Future directions in nutrition support

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The provision of nutrition support to patients in hospital and at home has advanced significantly over the past decade. Enteral or parenteral nutrition can be safely administered in patients of any age, size or disease state when care is taken to individually tailor nutrition therapy and monitor for potential complications. Nutritional support is increasingly recognised as an integral component of disease treatment protocols. In the future, it is likely that nutrition support will increasingly focus on modifying specific metabolic effects of disease by disease-specific nutrient manipulation. Adjuncts to nutritional therapy, such as growth factors, may provide opportunities to enhance intestinal adaptation and modify the metabolic response to stress. Advances in enteral and parenteral nutrition delivery systems will continue to improve with the aim of providing safe, effective and socially acceptable techniques of delivering long-term nutrition support. Nutrition support teams have proven their cost-effectivenes in the past decade; however, they are under increasing pressure to adapt to ever changing healthcare systems. The next decade will provide challenges and opportunities not only for the enhancement of nutritional management but also for the provision of evidence that specific nutritional intervention improves clinical outcome.

Key words: nutritional support, parenteral nutrition, enteral nutrition, nutrition support teams, outcome research.

Over the past decade there have been many advances in the provision of nutrition support to hospitalised and home-care patients. What can we expect in the next decade?

Patient factors

There are few contraindications for nutrition support in hospitalised patients who are unable to eat normally. Enteral or parenteral nutrition can be safely administered in patients of any age, size or disease state when care is taken to individually tailor nutrition therapy and monitor for potential complications of therapy. Due to improvements in bedside and laboratory-based nutritional assessment methods, such as the measurement of energy expenditure, body composition and serum and urine markers of nutritional status, we are able to define the individual requirements of a patient prior to commencement of a nutritional intervention and to monitor response of the patient to this intervention. There is evidence to suggest that the provision of nutrition support early in the treatment of severe disease, before the onset of nutritional deficiency, may benefit clinical outcome.[1]

Nutritional support is being increasingly recognized as an integral component of disease treatment protocols such as in bone marrow transplantation, HIV and cancer treatment.[1,2] The metabolic impact of nutrition support on the primary disease and its treatment is increasingly recognised.[1–4] The use of specific nutrients to modify disease progression or the metabolic consequence of treatment provides exciting opportunities for the future use of nutrition support.

Nutritional therapy administration

During the last 10 years there has been shift away from parenteral nutrition therapy in favour of enteral nutrition. There is a rapidly expanding list of enteral formulas available. Options for the route and method of administration of enteral formulas provide flexibility in administration protocols.

Enteral versus parenteral nutrition

Enteral nutrition has a number of potential advantages over intravenous or parenteral nutrition.[3] These include:

Safety. Parenteral nutrition requires an intravenous catheter for administration and frequently a central venous catheter is required. There is a significant risk of line-related complications associated with parenteral nutrition therapy including thrombophlebitis, catheter-related sepsis and embolism associated with parenteral nutrition therapy. There is also an increased risk of overfeeding and refeeding syndrome with parenteral nutrition therapy compared with enteral nutrition therapy. As a consequence of the severity and type of their primary disease, patients who require aggressive nutrition support are often at significant risk of infectious complications.[3,4] Minimizing additional risk factors for infection, such as central venous access and glucose intolerance, may be important in determining clinical outcome.[1,3,4]

Preparation and administration requirements. Parenteral nutrition requires a specialized facility and considerable expertise for safe and sterile manufacture. Trained and experienced nursing and medical staff are required for the safe administration of intravenous nutrition.[5] Such staff must also be prepared to manage complications. Although safe and effective enteral nutrition therapy also requires education and

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training, the same strict adherence to sterility and central venous catheter protocols is not required.

Cost. Parenteral nutrition is generally more expensive than enteral nutrition due to differences in manufacturing costs, the cost of intravenous administration and patient monitoring.

Minimal enteral feeding. The provision of small amounts of nutrition via the gut lumen aids in maintaining gastrointestinal mucosal integrity and function. Although these small amounts may not be nutritionally important to the body as a whole, they play an important role in limiting mucosal atrophy and reducing bacterial translocation across the gut mucosa. Successful transition to full enteral nutrition occurs earlier if a small amount of nutrition is maintained to the gut lumen when compared to the fasted state.[3]

Psychosocial. Although patients do not accept either enteral or parenteral nutrition as a social equivalent to food, most accept enteral nutrition as being less 'foreign' and less aggressive than parenteral nutrition.

