Nutrition for trauma patients: a critical recovery ingredient

Author : Louise O'Dwyer

Categories : Nutrition, RVNs

Date : April 12, 2017

The provision of adequate and timely nutritional support for patients during recovery from illness, trauma or surgery is vital.

Adequate and timely nutritional support for those recovering from trauma and serious illness is vital. IMAGE: Fotolia/Vista Photo.

While the majority of patients will recover from fairly mild illness or elective surgical procedures without any issues, patients presenting with more severe disease or trauma, or those undergoing more complex surgical procedures, are likely to have prolonged recoveries.

Nutrition, therefore, needs to be addressed early during the hospitalisation period. In fact, studies have shown the appropriate and early provision of nutrition reduces hospitalisation times in both humans (Chambrier and Sztark, 2012) and dogs (Serón-Arbeloa et al, 2011).

The appropriate absorption of essential nutrients and energy, along with fluids, is of primary importance during the first 14 days following trauma or the onset of severe illness (Chung et al, 2013) to ensure effective functioning of both the gastrointestinal and immune systems.

Avoiding bacterial translocation

Wherever possible, the enteral route should be selected versus parenteral nutrition, as intraluminal nutrition will stimulate the gastrointestinal tract and help reduce the incidence of bacterial translocation (Chung et al, 2013) – a process where intestinal bacteria migrate from the intestines through the intestinal wall and into the mesenteric lymph nodes and internal organs, where they are not typically found.

Bacterial translocation is often the cause of problems associated with surgery, such as unexpected inflammation, serious infection and resultant compromised organ function (Liu et al, 2012). This translocation – which, in itself, may be attributable to one or several causes – can also cause gastrointestinal tract-associated sepsis.

Furthermore, any malnutrition of the gastrointestinal tract decreases cell turnover and mucosal mucus production, which thereby decreases the barrier function and surface of the gastrointestinal tract, resulting in malabsorption of nutrients.

This absence of intraluminal nutrients also reduces blood flow to the gastrointestinal tract. Parenteral nutrition, meanwhile, does not deliver intraluminal nutrients, so may predispose an animal to bacterial translocation (Delaney, 2006).

Saga of sufficiency

The majority of critically ill patients will not have sufficient voluntary food intake to meet even minimal nutritional needs. In trauma patients, this situation is even more acute.

All too often, it is perceived this lack of adequate food intake, while not desirable, will have no serious implications on the patient’s clinical outcome and, for many patients, this will be the case; however, the more serious the illness and the more metabolically stressed the patient, the more likely the patient’s nutritional status will deteriorate to an extent where it may suffer nutritionally related complications, such as immunosuppression or poor wound healing (Okuma, 2007).

Importance of assessment

Figure 1. Body condition scoring is a vital component of a patient’s nutritional assessment.

While the more critical patients can be challenging in terms of providing assisted feeding, an initial nutritional assessment will greatly help in the process of:

1. choosing the route of feeding a suitable diet
2. developing a plan for monitoring the patient during feeding so problems or complications can be prevented – or at least recognised early – and quickly addressed

The assessment serves other purposes, too. First, it allows a determination of the patient’s nutritional status, with an evaluation based on the patient’s medical history and physical examination.

Also, once the assessment of the patient’s nutritional status is complete, these factors, along with the severity of the patient’s illness and whether any pre-existing or existing medical conditions are present, can be taken into consideration when deciding on whether some type of assisted feeding will be required for the patient and, further, how proactive the approach should be to initiating it.

Too frequently, history of the type and amount of food, and the patient’s appetite, are overlooked in the emergency situation and critically ill hospitalised patients, so should ideally be addressed as part of the nursing care plan. In addition to diet history and usual food intake, the physical examination should carefully evaluate the patient for:

- body condition score
- muscle atrophy
- peripheral oedema
- ascites
- pleural effusion

- risk factors for anorexia or vomiting (**Figure 1**)

Laboratory markers of malnutrition are also important considerations when formulating a feeding plan for each patient. For example, in non-stressed starvation, the body uses carbohydrates and fat stores for energy purposes.

