

Equine Asthma Syndromes
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There are basically 2 conditions that are, in many respects, very similar: recurrent airway obstruction (formerly referred to as 'heaves' or C.O.P.D.) and inflammatory airway disease. Together, these 2 conditions represent one of the most common medical conditions of the adult horse. For example, chronic inflammatory airway disease is the #2 cause for premature retirement of athletic horses. It can be identified in approximately 12% of adult horses. This cluster of conditions results from immune-mediated sterile inflammation centered on the terminal bronchioles ('terminal bronchiolitis') and are not infections.

Recently, experts in the field decided that the term 'equine asthma syndrome' should be used to describe these chronic inflammatory airway inflammatory conditions. The term 'severe asthma' is used to describe 'heaves' (recurrent airway obstruction). The term 'mild/moderate asthma' is used to describe inflammatory airway disease (IAD). For this purpose, we will discuss the former (severe asthma) and then make some comparative distinctions with the latter. Severe asthma is the diagnosis for >50% of adult horses presented for diagnosis of respiratory disease.

Severe asthma (recurrent airway obstruction [RAO]):

Other (older) names: 'heaves', chronic obstructive pulmonary disease (C.O.P.D.), small airway disease (SAD), summer pasture-associated obstructive pulmonary disease (S.P.A.O.P.D.), 'broken wind', haysickness, chronic airway disease, equine emphysema, & allergic bronchitis/bronchiolitis.

Type of affected horse: This is a condition of mature adult horses (average age at which the condition is initially diagnosed is 9 years). There is likely underlying genetic predisposition and exposure to both environmental factors (types of dust) and infectious agents (viral airway inflammation) also likely contribute to its development in different individuals.

Pathophysiological basis of the disease: Sterile, immune-mediated inflammation of the terminal bronchioles throughout the lung field. The principal inflammatory cell in airway inflammation for severe asthma is the neutrophil. Affected horses have developed sensitivity to inhaled 'dust' particles (both organic and inorganic), especially inhaled mold spores associated with hay (forage), straw (bedding), and the interior of horse barns. Sensitive horses can develop active airway inflammation as a result of inhalation of farm dust (diverse sources and types). Inflammation of the terminal bronchioles results in bronchiolar constriction and the production of excessive mucopus (increased quantity of mucus with neutrophils). Airway narrowing (bronchoconstriction) occurs and leads to need of increased expiratory effort during ventilation ('expiratory dyspnea'). Over time, abdominal contributions to expiration may lead to hypertrophy of the external abdominal oblique muscles that are described as a 'heave line' on each side of the horse's barrel (not all severely asthmatic horses develop a heave line, however). Once the condition has developed, affected horses are affected for life (and thus need to be managed for life).

Clinical expression is directly dependent on exposure to aggravating dusts in the atmospheric environment. When accommodated in the absence of provocative dust, respiratory function in asthmatic horses can be normal (although, unrecognized/uncorrected, long term disease leads to more refractory airway remodeling). Episodes of respiratory compromise can be readily provoked in asymptomatic individuals by inhalation of the problematic dusts (sometimes by just feeding hay). The severity of the condition tends to worsen with age, probably associated with both bronchiolar smooth muscle hypertrophy and the development of fibrosis. If ignored (not treated or managed), irreversible changes will occur and the individual will always experience difficulty with breathing.

Clinical presentation: Can be asymptomatic – severity depends on recent/current exposure to inhaled dusts. Asthma might simply cause reduced exercise capability in the mildest stages (exercise intolerance/poor performance). Mild signs can also include cough (often noted on start of exercise), bilateral nasal discharge, & increased respiratory effort at rest. Bilateral mucopurulent nasal discharge is often more noticeable when the horse's head is lowered (gravity drainage), as with grazing or following tranquilization. However, this condition can sometimes cause severe respiratory difficulty (dyspnea) in the resting horse – high respiratory rate coupled with nostrillar flaring, 'heaving' abdominal expiratory effort, and anxiousness. Severe, protracted asthma also leads to marked weight loss. It is important to note that asthma is very common! When faced with the following clinical signs in a mature horse, the asthma syndrome should be at or near the top of the list of differentials: cough, nasal

discharge, exercise intolerance, tachypnea at rest, weight loss, and dyspnea. In some instances, seasonal asthmatic attacks may occur in horses that are obese (obesity may contribute to worsening of coughing – ‘Pickwickian Syndrome’).

