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Focus on Upper and Lower Respiratory Diseases

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Disorders and Surgery of the Trachea

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Take Home Message

Primary tracheal abnormalities are not common in the horse. However, in cases of severe upper respiratory tract obstruction, an emergency tracheotomy is a life saving procedure and should be performed as quickly as possible.

The trachea is a membranous and cartilaginous, flexible yet rigid, tube that extends from the larynx to the 5th or 6th intercostal space where it bifurcates into the principal bronchi. The length of the trachea from the larynx to the point of bifurcation is approximately 70-80cm. Understanding the local anatomy relative to the trachea is important. The sternothyrohyoid muscles are located immediately ventral to the trachea except at the most cranial aspect where the sternohyoid muscles are present. The sternocephalic, omohyoid, and sternothyroid muscles are lateral to the trachea. The esophagus is located dorsolateral to the trachea in the middle of the neck and becomes ventral to the trachea at the thoracic inlet. Typically the esophagus is located on the left side of the neck. The common carotid artery, vagosympathetic trunk, and recurrent laryngeal nerve are located in the carotid sheath that courses along the dorsolateral aspects of the trachea. There are approximately 48-60 hyaline cartilage rings that provide rigidity to the trachea. These rings are incomplete dorsally. The dorsal space is bridged by connective tissue and the trachealis muscle. The tracheal cartilages prevent collapse of the trachea during inspiration and the incomplete dorsal structure allows for tracheal expansion when large volumes of air are inhaled and exhaled during exercise. There are fibroelastic annular ligaments between consecutive tracheal cartilages that allow for tracheal flexibility. The normal trachea is flattened dorsoventrally. The average dorsoventral diameter is 5cm and the transverse diameter is 7cm in the normal adult horse.12

The most common reason for surgery involving the trachea is an airway obstruction rostral to the tracheal opening. This surgery is often performed as an emergency procedure to bypass an upper airway obstruction. Other conditions such as tracheal rupture or perforation, tracheal collapse, tracheal stenosis, foreign body, granulomas within the tracheal lumen, surgery of the laryngeal lumen that would preclude orotracheal intubation, and bronchial masses are indications for surgery of the trachea. Knowing how to perform a tracheotomy can be a life saving skill and every equine practitioner should know how to perform this surgery. Indications for a tracheotomy include bilateral laryngeal paralysis, severe arytenoid chondritis, severe soft tissue swelling that is compressing the nasopharynx, and nasal trauma causing obstruction of both nasal passages. It is best to perform the tracheotomy before the horse is panicking secondary to severe respiratory distress. When this occurs the horse is often extremely dangerous and it is best to
wait until the horse “passes out” before attempting to perform the tracheotomy. If this happens, the tracheotomy must be performed as quickly as possible.

The tracheotomy site is located at the junction of the proximal and middle thirds of the neck. At this location the tracheal rings are easily palpable on midline. If time permits the area should be clipped, prepped, and an infusion of local anesthetic used to desensitize the skin. The horse’s head can be held in slight extension but should not be held in either exaggerated extension or flexion. The procedure is performed as follows. A vertical midline incision is made through the skin, subcutaneous tissue, and cutaneous colli muscle. The paired sternothyrohyoid muscles are divided on midline and the dissection is continued to the level of the tracheal rings. The annular ligament between two tracheal rings is incised to gain access to the tracheal lumen. The scalpel blade should be “stabbed” through the annular ligament parallel to the cartilaginous rings. The incision can be extended to one half the circumference of the trachea to facilitate placement of a tracheotomy tube. The incision into the lumen of the trachea should not be made through the tracheal rings. There are a variety of tracheal tubes that are available to the veterinarian. Self-retaining models are most popular since they do not require suture to secure them in place. It is extremely important to make sure the tracheotomy tube is being placed into the lumen of the trachea and not subcutaneously. Post-operative management includes making sure the tracheotomy tube is patent and removing and cleaning it one-to-two times daily.

Post-operative complications are not common but wound infection and subcutaneous emphysema are possible. It is important to make sure there are no “pockets” distal to the tracheotomy site that would allow accumulation of fluid. If fluid is accumulating then the skin incision should be lengthened to allow appropriate drainage. Once the tracheotomy is no longer required the wound is left to heal by second intention. This usually occurs in approximately 2 weeks.

A permanent tracheostomy is indicated in certain cases of bilateral arytenoid chondritis or bilateral laryngeal paralysis. Surgery can be performed either standing or under general anesthesia. Under general anesthesia, the horse is positioned in dorsal recumbency and ventral aspect of the neck is clipped and prepped for surgery. Many times a temporary tracheotomy has been performed. It is helpful if you think that a permanent tracheostomy will be needed to position the temporary tracheotomy towards the middle of the neck rather than more proximal. A ventral midline incision is made to expose the tracheal rings. It is best to remove the ventral portion of rings two to five. The paired sternothyrohyoid muscles are isolated and a section of each should be excised. This decreases tension of the mucosal closure. Once the tracheal rings are exposed two paramedian incisions through the tracheal rings are made. These incisions are approximately 3-cm apart. It is very important to make sure that an excessive amount of the tracheal ring is not removed or tracheal collapse will occur. No more than one-third of the total circumference of the ring should be removed from the ventral aspect of each ring. Avoid removing cartilage near the trachealis muscle. When incising through the rings take care not to penetrate the tracheal mucosa. The rectangular pieces of cartilage are dissected from the tracheal submucosa and removed. Then the tracheal mucosa and annular tracheal ligaments are incised in a double- Y pattern. The tracheal mucosa is sutured to the skin using 3-0 absorbable suture in a simple interrupted pattern.
Permanent tracheotomy can also be performed on the standing sedated horse using local analgesia. Using a set of stocks and a method to hold the head in an elevated and slightly extended position is helpful. Post-operatively the stoma should be cleaned as needed taking care not to disrupt the sutures. Over time the care of the stoma is minimal.

Trauma is the most likely cause of tracheal perforation. Most often there is swelling and subcutaneous emphysema. It is possible for the horse to develop pneumomediastinum leading to pneumothorax. Small defects can be treated conservatively and will usually resolve within 48 hours. Larger defects will need surgical treatment consisting of debridement and closure of the wound. A drain should be placed subcutaneously. The subcutaneous emphysema should resolve within 10 days after the tracheal defect is closed.

Granulomatous nodules can form in the trachea. These are seen during endoscopic examination. They may be an incidental finding and not require treatment. However, if they are causing an airway obstruction then surgery will be necessary. Transendoscopic laser surgery is a non-invasive means of treating this type of abnormality.

Tracheal collapse or stenosis occurs as a narrowing of the tracheal lumen. This can occur following a tracheotomy, trauma or secondary to peritracheal abscess formation. Treatment could include a resection and anastomosis of the trachea, extraluminal prostheses, and drainage of the peritracheal abscess.

The cause of tracheal collapse can be related to peritracheal abscession, masses, or trauma to the tracheal rings. Tracheal collapse at exercise of unknown etiology is also possible.

The clinical signs associated with tracheal collapse will be varying degrees of respiratory distress and exercise intolerance. Tracheal cartilage abnormalities associated with a previous tracheotomy, cartilage malformation, or mass may be felt on palpation. Endoscopy of the trachea should be performed to assess lumen.

Treatment for tracheal collapse depends on the etiology, length of trachea involved, and the accessibility of the affected area. Treatment options include resection and anastomosis of the affected segment, extraluminal prosthesis, and imbrication of the collapsed tracheal rings.

References