

Artificial nutrition support in hospital: indications and complications

Trevor Smith BM MRCP, Specialist Registrar in Gastroenterology and Clinical Nutrition

Marinos Elia MD FRCP, Professor of Clinical Nutrition and Metabolism; Honorary Consultant Physician

Institute of Human Nutrition, School of Medicine, University of Southampton, Southampton General Hospital, Southampton

Clin Med 2006;6:457–60

Malnutrition, both as a cause and consequence of disease, affects 10–50% of patients admitted to hospital. Malnourished patients have higher mortality rates and increased incidence of complications, with delayed recovery from illness during and after hospital stay. The care of malnourished patients should involve a multidisciplinary approach but doctors have the overall responsibility to identify those at nutritional risk, take appropriate action and monitor outcomes.¹ Malnutrition remains under-recognised and undertreated and, when it is identified, there is often misunderstanding regarding the specific indications and potential complications of artificial nutrition support.

Indications

Nutrition support should be considered in patients:

- who are malnourished, as defined as those who have:
 - body mass index (BMI) below 18.5 kg/m²
 - unintentional weight loss greater than 10% within the last 3–6 months
 - BMI less than 20 kg/m² and unintentional weight loss greater than 5% within the last 3–6 months
- at risk of malnutrition, defined as those who have:
 - eaten or are likely to eat nothing for more than five days
 - inadequate intake (eg less than half normal intake for 10 days) which is deteriorating or not improving
 - poor absorptive capacity and/or high nutrient losses and/or increased nutritional needs from causes such as catabolism.²

Approach to nutrition support

Nutrition support may simply involve helping patients to eat their meals (with or without the use of food fortification), oral nutritional supplements and/or a balanced multivitamin and micronutrient supplement. Problems such as loss of appetite or dysphagia may limit these approaches. Artificial nutrition support using either enteral tube feeding or parenteral nutrition should be considered in this situation. Specialist nutrition teams have an important role in assessing and monitoring the appropriate use of artificial nutrition support. However, fewer than half of UK hospitals have access to a nutrition support team,³ therefore doctors should know the principles involved and apply them even in the absence of specialist support.²

Enteral tube feeding

Enteral tube feeding is generally preferred in patients with an accessible gastrointestinal (GI) tract with adequate absorptive capacity because it is simpler, cheaper and more physiological. It may also help maintain gut barrier function, although there is little evidence that it reduces bacterial translocation in humans.⁴ The indications are not absolute but conditions likely to fulfil the general criteria indicated above are⁵

- severe dysphagia (eg head injury, stroke, motor neurone disease)
- major, full-thickness burns
- postoperative period when oral intake is limited
- massive small bowel resection, in combination with parenteral nutrition (enteral nutrition may hasten gut regeneration and return to oral intake in patients with more than 100 cm of small bowel)
- low-output enterocutaneous fistulae (<500 ml/day), especially distal intestinal fistulae.

Parenteral nutrition

Parenteral nutrition is typically used when the GI tract cannot be accessed or enteral tube feeding is likely to fail or has

Key Points

Malnutrition is a common clinical problem in hospitalised patients and is both a cause and consequence of disease

Artificial nutrition support with enteral or parenteral nutrition is indicated in patients who are malnourished or at risk of malnutrition where food fortification and/or oral nutritional supplements are inadequate

Enteral tube feeding should be used in preference to parenteral nutrition where the gastrointestinal tract is functioning adequately; if there is doubt, enteral and parenteral feeding can temporarily be used in combination

Enteral feeding tubes and venous catheters should be inserted by trained healthcare professionals and cared for meticulously to reduce the risk of complications

Artificial nutrition support should be introduced cautiously in patients who are malnourished or at risk of malnutrition in order to reduce the risks of refeeding syndrome

KEY WORDS: catheter-related sepsis, complications, hyperglycaemia, liver function, parenteral nutrition, refeeding syndrome, tube feeding

already failed to meet requirements, for example:

- complete intestinal mechanical obstruction
- ileus or severe intestinal motility disorders
- GI tract perforation
- short bowel syndrome with uncontrolled intestinal losses
- high-output fistulae
- severe complicated pancreatitis
- severe intestinal inflammatory disease (eg Crohn's disease or severe chemotherapy-induced mucositis).

