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Head and Neck Surgery Mini Series

Session 2: Upper Airway Surgery

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Upper Airway Surgery

- Signalment
- Type of respiratory noise Stertor vs Stridor
- Posture
- Palpation of throat/ neck region
- Tongue/mucous membrane colour
- Thoracic auscultation

Stabilisation of a patient with upper respiratory

- Calm quiet environment
- Minimise handling
- Oxygen supplementation if tolerated
- Sedation low dose ACP 0.01-0.03mg/kg iv if possible +/- methadone
- Cool if hyperthermic
- If severe induce anaesthesia intubate or place temporary tracheostomy if cannot be intubated

Brachycephalic Obstructive Airway Syndrome (BOAS)

Brachycephalic Obstructive Airway Syndrome (BOAS) is an upper respiratory syndrome occurring in brachycephalic breeds. It results from the breeding for a shortened skull which results in a number of anatomical abnormalities. This syndrome results in a number of symptoms including snoring, panting, overheating, exercise intolerance, prolonged recovery from exercise, cyanosis, retching, gastrointestinal signs and disturbed sleep patterns. For many affected dogs this condition can have a significant effect on quality of life and can be life threatening.

The brachycephalic breeds have been bred with a shortened skull and muzzle. This conformation is associated with a number of anatomical abnormalities that cause increased resistance to inspiratory airflow. The classically described primary abnormalities are stenotic nares and over long soft palate. However the whole anatomy of the airway in these breeds predisposes to increased airway resistance. A number of other abnormalities are reported including hypoplastic trachea, main stem bronchus collapse, aberant conchane nasopharyngeal turbinates, enlarged tonsils, macroglossia, excessive periepiglottic folds, epiglottic cyst and, laryngeal granulomas. The role of these various abnormalities in the severity of symptoms in an individual is unknown.

As a result of these primary abnormalities there is resistance to inspiratory airflow which results in increased inspiratory effort and the generation of supraphysiological negative airway pressures. This in turn results in secondary changes causes oedema and stretching of the soft tissues of the airway and collapse of the cartilages of the larynx. There are three stages of laryngeal collapse described in dogs. Stage I is eversion of the laryngeal ventricles, which we identify in the majority of dogs presenting for surgery. In stage II the cuneiform processes collapse medially and in stage III the corniculate processes collapse. These secondary changes to the airway further reduce the glottic diameter and increase the degree of airway obstruction. The timing of onset of laryngeal collapse in the disease process is variable between individuals and breeds but has been reported in dogs as young as 4.5 months. The significance of the development of laryngeal collapse is not fully understood. Although it is considered to worsen prognosis this is not consistently seen and some dogs with laryngeal collapse will have good outcomes from surgery.

As well as respiratory symptoms there is a high incidence of gastrointestinal abnormalities with reported with BOAS. Gastrointestinal signs are reported in up to 97% of patients with some BOAS patients presenting with primarily GI symptoms. Reported abnormalities include oseophageal deviation, gastroseophageal reflux, hiatal hernia, gastric atony and slow gastric emptying. The gastrointestinal problems can results in a self perpetuating cycle where reflux, regurgitation and vomiting worsen pharyngeal and laryngeal odema. The airway distress then promotes further reflux. Surgical correction of respiratory problems can often improve GI symptoms.

Anaesthesia for BOAS Patient

BOAS patients are high risk anaesthesia patients with risk of rapid decompensation either prior to or during induction. They also have a high risk of gastroesophageal reflux and subsequent aspiration.

They following anaesthesia protocol is recommended to reduce risk

- Preoxygenate if tolerated
- IV catheter
- Low dose ACP premed 0.01mg/kg
- Rapid induction with propofol
- Intubate keeping head up
- Smaller than expected ET tubes readily available
- Preoperative proton pump inhibitor

Surgical Correction of BOAS

The standard procedures for surgical treatment of BOAS are correction of overlong soft palate, correction of stenotic nares and removal of everted laryngeal ventricles. Although techniques are

described to treat laryngeal collapse they generally have a low success rate and high morbidity so are not performed as a first line treatment even if the patient has concurrent laryngeal collapse. Described procedures include arytrnoid lateralisation, partial laryngectomy and permanent tracheostomy.

