Esophagostomy Tube Placement

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Introduction

- One of several options for patients requiring long term nutritional support.
- Replaced pharyngostomy tubes which are associated with more complications.
- Indicated in patients that cannot maintain weight or body condition and are unable or unwilling to consume food orally.
  - Mandibular or maxillary fractures or oral neoplasia.
  - CNS disease.
  - Renal failure and hepatic disease.
  - Esophageal and gastric decompression.

Introduction

- Contraindications.
  - Esophageal disorders (esophagitis, stricture, megaesophagus, esophageal surgery patients).
  - Exception: for esophageal decompression in megaesophagus patients with persistent regurgitation in spite of gastrostomy tube feeding.

Tubes

- 12 to 19 French for cats.
- 12 to 24 French for dogs.
- Global feline esophagostomy, red rubber, Argyle.
- Large tube diameters allow for administration of blended canned or liquid diets.
- The distal rounded end may be removed to facilitate food administration and decrease risk of food impaction in the tube.
- Esophagostomy tubes may be used for weeks to months or longer.

Technique

- Anesthetize and intubate.
- Right lateral recumbency.
- Clip and surgically prepare lateral cervical area.
- Premeasure tube to the seventh or eighth intercostal space so the tube terminates in the distal thoracic esophagus.
- Insertion into the stomach increases the risk of gastroesophageal reflux, esophagitis and esophageal stricture formation.

Technique

- Reference: Symposium On Placing Feeding Tubes. Vet Med, July 2004;99(7):587.
- Video will be available on the web site at www.vshsd.com.

Tube Use

- Blended canned diets or liquid diets.
- Tube can be used on the first day.
- Warm food and administer over 10 to 15 minutes followed by 10 ml flush leaving a column of water in the tube.
- Maintaining the tube.
  - Clean the exit site daily with antiseptic solution or soapy water.
  - Covering the tube.
- Monitor patients weight and blood work as indicated base on the condition.

Calculating Nutritional Requirements

- Resting energy requirement (RER) +/- a multiple.
  - RER (kcal/day): $30(BW_{kg}) + 70$ or $70(kgBW_{kg}^{0.75})$.
  - In some sick animals RER was shown to be 30-60% higher than RER in healthy animals.
  - i.e. for 5 kg cat RER is 220 kcal/day.

Determining the Amount to Feed

- Calculate the caloric density of the food.
  - i.e. Hill's k/d 5 ½ oz can 200 kcal/can, 5 ½ oz/can x 30 ml/oz = 165 ml/can, 165 ml/can divided by 200 kcal/can = 0.83 kcal/ml.
  - RER of 220 kcal/day divided by 0.83 kcal/ml = 265 ml/day.

Initiating Feeding

- Feed one-third of daily calories on Day 1, two-thirds on Day 2, and full caloric intake on Day 3.
- Divide caloric intake into 3 to 4 feedings per day.
- i.e. 265 ml/day = 30 ml for 3 meals Day 1, 60 ml for 3 meals Day 2, and 90 ml for 3 meals Day 3.
- GI prokinetic drug (metoclopramide or cisapride) 30 minutes prior to each meal when initiating feeding.

Tube Removal

- Slow transition from tube to oral feeding.
  - When appetite returns reduce amount and/or frequency fed via the tube and monitor weight.
- When voluntarily eating well for several days the tube can be removed.
- Cut finger-trap friction suture and slowly withdraw the tube.
- Skin is allowed to heal by second intention.

Complications

- Uncommon but include:
  - Premature removal of the tube.
  - Vomiting.
  - Infection at the exit site.
  - Reflux esophagitis and esophageal stricture formation.
  - Paroxysmal coughing or upper airway obstruction with manipulation.
  - Hemorrhage.
  - Mediastinitis and pneumomediastinum.

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VETERINARY SPECIALTY HOSPITAL

DIAGNOSTIC CONSIDERATIONS IN VETERINARY ONCOLOGY
CONTINUING EDUCATION SERIES
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What is the starting point for diagnosing cancer in pets?

Primary Site Evaluation

Cytology or Biopsy

If a nodule or mass is identified, fine needle aspiration cytology is recommended for easily accessible sites such as the skin, or a small biopsy may be obtained if a sedative is necessary to sample less accessible sites such as the oral cavity or the ear canal. If needle aspiration cytology is non-diagnostic and a dermal nodule is still suspected to be malignant, then a small incisional biopsy (for masses > 1.5 cm, or masses of any size in locations of the body that will represent challenging malignant tumor removal such as on a limb), is then recommended to achieve a diagnosis.

