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Enteral Nutrition: Whom, Why, When, What and Where to Feed?

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Abstract

Oral and enteral nutrition affects both the anatomical and physiological integrity of the gastrointestinal tract. It downregulates systemic immune response, reduces overall oxidative stress and limits systemic inflammatory responses. It reduces bacterial translocation, limits pathogenic bacteria in the intestines and enables the production of short-chain fatty acids in the colon. Therefore, it is the most physiologic way of providing nutritional support in all patients. The enteral formulas are available as polymeric, semi-elemental and elemental diets. The beneficial effects on the gastrointestinal tract and systemic organs of 'early' enteral nutrition depend on the timing, dose, location and different modalities of enteral delivery. Being familiar with the basic tenets of providing enteral nutrition – the 'Who, Why, When, Where and What' – will result in safe nutritional interventions and achieve a positive clinical outcome.

Introduction

Oral and enteral nutrition (EN) is a physiologic way and an effective means of providing nutritional support and nutritional intervention in all malnourished patients, including perioperative and critically ill patients. Enteral formulas are

available as polymeric (containing whole protein, carbohydrates and fats), semi-elemental (containing proteins in the form of small di- and tripeptides, and fats in the form of medium chain triglycerides) and elemental (proteins in the form of free amino acids) diets. This article gives an overview of the 5Ws of EN – 'Who, Why, When, Where and What'.

Definition of Enteral Nutrition

According to ASPEN (American Society of Parenteral and Enteral Nutrition), EN is the provision of nutrients via the gastrointestinal tract (through a feeding tube, catheter or stoma) and is the preferred route in patients who cannot meet their nutritional needs through voluntary oral intake [1].

According to ESPEN (European Society for Parenteral and Enteral Nutrition), EN includes oral nutritional supplements as well as tube feeding via nasogastric, nasoenteral or percutaneous tubes [2].

Whom to Feed

Indications [3]:

(1) In persons with functional gastrointestinal tract in whom oral intake is impossible, inadequate or unsafe

(2) In malnourished patients and those who are at high risk of developing malnutrition

(3) In individuals with poor appetite associated with a chronic medical condition

(4) In patients with impaired swallowing function (neurological diseases/oropharyngeal dysfunction)

(5) In patients with major trauma, burns, wounds and in the malnourished preoperative patient

(6) In critically ill patients (who are not able to meet their metabolic demands) and those on mechanical ventilation

Contraindications [3]:

(1) Gastrointestinal failure, inflammation and severe postoperative stasis

(2) Complete intestinal obstruction

(3) High-output intestinal fistula

(4) Inability to access the gut: severe burns/multiple trauma

(5) Presence of shock

(6) Hyperlactatemia (>3 mmol/l)

(7) Hypoxia (paO_2 <50 mm Hg)
(8) Hypercapnia (pCO_2 >75 mm Hg)
(9) Severe acidosis (pH <7.2)

Why to Feed

As soon as enteral feeding is commenced, the resultant intestinal responses have a beneficial effect both on the intestines as well as systemic effects [4]. These can be summarized as follows:

- Stimulates intestinal contraction and initiates peristalsis
- Releases trophic substances (digestive enzymes and intestinal hormones) which maintain the enterocytes of the gastrointestinal tract
- Increases the blood flow to the intestinal tract soon after commencing the feeds, which supports the mucosa-associated lymphoid tissue
- Increases IgA production in response to the antigen associated with the feeds. IgA coats the microorganisms and prevents their adherence; it also proliferates and migrates via the systemic circulation to the lungs, liver and kidneys
- Increases the processing of naïve CD4 cells (due to the antigenic stimulus) and these lymphocytes are incorporated in the gut-associated lymphoid tissue. In turn, these lymphocytes gain access to the systemic circulation and are incorporated in the mucosa-associated lymphoid tissue at different sites (lungs, liver and kidneys). Feeding also generates CD4 cells towards the Th2 pathway, resulting in a systemic anti-inflammatory effect
- Feeding also promotes the role of commensal bacteria and also reduces the colonization of pathogenic bacteria and their toxins. In addition, the constituents of the diet promote the production of short-chain fatty acids, which act as fuel to the colonocytes and also result in antioxidant and anti-inflammatory effects

