Nutrition is an integral part of veterinary critical care medicine. A majority of critically ill patients are anorexic for prolonged periods of times resulting in catabolic states. Prolonged anorexia can lead to atrophy of the gut mucosa in as little as 24 - 48 hours. In these patients who are unwilling or unable to eat voluntarily, feeding tube placement may be necessary to provide enteral nutritional support. There are a number of different feeding tubes that can be placed including nasoesophageal tubes, nasogastric tubes, esophageal feeding tubes, percutaneous gastrostomy (PEG) tubes and surgically placed gastrostomy or jejunostomy tubes. The goal of enteral nutritional support is to provide adequate caloric and nutritional intake via the gastrointestinal tract to decrease catabolism and maintain mucosal integrity.

Feeding tube selection is based upon clinician comfort level, the patient’s underlying disease process, comorbidities, the desired diet to be fed, estimated amount of time the tube will be in place, whether the tube is to be utilized in the hospital or at home and owner comfort level. Nasogastric and nasoesophageal feedings tubes are best utilized for in hospital patients and in this author’s opinion patients should not be discharged home with these tubes in place under most circumstances.

Nasogastric/ Nasoesophageal tubes
Nasogastric (NG) and nasoesophageal (NE) feedings tubes are short term feeding tubes (<14 days) that can be placed in awake or lightly sedated patients. Red rubber catheters or commercially available feeding tubes may be used. The commercially available feeding tubes can be purchased with and without an internal guide wire. Placement into the distal esophagus or gastric lumen is based on clinician preference. Historically nasogastric feeding tubes were avoided due to the concern for gastric reflux but human studies have shown no difference in gastric reflux with NG tubes. NG tubes offer the benefit of being able to aspirate gastric contents and measure residual volumes in those patients with ileus or gastric distension.

To place either an NG or NE tube 1-2 drops of a topical anesthetic (ie. 0.5% proparacaine) should be placed into the nares. NG/NE tubes come in a variety of sizes ranging from 3.5F to 14F. The size of feeding tube varies based on their nasal confirmation. Most cats and small dogs will receive a NG/NE feeding tube between 3.5 - 6F. Tube length should then be measured. For NE tubes the distance from the nares to 8th intercostal space should be measured; for NG tubes
the distance is measured from the nares to the last rib. The tubes can then be marked with a permanent marker if no markings are present on the tube. The tube is then lubricated with sterile lubricant and directed into the ventromedial aspect of the nares (“ventral and central”). Mild resistance may be noted as the catheter is advanced through the nares. If severe resistance is encountered, stop placement and remove the tube. On further attempts, the other nares or a smaller tube should be utilized. As the tube is navigating through the pharynx the patient may swallow. The tube is then advanced to the desired distance. Once the tube is placed the guidewire (if present) should be removed and the tube is gently aspirated. If continuous air is obtained without gastric contents, the patient is coughing or respiratory distress is noted the tube should be removed as you are likely in the trachea or bronchus. Negative pressure will likely occur with NE tubes. The presence of gastric ingesta confirms placement in the stomach. The tube is then secured to the nares using a finger trap suture and the side of the side using a simple interrupted suture. Radiographs must be taken to confirm proper placement of the tube. The radiographs should include the pharyngeal region to ensure proper tube placement within the esophagus. An e-collar should then be placed on the patient to prevent the pet from dislodging the tube.

NG and NE tubes should not be placed in patients with known coagulopathies, those with respiratory distress, with facial trauma or those with impaired ability to protect their airways (ie. dogs with laryngeal paralysis). Patients receiving nutrition via NG/NE tubes are usually limited to a liquid diet given the diameter of the feeding tubes. These tubes can also cause local irritation including epistaxis, rhinitis and sinusitis and can be dislodged secondary to sneezing, vomiting or regurgitation. Other possible complications of NG/NE tube placement include clogging of the tube, esophageal irritation or inadvertent placement into the airways.

**Esophagostomy tubes**

Esophageal feeding tubes (esophagostomy tube - E-tube) are larger bore tubes that are placed into the proximal esophagus through the mid-cervical region, terminating in the distal esophagus. E-tubes offer several advantages over NG/GE tubes in that they can be left in patients for weeks to months. They also allow a blended diet to be administered and appear to be well tolerated by veterinary patients. Furthermore, these tubes can be used in patients with facial trauma or oral disease. E-tubes however require patients to be placed under general anesthesia for placement and can result in local infection/cellulitis at the insertion site. Other possible complications of E-tube placement include patient dislodgement, esophageal irritation, jugular vein/ carotid artery injury, infection at the surgical site, displacement secondary to regurgitation/vomiting and clogging of the tube. Contraindications for E-tube placement include esophageal motility disorders, esophageal stricture, laryngeal dysfunction and coagulopathies.