Technique for soft palate resection

- Patient is positioned with upper jaw hung from two drip stands. Lower jaw is taped to table pulling mouth open. Cuffed ET tube is in place.
- The palate is resected at the caudal border of the tonsillar crypt. It should just overlap epiglottis
- Care how far tongue and palate are retracted as changes anatomical relationships.
- Place stay suture either side of palate at extent of resection
- Pull palate forward with Allis tissue forceps
- Cut palate in stages with scissors
- Suture mucosal edges together with continuous suture. 2 metric Monocryl is preferred
- Tie off on far stay suture

Technique for removal of everted largngeal ventricles

- Need to extubate for this procedure and maintain anaesthesia with propofol
- Grasp the everted ventricle with Allis tissue forceps.
- Cut along base with scissors
- Repeat on opposite site and reintubate

Technique for correction of stenotic nares

- Patient is placed in sternal recumbancy with the head resting on sandbag
- Vertical and horizontal wedge techniques are described but vertical wedges are preferred
- Cut vertical wedge using No 11 blade. Ensure deep cut into cartilage
- Bleeding will be profuse but will stop once edges are sutured.
- Close with simple interrupted Vicryl sutures usually 1.5M

Recovery

Recovery from anaesthesia and surgery is a high risk time for BOAS patients. Risk can be reduced by a number of precautions

- Leave intubated as long as possible
- Monitor closely
- Hospitalise overnight
- Keep lightly sedated if agitated using ACP 0.01mg/kg up to q 6 hours
- Avoid opiates as causes panting
- No food until morning after surgery
- Some patients can struggle following surgery and require tracheostomy tube placement

Aftercare

- NSAIDs for 7 days
- Soft food only 14 days
- Short harness walks for 14 days
- Ensure dog does not rub nose
- Expect some increased retching initially post surgery

Complications

- Airway obstruction due to bleeding, odema, vomiting
- Respiratory decompensation following GA
- Aspiration pneumonia
- Nasopharyngeal reflux due to over shortening of palate
- Wound dehiscence of nares

Results following BOAS surgery

- 90% dogs improve following surgery.
- Owners should expect improvement not complete resolution of symptoms.
- 60% of patients show significant improvement

- 30% of patients show some improvement
- 10% of patients show no improvement
- 1-4% mortality rate
- No factor patient factor including laryngeal collapse has been shown to be predictive of outcome following BOAS surgery including laryngeal collapse
- The cavalier King Charles Spaniel (CKCS) is often considered a brachycephalic breed and present with typical brachycephalic airway signs such as respiratory noise, snoring, stertor and exercise intolerance. They are represented in reviews of dogs undergoing corrective airway surgery for BOAS and dogs requiring tracheostomies. However these dogs often do not demonstrate the typical abnormalities of the brachycephalic breeds. They often do not have an overlong palate as judged by standard criteria or stenotic nares or everted laryngeal ventricles. Some present with isolated laryngeal collapse and I have seen some dogs with concurrent laryngeal paralysis. As a breed they often have a particularly thick soft palate and small nasopharynx which may be the main factors driving the symptoms in this breed. Other breeds that can present with BOAS like symptoms but often without the typical abnormalities include the Bull terrier and Mastiff breeds. Like the CKCS these breeds often do not have a surgically correctable problem.

Laryngeal paralysis

Laryngeal paralysis is characterised by lack of abduction of arytenoid cartilages during inspiration. This is due to lesions of the recurrent laryngeal nerve affecting the cricoarytenoideus dorsalis muscle. Symptoms include change in bark, coughing and gagging often with eating/ drinking, inspiratory stridor, exercise intolerance and syncope. This is often a slowly progressive disease but can present as an acute crisis. Symptoms are often exacerbated by stress, increased ambient temperature and humidity.

