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# Effects of enteral and total parenteral nutrition on length of stay in intensive care unit in postoperative period

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**Abstract**

Patients post-operatively followed in intensive care units in are known to have high morbidity and mortality rates. The aim of the present study was to compare the effects of enteral versus total parenteral nutrition for length of ICU stay in postoperative patients. Nutritional support for patients were divided into two groups; enteral nutrition (Group E) total parenteral administered (Group P). Demographic findings, APACHE II score and serum albumin levels were determined in the preoperative period in both groups of patients. In both groups were recorded type of operation and blood transfusion during the operation. Gas, fecal discharge time in the postoperative period, of patients in groups and, postoperative day 7th, serum albumin, and serum C-reactive protein (CRP), length of stay intensive care unit and mortality rates were determined. Abdominal cramps, the tension in the abdomen, nausea and diarrhea in patients in group E were accepted as complications of enteral nutrition. In this study were included group E 89, group P 82 patients. Between groups were similar demographic features, APACHE II score and serum albumin levels. Both groups was not significant difference operation type, operation time and blood transfusion. Postoperative gas discharge and fecal discharge were significantly difference earlier period in Group E ($p < 0.05$). In terms of the serum albumin and CRP levels were not significant difference between groups postoperative day 7th. Gastrointestinal complications was detected in Group E 58.5% and in Group P 28.9%. Both groups showed two patients mortality in postoperative period. The median length of ICU stay was shorter Group E versus Group P in postoperative period ($p < 0.05$). In the postoperative period the implementation of enteral nutrition was associated with the decreased length of ICU stay and recovered earlier gastrointestinal function. We thought that enteral nutrition support can be used safely and priority postoperative patients in ICU.

**Keywords:** Intensive care, length of stay, postoperative, enteral nutrition, parenteral nutrition

## Introduction

Early postoperative care is the most critical period in the treatment process of surgical patients. Nutrition is required to sustain life as well as to provide growth and development. Energy and protein requirement increases during the postoperative period due to the metabolic response related with trauma and surgical stress (1). Increase in mortality is observed during the hospitalization period due to significant complications such as surgical area infections, pneumonia, postoperative hospital infections, anastomotic leakage and wound healing resulting from negative energy balance and insufficient nutrition during the perioperative period (2). Duration of intensive care stay and cost increase as a result.

Both enteral and parenteral methods can be used for providing nutrition to surgical patients during the postoperative period (3). Today, enteral nutrition is preferred due to physiological, easy applicability, protection of the intestinal system, less complications and low cost (4). It is suggested to start enteral nutrition (EN) as soon as possible in cases when the gastrointestinal tractus is functional (5). Whereas parenteral nutrition (PN) is suggested if EN cannot be started during the first 24 hours following intensive care admission (6).

We think that gastrointestinal system functions may be recovered at an earlier time thereby decreasing the duration of stay in intensive care following the application of EN during the postoperative period. The objective of this study was to examine the effects of enteral and total parenteral feeding supports on intensive care stay durations for patients who are cared for in the intensive care unit postoperatively.

## Material and Methods

Following the ethical council approval and the reception of the informed consent forms from the patient or patient relatives, the prospective observational study was carried out during 2014-2015 with 211 postoperative patients (ASA I-III) followed up at the Inonu University Faculty of Medicine Anesthesiology and Reanimation Department Intensive Care Unit. The patients were classified into two groups with regard to nutritional support as enteral nutrition

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(group E) and total parenteral nutrition (group P) patients. Enteral feeding was started for the E group starting from the 1st postoperative day via nasogastric tube, whereas total parenteral feeding was administered to the P group starting from the 1st day via subclavian/internal jugular vein.The daily energy requirements of the patients were calculated and nutrition was provided as 30-35 kcal/kg/day on average. The patients were monitored daily and it was evaluated whether they received their calculated daily calorie intake or not. Insulin infusion was provided if necessary to keep the serum glucose levels of the patients between 120-180 mg/dL. Patients were excluded if for some reason they could not intake the calculated daily calorie amount, they had kidney or liver function disorder, shock and multiorgan failure in their follow ups of if their enteral or parenteral nutrition support was changed.

