

Small Airway Disease (SAD) & Chronic Obstructive Pulmonary Disease (COPD)

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What is Chronic obstructive pulmonary disease (COPD)?

Chronic obstructive pulmonary disease, possibly **the most common** medical condition of mature horses, is also known by a number of other names, each term referring to a different clinical manifestation:

- Heaves
- Recurrent airway disease
- Inflammatory airway disease
- Chronic bronchitis/bronchiolitis
- Small airway disease
- Bronchiolar hyperreactive disease
- Equine asthma
- Emphysema
- Broken wind
- Hay sickness
- Summer pasture associated obstructive pulmonary disease
- Chronic airway disease

COPD is a condition in which inflammation in the small airways of the lung leads to impaired ventilation of the lung. The airway begins at the nostrils and passes down the windpipe (trachea) into the lungs. The smallest branches of the windpipe that are very close to the actual blood – gas interface (pulmonary alveoli) are known as terminal bronchioles.

Most commonly, COPD occurs as a consequence of immune-induced inflammation in the terminal bronchioles ("bronchiolitis") of the horse's lung. There are several potential causes for immune-mediated bronchiolitis.

When are signs of COPD recognized?

In horses, there are two distinct variants of bronchiolitis. COPD is very common in horses aged over 6 to 7 years. In these horses, clinical signs of COPD are directly attributable to exposure to allergenic dust in the environment (aeroantigens). Clinical signs of COPD arise whenever horses inhale these aeroantigens. If the horse is not exposed to aeroantigens, signs of COPD may be completely absent. The most common aeroantigens include molds that grow on hay and straw. When horses begin to develop COPD, the clinical signs are usually seasonal in occurrence during the first few years and may be correlated with the environment in which the horse is accommodated. As a rule, these mature COPD-affected horses are more likely to develop symptoms when accommodated indoors and fed hay, especially when bedded on straw. These same horses may become **completely asymptomatic** when accommodated outside at pasture.

The second variant of bronchiolitis occurs in younger horses, typically aged between 3 to

6 years. These horses are often accommodated in barns at race or race training facilities. This variant of bronchiolitis/COPD is also known as inflammatory airway disease or small airway disease (S.A.D.). SAD is believed to be more directly related to the effects of immune reaction against various respiratory viruses in the small airways.

What are the clinical manifestations of COPD?

The most common clinical manifestations of COPD are directly referable to increased resistance to air movement through the airway passages as a result of bronchiolitis. In the beginning, mildly affected horses exhibit slightly increased respiratory effort and respiratory rate following exercise. As the condition progresses, increased respiratory effort will be apparent in the standing horse at rest. Horse owners often miss these early changes in the exercise capacity and respiratory character of mildly affected horses. In time, further clinical signs include intermittent coughing and a bilateral nasal discharge. Severely affected horses may lose weight. All of these clinical signs are more prominent at a time when horses are exposed to aeroantigens in the atmosphere, typically during periods of indoor accommodation. COPD does not cause a fever – an important point when differentiating this condition from the infectious respiratory diseases. However, in hot weather, the rectal temperature of COPD-affected horses may indeed be increased because the reduction in airflow through the airways interferes with thermo-regulation and causes reduction in the ability of the horse to eliminate heat (leading to hyperthermia).

The symptoms often become less prominent or inapparent when the horses are accommodated at pasture. In rare cases, COPD-affected horses will be found in a sudden state of severe respiratory distress. Such horses may not have appeared abnormal to the horse owner although, on recollection, these horses are commonly reported to have had an occasional cough. Signs of acute-onset severe respiratory distress include increased respiratory rate, increased respiratory effort (with abdominal breathing), flaring of the nostrils, and cyanotic (blue colored) mucous membranes.

In one exceptional type of COPD, the affected horse exhibits respiratory symptoms when accommodated outside at certain times of the year. It is believed that these horses are "allergic" to inhaled pollen (like hay fever in children). This COPD variant is known as "summer pasture-associated obstructive pulmonary disease" or SPAOPD, for short. For these horses, the clinical expression of disease occurs in the summer and fall when they are accommodated at pasture. SPAOPD is apparently much more common in the Gulf coast states.