Congenital and acquired forms of laryngeal paralysis are recognised. Congenital laryngeal paralysis is rare. It is reported in Bouvier de Flandres, Bull Terriers, Dalmations and Huskies. They majority of congenital cases present before 1 year of age and often have other neurological signs

The most common form is anaquired idiopathic neuropathy of the recurrent laryngeal nerve which is typically seen in middle aged and older medium and large breed dogs. The Labrador is the classic breed for this form. Average age of onset is 9 years. Affected dogs can develop dysphagia, megaoseophagus and hindlimb dysfunction over time as part of a wider polyneuropathy. Other rarer acquired causes include other polyneuropathies, cranial mediastinal neoplasia and cervical trauma, neoplasia or surgery.

Diagnosis is based on failure of adduction of the arytenoids on inspiration under a light plane of anaesthesia. Ensure the larynx is assessed under very light anaesthesia as movement is abolished

by deeper anaesthesia. Also be aware of paradoxical movement where the vocal folds move inwards on inspiration due to the paralysis. This movement can be mistaken for normal laryngeal movement. Movement should be correlated to the phase of respiration (inspiration or expiration). Additional work up includes basic blood work to assess general health as these are geriatric patients and thoracic radiographs. Radiographs are taken to assess for underlying neoplasia, aspiration pneumonia and other airway diseases.

Unilateral arytenoid lateralisation is the surgical treatment of choice with a high success rate. Other described techniques include bilateral arytenoid lateralisation, partial arytenoidectomy and castellated laryngo fissure. However these procedures have no advantages and have greater complication rates.

Technique arytenoid lateralisation

This surgery is difficult without a clear understanding of the anatomy of the larynx. Ideally practice on a cadaver or perform with a surgeon experienced in procedure first.

- Place in right lateral recumbancy if right handed surgeon
- Place sand bag under neck with forelimbs tied caudally
- Locate larynx by palpation and locate jugular vein and bifurcation
- Skin incision over larynx ventral to jugular vein.
- Continue dissection through subcutaenous fat and platysma muscle.
- Stay ventral to jugular and elevate jugular dorsally.
- Expose thyropharnygeus muscle.
- Palpate dorsal edge of thyroid cartilage.
- Cut thyropharyngeus muscle over the edge of thyroid cartilage.
- Break down fascial layer between thyroid cartilage and cricoid
- Cut cricothyroid articulation,
- Retract thyroid cartilage ventrally.
- Palpate muscular process and cut circoarytenoid dorsalis muscle attachment.
- Lift muscular process and open circoarytenoid articulation with scissors.
- Care with dorsal dissection can penetrate oseophagus.
- Lift muscular process so can see both sides of cricoaytenoid articulation.
- Palpate the caudal edge of the cricoid cartilage

- Place suture through caudal edge of cricoid cartilage. 3 metric Prolene for most medium breed dogs
- Elevate muscular process.
- Place suture through centre of articulation from medial to lateral. Either place a second circoarytenoid suture or a thyroarytenoid suture.
- Tie circo arytenoid suture. Care not to tension excessively
- Tie thyroartytenoid suture if placed
- Closure of thyropharyngeous with continuous suture
- Closure of subcutaneous and skin
- Check lateralisation after surgery with laryngoscope

Aftercare

- Keep calm and quiet
- Sedate if necessary
- NPO first 24 hours
- Feed meatballs of firm tinned food.
- NSAIDs 7-10 days
- Harness walk

Complications

Reported incidence 10-58%. Serious complications other than aspiration pneumonia should be less than 5%. Complications seen include

- Seroma formation
- Intra or postoperative fracture of muscular process
- Aspiration pneumonia
- Airway obstruction due to swelling/ haemorrhage
- Persistent coughing/retching

Aspiration pneumonia is a serious complication which can potentially be fatal. It is reported to occur in 18-28% of dogs following surgery. It can occur within hours to months after surgery. This is potentially life threatening and 23% patients do not survive. There is a higher risk if pre operative

swallowing problems are present. Risk can be reduced by avoid over lateralisation and by long term change to feeding.