When to Feed

EN should commence [5, 6]:
(1) Within 12–24 h of an acute event (operation/trauma)
(2) After stabilization of vital functions (e.g. hemodynamics/volume status)
(3) After resuscitation

Table 1. Types of enteral feeds

Whole protein
With or without fiber
Modified protein
Semi-elemental (di-/tripeptides)
Disease-specific nutrition
Respiratory disease (altered carbohydrate:fat ratio)
Renal disease (low in proteins/electrolytes)
Immunonutrition (glutamine, arginine and fish oil)
Hepatic disease (rich in branched-chain amino acids)
Cardiac disease (low in sodium)
HIV/AIDS (modified fats/peptides)
Milk intolerance (soy based)

(4) After assessment
(5) After planning
(6) After confirming the position of the respective tubes

What to Feed

There are various types of commercially available EN supplements available in either ready-to-use, liquid or powdered form, which has to be reconstituted. They provide from 1.0 up to 2.0 kcal/ml; their pH ranges from 5.5 to 7.0 and their osmolality from 300 to 600 mosm/l (table 1).

These supplements are available as whole protein (with or without fiber), modified protein, e.g. semi-elemental (di-/tripeptides) and elemental, and disease-specific formulations, such as formulations for patients with respiratory (altered carbohydrate:fat ratio), renal (low in proteins and electrolytes for predialytic patients and protein-rich feeds for patients on dialysis), cardiac (low in sodium) and hepatic diseases (rich in branched-chain amino acids, and low in standard amino acids and electrolytes), diabetes (low in carbohydrates and rich in monounsaturated fatty acids), milk intolerance (soy-based) and for those with HIV/AIDS (modified fat/peptides), for example, and as immunonutrition (rich in arginine, fish oil and nucleotides, which are useful for patients in the perioperative period and with metabolic stress and impaired immunity).

Polymeric feeds are available as standard, high-protein, energy-dense and high-fiber supplements. Standard polymeric feeds have the standard distribution of macronutrients and are for those with a normal gastrointestinal function.

High-protein supplements have a protein content of 15% or more of the total energy and are useful in various catabolic states and for wound healing. Energy-dense formulations provide 2.0 kcal/ml and are useful in those with fluid-restricted intake and with dyselectrolytemia. High-fiber supplements with a fiber content of 5–15 g/l are helpful in bowel dysfunction.

Oligomeric enteral formulations are either partially hydrolyzed or peptide based. Monomeric supplements contain free amino acids like glutamine or arginine. Both of these formulations are useful in patients with malabsorption and maldigestion.

The choice of feeds depends on the patient's condition, availability, local practices and preferences.

Where to Feed

The standard routes are oral and through enteral tubes: nasogastric, nasoenteric percutaneous endoscopic gastrostomy (PEG, PEG-J tubes) and feeding jejunostomy (FJ) tubes.

The oral route is preferred in patients who can swallow safely. Nasogastric/nasojejunal tubes can be used for feeding up to 4 weeks, and those requiring long-term feeds will need a PEG, PEG-J or an FJ tube.

Patients can be fed safely, either by gastric or a postpyloric tube placement. A recent meta-analysis has not shown any significant difference in the incidence of aspiration, new-onset pneumonia or mortality. However, postpyloric feeding has shown a decrease in gastric residual volumes and an increase in energy delivery. In patients with severe gastroparesis or acute necrotizing pancreatitis, postpyloric feeding has been shown to be beneficial. Standard protocols should be followed when gastric residual volumes exceed 400 ml, and prokinetic agents might be helpful.

Enteral Nutrition Protocols [5]

EN protocols are depicted in figure 1.

