Nutrition in critical illness: Critical care nurses’ knowledge and skills in the nutritional management of adults requiring intensive care – A review of the literature

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**Key Words:** Nutrition, Critical Illness, Nutritional Status and Critical Care Nurses.

**Abstract**

**Background:** Critical illness is physiologically debilitating and is affected by the nutritional status of patients. There is a strong relationship between adequate nutritional status and recovery from critical illness. The health care team, nurses in particular, play a major role in the management and maintenance of an optimal nutritional status in patients who are critically ill.

**Aims of the review:** 1) To examine current evidence regarding the relationship between nutrition and critical illness 2) to examine the relationship between nutritional intake and clinical outcomes of critically ill patients; 3) To determine the role of critical care nurses and the health care team in meeting the nutritional needs of critically ill patients.

**Methods:** A Computerized search of Google Scholar, CINAHL, ProQuest, Medline, and HINARI was done using key terms. The search was delimited to peer reviewed, full text descriptive and intervention research articles with abstracts, which were reviewed.

**Results:** Current evidence suggests that there is a strong positive relationship between nutritional status and critical illness. Improved nutritional status is associated with positive clinical outcomes. However, the evidence is inconsistent in supporting this relationship. The healthcare team particularly nurses’ play a major role in the nutritional status of critically ill patients.

**Conclusion:** Maintaining optimal nutritional status is key to improving clinical outcomes of critically ill patients. Knowledge and skills of the healthcare team in nutritional management and the availability of management protocols are important in maintaining optimal nutrition of critically ill patients.

**Introduction**

Critical illness is life threatening and results from trauma, surgery, sepsis, shock or severe burns usually requiring Intensive Care (Mizock, 2010). Critical illness is characterized by severe morbidity, often resulting in mortality. In this state, patients are susceptible to dysfunction of multiple organ systems including respiratory, cardiovascular, and digestive systems (Kan et al., 2003).

Critically ill patients usually experience stress, inflammatory responses and hypermetabolism. In critical illness states there is a higher ratio of catabolic compared to anabolic activities. During the catabolic state stored nutrients such as fat, protein and carbohydrates are depleted due to the body’s additional demands for substrates for tissue repair (Grau et al., 2007). Additionally, accelerated lipolysis, insulin resistance, protein catabolism, and weight loss are readily observed during critical illness due to the increased metabolic changes that patients undergo (Grau et al., 2007).

Current evidence regarding the role of nutrition in the recovery of patients from critical illness is inconsistent. Some researchers report evidence supporting the argument that
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Adequate nutritional status is a positive modifier of critical illness (Calder, 2007; Dobson & Scott, 2007; Zeigler, 2009; & Joseph et al., 2010). However, Barr, Hecht, Flavin, Khorana & Gould (2004) suggested that early parenteral feeds were associated with higher mortality when compared to enteral feeds. Enteral feeds were associated with lower risk of death (hazard ratio =0.44, 95% CI, 0.24-0.80; \( p=0.007 \)). Critically ill patients are frequently comatose and suffer from self care deficit which affects their ability to meet their nutritional needs. These needs are therefore met by nurses and other members of the health care system.

In Jamaica, between June 2001 and May 2002, the University Hospital of the West Indies (UHWI), admitted 285 clients to the Intensive Care Unit (ICU). The overall mortality rate among critically ill patients was 34%; 77% died in ICU while 23% died on the ward after discharge from the ICU (Augier, Hambelton & Harding, 2005). In the intensive care unit, critical care nurses (CCN) are responsible for assessment of nutritional status, administration of feeds, observing patients for tolerance of feeds and nutritional advocacy. However, there are no protocols guiding nurses in nutritional management of critically ill patients. The aims of this review are to examine: 1) current evidence regarding the relationship between nutrition and critical illness 2) the relationship between nutritional intake and clinical outcomes of critically ill patients; 3) the role of critical care nurses and the health care team in meeting the nutritional needs of the critically ill patients. Examination of these issues will facilitate the identification of gaps in current literature and support the need for new research.

