How we Provide Nutritional Treatment in Hospitalized Patients?

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ABSTRACT

Background: *In this study, we aimed to evaluate enteral nutrition (EN), parenteral nutrition (PN) and supplemental parenteral nutrition (SPN) in terms of achieving nutritional goals.*

Methods: *Patients receiving either EN, PN, or SPN treatment followed up by the clinical nutrition team between January and December 2017 at the university research and training hospital were included in the study. Daily nutritional requirements were calculated according to the recommendations. Total energy intake during nutritional treatment (NT) and all metabolic, mechanical, technical complications of NT were recorded.*

Results: *A total of 603 inpatients were included in the study. The nutritional goal was achieved in the majority of the SPN group patients (87.5%) statistically significant relation was found between the achievement of the target (or not) and PN access route (peripheral or central) ($P < .001$). However, none of the complications found statistically related to achieving the target, including gastrointestinal complications of EN ($P = .46$), metabolic complications of EN ($P = .07$), mechanical complications of EN ($P = .79$), metabolic complications of PN ($P = .89$), gastrointestinal complications in SPN group ($P = .45$), and metabolic complications in SPN group ($P = .68$).*

Conclusion: *Nutritional goals could be achieved with SPN without increasing complications in the majority of patients. Commencement of SPN should be considered for positive outcomes in patients who failed to achieve desired nutritional outcomes.*

Keywords: *Enteral nutrition, hospitalized patients, parenteral nutrition, supplemental parenteral nutrition*

INTRODUCTION

Malnutrition in hospitalized patients is associated with poor nutritional intake, aging, comorbidities, and physical condition limitations alone or in combination.[1] The prevalence of malnutrition in hospitalized patients was reported between 20 and 50%.[2,3] Early recognition of malnutrition and initiation of nutritional treatment (NT) is an essential approach for the management of the hospitalized patients[2] in order to minimize and prevent negative outcomes of malnutrition such as prolonged hospital stay, increased mortality, and morbidity.[4,5,6]

Another concern after diagnosing patients with malnutrition is choosing the appropriate and safest route for nutrition. NT can be provided via several routes such as enteral nutrition (EN), parenteral nutrition (PN), or in a combination of EN and PN, which is called supplemental parenteral nutrition (SPN).[7] SPN is also called "top-up nutrition" or "bridge therapy."[8,9]

NT is essential for every patient who is malnourished or at risk of malnutrition, and provision and timing of NT, especially in intensive care unit (ICU) patients, is crucial.[7] Energy and protein requirements for the malnourished patients should be precisely calculated in order to provide optimum NT.[10] Several guidelines advocate enteral route whenever possible,[11,12] but in many patients, especially in ICU, nutritional goals cannot be achieved by EN alone.[13,14] When EN fails to meet nutritional goals, clinicians should consider SPN to ensure adequate energy and proteins provision to the patients and improve their outcomes.[7,11]

Because of limited evidence and concerns about the potential complications of SPN, some clinicians may not be eager for the adoption of this approach.[4] Yet some publications support SPN, which encourages clinicians.[8]

In this observational study, we aimed to evaluate the EN, PN, and SPN to achieve nutritional goals.

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MATERIALS AND METHODS

Patients receiving either EN, PN, or SPN treatment followed up by the clinical nutrition team (CNT) between January 2017 and December 2017 at the university research and training hospital were included. The sample size was estimated based on the study period. All patients who met inclusion criteria during the study period were recruited. In order to minimize bias, standardized forms were used for data collection, the study population was clearly defined, and collected data were analyzed by 2 researchers independently. Informed consent to participate in this study was obtained from all participants. All patients' nutritional status and clinical and demographic data, including admission diagnosis, relevant laboratory tests, medications, comorbidities, were recorded prospectively by CNT.

Daily nutritional requirements were calculated according to the ESPEN's practical recommendations (25-30 kcal/kg/day formula for calculating energy requirements and 1.2-2 g/kg/day formula for protein requirements).[12,15,16] Achieving nutritional goals were determined as reaching at least 80% of the target on days 3-5 of the NT.[16] Prior to the NT, all patients were evaluated thoroughly by the CNT, and metabolic and biochemical abnormalities were corrected if needed. During NT, vital signs, weight, energy, protein intake, fluid and electrolyte balance, and serum prealbumin values were closely monitored. Total energy intake during NT and all metabolic, mechanical, and technical complications of NT were recorded. If the nutritional goals could not be achieved, the reasons for this discordance were also noted.

As descriptive statistics, mean and standard deviation or median and minimum–maximum values are given for continuous variables, and frequency and percentage are given for categorical variables. The difference between groups was analyzed with an independent *t* test or one-way analysis of variance test depending on parametric test assumptions. Chi-square tests are used to evaluate whether a significant relationship between categorical variables exists or not. All the data were analyzed by using SPSS version 23. The study was approved by the University, Non-Interventional Clinical Research Ethics Board; the procedures used in this study adhere to the tenets of the Declaration of Helsinki.