However, during the stressed type of starvation associated with a variety of illnesses – including trauma – the body's normal mechanisms to compensate and preserve lean muscle mass are superseded by the massive release of inflammatory cytokines, glucocorticoids and catecholamines, which cause peripheral insulin resistance and allow proteolysis, muscle wasting and lipolysis (Otani, 2003; Yoshikawa, 1996).

The assessment will also help determine which method or route of feeding will be safest, most effective and best tolerated by the patient, as well as helping identify potential problems that may occur, allowing for the planning of nutrition to prevent these problems, or to at least anticipate and monitor for their presence.

All too frequently, a lack of nutritional support contributes to protein-calorie malnutrition, leading to:

- increased length of hospital stay
- increased patient morbidity
- depressed immune function
- delayed wound healing
- increased patient mortality

Calculating calorie requirements

On the first day of feeding, the patient should be fed approximately 25-30% of its caloric requirement. IMAGE: Fotolia/vladans.

The patient should be fed approximately 25 to 30% of its caloric requirement on the first day of feeding,

The resting energy requirement (RER) is the number of calories necessary for a non-stressed animal in the postprandial state in a calm, thermoneutral environment.

In other words, it is the amount of energy necessary for basic functions, not including obtaining and digesting foodstuffs. RER is calculated by one of two formulas:

Linear formula

RER in kcal/day = (30 × bodyweight in kg) + 70

Exponential formula

RER in kcal/day = 70 × (bodyweight in kg)0.75

The exponential formula is considered to be the most accurate because it is based on a combination of body surface area and metabolic rate (Firth, 2013).

The patient should be fed approximately 25 to 30% of its caloric requirement on the first day of feeding, with subsequent gradual increases of 25 to 30% of its caloric requirement per day (Corbee and Van Kerkhoven, 2014).

Previously, we added an illness energy requirement (IER) to the RER, which is an energy requirement associated with illness, injury, infection and inflammation. The IER is an arbitrary number multiplied by the RER in an attempt to combat the proposed increase in caloric requirements associated with various forms of illness.

However, studies have found no increase in RER in numerous hospitalised patients, so this value is generally the one selected when calculating the patient’s nutritional requirements, and is thought to occur because of the “down regulation” of metabolism that often occurs with critical illness.

Overfeeding, particularly carbohydrates, can contribute to respiratory acidosis and increased patient morbidity, and doing so in the early course of illness – particularly after a long period of anorexia or weight loss – can result in hyperalimentation and so-called “re-feeding” syndrome. Because of this, nutritional assessment of each patient should occur on an individual basis, depending on:

- the patient’s primary illness
- the expected time the patient will need
- nutritional supplementation
- the patient’s tolerance to enteral or parenteral feeding
- anaesthetic risks
- underlying illnesses, including pancreatitis, gastric stasis, oesophageal motility disorders and severe diarrhoea

Weighing and reassessment of body condition scoring should be performed daily, at minimum, with the patient’s RER being increased or decreased depending on these parameters.

Creating a nutritional plan

One of the first stages in creating a nutritional plan is to ensure fluid deficits – for example, hypovolaemia or dehydration – have been addressed, as it will ensure the patient is haemodynamically stable. Correction of electrolyte or acid-base imbalances will also be needed.

Once these issues have been corrected, the nutritional plan can be introduced, with the aim to achieve target levels of nutrient delivery within 48 to 72 hours.

It is also essential the nutritional plan is reassessed, which includes:

- assessment of the patient toleration of feeding
- regular assessment of bodyweight and body condition scoring
- monitoring for complications associated with nutritional support, such as electrolyte disturbances, hyperglycaemia, vomiting, regurgitation, aspiration and infections related to the presence of a feeding tube

In patients that do not have contraindications to enteral feeding, the placement of a feeding tube should be considered early in the hospitalisation period – particularly if injuries are present that indicated the requirement of prolonged nutrition, such as jaw fractures.

