**SMALL AIRWAY INFLAMMATORY DISEASE AND RECURRENT AIRWAY OBSTRUCTION**

Many terms and abbreviations have been used over the years for various inflammatory and reactive airway conditions causing cough in the horse.  Most recently in a consensus statement by the American College of Veterinary Internal Medicine, it has been proposed that these various syndromes be characterized under the term equine asthma.  Inflammatory airway disease (IAD) has been used to describe the condition seen in young horses, most often characterized by exercise intolerance and intermittent cough, in horses that are normal at rest.  They can completely recover, either with treatment or occasionally spontaneously.

Inflammatory Airway Disease (IAD) is a non-infectious disease of the lower respiratory tract. IAD is triggered by dust, allergens or other endotoxins that cause an immune response when inhaled. Typically, horses with IAD have no clinical signs at rest however respiratory signs will be noticed during exercise. Horses may exhibit any or all of the following: exercise intolerance, cough, increased respiratory secretions and mucus. IAD is a non-septic disease, therefore fever and other signs of infection are absent.  [The ACVIM Consensus Paper](https://vet.ucalgary.ca/sites/default/files/teams/41/acvim-consensus-statement.pdf) (2007) states that to confirm a diagnosis of IAD horses must have no evidence of systemic signs of infection (fever) and they must not exhibit any respiratory clinical signs at rest. During exercise they will have at least one of the following: poor performance, exercise intolerance, or coughing, with or without excess tracheal mucus. They must also show evidence of lower airway inflammation.

They can completely recover with treatment and occasionally they recover spontaneously.

Horses exposed to high levels of environmental dust, organic molds and other endotoxins appear to be the most susceptible to developing IAD. There may also be a genetic component as some horses are more susceptible to bacteria, viruses and other inhaled environmental pollutants than others.  Horses usually have no history specific to IAD and it can affect them at any age.

Recurrent airway obstruction (RAO, also known as heaves) is the common respiratory disease of horses characterized by airway narrowing (bronchoconstriction), mucus production, and bronchospasm.  Unlike IAD, horses with RAO are not normal at rest, and usually have an increased respiratory rate and/or cough.  The average age of onset in RAO affected horses is 9-12 years, and both genders are commonly affected. The most common signs of RAO are chronic cough, nasal discharge, exercise intolerance, and respiratory difficulty. The classic “heave line” that can be seen along the bottom edge of the ribs is due to enlargement of the abdominal muscles, which are assisting in breathing and become large from excess work. Severely affected horses may also exhibit weight loss, anorexia, and exercise intolerance. Most affected horses do not have a fever unless a secondary bacterial pneumonia has occurred.

Most evidence suggests that RAO is the result of the lung's hypersensitivity to inhaled antigens. RAO is similar to asthma in people, and has allergic and inflammatory components. The most common allergic triggers for RAO are mold, organic dust, and endotoxin present in hay and straw. RAO occurs worldwide, with the highest prevalence in stabled horses fed hay.

Diagnosis of RAO is based on the history and characteristic clinical examination findings in the majority of horses as well as diagnostic tests to confirm and characterize the inflammation. These include upper airway and tracheal endoscopy, bronchoalveolar lavage (BAL), lung function testing, thoracic radiographs (X-rays) and ultrasound examination. Bronchoalveolar lavage is indicated in horses most horses with suspected airway disease. Radiographs and ultrasound are recommended for horses that fail to respond to standard therapy, or to further characterize inflammation in the lungs and rule out severe conditions like pneumonia. Bronchoalveolar lavage fluid cytology is the most common and helpful tool used to assess inflammation and sample cells of the lower airway. Horses are given a sedative and an endoscope or a small tube is passed through the nostrils into the lower airway until it wedges into a small bronchus in the lung. Saline solution is washed over the lung tissue and cells are recovered by aspirating the fluid from the airways.  This sample is sent away to a lab for analysis.

The most important treatment for RAO is environmental and dietary management to reduce exposure to organic dusts and mold. RAO is a chronic disease that will require life-long management changes for the horse. Unfortunately, it is not a disease that can be treated for a short time and resolve forever. Many horses with mild to moderate disease can be successfully managed with environmental and dietary changes alone. Round bale hay is high in endotoxin and organic dust content, and the presence of round bale hay is a potential cause of treatment failure in horses on pasture. Maintaining horses on pasture full-time is generally recommended for those with RAO, however sometimes the recommendations change based on the patient. Try to avoid storing hay above the stalls in a barn loft and minimize sweeping the floor when affected horses are stalled. Straw is not recommended as bedding for RAO affected horses, and low dust bedding such as chopped paper, cardboard or pressed shavings should be considered. Moderate to severely affected horses should have all hay removed from the diet and be transitioned to a complete pelleted feed or cubes. It is important to remember that although medications will alleviate the clinical signs of RAO, respiratory disease will be difficult to control if the horse remains in a mold/dust-filled environment once the medications are discontinued.