It is NOT generally recommended to "just take out the mass and see what it is" (with the exception of the circumstances** noted below), because if a malignant cancer is diagnosed, then a second surgery is frequently necessary to obtain adequate margins. The chance for surgical cure may then be compromised because the margins of normal tissue around the tumor have been disrupted and contaminated by the first surgery when common mass removal surgical practices are utilized. Finally, the patient may have suffered unnecessary surgical morbidity for removal of benign mass.

Excisional biopsy** is reasonable for very small nodules that are suspected to be benign and for which cytology was non-diagnostic, but if this route is chosen, then a very conservative surgery with no surgical margins should be performed. This is because no normal tissue surgical margin is necessary to cure benign neoplasms, but if the tumor is ultimately identified to be malignant, then, as noted above, a second surgery will be recommended and a very conservative first surgery will not have disrupted normal tissue margins and will have spared skin to allow for better outcome for the definitive surgery. Clients should be forewarned of the possible need for this second surgery before this technique is utilized.

One instance when excisional** "biopsy" with wide margins is reasonable is when the clinician strongly suspects a malignant neoplasm but cannot confirm this with cytology, AND feels he or she has the surgical skills necessary to achieve the surgical margin required to surgically cure a malignant neoplasm (or at least can perform the best surgery that anyone could perform in that site; even cancers excised by ACVS surgeons sometimes require adjuvant radiation therapy). This surgery should be performed with surgical margins one would obtain if the mass had been confirmed as malignant pre-operatively. The peril of this approach is that clients may become upset if a very large surgery is performed for a tumor that was ultimately determined to be benign.

Therefore, careful pre-surgical client communication is indicated in these situations. Finally, if an excisional biopsy is performed on a case that may require radiation therapy after surgery, **pre**-surgical consultation with Dr. Burke (ACVR, Radiation Oncology) is recommended.

Blood and Urine Specimens
Cancer may be diagnosed or suspected on routine CBC, biochemical profile and urinalysis if leukemia, hyperglobulinemia, or hypercalcemia are present on the blood panel, or dysplastic epithelial cells are noted in the urinalysis.

In human oncology, there are blood tests that search for tumor related antigens that may identify very early cancer such as the PSA (Prostate Specific Antigen) test for prostate cancer. Unfortunately, with the exception of leukemia, at this time there is not a commercially-available blood test that will specifically identify cancer in our companion animals. The urine bladder tumor antigen test (BTA) IS commercially available but is non-specific in that any disease that causes proteinuria/hematuria can cause a false positive result. This test may be useful for monitoring for early recurrence following resection of a bladder tumor, but this application has not been yet reported in the literature.

Radiography and Ultrasonography
Radiography and ultrasonography are commonly used tools when pursuing a cancer diagnosis. Pulmonary or mediastinal masses, lymphadenopathy, or pleural effusion are cancer-related findings identifiable by thoracic radiography. Diffuse hepatic and splenic disease, intestinal thickening or masses, enlarged lymph nodes, abdominal effusion, or masses in any organ can be cancer-related findings that are identifiable using abdominal ultrasound in a more sensitive manner than is possible with abdominal radiography. Ultrasound-guided sampling of these abnormal tissues is a non-invasive method of diagnosing the cause of these abnormalities.

In one report, when ultrasound-guided needle biopsies were performed by experienced individuals on dogs and cats with a variety of intra-abdominal diseases, minor complications were observed in 13 of 233 biopsies and major complications in 3 of 233 biopsies. 218 patients had needle biopsies correlated with subsequent exploratory surgery or necropsy. 15 patients had normal needle biopsies and no further confirmatory diagnostics were performed. No complications were reported in 70 patients following ultrasound-guided fine needle aspirates; 84.3% of FNA correlated with the ultimate diagnosis. In another report, 91% (n=56) of ultrasound-guided fine needle aspirates correlated with confirmed disease processes (majority were neoplastic).

How do we determine the extent of the cancer once a neoplastic process is identified?

Staging
Determination of the extent of a cancer process within the patient's body is called staging. Because the prognosis for several cancers (oral melanoma, mammary carcinoma, thyroid carcinoma, pulmonary carcinoma) has been linked to the size of the primary tumor, the simple act of staging the primary tumor by obtaining a measurement of a primary tumor site can provide important prognostic determination.

