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Small Animal Nutrition Mini Series

Session Three: Clinical Nutrition – Feeding Hospitalised Dogs and Cats

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Nutrition for Hospitalized Dogs and Cats

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In human hospitals it is estimated that 30 – 50% of the patients suffer from malnutrition and there is evidence that this is similar in hospitalized cats and dogs. Malnutrition compromises the immune system, slows healing, and increases the rates of morbidity and mortality.

Simple and stressed starvation

Starvation occurring without illness or injury is called " non-stressed" or "simple" starvation. Starvation is stressful; the terminology is used to distinguish it from starvation with the added stresses of injury or illness.

When starvation occurs the body will try to maintain normal concentrations of blood glucose. The initial source of glucose is from glycogenolysis of the hepatic glycogen. In humans the liver glycogen is depleted within about 24 hours; in dogs peak depletion occurs between the second and third day of fasting. Data on depletion of hepatic glycogen is not available for cats. As the hepatic glycogen is depleted, gluconeogenesis using glycerol from metabolism of triglycerides from body fat and from the carbon skeleton from amino acids takes over as the primary mechanism to maintain blood glucose.

In non-stressed starvation the body adapts by decreasing the metabolic rate and thereby decreasing the resting energy requirements, by decreasing physical movement, by increasing the use of ketones as an energy source by the brain, and especially by an increased oxidation of triglycerides. These processes decrease the necessary rate of gluconeogenesis and help decrease the amount of protein from being used as a substrate.

The response to stressed starvation differs in that there is stimulation of the sympathetic nervous system, an increase in the counter regulatory hormones adrenaline, glucagon and cortisol, and increased inflammatory mediators, notably tumour necrosis factor and interleukin 1. Because of this stress response the metabolic rate may be increased, increasing the oxygen demand and protein catabolism for gluconeogensis continues at a high rate, using both visceral and skeletal muscle. The shift to increased oxidation of triglycerides is not as pronounced, and protein continues to be utilised for energy at a rapid rate.
All of the protein in the body is functional, so this breakdown or catabolism of endogenous protein compromises many systems, such as the cardiac, respiratory, and immune systems.

Nutritional goals

One of the main goals of nutritional support is to prevent or slow the use of protein for gluconeogenesis, sometimes termed "protein sparing". Another goal is to maintain the patient's weight.

In thin animals it may seem preferable to increase weight, but if the animal is in a catabolic metabolic state due to stress, this may not be a realistic goal. Over feeding can also be detrimental due to the increased metabolic rate, heart rate, and production of CO_2.

Patient Assessment – Who and When to Feed.

A dietary history should be taken for all patients, and includes what the animal has been fed, how much and when. Any animal that has been anorectic for over 3 to 5 days is a candidate for nutritional support. In human hospitals with a nutrition service, supplemental nutrition is supplied to patients not receiving at least 2/3 of their estimated requirements.

The assessment of body condition includes thorough palpation and visual assessment. If the patient has lost over 10% of its body weight acutely or over 20% over a longer time it should be given nutritional support. Body condition scoring using either a 1 to 5 or a 1 to 9 (higher is fatter) system adds a measure of objectivity to the assessment. There are useful pictorial sheets available for body scoring, which also aid in teaching clients about ideal body condition. Body condition scoring assesses body fat, and some patients lose muscle mass with or without the loss of body fat. A muscle condition score has been developed to help assess this. Bilateral loss of muscle mass over the temporal, shoulder and/or lumbar muscles can indicate muscle wasting (other differentials include neuropathies and myopathies).

The overweight patients, especially dogs, present a difficult case. In cats, fasting is well known to predispose the patient to hepatic lipidosis. In dogs, it is tempting to feel that the animal can support itself nutritionally from its own body fat. However, if the dog is ill or injured, it has the same metabolic changes and the same protein catabolism as a leaner dog. Even though the animal is fat, it will be losing functional proteins. The time for the diet is when it is healthy.

For most patients, feeding sooner is better than later. Fasting animals with acute diarrhoea for 24 hr is still practised by some clinicians, although this may work best for osmotic diarrhoea (e.g. dietary indiscretion). “Feeding through diarrhoea” is used for some human cases, especially for secretory diarrhoeas (see GI notes). The gut and the microbiome (gut flora) are compromised within 24 hr of fasting. A healthy human patient is thought to have a seven day energy and protein “reserve”; and in a mildly injured patient nutritional supplementation may not be initiated for 5 days. In a more compromised or severely injured patient nutritional support is initiated as soon as the patient is haemodynamically stable (usually within 24 hr of hospitalisation).

