EMERGENCY MEDICINE/CRITICAL CARE

Supportive Feeding Methods for Small Animals

MEET THE AUTHOR

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The nutritional goal with all sick companion animals is that they consume the designated diet in sufficient quantities. Many patients may require, or benefit from, a veterinary therapeutic diet, but your initial goal is to ensure that the patient is receiving its daily caloric requirement from a nutritionally balanced diet.

Providing critical care nutrition depends on the disease process and/or the patient's specific requirements. Each patient must be considered on its own, after completion of a full clinical examination and history taking, including nutritional history.[1] For critically sick animals, the added stress of being in a hospital environment can affect food consumption and metabolism. Before any nutritional support can be initiated, hydration and electrolyte status must be corrected and maintained. Not to be forgotten are the roles of pain and nausea in reducing food intake, for which pharmaceutical interventions can be used and/or the initiating cause investigated.

As with all hospitalized patients, human and animal, malnutrition has been associated with increased infections, prolonged hospitalizations, and increased death rates. Although your main goal is to prevent and/or treat malnutrition when present, it is beneficial to consider short-term and long-term goals (**BOX 1**). As disease processes change and the patient's physiologic and metabolic responses alter the nature of the nutritional support, both short-term and long-term nutritional goals may also change.

BOX 1

Nutritional Goals

Short-term nutritional goals

- Provide for any ongoing nutritional requirements (in terms of energy and nutrients)
- Prevent or correct any nutritional deficiencies or imbalances
- Minimize metabolic derangements
- Prevent further catabolism of lean body mass

Long-term nutritional goals

- Restore optimal body condition (using body condition and muscle condition scores)
- Provide required nutrients to the animal within its own environment

DETERMINING NUTRITIONAL NEEDS

Energy requirements during sickness are based on resting energy requirements (RER) (**BOX 2**). These values are based on the assumption that the patient is inactive and often confined to a small area. Illness factors are no longer used in RER calculations, replaced by nutritional assessments to ensure adequate nutrition. Good indicators that the patient is receiving sufficient calories, which can be assessed daily, are stable body weight, healing rates, and lean body mass.[1]

CLINICAL NUTRITION

Water (Hydration)

Providing assisted feeding before the patient is hemodynamically stable can further compromise the patient. Therefore, before assisted feeding is started, the first steps for nutritional support are to correct dehydration, replace electrolytes, and normalize acid-base status. During intravenous fluid therapy, monitor hydration level indicators. Daily maintenance fluid requirements are approximately 50 to 60 mL/kg/day or 2 mL/kg/hour. If dehydration persists or edema results, recalculate flow rates. Any additional fluid losses from persistent vomiting or diarrhea need to be factored in. Urine output should also be monitored.

Protein

A patient can experience protein energy malnutrition during periods of illness, after injury, or even after routine operations. To conserve limited resources during these periods, body systems can shut down, resulting in clinical shock. Clinical shock is treatable, but the length of time that shock can be endured varies, and it can ultimately be lethal. Shock occurs in ebb and flow phases. The ebb phase consists of decreased blood pressure, cardiac output, and oxygen consumption. The flow (or hypermetabolic) phase is the period during which the patient's body initiates defense and repair mechanisms.[2]

Patients in a catabolic state will derive protein from skeletal muscle; for these patients, provision of nutritional support with adequate protein levels for the specific life stage and nutritional assessment is vital. To ensure that proteins are not used as a source of energy, sufficient calories need to be supplied from fats and carbohydrates. When providing protein, consider its quality and digestibility. Commercially available critical care diets are supplemented with specific amino acids. Many enteral diets are supplemented with glutamine and arginine. Glutamine is an amino acid needed to keep up with the increased levels of gluconeogenesis in

BOX 2

Calculating Enteral Feeding Amounts

1. Calculate the patient's resting energy requirement (RER):

   $RER = 70 \times (\text{kg body weight})^{0.75}$
   (can be used for animals of all sizes)

   OR

   $RER = 30 \times (\text{kg body weight}) + 70$
   (should not be used for animals weighing <2 kg or >45 kg)

2. Choose the diet and the method of feeding that will most benefit the patient
3. Divide the energy content of the diet (kcal/mL or grams) by the energy requirement of the animal (kcal/day) to determine the amount of food required daily
4. Divide the total amount to be given in a day by the total number of feedings to be given, or by maximum volume of each feeding

rapidly dividing cells. A glutamine deficiency can lead to gut mucosal atrophy and increased bacterial translocation resulting from a compromised mucosal barrier. This process has led to the suggestion that during severe illness, glutamine may be a "conditionally essential" amino acid. High levels of glutamine have a trophic effect on the gut mucosa. The essential amino acid arginine has a positive effect on the immune system and can subsequently improve survival times for septic patients.

