SPECIAL ARTICLE

Enteral Vs. Parenteral Nutrition: Advantages and Disadvantages

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ABSTRACT The goal of nutritional support is to maintain or replete lean body mass, to support host defense mechanisms, to avoid specific nutritional deficiencies, and in general to improve clinical outcome in a malnourished patient or in at risk to develop malnourishment. Nutritional support can be instituted by enteral or parenteral route; each has its advantages and disadvantages. Which mode of delivery is chosen much depends on the clinical condiron of the patient. In general enteral route is preferred, since it is more physiological; however, in certain condition where enteral route is either impossible or dangerous, parenteral nutrition can be used as an alternative which might be life saving. The advantages and disadvantages of nutritional support delivery is discussed briefly and comprehensively. [**Paediatr Indones 1996;36:91-97**]

Introduction

Nutritional support serves to maintain or replete lean body mass, to support host defense mechanisms, to avoid specific nutritional deficiencies, and in general to improve clinical outcome in a malnourished patient or in at risk to develop malnourishment. The decision to institute nutritional support prompts discussion of how best to accomplish these goals. There are 2 basic means of delivering nutritional support, i.e., via enteral and parenteral routes. Each has specific indications, advantages and disadvantages, and can be further subdivided based on the degree of invasiveness. Fig. 1 suggests an approach to determining the optimal modality for delivering nutritional support. As a general rule, "if the gut works, use it", if not, parenteral nutrition can be a life-saving alternative.

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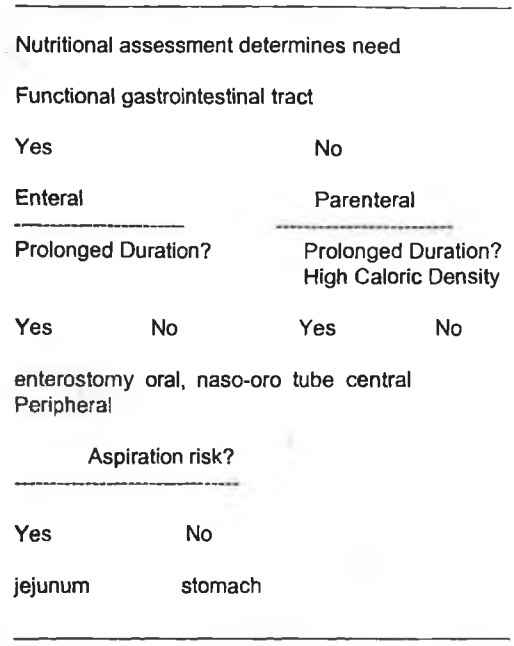
Enteral Nutrition: Advantages

Enteral nutrition is clearly preferred for patients with a functioning gastrointestinal tract because it is more physiological, entails fewer complications and is consid-

Figure 1. Selection of nutrition support modality (modified after Ref. 1)



erably less expensive than total parenteral nutrition. The physiological functions of the gastrointestinal tract are to provide a port of entry for nutrients, to facilitate their digestion, absorption and metabolism, and to provide a barrier to potentially noxious agents, e.g. bacteria, viruses, toxins. Factors affecting this barrier include mucosal thickness and permeability, as well as gut-associated lymphoid tissue (GALT). Consisting of both affector (Payer's patch, mesenteric lymphoid cell) and effector (intestinal lymphocytes and secretory IgA) components, GALT plays an important role in maintaining the intestinal host-defense barrier against bacteria and viruses. These functions are dependent upon a healthy gastrointestinal mucosa which is influenced by factors in both lumen and blood.