How Much to Feed

Basal energy requirement (BER) is the energy needed for a healthy resting animal in a postabsorptive (unfed) state in a thermoneutral environment. Resting energy requirement (RER) is BER plus the energy needed for assimilation of food and recovery from physical activity. In humans it is estimated to be about 10% greater than BER. It is the same as resting energy expenditure (REE). Resting energy requirement is calculated by body weight =

$(kg)^{0.75} \times 70$

OR

$(30 \times \text{body wt in kg}) + 70$.

Maintenance energy requirement (MER) is the energy required by an animal at home with a moderately active life. It is usually estimated as a multiple of RER; e.g.1.4 to 1.8 x RER for dogs and 1.1 to 1.4 x RER for cats. It does not include energy needed for growth, gestation, lactation or work. A dog (or less likely a cat) with a very active lifestyle may need more energy than is supplied by the estimation of MER, and sedentary ones need less.

In the past, some clinicians have used “IER” for illness/injury energy requirement, and multiply the RER by a factor that is estimated by the severity of the disorder. These “fudge factors” are largely borrowed from human medicine and vary from 1.2 to 2 x RER. Using indirect calorimetry in hospitalised dogs, most had energy requirements near RER. Human patients are started near RER and adjustments made based on clinical assessment; this is a reasonable and safe procedure for most veterinary patients as well. Patients whose needs are known to be above RER include those with head trauma and severe burns.

Methods of Feeding

Oral

Voluntary oral is the easiest method for everyone. Ways to encourage cats to eat include feeding moist food with a high protein and fat content, warming the food to just below body temperature, and using foods with a strong odour like fish. Many cats prefer a flat dish to a bowl, and some have a preference for porcelain or glass to plastic or metal. Some cats like to be petted or hand fed small amounts, or will eat a small amount when a new food is introduced.

Many of the same methods can be used to entice dogs to eat as they also prefer warm, high protein foods.

Drugs that have previously been used to entice cats to eat include IV valium and oral oxazepam. These often work but only for a very short time (minutes), and run the risk of causing hepatic necrosis. Oral cypoheptadine also works in some cats, although we have had two cases of haemolytic anaemia that appeared to be drug related while using it.

Corticosteroids and anabolic steroids may increase food intake, but it is unlikely that they wills start an anorectic animal eating. The use of B vitamins has been rumoured to be useful for appetite stimulant; however this has never been proven. Many ill or anorectic animals, especially cats, are deficient in B vitamins, so supplementation may be worthwhile, but don't expect a change in appetite.

Maropitant is an effective antiemetic; we often use it even in animals which are not vomiting to determine if nausea is a cause of poor appetite. It also has an analgesic effect on the viscera. Mirtazepine is an effective appetite stimulant which we also frequently use, and can be combined with other antiemetics such as metoclopramide. We often use these in conjunction with a prokinetic drug and an antiemetic drug. Prokinetic drugs include ranitidine and cisapride. Metoclopramide has a prokinetic effect on gastric emptying and duodenal motility but not further down the GI tract.

Tube Feeding

Naso-oesophageal or naso-gastic (NG) tubes may be placed in animals that will need nutritional supplementation for less than a week. They can usually be put in without general anaesthesia (and sometimes without sedation) using topical anaesthesia. We suture the tubes in using a Chinese finger trap with a pre-placed suture and use Elizabethan collars; however, there is no magic way of keeping an NG tube in a cat who is very determined to remove it.

Because of the small diameter of NG tubes it is necessary to feed a liquid formula. Slow bolus feeding is usually used, although continuous feeding is possible in a monitored situation. Patients should not be left alone with continuous NG tube feeding because if they vomit up the tube the feeding formula could be administered via the trachea.

