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# Endoscopy- A practical Approach Mini Series

## Session 2: Airway and upper GI endoscopy

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**Tracheobronchoscopy**
'Tracheobronchoscopy', usually referred to as  bronchoscopy' is the endoscopic examination of the trachea and bronchi. Frequently, the procedure may involve bronchoalveolar lavage to obtain diagnostic samples.

Occasionally, cytology samples may be collected during bronchoscopy using a bronchial cytology brush. Mainly due to the risk of bleeding or airway perforation, endoscopic grab biopsies are seldom taken at bronchoscopy.

**Indications** for bronchoscopy include:

- Investigation of chronic cough
- Focal pulmonary changes on diagnostic imaging
- Diffuse pulmonary changes on diagnostic imaging
- Airway sampling to test for infectious causes To assess for and retrieve an respiratory tract foreign body

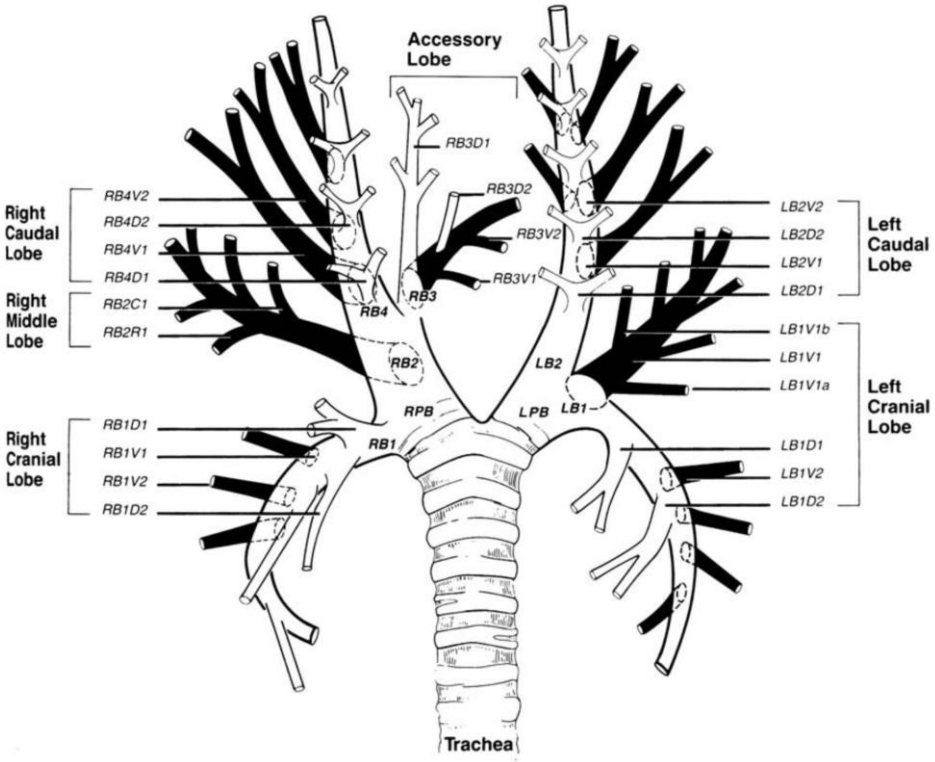
**Contraindications** for bronchoscopy include:

- Suspected bleeding disorders (e.g. rodenticide intoxication, other secondary coagulation disorder) Significant thrombocytopenia
- High anaesthesia risk for patient (e.g. acute dyspnoeic cat)

**Bronchoscopy equipment required:**

- Flexible bronchoscope - The diameter will dictate the size of patients you can examine. A videoendoscope with a diameter of 4 to 6mm will suit most patients, but the narrower scopes tend to be shorter - often less than 60cm, which limits their use in large dogs.A biopsy channel of at least 2mm diameter is preferred, to accommodate suction catheters or grab forceps.
- Most smaller endoscopes, including bronchoscopes, can be deflected in only one plane; steering in other directions is facilitated by torquing the scope (rotating it along its long axis).
- Endoscopy tower with light source, monitor, image processor, air pump
- Suction device
- 'Elbow' connector for anaesthetic circuit
- Mouth gag in case procedure performed after extubation
- BAL sampling catheter
- Syringes containing 0.9% saline for BAL
- Materials for TIVA (total intravenous anaesthesia) if might be required
- Endoscopy reporting form including bronchial tree schematic diagram

Bronchoscopic anatomy of the dog. (From Amis TC, McKiernan BC. Systematic identification of endobronchial anatomy during bronchoscopy in the dog. Am J Vet Res 1986;47(12):2655;




**Bronchoscopy set-up**

It is crucial to plan a bronchoscope procedure ahead of time, so that time under anaesthesia is minimised. It is not acceptable to prolong a procedure while searching for equipment or materials that could have been prepared beforehand.

