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Original Article

A retrospective study about the influence of early nutritional support on mortality and nosocomial infection in the critical care setting

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SUMMARY

Background & aims: To determine whether early nutritional support reduces mortality and the incidence of nosocomial infection, in critically ill patients in the current practice.

Methods: A retrospective observational study was conducted in all critically ill patients who had been prescribed nutritional support, throughout one year, in an Intensive Care Unit. The time to start and the route of delivery of nutritional support were determined by the attending clinician's assessment of gastrointestinal function and hemodynamic stability.

Age, gender, severity of illness, start time and route of nutritional support, prescribed and delivered daily caloric intake for the first 7 days, whether they were a medical or surgical patient, length of stay in ICU, incidence rate of nosocomial infections and ICU mortality were recorded.

Patients were classified according to whether or not they received nutritional support within 48 h of their admission to ICU and Binary Logistic Regression was performed to assess the effect of early nutritional support on ICU mortality and ICU nosocomial infections after controlling for confounders.

Results: Ninety-two consecutive patients were included in the study. Start time of nutritional support showed a mean of 3.1 ± 1.9 days. Patients in the early nutritional support group had a lower ICU mortality in an unadjusted analysis (20% vs. 40.4%, $p = 0.033$). Early nutritional support was found to be an independent predictor of mortality in the regression analysis model (OR 0,28; 95% confidence interval, 0.09 to 0,84; $p = 0.023$). Our study did not demonstrate any association between early nutritional support and the incidence of nosocomial infection (OR 0.77; 95%. confidence interval, 0.26 to 2,24; $p = 0.63$), which was related to the route of nutritional support and the caloric intake. The delayed nutritional support group showed a longer length of stay and nosocomial infections than the early group, although these differences were not statistically significant.

Conclusions: Our study shows that early nutrition support reduces ICU mortality in critically ill patients, although it does not demonstrate any influence over nosocomial infection in the current practice in intensive care.

1. Introduction

There is a consensus about nutritional support as an important practice in the treatment of critical care patients and that it determines better outcomes. Malnutrition is prevalent in intensive care unit patients, reported to be as high as 40%, and is associated with increased morbidity and mortality[1] because the metabolic response to illness leads to a wasting of the lean body mass that produces impaired immune function, impaired ventilatory drive, and weakened respiratory muscles, leading to prolonged ventilatory dependence and increased infectious morbidity. The benefits of nutritional support in critically ill patients include improved wound healing, decreased metabolic response to injury, improved gastrointestinal structure and function, and improved clinical outcomes, including a reduction in complication rates and length of stay (LOS), with accompanying cost savings.[2]

Despite the widespread use of nutritional support, many areas in clinical practice remain controversial: it is unclear if the route of nutrition has an influence on mortality, what is the most appropriate

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time to start, the best dosage, whether mixed nutritional support is better than just enteral nutrition or whether a relationship exists between nutritional support and nosocomial infections.[3]

The evidence supports a clinically important and statistically significant reduction in infection when enteral nutrition is administered early to critically ill surgical patients, as well as a clinically important and almost statistically significant reduction in mortality.[4] Although there is no evidence that parenteral nutrition improves important clinical outcomes in critically ill patients, the ESPEN Guidelines on Parenteral Nutrition in Intensive care[5] recommends that all patients who are not expected to be on normal nutrition within 3 days should receive parenteral nutrition within 24–48 h if enteral nutrition is contraindicated or if they cannot tolerate enteral nutrition (Grade C).

The aim of this study was to determine whether the time to start nutritional support affects outcomes in critically ill patients, in the current practice. The outcomes we considered were mortality and incidence of nosocomial infections.

2. Material and methods

This retrospective and observational study was approved by the Hospital Ethics Committee and was conducted in a medical surgical 10-bed Intensive Care Unit (ICU) in a 350-bed general hospital throughout a one-year period. Our ICU takes care of medical and surgical patients. Almost all the latter are patients undergoing major abdominal surgery. All consecutive patients who were prescribed enteral or total parenteral nutrition were admitted into the study. Nutritional support was indicated in all critically ill patients, in whom inadequate oral intake was expected over a 5-day period.[2]

The attending physician determined the type of nutrition for any critically-ill patient who is anticipating to remain unable to take oral nutrition for more than 5 days, once the patient has been resuscitated. Those patients considered having intestinal failure or in whom bowel rest was required, were given parenteral nutrition. If the clinician felt that the patient had a functioning gastrointestinal tract, the patient was given enteral nutrition. Mixed nutrition was given to the patients who fail to tolerate at least 50% of their goal rate of enteral feedings by postinjury day 7. Enteral nutrition was delivered by a continuous pump-driven infusion 24 h per day through a nasoenteral tube. The volume of gastric residual was measured four times a day. Total parenteral nutrition was administered continuously through a central IV line 24 h per day. Energy and nitrogen requirements were calculated from a computer program previously validated.[6]