- Commence EN in patients who are unable to eat voluntarily
- Commence within 24–48 h
- Withhold EN in patients with severe hemodynamic instability
- Neither presence or absence bowel sounds, nor passage of flatus or stools are necessary to start EN
- Either gastric or small bowel feeds are acceptable
- Determine the target goal at the time of EN initiation

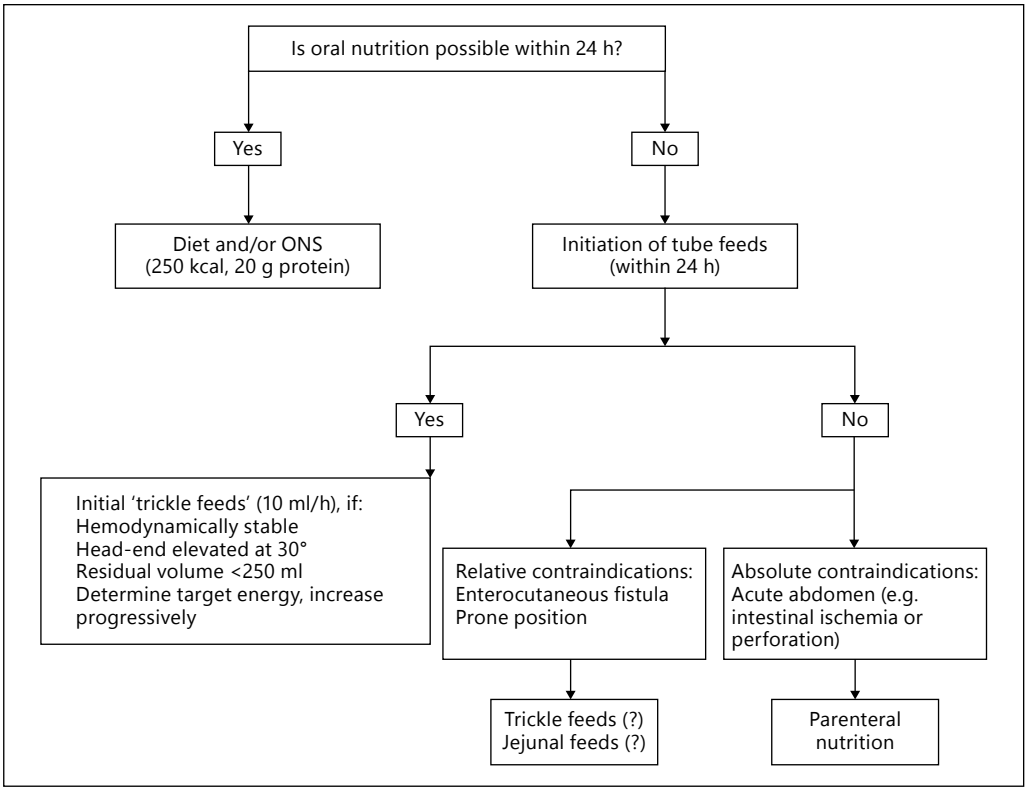

Fig. 1. EN protocols. ONS = Oral nutritional supplements.

- Provide >50–65% calories to achieve clinical benefits over the 1st week
- In critically ill, obese patients, permissive underfeeding is recommended
- Protocols for monitoring and to advance feeds should be adhered to
- All patients should be assessed for the risk of aspiration
- Immune-modulating diets are appropriate for most patients; apply caution in patients with severe sepsis
- Antioxidants, vitamins and trace minerals should be provided to all
- Glutamine should be considered in burn, trauma and mixed intensive care unit patients

Conclusion

Early EN affects both the anatomical and physiological integrity of the gastrointestinal tract. It downregulates systemic immune responses, reduces overall oxidative stress and limits the systemic inflammatory response syndrome. These

benefits alter the course of the patient's disease significantly. The timing, dose, different aspects of delivery, and their local and systemic effects determine whether the patient benefits from EN. Being familiar with the basic tenets of nutrition intervention is the best way to achieve a positive clinical outcome.

Disclosure Statement

None.

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