What other equipment might be necessary? Endotracheal tube or a laryngeal mask?

Might a difficult airway kit be required (selection of tube sizes, local anaesthetic spray, flexible introducer, laryngoscope, dog urinary catheter with ET tube adaptor fitting)?

Tracheostomy kit? Soft tissue surgeon?

Biopsy materials?

Bacterial charcoal transport swabs?

Plain swabs (for PCR/virology)?

Camera?

Drugs?

Consider whether you might perform bronchoalveolar lavage or if you anticipate a foreign body. If a foreign body is expected, do you have various endoscopic forceps to attempt retrieval?

If you will be attempting to retrieve a foreign body, do you have a chest drain available in case of pneumothorax?

Consider beforehand whether the patient will be intubated or whether the ET tube is too small to pass the bronchoscope.

A pre-procedure checklist is advisable, to ensure that nothing is forgotten or not considered.

**TIVA or inhaled anaesthesia?**

TIVA (total intravenous anaesthesia) can be used in patients for which the bronchoscope is too large to fit through the endotracheal tube.

| TIVA | Inhaled |
|---|---|
| Additional training often required | Most technicians familiar |
| Allows rapid increase to plane of anaesthesia | Inhaled agents exhaled, little metabolised, so plane of anaesthesia easily adjusted |
| ET tube can be removed | ET tube or mask essential |
| Personnel not as risk of exposure to inhaled anaesthesia | Risk of exposure of personnel to volatile halogenated CFCs |
| Recovery times may be prolonged if TIVA used for extended period | Usually more rapid recovery |
| Expensive for large dogs | Cheaper |

**Endotracheal intubation**

Prior to the procedure consider:
- do you need to inspect the proximal trachea?
- could there be a foreign body in the trachea?
- do you need to examine laryngeal function?
- will the bronchoscope fit through the endotracheal tube and still allow for adequate airflow?

**Poiseuille's Law** defines the resistance to flow in a tube**:**
where R is the resistance to flow

η is the viscosity of the 'fluid' within the tube
L is the length of the tube
r is the radius of the tube

π is the constant 'pi'

$$R = \frac{8\eta L}{\pi r^4}$$

This means that resistance is directly proportional to length - the longer the tube; the greater the resistance.
Resistance is inversely proportional to the radius to the power 4 - this means that reducing radius in half increases resistance 16 fold. So, just because you *can* fit a bronchoscope down the endotracheal tube doesn't mean that you *should*!
Discuss with your anaesthetist before deciding whether the patient should be intubated or not. Other options for oxygenation include jet ventilation using a separate catheter (e.g. dog urinary catheter) in trachea or via an endoscopic catheter passed down biopsy channel. The disadvantage of using a catheter down the endoscope channel is that only the cannulated airway is being ventilated.
Other means of oxygenation include flow-by oxygen or a nasal oxygen cannula.

**Indications for laryngoscopy**

- Stridor
- Change in phonation

- Inspiratory dyspnoea
- Exercise intolerance

**Laryngoscopy procedure**
Laryngoscopy can be done with a flexible endoscope which allows recording of images and video loops, as well as affording lower airway examination.
Alternatively, a conventional laryngoscope can be used, as long as the blade is sufficiently long, though this does not allow for recording of the images.

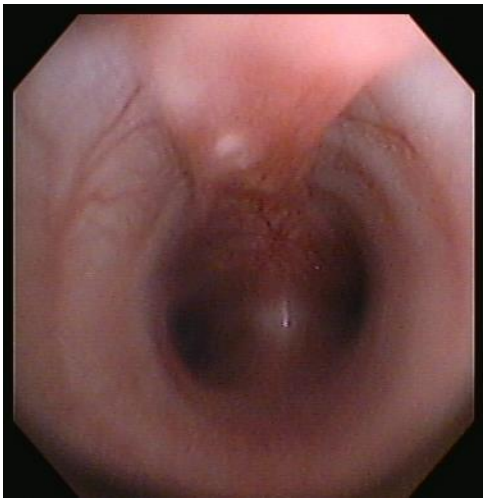
To allow a representative assessment of the larynx and its function requires:
- sufficient sedation or anaesthesia for safe open-mouthed restraint
- suppression of the gag reflex
- avoidance of depression of laryngeal function

Usually, induction of a light plane of anaesthesia with propofol or alfaxalone is preferred, without any premedication. The larynx should be inspected for symmetry, mucosal colour,
structure, swelling or masses.
While an assistant watches the patient's chest movements and calls out inspiration and expiration, the clinical should observe the larynx for motion. It is best to record the procedure for later reference.
If you suspect that the plane of anaesthesia is affecting laryngeal movement (i.e. bilaterally depressed laryngeal motion), consider doxapram (2mg/kg IV) to stimulate laryngeal motion, but discuss this with your anaesthetist first.