Methodology

Search strategy

The literature included in this review was retrieved from computerized search of Google Scholar, CINAHL, ProQuest, Medline, and HINARI, and was published between 2003 and the present. The search was delimited to peer-reviewed, intervention and descriptive full text research articles with abstracts. Key terms were “adequate nutrition”, “nutrition in critical illness”, “nutrition”, “critical illness”, “adequate intake”, “adequate nutrition in critical illness”, “nurses role” AND “nutritional management”. A total of 582 articles were identified. A literature review matrix was developed to aid in the selection of the most relevant studies. Twelve articles were selected and included in this review, having met the following criteria: They examined critically ill patients, receiving hospital based care, acutely ill, admitted for surgical or medical reasons and had their nutritional status or nutritional intake assessed. The articles needed also to report on the role of the health care team specifically regarding nutritional management of critically ill patients. Papers were excluded if they were; editorials; commentaries or described patients managed outside hospital settings.

Literature review

The current evidence regarding the role of nutrition in the recovery of patients from critical illness is inconsistent. Some researchers report evidence supporting the argument that nutritional status is a positive modifier of critical illness (Calder, 2007; Dobson & Scott, 2007; Zeigler, 2009; & Joseph et al., 2010). However, Barr et al. (2004) suggested that early parenteral feeds were associated with higher mortality when compared to enteral feeds. Enteral feeds were associated with lower risk of death. In general, the last decade has yielded research which focuses extensively on examining relationships between nutrition and critical illness; feeding and clinical outcomes in critically ill patients and health team’s management of nutritional needs of critically ill patients.
The relationship between nutrition and critical illness

As the nutritional status improves the health status of critically ill patients also improves (Calder, 2007; Dobson & Scott, 2007; Zeigler, 2009; & Joseph et al., 2010). Delgado et al. (2004) conducted a retrospective study to determine the energy requirements of critically ill, mechanically ventilated patients based on their nutritional status and to evaluate the incidence of hospital malnutrition and the inflammatory response in children and adolescents. They assessed participants’ nutritional status by measuring interleukin levels and anthropometry and compared nutritional status and clinical outcomes within and between groups. The study reported that 53% (571 of 1077) of participants had moderate or severe malnutrition. However, there was no significant difference in mortality rates between well-nourished (WN), moderately malnourished (MM) and severely malnourished (SM) groups (WN= 18.5%, MM= 19.5%, SM= 17.9%, p=0.05). There were similar results for sepsis incidence and hospitalization between groups. The researchers concluded that malnourished patients are capable of releasing inflammatory markers which might have an impact on their nutritional status.

In a comparable study, Finkielman et al. (2004) examined the impact of Body Mass Index (BMI) on the mortality and hospital length of stay of ICU patients in Minnesota, USA. They calculated the BMI of each participant and classified them, based on World Health Organization (WHO) standards as underweight, normal range, and grades 1, 2, and 3 of overweight categories. The Acute Physiology and Chronic Health Evaluation (APACHE) III was used to classify disease severity, and the participants’ reports were examined to determine clinical outcomes. In this study a BMI < 18.5 was independently associated with increased mortality (Odds Ratio (OR) 1.71, 95% CI 1.34-2.71, p< 0.0001). A BMI above normal was also associated with poor clinical outcomes including increased mortality. A BMI of 30-39 was associated with a lower mortality rate (OR=0.72, 95% CI =0.56-0.94, p=0.0138). Although this study found no difference in ICU length of stay among BMI groups, the associations between BMI and mortality rate suggest possible relationships between the overall management of patient’s nutritional intake and their clinical outcomes.

Nutritional intake and clinical outcomes of critically ill patients

Malnutrition, especially undernutrition, is common in hospitalized and intensive care patients. In two teaching hospitals in California, 67% of all hospital admissions experienced deterioration in their nutritional status during their hospital stay (Barr et al., 2004). In Europe and North America, 40 - 50% of hospitalized patients are at risk of malnutrition. Similar results have been reported in incidence studies in Brazil (Barr et al., 2004). Intensive care patients are at greater risk of morbidity and mortality as critical illness worsens nutritional status because of an increase in metabolic demand and impaired substrate utilization (Grau et al., 2007). Impairment in the nutritional status of critically ill patients exacerbates physiological dysfunction. According to Joseph et al. (2010) “to prevent and reverse pathophysiologic alterations in critical illness, early optimal nutritional support …. is obligatory” (p. 29).

