

HEALING STRATEGY.

Nutrients are the essential building blocks for helping heal wounds in animals. Develop a plan that ensures patients get adequate nutrition.

NUTRITION NOTES

Nutrition and Wound Healing

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This article is from **NAVC's 2019 VMX Conference Proceedings**.

Assurance of adequate patient nutrition is, perhaps, one of the most underappreciated facets of wound healing. Healing requires the body to have sufficient energy stores, in the form of fats and carbohydrates, to rebuild tissue. Without these resources, the body begins to break down endogenous protein in an attempt to meet its needs for the “building blocks” of healing. Nutritional support is therefore critical for animals with healing wounds, and a strategy to provide adequate nutrients should be created for every wound patient.

Protein also helps with the prevention of edema. Glucose provides energy to leukocytes and fibroblasts, which are critical components in collagen formation and wound strength.

KEY NUTRIENTS FOR WOUND HEALING

Animals with wounds are in a catabolic state, and without appropriate nutritional intake, they are often in a negative nitrogen balance. This state can contribute to slower wound healing times or even failure to heal.

Protein and glucose are key nutrients for healing. A plasma protein level of less than or equal to 6.0 g/dL (normal, 7.0 to 7.5 g/dL) is associated with slower healing, and levels less than 5.5 g/dL increase the risk of failure to heal by 70%.^{1,3} Protein also helps with the prevention of edema. Glucose provides energy to leukocytes and fibroblasts, which are critical components in collagen formation and wound strength. Therefore, inadequate dietary intake of these 2 nutrients not only delays healing but also contributes to ineffective development of the wound bed and wound strength.

CALCULATING NUTRITIONAL NEEDS

The goals of nutritional support are to maintain the patient's body weight and avoid overfeeding.

BOX 1 Factors in Choosing Feeding Tubes

- Patient status and ability to tolerate sedation and anesthesia
- Available tubes and diets
- Staff technical skill in tube placement
- Expected duration of tube feeding
- Owner comfort and motivation in performing tube feeding

Calculating energy requirements is a good place to begin. Quite simply, a patient should be fed enough to meet daily metabolic needs. For a hospitalized patient, this amount is estimated as the resting energy requirement (RER), calculated as:

$$\text{RER} = 70(\text{body weight in kilograms})^{0.75}$$

For wound patients with a normal protein tolerance, protein intake should start at 4 to 6 g of protein per 100 kcal (15% to 25% of total energy) for dogs and 6 g of protein per 100 kcal (25% to 35% of total energy) for cats. In animals with overwhelming wounds (e.g., burn wounds, degloving injuries), this amount may need to be adjusted to meet increased protein needs.¹

After tube placement, feedings of previously anorexic patients should begin with 25% to 50% of the patient's RER and increased to full RER over the following 2 to 4 days.

"Illness factors" based on the degree of critical illness/injury are no longer used to estimate greater nutritional needs. Therefore, rather than guess at individual patient needs by using general formulas for patients with differing degrees of wound compromise, it is best to begin with the RER and then assess the patient's response and adjust the calories delivered accordingly.

If the patient eats voluntarily, it is possible to calculate a "food dosage." Regular reassessment (based on objective and subjective parameters such as those for assisted feeding, below) is necessary to ensure that nutritional needs continue to be met.

OPTIONS FOR ASSISTED FEEDING

When voluntary intake falls short of meeting nutritional needs, enteral feeding is preferred, as feeding through the gastrointestinal (GI) tract helps maintain intestinal health. A feeding tube should be considered, especially if the patient is being sedated or anesthetized for wound treatment. Nasoesophageal and nasogastric tubes can often be placed easily with local anesthetic or light sedation. Esophagostomy tubes require general anesthesia but may be tolerated better.

Feeding patients as far proximal as possible in the GI tract is recommended, as is being proactive about feeding tube placement, especially if the animal shows any reluctance to eat in the first 2 to 3 days after injury or wound treatment.