**Bronchoscopic method**
Position the patient in sternal recumbency, with sandbags to allow the neck to be straightened.
Lubricate the bronchoscope with a small amount sterile lubricating jelly if passing through the ET tube.
Start recording the bronchoscopy
Observe the larynx and its movement (if not intubated). It is often easier to directly visualise the larynx to pass the scope through, rather than looking through the scope - a laryngoscope is useful for this.
As soon as you enter the tracheal lumen, orientate the scope so that the dorsal tracheal ligament is dorsal on the image. The normal trachea should have smooth, pink mucosa with no mucus present. The impression of the cartilage tracheal rings is seen and these should be smooth and regular. Blood vessels may be seen in the normal trachea. The dorsal tracheal ligament should not impinge significantly on the tracheal lumen.

Bronchial divisions should appear sharp. No bronchial collapse should be seen.

Normal canine trachea
and tracheal bifurcation

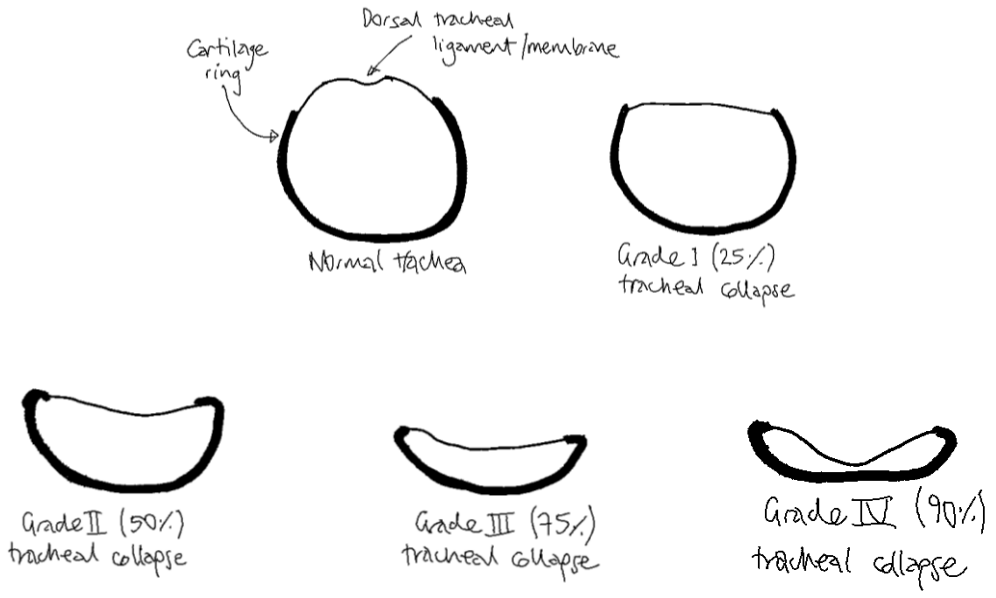


Ensure you methodically examine all areas - work methodically using the bronchial tree diagram if necessary.

**Bronchodilator pre-treatment**
Particularly in cats, but in any patient in which bronchoconstriction is anticipated to be a problem, administration of terbutaline by intramuscular injection 20 minutes before the procedure should be considered.

**Tracheal collapse**
Tracheal collapse is a dynamic disease, mostly affecting small breed or toy breed dogs. Progressive weakening of the tracheal rings occurs due to reduced glycosaminoglycan content. It also affects the cartilage in the mainstem bronchi and some larger bronchioles. The weakness of the supporting cartilage allows dynamic flattening under negative pressure during inspiration or expiration. The region of the airway that collapses depends upon the phase of respiration: extrathoracic collapse usually occurs on inspiration and intrathoracic on expiration.

There are numerous methods for diagnosis of tracheal collapse. Evidently, all methods require that the patient does not have an endotracheal tube placed. Thoracic radiographs may miss the phasic collapse, but are straightforward and inexpensive. Fluoroscopy is good for watching in real-time in the conscious patient in a normal (standing) position. CT can be performed at various phases of respiration and gives a three-dimensional appreciation of the shape of the tracheal rings, as well as allowing better assessment for bronchial collapse. Tracheoscopy allows good dynamic assessment and grading of tracheal collapse, but not measurement.




It is important to note that measurement for tracheal stenting requires a careful standardised technique - radiographs need to be taken under GA to allow exposures to be taken at full inspiration and expiration. Radiographs underestimate tracheal diameter compared to CT scans.