Delivery systems

Enteral nutrition delivery systems. An increase in successful enteral feeding has occurred as a result of advances in enteral feeding delivery systems. Traditionally, enteral feeding has been administered via a nasogastric or gastrostomy tube. Post-pyloric placement of feeding tubes reduces the risk of aspiration in unconscious patients or patients with impaired bulbar function. Naso-jejunal or gastrojejunal tubes can be placed at the bedside by non-invasive methods including endoscopic, fluoroscopic and ultrasound guidance. Therefore, enteral feeding can be tolerated in many patients in an intensive care setting who previously would have been treated with parenteral nutrition.

Percutaneous endoscopic gastrostomy (PEG) placement has revolutionized long-term nutrition management. It can be performed in less than 20 minutes under local anaesthesia and patients can be fed and discharged on the same day as placement. This has provided an option for patients who are unsuitable for general anaesthesia or a more invasive surgical approach.

The development of low-profile feeding tubes provide a subtle, more aesthetically acceptable option which is attractive to patients requiring long-term enteral nutrition. The range of feeding tubes and the options for tube replacement are being constantly improved. The development of a range of sizes and connections offers flexibility for individual patient age, size and disease requirements.

Enteral feeds are generally given as a bolus or gravity drip method. Enteral feeding pumps are small and light enough for a patient to carry in a bag or backpack and are reliable enough to provide accurate feed delivery. They allow patients to achieve a near normal lifestyle despite requiring a continuous enteral infusion.

Parenteral nutrition delivery systems. Due to the risk of chemical thrombophelitis with glucose infusions of greater than 10% concentration, parenteral nutrition has traditionally been administered via a venous catheter placed in a large central vein. These catheters are placed as a temporary catheter or a semi-permanent catheter; for example, a Hickman or Broviac catheter. Implanted central venous catheters such as a Portacath or Infusaport have the advantage of being totally covered by skin. This may provide some reduced risk of catheter infection and is particularly useful if central venous access is only required intermittently. There is increased use of the peripherally inserted central catheter (PICC), which allows central venous canalulation with reduced risk of major complications associated with the subclavian approach.

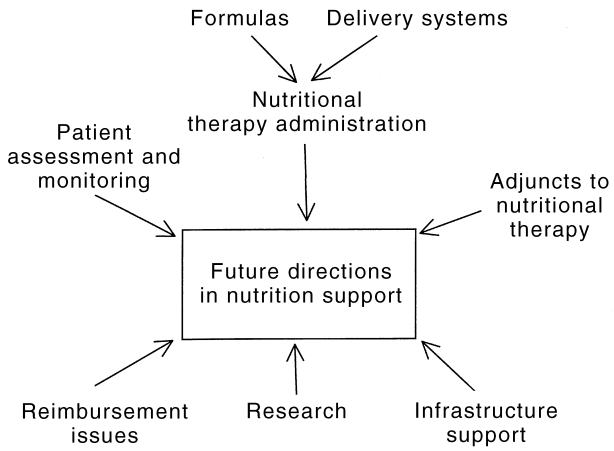

Figure 1. Factors influencing future directions in nutrition support.

There has been increased interest in providing parenteral nutrition via the peripheral route. The main incentive is to reduce the complications of infection associated with central parenteral nutrition therapy. The limitation of glucose tolerated by the peripheral veins is compensated for by an increased proportion of infused lipid and amino acids.

Other attempts to reduce the risk of infection and thrombosis with central venous catheters include catheters with silver impregnanted cuffs, antibiotic bonded catheters, heparin bonded catheters, prophylactic urokinase and in-line filters. Needleless systems have been developed to reduce the risk of accidental needle stick injury by health personnel.

The method of administration is also under scrutiny. In hospital continuous infusion of parenteral nutrition has been traditionally recommended; however, there are potential metabolic benefits of cycling parenteral nutrition.

Type of nutrition provided

Over the past 5 years there have been many studies published in nutrition literature examining the potential role of disease-specific nutritional therapy. Despite the large number of studies performed to date, this is still an area of controversy.