Primary Tumor Staging

Determination of localized extent of tumor cannot always be identified by examination or radiography alone. CT and MRI are of **much** greater value than radiography and even ultrasonography for local staging of, and therapeutic planning for oral, intra-nasal, intra-thoracic, intra-abdominal, and subcutaneous soft tissue neoplasms. For example, in one study, 17/26 subcutaneous neoplasms were determined to be more locally extensive following CT evaluation than physical examination or radiography had identified.

Lymph node evaluation
Regional lymph nodes are often the first site in which metastasis will be identified. Regional nodes may be internal (sternal for a tumor on the thoracic dermis or sublumbar for an anal sac tumor), therefore the clinician must remember to perform the appropriate evaluation to identify the status of the associated regional node. Because studies have shown that lymph node metastasis can be identified cytologically even when nodes are normal in size, it is recommended that the draining lymph node for a primary tumor site be aspirated, if can be safely done, even if it is normal in size.

Thoracic Imaging
Once a cancer process is diagnosed, thoracic radiographs are then obtained to identify lung nodules, pleural effusion and intrathoracic lymph node enlargement which may represent sites of metastasis. At VSH we also have the ability to easily utilize an in-house spiral CT-scan of the lung field that may identify approximately 10% more pulmonary lesions than plain thoracic radiographs.

Clinicians at VSH will often perform a CT-evaluation of the thorax to screen for metastasis if they are already using a CT scan to evaluate the tumor margins in the primary tumor location, because of the increased sensitivity and the rapidity of this test using our state-of-the-art machine (expense for "second-body site" CT is comparable to a 3 view thoracic radiograph or abdominal ultrasound). Thoracic CT is also useful if a pulmonary lesion is suspected on a thoracic radiograph but cannot be confirmed on the typical 3 view radiograph series. However, due to expense and requirement of general anesthesia for most patients, we do not perform a CT scan of the thoracic cavity for every patient with cancer before they undergo therapy.

Abdominal Imaging
Ultrasonography is far superior to abdominal radiography for identifying intra-parenchymal mass lesions or enlarged abdominal lymph nodes that may represent metastatic cancer sites. I also recommend abdominal ultrasonography as a general health screening tool for aging patients that are scheduled to be treated with an extensive procedure such as amputation or maxillectomy, a surgical procedure that requires skin grafting, chemotherapy, or radiation therapy. Abdominal CT is occasionally utilized for even more detailed pre-surgical imaging of abdominal masses as this diagnostic will provide the best information regarding vascularity and tissue/vascular invasion.

Laparoscopy and Thoracoscopy
These techniques are utilized as non-invasive methods of biopsy of tissues that are not safely accessible by ultrasound-guidance (such as cardiac or lung masses) or to non-invasively obtain larger specimens for more accurate diagnosis (such as liver biopsies) than can be obtained by smaller biopsy samples. The thoracoscopic pericardial window procedure is both therapeutic and diagnostic as one can visualize and biopsy cardiac masses if present. These techniques are used to diagnose both primary and secondary sites of cancer and several clinicians at VSH have extensive experience with these techniques.

Nuclear scintigraphy
This service is available at VSH and, as a cancer evaluation method, is utilized most often for thyroid neoplasms and osseous metastatic sites. Dogs w/ non-functional thyroid tumors (the most common type) may have ^{99m}Tc-pertechnetate uptake. However, there appears to be questionable utility for use of this method for identification of pulmonary metastatic disease as compared to thoracic radiography. There is correlation between distribution of technetium uptake and capsular invasion, and this technique is useful in identifying ectopic sites of neoplasia which may be valuable for surgical planning.

Nuclear scintigraphic bone scans are sensitive but not specific methods for identification of osseous metastatic sites. In a summary of several reports of this method for detection of metastatic bone sites in dogs with appendicular osteosarcoma, between 1/70 and 14/25 patients had positive bone scans. In the latter study, 7/14 of the bone lesions were confirmed histologically as osteosarcoma. Regions of osteoarthritis and osteomyelitis are also expected to be positive on these scans. A bone scan is offered for all canine osteosarcoma patients pre-amputation and is recommended for all patients for which osseous metastatic neoplasia (carcinoma, osteosarcoma) is suspected.