When patients are anaesthetised for assessment of tracheal collapse, this allows concurrent additional assessment and bronchoalveolar lavage to identify concurrent or complicating problems such as secondary infections that may exacerbate clinical signs.

**Tracheal hypoplasia**
Tracheal hypoplasia is a congenital anomaly which can be concurrent with BOAS. It is a static condition - not dynamic like tracheal collapse. Male English Bulldogs are predominantly affected. The tracheal lumen is limited and the shape of the tracheal cartilages may appear malformed.

**Tracheal foreign bodies**

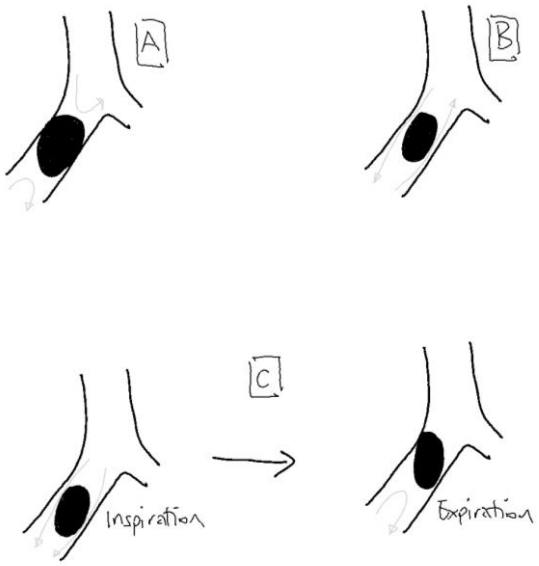
Tracheal foreign bodies may present with acute onset dyspnoea or coughing. This is usually an inspiratory dyspnoea with a slow inspiratory phase, but the pattern of dyspnoea and respiratory pattern may vary if the foreign body creates a valve effect.

If a foreign body is inhaled deeper into one of the airways, the presentation may be more chronic as the patient may not be hypoxic. A common example of this is that dogs with grass awn bronchial foreign bodies frequently present with a chronic cough that has been partially responsive to antibiotics, following an initial acute onset.

If a tracheal foreign body is suspected, great care must be taken not to push it further down airway by intubating the trachea. Do not intubate before inspecting!

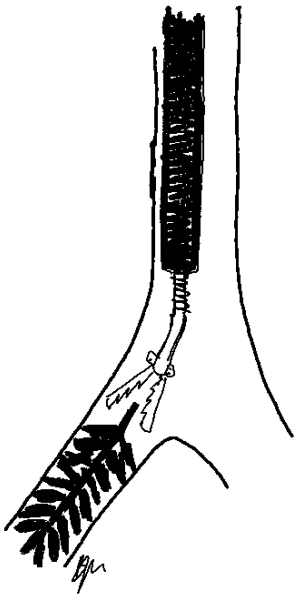
Pre-procedure thoracic radiographs may allow identification of a foreign body, allowing some planning of how to remove it before anaesthetising.

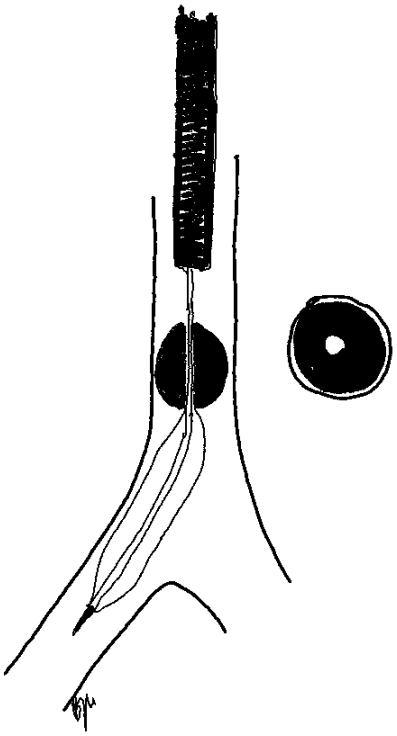
**Techniques for tracheal / bronchial FB removal**

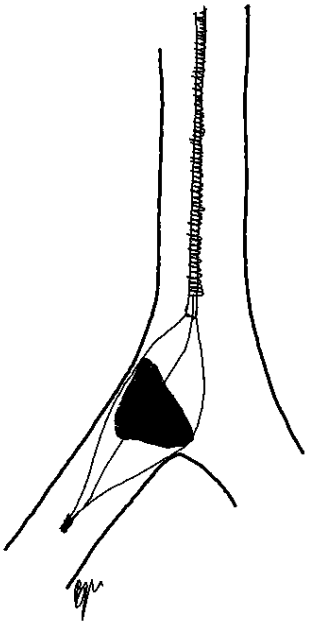



In small patients with acute dyspnoea and a suspected tracheal FB, a non-endoscopic attempt may be made at removal, but suspending the patient upside-down and shaking gently. Bear in mind that if the foreign body moves, it may cause complete obstruction which would require immediate anaesthesia and retrieval. Various forceps and other devices can be used for endoscopic retrieval of foreign bodies, including:

- Grasping forceps (e.g. 'Ratigator')
- Basket forceps (urolith type)
- Balloon catheter







Before removing a tracheobronchial foreign body, consider what lies beyond it: More foreign material? Pus? Perforation? Always ensure to examine the airway after removing the foreign body.