The demographic data and APACHE II scores were determined at the time of intensive care admission for patients included in the study. Gas and stool discharge times, serum albumin, C-Reactive Protein (CRP) levels on postoperative 1st and 7th days, intensive care stay durations and mortality rates were determined for the patients. Abdominal cramps, tightness of the abdomen, nausea and diarrhea were accepted as complications of enteral feeding.

SPSS software version 21.0 (Statistical Package for the Social Sciences Inc., Chicago, IL, ABD) was used for statistical analyses. All data were subject to Kolmogorov-Simirnov test after which single way variance analysis test for data with normal distribution and Kruskall – Wallis test for data with skew distribution were used. One way variance analysis for repeating measurements was used for data with normal distribution in group evaluation, whereas Friedman test was used for data with skew distribution. Chi-square test was used for the comparison of the nominal values among groups. $p<0,05$ was accepted as statistically significant.

## Results

Of the patients, 18 were excluded due to the change in nutrition support, 4 due to onset of kidney or liver function disorder, 10 due to development of shock table, 8 due to development of multiorgan failure. There were 89 patients in the E group and 82 patients in the P group. The surgery procedures applied to the patients have been shown in Table 1. Demographic findings and APACHE II scores along with serum albumin levels were determined to be similar among the groups (Table 2, $p> 0.05$). No statistically significant difference was determined between the groups for the day of admission to intensive care, postoperative 7th day serum albumin and CRP levels (Table 3, $p> 0.05$). No statistically significant difference was determined between two groups with regard to blood transfusion.

**Table 1.** The surgery procedures applied to the patients

| | Group E | Group P |
|---|---|---|
| **Gastric resection** | 15 | 13 |
| **Colon resection** | 15 | 14 |
| **C/S** | 16 | 15 |
| **Vertebroplasty** | 14 | 12 |
| **Subarachnoid hemorrhage** | 15 | 17 |
| **Hip revision** | 14 | 14 |

**Table 2.** Demographic findings and APACHE II scores

| | Group E | Group P | p |
|---|---|---|---|
| Age (year) | 46±12 | 44±11 | 0.343 |
| Gender (M/F) | 47/42 | 40/42 | 0.234 |
| Weight (kg) | 77±9 | 79±4 | 0.342 |
| Lenght (cm) | 173±6 | 175±2 | 0.432 |
| BMI (kg/m2) | 25.6±4 | 25.3±6 | 0.213 |
| APACHE II | 23±6 | 24±3 | 0.324 |

**Table 3.** Serum Albumin and CRP levels

| | | 1th day | 7th day | p |
|---|---|---|---|---|
| **Albümin (g/dL)** | **Group E** | 2.6±0.3 | 3.1±0.4 | 0.034 |
| | **Group P** | 2.7±0.2 | 3.0±0.5 | 0.026 |
| | **p** | 0.634 | 0.432 | |
| **CRP** | **Group E** | 1.4±0.2 | 1.3±0.1 | 0.456 |
| | **Group P** | 1.5±0.3 | 1.4±0.2 | 0.342 |
| | **p** | 0.324 | 0.293 | |

**Table 4.** Outcome variables

| | Group E | Group P | p |
|---|---|---|---|
| **Blood transfusion (U)** | 2.3±0.4 | 2.1±0.5 | 0.432 |
| **Intensive care duration of stay (day)** | 5.4±1.2 | 6.9±2.3 | 0.032 |
| **Duration of hospitalization (day)** | 12.3±3.3 | 13.4±3.1 | 0.673 |

When postoperative major complications were evaluated; anastomotic leakage, intraabdominal abscess, respiratory failre were observed in Group P. Three patients with respiratory failure required mechanical ventilator support for postoperative three days. Two patients in Group E required postoperative two day mechanical ventilator support. No statistically significant difference was determined among the groups with regard to major surgical complications. When all infection ratios were evaluated, no statistically significant difference was determined between Group E and Group P. Postoperative gas discharge, stool discharge were observed earlier at a statistically significant level in Group E ($p< 0.05$). Gastrointestinal system complications (diarrhea, nausea, vomiting) were determined as 58.5% in Group E and as 28.9% in Group P. Two mortalities occurred in both groups during the postoperative period. No statistically significant difference was determined among the two groups with regard to blood transfusion and duration of hospitalization. Whereas intensive care duration of stay was observed to be shorter for Group E at a statistically significant level (Table 4, $p< 0.05$).

