collection and/or Processing – D.K., Z.G., H.T., A.K.; Analysis and/or Interpretation – P.T., Z.G.; Literature Search – P.T., D.K.; Writing Manuscript – P.T., S.K.; Critical Review – H.T., A.K., Z.G., D.K.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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