RECURRENT LARYNGEAL NEUROPATHY (RLN)

Aetiology

- Permanent dysfunction of the intrinsic muscles of the larynx which receive their motor innervation through the recurrrent laryngeal branch of the vagus nerve; results in partial obstruction of the airway evident during exercise and comprised atheletic performance through hypoxia

<u>Less common causes</u>;

- Trauma to the recurrent nerve by perivascular injection of irritant medicaments
- Other direct trauma to the recurrent nerve
- Damage to the vagal trunk by guttural pouch mycosis or strangles infection

<u>Toxic and metabolic insults to the recurrent nerves are likely to be bilateral</u>;

- Toxicity by heavy metals, such as lead, and organophosphate poisoning
- Nutritional deficiences such as thiamine
- Live failure

Prevelance

- Horses of any age from birth onwards
- Horses over 16 hands tall are most susceptible and rare below 15.2 hands
- Clinical signs usually appear before the horse if 6 years of age

Clinical Signs

- Consistent inspiratory sounds which can be heard throughout the period of exertion at the canter and gallop
- Sounds range from a low-grade musical 'whistle' similar to noise produced by blowing over the top of an empty bottle, to a harsh 'roaring' noise like a sawing wood
- Disappearance of sounds within a short period of pulling up expected; recovery with resting respiratory rate in a normal period
- Some horses produce adventitious respiratory noises only under extreme exertion

Diagnosis

<u>Palpation</u>;

- Larynx is palpated to seek evidence of atrophy of the intrinsic laryngeal musculature especially on the left side
- Arytenoid depression test; right side of larynx is forced to adduct by pressure on the right arytenoid muscular process to provide a convining increase in stridor at the conclusion on exercise than at rest
- Evidence of cicatrix from previous ventral laryngofissure surgery. The area ventral to the left linguo-facial vein should be checked fro a prosthetic laryngoplasty ('tie-back') scar
- Spacing between the cricoid and thyroid cartilages. Deformities of the thyroid laminae as part of the 4th brachial arch defect syndrome.
- Assessment of the strength of the 'slap' response

<u>The 'Grunt-to-the-stick' test</u>;

- Startling the horse by threatening it
- Laryngeal fixation in an incompletely closed position, together with a rapid rise in pressure within the airway, produces a low-pitched grunt
- Tests the competence of laryngeal adduction

<u>Resting endoscopy</u>;

Treatment

1. **Ventriculo-cordectomy (Hobday or Williams procedure)**;

- Peformed by conventional or laser surgery
- Removal of the mucous membrane lining from the laryngeal ventricle(s) and excision of the vocal fold(s)

2. **Prosthetic laryngoplasty (abductor prosthesis operation – 'tie back');**

- Implants a suture between the caudal border of the cricoid cartilage and the muscular process or the arytenoid to mimic the action of the CAD muscle as if it were a semi-contracted state

3. **Nerve/muscle pedicle grafting;**

- Transplant small cubes of muscle taken from the omo-hyoideus together with their motor supply through the firtst and second cervical nerves into the atrophied CAD muscle to restore abductory function to the larynx
- Grafts grow in response to mechanical stimulation

4. **Total, partial and sub-total artenoidectomy;**

- Removal of the intra-laryngeal structures which cause obstruction
- Removal of infected cartilage in cases of chromic chondropathy and the removal of the left arytenoid cartilage when other techniques have failed

5. **Tracheotomy intubation;**

- Provides an alternative airway and to by-pass the site of airway obstruction
- Provides a short-term expedient to racehorses which would otherwise be side-lined by alternative surgies
- When the tube is removed the defect heals quickly by second intention, and the option to perform a more enduring surgical correction will have not been compromised

6. **Permanent tracheostomy;**

- Create a fistula between the tracheal

- Examine asymmetry of the rima glottidis in cases of true left laryngeal hemiplegia