Grass awn bronchial foreign body with pus

Always have suction available to clear pus and blood, as well as to retrieve diagnostic samples (BAL). Do not, however, apply excessive suction: Guidelines from the American Association for Respiratory Care (AARC) for 'safe suctioning' suggest restricting suction pressure to less than −20 kPa (−150 mmHg) and apply suction for no more than 15 seconds at a time.

**Bronchoalveolar lavage (BAL)**
BAL indications include:

- chronic cough or chronic lower airway dyspnoea
- chronic hypoxia
- radiographic interstitial or alveolar changes
- haemoptysis without bleeding disorder

Contraindications to BAL include:

- bleeding disorder
- unstable for anaesthesia
- unstable dyspnoea
- unstable suspected feline bronchial disease
- severe hypoxia

**BAL equipment:**

- Bronchoscope
- 3 syringes containing sterile saline - at body temperature

*5mL aliquots for cats*
*5 - 10mL aliquots for cats & small dogs*
*10 - 20mL aliquots for medium to large dogs*

- Suction catheter
- Christmas tree connector with male Luer-lock fitting
- Suction machine (preferable)
- 1.8mm suction catheter
- mucus trap
- suction tubing

**BAL technique**
Sample on right and left sides, as well as any focal abnormal area - preferably identify the region to be sampled on CT images; alternatively select the abnormal area on bronchoscopy.

Gently wedge the bronchoscope as far down as possible, with the aim of occluding the lumen.
Then deploy the BAL catheter through the biopsy channel as far distal in that bronchus as possible.
Avoid excessive force as this may cause perforation and pneumothorax.
Attach the saline syringe to catheter and push the whole volume, followed by air to empty the catheter.
Gently coupage the relevant area.
Detach the syringe and attach suction.
Gently move the catheter to suction fluid; avoid suctioning against bronchial wall.
The sample will collect in the suction trap - around 25 - 50% of the aliquot should be retrieved; the remainder will be absorbed by the lung.

The same procedure can be done using a large syringe for suction, but this does not allow continuous suction as the syringe rapidly fills with air. A randomised controlled study did, however, demonstrate no difference in cytologic diagnostic value for syringe suctioned samples compared to those obtained using a suction trap and suction unit, but the volumes retrieved were lower with the syringe method.

**Blind 'BAL'**
In small patients, the passage of the bronchoscope is limited by the small size of the bronchi. In some cases, it is simpler to perform a blind 'BAL' by passing a dog urinary catheter through the trachea or endotracheal tube, until it cannot be passed further. This technique, combined with a suction trap and suction unit often yields the highest sample volumes in cats in my experience.
This is only appropriate in diffuse disease, as the catheter tip cannot be guided.

**BAL sample submission:**

Other bronchoscopic samples include cytology brushing, using a guarded endoscopic cytology brush. After retrieving the sample, first roll it onto a glass slide for cytology, then rinse the brush in a small volume of saline to retrieve more cells for 'Cytospin' examination.

**Upper gastrointestinal endoscopy**

Indications for upper gastrointestinal endoscopy:

- chronic diarrhoea
- chronic vomiting
- unexplained weight loss
- ongoing acute haematemesis
- suspected GI ulceration
- FB retrieval
- Repeated retching
- Unexplained ongoing regurgitation
- Placement of PEG tube
- Checking O-tube placement

Contraindications for upper GI endoscopy:

- Near-perforating ulcer suspected on ultrasound
- Systemic bleeding disorder
- High anaesthetic risk
- Incomplete routine GI work-up in chronic cases (e.g. no faecal analysis in chronic diarrhoea patients)

| Test | Samples to submit | |
|---|---|---|
| **Cytology** | Air-dried smear;<br>sample in EDTA;<br>sample in EDTA + 1 drop formalin | |
| **Bacterial culture (+/- fungal culture)** | Two charcoal swabs dipped in BAL sample<br>+/- mucus in sterile pot | |
| **PCR** | Plain fluid sample in sterile pot | Cats: Viral + *Mycoplasma (resp)*<br>Dogs: Viral + *Mycoplasma* + *Angiostrongylus vasorum* |