Veterinary examination findings: Affected horses may appear to be normal at the time of examination or some signs (noted above) may be evident at rest. Certainly, it is very important to focus on the animal's breathing pattern at rest (before it is excited by the examination process – ‘white coat’ phenomenon). One of the mildest consistent signs of asthma is slightly increased respiratory effort at rest (often not appreciated by the owner). If spontaneous coughing is not evident, it may be possible to elicit a cough during laryngeal/tracheal palpation. Auscultation of the trachea may reveal rough breath sounds (mucopus in tracheal lumen, tracheal ‘rattle’). Auscultation of the chest may reveal variable abnormalities including a prolonged (sometimes biphasic) expiratory phase, wheezes (narrowed small airways), & crackles. In some cases, it is relatively ‘difficult’ to hear any breath sounds when considered in terms of the increased respiratory effort. Auscultation is somewhat insensitive for diagnosis – abnormalities may not be clearly evident (sensitivity may be enhanced by auscultation following exercise or during re-breathing examination). There may or may not be an evident ‘heave line’ (very inconsistent). Fever is not usually identified in asthma cases (unless complicated by secondary bacterial infection/bronchopneumonia - uncommon). Look carefully at the patient and also examine the accommodation environment for dust. It may be helpful to request that the owner keep a diary/log of the patient's activities coupled to what is going on in the barn environment at any time during the course of several days. Important sources of problematic dust may be identified inside and outside. Presence of cobwebs or black mold growing on walls in a barn environment suggests that ventilation is suboptimal.

Diagnostic tests for corroboration and characterization:

Routine **blood work** (hematology and plasma/serum biochemical profile): rare to identify any abnormalities – but useful to rule-out infectious disease/pneumonia/pleuropneumonia (when there are often hematological changes consistent with inflammation) or other comorbidities. Arterial blood gas analysis: hypoxemia is often present (may improve following bronchodilation).

Ultrasonography of the chest: findings usually WNL; in some cases, pulmonary wetness (increased comet tails/B-line artifacts) may be evident.

Radiography of the chest: usually reserved for refractory/unresponsive (within 2 weeks) cases, for those horses with an inspiratory component to ventilatory difficulty (more likely interstitial lung disease), and those horses with fever (concern with infectious pneumonia). Chest radiography is most helpful for ruling out important differentials – it is not very helpful for confirming the diagnosis of asthma. Some asthmatic horses have an expanded lung field that is radiographically evident (pulmonary hyperinflation).

Endoscopy of the respiratory tract: rule out co-morbidities (such as laryngeal/pharyngeal conditions, etc). See large quantities of mucopus in airway with asthma. With long ‘scope, can see the bronchial bifurcation – may observe blunting/rounding of the tracheal septum (due to pulmonary hyperinflation).

Airway fluid cytology: Bronchoalveolar lavage (BAL) is the preferred method (compared with trans-tracheal wash). See ‘sterile’ neutrophilic inflammation, excessive mucus, and increased number of Curshmann's spirals. BAL may support diagnosis in mild cases in the absence of prominent clinical signs or significant tracheal lumen exudate. Bacteriological culture of airway typically yields zero pathogens or opportunists (advancement of the URT microbiota in face of a dysfunctional mucociliary escalator).

Test therapy: Dyspneic patients (early stages) usually improve quickly following administration of a bronchodilator (such as albuterol by inhalation OR atropine or Buscopan™ administered IV).

Pulmonary function tests: offered at some centers, but not widely available.

Important differential diagnoses:

Other (milder) forms of asthma.

Summer pasture-associated obstructive pulmonary disease (SPAOPD); now referred to as Equine Pasture Asthma

Acute viral airway inflammation

Interstitial pneumonia (pulmonary interstitial fibrosis) (Equine Multinodular Pulmonary Fibrosis, EMPF)

Infectious bronchopneumonia (viral, bacterial, fungal) and pleuropneumonia

Eosinophilic pneumonitis

Lungworm parasitism (*Dictyocaulus arnfieldi*)

Exercise-induced pulmonary hemorrhage

Pulmonary/thoracic neoplasia

Smoke inhalation

Anhidrosis (exercise intolerance, hyperthermia, tachypnea, nostrillar flaring, etc)

Pneumothorax (usually following trauma)
Diaphragmatic hernia (often following trauma)
Arytenoid chondropathy/chondritis

Management of RAO: Most early cases respond favorably (completely returning to normal pulmonary function) with management advice (drugs not necessarily needed). The critical part of management advice is to identify and avoid potential sources of inhalant atmospheric dusts that both cause and drive/perpetuate airway inflammation (see below). Dietary supplementation with an n-3 ('omega-3') polyunsaturated fatty acid supplement is helpful. Dietary advice intended to reverse obesity may be needed in some cases.