A study conducted by Artinian et al., (2006) supports the assertion made by Joseph et al. (2010). This study utilized a convenience sample of 4049 critically ill mechanically ventilated medical patients to test the hypothesis that lower mortality would be observed in patients who receive early enteral feeding. Both the Acute Physiology and Chronic Health Evaluation (APACHE) and Simplified Acute
Physiology Score (SAPS) were used to determine illness severity. The study ascertained the length of hospital stay, clinical outcomes such as ventilator associated pneumonia (VAP), ICU and hospital mortality. The clinical outcome factors were compared within and between groups of early and late enterally fed patients. Artinian and colleagues found that despite disease severity, critically ill patients who were fed early (within 48 hours of commencing mechanical ventilation) had a lower risk of ICU and hospital mortality compared to those who were fed late. (18.8% vs. 21.4%, p=0.001). Additionally, VAP was increased in patients who were fed early compared to those who were fed late (284 vs. 143, p=0.01). Although there was a positive relationship between early feeding in critical illness and improved clinical outcomes such as hospital and ICU mortality, there was an increased risk of VAP.

In a similar study, O’Leary-Kelley et al. (2005) compared the number of calories received via enteral feeds to calculate Estimated Energy Requirements (EER) and examined the factors affecting delivery of enteral feeds among 60 medical–surgical ICU adult patients. The researchers classified participants into two groups, based on how their EER was determined, either by indirect calorimetry (25 participants) or using the Harris-Benedict Equation with a stress factor of 1.3 to 1.5 (35 participants). Nutritional data collected included weight, type of enteral formula used, and the reasons for and duration of feeding interruptions. Study findings indicated that ICU patients were not fed adequately; 68.3% of participants were underfed. ICU tests and procedures, nursing care and gastrointestinal (GI) dysfunction accounted for 70% of the feeding disruptions. Energy requirements calculated by indirect calorimetry differed by more than 488 Kcal (p <0.001). These data suggested that methods to determine energy requirements for critically ill patients are not consistent and the amount of calories delivered may be impacted by the method used to determine energy requirements. Such inconsistency is problematic and poses a threat to accurate diagnosis and management of patients’ nutritional intake.

Indirect calorimetry was also used by Kan et al. (2004) in a correlational study to examine the energy requirements of 54 critically ill, mechanically ventilated patients using their nutritional status as the outcome variable. The researchers used indirect calorimetry to measure participants’ Measured Energy Expenditure (MEE). Total energy requirements were estimated at 120% of Resting Energy Expenditure (REE). The study examined the number of calories administered and compared this to the required amount determined by calorimetry. Nutritional status was measured using anthropometry and biochemical tests and compared to the participants calorie intake. The APACHE severity illness score was also compared with nutritional status and caloric intake. The researchers found that 15 patients were underfed, receiving <90% of total energy requirements, 20 patients were appropriately fed within ± 10% of required energy, and 19 patients were overfed >110% of total energy requirements. The nutritional status of the participants was generally unchanged throughout the 7 days of the study except for mid-arm muscle circumference (MAC). Underfed patients had a reduction in MAC at day 7. There was significant change in the biochemical status of the participants and the illness severity was different among the feeding groups. However, the length of stay was positively correlated with the carbohydrate intake in adequately fed participants. It is important to note that the nutritional intake of patients that resulted in changes in their MAC was based on whether or not their feeding regime was maintained by members of the health team.
The role of the nurses and the health care system in meeting the nutritional needs of critically ill patients

Most ICU patients are unconscious or in a subconscious state at some point during hospitalization and have no input in decisions about the type and volume of food they receive (McClave et al., 2009). Nurses, dieticians, pharmacists, and physicians are responsible for ensuring that nutritional adequacy is attained through nutrient supply, administration, and monitoring of patients’ nutritional status (McClave et al., 2009). CCNs are responsible for withholding or discontinuing feedings when intolerance is observed; they review patients’ flow sheets, medications, laboratory and radiological findings and are responsible for identifying any changes in the physiological and nutritional status of the patient (Yeager et al., 2006).