Advantages of upper GI endoscopy, compared to biopsies at laparotomy

| | **Endoscopy** | **Laparotomy** |
|---|---|---|
| **Invasiveness** | Less invasive | More invasive |
| **Biopsy quality** | More superficial - can miss lesions deeper than mucosa/submucosa | Full thickness - more likely representative |
| **Area assessed** | Can only access proximal and distal small intestine - much of SI unreachable | Can assess full GI tract |
| **Therapeutic?** | Minimal therapeutic interventions possible | Allows excision of lesions |
| **Recovery time** | Rapid recovery; additional analgesia seldom required | Requires rest and time for healing; analgesia required |
| **Risk** | Minimal risk of perforation | Significant risk of biopsy site dehiscence |
| **Experience level** | Requires experience to cannulate pylorus every time | Less experience required to obtain diagnostic samples |

**Pre-endoscopy work-up for chronic GI signs** should include:

- Clinical and dietary history
- Blood tests - CBC, biochemistry, TLI, B12, folate +/- SpecPL / DGGR lipase
- +/- basal cortisol assay if appropriate (lack of stress leukogram OR reduced Na:K ratio)
- Abdominal ultrasound scan
- Lateral thoracic radiograph to rule out regurgitation if history unclear
- Faecal analysis, including parasitology
- +/- exclusion diet trial for chronic diarrhoea or vomiting with normal abdominal US findings

**Pre-endoscopy preparation - upper GI**
The patient should be fasted for at least 12 hours - preferably longer.
In case of gastro-oesophageal reflux during the procedure, omeprazole should be considered - starting the day before the procedure.
Water is withheld water within the hour before endoscopy, to prevent an excessive volume of fluid that then has to be suctioned out at the start of the procedure.

Upper GI endoscopy equipment:

- Gastroscope - for cats & small dogs a 7-8mm diameter videoendoscope of 1.4 to 1.6m length is suitable. For large dogs a 10 - 12mm scope of 1.8m is suitable.
- Endoscopy tower including screen, processor, light-source, air pump
- Water bottle & connector for flushing scope channel

- Suction unit
- Biopsy forceps - 1.8mm cup forceps - single-use disposable forceps are relatively inexpensive and ensures that your instrument is sharp and effective
- Formalin pots
- Histology cassettes and sponges
- PPE - gloves, apron +/- goggles and mask
- Mouth gag - either a proprietary gag, or one made from a section of suction tubing.

**NEVER perform endoscopy without a mouth gag in patient** - the scope can be seriously damaged if bitten.

**Prior to endoscopy**
Before anaesthetising the patient ensure:

- that the endoscopy computer and software is functioning
- that the endoscope is functional & communicating with the software
- that the water jet, air flush and suction are all working
- that the patient is registered on the endoscopy software program

**Anaesthesia for upper GI endoscopy**

Premedication with an opioid such as methadone (full μ-agonist) or butorphanol, combined with an alpha-2 agonist (medetomidine, or dexmedetemidine) is suitable for most patients. Patients are then maintained on volatile inhaled agent and oxygen. If the procedure is particularly prolonged, the alpha-2 agonist may wear off, resulting in a rapid reduction of depth of anaesthesia.

**Patient positioning**

Upper GI endoscopy should always start in left lateral recumbency, which means that the pylorus is on the non-dependent side: This means that the pylorus will most likely contain gas and can therefore be seen (otherwise gastric fluid would pool in the pylorus, obscuring it).

Very occasionally it might be helpful to change the patient to dorsal recumbency if it is difficult to pass through the pylorus.

**Upper gastrointestinal endoscopy procedure**

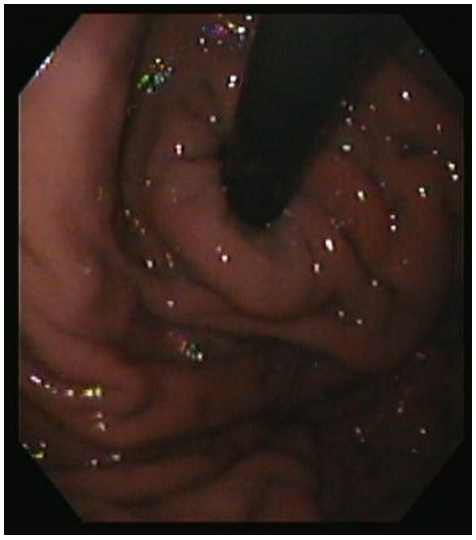
Don PPE.
Place the mouth gag in the patient.
Lubricate scope from tip to handpiece using sterile lube sachets.
Start recording the procedure.