In more severe and advanced cases, it may be necessary to combine atmospheric management advice with drugs. The two key drug categories for management of airway disease are **bronchodilators** and **corticosteroids**. Various other drugs have been advocated, marketed, but have generally failed to reliably produce clinical improvements. Examples of drugs that are generally not helpful for the management of equine airway inflammation include: antihistaminics, NSAIDs, antibiotics, etc. In some cases, antibiotics cause short-term improvement because they inhibit the microbial extension from the URT that results from disrupted mucociliary function.

Drugs should be used if management changes are either ineffective or if management adjustments are not practical or insubstantial for a given patient circumstance. There are two methods for drug administration for horses affected with airway inflammation: systemic and inhalation drug administration. Sometimes, both methods can be used together. Inhalant drugs are recommended and preferred where possible because they reduce the likelihood of systemic side effects (such as adrenal suppression and increased risk of endocrinopathic laminitis resulting from systemic corticosteroid administration). However, setting up a client for inhalant drug administration is somewhat more time consuming for the client and somewhat more expensive. It is very important to remember to NOT administer a bronchodilator (inhalant or systemic) if the patient is presently (or will shortly) be in a dusty environment – bronchodilator administration can increase exposure of lower airways to dust and worsen progression of the disease.

There is good evidence that dietary (oral) supplementation using an n-3 polyunsaturated fatty acid product ('omega-3 PUFA') can be very helpful in the management of equine asthma. Several proprietary products are available on the market for horses, some based on Flax Seed and others based on fish liver oil.

The Summer Pasture form of equine asthma:

Be aware that some horses develop signs of respiratory distress (increased rate and effort of breathing, cough, nasal discharge, etc) in the summer. This condition has been previously referred to as Summer Pasture-associated obstructive pulmonary disease (SPAOPD) and is now referred to as Equine Pasture Asthma. As the name suggests, affected horses develop airway sensitivity to atmospheric dusts associated with the outdoor environment in summer (molds, pollens, but also heat and humidity play a role). Affected horses are said to have developed a 'summer cold'. As with the severe asthma syndrome, horses affected with pasture asthma can develop marked hypoxemia and air hunger at rest. In its early stages, it is reversible, but untreated, it will lead to permanent pulmonary dysfunction. Most cases are seen at the end of summer and in the fall season, but some will present to veterinarians in the spring. In the early stages of this disease, affected horses may be asymptomatic in the winter (unscrupulous owners may try to sell these horses in the winter when there are no signs of a problem). Pasture asthma is most commonly reported in the Gulf Coast states (prevalence of 3-5% in Louisiana). Affected horses eventually become respiratory cripples and lose a lot of weight.

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

- Optimize the weight of affected horses (which are sometimes too fat)
- Fresh (outdoor) air is usually very important (exception = SPAOPD)
- Avoid all dusty environments
- Do not accommodate inside barn unless absolutely necessary
- Do not feed with hay unless absolutely necessary (use a complete pelleted ration) – if hay will be used, it is recommended to STEAM the hay (<https://www.haygain.us/collections/hay-steamers>)
- Allow access to appropriate grazing
- Avoid excessively dusty paddocks – once initiated, all dust is aggravating to asthmatic horses

- 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 – asthmatic horses may be affected by close proximity to hay, straw, and drying dung piles.
- 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 or farm 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 (cobwebs signify insufficient ventilation)
- Indoor environment should be routinely kept as dust-free as possible
- Do not undertake cleaning operations when asthmatic horses are in the same environment (risk of churning up dust) (remove horse from environment before cleaning operations)
- Do not accommodate in close proximity to dusty arenas
- Do not run leaf blowers (diesel exhaust) in the barn
- If hay must be used (ideally it will not), use only the best quality hay which is neither dusty nor moldy (steaming hay is a good idea)
- 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
- Big "round bale" hay is relatively poor quality and should not be used with asthmatic horses
- Hay may be soaked under water (complete immersion) prior to feeding (eg: in a plastic hay net) for 30 minutes immediately prior to feeding and fed in a hay net, dripping wet; unconsumed wet hay should be removed within 2 hours (soaking promotes mold growth)
- Exercise in cold weather may bronchoconstriction and should be avoided
- Minimize ammonia build-up from wet bedding/urine pooling and inefficient stall drainage
- Use cardboard bedding (www.airlite.com)
- 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
- Avoid cigarette smoking people
- If hay has to be fed, it should be fed on the ground, not at head level in a hay net.
- asthma horses should not be allowed outside in summer/fall – they must be isolated from the outside environment (no pasture turn out whatsoever!)
- Hot, humid summer conditions are exacerbative for asthma in some instances
- When faced with a disbelieving owner or barn manager, it is suggested that environmental air quality testing should be undertaken (this service is offered by various commercial environmental labs).

What is the difference between severe asthma (RAO) and mild asthma (IAD)?