A red rubber catheter can be used as an esophagostomy tube or commercially available esophagostomy tubes can be purchased. Most cats will tolerate a 10 - 14 French tube while dogs can tolerate up to a 20 French tube depending on their size. For E-tube placement the patient
must be placed under general anesthesia and intubated. The patient should be placed in right lateral recumbency and the left lateral aspect of the cervical region (from the ramus of the mandible to the thoracic inlet) is shaved and aseptically prepared. The tube is measured from the insertion site over the mid cervical region to the 7 - 8th intercostal space. The distal portion of the red rubber catheter can be cut at a slight angle to help prevent clogging. The proximal aspect of the tube is then marked with a permanent marker where it will exit the skin. Curved forceps (typically Carmalts) are inserted into the mouth and down the esophagus to the mid cervical region. The carmalts are then turned laterally and slightly opened. The carmalt opening can then be palpated externally and a scalpel is used to make a stab incision over the opening. The jugular should be identified prior to your stab incision and avoided. The carmalts are then directed through the skin. The distal end of the catheter is then grasped by the carmalts and pulled through the opening and out the mouth. The distal aspect of the tube is then turned in the mouth and pushed with your finger into the proximal esophagus until it flips. The tube is then gently pushed caudally until the marker of the tube is at the level of the skin opening. The tube is then secured with a purse string and finger-trap at the level of the skin incision. A lateral thoracic radiograph should be taken to confirm proper placement. A light bandage should also be placed over the cervical region to help stabilize the tube and cover the insertion site.

Once the patient has recovered from general anesthesia the E-tube can be immediately used. The E-tube insertion site should be viewed daily to look for any signs of infection including redness, swelling, discoloration, discharge or odor. The client should also be instructed to monitor the tube for any movement. The bandage should be changed at least once weekly or commercially available E-tubes collars can be purchased. Patients can also readily eat with this tube in place and the tube can be removed at any time.

**Gastrostomy Tubes**

Gastrostomy tubes (G-tubes) can also be placed in veterinary patients. Placement of these tubes requires more technical skill and a longer period of general anesthesia. These tubes are typically placed either percutaneously via endoscopic guidance (called a PEG tube) or via surgical placement. Surgically placed gastrostomy tubes offer the advantage of having the surgeon pexy the stomach to the abdominal wall but require laparotomy. G-tubes are useful in patients with esophageal disease but feeding must be delayed for 24 hours after placement to allow for a fibrin seal to form around the stoma. A blenderized diet can also be fed with G-tubes and like E-tubes these can be used for long term nutritional maintenance. These tubes must remain in place for at least 2 weeks prior to removal. This is to allow the stomach to adhere to the body wall and prevent leakage of stomach contents into the abdomen. Complications associated with G-tube placement include secondary peritonitis due to leakage of gastric contents or premature tube removal, damage to abdominal viscera during percutaneous placement, cellulitis/infection at the stoma site, pressure necrosis at the stoma site and inadvertent tube removal.

How to feed your patient
Diet choice and the volume of diet provided initially varies based on a number of factors including age, days of anorexia, underlying disease and activity level. Most hospitalized patients will be fed based on their resting energy requirements (RER), which is the amount of calories needed to maintain homeostasis in a thermoneutral environment at rest. RER can be calculated using the equation: $70(BW_{kg})^{0.75}$. Ideal body weight used be utilized in obese patients. It is important to note that pediatrics and those with certain diseases such as sepsis, head trauma, seizures or burns may require higher caloric intake. The goal is to maintain a patient’s body weight (once hydrated) while in the hospital. Most patients will begin being fed approximately $\frac{1}{4} - \frac{1}{3}$ RER at day 1 and their caloric intake will be increased over 2-4 days until 100% RER is provided. Overfeeding should be avoided as it can cause severe metabolic and GI complications.

Water should always be administered through the tube prior to feeding. If any coughing, retching or vomiting is noted the feeding should be stopped and the attending clinician alerted. Food should always be warmed to room temperature prior to administration and given slowly over 10-20 minutes depending on the volume administered. Do not microwave or otherwise heat the food as this can lead to burns of the esophageal or gastric mucosa. The tubes should then be flushed with 5 - 20 ml of lukewarm water after feeding to prevent clogging.

The remainder of the talk will focus on clinical discussions of patients requiring feeding tube placement and supplemental nutrition.