Polymerase chain reaction (PCR)
PCR is currently being utilized to identify clonal expansion of neoplastic lymphocytes and plasma cells in dogs and cats. This method is useful for differentiation between antigen-stimulated (reactive) and neoplastic populations of lymphocytes. It may also be useful for identification of systemic foci for lymphoid neoplasms.

Unfortunately, there is occasional clonal, but non-neoplastic, lymphocyte expansion in patients infected with certain infectious organisms such as *Ehrlichia* spp. In addition, only 50% sensitivity is reported in cats. PCR technology may be used in the future for detection of minimal residual disease (identification of metastatic cells or residual local neoplastic cells) with markedly improved sensitivity compared to traditional screening methods (imaging, cytology, histology).

PCR can be performed on blood samples with lymphocytosis, bone marrow aspiration material, aspirates and biopsies of lymph nodes, mediastinal mass aspirates and biopsies, and splenic aspirates. It is recommended to obtain PCR specimens at the time of sampling for routine cytology and biopsy in the event that an ambivalent diagnosis of "lymphoid neoplasia *vs*. reactive lymphocytes" is made, to avoid the necessity of re-sampling sites with difficult access.

Another future potential use of PCR will be to differentiate metastatic cells from normal resident cells in regional nodes, blood, or distant organs for neoplasms such as mast cell tumors. For example, if a specific genetic mutation is determined to be present only in neoplastic mast cells *vs*. normal mast cells, current staging techniques would have vastly improved specificity, as well as sensitivity for neoplastic cell detection.

Summary
The level of diagnostic sophistication that we have available for our veterinary oncology patients is ever-increasing. These tools will continue to improve our ability to treat our patients more effectively and to make the best treatment choices for our patients and their families as they treat cancer in their special companions.

Surgical Treatment Options for Tracheal Collapse: Rings or Stents

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Tracheal Collapse

- Pathophysiology
- Diagnosis
- Medical treatment
- Surgical treatment
- External prosthesis
- Internal stenting

Pathophysiology

- Intrinsic weakness of tracheal cartilage
- ↓ GAGs, chondroitin sulfate, calcium
- Transformation to fibrocartilage
- Rings flatten and dorsal membrane sags into lumen
- Congenital origin?
  - Signs can occur < 6 months of age
- Initiating factors
  - Cardiac disease, obesity, allergies, trauma, smoking
- Other airway disorders (infxn, palate, bronchitis)

Diagnosis

- Middle-aged (average 6 years)
- Small breed
- Yorkie, Poodle, Pomeranian
- Cough, gag, retch, wheeze, respiratory distress
- Worse with excitement, heat, exercise
- Cough on palpation, flattened rings, stridor/wheeze
- Associated conditions
  - Other upper airway disease
  - Obese, dental disease, heart murmur

- Radiography
  - Diagnostic in 59% to 84% of cases
  - Esophagus or other soft tissue obstructing view
  - Phase of inspiration/expiration
  - Evaluate for concurrent disease
- Fluoroscopy
  - Demonstrate dynamic changes
  - Evaluate location and extent of the collapse
  - Extrathoracic
  - Intrathoracic
  - Mainstem bronchi
  - No need for general anesthesia

- Bronchoscopy
  - Flexible or rigid scope
  - General anesthesia
  - Supply oxygen
    - Through biopsy port
    - Tracheal catheter
  - Allows for assessment of
    - Grade
    - Location
    - Inflammation
    - Concurrent abnormalities
  - Allows for collection of airway samples
    - Culture
    - Cytology

Medical Treatment

- If dyspneic, give oxygen and sedation:
- Acepromazine (0.02 to 0.05 mg/kg IV) with
- Butorphanol (0.2 mg/kg IV)
- Oxygen cage?? (very careful)
- Check temperature/cool as necessary
- Avoid intubation if at all possible
- Only consider surgery in dyspneic patients if unable to stabilize in hospital
- Reduce initiating factors
  - Weight loss
  - Control hypothyroidism, Cushing's, diabetes
  - Treat cardiopulmonary disease
  - Remove allergens/smoke
  - Remove collars
  - Treat dental disease
  - Avoid stressful situations
    - **Including visits to the veterinarian**