The clinical expression of these two conditions is very similar. In recent years, it has become appropriate to strive to make distinction between the two. However, many of the diagnostic approaches and treatment/management recommendations are identical. Some have suggested that mild/moderate asthma (IAD) simply represents an early stage of severe asthma (RAO) (this is not confirmed). Here are the (important) distinguishing features:

Clinical presentation: Mild/moderately asthmatic horses tend to be younger (1-10 years) but can be any age whereas severely asthmatic horses are at least 6 or 7 years of age. The presenting clinical problem for mild/moderately asthmatic horses tends to be one of reduced exercise capacity (impaired performance) – it is recognized as a problem for exercising horses and may not be evident at rest; severely asthmatic horses usually display increased respiratory effort at rest and may be described as having ‘air-hunger’ at rest. Other clinical signs of airway inflammation (such as coughing) are present to a lesser degree in mild/moderate asthma.

Results of diagnostic tests: Again, diagnostic test results can be very similar between both syndromes. Markers of ‘severity’ (example: quantity of tracheal mucopus) are less in mild/moderate asthma than severe asthma. The nature of the cytological characteristics of airway fluid (BALF) differ between the two conditions – severe asthma is characterized by neutrophilic inflammation whereas mild/moderate asthma is characterized by increased numbers of eosinophils, lymphocytes, and metachromatic cells (mast cells and basophils).

Pharmacological strategies that may be used for the management of equine asthma:

Commonly recommended drug strategies:

If a decision is made to use drug treatment for the management of asthma, the next question pertains to method of administration. In severe cases, systemic drugs may be deployed alongside nebulized drugs to bring the condition under control. Systemically administered corticosteroids may be used alongside an inhalant corticosteroid (such as ciclesonide) and an inhalant bronchodilator (such as albuterol) for the first 3-4 weeks of treatment. When the clinical signs have improved, the patient can be managed using only daily inhalant drugs thereafter (‘maintenance therapy’). It will usually require 3-4 weeks to achieve a satisfactory clinical response. Ciclesonide is available in the USA as Aservo EquiHaler™ from Boehringer-Ingelheim.

Commonly recommended drug strategies:

Example of a dexamethasone dosing regimen:

Week 1: 0.165 mg/kg PO SID

Week 2: 0.083 mg/kg PO SID

Week 3: 0.04 mg/kg PO SID

Example of a prednisolone dosing regimen:

Week 1: 500 mg, PO, BID

Week 2: 400 mg, PO, BID

Week 3: 300 mg, PO, BID

Week 4: 200 mg, PO, SID

Inhalation drug distribution can be improved when used following albuterol administration.

Fluticasone propionate (Flovent-220™, 2 µg BID, 9-12 puffs BID)

Our recommended inhalant bronchodilator is albuterol (beta-2 agonist). This drug is powerful and has a rapid onset (5 minutes) and its effect lasts ~1 hour. The rapidity of its action means that it can be used for ‘rescue’ if needed. Inhalant albuterol is useful for purposes of demonstrating reversibility of bronchoconstriction in a given patient.

Here is a relatively affordable source of albuterol:

[Pro Air 8.5 HFA, contains 200 (90 mg) puffs, \$50, \$0.25/puff, 720 µg dose = 8 puffs, ~\$2/treatment]

Patients should not be exposed to respirable dust when using potent bronchodilator treatment.

An alternative inhalant bronchodilator is Fenoterol (1,000-1,500 µg q 4-6 h).

Clenbuterol hydrochloride (Ventipulmin™) may be also used as an orally-administered bronchodilator.

25% of horses respond to low dose (0.8 µg/kg BID)

75% of horses respond to higher dose (1.6 µg/kg BID)

Deploy in step-wise dose increments

Clenbuterol also exhibits mucokinetic and anti-inflammatory effects in vitro

It can be excitogenic and affects heart at higher doses (2.4 µg/kg)

Atropine (0.01-0.02 mg/kg, IV) (and N-butylscopolamine, or Buscopan™) (~7 ml, slow, IV) may be used as a bronchodilator. It has a short half-life (~ 2 h). There is some risk of ileus (colic) but the risk is not high when used as a single dose. Atropine also desiccates bronchial secretions – this is undesirable.

Ipratropium bromide (inhalant version of atropine) might also be considered (marketed as Atrovent™). It is not as rapidly acting as albuterol and is therefore not a 'rescue' drug. Rather more expensive!

Magnesium sulfate may be administered IV to promote bronchodilation in refractory cases (40 mg/kg of body weight, IV, over ~20 minutes).

Useful new product: Boehringer-Ingelheim recently introduced an inhaler specifically for horse affected with asthma. The product is Aservo™ EquiHaler™. It facilitates administration of an effective corticosteroid for use in the management of asthma: **Ciclesonide** inhalation solution.