Barr et al. (2004) hypothesized that the introduction of a nutritional protocol would lead to an increase in the number of critically ill patients fed enterally. They examined a sample of 200 patients; 100 pre-implementation and 100 post-implementation. Nutritional support would be initiated sooner and advance more rapidly in patients who are unable to take oral feeds. The researchers examined whether a protocol, that would increase the knowledge of CCNs, affected the degree to which patients were fed and whether the clinical outcomes were subsequently impacted by patients’ nutritional status. Nutritional outcome measures included the number of patients who received enteral feeds, time to initiate nutritional support and percent caloric target administered on day 4. The duration of mechanical ventilation of each participant was also assessed. The researchers found that instituting a protocol significantly increased the probability of being fed enterally (OR= 2.4, 95% CI =1.2-5.0, p=0.009) and reduced the duration of mechanical ventilation (17.9±31.3 vs. 11.2±19.5 days, p=0.03). The researchers concluded that early institution of nutritional support by nurses and doctors within the ICU and the use of enteral nutrition improved clinical outcomes in critically ill patients. This study demonstrated that the use of a nutrition protocol improved the nutritional knowledge of CCNs and, subsequently, the nutritional status and clinical outcome of critically ill patients.

Quenot et al. (2010) in a study of 203 patients in 19 units measured the amount of nutrients required, prescribed, and actually administered to critically ill patients, assessed adherence to the practice guidelines, and investigated factors leading to non-adherence. The researchers examined whether doctors prescribed calories in keeping with critically ill patients’ requirements, and whether nurses administered the calories to critically ill patients in keeping with the prescriptions of the doctors. Additionally, the study examined whether the nutritional status of the patient was impacted by the availability of practice guidelines. These guidelines could improve the knowledge of nutritional management for health care practitioners in general and nurses in particular. Forty-four nurses and ICU employees were conveniently recruited to record the number of calories calculated as required, prescribed and administered as well as the reasons for and frequencies of feeding interruptions. The results of the study were that patients were prescribed >80% of required calories by doctors and patients were administered >80% of prescribed calories by nurses who were equipped with direction from the practice guidelines. Only Gastric Residual Volume (GRV) was significantly associated with non-adherence to practice guidelines for enteral nutrition administration.

According Kundrup et al. (2004), education is an important factor in the provision of nutritional care. This conclusion was drawn in a study using a purposive sample of 750 patients
and 268 nurses. The primary objective was to define the potential causes of inadequate nutritional care in three intensive care institutions in Norway. The nutritional status of the clients was categorized, based on the intake meeting estimated energy requirements. The study found that 167 of the 740 (23%) patients, who could be evaluated, were nutritionally at-risk patients ($p = 0.0001$). The study also showed that 59% of patients were screened for nutritional risk on admission and only 47% of screened patients had nutritional care plans developed. A questionnaire was distributed to nurses caring for these patients to identify the reasons for the nutritional care that was provided. The responses were summarized in themes, and the most frequent response in the education theme was lack of knowledge about how to estimate the requirements of the patients who were admitted. The researchers recommended an improvement in policy and protocols as well as training of the health team to improve the nutritional care of patients. This evidence draws attention to the integral role that nurses play in influencing nutritional outcomes of patients who are critically ill. Specifically, it signals the need for nutritional protocols, including education, to improve critical care outcomes.

**Summary**

Evidence from reviewed studies suggests a strong positive relationship between nutritional status and critical illness. Improved nutritional status is associated with positive clinical outcomes. Conversely, poor nutrition and poor clinical outcomes of critically ill patients result from a number of interrelated factors. These include interruption in feedings due to ICU tests and procedures, a dysfunctional gastrointestinal system, and feeding intolerance, as well as the lack of knowledge and skills of the health care team in nutritional management. However, very few studies examining the relationship between nutrition and clinical outcomes in critical illness were randomized and had adequate power. Despite these limitations, current evidence suggests that improvement in the knowledge, skills of the health care team and availability of nutritional management protocols are associated with improvement in the nutritional status and clinical outcomes of critically ill patients’.

**Conclusion**

Maintaining optimal nutritional status is key to improving clinical outcomes of critically ill patients. Knowledge and skills of the healthcare team in nutritional management and the availability of management protocols is important in maintaining optimal nutrition of critically ill patients.

**References**


