Nutrition in Intensive Care Medicine: Beyond Physiology

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Oral Feeding

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Abstract

Early nutrition can help to improve energy and protein intake and decrease the negative impact of the metabolic response to surgery. A key goal is to identify patients who exhibit increased respiration risk before beginning oral alimentation. Once a simple bedside 3-oz (90 ml) challenge, or early intervention in the oral care, administered by a trained provider is passed, specific diet recommendations can be made safely and confidently without the need for further objective dysphagia testing. Gastrointestinal motility disorders occur as part of the pathophysiology of diseases and critical illness, or are a result of medication therapies or enteral feeding complications. Inadequate energy intake in the first 7 days following extubation have recently been described. It would be highly beneficial to determine when it is best to initiate timely oral alimentation for recovering extubated intensive care unit (ICU) and more specifically surgical ICU patients to support the maintenance and rebuilding of lean body mass, maintain hydration, and permit the ingestion of oral medications. In a cross-sectional multicenter study conducted in 18 Spanish ICUs, within the scope of the 2007 European Nutrition Day, only 95 of 348 investigated patients (27.3%) received oral nutritional support. Constipation and diarrhea were common adverse effects. Unexpectedly, however, constipation episodes were more frequent than diarrhea in the patients not receiving oral nutritional support.

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Traditional nutritional management of patients undergoing major abdominal surgery has involved a period of ‘nil by mouth’ with nasogastric decompression, followed by a clear liquid diet that gradually progresses to regular food on the fourth or fifth postoperative day. The Enhanced Recovery after Surgery (ERAS) program, with early oral feeding as one of the key elements, recommends having extensive preoperative patient information, avoiding nasogastric decompression tubes, midthoracic epidural anesthesia/analgesia with low doses of opioids, avoiding fluid overload, and multimodal management of postoperative nausea and vomiting (5-HT3-antagonist and/or dehydrobenzperidol and/or dexamethasone). Patients should start drinking within 4 h after surgery and are allowed to eat normal food on the first postoperative day. This was developed by 26 Dutch hospitals in 2006 and
proved that the feasibility of early oral nutrition in most of the patients stresses the necessity of abolishing postoperative starvation. Patients can eat and drink immediately after the operation. Structured PONV (postoperative nausea and vomiting) management is an important prerequisite for a successful early start of nutrition after abdominal surgery [1].

Identification of the Problem

It is necessary to identify patients who exhibit increased aspiration risk. For this, we can use the techniques detailed below.

3-oz (90 ml) Water-Swallowing Test
This task requires dinking 3 oz of water directly from a cup or via a straw, either assisted or independently, without interruption [2]. Criteria for failure are the inability to drink the entire volume, interrupted drinking, or coughing during drinking or immediately after completion of the test. If a patient fails the 3-oz water-swallow challenge, it should be repeated within 24 h because intensive care unit (ICU) and step-down unit patients often demonstrate rapid improvement in swallowing function. However, if the challenge is passed, cognitive limitations and dentition status determine specific oral diet recommendations and the ability to safely drink thin liquid and eat an oral diet 12–24 h after passing the 3-oz challenge.

The recommended diets span thin liquids with puree and food with a soft or regular consistency. It is not necessary to modify thin liquids with thickening agents to nectar or honey consistencies to promote safe ingestion.

Factors such as premorbid feeding status and ability, cognitive status, cooperativeness and levels of consciousness, gross oral motor functioning, respiratory muscle function and endurance, and posture limitations need to be assessed before using a 3-oz water swallow challenge. This test is not recommended for use in patients with head and neck malignancy or those who require a tracheotomy tube.

Endoscopy or Fluoroscopy Test
This is recommended for patients with head and neck malignancy, a tracheotomy tube (e.g. for airway maintenance), ongoing mechanical ventilation, and pulmonary toilet. Silent aspirations occur more frequently because of laryngeal desensitization from chronic aspiration of secretions and combined chemoradiation therapy.

Early Intervention
Patients with diminished consciousness can participate in early intervention programs, like the one in the study by Takahata et al. [3] in patients with intracerebral
hemorrhage. It consists of oral care (5 min), which includes teeth brushing and rinsing with 100 ml of water removed by suction to prevent the patient from accidentally swallowing it and while the patient is in a lateral semi-sitting position. Stimulation of the mouth, tongue, and oral cavity is also performed, at least 3 times daily. To initiate oral feeding, the diet must have an appropriate texture (jelly or puree) and the patient has to be fed in a semi-sitting way with the chin tucked position and monitoring of oxygen levels.

The Functional Oral Intake Scale (FOIS) developed by Crary et al. [4] is applicable to patients with impaired consciousness and evaluates swallowing based on nutritional status and diet texture. It is a simple scale with a high intrarater agreement and sensitivity. It has been validated by comparison with the Mann Assessment of Swallowing Ability and video-fluoroscopic swallowing evaluation. Patients free of nutritional supplementation (FOIS score 4–7) are able to eat (table 1).

### Intervention

The early intervention program is based on a behavioral intervention coordinated by a team, and typically requires several months for all of the team members to attain enough experience.

**Nutrition Risk Screening of Critically Ill Patients**

Determining baseline nutrition status is the first step in the development of a nutrition plan. Visceral proteins are of little value in the nutrition assessment of the critically ill patient. The Nutritional Risk Screening (NRS-2002) tool is a quick and efficient way of estimating nutrition status. The most important step in preventing refeeding syndrome is the identification of patients at risk for disorders. Nutritional intake must be monitored weekly by members of a nutritional support team to ensure adequate nutrition during the patients’ hospital stays [5].