An additional consideration often overlooked with trauma patients is the requirement for daily sedation or anaesthesia for procedures such as dressing changes or wound debridement. It is not uncommon for these patients to be fasted for periods of 8 to 12 hours prior to having these procedures performed, so if this is not factored into the nutritional plan, malnourishment is a definite possibility.

Choice of feeding tube

Figure 2. A patient with a nasogastric tube in place receiving a continuous rate infusion of nutrition.

The best feeding tubes for prolonged use are made of polyurethane or silicone. For short-term feeding – less than 10 days, for example – polyvinyl chloride can be used.

Silicone is softer and more flexible than other tubing materials and has a greater tendency to stretch and collapse, while polyurethane is stronger, allowing for thinner tube walls and a greater internal diameter, despite the same overall French gauge (Fr) size.

Both silicone and polyurethane tubes do not disintegrate or become brittle in situ. The Fr unit measures the outer lumen diameter of a tube, with each unit equal to 0.33mm.

Naso-oesophageal and nasogastric tubes

Naso-oesophageal tubes can be inserted using minimal equipment and standard techniques. Nasogastric tubes are inserted in a similar fashion as naso-oesophageal tubes, but they should be long enough to reach 7cm to 10cm past the last rib.

Both types of tubes are useful for providing short-term nutritional support – usually less than seven days – and can be used in animals with a functional oesophagus, stomach and intestines.

Naso-oesophageal tubes are contraindicated in animals that are vomiting, comatose, have a lack of gag reflex or have respiratory diseases. Complications include epistaxis, intolerance of the insertion procedure and inadvertent removal by the animal. Because of the small internal diameter of these tubes, only liquid enteral diets can be used.

Feeding may be delivered via a syringe pump as a continuous rate infusion, or as bolus feedings (**Figure 2**). If a syringe pump is used, the delivery equipment must be completely changed every 24 hours to help prevent bacterial growth.

Clogging of these tubes is a common problem, due to the narrow bore, but the incidence can be decreased by using a syringe pump or flushing the tube well before and after bolus feedings. A column of water should always remain within the feeding tube in between feeds. If the tube becomes clogged, replacement may be necessary, or carbonated drinks may be used to remove the blockage.

Diluting the liquid diet with water may also help prevent clogging, but this decreases the caloric concentration of the diet and increases the volume necessary to meet caloric needs.

Maintenance of the tube should be carried out by cleaning the external nares gently using a warm, damp cotton wool ball. If tubes do become blocked, carbonated drinks may again be used to unclog the blockage. The tube can be removed at any point following placement. When removing the tubes, they are simply pulled out after the skin adhesive or sutures are removed.

Oesophagostomy tubes

Oesophagostomy tubes are ideal for patients with head or jaw injuries, and are particularly useful in cats (**Figures 3 and 4**). The placement of oesophagostomy tubes requires general anaesthesia, with the animal intubated and in lateral recumbency. Complications include tube displacement from vomiting, removal or damage to the tube by the animal, and skin infection around the exit site.

Depending on the insertion technique used and the size of the animal, an 8Fr to 20Fr catheter may be used. The large bore of these catheters allows the feeding of a thicker recovery diet, while they are easy for owners to use and maintain, as long as vomiting is not a problem. The tube may simply be pulled out after the sutures are removed, with the exit hole allowed to heal by second intention. A light bandage may be applied over the exit site for the first 12 hours.

After every bolus feeding, the tube will require a flush of water to rinse it of food debris. The tube exit site will require topical cleaning using sterile saline or chlorhexidine solution – the use of topical antimicrobials rather than antibiotic cream at the stoma site should be encouraged. A light bandage is applied and the entire dressing changed every 6 to 12 hours.

When the tube is no longer needed, it is simply removed by cutting the skin sutures and pulling out. The wound can be stapled or left to granulate, while the exit site will granulate within a few days.