In horses that have been affected with COPD for several years, there sometimes develops a line of muscle thickening in the flank.

This muscle thickening, referred to as a "heave line," occurs as a result of increased abdominal breathing efforts. However, the absence of a heave line should not be used to rule out a diagnosis of COPD.

Although there are numerous other causes of weight loss and exercise intolerance, COPD is generally the most common cause of coughing, nasal discharge, and respiratory embarrassment in adult horses. COPD is so common that, in many instances, the significance of signs of mild disease (such as intermittent coughing or slight nasal discharge) is not properly appreciated. All too often, intermittent coughing in barn-accommodated horses is attributed to an "innocuous" barn cough. In those cases, recognition and early treatment for COPD would be more effective than, as often happens, waiting until severe lung damage has occurred (irreversible lung scarring).

What causes COPD?

COPD is the situation in which the movement of air to and from the lung is obstructed by the effects of bronchiolitis. Bronchiolitis is inflammation of the tiny airway passages deep in the lung. Bronchiolitis causes obstruction by virtue of four different effects.

- Bronchoconstriction: The presence of inflammation in the bronchiole leads to contraction of the muscle in its wall.
- Thickening of the wall of the bronchiole.
- Production of exudate: The presence of inflammation in the wall of the bronchiole leads to increased secretion of thick airway-blocking exudate that contains inflammatory cells and mucus ("mucopus").
- Fibrosis: In time, the presence of inflammation in the wall of the bronchiole causes structural changes that are relatively permanent and act to permanently interfere with the ability of drugs to cause luminal dilatation.

The exudates, like the normal secretions of the respiratory tract, are moved up toward the mouth and swallowed. In COPD, the excessive quantity of exudate (mucopus) often appears at the nostrils and is recognized as a dirty nose or a nasal discharge (usually from both nostrils). The quantity of mucopus that appears at the nostrils is often increased when the horse grazes grass or eats hay off the ground because the effect of gravity help it to drain down the airways to the nostrils. Coughing occurs because clumps of mucopus act to physically activate cough receptors in the wind pipe as a result of mechanical irritation.

At the root cause of COPD, bronchiolitis is provoked by an immune-mediated reaction against inhaled aeroantigens. Horses are exposed to inhaled aeroantigens whenever they eat hay (some hay is worse than other hay, but all hay represents a risk), are bedded on straw, and are accommodated in barns (especially old barns and in barns in which hay and straw are stored). Horses affected with SPAOPD



are exposed when they are accommodated at pasture in summer. COPD-affected horses may also exhibit aggravation of signs when exposed to non-allergenic air contamination (dusty arena, wood shavings, and petrochemical pollution) – this exacerbation of signs is related to the fact that the affected horse's airway has already been sensitized by the presence of inflammation due to exposure to aeroantigens, however.

Others have suggested that COPD represents a natural continuance of the effects of viral respiratory tract inflammation as younger horses. COPD has also been recognized as a complication of smoke inhalation (in horses that survive barn fires) and lung worm infections. It is possible that any provocative factor that leads to airway inflammation could, given the appropriate circumstances (concomitant mold exposure) lead to a state of immunological hypersensitivity in susceptible horses.

How is the diagnosis of COPD established?

During physical examination of COPD-affected horses, the veterinarian will place importance on the breath sounds detected through the stethoscope (thoracic auscultation). Thoracic auscultation should be properly undertaken in a quiet environment and both sides of the chest will be examined. Some veterinarians also listen to the breath sounds in the windpipe. Making the horse breathe a little harder may increase the ease with which breath sounds can be detected and evaluated. This increased work of breathing can be accomplished by either having the horse trotted for a few minutes or by making the horse quietly breathe into a bag (re-circulating carbon dioxide increases the breathing effort). The size of the lung field is often examined by tapping on the chest (thoracic percussion) – in COPD, the size of the lung field is often increased. It is often very easy to elicit a cough from COPD-affected horses by lightly squeezing the windpipe just behind the larynx.