Systemic corticosteroids and aerosolized bronchodilators are the most immediately helpful therapy for a horse in respiratory distress. The combination of these drugs, and their frequency of use will depend on your horses’s particular condition and the severity of their signs. Inhaled therapies are beneficial because of reduced side effects from the corticosteroid administration. Depending on the clinical signs and severity of RAO, horses with this condition can be managed successfully for much if not most of their lives. Many of these horses are able to be excellent pleasure, trail riding, or even competition horses with dedicated owners that understand that it is a considered a chronic condition that will require life-long management.

Here is a recap of the most important environmental management tools:

* Provide as much turnout as possible – 24/7 is best, with adequate shelter from wind and precipitation. If you must keep your horse in a stall ensure there is excellent ventilation and keep doors and windows open as much as possible. Clean stalls at least once a day to remove ammonia from urine and manure. Move the horse away from the area when mucking out and don’t return them until the dust settles. Also avoid sweeping around a horse with heaves. Avoid using straw or old hay as bedding, as it tends to be dusty and can be filled with mould particles. Use minimal-dust bedding such as paper, wood shavings or wood pellets. Even shredded paper or cardboard are said to be excellent bedding for heaves horses if you can source it.
* Do not turn out in a dirt pen. Ideally horses will be kept on pasture (short grass) as long as possible.
* Store hay in a separate building from horses. When feeding hay, it can be helpful to soak it for about five minutes prior to feeding to decrease the amount of dust and mould spores that will be released and inhaled while eating. Soak with nets and buckets or, if expense isn’t a barrier, try a commercially available hay steamer.
* When the horse is on turnout, don’t offer a round bale. Most horses will stick their heads in the bale’s centre where they will inhale all sorts of nasty particles. Instead consider spreading hay on the ground to encourage mucous drainage from the head-down position. If the ground is dusty (such as dirt) consider using a ground level feeder that they hay can be fed in so that we can still take advantage of the head down position for sinus and trachea drainage.
* Some owners might even find it best to offer pelleted or cubed feeds instead of high-dust feeds such as rolled oats. Occasionally, pellets are dusty too, in which case adding a sprinkle of water a few minutes before feeding will help prevent airbourne particles from reaching the horse’s breathing zone.
* Other tips: watch the dust that flies during grooming sessions; stay out of dusty rings or arenas; avoid riding in cold  
  weather, which can exacerbate symptoms; and don’t idle farm machinery or vehicles near a horse with heaves.

**EQUINE INDUCED PULMONARY HEMORRHAGE**

A 'bleeder' is a horse that has shown signs of bleeding from the lungs after exercise. Some horses may have blood that comes out of the nostrils (called epistaxis), but most will not. The most common clinical sign is decreased performance. Some owners have reported signs such as coughing or behavioral changes, but there are many horses with EIPH that show no clinical signs at all. Each horse is different, and clinical signs can also vary with the severity of the disease.

This condition is known as exercise induced pulmonary hemorrhage (EIPH) and is most commonly diagnosed by the presence of blood in the airways after exercise using an endoscope or a bronchoalveolar lavage.  EIPH is not yet fully understood, but currently the most widely accepted theory is that during exercise, blood pressure in the lungs can increase to such a high level that small capillaries burst, and blood ends up in the lungs. There is also a theory that in some cases it may be influenced by lung inflammation and in others by obstruction to airflow in the throat. The obstructions in the throat area can happen sometimes only during exercise or be permanent (for example ‘roarers”). In horses that do not show signs of lung inflammation nor throat obstruction or cardiac problems, it is unclear why EIPH occurs.

Approximately half an hour after strenuous exercise, this blood can usually then be seen in the trachea. Only about 5% of horses with EIPH will have blood that comes out of the nostrils. Therefore, there may be many horses that have EIPH without an owner knowing. The most common clinical sign is decreased performance.

There are two common ways to diagnose EIPH:

1. Endoscopy of the trachea (windpipe) 30 minutes after exercise: An endoscopy uses a long tube with a camera on the end that goes into the horse's nostril, looks into the back of the throat and down the wind pipe (trachea). It is a very quick procedure that most horses tolerate well, and usually does not require sedation to be performed. The trachea is visibly assessed to see if blood is present. The endoscopy should be performed between 30 and 60 minutes after strenuous exercise.
2. Bronchoalveolar lavage (BAL). This should be performed between 30 and 60 minutes after strenuous exercise, however quality diagnostic samples can be retrieved for up to 2 weeks post-performance. However, the likelihood of a quality sample decreases steadily over that time period.

