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Nutritional Care in Iranian Intensive Care Units

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ABSTRACT

Intensive care units (ICUs) provides intensive treatment medicine to avoid complications such as malnutrition, infection and even death. As very little is currently known about the nutritional practices in Iranian ICUs, this study attempted to assess the various aspects of current nutrition support practices in Iranian ICUs. We conducted a cross-sectional study on 150 critically ill patients at 18 ICUs in 12 hospitals located in 2 provinces of Iran from February 2015 to March 2016. Data were collected through interview with supervisors of ICUs, medical record reviews and direct observation of patients during feeding. Our study showed that hospital-prepared enteral tube feeding formulas are the main formulas used in Iranian hospitals. None of the dietitians worked exclusively an ICU and only 30% of patients received diet counselling. Regular monitoring of nutritional status, daily energy and protein intake were not recorded in any of the participating ICUs. Patients were not monitored for anthropometric measurements such as mid-arm circumference (MAC) and electrolyte status. The nasogastric tube was not switched to percutaneous endoscopic gastrostomy or jejunostomy (PEG/PEGJ) in approximately 85% of patients receiving long-term enteral nutrition (EN) support. Our findings demonstrated that the quality of nutritional care was inappropriate in Iranian ICUs and improvement of nutritional care services within Iranian ICUs is necessary.

Keywords: Nutritional status; Intensive care units; Enteral nutrition

INTRODUCTION

Intensive care units (ICUs) provides intensive treatment medicine to avoid complications such as malnutrition, infection, and even death [1]. Nowadays, nutrition therapy in ICUs is very important as nutritional support represents the quality of care for these patients. Critical illnesses, which are common among patients in ICUs, result from hypermetabolism, hypercatabolism, and nitrogen loss. These metabolic changes are mediated by activation of the inflammatory immune response, which lead to immune dysfunction, severe loss of fat and lean body mass, an increased-risk infectious complications, multi-organ dysfunction, prolonged hospitalization and mortality [2-4]. The provision of artificial nutrition for critically ill patients is of great importance as many are unable to maintain their own

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nutritional needs [3]. In critically ill patients who are incapable of consuming oral foods, enteral nutrition (EN) is the most important way to deal with metabolic conditions and the preferred route of nutrient supply [5]. Inadequate provision of energy correlates with the occurrence of complications, such as acute respiratory distress syndrome (ARDS), infections, renal failure, pressure sores, decreased wound healing, increased mortality, and increased length of stay (LOS) in ICU, with a consequence of increased total cost of hospitalization [6]. Unfortunately, malnutrition is common among ICU patients and the incidence of malnutrition has been reported to be 40%–100% in hospitalized patients in ICU [7]. Feeding, especially enteral feeding, plays an important role to improve immunity, reduce malnutrition and deal with infections among ICU patients. Nutritional assessment is a detailed examination of metabolic, nutritional and functional variables by an expert clinician, dietitian or nutrition nurse [8]. Along with other support processes, nutritional investigations should be used to monitor the patient and evaluate the needs to develop an appropriate nutritional care plan. Nutrition monitoring in the ICU is a complex system of coordinated activities that provides information about the dietary, nutritional, and related health status of patients, the relationships between diet and patients' clinical outcomes, and the factors affecting dietary and nutritional status. Nutrition care monitoring in the ICU leads to an appropriate care plan to detect indications of and prevent malnutrition and its complications, identify possible side effects, reduce the loss of muscle mass, prevent worsening of the disease, and improve patient recovery [9-11]. About 2 million people refer to medical care centers in Iran every year of whom 20%–30% need intensive care [12]. Since no study has examined the monitoring of ICU patients receiving EN in Iran, the aim of this study was to evaluate the current nutrition support practice in the critical care setting in Iran.

MATERIALS AND METHODS

This cross-sectional study was conducted in 18 ICUs of 12 hospitals of Kermanshah and Mazandaran (2 provinces of Iran), which the former is in the west and the latter is in the north of Iran. Based on the total number of hospitalized patients in ICUs of each hospital, sample size was calculated to have a study power of 90% and confidence level of 95%. After calculating the sample size, a convenience sample of 150 chronically critically ill subjects was consecutively enrolled during a period of 12 months.