RESULTS

A total of 603 inpatients received NT during the study period. Of these, 358 (59.4%) were male and the median age was 63 (range:18-103). The median consulting time to the CNT from the hospital admission was 0 days (range: 0-12 days). The median body mass index was 23 kg/m^2 (10-48) and median NRS score was 4 (3-7). Patients with at least 1 comorbidity was 68 (57.6%) in EN, 186 (41.2%) in PN and 16 (50%) in SPN group. In all the patients receiving SPN, due to nutritional achievement failure with EN, PN was started within 48 h (early SPN). The presence of fistula, decubitis ulcers, and infection rates were similar in all groups (Table 1).

Table 1. Patient Demographics

	EN, *n* (%)	PN, *n* (%)	Supplemental PN, *n* (%)
Patients	119 (100)	452 (100)	32 (100)
Gender (male)	66 (55.5)	268 (59.3)	24 (75)
Mechanical ventilation	101 (84.9)	407 (90)	28 (87.5)
At least one comorbidity	68 (57.6)	186 (41.2)	16 (50)
Fistulas	119 (100)	425 (94.2)	30 (93.8)
Decubitis ulcers	96 (80.7)	423 (93.6)	26 (81.3)
Infection	72 (60.5)	289 (63.9)	19 (59.4)

EN, enteral nutrition; PN, parenteral nutrition.

Peripheral PN was the preferred route of administration (62.5%) during SPN. In both EN and SPN groups, gastrostomy (38.5% and 34.4%, respectively) and nasogastric (49.6% and 31.3%, respectively) access were preferred routes of enteral feeding. PN was mostly administered in patients at surgical wards (40.5%), whereas both EN and SPN were administered mostly in internal medicine wards (31.1% and 34.4%, respectively) (Table 2).

The nutritional goal was achieved in the majority of the SPN group patients (87.5%) (Table 3).

According to the chi-square analysis, a statistically significant relation was found between the achievement of the target (or not) and access route (peripheral or central) ($P < .001$). However, none of the complications found statistically related to achieving the target, including gastrointestinal complications of EN ($P = .46$), metabolic complications of EN ($P = .07$), mechanical complications of EN ($P = .79$), metabolic complications of PN ($P = .89$), gastrointestinal complications in SPN group ($P = .45$), and metabolic complications in SPN group ($P = .68$).

DISCUSSION

If patients cannot be fed orally, nutrition treatment can be administered either by enteral or parenteral routes.

Table 2. Detailed Nutritional Data

	EN, *n* (%)	PN, *n* (%)	Supplemental PN, *n* (%)
EN access routes			
Gastrostomy	46 (38.5)	-	11 (34.4)
Jejunostomi	5 (4.3)		8 (25)
Nasogastric	58 (49.6)		10 (31.3)
Nasoduedonal	9 (7.7)		1 (3.1)
Nasojejunal	0 (0)		2 (6.3)
Most common department	Internal disease 37 (31.1)	Surgery 183 (40.5)	Internal disease 11 (34.4)
Most common reason for NT	Dysphagia 62 (53.0)	GIS Malignity 207 (45.9)	Dysphagia 15 (48.4)
EN-related GIS complications	96 (84.2)		22 (73.3)
PN-related metabolic complications		394 (88.7)	24 (85.7)
PN access routes			
Periferal		253 (55.97)	20 (62.5)
Santral		199 (44.02)	12 (37.5)
Port		68 (34.17)	3 (25)
IJV		31 (15.57)	0 (0)
Hickman		38 (19.09)	4 (33.3)
SCV		62 (31.15)	5 (41.66)
PICC		0 (0)	0 (0)

EN, enteral nutrition; PN, parenteral nutrition; NT, nutritional treatment; GIS, gastrointestinal system; IJV, internal jugular vein; SCV, subclavian vein; PICC, peripherally inserted central catheter.

Although enteral nutrition is preferred over parenteral nutrition (PN) as it is more physiological, maintains gut function, and is associated with less overall complication rates, many patients' nutritional goals cannot be achieved by the enteral route alone. The present study aimed to compare enteral or PN alone, with supplemental parenteral nutrition to achieve nutritional goals in a tertiary referral center.