Gastrostomy tubes may be placed at surgery or using an endoscope. When the endoscope is used the tube is termed a percutaneously endoscopically placed gastrostomy (PEG) tube. There are instruments for blind placement of gastrostomy tubes; however, I prefer to see what I am doing to ensure that the tube exits the stomach correctly (rather than exiting the oesophagus or transversing the spleen). Placement of gastrostomy tubes requires anaesthesia. The tubes can be used long term, even months to years. A low profile tube may be placed in animals that need long term support. Pet food slurries or liquid formulas may be fed. Feedings are usually done as a bolus, although continuous feeding with a pump can be used.

Oesophagostomy tubes have largely replaced the use of gastrostomy tubes in any patient with a functional oesophagus. They are easier to place and may be used long term. They do require anaesthesia to place. Bolus feeding can be used and the type of diet used depends upon the size of the tube.

Jejunostomy tubes (J tubes) are placed surgically when the upper gastrointestinal tract is non-functional, e.g. gastric surgery or intractable vomiting. We also place J tubes in patients with pancreatitis whenever possible (when surgery is already planned). In humans, a more rapid recovery from pancreatitis has been noted when they were fed via a J tube. Only liquid formulas of fairly low viscosity will run through a J tube, and continuous or very slow bolus feeding must be used as there is no reservoir capacity within the small intestine.

Microenteral Nutrition

Microenteral nutrition is the delivery, by any of the above methods, of small amounts of water, electrolytes and easily absorbed nutrients (e.g. glucose and peptides) by slow constant rate infusion (e.g. 0.25 ml/hr) or small boluses every 2 – 3 hours. Commercial oral re-hydrating solutions can be used. The goal of microenteral nutrition is more to feed the gastrointestinal (GI) system than to meet the patients' nutritional needs. The presence of nutrients in the gut increase GI blood flow, improve GI immune function, helps prevent down regulation of brush border enzymes, decreases the risk of GI ulcers, and helps prevent increases in intestinal permeability. It facilitates a more rapid return to full enteral feeding, and can be used with parenteral nutrition.

Parenteral nutrition

If the gastrointestinal tract is not functional, or if the animal is unable to meet its energy and protein requirements while being fed enterally, parenteral nutrition should be considered. Parenteral nutrition is often considered too difficult, too technical, and too expensive. These prohibitions mean that many animals suffer from worsening malnutrition during their stay in the hospital.

Total parenteral nutrition

Total parenteral nutrition (TPN) is designed to meet 100% of the animal's nutritional needs and is usually administered via a central vein such as the jugular vein. It should probably be termed central parenteral nutrition as it rarely provides 100% of the requirements in veterinary patients. Products used for this are too hyperosmolar (very concentrated) to administer via a peripheral vein such as the cephalic vein. Products used for TPN usually include a combination of glucose and lipids (fat) for energy, and amino acids to provide the building blocks for proteins. Most veterinary practices use products prepared for human use; these products may come with each component separate, or may combine the glucose and amino acids. Commercial bags are available for combining the products. The products need to be combined very sterilely (e.g. in a surgical suite while gowned, masked and wearing sterile gloves). If separate products are used they should added together in the following order: glucose mixed with amino acids, and lipids added last.

Disadvantages of using TPN include cost, necessity (and difficulty) of placing and maintaining a central venous catheter, necessity of compounding the solutions, risk of infection or central vein thrombus, and metabolic disturbances. These difficulties and disadvantages limit the use of TPN in veterinary practices. Another option is to administer a less concentrated solution using a peripheral vein.

Peripheral parenteral nutrition

Peripheral parenteral nutrition (PPN) is the provision of intravenous nutritional support using a peripheral vein. The goals of PPN may include sparing endogenous protein from catabolism by providing an energy source such as glucose or lipids, and providing amino acids for protein synthesis. Patients that are good candidates for PPN include non-debilitated patients that will likely only need intravenous support for less than a week, those in which a jugular catheter cannot be placed, and as adjunct feeding for those whose nutritional needs cannot be met completely with oral or tube feeding. Another indication would be for a patient who would benefit from short term parenteral nutritional support prior to placement of a gastrostomy or jejunostomy tube. Debilitated patients who cannot be fed enterally should ideally be given total parenteral nutrition, but if this is not available, use of partial nutrition delivered peripherally could be used prior to referring the patient for central vein TPN. If a patient will need to be fed intravenously for longer than a week, central vein TPN might be preferred, both because the nutrient density of the solution can be greater and will better meet the animals needs, and also because the longer a catheter is located in peripheral veins, the more likely they are to thrombose.