What's for Dinner? Nutrition in the ICU

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Introduction

Critical patients in the ICU are expending calories at an exponential rate. While a normal patient who is "recumbent" might only need a limited amount of calories to sustain life, patients with critical illness need supra-physiologic calorie administration to maintain vital functions. Nutritional treatment of a patient with severe illness should not be an after-thought but an integrated part of the treatment plan. Veterinary technicians are typically administering nutritional therapy, and as such are responsible for assessing nutritional status, and providing nutritional treatments for these patients.

Starvation in critical illness

Starvation experienced by a patient who is critically ill is different than that of a patient who is simply starving (lack of access to food, etc). The latter patient experiences simple starvation in which fat stores are broken down into energy to maintain vital functions. The patient conserves their lean body mass (skeletal muscle) in place of fat. In contrast, the critically ill and starved patient undergoes "stressed" starvation and typically recruits protein stores (in the form of skeletal muscle) for energy. This protein catabolism affects immune function, wound healing, and strength. Mammals do not create their own nutrients for energy, we are dependent on food intake to meet energy and metabolic needs.

Nutritional plan

The elements of the nutritional plan include:

1- Who to feed
2- When to feed
3- Where to feed
4- What to feed

According to nutritional specialists, every patient who can have feedings (not contraindicated) should be fed. There are very few actual contraindications to feeding, so this means most of our sick patients should be fed. Some issues, like vomiting or pancreatitis, are more relative contraindications to feeding and studies have shown how to feed patients through vomiting or even early feeding in pancreatitis. Patients in severe shock should not be fed as these nutrients will not be absorbed.

All patients should be assessed for nutritional status when entering the hospital. Withholding nutrition should not be performed for more than 2-3 days at most. This gives the clinician time to stabilize life-threatening issues such as fluid volume/dehydration, arrhythmias, and electrolyte abnormalities. Additionally, this 2-3 days really represents the time of onset of anorexia, so if they have not been eating well for 3 days, and we wait an additional three days in hospital, that is 6 days without food and there are sure to be some physiologic consequences to that. Ideally, placing a bowl of food into the cage, and having the patient eat readily is the ultimate scenario, but this is not always the case. In addition to interventions like warming the food, trying different foods, patients may need a more invasive nutritional plan to provide nutrients.

Routes to feed

There are typically two routes to provide nutrition: enteral and parenteral. Enteral nutrition is preferred because enterocytes receive nutrition as well. Intravenous feeding (such as in parenteral nutrition) provides nutrients for other organ systems, but not for the GI tract. Enteral nutrition options involve using the gut in some capacity. Voluntary feeding, force feeding, and placement of a feeding tube represent the options in this area. While voluntary feeding is not always achieved force feeding shouldn't be thought of as a viable alternative. Several problems exist with force-feeding. Risk of aspiration is great, and typically the amount of food administered isn't

actually what the patient receives. Food ends up on the walls, in towels, or on the staff member performing the treatment, Additionally, force feeding may result in food aversion and a dis-interest in eating on the part of the patient, which is certainly a setback.

Feeding tubes

Feeding tubes are a great option for providing nutrition to critically ill patients. Options include: nasoesophageal and nasogastric tubes, esophagstomy tubes, gastric tubes (PEG or otherwise), and jejunostomy tubes. The least invasive tubes to place are the nasal tubes with gastric tubes requiring an endoscope or surgical placement. Jejunostomy tubes are usually always placed with a surgical technique. Various aspects of feeding tubes are summarized in the below table:

Tube	**Location of feeding**	**Long or short term**	**Types of diets infused**	**Complications**
Nasoesophageal	Esophagus	Short	Liquid, not bulky	Very few
Nasogastric	Stomach	Short	Same	Aspiration, mechanical damage, discomfort
Percutaneous Endoscopic Gastrostomy (PEG) tubes, or Gastrostomy tubes	Stomach	Long	Larger diets- some bulk, blended diets	Stoma infection, accidental disconnection/removal, leakage of stomach contents
Jejunostomy	Jejunum	Short	Liquid/elemental diets	Accidental removal, leakage of intestinal contents
Esophagostomy	Esophagus	Long	Liquid to blended diets	Very few, stoma infection.

Typically critical care patients need a diet that is very high in calories per unit of food- called a calorically dense diet. This allows us to feed a large number of calories in a reasonable amount of food. Various diets are available for critical care use including Hill's A/D, Iams Maximum Calorie, Royal Canin Recovery, and Clinicare (Abbott Animal Health). Clinicare is the only true liquid diet and can be infused through most tubes. Other diets must be blended as they are chunky and can result in tube clogs.

Feeding through feeding tubes is done either with bolus feedings or a constant rate infusion. Typically a patient needs a caloric amount equal to the resting energy requirement (RER) which is a daily amount of calories in a sedentary patient. This is 30 x BW (kg) + 70. For example, and 10 kg patient would need (30 x 10 = 300, +70 =) 370 kcal per day. If doing bolus feedings, this amount is typically divided into 4-6 feedings. A constant rate infusion would infuse the total amount of calories divided by 24 hours. So our 10 kg patient would get (370 / 24) = about 15 calories an hour. Amounts of calories per mL / ounce varies, but on average Clinicare is 1 kcal per mL. Easily enough this patient could receive 15ml/hr of Clinicare. Typically this is divided into 30-50% to be started on Day 1. So 30-50% of the RER is started on Day 1, if the patient tolerates it well, that can be doubled (to 60%) and then finalized on day 3. The nutritional conversion (kcal per ounce or ml) can usually be found on the back of most cans of food.

Complications of enteral feeding

Complications of tube feeding can present some challenges to the ongoing management of these patients. Clogged tubes can occur with any kind of diet and can be so serious as to necessitate tube removal. However, troubleshooting can often resolve the problem. Typically pressurizing the tube with some water, or infusing some soda can break up a clog. Potentially a stylet or wire can be used to break up the clog. Flushing with warm water

after feedings can help prevent clogs. Other rare complications include aspiration, esophageal erosion, inadvertent removal, and potentially pressure necrosis.

Parenteral nutrition

If the enteral route is not available, parenteral nutrition is an option in small animal patients. Partial parenteral nutrition (PPN) also called peripheral PN can be administered through a peripheral catheter but only meets a portion of the patient's metabolic needs. Total parenteral nutrition or TPN (also called Central PN) can be formulated to meet most of a small animal patients metabolic and caloric needs. However, TPN is hyperosmolar and needs to be administered through a central line. These solutions can be technically challenging as they can be sources of sepsis (infection because of their high glucose concentration), and significant metabolic derangements. The clinic needs to be ready for intensive monitoring with a patient receiving TPN.

Conclusion

Critically ill patients are faced with having to "fight off" their critical illness through the use of calories to fuel their metabolic processes. Without an external source of nutrition, these patients may break down fat and protein leading to severe instability and impaired healing and recovery from illness. Various options for feeding critical patients are available including enteral and parenteral options. Veterinary technicians are essential in assessing nutritional status of patients and implementing nutritional therapies.

References available upon request.