The nutrition checklist developed by 5 nutritionists was used to determine the nutritional status of patients admitted to the ICU. This checklist had 4 sections including demographic information, nutritional status, physical examination and biochemical values.

1. Demographic information included age, gender, diagnosis, duration of hospitalization, time to start intestinal feeding, causes of delay in starting intestinal nutrition and duration of intestinal nutrition.

2. For evaluation of nutritional status, we collected information regarding the presence of dietitian, type of diet (including diabetic, high protein, low calorie, low potassium, chronic obstruction pulmonary disease [COPD], diarrhea and uremic diets), procedure and route used for EN, kind of formula, presence of feeding protocol, regular monitoring of nutritional status, direct education by the nurse, daily records of energy, and protein and ensuring patient's adequate energy intake.

3. The physical examination consisted of assessment of edema formation, weight changes, dehydration, state of bloating and abdominal discomfort, gastric residual volume (GRV) monitoring (routinely), recording of clinical signs of vitamin and mineral deficiencies such as dermatitis, schillosis and fragile hair, recording of gastrointestinal complications such as vomiting, reflux and aspiration and measurement of the patient's nutritional status in patients including mid-arm circumference (MAC).

4. For biochemical values, we examined hematology variables (cell blood count [CBC] diff), biochemical parameters (fasting blood sugar [FBS]), lipid profiles such as triglyceride (TG), blood urea nitrogen (BUN), creatinine, serum electrolytes, total iron-binding capacity (TIBC), iron (Fe), urine analysis (U/A), output and consistency of stool. These measurements were taken daily, weekly, monthly, or as necessary.

Patients who received at least 5 days of nutritional support during the observation period were included in the study, and therefore those who had incomplete information were excluded from the study. ICU supervisors were asked to describe the characteristics of their ICU, general aspects of nutrition support practice, role of the dietitian, access to metabolic carts, and use of feeding protocols or algorithms. All data on nutritional assessment including dietary intake, anthropometric measurements and biochemical values were collected by reviewing medical records. Physical examination was performed by direct observation of patients, such as to check the status of the head during feeding. Obtained data were then compared with the most recent guidelines established by the European and Canadian Enteral and Parenteral Nutrition Societies, Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN).

Ethics

This study was approved by the Ethics Committee of Deputy of Research and Technology at Kermanshah University of Medical Sciences (ethic number: KUMS.REC.93379).

Statistical analysis

Data were analyzed using SPSS 20 software (IBM Corp., Chicago, IL, USA). Descriptive statistics including frequency, frequency percentage, mean and standard deviation were used to describe the characteristics and nutritional status of patients.

RESULTS

In this study data were collected from 150 patients (90 males and 60 females) admitted to 18 ICUs in different hospitals in 2 provinces of Iran (Kermanshah and Mazandaran) from February 2015 to March 2016. The mean age of patients was 62.83 ± 21.16 years and there were no statistically significant differences between 2 genders. The most common admission diagnoses for patients were surgical subsets (trauma, traumatic brain injury, open abdomen, and burns), cerebrovascular accidents (CVAs), loss of consciousness (LOC), respiratory failure/pneumonia, renal failure, sepsis, cardiovascular disease (CVD), and cancer. Of participating ICUs, only 1 ICU used a standard enteral feeding protocol (**Table 1**).

After interviewing the staff, we learned that dietetics services were rendered for only 30% of the patients. All of the dietitians working in ICUs were not exclusively trained to work in the ICU and they were general dietitians, so physicians and nurses routinely made a referral to a

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Table 1. Characteristics of the 150 critically ill patients

Variable	Value
Age	62.83 ± 21.16
Sex	
Male	90 (60.0)
Female	60 (40.0)
Mechanical ventilation	
With	56 (37.3)
Without	94 (62.6)
Reasons for ICU admission	
Surgical subsets (trauma, TBI, OA, and burns)	43 (28.7)
CVA	27 (18.0)
LOC	24 (16.0)
Organ failure (pulmonary, renal, and liver)	17 (11.3)
Sepsis	13 (8.7)
CVD	5 (3.3)
Cancer	4 (2.7)
Others (MS, DKA, poisoning)	17 (11.3)
Type of diet	
Handmade formula in hospital or at home	103 (68.6)
Diabetic	15 (10.0)
High calorie, low protein	23 (15.4)
COPD	1 (0.6)
Uremic	8 (5.4)
Total	150 (100.0)

Data are shown as mean ± standard deviation or number (%).
ICU, intensive care unit; TBI, traumatic brain injury; OA, open abdomen; CVA, cerebrovascular accidents; LOC, loss of consciousness; CVD, cardiovascular disease; MS, multiple sclerosis; DKA, diabetic ketoacidosis; COPD, chronic obstruction pulmonary disease.

