Upper Airway Emergencies in the Horse

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Introduction

The upper airway, also known as the "extrathoracic airway," is a conduit for air to and from the lungs. It includes the nostrils, nasal passages, pharynx, larynx, paranasal sinuses, guttural pouches, and extrathoracic trachea. Other functions include olfaction, phonation, filtering and conditioning of air, deglutition, and protection of the lower airway from aspiration.

Horses are obligate nasal breathers due to the tight seal that exists between the caudal edge of the soft palate and the larynx. Due to this anatomical arrangement, horses are unable to switch to mouth breathing like most animal species during exercise. However, horses still have an impressive ability to increase their oxygen uptake during exertion. Respiratory minute volume in horses is approximately 67 L/min at rest, but can increase 27-fold to 1800 L/min during exercise. This contrasts with a 6-8-fold increase found in human athletes. To accommodate these changes the horse's upper airway undergoes changes in caliber, rigidity and shape.

The most important determinant of airway resistance is the airway radius. If the radius of the airway is halved, the total airway resistance will increase 16-fold. Consequently, small changes in upper airway radius/diameter can have major influences on performance, even if it causes no evidence of obstruction at rest. Therefore, when clinical signs of upper airway obstruction are evident at rest, a large percentage of the airway is likely involved. A horse presenting with significant stridor at rest will likely have an obstruction involving greater than 80% of the airway. Once these signs are evident, progression towards complete obstruction can be rapid. It is therefore advisable to treat any acute respiratory noise at rest as an emergency.

Clinical Signs of Upper Airway Obstructions

Most upper airway emergencies present with signs of respiratory distress. Signs of respiratory distress may include an increased respiratory rate, exaggerated intercostal and/or abdominal effort, flared nostrils, and extended head/neck position, and respiratory noise. When evaluating a patient in respiratory distress, the first goal should be to determine if the problem is an upper respiratory or lower respiratory disorder. Stridor, or intense respiratory noise that is audible without a stethoscope, is more common in horses with upper rather than lower airway disease. Additionally, upper airway obstructions are more likely to cause noise during inspiration than expiration.

A horse with an acute respiratory noise/signs of obstruction may rapidly progress to complete obstruction. This can happen if the primary disease process is progressive (such as edema). Additionally, the turbulent airflow associated with the obstruction can lead to worsening edema. Finally, increased negative pleural pressure caused by increased respiratory effort against an obstruction may lead to pulmonary edema.

Select Causes of Acute Upper Airway Obstruction

Nasal Obstruction

Nasal obstruction must be bilateral to cause significant airflow reduction at rest. It is an uncommon cause of upper respiratory obstruction. The most common causes include nasal trauma, insect/snake bite, anaphylaxis, bilateral jugular vein thrombosis, edema following anesthesia or prolonged sedation, and chronic intranasal masses (acute clinical signs occur when the mass reaches a critical size).

Laryngeal/Pharyngeal Obstruction

Laryngeal/Pharyngeal obstructions are the most common causes of upper airway obstruction. Like obstruction of the nasal passages, edema is often a major component of the disease process. Common causes include laryngeal edema, arytenoid chondropathy, laryngeal paralysis, post anesthetic laryngeal spasm, retropharyngeal lymphadenopathy, guttural pouch edema, pharyngeal trauma/foreign body and neoplasia.

Tracheal Obstruction

Tracheal obstruction is a rare cause of upper airway obstruction, but can occur following neck trauma or be the result of a mass that compresses the trachea. Tracheal collapse secondary to chondromalacia of the tracheal rings is a condition that most commonly affects ponies and American Miniature Horses.

Temporary Tracheostomy

While identification and treatment of the underlying cause of upper airway obstruction is the goal of treatment, initial treatment of severe cases involves establishing a patent airway. A surgical tracheotomy is often the preferred method, but passage of a nasotracheal tube may also be effective.

The terms tracheotomy and tracheostomy and often used interchangeably, but refer to slightly different procedures. A tracheotomy refers to the surgical procedure of cutting into the trachea. In contrast, a tracheostomy is the creation of a stoma. If a tracheotomy incision is kept open through the use of a tube, the term temporary tracheostomy may be used. A permanent tracheostomy refers to the surgical procedure in which a permanent stoma is created by suturing skin to the tracheal mucosa.

Ideally, a tracheotomy is prepared with the patient sedated and the surgical site is aseptically prepared and infiltrated with local anesthetic. In some emergency situations, these steps must be minimized or omitted. A 6 to 10 cm incision is made on ventral midline where the tracheal rings are easily palpated, at the junction between the cranial and middle third of the neck. The skin, subcutaneous tissues and cutaneous colli muscles are incised to expose the paired sternothyrohyoid muscles. Ideally these muscles are divided by blunt dissection to expose the trachea. Next a stab incision is made through the annular ligament between two tracheal rings. The tracheal cartilages should not be incised as this can lead to complications including granuloma formation. The incision is extended until it is sufficient to allow placement of the tracheostomy tube, but should not exceed 50% of the tracheal circumference. A variety of

tracheostomy tubes are available. Self-retaining models are the most popular as they do not require suture to secure in place.

Injuries to the Upper Airway that Cause Secondary Lower Airway Disease

In some cases, injury to the upper airway may result in secondary lesions or obstruction within the lower airway. Two examples of this are pulmonary edema secondary to upper airway obstruction, and pneumothorax secondary to tracheal lacerations.

Pulmonary edema may occur in horses following obstruction of the upper airway. It is believed to be the result of significant negative intrathoracic pressures that are generated during attempts to breath against an obstructed airway. This is most commonly seen during recovery from anesthesia. Clinical signs include discharge of serous fluid or foam from the nostrils, tachypnea, and tachycardia. Treatment includes maintenance of an airway (which may include performing a tracheostomy), anti-inflammatories, and diuretics (such as furosemide). Treatment with supplemental oxygen and prophylactic antibiotics may also be considered.

Tracheal lacerations in the horse are rare causes of injury that are most commonly caused by a traumatic incident to the cervical region, such as a kick from another horse. Small tracheal perforations may be asymptomatic and heal with conservative management. However, larger perforations may lead to the development of significant subcutaneous emphysema. If left untreated, this may progress to a pneumomediastinum and a life threatening pneumothorax. If subcutaneous emphysema is extensive, or progressive, airflow must be directed away from the site of injury to prevent continued trapping of air within the subcutaneous tissues. This can be achieved by direct closure of the tracheal defect (if applicable), incising over the tracheal defect to release trapped air, or performing a tracheostomy caudal to the tracheal defect.

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