- Treat infection
  - 65% of dogs with tracheal collapse have + culture *Pseudomonas, Enterobacter, Bordetella, Mycoplasma*
  - Consider cytology plus culture results
  - Antibiotics
    - Clavamox
    - Doxycycline or Chloramphenicol for mycoplasma
    - Azithromycin
    - If pneumonia: ampicillin or Unasyn plus fluoroquinolone or aminoglycoside
- Control cough
  - Butorphanol, hydrocodone
  - Avoid with pneumonia
  - Reduce volume of mucus
  - Bronchodilators for airways<2 mm
  - Antihistamine
- Control inflammation
  - Oral prednisone (***short course***)
  - Inhaled glucocorticoids
    - Improvement within 24 hours of treatment, maximum benefit may take 1 to 2 weeks
    - Flovent (fluticasone)
    - Pulmicort (budesonide)

100 dogs with chronic cough/tracheal collapse
Treatment protocol
Prednisone taper, Lomotil, control initiating factors
Status at one year = 71% resolution of signs

Journal of Small Animal Practice (1994) 35, 191-196

Surgical Treatment

Indications
Grade II to IV tracheal collapse
Failure of medical management
Severe clinical signs
Early in disease course?
Better outcome < 6 years of age
Extraluminal prosthesis vs Intraluminal stent
Pre-surgical considerations
Potential for collapse at other locations in future after surgery
Coughing associated with pulmonary or cardiac disease will not improve with tracheal surgery alone
If there is also collapse of mainstem bronchi, surgery may not significantly alter the clinical condition

Extraluminal Prosthesis

C-shaped rings
Polypropylene syringe case
Polyvinyl chloride drip chamber of IV set

Location
Cervical trachea to 2nd or 3rd intercostal space
Thyroid arteries and recurrent laryngeal nerves dissected off trachea only in area of ring placement
Suture ring to cartilage and dorsal membrane
Leave suture ends long as stay sutures to manipulate trachea
Radiographs +/- laryngeal exam after surgery
Continue medical management
Coughing may continue for 8 weeks until mucosa covers suture

Potential complications
Pneumothorax during anesthesia
Cough
Laryngeal paralysis
Tracheal necrosis
Suture tearing/failure of prostheses
Infection

Results
90 dogs with grade II to IV collapse
30 month median follow-up
84% owners reported dogs normal or improved
Immediate post-op complications
Cough (24%), dyspnea (15%), laryngeal paralysis (11%)
5 died (3 permanent tracheostomy, 2 laryngeal paralysis)
Long term complications
Cough (56%) > 1 month
Dogs $\geq$ 6 years more complications

JAVMA (1996) 208, 380-384

Intraluminal Stents

- Metal expandable
- Palmaz, Wallstent, Ultraflex
- Indicated for collapse at thoracic inlet/intrathoracic
- May also be used for cervical collapse
- Advantages
  - Placement is rapid and non-invasive
  - Laryngeal paralysis not a post op complication
  - Rapid relief of clinical signs/well tolerated

- Palmaz (Johnson & Johnson)
  - Ballon expandable, slotted stainless steel tube
  - Veterinary literature
    - Cervical stents collapsed
    - 5/19 migrated
    - Cough, dyspnea, positive bacterial culture

- Wallstent (Boston Scientific)
  - Self expandable, woven cobalt/chrome alloy
  - Recent retrospective of 24 dogs
    - 95.8% initial improvement
    - 8.3% died due to incorrect placement or size
    - Severe granuloma formation in 5
    - 30% asymptomatic and 60% markedly improved at long term follow-up

- Ultraflex (Boston Scientific)
  - Self-expandable, single-strand, woven nitinol, titanium alloy
  - Case reports
    - Caudal migration X 2 followed by suture then cranial migration followed by additional stent X 2
    - 10 month follow-up no medication, no coughing
      Gellasch KL, et al. JAVMA 221:1719,2002
    - Stent fracture successfully treated with resection/anastomosis with rings
      Mittleman E, et al. JAVMA 225:1217,2004
- Stent Size
  - Too small = migration
  - Too big = pressure necrosis, granulation, fistula
  - Tracheal diameter is not uniform
  - Radiography with neck extended, maximum inflation 20 cm H20
  - Maximum diameter (D) + 2 to 5 mm
  - Length of collapse (L) + 1 to 2 cm

- Complications
  - Coughing
  - Stent migration
  - Severe granulation tissue
  - Stent collapse/deformation/fracture
  - Infection

- Veterinary Stents
  - Infiniti medical

Conclusion

- Medical treatment first unless severely collapsed and unable to stabilize without surgery
- Medical treatment for mainstem bronchi collapse
- Surgery unlikely to help

External prosthesis for cervical collapse
I Intraluminal stent for intrathoracic collapse

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