Table 2. Characteristics of staff of the participating ICUs

Characteristic	No. (%)
Presence of dietitian(s)	50 (33)
Full-time dietitian	0 (0)
Present of feeding protocol	8 (5.33)
Regular monitoring of nutritional status	0 (0)
Patient education by nurse	0 (0)
Daily record of energy and protein	0 (0)
GRV monitoring (routinely)	124 (82.66)

ICU, intensive care unit; GRV, gastric residual volume.

nutritional consulting for ICU patients. A standard enteral feeding protocol was used in 1 of 18 participating ICUs in this study. The characteristics of participating ICUs are shown in **Table 2**.

The mean time to start enteral feeding was 2.36 ± 2.5 days after admission to ICU. In the absence of a contraindication, feeding was initiated for 48.6% of patients on the first day (**Table 3**). The most frequently cited threshold levels for bolus feedings reported by 86% of critical care nurses were 200 and 250 mL. The volume of feeding solution administered during the first 24 hours of EN was 200–500 mL in 70.66%, 500–1,000 mL in 20%, 1,000–1,500 mL in 6% and 1,500–2,000 mL in 3.33%, respectively. The mean EN duration was 14.96 ± 18.7 days. Most of the patients (86.6%) received enteral feedings only; one of them received sterile ready-to-eat feeding (commercial formulas) and the remainders received feeding solutions prepared from nutrients mixed together and homogenized in the hospital kitchens (handmade formula). In 5 (28%) hospitals, only one type of formula was used for patients receiving EN, regardless of their specific needs. Of the 150 patients, 145 (98.6%) received gastric feeding, 5 (3.3%) received jejunal feeding; 141 patients (94%) received nutritional support through bolus method and 6% through continuous feeding. The system

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Table 3. Nutritional and clinical status of the 150 critically ill patients

Variable	Value
The duration of ICU stays	17.90 ± 20.16 (5–115)
The day of start EN after ICU admission	2.36 ± 2.5 (0–18)
Enteral access	
EN only	130 (86.6)
Enteral and parenteral nutrition	20 (13.3)
Feeding methods	
Bolus	141 (94)
Continuous	9 (6)
Alternative	0 (0)
Type of EN formula	
Hand formula made in hospital	130 (86.6)
Hand formula made at home	19 (12.7)
Commercial formula	1 (0.7)
Amount of EN formula provided during the first 24 hr, mL	
200–500	106 (70.6)
500–1,000	30 (20)
1,000–1,500	9 (6)
1,500–2,000	5 (3.4)
EN duration, day	14.96 ± 18.7 (1–112)
Route	
Orogastric/NG	145 (96.6)
ND/nasojejunal	2 (1.4)
PEG/PEGJ	3 (2)
Use of supplement*	69 (46)
Total	150 (100)

Data are shown as mean ± standard deviation or number (%).
ICU, intensive care unit; EN, enteral nutrition; NG, nasogastric; ND, nasoduodenal; PEG/PEGJ, percutaneous endoscopic gastrostomy or jejunostomy.
*Most supplements used were albumin, protein, multivitamin minerals.

used for administration was by pump (6%), gravity drip (74%), and bolus syringe (20%). The flushing of enteral feeding tubes was performed between 1 and 6 times per day (median 4). Percutaneous endoscopically placed gastrostomy tubes (percutaneous endoscopic gastrostomy or jejunostomy [PEG/PEGJ]) were used in only 3 (15%) of 20 patients receiving long-term (4 weeks or more) EN (**Table 3**).

The mean head of bed (HOB) elevation was 30° for all patients. None of the ICUs were equipped with beds to measure patient's weight accurately. Height was estimated based on the forearm (ulna) length and according to the age and sex of the patients; the ideal body weight was used to calculate Basal Energy Expenditure (BEE). Changes of MAC and electrolyte status (including calcium, magnesium, zinc, and phosphorus) were not measured in 93% and 62% of patients, respectively, during hospitalization in the ICU (**Table 4**).