Results

- 90% of dogs have significant improvement after surgery.
- 50% have no stridor after surgery
- 70% alive 1 year after surgery
- Negative prognostic indicators

    Pre operative pneumonia

    Dysphagia/ megaoesophagus

    Pre operative need for tracheostomy

Temporary Tracheostomy

Temporary tracheostomy tubes are regularly used in small animal practice. They are most commonly placed to by pass life threatening upper airway obstruction or where obstruction is anticipated after surgery. They are also placed to improve access to the oropharynyx and upper airway for certain surgeries or to aid long term mechanical ventilation. Management of BOAS patients pre and post surgery is one of the most common indications for tracheostomy tube placement.

Technique for temporary tracheostomy

- Midline cervical incision
- Separate sternohyoidius muscles to expose ventral trachea
- Horizontal incision between tracheal rings 3/4 or 4/5. Not more than 50% tracheal diameter. Other incision types have been described (vertical, vertical flaps and horizontal flaps) but show no definitive benefits in clinical practice.
- Long stay sutures placed around the tracheal rings above and below the incision to allow easy tube placement and exchange.
- Tracheostomy tube of appropriate size placed. Approximately 50% of tracheal diameter as a guide.
- Tube secured in place with umbilical tape.
- Soft tissues not closed around tube as predisposes to subcutaneous emphysema formation.

Tube types

There are a variety of tube types that can be used single lumen, double lumen, cuffed and uncuffed. Single lumen are easy to place but required complete removal when cleaning is required. Double lumen have an inner cannula that can be removed for easier cleaning however they are larger in

diameter due to the inner cannula and may be too large for some smaller patients. Cuffed tubes are only required if they will be used for maintaining anaesthesia or ventilation.

Recently the use of silicon stoma tubes for tracheostomy in dogs has been described and may offer some potential advantages over standard tubes.

Tube management

Tracheostomy tube placement is relatively simple but they require intensive management following surgery as serious and potentially life threatening complications are not uncommon. Twenty four hour observation is required as patient deterioration following tube obstruction or dislodgement can be rapid.

As the tracheostomy bypasses the upper airway inspired air is dry and cool. The tracheobronchial tree responds with increased mucus production which tends to result in tube blockage. This necessitates an intensive management schedule to avoid complications.

- Tube changing and cleaning. At least twice daily
- Tube suctioning. Preoxygenate before suctioning. Ensure shallow suctioning of tube and airway using a soft suction catheter. Not more than 10-15 seconds of uninterrupted suctioning to avoid hypoxia. Suctioning can stimulate a vagal reflex resulting in a severe bradycardia and ideally ECG monitoring is used during suctioning. Frequency as required but probably every 4-6 hours.
- Airway hydration. Consider nebulisation or direct instillation of sterile saline (0.2ml/kg) via tube every 4 hours. IVFT may also help maintain hydration
- Stoma cleaning.
- Gentle exercising and coupage to help mobilise airway secretion.

Tube removal

In veterinary medicine tube placement is usually for relatively short periods of hours to days. The decision to attempt removal is based on the likely time for resolution of the obstruction. The tube can either be obstructed for a period of time if small enough to allow air passage around it or removed. In either situation the patient is closely monitored for respiratory distress. The stoma is left heal by secondary intention which usually occurs over 7-10 days.

Complications

Complications are relatively common with tracheostomy tubes reported in up to 87% of patients. Complications can be serious with 10% of patients dying or being euthanized due to tube related complications. Bulldogs have been reported to be more prone to complications probably due to their relatively small trachea and increased depth of overlying soft tissue making them prone to tube dislodgement and obstruction. Cats are also reported to have higher complication rates with a major

complication rate of 44% reported. The higher complication rate maybe due to their small trachea and propensity to produce thicker secretions.

Common complications include

- Tube obstruction
- Tube dislodgement
- Retching and coughing
- Subcutaneous emphysema
- Aspiration pneumonia
- Severe bradycardia
- Excessive stoma discharge

Tracheal stenosis following tracheostomy is common in man but rarely seen as a clinical problem in small animals.