If an assistant is available they should insert the endoscope into the patient's mouth while the operator takes the handpiece of the scope in their non-dominant hand and operates the deflection controls with their dominant hand to orientate the scope tip.
The operator applies gentle insufflation with air (placing the tip of their index finger over the hole in the blue button) to open the field of view.
The normal oesophagus appears homogenous, smooth and pale pink with no visible blood vessels. It should have no contents at all - any fluid present should be suctioned out. If the oesophagus doesn't inflate well, an assistant can pinch the cervical oesophagus to occlude it gently.
The oesophagus has a slight kink at the thoracic inlet and as it drapes over the trachea, the impression of the latter is seen.
In the distal third of the feline oesophagus circumferential striations are a normal finding.

The lower oesophageal sphincter should appear homogenously pink and closed at approach.
No narrowing or stricture should be seen. Reddening, erythema, streaks or spots or haemorrhage are abnormal. An open lower oesophageal sphincter is abnormal and most commonly occurs due to oesophagitis, hiatal hernia, or less commonly neuromuscular disease.

Passing through the lower oesophageal sphincter takes minimal pressure and does not require any significant manipulation of the scope tip - simply keep the sphincter in the centre of the field of view, apply mild insufflation and push gently.
When the stomach is entered, mild insufflation opens up the view of the gastric rugae - these can be followed towards the pyloric antrum.
Full orientation in the stomach requires further insufflation with air. Before the pylorus is approached, retroflexion of the tip of the endoscope ('J-manoeuvre') allows examination of the cardia (the scope is seen entering at that point). The gastric mucosa should appear smooth and homogeneously pink; the rugae should be smooth and should flatten out on full insufflation.
Overinflation should be avoided as by stretching the greater curvature it compresses the lesser curvature and makes the pylorus more difficult to approach.

After the J-manoeuvre, gradual release of the flexion brings the incisura angularis into view, below which lies the pyloric antrum.



Incisura angularis and pylorus

Before approaching the pylorus, suction is applied to reduce the degree of inflation, which brings the pylorus closer. The scope should be pushed towards the pylorus, keeping the pyloric sphincter in the centre of the image. If the pylorus appears to move further away, this is because the endoscope is forming an expanding loop in the stomach (one of the reasons we lubricate the scope to minimise this). There are two main solutions for this expanding scope loop problem:

Solution 1 - Pull the scope back until just inside stomach, suction out almost all of the air, then re-approach the pylorus with minimal insufflation.

Solution 2 - Pull the scope back until just inside stomach, suction out almost all of the air, then have an assistant apply gentle pressure caudal to the last rib to resist the expanding loop of the scope while you re-approach pylorus with minimal insufflation.

Occasionally a stable froth or foam in the stomach obscures the view of the mucosa, and the bubbles refract light from scope, which impedes complete examination. Using an endoscopic catheter (same as used for BAL) instil 'BIRP™' (dimethicone) (this is used to treat 'frothy bloat' in cattle). Approximately 5mL for a Labrador seems to be sufficient. After applying that, continue with duodenoscopy - by the time the scope is withdrawn back into the stomach, the froth will have dissipated.

Passage of the pylorus should be performed as part of a full upper GI endoscopy - it is extremely unusual to find a pylorus that cannot be intubated, though this may take some practice. If the duodenum is not examined, many diagnoses will be missed.

To pass through the pylorus, the pyloric sphincter is kept in the middle of the image. If the pylorus is closed, the operator may wait until it slightly relaxes, but this is not always necessary to intubate it. Keeping the scope the tip is placed on the pyloric sphincter and the scope is advanced progressively but not forcibly, while deflecting the scope tip down and to the right. Initial red-out is seen as the sphincter is passed, but gentle manoeuvre of the scope tip and mild insufflation should result in a clear view of the descending duodenum. The scope is gently advanced down the duodenum, keeping the scope tip central at all times. The duodenal papilla may be seen in dogs, and occasionally in cats.
The duodenum should have a fairly smooth appearance with just a slight granularity. The villi and villi motion may be seen with some scopes. Peyer's patches are normal in dogs, but not always apparent - they appear as oval depressions in the mucosa and should not be biopsied.
If 'red-out' occurs, the scope should not be advanced, but rather withdrawn slightly, insufflation applied and then re-steered to the central position. Normal duodenum
Though subjective assessment of the endoscopic appearance of the duodenum may suggest whether it is normal or abnormal, histologic detail is required to make most diagnoses. One pathognomonic appearance at endoscopy, however, is that of the dilated lacteals in lymphangiectasia. Biopsies are still required, however, to determine whether there is an underlying cause.