DISCUSSION

Assessment of nutritional status and monitoring of patients in ICUs is essential to reduce morbidity and mortality [9]. In modern critical care, the notion of 'therapeutic nutrition' is replacing traditional 'supportive nutrition' [13]; therefore, nutritional support plays an important role in the care of critically ill patients and needs to be continuously monitored. Our prospective observational study had 2 primary purposes: to describe the quality of nutritional monitoring in critically ill adult patients receiving enteral feeding and to compare

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Table 4. Physical examination and biochemical values of 150 critically ill patients

Physical examination	Not	Once after admission	Daily	Weekly	Monthly
Edema	110 (73.4)	-	36 (24.2)	4 (2.4)	-
Weight changes	103 (68.6)	12 (8)	35 (23.4)*	-	-
Dehydration	-	-	150 (100)	-	-
State of bloating and abdominal discomfort	117 (78)	-	33 (22)	-	-
GRV monitoring	24 (16)	25 (16.6)	101 (67.4)	-	-
Clinical signs of vitamin and mineral deficiencies	36 (24)	-	-	114 (76)	-
Gastrointestinal complications	51 (34)	-	99 (66)	-	-
Patient's MAC	109 (72.6)	30 (20)	-	11 (7.4)	-
Biochemical value					
CBC/diff	28 (18.6)	-	85 (56.6)	30 (20)	7 (4.7)
FBS	5 (3.3)	-	134 (89.3)	10 (6.7)	1 (0.7)
Lipid profile	110 (73.4)	-	23 (15.3)	7 (4.6)	10 (6.7)
BUN and creatinine	2 (1.3)	123 (82)	-	25 (16.7)	-
Calcium, magnesium, zinc, and phosphorus	93 (62)	-	10 (6.6)	45 (30)	2 (1.4)
Vitamin B_{12}	137 (91.3)	-	-	-	13 (8.7)
TIBC, Fe	145 (96.7)	-	-	-	5 (3.3)
U/A	-	-	-	150 (100)	-
Output and consistency of stool measurement	-	-	132 (88)	-	18 (12)

All of variables were shown number (%).
GRV, gastric residual volume; MAC, mid-arm circumference; CBC, cell blood count; FBS, fasting blood sugar; BUN: blood urea nitrogen; TIBC, total iron-binding capacity; Fe, iron; U/A, urine analysis.
*Estimation ideal body weight.

it with current guidelines used for Iranian patients hospitalized in ICUs. The study showed that the enteral route is the main route of administering nutrition support in Iranian ICUs. Nurses inserted enteral feeding tubes based on their own experiences and did not follow the guidelines. Although, sterile ready-to-eat feeding is available in developed nations today, kitchen-made products (called hospital-prepared enteral tube feeding formulas) are the main formula used in Iran hospitals mostly, due to economic and cultural reasons, lack of insurance coverage, and most importantly lack of awareness of the importance of the nutritional status of patients in the improvement of clinical outcomes. These solutions contain natural food sources such as milk, eggs, meat, fruits, and vegetables which are blended to become the form of soup. Theoretically, it might be thought that this solution can meet nutritional needs of different patients; however, studies in this area do not confirm the effectiveness and the gavage solution provided by hospitals cannot meet the calorie and protein needs of patients [14] Another problem of using this formula is that the patient's calorie intake cannot be calculated. Moreover, one potential complication is microbial contamination of these solutions. It is well known that enteral feeding tubes may become contaminated with bacteria and other microorganisms during preparation and administration, leading to the development of infectious complications in patients [15]. One study from Iran indicated that a majority of the blenderized enteral tube feedings is not safe and, in comparison to the standard limits, they are highly contaminated and pose substantial risk for developing a foodborne disease or nosocomial infection [16]. About 90% of our patients did not receive individual dietary prescriptions based on their weight, recent nutritional history and actual caloric needs, but like any other management strategy in the ICU, nutrition therapy must be tailored to the individual needs of the patient [17]. The results of an observational study on 886 critically ill patients showed that setting personalized diets for critically ill patients results in a 50% decrease of 28-day hospital mortality. Indeed, meeting only the energy target appears to be insufficient to improve health outcomes [18].