## Discussion

Intensive care duration of stay was determined to be shorter at a statistically significant level for the patient group subject to enteral nutrition product despite more frequent gastrointestinal system complications.

It is suggested to start early nutrition support in the first 24-48 hours following the admission to intensive care for clinical nutrition application (7). It is observed that the nutrition support provided in many intensive care units meet only 50% of the energy demand of patients (11). It is put forth that nutritional support plays an important role in the treatment of critical patients, that it is more suitable to switch the patient to PN support in case of intestinal function disorders, that complications may occur due to EN after abdominal surgeries and that the best method is parenteral nutrition (10). In addition, it was put forth that nutritional support is started in 44 hours on average in intensive care units but that target calorie and protein is fully provided only in 2,5% (12). PN and EN treatments were monitored in our study and the target calorie was reached in all patients.

The reason why we apply TPN to the patients was that they could not be fed sufficiently via oral and/or enteral means (lack of appetite, nausea, vomiting, diarrhea, partial obstruction). It is stated that TPN is as efficient as EN as an alternative in cases when GIS is not used or EN is not tolerated (9).

PN or EN both have many complications. Nutrition dose is reduced or stopped altogether when such complications are observed during intensive care stay. The most frequently observed complications in EN are diarrhea, abdominal distension, high gastric residue, vomiting, electrolyte disorders. In addition, the detachment of the feeding tube, its shifting, blockage occur frequently during nursing care services (care, positioning etc.), examinations, inspections and before the surgery (13). One or more feeding breaks were observed in 40 of our EN patients. The reason for stopping EN are tube complications (detachment, shifting, blockage) and uncontrollable diarrhea. Nutritional treatment was paused for 26 of our PN patients. The most frequently observed reasons for this were hemodynamic imbalance and hypernatremia. Stopping both EN and PN were found to be related with YBÜ mortality. Whereas in our study, mortality ratios were determined to be similar in both groups and no statistically significant difference was determined between the groups.

A significant increase in infectious complications was observed in the TPN group during a postoperative period of 30 days in a study examining the effect of TPN on infections (14). However, it is suggested that infection frequency does not increase for patients treated with TPN and that non-infection complications are rarely observed (15). No statistically significant difference was determined in our study between the groups with regard to infectious complications. The reason for this may be the fact that intensive care infections are affected by multiple factors. Paying attention to sterilization during TPN and surgery, intestinal cleansing and the addition of glutamine to TPN may also be the reasons. It is known that glutamine enriched nutritional support reduces infection incidence at a statistically significant level (16).

There are various limitations of our study. The first is that it is a single centered study. This results in a small number of participation while also preventing the generalization of the results. The second limitation is that this is a retrospective study. This reduces the strength of the study as well as the ability to access some data while also preventing the putting forth of certain relationships. Finally, this study was carried out at the anesthesia intensive care unit. Complex patient population such as trauma, burns, postoperative patients were not included in the study.

As a result, we are of the opinion that system functions may be recovered faster thereby reducing the intensive care stay durations by applying EN to postoperative patients. However, it is necessary to support our results by way of multi-centered studies with a greater number of patient participation.

## Conclusion

Ink age determination is a process that starts with the acceptance of the document by the laboratory ends with the reporting. While examining the dates of the arrangement of paid annual leave in 5 separate files, which had come from the court, the deterioration period of the luminescent materials was determined after the evaporation period of the ink solvent was completely exhausted. In order to do this each ink sample was analyzed by HPLC and evaluated in regard of age by using the dye ratio technique. It was found that the signatures of each case were signed at the same time, not at different times because there was no significant difference between the minimum and maximum values of the dye ratios when each case was evaluated in itself.

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