The endoscope is passed progressively down the duodenum, observing along the way. When passed to the fullest extent possible, biopsies are taken on the way back up, gradually withdrawing the scope by 3 - 5cm at a time. Biopsies should result in minimal bleeding in the normal duodenum. Aim for minimum of 6 biopsies, preferably more (up to 12) should be taken - it has been shown that inexperienced endoscopists need to take more biopsies to make a diagnosis.

For duodenal biopsies, a "turn and suction" biopsy technique is used:
1. Keeping the scope tip in the centre of the lumen, advance the biopsy forceps until the full jaw is seen beyond scope tip
2. Open the forceps
3. Retract the forceps gently to abut scope tip
4. Turn scope tip perpendicular to gut wall
5. Suction, advance forceps gently and close the forceps
6. Pull, unflex the scope
7. Keeping jaws closed, retract the forceps

**Handling biopsies**
A few methods:
1. Rinse biopsy off in formalin pot; then rinse forceps in saline
2. Rinse biopsy off in saline pot (transfer to formalin afterwards)
3.Orientate biopsy on moist foam in histology cassette

After obtaining duodenal biopsies, the scope is withdrawn into the stomach and gastric biopsies are taken. Gastric biopsies do not require the turn and suction technique but are simply taken with the forceps perpendicular to mucosa. The forceps are pulled slowly towards the scope to break submucosal attachments.

The oesophagus is difficult to biopsy and is only biopsied if neoplasia is suspected. If the oesophagus looks inflamed, it probably is inflamed.

Hiatal hernia may sometimes be seen during the J-manoeuvre at full insufflation - it appears as circular segment of cardia around the lower oesophageal sphincter doming away relative to the rest of the mucosa.

**Oesophageal foreign body removal**
Terrier breeds, particularly WHWT are over-represented amongst dogs with oesophageal foreign bodies. The foreign bodies are usually bone, rawhide or dog chew.
Approximately 50% are lodged caudal to heart base; 30% at heart base and 20% proximal.

Presenting signs include distress & retching after eating; regurgitation, not eating and inability to keep water down. Owners often describe the signs as 'vomiting', but this can simply be retching and regurgitation.
Due to highlighting by oesophageal gas, foreign bodies may often be seen on a lateral thoracic radiograph.

Options for oesophageal foreign body removal include oesophagoscopic retrieval or pushing to the stomach for removal at gastrostomy, or digestion.

Approximately 10% of oesophageal foreign bodies cannot be retrieved, or require surgery due to a tear. It is usually easiest to use a large rigid grab forceps alongside the endoscope, but care should be taken not to damage the scope with forceps teeth. Endoscopic grab instruments may not be strong enough to apply sufficient traction.

Negative prognostic factors for oesophageal foreign bodies include a longer duration (>24hrs); fish hooks could not be removed endoscopically in 25% of patients in one study. )

It is important to realise that there may be a rapid efflux of gastric/oesophageal contents when a foreign body is dislodged - have suction ready, to reduce the risk of aspiration.

'Buscopan' can be used to promote oesophageal relaxation if the foreign body is large or firmly lodged.
If there is any doubt about an oesophageal tear, or if there is any dyspnoea, thoracic radiographs should be taken after the procedure. Be ready for thoracotomy if a tear occurs.

**Capsule 'endoscopy'** does not replace conventional endoscopy - its does not give a histopathological diagnosis and does not allow biopsy collection. It can be useful for identifying sources of bleeding that cannot be seen on conventional endoscopy, however.
GI lesions were found in 100% of dogs with microcytosis in one study, that had not been explained by prior investigations.
The capsule needs to be recovered and submitted for retrieval of images. Due to the size of the capsule, it is contraindicated in dogs <4.3kg bodyweight.

**PEG tube placement**

Equipment:

- PEG tube kit
- Basic surgery kit
- Endoscopy grab forceps
- Gastroscope & tower
- Endoscopist
  (surgical) assistant

Patient preparation:
Left lateral recumbency
Clip & sterile prep the right side of abdomen (from penultimate rib)

**PEG tube placement:**
1. Introduce scope into stomach & inflate until few rugae evident
2. Select the PEG site, away from pylorus - the assistant presses with finger while the endoscopist watches the scope image, to agree on a suitable site
3. Assistant inserts needle from PEG kit at the agreed point - firmly
4. When needle seen in gastric lumen, pass wire loop from kit through the needle
5. Endoscopist grabs wire with endoscopic forceps
6. Keeping forceps grasping wire, the endoscopist pulls the endoscope + forceps + wire out of the patient's mouth
7. Release the wire from the forceps and loop the PEG tube (with suaged-on wire) through the wire loop
8. Pull the wire loop out through the needle in stomach wall
9. PEG tube follows through - pull until snug against the body wall
10. Reintroduce the endoscope to check that the PEG disc is not blanching mucosa
11. Lock PEG in place using cuff provided with PEG kit