Peri-operative parenteral nutrition

Peri-operative parenteral nutrition is an area of particular controversy as many studies have produced conflicting results, some suggesting that its use may be harmful.⁶ This may reflect serious underlying disease in hospitalised patients, although it is also possible that nutritional requirements during severe illness have been misunderstood.⁷ For example, overfeeding may have contributed to many of the metabolic and infective complications documented in some studies. In addition, randomised controlled trials (RCTs) investigating the efficacy of parenteral nutrition can be misleading because they exclude, on ethical grounds, patients who definitely need parenteral support.⁸

Despite these limitations, RCTs of peri-operative parenteral nutrition have shown significant reduction in complica-

tion rates when its use is restricted to malnourished patients.⁸ The National Institute for Health and Clinical Excellence has therefore recently recommended its use in patients who are malnourished or at risk of malnutrition and unable to be fed enterally.² This recommendation mirrors earlier recommendations of the Malnutrition Universal Screening Tool Report which provided the evidence base and a practical way of identifying and treating patients with malnutrition.^{9,10}

Complications

Enteral tube feeding and parenteral nutrition are both effective means of delivering artificial nutrition support but they are associated with a number of complications, some potentially life-threatening (Table 1). Patients therefore require careful monitoring, ideally involving a multidisciplinary nutrition support team.

Enteral tube insertion

Problems arising shortly after insertion of enteral tubes should arouse suspicion of an insertion complication. Such complications can be minimised by ensuring that correct placement procedures are followed by trained healthcare professionals. Nasogastric tube positioning should be confirmed with a tube aspirate pH<5. If there is any doubt about tube positioning, the patient is on acid suppression or a naso-jejunal tube has been

inserted, an X-ray is needed to exclude bronchial placement. Injection of air through the tube and auscultation with a stethoscope is unreliable and should not be used.¹¹ To minimise the risks of pulmonary aspiration, patients should be fed propped up by 30° or more and kept propped up for 30 minutes after feeding.¹¹

Venous catheterisation

Problems arising shortly after insertion of a venous catheter (frequently a central venous catheter) for parenteral nutrition should also arouse suspicion of an insertion complication (eg shortness of breath due to pneumothorax, blockage of line due to kinking of catheter). Meticulous care in inserting catheters under aseptic conditions by trained operators can do much to minimise the risk of these complications.

Catheter-related sepsis

Catheter-related sepsis is a major complication, the causes of which frequently relate to inappropriate procedures and techniques, for example multiple blood sampling and inadequate aseptic technique when inserting and accessing lines. If line sepsis is suspected, parenteral feeding should be stopped and blood cultured both from peripheral and central line sites prior to initiating antibiotics. Temporary lines should usually be removed, although in minor catheter-related sepsis due to *Staphylococcus*

Table 1. Complications associated with enteral and parenteral nutrition.

Complication	Enteral	Parenteral
Insertion/Mechanical	Nasal damage, intracranial insertion, pharyngeal/oesophageal pouch perforation, bronchial placement, variceal bleeding, bleeding or intestinal perforation following PEG/PEJ, tube blockage, displacement	Local haematoma, arterial puncture, air embolism, pneumothorax, line blockage, thromboembolism, line displacement
Delivery	Pulmonary aspiration, oesophagitis, GI intolerance (nausea, bloating, pain, diarrhoea)	Catheter-related sepsis, infected feed/administration set
Metabolic	Refeeding syndrome, hyperglycaemia, fluid overload, electrolyte disturbance	Refeeding syndrome, hyperglycaemia, fluid overload, electrolyte disturbance, liver dysfunction, respiratory failure

GI = gastrointestinal; PEG = percutaneous endoscopic gastrostomy; PEJ = percutaneous endoscopic jejunostomy.

epidermidis it may be possible to keep the line and treat with antibiotics.

In addition, line sterilisation can sometimes be achieved with appropriate antibiotic therapy in those patients with difficult venous access or long-term tunnelled catheters, although venous catheters should be removed in all patients with uncontrolled sepsis. Line sepsis rates should be routinely audited with the aim of achieving sepsis rates below 5%. Parenteral nutrition bags are another potential source of sepsis; for this reason, all bags should be prepared under aseptic conditions, for example in a pharmacy aseptic unit, without further addition of drugs or electrolytes on the ward.