Advances in enteral formulas. There has been an explosion in the range of enteral formulas that are commercially available. The 'new' formulas range from infant formulas which provide supplementation of long chain polyunsaturated fatty acids, reported to enhance neurological development in the first 3 months of life, to formulas which target specific diseases, such as formulas with branched chain amino acids intended for patients with liver disease (Table 1). The role of disease-specific enteral formulas is an exciting area of active research.

Advances in parenteral nutrition solutions. Parenteral nutrition formulations are being developed to provide specific amino acid profiles and dipeptide combinations to reflect requirements in specific diseases such as post-trauma, bowel disease and extreme prematurity in infants. New roles for parenteral antioxidant therapy and micronutrients in the

Table 1. Examples of disease-specific enteral formulas

Disease	Nutrient supplementation
Metabolic stress, critically ill	High protein, high calorie glutamine, arginine Omega-3-fatty acids, mRNA nucleotides
Hepatic failure	Branched chain amino acids, medium chain triglycerides
Respiratory failure	High calorie, high nitrogen, low carbohydatre
Renal dialysis	High calorie density fluid and electrolyte restricted
Malabsorption	Elemental, medium chain triglyceride
Trauma, burn	High calorie, high protein, increased zinc, vitamin C and A
Glucose intolerant	Fibre, low carbohydrate

modification of disease activity are being explored. Intravenous fat emulsions are now available as long chain triglycerides (as in Intralipid), medium chain triglycerides, and mixtures of long and medium chain triglycerides and also as structured lipids. These new formulations are designed to reduce the immunological and pulmonary complications associated with long chain triglyceride administration. Pharmacological considerations of solution admixtures and drug additions have been necessary to ensure the safe administration of parenteral nutrition solutions.

Adjuncts to nutritional therapy

Disease or surgical resection of the small bowel is an indication for long-term nutrition support. Strategies to hasten or enhance the process of intestinal adaptation following resection or injury have the potential to have major clinical, social and financial benefits. Growth factors such as growth hormone and insulin-like growth factor-1 are currently being studied. The combination of fibre, short chain fatty acids, glutamine and growth hormone has been shown to be beneficial in clinical studies in patients with short bowel syndrome.[6] Growth hormone has also been studied as an adjunct to nutritional therapy in the critically ill.[6]

Nutrition support in the home

Developments in the delivery of nutrition support have provided improved options for home enteral and parenteral nutrition administration. Parenteral nutrition has been administered safely in the home for over 20 years. Age is no longer a limitation and infants can safely receive parenteral nutrition therapy at home with the appropriate education, support and monitoring.

Patient support groups have developed for patients, as well as families of patients, requiring enteral (Gastrostomy Information Support Society) and parenteral nutrition (Oley Foundation). These groups have an important educational and social role in the support of other patients requiring nutrition support.

Nutrition support practices

Nutrition support teams have proven their cost effectiveness in the past decade; however, they are under increasing pressure to adapt to ever-changing health care systems.[5] Commercial home care companies are becoming an alternative to hospital-based care. Reimbursement policies of government and health care insurance agencies are changing, with increased demands on the healthcare system. Healthcare providers are requiring unequivocal clinical and cost benefits to justify medical interventions and there is a need for well-designed clinical studies to critically assess the outcome of specific nutritional therapies.

Best practice standards and guidelines for the provision of nutrition support therapy are becoming increasingly important to guiding patient care. These have been developed by the Australian Society for Parenteral and Enteral Nutrition (AuSPEN), the American Society for Parenteral and Enteral Nutrition (ASPEN) and the British Association for Parenteral and Enteral Nutrition (BAPEN). The development of clinical pathways to guide decision making and effective and timely management of nutrition is continuing.

Nutrition support research

The key to improving nutrition support in the future is well-designed research studies. Research should not only be aimed at providing evidence for new strategies in nutritional management but also at critically assessing current management options in terms of clinical and cost outcomes. There are many questions and opportunities in the area of nutritional research waiting to be explored.

Despite major advances in the provision of nutrition support over the past decade, the incidence of malnutrition in hospitalised patients remains disturbingly high. The next decade will provide challenges and opportunities not only for optimizing nutritional management but also for providing evidence that specific nutritional intervention improves clinical outcome.

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