Gastrostomy tubes

Figure 3. A 3D reconstruction of a head trauma cat with maxillary and mandibular fractures, and a temporomandibular joint luxation – the ideal candidate for placement of an oesophagostomy tube.

Gastrostomy tubes can be inserted blindly using specialised equipment, placed with the aid of a gastroscope – that is, percutaneous endoscopic gastrostomy (PEG) tube – or be surgically inserted. These tubes can be placed in any animal that can withstand general anaesthesia.

A minimum of 12 hours, preferably 24 hours, is needed for a temporary stoma to form before feeding can begin, and the feeding tube should be left in place for a minimum of 7 to 10 days to allow a permanent stoma to form before removal. These tubes can be left in long term (1 to 6 months), often without replacement.

Complications associated with PEG tubes include those that arise acutely during tube placement. For example:

- splenic laceration
- gastric haemorrhage
- pneumoperitoneum

Others are delayed, such as:

- vomiting
- aspiration pneumonia
- tube removal

- tube migration
- peritonitis infection around the stoma

Most animals are able to eat normally with gastrostomy tubes in place, and the tubes can easily be used as a source of additional nutritional supplementation until the animal is eating normally.

For animals difficult to medicate or requiring long-term medications, many medicines can be given through the feeding tube at the clinician's discretion.

The major disadvantages of gastrostomy tubes are the need for general anaesthesia during insertion and the risk of peritonitis from inadvertent removal before a permanent stoma develops.

For animals requiring feeding tubes over a long duration, the initial gastrotomy tube can be replaced with a low-profile silicone tube. The tube can be placed through the external stoma site without an endoscope.

Jejunostomy tubes

Figure 4. A fractured hard palate in a cat following a road traffic collision.

Jejunostomy tube feeding is indicated when the upper gastrointestinal tract must be rested or when decreased pancreatic stimulation is desirable.

Jejunal tubes can be placed either surgically or threaded through a gastrostomy tube (transpyloric placement). However, standard gastrojejunal tubes designed for humans are unreliable in dogs because of the frequent reflux of the jejunal portion of the tube back into the stomach. For this reason, "weighted" tubes should be selected.

Common complications of jejunostomy tubes include osmotic diarrhoea and vomiting, while it is recommended the tube be left in place for 7 to 10 days to allow adhesions to form around the tube site, preventing leakage into the abdomen. Completely changing the delivery equipment every 24 hours helps to prevent bacterial growth within the system.

Clogging is a common problem; the use of a syringe or IV pump and flushing the tube well every four hours may help decrease the incidence of clogging.

When removing the tube, it may simply be pulled out after the sutures are removed, with the exit hole allowed to heal by second intention. A light dressing should be applied for the first 12 hours following removal.

Feeding via a tube

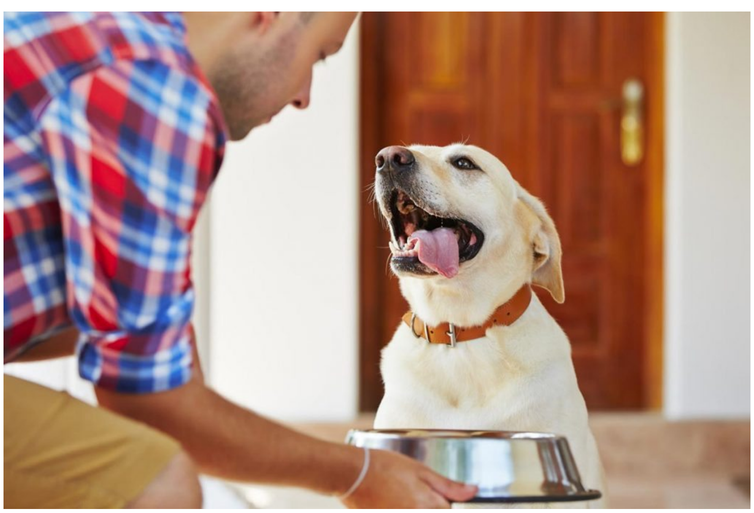
It is important to start feeding any patient with a feeding tube in place gradually. The patient's full RER should be introduced over two to three days. This gives the patient's gastrointestinal tract and metabolism time to adjust to tube feeding.