Use of a novel protein source in patients with intestinal inflammation has been advocated. It has been postulated that an inflamed intestinal environment can play a role in the development of food allergies.[3] Sensitivity to food antigens has also been hypothesized in cases of inflammatory bowel disease.[4]

Vitamins and Minerals

Whether to supplement vitamins and minerals for hospitalized patients will depend on the disease and its severity. Short-term nutritional support should include sodium, chloride, potassium, phosphate, calcium, and magnesium. All patients receiving intravenous fluid therapy, with or without parenteral nutritional support, should have electrolyte levels monitored daily. Support for polydipsic/polyuric patients should include water-soluble vitamins.[5] Because zinc helps promote wound healing and plays a role in protein and nucleic acid metabolism, supplementation of nutritional support diets with zinc has been recommended.[6]

Carbohydrates

Dietary carbohydrate levels should be adequate for supplying the calories needed for recovery. Carbohydrates in any critical care diet need to be highly digestible. Because fiber decreases digestibility and binds nutrients, fiber quantities should be kept to a minimum. The crude fiber concentrations in commercial diets are generally very low: 3.0 to 6.9 g/1000 kcal in recovery diets and 1.2 g/1000 kcal in liquid diets.[7]

Fats

Patients receiving a critical care diet need higher quantities of fat because more calories can be obtained from fat than from carbohydrates. Inclusion of omega-3 fatty acids can help decrease an inflammatory response. Liquid diets will contain an average of 45% to 47% calories from fat and recovery diets an average of 55% to 68%.[7]

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DETERMINING SUPPORTIVE FEEDING METHOD

When assessing patients to determine the preferred method of critical care feeding, evaluate the patient's nutritional status. Look for low body condition score and/or muscle condition score (**wsava.org/global-guidelines/global-nutrition-guidelines**); poor hydration status, weight, and/or hair coat quality; signs of inadequate wound healing; hypoalbuminemia; lymphopenia; and coagulopathy.[8] Consider fluid shifts in these animals, which can severely affect hematologic values and body weight. Identify specific electrolyte imbalances, hyperglycemia, hypertriglyceridemia, or hyperammonemia, any of which will largely affect the nutritional critical care plan.[9]

Supportive feeding methods should be considered for patients with a history of >10% weight loss, decreased food intake, and/or anorexia; increased nutrient demands due to trauma or surgery; increased nutrient losses resulting from vomiting, diarrhea, burns or scalds; and acute exacerbation of chronic disease. Consider also whether specific areas of the alimentary canal need to be bypassed. The ideal diet for these patients should be digestible and have high energy density. A relatively high percentage of energy should be provided as protein and fat rather than carbohydrates. The percentage of total calories from digestible carbohydrates in liquid enteral diets is typically restricted to 21% to 25%.[7]

Critical care diets for cats and dogs are available in 3 consistencies: powdered, liquid, and moist. For liquid diets, the volume of administered at each bolus feeding in dogs and cats should not exceed 10 to 12 mL/kg (including tube flush volumes).[10] This volume is only an estimate, and each animal's requirements should be evaluated on an individual basis. Tolerance to liquid diets is best when small feedings are delivered frequently. Some animals will benefit from trickle feeding; a syringe driver (small infusion pump) can be used to provide constant-rate infusion of the diet. Moist diets can be thixotrophic; that is, that when mixed, their viscosity decreases, making them thinner.

Microenteral nutrition is the delivery of very small amounts of water, electrolytes, and easily absorbable nutrients directly into the gastrointestinal tract.

Encouraging Animals to Eat

The process of encouraging animals to eat should never be forgotten. Voluntary intake can sometimes be established by taking time to personally encourage the animal to eat. Encouragement can be attempted through grooming the patient (especially dogs and cats), removing any nasal discharge that is blocking their sense of small, offering "TLC," providing competition, hand feeding, offering a selection of different diets, and moving the patient to a different environment

Providing Microenteral Nutrition

Microenteral nutrition is the delivery of very small amounts of water, electrolytes, and easily absorbable nutrients directly into the gastrointestinal tract. Although often underused in veterinary practices, this method helps meet the nutritional requirements of the intestinal mucosa, which helps to preserve the intestinal blood flow, the mucosal barrier, and its immune function.[11] Initial volumes of 0.25 to 0.5 mL/kg/hour are recommended[12] and will add exceptionally little to the volume of fluids normally produced by the stomach. Volume can be gradually increased to 1 to 2 mL/kg/hour over 24 to 48 hours. Enteral solutions that can be used include oral rehydrating solutions and those containing glutamine. Microenteral nutrition can be administered orally or via feeding tubes.

CHOOSING A FEEDING TUBE

If tube feeding is determined to be the best way to provide nutrition, the next step is choosing the best type of tube.

FIGURE 1. Cat with nasoesophageal feeding tube. RVNs can place these tubes to facilitate short-term feeding.

FIGURE 2. Cat with esophagostomy feeding tube protruding from stoma. These openings should be inspected at each feeding.