In this study, even though patients were managed by an experienced CNT, in almost half of the PN and in one-third of the EN patients, nutritional goals (reaching 80-100% of the target energy requirements) were not achieved. However, this could be achieved in 87.5% of the SPN patients ($P < .001$). Kutsogiannis et al. had similar findings in their study that was conducted in ICU, with calorie adequacy of 81.2% and protein adequacy of 80.1% in the early SPN group and lower adequacy (63.4 and 59.3%, respectively) with EN group ($P < .001$).[17] Higher energy delivery was also reported in patients receiving SPN compared to EN (mean 103 and 77% of energy target, respectively) by Heiddeger et al. in a randomized study performed in critical patients.[8] In contrary to these findings, it was stated by Heyland et al. that calorie (55.6, 60.3, and 62.8%, respectively) and protein (56.3, 58.8, and 60.9%, respectively) delivery were similar in all patients receiving EN, PN, or SPN in ICU.[18]

In our study, the median consulting time by the CNT after the hospital admission was 0 days (range: 0-12 days), and this was the consequence of early (within 24 h) screening of the patients. This approach is consistent with the American Society for Parenteral and Enteral Nutrition (ASPEN) recommendation, indicating that all patients need to undergo nutritional screening within 24 h.[19]

Peripheral or central PN was found to be effective in terms of achieving the targets in PN group in this study which is similar to literature. Peripheral access route has its own limitations with providing nutrients independent from the requirements. Ponta et al. pointing out that the gap between requirements and actually received energy amount in PN treatment could be related to a peripheral access route.[20]

Table 3. Achieving the Nutritional Treatment Targets According to the Route of Nutrition Treatment

Level of Targets	EN Treatment	PN Treatment	Supplemental PN Treatment	*P*
Achieving 80-100% of the target	83 (69.7)	243 (53.8)	28 (87.5)	<.001
Achieving 60-79% of the target	8 (6.7)	120 (26.5)	1 (3.12)	
Achieving 50-59% of the target	5 (4.2)	46 (10.2)	3 (9.37)	
Achieving 49% or less of the target	23 (19.3)	43 (9.5)	0 (0)	
Total	119 (100)	452 (100)	32 (100)	

EN, enteral nutrition; PN, parenteral nutrition.
$P < .05$ is statistically significant.

The infectious complications are the main concern about SPN in clinical practise however, promisingly, in our study, in terms of the complications, including infections, no differences were seen between EN, PN, or SPN subgroups. Similarly, no difference in infectious complications between SPN and EN alone groups was also reported by other researchers.[7,17] However, none of the studies specifically addressed SPN use in patients with increased complications of malnutrition[17] as stated in our study. Moreover, factors, such as precise determination of nutritional goals and appropriate timing of NT, have an effect on reducing infections and antibiotic use while providing targeted energy requirements by SPN.[8]

In our study, no differences between EN, PN, and SPN subgroups were noticed in terms of metabolic complications, which shows that SPN group was not overfed. These findings are in accordance with the study of Heidegger et al.[8]

NT undertaken by CNT results in better outcomes and efficacy, low complication, and mortality rates.[21] This may be the explanation of low complication rates in this study.

SPN is encouraged by guidelines. The European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines state "in patients who tolerate EN and can be fed approximately to target values, no additional PN should be given but consideration of a combination of enteral and PN after only 2-3 days in the ICU if EN alone is insufficient at that time."[12] The 2016 Society of Critical Care Medicine (SCCM) and the ASPEN guidelines state "in patients at either low or high nutrition risk, use of supplemental PN be considered after 7-10 days if unable to meet 60% of energy and protein requirements by the enteral route alone. Initiating supplemental PN prior to this 7- to 10-day period in critically ill patients on some EN does not improve outcomes and may be detrimental to the patient."[7,22] On the other hand, Canadian guideline underlines that "in the patient who are not tolerating adequate EN, there are insufficient data to put forward a recommendation about when PN should be initiated. Practitioners will have to weigh the safety and benefits of initiating SPN in patients who are not receiving target energy on a case-by-case basis."[7,18]

This study has some limitations. Even though a large number of patients were recruited for this study, some outcome measure parameters such as mortality, length of hospital stays, and cost comparison between EN, PN, and SPN subgroups were not analyzed due to the design of the study.

Screening, assessment, and taking the most appropriate action at the right time are essentials of NT. The first choice is always considering EN, however, if nutritional goals could not be achieved by EN alone, SPN could be a reasonable option to fill the gap between actual requirements and delivered amount.

While some clinicians are skeptical about prescribing SPN according to the available evidence, the commencement of SPN should be considered for positive outcomes in patients who failed to achieve desired nutritional outcomes. Consulting CNT should also be considered to ensure minimizing the complications of NT.

Ethics Committee Approval: The study was approved by the Hacettepe University, Non-Interventional Clinical Research Ethics Board with the number of GO20/636.

Informed Consent: Informed consent was obtained from each patient included in the study.

Peer-review: Externally peer-reviewed.

Author Contribution: All authors contributed to the study conception and design. Material preparation and data collection were performed by B.K.C., C.B. and M. E. The first draft of the manuscript was written by B.K.C. and K.D. and all the other authors commented on previous versions of the manuscript. Statistical analysis and interpretation of data were performed by C.B. and M.E. Study supervised by M.H. K.D. and O.A. All authors read and approved the final manuscript.

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