Food within the gastrointestinal tract set into motion a series of events that directly and indirectly affect mucosal growth and function.[2] Direct effects are due to dietary nutrients (especially glutamine for small intestine, short chain fatty acids for colon) and growth factors (polyamines), as well as mechanical stimulation, and trophic gastrointestinal peptides with hormonal or paracrine activity (e.g. gastrin, epidermal growth factor). There is evidence from animal experiments and clinical studies that circumventing the luminal route, even in the face of adequate parenteral nutrition support, has adverse affects upon intestinal mucosa. Absence of enteral feeding in parenterally alimented, well nourished rats and rabbits resulted in decreased mucosal weight, thickness, protein and DNA content, especially in the proximal gastrointestinal tract. Total and specific activities of disaccharidases were decreased.[3-5] Permeability to macromolecules, e.g. lactulose, mannitol, increased.[6] Biliary and intestinal IgA concentrations and intestinal CD4-positive lymphocytes were reduced,[7,8] while bacterial translocation from gut to mesenteric lymph nodes was increased.[9] Rats fed parenteral nutrition solution enterally had improved survival after induction of an experimental septic peritonitis compared with their counterparts given the same solution intravenously.[10]

Species' differences exist and some of these adverse effects of enteral deprivation are less prominent in the human.[11]

Nonetheless, there have been clinical studies suggesting the beneficial effects of enteral feeding especially upon intraabdominal and pulmonary septic complications. In a meta-analysis of data[12] originating from an 8-center trial involving 230 trauma and general surgery patients randomly assigned to receive either enteral or parenteral nutrition, the enterally -fed patients had significantly fewer total complications (38% vs 59%) and fewer septic complications (17 vs. 44%). A study[13] involving head-injury patients suggests that timing of intervention is critical: early-fed patients (within 36 hours via naso-jejunal tube) had significantly less infectious complications than patients in whom intragastric things in perspective, it should be noted, however, that studies showing decreased septic morbidty with enteral feeding are unlinded and may possibly reflect investigator bias.[14] Not all studies have uniformly reported better improvement of outcome with enteral nutrition.[15,16]

Finally, enteral nutrition, even that involving invasive placement of gastric or jejunal tubes, is approximatelly 4 to 10-fold less expensive than parenteral nutrition. To date, specialized enteral nutritional products have been developed for use in prematurity (enriched with essential amino acids), hepatic (low aromatic and high branched chain amino acids), pulmonary (low carbohydrate-fat ratio) and metabolic disease (excluding offending substrates). Intense research is currently underway investigating enteral factors, e.g. omega-3 fatty acids, arginine, glutamine, nucleotides, with the potential for improving trophic or immunological function.[17]

Enteral Nutrition: Disadvantages

The major limitation of the enteral approach to nutrition support is presented by the dysfunctional gastrointestinal tract. Feeding intolerance due to dysmotility and malabsorption often result in frequent interruptions and suboptimal delivery rates. Complications may be classified into gastrointestinal problems, mechanical difficulties, and metabolic problems (Table 1).

Parenteral Nutrition: Advantages

The major advantage of parenteral nutrition is the provision of adequate nutrients in the face gastrointestinal dysfuncion. It is also useful in the face of fluid restriction since caloric density can be increased with a central venous catheter beyond that tolerated by the enteral route. The general indication[19] for parenteral nutrition is the patient who cannot, will not, or should not eat, enterally or orally or who cannot eat enough or be fed adequately by tube (Table 2).

The decision to use the peripheral or central venous approach depends on anticipated duration of therapy, caloric requirements, venous accesssibility and frequency of complications.[20] If parenteral nutrition will be required the peripheral route is preferred since the rate of serious complications is much less than with central venous catheters. For example, in one study,[21] the risk of hospital-acquired bacteremia was 3.7/1000 admissions for peripheral devices, but 44.8/1000 ad-

Table 1. Problems associated with enteral nutrition support measures

Gastrointestinal problems
- nausea and vomiting
- gut dysmotility (especially gastric ileus, delayed gastric emptying)
- gastroesophageal refluk
- abdominal distention
- diarrhea (18)
- osmotic (malabsorption, tube feeding formulas)
- secretory (infectious, contaminated formula)

Mechanical

Placement
- Gastric-gastroessophageal reflux, aspiration pneumonitis
- Jejunal-"dumping" syndrome