Nasoesophageal/Nasogastric Tubes

Nasoesophageal/nasogastric tubes (**FIGURE 1**) are generally well tolerated by cats and dogs and are suitable for short-term nutritional support, usually 3 to 7 days, although longer periods have been documented. Contraindications for their use include unconsciousness; vomiting; and disease or dysfunction of the pharynx, larynx, nares, swallowing reflex, esophagus, and/or stomach. Whether the tube should terminate in the caudal esophagus or the stomach is under debate; no direct evidence supports termination in either location.

After the tube has been placed, slow injection of a small amount of water into the tube will indicate correct placement; induction of a cough reflex would indicate incorrect placement in the trachea. Lateral radiographs can also indicate correct placement, as can attaching a capnograph to the tube. Before feeding, additional administration of a small amount of water will help confirm that the tube is still positioned correctly.

Tubes can become blocked because the tube bore is narrow. Blockages can sometimes be removed by administration of small amounts of carbonated drinks, cranberry juice, or solutions of pancreatic enzymes. The chance of blockage can be minimized by administering 5 to 10 mL of water through the tube after feeding the liquid diet.

Esophagostomy Tubes

Esophagostomy tubes (**FIGURES 2-4**) enter the esophagus through a surgical incision on the side of the neck, bypassing the nose and mouth. They are commonly used in cats who have experienced facial trauma. They can be used in patients who do not tolerate nasoesophageal tubes well. Esophagostomy tubes must be placed aseptically, with the patient under general anesthesia. Tubes must be cleaned and inspected frequently, under aseptic conditions. Complications can include infection, airway obstruction, and damage to the cervical nerves and blood vessels.

Percutaneous Endoscopic Gastrostomy Tubes

Percutaneous endoscopic gastrostomy (PEG) tubes are placed through the abdominal wall and into the stomach. They must be placed with the patient under general anesthesia and must remain in place for at least 5 days (to allow for healing at the stoma site before the tube can be pulled). PEG tubes are used for long-term nutritional support and/or for patients with esophageal problems (e.g., megaesophagus). Adhesions between the gastric serosa and the peritoneum can form within 48 to 72 hours, or longer in malnourished patients. Feeding through a PEG tube can commence 4 hours after its insertion. On the day of placement, administer only one third of the calculated daily energy required; on day 2, two thirds; and by day 3, the full amount. If feedings or volume are not well tolerated, smaller meals can be administered more frequently. For some patients, using a syringe driver to maintain a trickle

FIGURE 3. Esophagostomy feeding tube in tortoise. These tubes are an excellent option for supportive feeding of a wide variety of species.

FIGURE 4. Cat wearing tube collar to protect esophagostomy feeding tube. A variety of tube collars, which enable regular checking of the stoma, are commercially available.

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feed can be advantageous. If patients are unable to take fluids orally, mouth care should be performed at least every 4 hours. Mouth care involves ensuring that the mucous membranes remain moist and free of bacterial infections (i.e., by flushing or swabbing with chlorohexidine-based oral hygiene products designed for dental care).

MAINTAINING AND REMOVING A FEEDING TUBE

The use of assisted feeding methods has great advantages, but care of the feeding tube is vital. The artificial opening into the gastrointestinal tract through which the tube (esophagostomy, gastrostomy) is inserted is referred to as a stoma (**FIGURE 2**). The stoma must be treated as a surgical wound and cleaned daily with normal saline or cooled boiled water for the first 7 to 14 days or until it is healed. Dressings around tubes are not necessary unless indicated (e.g., if the stoma site is infected or if the animal is interfering with the site). Before administering any diet, always ensure that the tube is still situated within the gastrointestinal tract. This can be achieved by slow administration of water into the tube, assessing for any coughing or sneezing. Radiography can also aid in assessing location of the tube but is not practical for use at every feeding. A capnograph can be used to detect CO_2 in the tube, a potential problem especially with nasoesophageal feeding tubes. Detection of a trace of CO_2, similar to that of an anesthetized patient, indicates that the tube has moved into the trachea.

To remove a gastrostomy tube from a patient weighing over 10 kg, pull it taut and then cut it off flush with the skin. The tip will be passed in the feces. If kept clean, the resulting gastrocutaneous fistula will heal rapidly. For smaller patients, the tube tip should be retrieved via endoscopy to avoid the potential of it obstructing the narrower digestive tract of the small animal.

SUMMARY

Use of feeding tubes to deliver nutrition (calories and nutrients) is a valuable part of the nutritional assessment. Consider the calories needed, the composition of the nutrients within the diet, the diet to be used, the form in which the diet is to be delivered, and whether the animal is able to consume, digest, and absorb the diet.

KEY POINTS

- To ensure that adequate nutrition is being achieved, always perform a nutritional assessment on every patient at every visit.
- Remember that RERs calculate only the number of calories to be fed; they do not consider nutrients.
- Always consider assisted tube feeding as an option for providing nutrition. **TVN**

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