Monitoring parameters in these patients should include physical examination findings, body weight (obtained at least every 12 hours), GI signs, blood work (packed cell volume/total protein, glucose, electrolytes), tube placement/stoma site assessment, and hydration status.

FEEDING TUBES

Options for feeding tubes in wound patients include nasoesophageal, nasogastric, esophagostomy, gastrotomy, and jejunostomy tubes. All types are well tolerated by patients. The decision of which to place is based on the factors in **BOX 1**.

After tube placement, feedings of previously anorexic patients should begin with 25% to 50% of the patient's RER and increased to full RER over the following 2 to 4 days. If the animal was eating up until the time of trauma or hospitalization, more aggressive feedings are often possible.

Nasoesophageal and Nasogastric

Nasoesophageal and nasogastric feeding tubes are easy to place using a local anesthetic in the nares (ophthalmic proparacaine hydrochloride) or light systemic sedation. Patients with upper respiratory issues, facial trauma, or coagulopathy and patients that



are unable to protect their airway are not candidates for this feeding method.

A small-bore (3.5- to 8-Fr) silicone, polyurethane, or red rubber tube is most commonly used and is placed through the nares into the distal third of the esophagus (nasoesophageal) or stomach (nasogastric). It is critical to measure and mark the tube before insertion and document its final location radiographically at the time of placement. An Elizabethan collar should be placed to discourage inadvertent patient removal. Patients may dislodge the tube by vomiting or sneezing.

This feeding tube option is best suited for short-term use (maximum of 7 to 10 days) and, because of the small tube diameter, a liquid diet is the only reasonable diet that can be used.

Esophagostomy

Esophagostomy tubes require general anesthesia and greater technical skill for placement but are well tolerated by patients. Their placement is well described in the literature,³ and assistance should be sought from someone confident in the procedure.

These tubes are larger (12 to 22 Fr) and include silicone, polyurethane, or red rubber tubes. They most frequently enter at the level of the left proximal to midcervical area and terminate in the distal esophagus. Radiographs (orthogonal views) should be taken to document final tube placement. Although a stoma is created, if the tube is removed immediately after placement, the area can be expected to heal without incident. Local cellulitis or infection at the entrance site is possible, so covering the tube with a light wrap is recommended. If the patient is prone to scratching at the tube entry site, an Elizabethan collar should be used.

A more substantial diet (such as liquefied canned food) can be used with these tubes and is a good option if longer use is anticipated. Animals will eat while the tube is in place, so placing it before needing to use it is not typically problematic.

Gastrostomy

A gastrostomy tube is a good long-term option in animals that are not candidates for the feeding tubes described above. Gastrostomy tubes are typically larger, mushroom-tipped tubes that can be placed

percutaneously or through endoscopic or surgical procedures, which can be more technically challenging. Although well tolerated, gastrostomy tubes must be left in place for at least 2 weeks before removal. These tubes can leak and cause irritation or peritonitis.

Jejunostomy

Jejunostomy tubes are not typically necessary for nutrition in wound patients; however, when feeding distal to the duodenum is necessary, they are an option. The tubes used are usually smaller (<8 Fr) and are technically challenging to place appropriately.

Because of the small tube diameter, constant rate infusion of a liquid diet is often required to meet nutritional needs. The disadvantages of these tubes include peritonitis, irritation, or infection at the stoma site and clogging of the tube.

PARENTERAL NUTRITION

When oral or enteral feeding is not an option, parenteral (intravenous) nutrition can be considered. Feeding using the GI tract is usually not a problem in wound patients, but severely compromised patients may benefit from parenteral nutrition. **TVP**

References

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2. Swaim SF, Krahwinkel DJ. Wound management. *Vet Clin North Am Small Anim Pract* 2006;36(4):713-737.
3. Johnston SA, Tobias KM. Chapter 98. *Veterinary Surgery: Small Animal*. Vol 2. St. Louis, MO: Elsevier; 2018:1901-1917.

Suggested Reading

1. Pavletic MM. *Atlas of Small Animal Wound Management and Reconstructive Surgery*. 3rd ed. Ames, IA: Wiley-Blackwell; 2010.



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