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**Table 1. Functional Oral Intake Scale (FOIS)**

<table>
<thead>
<tr>
<th>Level 1: Nothing by mouth</th>
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<tbody>
<tr>
<td>Level 2: Tube-dependent with minimal attempts of food or liquid</td>
</tr>
<tr>
<td>Level 3: Tube-dependent with consistent oral intake of food or liquid</td>
</tr>
<tr>
<td>Level 4: Total oral diet of a single consistency</td>
</tr>
<tr>
<td>Level 5: Total oral diet with multiple consistencies, but requiring special preparation or compensations</td>
</tr>
<tr>
<td>Level 6: Total oral diet with multiple consistencies without special preparation, but with specific food limitations</td>
</tr>
<tr>
<td>Level 7: Total oral diet with no restrictions</td>
</tr>
</tbody>
</table>
Nutrition Assessment of Critically Ill Patients

It is appropriate to consider any patient to be at nutritional risk if staying more than 2 days in the ICU without near normal oral intake, and it is appropriate to critically review the individual nutrition-related factors given that no ICU-specific scoring system including nutrition-related indicators exists [6]. An individual's nutrition history is the first step in risk assessment and has three key indicators: (1) actual BMI, (2) recent (3–6 months) weight loss, and (3) recent decrease in nutrient intake. A valid BMI is difficult to obtain without the individual's measurement of height and weight.

Energy and Nitrogen Requirement

In acute and chronic disease, the resting metabolic rate is elevated above the values calculated by the Harris-Benedict equations. Therefore, 25 kcal/g of the ideal body weight furnish an approximate estimate of daily energy expenditure and requirements, and requirements may approach 30 kcal/kg of the ideal body weight under conditions of severe stress. To avoid the risk of overfeeding, the calorie and nitrogen requirement should be calculated with indirect calorimetry or based on unusual body weight. Moreover, in such cachectic patients, care should be taken to increase the amount of calories and protein slowly to prevent refeeding syndrome [7].

It is recommended to maintain the glucose-fat calorie ratio at 60:40 or even 70:30 of the nonprotein calories. When fluids restriction is indicated at 50:50, the ratio is accepted.

In illness/stressed conditions, a daily nitrogen delivery equivalent to a protein intake of 0.8–1.5 g/kg ideal body weight (or approx. 20% of total energy requirements) is generally effective to limit nitrogen loss during metabolic stress and increasing in recovery when a normal anabolic state has returned [7, 8].

Types of Diets Used

The type of food must have the same texture, and foods containing filaments or lumps or which have a sticky consistency should be avoided. Gelatine (which is ideal to hydrate), puree fruits and enriched vegetables, liquid or solid yogurts (taking care of removing the liquid that contains the solid yogurt), fruit pieces, or cereals are good foods to use. The introduction of yogurt can improve the intestinal tract after large amounts of antibiotics. Pureed vegetables with meat or fish, pureed fruit mixed with yogurt, custard, yogurt or jellies are also recommended.

Inadequate energy intake in the first 7 days following extubation independent of age, nutritional status, severity of illness, location in the hospital, ICU and hospital length of stay, and days on mechanical ventilation have recently been described [9]. The use of therapeutic dietary restriction may also increase the risk of malnutrition in extubated patients. Moreover, prescription of therapeutic diets (e.g. low sodium or low fat), which by definition restricts single or multiple nutrients, is counterintuitive...
for these patients with minimal intake. There is no common recommended guideline or protocol on how to act with oral feeding in the ICU, in particular in the prevention of malnutrition or refeeding, and the value of having an expert, such as a dietitian, focusing on the nutritional needs of each individual patient has yet to be understood. Nutritional intake of these patients must be monitored weekly by members of a nutritional support team to ensure adequate nutrition during the patients’ hospital stay after extubation from mechanical ventilation [9–13].

**Obstacles**

*Gastrointestinal Motility Disorders in Critically Ill Patients*

Motility disorders may involve any part of the gastrointestinal tract, including the esophagus, stomach, small intestine, and colon. The symptoms for these disorders commonly include delayed gastric emptying, constipation, adynamic ileus, and diarrhea.

Delayed gastric emptying is common in critically ill patients, especially in patients who are mechanically ventilated or have suffered a traumatic brain injury. Fluid and electrolyte disturbances are common in ICU patients and can have profound effects on gastrointestinal motility.

Constipation is a symptom of underlying pathologies and has been reported in as many as 83% of critically ill patients [14]. Common medications used in the ICU that can decrease gastrointestinal motility and cause constipation include sedatives and opioid analgesics.

Medications that commonly cause diarrhea include antibiotics, laxatives, oral magnesium, phosphate supplements, antacids, prokinetic agents, and hyperosmolar or sorbitol-containing oral liquid medications.

**The Spanish Experience**

*A Spanish Study*

A cross-sectional and multicenter study was conducted in 18 Spanish ICUs within the scope of the 2007 European Nutrition Day (unpubl. data). In this study, among the 348 investigated patients, 95 (27.3%) received oral nutritional support, 64 (18.4%) parenteral nutrition, 122 (35.1%) enteral nutrition, and 15 (4.3%) combined enteral and parenteral nutrition. No nutritional support was given to the remaining 52 patients (14.9%). Oral nutritional support was more frequent in nonventilated patients (56.3 vs. 2.7%) and both parenteral (23.9 vs. 11.9%) and enteral nutrition (52.7 vs. 14.4%) in ventilated patients than in those breathing spontaneously. Constipation and diarrhea were common adverse effects of enteral nutrition. Unexpectedly, however, constipation episodes were 3.5 times more frequent than diarrhea episodes (34.3 vs. 9.7%) in
the patients not receiving oral nutritional support. As anticipated, patients fed exclusively with oral nutrition were significantly less severely ill compared to those not fed by oral nutrition (table 2).

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