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ORIGINAL ARTICLE

Changes in nutritional status in ICU patients receiving enteral tube feeding: A prospective descriptive study

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Summary
Objectives: This study aimed to assess the changes in nutritional status in Korean ICU patients receiving enteral feeding, and to understand the contribution of baseline nutritional status and energy intake to nutritional changes during the ICU stay.
Methods: This was a prospective study of nutritional changes in 48 ICU patients receiving enteral feeding for 7 days. The Subjective Global Assessment scale was used upon admission. In addition, anthropometric measures (triceps skinfold thickness, mid-arm circumference, mid-arm muscle circumference, body mass index and percent ideal body weight) and biochemical measures (albumin, prealbumin, transferrin, haemoglobin and total lymphocyte count) were evaluated twice, upon admission and 7 days after admission.
Results: Seventy-five percent of ICU patients were severely malnourished at admission. Although the nutritional status worsened in both the patients with suspected malnourishment and the patients with severe malnutrition at admission, the nutritional status worsened significantly more in the patients with severe malnutrition than in the patients with suspected malnourishment. Moreover, a number of nutritional measures significantly decreased more in underfed patients than in adequately fed patients. The most significant predicting factor for underfeeding was under-prescription.
Conclusion: The ICU patients in our study were severely malnourished at admission, and their nutritional status worsened during their ICU stay even though enteral nutritional support was provided. The changes in nutritional status during the ICU stay were related to the patients' baseline nutritional status and underfeeding during their ICU stay. This study highlights an urgent need to provide adequate nutritional support for ICU patients.

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Introduction

Malnutrition is a common problem in hospitalised patients. More than 35% of intensive care unit (ICU) patients are reported to be malnourished upon admission to the ICU (Nisim and Allins, 2005; Sungurtekin et al., 2008). Moreover, two-thirds of 200 patients experience worsening of their nutritional status during their hospital stay (Barr et al., 2004). Similarly, malnutrition is highly prevalent in patients hospitalised in Korean ICU, occurring in up to 87% of patients (Lee et al., 2003).

Malnutrition can lead to a higher risk of infection (Krishnan et al., 2003), development of pressure ulcers (Thomas, 2001), and reduced wound healing (Jagoe et al., 2001), which can result in prolonged hospital stays (Rodriguez, 2004) and increased healthcare costs (Martin et al., 2004). Eventually, malnutrition can increase morbidity and mortality (Martin et al., 2004).

Although enteral nutrition is the preferred method for nutritional support in ICU patients, patients with enteral feeding are at great risk of malnutrition due to insufficient nutritional intake (Parrish, 2003). This may be in part due to insufficient prescription (Krishnan et al., 2003), incomplete delivery of prescribed enteral nutrition (Kim et al., 2010; O'Leary-Kelley et al., 2005; Reid, 2006) or gastrointestinal (GI) intolerance of tube feeding (Petros and Engelmann, 2006). Furthermore, the patient's baseline nutritional status assessed on admission may have a negative influence on changes in nutritional status during the ICU stay (Barr et al., 2004).

To date, however, there have been few attempts to study the changes in nutritional status in patients with enteral nutrition, particularly so with relation to the nutritional status at admission. Furthermore, there is little data about malnutrition in Korean ICU patients. Nothing is known about the factors that contribute to the nutritional changes in this population. Therefore, evaluating the nutritional status at admission and monitoring the nutritional changes during the ICU stay are essential for developing an evidence-based enteral nutrition protocol to improve nutritional status in Korean ICU patients.

The aims of the current study, therefore, were to assess the nutritional status of patients receiving enteral tube feeding in the ICU at admission and to evaluate its effects on nutritional status over the 7 days after admission. This study also aimed to understand the contribution of energy intake during hospitalisation to the changes in nutritional status during the ICU stay.

Methods

Study design

This was a prospective, descriptive study of nutritional changes in enterally fed ICU patients. Patients were recruited from the medical ICU of Seoul National University Hospital (SNUH) in South Korea. Data was collected from September 2003 to October 2004. The study obtained approval from the Institutional Review Board at the Seoul National University College of Nursing (Ref:2010-13). Informed consent was obtained from patients or legal surrogates of patients.

Sample

Adult medical patients (≥18 years of age) who had been admitted to the medical ICU were screened for eligibility. Inclusion in the study was restricted to patients who started enteral tube feeding after admission to the ICU, had not received preoperative or postoperative care, did not have do-not-resuscitate orders, had received nothing by mouth since admission, and had not received total parenteral nutrition. A total of 80 patients meeting the eligibility criteria were initially enrolled in this study, but 32 patients who stopped enteral feeding were excluded from the analysis for the following reasons: they were changed to oral or parenteral nutrition ($n = 14$), transferred or discharged from the unit ($n = 10$), or expired ($n = 8$) within the 7 day study period. Therefore, 48 patients who received enteral tube feeding for 7 days were included in this study. The data from the patients excluded was used only to compare subjective and objective nutritional status on admission between patients who were included and those who were excluded.

Data collection

After screening patients, we collected demographic data from patients' electronic medical records (EMRs). The severity of disease assessed with the Patient Severity Classification Tool (PSCT) (KHNA, 1994) was also obtained from EMRs. The PSCT ranges in level from one to six, and the higher the level, the more severe the disease.

Nutritional status data

For the subjective assessment of nutritional status, the Subjective Global Assessment (SGA) scale was used upon admission (Desky et al., 1987). This scale has been recommended for use as a validated assessment method (Delmore, 1997). Although the information was obtained primarily from the caregivers for patients with communication problems ($n = 19$), the SGA scale has been reported to be a reliable method with the agreement ($k = 0.9$) between raters (Sheean et al., 2010). For objective assessments of nutritional status, the ninth revision of the International Classification of Disease, Clinical Modification (ICD-9-CM) (Swails et al., 1996), anthropometric measurements, and biochemical measurements were evaluated twice-upon admission and 7 days after admission. Anthropometric measures included triceps skinfold thickness (TSF), mid-arm circumference (MAC), percent ideal body weight (PIBW), body mass index (BMI) and mid-arm muscle circumference (MAMC) (Bickley, 2003). TSF and MAC were measured three times in the arms without oedema or wound dressing using a calliper (Caldwell, Justics & Co Inc.) and an inelastic measuring tape, and then a mean value was obtained (Lee and Kwon, 2000). The arms were held vertically so as not to touch any surface because wound dressings, oedema, and the patients' position may influence measurements (Sabol, 2004). MAMC, BMI and PIBW were calculated using equations (ADA, 2000). For biochemical measures, we obtained the values for serum albumin, haemoglobin, total lymphocyte count, and C-