In virtually all horses affected with COPD, the response to avoidance of aeroantigens (without the use of any drugs) is excellent within a few days and this response serves to further corroborate the diagnosis of COPD.

What is the treatment for COPD?

The treatment for COPD falls into two broad categories:

- Changes in management intended to eliminate exposure to inhaled aeroantigens (see list at right)
- Drug strategies intended to promote airway function

The MOST IMPORTANT aspect of treatment for COPD is clearly the avoidance of aeroantigens. For most COPD-affected horses, a complete recovery from the problem can be achieved simply by effectively eliminating inhaled aeroantigens from the horse's environment. As a rule, without resort to some improvement in the management, the drug strategies are rather

Management adjustments intended to reduce the risk of exposure to inhaled aeroantigens:

- Optimize the weight of affected horses (which are sometimes too fat)
- Fresh (outdoor) air is usually very important (exception = summer pasture - associated COPD)
- Avoid all dusty environments
- Do not accommodate inside barn unless absolutely necessary
- Do not feed with any hay unless absolutely necessary
- Allow access to appropriate grazing
- Avoid excessively dusty paddocks – once initiated, all dust is aggravating to horses affected with COPD
- When necessary, pasture grazing should be supplemented with oats, silage, haylage, pelleted feed, alfalfa cubes, etc. HorseHage™ can be used as an alternative roughage source in the diet (available from Marksway-Hillandale Farm, Pomfret Center, CT). Beet pulp is another useful roughage for these horses. Other recommended COMPLETE PELLETTED RATIONS include Purina Horse Senior and Purina Horse Chow.
- Hay or straw should not be stored in close proximity to grazing areas – certainly not in the same air space.
- Do not feed any other horses in the same pasture with hay – COPD horses may be affected by close proximity to hay and straw.
- Do not allow access into the barn
- Protection from particularly cold weather may be afforded by an open "lean-to" arrangement or by use of a New Zealand rug
- If indoor accommodation MUST be used, all horses in the communal barn should be managed under the same precautions
- Minimize exposure to busy road traffic (vehicular exhaust is an aggravating factor)
- Straw bedding should be avoided
- Preferred bedding materials include peat moss, paper, clay, wetted-down wood shavings/saw dust, sand.
- Hay or straw MUST NOT BE STORED IN THE SAME AIR SPACE as indoor-accommodated horses
- Extraction fans are rarely very useful (and may even be exacerbative). They should not be used as an "excuse" for proper ventilation
- Avoid damp, dusty, poorly ventilated barns
- Indoor environment should be routinely kept as dust-free as possible
- Do not undertake cleaning operations when COPD-affected horses are in the same environment (risk of churning up dust)
- If hay must be used (ideally it will not), use

only the best quality hay which is neither dusty nor moldy (actually, all hay is moldy to some extent)

- Hay which has been cut and baled in a wet spring/summer will be particularly bad (in terms of mold content) the next winter/spring
- Barn-dried hay is preferable
- Hay should be soaked under water prior to feeding by completely immersing the hay (eg: in a plastic hay net) for 2 hours immediately prior to feeding and fed in a hay net, dripping wet
- Exercise in cold weather often aggravates the problem and should be avoided
- Minimize ammonia build-up from wet bedding/urine pooling and inefficient stall drainage
- Although an expense would be involved (but not as great as might be anticipated), special adaptation of a single stall or loose box can be undertaken. The stall would be sealed-off from the common air-space of the barn environment and ventilated through a high efficiency filter in association with an air-conditioner.
- Do not accommodate in close proximity to busy or dusty roads
- If hay has to be fed, it should be fed on the ground, not at head level in a hay net.

Bottom line

This condition is eminently treatable. MOST affected horses benefit greatly from simple changes to the atmospheric management and do not require to be treated using expensive drugs. MOST affected horses revert to normal breathing if the underlying causative aeroantigens can be eliminated. A minority of affected horses have sustained permanent and irreversible changes (scarring, etc) that prevent and impede successful treatment.