In this study, estimation of caloric needs in patients who received individual diets was based on the Harris-Benedict equation. Due to non-static variables affecting energy expenditure such as weight, medications, treatments, and body temperature, predictive equations provide a less accurate measurement of energy requirements than indirect calorimetry (IC). The accuracy of predictive equations range from 40%–75% compared with IC [17,19]. On the other hand, healthcare professionals who prescribe nutrition formulations tend to under-order calories, and thus patients only receive approximately 80% of what is ordered. This combination of inaccurate calculation, under-ordering calories and inadequate delivery of meals result in barely meeting the caloric requirements in about one-half of the patients [20]. These issues lead to lower mean intake of energy and protein compared with actual needs, increased risk of iatrogenic malnutrition in ICUs and its complications, increased cost of hospitalization and mortality. It is commonly accepted that the maximum duration of EN support via nasogastric (NG) tube is 30 days [21]. However, due to lack of strict monitoring and feeding algorithms in Iranian ICUs, the analysis of our data showed that NG tube was switched to PEG/PEGJ in only 15% of patients receiving long-term EN support (32–112 days). According to our data, the majority of patients (98.6%) received gastric feeding routinely without any institutional framework because EN therapy delivered via a tube into the stomach was technically easier. It is indicated that EN delivered through the transpyloric route reduces the incidence of regurgitation, aspiration and overall pneumonia [22-25], improves nutrition delivery compared with gastric feeding, and patients who received nasoduodenal (ND) feedings achieved nutritional goals earlier than those who received NG feeding [22-24]. Although internationally recognized guidelines for enteral feeding state that small bowel feeding is preferable to gastric feeding [17,26], this route was rarely used in our study. Furthermore, some studies suggested that inserting small bowel tubes can overcome delays in feeding [17,25], that was found in one-third of our study participants. The placement of NG tube was checked frequently in only 29% of patients in the current study. Although the abdominal radiograph is considered the “gold standard” for determining the position of the feeding tube [27], the results of the study indicate that the practice of auscultation and injecting air into the tube were the only methods used in the participating ICUs. Many studies have concluded that the presence of gurgling sounds following an injection of air is not a reliable sign showing that the tube is correctly positioned in the stomach and also it has not been supported by guidelines [28-31]. We also observed that the majority of nurses used the bolus method for nutrient delivery. Bolus method may cause more complications such as bloating and diarrhea than the continuous method; therefore, continuous infusion of enteral feeding is usually the recommended delivery method [32-34]. We noticed that GRV monitoring was conducted before the start of feeding by a considerable number of nurses (86%), but high-quality RCTs indicated that GRV measurement was unnecessary and could not demonstrate a correlation between pneumonia, regurgitation or aspiration rate and the magnitude of GRV; indeed, these complications occur even in the absence of high GRVs [35-37]. Pneumonia is more closely associated with inhalation of contaminated oropharyngeal secretion than regurgitation and aspiration of gastric contents [38]. Furthermore, it has been shown that eliminating the measuring of GRVs improves delivery of EN due to reducing inappropriate interruption without jeopardizing patient safety [36,39]. SCCM and ASPEN critical care guidelines in their last edition suggested not using GRVs as part of routine care to monitor ICU patients receiving EN [17]. Critically ill patients are at increased risk of malnutrition due to hyper metabolism and negligence exacerbates their nutritional status. Healthcare providers need better information about organizational factors that affect nutrition management and that nutritional adequacy affects hospital outcomes and consequently discharge disposition. This increased understanding is crucial for chronically critically ill patients who survive hospitalization, but continue their recovery in extended care facilities.

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CONCLUSION

Nutrition is often overlooked in the ICUs, and lack of access to ICU care can have negative effects on the patients. We have shown that the overall adequacy of nutrition monitoring is suboptimal in Iranian ICUs. Therefore, it seems that determination of a standard protocol in order to improve the nutritional support of ICU patients and educating healthcare professionals who are responsible for the care of critically ill patients in the ICU are essential. The training of healthcare staff directly involved in the care of patients will ensure that the protocol is implemented effectively and safely to the patients.

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