A grading system of laryngeal function with reproducible values is necessary if the subjectivity of endoscopy of the larynx is to be eliminated, paricularly when left laryngeal dysfunction is incomplete

- *Grade 1*; all movements by the left and right arytenoid cartilages (both adductory and abductory) are synchronized and symmetrical
- *Grade 2*; all major movements of the arytenoid cartliages are symmetrical with a full range of adduction and abduction. Transient asynchrony, flutter, or delayed abduction, especially by the left arytenid cartilage
- *Grade 3*; rima glottidis is aymmetric during quiet breathing, but the left arytenoid cartilage and vocal fold are capable full abduction, typically in response to the nostril occlusion manoeuvre or after swallowing
- *Grade 4*; consistent asymmetry of the rima glottidis at rest, the left arythenoid cartilage is not capable of full abduction, but some residual movements are present
- *Grade 5*; true hemiplegia: active movement is absent on the left side with the arytenoid cartilage resting on or near the midline
- Grades 1 and 2 are within normal limits
- Grade 3 comprises equivocal dysfunction
- Grades 4 and 5 are considered abnormal

<u>Dynamic endoscopy</u>;

- HSTE or OG endoscopy provided a complete assessment of laryngeal function due to inconsistencies of interpretation of endoscopy at rest

<u>Exercise test</u>

<u>Other diagnostic tests</u>;

- Ultrasonography, the radio-stethoscope with sound frequency analysis, electro-myographic recording of laryngeal muscle activity and measurement of conduction time in the 'slap' reflex

lumen and the skin surface of the ventral neck
- Not aesthetically acceptable
- Regular requirement for nursing to remove exudation from the skin adjacent to the stoma and to maintain local hygiene

Prognosis

- Prosthetic laryngoplasty is far from ideal a treatment by remains the best practible option available. Refinements are required to provide consistent and enduring abduction without dysphagia. Surgery can produce complication in the form of coughing, nasal reflux of ingesta or recurrence of dyspnoea.
- Nerve/muscle pedicle grafting is a potential alternative, but its application is most likely to be limited to horses confirmed at an early stage and when the prolonged convalescent period is less restrictive
- Functional electrical stimulation of the recurrent nerve using an implanted stimulator with an external control unit is a a novel approach suggected as a future potential remedy

PROSTHETIC LARYNGOPLASTY ('TIE-BACK')	
Procedure	A prosthetic suture is placed between the cricoid cartilage and muscular process of the arytenoid cartilage. The suture is secured and abduction of the arytenoid cartilage is done next. - A 1 or 2 80lb nylon suture is placed with a swaged on small needle - The suture is passed dorsally through the cricoid cartilage, under the cricopharyngeus muscle and through the arytenoid cartilage - The caudal free end of the nylon is then passed under the cricophayngeus muscle and the nylon secured as the nylon exits the muscular process of the arytenoid cartliage - Both ends of the nylon suture are passed through 2 crimping devices - Tension is applied to each of the free ends of the nylon and Kelly forceps positioned on each end of the nylon close to the crimps - A right angled retractor is recommended to retract the cricopharyngeus muscle caudally - The tension device is positioned between the 2 Kelly forceps and tension applied to each end of the nylon either side of the crimps - Intra-operative endoscopy is used to determine the optimal degree of arytenoid abduction - Once optimal degree of arytenoid abduction is achived the tension device is locked in position and the clamps are crimped twice with the precision crimping device - The free ends of the nylon are transected and the incision closed routinely - If using 2 sutures, securing the dorsal suture first is recommended
Complications	Includes; - Coughing - Aspiration of food or dirt particles into the trachea causing pneumonia - Incisional infection or dehiscence - Seroma under incision - Infection of the suture - Breakage of the suture - Failure to maintain abduction of the cartilage
Aftercare	Includes; - 30 days of stall rest with hand-walking/grazing - Small paddock turnout or light exercise for 30 days - Gradual return to exercise at 45-60 days post surgery