The following data were collected: sex, age, weight, height, admittance date, date that nutrition support started and type of nutrition support – enteral, parenteral or mixed nutrition – acute physiologic and chronic health evaluation II (APACHE II), whether they were a medical or surgical patient, presence and duration of central venous catheter (CVC), urine catheter and mechanical ventilation (MV) and prescribed and delivered daily caloric intake during the first 7 days.

The cohort was divided into two groups according to the start time of nutritional support. The early nutritional support group included patients who were started on artificial nutrition within 48 h of admission in ICU. The remainder of the patients comprised the late nutritional support group.

The primary endpoint was ICU mortality rate. The secondary endpoint was Nosocomial Infection that included ventilator associated pneumonia (VAP), bloodstream infection (BSI) or urinary tract infection (UTI). Nosocomial infection was defined when an infection appeared 48 h or more after ICU admission. Ventilator associated pneumonia (VAP) was defined as new or progressive infiltrates and a new onset of purulent sputum or organism isolated from the blood or a tracheal specimen culture, 48 h after initiating mechanical ventilation. Nosocomial bloodstream infection was defined as a recognized pathogen cultured from one or more blood cultures not related to an infection at another site and one of the following signs or symptoms: fever (38 °C), chills or hypotension, 48 h after ICU admission. Nosocomial UTI was defined as one of the following signs or symptoms with no other recognized cause: fever (38 °C), urgency, frequency, dysuria, or suprapubic tenderness and a positive urine culture, that is $>10^5$ microorganisms per cm^3, 48 h after urinary catheter had been placed.[7]

Statistical analyses were done with SPSS 16 (SPSS inc., Chicago, IL, USA). Means and standard deviations were calculated for continuous variables, and frequencies for discrete variables. Continuous variables were comparatively analyzed with Student's T Test, Mann–Whitney U or One-Way Analysis of Variance, and discrete variables were analyzed with Chi Square Test or Fisher's Exact Test. Binary Logistic Regression was performed to assess the effect of early nutritional support on ICU mortality and on nosocomial infection after controlling for important confounders such as: age, gender, route of nutritional support, whether they were a surgical or medical patient, percentage of the prescribed calories received during the first week of nutritional support and the relative position with respect to the 50th percentile of the APACHE II score, as we believed that these variables were important confounders or they had a p value less than or equal to 0.1 associated with the mortality and nosocomial infection, in a preceding univariate analysis. Odds Ratios were computed from the coefficients in the logistic model and 95% confidence intervals were calculated for all variables. All p values were two tailed and values less than or equal to 0.05 were considered statistically significant.

3. Results

Ninety-two patients that received nutritional support were included in the study. Demographics data of our study group are listed in Table 1. There were 66% male and 34% female, and 47% medical and 53% surgical patients. There were 528 nutritional consultations for the computer program to calculate caloric and nitrogen requirements. There were 1354 nutrition days (mean of 13.27 ± 13.4), 858 days of enteral nutrition (mean of 12.4 ± 11.2) and 713 days of parenteral nutrition (mean of 10.49 ± 9.4).

Route of nutritional support: enteral nutrition was the sole source of nutrition for 37 patients (40.2%). 37 patients (40.2%) received only parenteral nutrition 18 patients (19.6%) received mixed nutrition.

The mean energy and daily nitrogen requirement calculated by the computer program were 1886 ± 276 kcal and 14.5 ± 4.5 gr. respectively. Patients received 59% ± 28% of their requirements throughout the study period. The percentage of prescribed calories received in the study period by the enteral route was 37% ± 18% in enteral nutrition patients and 15% ± 13% in mixed nutrition patients and by IV line 66% ± 23% in parenteral nutrition and 77% ± 22% in mixed nutrition patients.

According to the start time of nutritional support there were two groups: the early and the delayed nutritional support groups. At baseline, significant differences in patient characteristics were found between the two study groups (Table 1). The early nutritional support group had a lower proportion of mechanical ventilation patients than the delayed group (71% vs. 91%; $p = 0.01$). There was also a lower proportion of enteral nutrition patients (32% vs. 53%) and a higher proportion of patients with parenteral nutrition. No statistically significant differences were observed in the APACHE II score. The distribution of patients with respect to