Naso-enteric tubes
- nasopharyngeal erosions
- otitis media, sinusitis
- esophagitis, esophageal strictures
- gastric irritation/ulcer/bleeding
- tube misplacement, dislodgement, plugging
- organ perforation
- psychological stress

Enterostomy
- surgical/endoscopic complications
- wound infection, seroma dehiscence
- gastric irritation/ulcer/bleeding
- tube site irritation, infection
- leakage, persistent sinus/fistula
- tube dislodgement, plugging
- organ perforation

Metabolic
- overhydration
- dehydration
- hyper(hypo)kalemia
- hypophosphatemia
- metabolic acidosis
- essential fatty acid deficiency
- liver-function abnormalities
- drug-nutrient interactions

Table 2. Common indications for parenteral nutrition

Gastrointestinal diseases
- congenital nomalies (gastroschisis, omphalocele, atresias)
- necrotizing enterocolitis
- inflammatory bowel disease, bowel fistulas,
- chronic, intractable diarrhea
- chronic intestinal obstruction or pseudoobstruction
- short gut syndrome

Non-gastrointestinal diseases
- cardiorespiratory diseases
- renal failure
- hepatic coma
- pancreatitis
- malignancies
- anorexia nervosa

Surgical conditions
- perioperative support
- severe trauma/burns

Very low birth weight infants (<1500 gm)

missions for central venous catheters. The major complication is peripheral vein thrombophlebitis, characterized by development of inflammation, subsequent thrombosis and occlusion. It may potentially lead to extravasation. a greater understanding of etiological factors associated with cannula thrombophlebitis (e.g. bacterial colonization, cannula size, material, and placement site; duration of infusion, osmolarity, pH, particulate matter) has led to a number of prophylactic efforts which have been reported to decrease the incidence and increased catheter longevity. These include use of buffered, filtered solutions, addition of glycerol, lipid, heparin and/or hydrocortisone,

application of topical non-steroidal anti-inflammatory drugs and transdermal glyceryl trinitrate patches.[20]

However, high caloric requirements often preclude the use of the peripheral route because of increased osmolarity. An osmolarity greater than 800 mOsm/L is generally not tolerated. Under the best of conditions, peripheral sites rarely last longer than 4-5 days. Eventually, venous access becomes a problem necessitating the consideration of central venous catheter. These are single to triple lumen catheters placed in a large vein, usually the superior vena cava, via percutaneous or cut-down insertion into the jugular or subclavian vein. Insertions into the saphenous and femoral veins have also been used but are associated with higher complication rates. Central venous catheter have been reported,[22] facilitate continous venous access, cycling of parenteral nutrition and home discharge. On the other hand, they have a higher rate of serious complications, including insertion -related accidents (e.g. pneumothorax), thrombosis, breakage and sepsis. The risk for septic complications appears to be increased by femoral placement, multiple lumen tubes and multi-functional use.[23-5]

Parenteral Nutrition: Disadvantages

The major disadvantages of parenteral nutrition (Table 3) relate to complications rising from the intravenous presence of a foreign body and the ability for greater (and therefore more unphysiological) manipulation of nutrient intake. It is more expensive than the other nutritional modalities due to greater costs of preparing the solutions, need for more intensive monitoring and higher risk of complications.

Table 3. Problems associated with parenteral nutrition support measures.

Mechanical
- complications of insertion (pneumothorax, artery injury, air embolism, catheter tip misplacement, breakage and embolization, perforation)
- later complications (thrombosis, displacement, breakage, blockage, perforation)

Metabolic
- nutritional deficiencies or toxicities due to improper infusion
  - e.g. essential fatty acid, zinc deficiency
  - e.g. aluminum toxicity
- hyper(hypo)glycemia
- hyperosmolarity
- CO2-retention
- azotemia, hyperammonemia
- electrolyte imbalances
- metabolic acidosis
- hyperlipidemia
- abnormal organ function (liver, kidneys, intestine, bone)

Infectious
- catheter site infections
- catheter-related sepsis (Staph, Gram neg.org. Candida), focal endocarditis
- sepsis due to increased intestinal bacterial translocation?

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