Metabolic disturbances

Metabolic disturbances occur with both enteral and parenteral nutrition support, although they are more common with the latter as many of the body's homeostatic mechanisms are overridden. Hyperglycaemia is common, particularly in the critically ill who have coexisting insulin resistance which predisposes to septic complications. A raised blood glucose of a few mmol/l may have major deleterious effects on clinical outcome in critical illness in both medical and surgical patients.^{8,12,13} These patients should be monitored closely, with careful consideration of feeding levels and a low threshold for introducing insulin therapy.

Refeeding syndrome

Malnourished patients who are depleted of both macro- and micronutrients are at risk of refeeding syndrome as feeding is instigated. The body adapts to malnutrition by downregulating cellular membrane pumping in order to conserve energy, which in turn leads to whole body depletion of intracellular potassium, magnesium and phosphate. Sodium pumping is less effective and accumulates with water within the cell. The sudden introduction of artificial nutrition support reverses these processes, with carbohydrate stimulating the release of insulin, which in turn

increases the cellular uptake of potassium, magnesium and phosphate,¹⁴ producing dangerously low circulating concentrations of these electrolytes. The metabolic disturbances seen with refeeding syndrome can result in cardio-respiratory failure, arrhythmias, neuromuscular dysfunction, confusion, coma and death. Patients at particular risk of refeeding syndrome include those:

- with one or more of the following:
 - BMI below 16 kg/m²
 - unintentional weight loss over 15%
 - very little nutritional intake for more than 10 days
 - low plasma concentrations of potassium, phosphate or magnesium prior to feeding
- with two or more of the following:
 - BMI below 18.5 kg/m²
 - weight loss greater than 10%
 - very little nutritional intake for longer than five days
 - history of alcohol abuse or drugs, including insulin, chemotherapy or diuretics.

Those at risk should be fed cautiously for the first few days, with generous electrolyte and thiamine supplementation together with a balanced multivitamin and trace element supplement. Energy provision should be no more than 20 kcal/kg/day for the first 48 hours, with levels as low as 5–10 kcal/kg/day in the most severely depleted patients. The presence of normal or high serum electrolytes does not exclude the risk of refeeding syndrome as these patients often have a whole body electrolyte depletion of thousands of mmol. Patients with renal failure and raised serum electrolytes may also require supplementation as refeeding progresses and renal function improves (eg during the diuretic phase of acute renal failure). Low pre-existing electrolyte concentrations (eg potassium, magnesium and phosphate) should be corrected but this could be done at the same time as cautious introduction of feeding. Correction of electrolyte abnormalities prior to feeding does not eliminate the risk of refeeding syndrome.²

Liver function

Abnormal liver function tests (LFTs) are frequently observed in patients receiving parenteral nutrition, often related to underlying disease, sepsis, drugs and small bowel bacterial overgrowth rather than to parenteral nutrition *per se*. Excessive administration of glucose and lipid may result in steatosis due to hyperinsulinaemia, lipogenesis and direct fat deposition in hepatocytes. Parenterally fed patients developing abnormal LFTs should be carefully assessed to exclude occult sepsis, with consideration given to recent and/or current drug therapy and other associated disease likely to cause abnormal LFTs. Overfeeding should be avoided, but it is rarely necessary to stop parenteral nutrition. Patients with persistently abnormal or progressively deteriorating LFTs require specialist assessment.

Respiratory failure

Respiratory failure has also been described with excessive administration of energy, which increases oxygen demands and carbon dioxide production.⁵

Conclusions

Malnutrition is common in patients admitted to hospital and has detrimental effects on clinical outcome. It is important that the nutritional care of patients is considered carefully in their overall management plan, with artificial nutrition support offered to those unable to meet their needs with food or oral supplements. Enteral tube feeding should be used in those with an accessible and functioning gut, with parenteral nutrition reserved for those in whom this approach is not possible. Artificial nutrition support should be monitored carefully, ideally involving a nutrition support team, to minimise the risks of potentially life-threatening mechanical and metabolic complications.