It is generally advised to start with one-third to half the calculated amount of food diluted with water and gradually increase the volume fed each day.

A good protocol to use is 10ml/kg every two to three hours on day one, increasing gradually to 50ml/kg three to four times per day. A minimum of three feeds should be given per day.

Food must be iso-osmolar and given slowly (over 10 to 15 minutes) and warmed to approximately body temperature.

How long to feed?



It is important to continue feeding a specialist diet for a period after the patient goes home. IMAGE: Fotolia/chalabala.

Patients should be tube-fed until they voluntarily start to eat more than 85% of their calculated daily requirements. Tube feeding should be withdrawn gradually – just as it was introduced gradually – to allow the necessary gastrointestinal and metabolic adjustments.

It is important to continue feeding a specialist diet at increased requirements for a period after the patient goes home. The following periods are used by the author:

- 2 weeks following uncomplicated major surgery
- 2 to 4 weeks after trauma
- 4 to 12 weeks after major trauma including head trauma
- several months in chronic disease and neoplasia cases

Conclusion

Nutritional support in trauma patients is all too often not considered a priority, but careful consideration needs to be given to the individual patient's nutritional status on presentation, the injuries the patient has sustained, any alterations in metabolic condition, requirement for periods of fasting to allow procedures to be performed during the hospitalisation period and the provision of continued nutrition once the patient has been discharged from the hospital.

Careful consideration of all these factors, along with planning and execution of a nutritional plan, can play a major role in the successful recovery of these patients.

References

- Chambrier C, Sztark F, Société Francophone de Nutrition Clinique et Métabolisme and Société Française d'Anesthésie et Réanimation (2012). French clinical guidelines on perioperative nutrition. Update of the 1994 consensus conference on perioperative artificial nutrition for elective surgery in adults, *Journal of Visceral Surgery* **149**(5): e325-e336.
- Chung CK, Whitney R, Thompson CM, Pham TN, Maier RV and O'Keefe GE (2013). Experience with an enteral-based nutritional support regimen in critically ill trauma patients, *Journal of the American College of Surgeons* **217**(6): 1,108-1,117.
- Corbee RJ and Van Kerkhoven WJS (2014). Nutritional support of dogs and cats after surgery or illness, *Open Journal of Veterinary Medicine* **4**(4): 44-57.
- Delaney SJ (2006). Management of anorexia in dogs and cats, *Veterinary Clinics of North America: Small Animal Practice* **36**(6): 1,243-1,249.
- Firth A (2013). Early enteral nutrition – principles and practice, *The Veterinary Nurse* **4**(7): 393-399.
- Liu DT, Brown DC and Silverstein DC (2012). Early nutritional support is associated with

decreased length of hospitalization in dogs with septic peritonitis: a retrospective study of 45 cases (2000-2009), *Journal of Veterinary Emergency and Critical Care* **22**(4): 453-459.

- Okuma T (2007). Clinical nutrition in keywords: enteral tube feeding, *Nutrition Society* **66**: 299-306.
- Otani J (2003). Feeding tube practices before and after gastrointestinal surgery, *Infusion Therapy News* **2**: 3-5.
- Serón-Arbeloa C, Puzo-Foncillas J, Garcés-Gimenez T, Escós-Orta J, Labarta-Monzón L and Lander-Azcona A (2011). A retrospective study about the influence of early nutritional support on mortality and nosocomial infection in the critical care setting, *Clinical Nutrition* **30**: 346-350.
- Yoshikawa K (1996). Feeding tube techniques and carbohydrate metabolism, *Journal of Experimental and Clinical Medicine*, Special Issue: 9-14.