There is currently no cure for EIPH, but there are some prevention treatment options to help reduce the severity and incidence.  Furosemide (Lasix) is a diuretic, meaning it acts on the kidneys to increase urine production and urination. This dehydrates the horse and the goal is to decrease blood pressure. The decrease in blood pressure is due to the decrease in blood volume. Lasix is somewhat controversial, as horses may lose a significant amount of electrolytes and are also not supposed to drink any water for several hours before their race. Some horses respond well and will show a decrease in the severity of EIPH while using Lasix, but some horses will not respond to the drug at all. There is some weak evidence that nasal strips may help some horses that have a low severity of EIPH. Nasal strips work to increase the amount of air flow through the nostrils by a small percentage. Bronchodilators and corticosteroids work by dilating the smallest airways and reducing inflammation (respectively) in the lungs, which decreases resistance and increases air flow. There is very little evidence to show that they are an effective treatment for EIPH. One or both of these may be more useful if there is evidence of inflammation as an underlying cause.

**LARYNGEAL HEMIPLEGIA**

Laryngeal hemiplegia is a disease that affects the upper airway in horses. It causes a decrease in airflow to the lungs and can cause exercise intolerance. Horses with the disease are called “roarers” because they make a characteristic respiratory noise that sounds like “roaring” when exercised.  The larynx is the structure that connects the nasal passage to the trachea. It consists of a group of cartilages that allow air to pass into the trachea and protect the airway during swallowing. Laryngeal hemiplegia is caused by paralysis of one or both of these cartilages (the arytenoids), due to lack of innervation causing atrophy to the muscle that moves the cartilage. The left arytenoid cartilage is the most common side affected (up to 95%). In a normal horse, the arytenoids allow maximal airflow into the trachea during abduction. Horses with laryngeal hemiplegia have paralysis of the arytenoid cartilage, which prevents them from abducting or opening their throat during inspiration. This leads to decreased airflow into the lungs due to obstruction from the paralyzed cartilage resulting in respiratory noise and exercise intolerance.

Laryngeal hemiplegia is most commonly reported in the racing Thoroughbreds but it also occurs in other performance horses including warmbloods, draft horses, standardbreds, and quarter horses. It is commonly seen in taller male horses, usually greater than 15 hands.  While the disease is not life-threatening, there are several surgical options available to treat your horse if they are experiencing clinical signs and most of them have a good prognosis for improving your horse’s performance.

Laryngeal hemiplegia is a graded on a scale of 1–4, with 4 being complete paralysis of the cartilage. Standing endoscopy can diagnose higher grade cases. High-speed treadmill endoscopy or over ground dynamic respiratory examination may be necessary to diagnose cases that are questionable on standing endoscopy and can be used to ensure that no other concurrent upper airway problems are contributing to the exercise intolerance or respiratory noise.

Treatment recommendations vary depending on the severity/grade, the breed, the age and the use of your horse. There are 4 treatment options: prosthetic laryngoplasty (a "tie-back surgery"), ventriculectomy +/- cordectomy, arytenoidectomy, and neuromuscular pedicle graft.

**DORSAL DISPLACEMENT OF THE SOFT PALATE**

Dorsal displacement of the soft palate (DDSP) describes the condition where the soft palate displaces upwards to sit on top of the epiglottis. When this happens the soft palate ends up obstructing the opening to the trachea and thereby reduces the amount of air that a horse can take in. DDSP most commonly occurs intermittently, especially during intense periods of exercise, and can be a cause of respiratory noise and poor performance. It is likely due to abnormal contraction of the muscles in the soft palate and throat, causing the soft palate to become flaccid and subsequently displace. Less commonly, structural problems with the soft palate or epiglottis such as cysts, masses, or deformation of the epiglottic cartilage result in displacement of the soft palate even when the horse is at rest. Additionally, some neurological conditions or conditions that damage the nerves that control swallowing and airway function can also result in DDSP. Intermittent displacement of the soft palate is most common, although in some rare cases a more permanent form of displacement can occur. In these cases horses often will cough.

It should be noted that at rest, many horses will displace their soft palate. This is normal unless they are having difficulty in replacing it. In addition, a sedated horse will displace their soft palate and it can remain displaced for some time - this is not confirmation of a pathological problems.

The most common signs of DDSP are a history of exercise intolerance and upper respiratory noise. The noise occurs during exhalation and is often described as a gurgling or vibrating noise. Some horses may also exhibit open mouth breathing when the soft palate is displaced as air is directed through the mouth during exhalation instead of through the nose. When the horse swallows, the soft palate and epiglottis relationship usually returns to normal and the horse can then proceed without difficulty and the respiratory noise goes away.

The diagnosis of permanent dorsal displacement of the soft palate is easily made by endoscopic examination of the upper airway. Confirmation of this condition is best made with the use of overground endoscopy in which an endoscope is placed up the nostril to view the respiratory tract as the horse is exercised on their own or alongside another horse. The appearance as seen above is typical with the epiglottis lying on top of the soft palate.  The more common intermittent displacement of the soft palate is often suspected based on the history of the horse making a characteristic gurgling sound during exercise combined with a history of the horse stopping during high performance. If the soft palate displaces during exercise and is not immediately replaced then a diagnosis of dorsal displacement of the soft palate can be made and steps aimed towards treatment can begin.

References:

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