References

- 1 Royal College of Physicians. *Nutrition and patients: a doctor's responsibility*. Report of a working party. London: RCP, 2002.
- 2 National Institute for Health and Clinical

- Excellence. *Guidelines for nutrition support in adults*. Clinical Guideline 32. London: NICE, 2006.
- 3 Elia M, Russell CA, Stratton RJ (eds). Trends in artificial nutrition support in the UK during 1996–2000. Committee of the British Artificial Nutrition Survey, BAPEN, 2001.
 - 4 MacFie J. Enteral versus parenteral nutrition: the significance of bacterial translocation and gut-barrier function. Review. *Nutrition* 2000;16:606–11.
 - 5 Elia M. Special nutritional problems and the use of enteral and parenteral nutrition. In: Warrell DA, Cox TM, Firth JD (eds). *Oxford textbook of medicine*, 4th edn. Oxford: Oxford University Press, 2003.
 - 6 Heyland DK, MacDonald S, Keefe L, Drover JW. Total parenteral nutrition in the critically ill patient: a meta-analysis. *JAMA* 1998;280:2013–9.
 - 7 Elia M. Changing concepts of nutrient requirements in disease: implications for artificial nutritional support. *Lancet* 1995; 345:1279–84.
 - 8 Stratton RJ, Green CJ, Elia M (eds). *Disease-related malnutrition: an evidence-based approach to treatment*. Wallingford, UK: Cabi Publishing, 2003.
 - 9 Elia M (ed). *The 'MUST' report. Nutritional screening for adults: a multidisciplinary responsibility. Development and use of the 'Malnutrition Universal Screening Tool' ('MUST') for adults*. A report by the Malnutrition Advisory Group of the British Association for Parenteral and Enteral Nutrition, 2003. www.bapen.org.uk
 - 10 Elia M, Stroud M. Nutrition in acute care. *Clin Med* 2004;4:405–7.
 - 11 Stroud M, Duncan H, Nightingale J; British Society of Gastroenterology. Guidelines for enteral feeding in adult hospital patients. *Gut* 2003;52(Suppl 7):vii1–vii12.
 - 12 Van den Berghe G, Wouters P, Weekers F *et al*. Intensive insulin therapy in the critically ill patients. *N Engl J Med* 2001;345:1359–67.
 - 13 Van den Berghe G, Wilmer A, Hermans G *et al*. Intensive insulin therapy in the medical ICU. *N Engl J Med* 2006;354:449–61.
 - 14 Solomon SM, Kirby DF. The refeeding syndrome: a review. *J Parenter Enterol Nutr* 1990;14:90–7.

The management of upper gastrointestinal haemorrhage

Terence Wong MA MD FRCP, Consultant Gastroenterologist, *Department of Gastroenterology, St Thomas' Hospital, London*

Clin Med 2006;6:460–4

Upper gastrointestinal haemorrhage (UGIH) is a common medical emergency with an incidence of 50–170 per 100,000 adults per year in the UK.^{1,2} A UK audit found an overall mortality of 14%, with a higher mortality in older patients or those with severe comorbidity.³ Mortality has not declined recently because of the increasing age and comorbidity of patients.⁴

Initial assessment

The initial management of the patient should include a risk assessment of the severity of the bleed and fluid resuscitation (Table 1).

Risk scores in upper gastrointestinal haemorrhage

Several risk scoring systems have been devised to predict the outcome of UGIH, the commonest of which are the Rockall and Blatchford scores.

Rockall score. This widely used scoring system was based on a prospective national audit of 4,185 cases of UGIH.³

The Rockall score, which identifies the risk factors associated with mortality after UGIH, comprises three clinical factors and two endoscopic variables as predictive of mortality (Table 2). The scoring system has been used both pre- and post-endoscopy. The higher the Rockall score the worse the prognosis; an overall score below three is associated with an excellent prognosis. In this audit, 15% and 26% were identified as low risk pre- and post-endoscopy, respectively (Table 3).

Blatchford score. The Blatchford score uses solely clinical and laboratory variables and has no endoscopic component.⁵ In contrast to the Rockall score, the main outcome measurement is the requirement for clinical intervention (blood transfusions, surgical or endoscopic interventions). The score was based on a prospective audit of 1,748 admissions for UGIH in West Scotland

Table 1. Urgent investigations in a patient with upper gastrointestinal haemorrhage.

- Haemoglobin, white cell count, platelet count
- Urea and electrolytes
- Liver function tests
- Blood cross match
- Prothrombin time
- ECG
- Chest X-ray

Key Points

Risk stratification and resuscitation of patients with upper gastrointestinal haemorrhage are important in the initial management

Advanced age, comorbidity and haemodynamic shock are associated with increased mortality

Endoscopic haemostasis is associated with reduced rebleeding rates and requirement for surgery

KEY WORDS: endoscopy, gastrointestinal haemorrhage, peptic ulcer, proton pump inhibitors, terlipressin, varices