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CHRONIC RESPIRATORY DISEASE: IS THERE A NUTRITION LINK?

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Introduction

Chronic respiratory disease is common in horses. The best known condition is chronic obstructive pulmonary disease (COPD), a disease characterized by chronic cough, increased respiratory rate, forced abdominal breathing, and exercise intolerance. Feeding and housing management play a critical role in the perpetuation of COPD. Specifically, dusts and molds contained within feed and bedding can trigger the allergic responses within the lung that ultimately result in development of COPD. Therefore, management of affected horses is heavily reliant on measures that minimize exposure to these airborne irritants.

“My horse has allergy problems” is not an uncommon statement by horse owners. Nutritionists are frequently put on the defensive by this statement because, in many situations, diet is identified as the most likely cause for these problems. Allergy or, more correctly, hypersensitivity refers to an altered state of immunoreactivity resulting in self-injury. Stated another way, an allergic reaction occurs when the immune system “overreacts” to a specific stimulus. Clinical signs of hypersensitivity reactions will vary depending on the severity of the reaction, the body system(s) involved, and whether the reaction is localized or generalized.

In the horse, the skin and the respiratory tract are frequently affected by hypersensitivity reactions. Urticaria, contact dermatitis, and insect hypersensitivity are examples of hypersensitivity-induced skin disease. Some authors and, in particular, commercial laboratories that offer allergy testing services believe that food allergy (to feed ingredients such as oats, corn, alfalfa, beet pulp, and barley) is an important cause of these skin reactions. The infamous “protein bumps” is an example of an urticarial reaction. In reality, skin hypersensitivity reactions are very rarely due to diet. More commonly, these reactions are due to insects, parasites (e.g., *Onchocerca* spp.), bedding, tack, drugs, and various other agents that, upon contact with the skin, may trigger a hypersensitivity reaction.

The most common equine disease with an allergic basis is chronic obstructive pulmonary disease (COPD), also known as recurrent airway obstruction, small airway disease, or heaves. Inflammatory airway disease (IAD) is a term used to describe a milder clinical syndrome that is frequently observed in younger horses.

Currently, there is no consensus whether IAD progresses to the more severe syndrome in the older horse. The remainder of this paper discusses these chronic airway diseases.

Chronic Obstructive Pulmonary Disease

COPD is a common respiratory tract disease of horses in temperate climates where horses are stabled; the condition is quite rare where horses are kept outside year-round. The exception is summer pasture-associated obstructive pulmonary disease. This condition, which is mostly a problem in the southern states, develops during the summer months when horses are at pasture. The cause of the pasture-associated disease is not known, although a hypersensitivity reaction to pollens is suspected.

The clinical signs of COPD are usually observed after exposure to hay and straw dust during stabling. In this sense, nutrition does play a role in the development of COPD. However, this author has also seen the clinical signs of COPD (e.g., cough, increased respiratory rate, exercise intolerance) attributed to a true “food allergy.” This diagnosis is often based on the results of a RAST test, a blood test that measures concentrations of immunoglobulin E (IgE) specific to various allergens (inhaled and food). However, these tests are notoriously unreliable for the diagnosis of hypersensitivity conditions, mostly because the IgE measurements are nonspecific. Typically, both normal and diseased horses will have “positive” blood tests for the various IgE types assayed, reflecting a level of exposure rather than susceptibility to COPD or other hypersensitivity reactions. Therefore, the RAST test is not useful for differentiating normal horses from those prone to hypersensitivity reactions. Unfortunately, some veterinarians and owners interpret these “positive” test results as proof of a food hypersensitivity and proceed to remove various ingredients from the diet. Similarly, no relationship has been demonstrated between skin and lung airway reactivity. Therefore, there is no justification for the use of skin testing procedures, wherein tiny amounts of various purported allergens are injected into the skin, for the identification of culprit allergens.

The main cause of COPD is an allergic response to organic dusts, including molds in feed and bedding. In this respect, equine “heaves” resembles those human occupational lung diseases caused by inhaled organic dusts. Dust in horse stables contains over 50 types of molds, large numbers of forage mites, endotoxins, and other inorganic factors. The primary source of organic dust is hay and straw. Many of the molds contained in hay and straw are sufficiently small to reach and deposit in the small airways of the lungs when breathed in by the horse.

Water content at the time of baling is the most important factor in determining the mold count of hay or straw (Clarke and Madelin, 1987). Baling at 15 to 20% water content is associated with little heating. However, baling at 20 to 30% water may result in heating and moderate mold contamination, while baling at 35

to 50% water leads to spontaneous heating to 50 to 60° C and very heavy mold counts.

The concentration of molds and other organic dusts in the horse's breathing zone, the airspace around the nose, is a critical factor in the development of disease exacerbation in COPD-susceptible horses. Although horses can and do inhale organic dusts present in straw, hay is the major source of these aeroallergens. Characteristic feeding behavior, such as eating hay for long periods and shaking the hay, results in dust concentrations in the breathing zone that are much higher than in the rest of the stable (Woods et al., 1993). Therefore, while bedding and barn ventilation are considerations in improving the environment of COPD-affected horses, it is more important to remove the offending hay. This helps to explain the occurrence of COPD episodes in horses even when kept outdoors such as a susceptible horse given access to large round bales that contain significant mold contamination.

COPD is very similar to human asthma. Exposure of COPD-susceptible horses to hay and straw dust initiates inflammation in the lower airways (Robinson et al., 1996). This inflammatory response results in the accumulation of mucus in the airways, edema or thickening of the airways, and bronchospasm (airway narrowing). During clinical episodes, the airways are also hyperresponsive to nonspecific stimuli such as ammonia and other air pollutants, resulting in severe bronchoconstriction. Importantly, these lung changes are reversible after removal of the offending allergens.

In mild cases, the horse may appear normal at rest. However, during exercise, the horse may cough and discharge mucus from the nostrils. Horses with more severe COPD have obvious clinical signs at rest; these include frequent coughing, nasal discharge, increased respiratory rate, and increased effort of breathing. These horses will be exercise intolerant. Forced expirations eventually result in overdevelopment of the abdominal muscles, recognized as a "heave line." In individual horses, clinical signs often wax and wane, with more severe disease when the horse is stabled. Sudden changes in management or feeding (e.g., a new batch of hay or straw) can precipitate very severe clinical episodes. In most cases the severity of the clinical disease worsens with time unless prevented by treatment and management changes.

It is important to recognize that there is no cure for COPD. However, in all but the most severe cases, management and treatment measures can result in marked clinical improvement and minimize the number of further episodes. The most important component of treatment is environmental control to reduce exposure of the horse to the aeroallergens and other pollutants that cause the airway inflammation (Mair and Derksen, 2000; Jackson et al., 2000). Keeping the horse at pasture, without exposure to hay and straw, is by far the most effective means of environmental control. Indeed, in horses with signs of COPD, significant improvement in lung function can occur within three days of changing from a stable to a pasture environment (Jackson et al., 2000).

If the horse must be stabled, removing dry hay from the diet is the most important aspect of environmental control (Vandenput et al., 1998). In mild cases, soaking the hay prior to feeding is often effective in reducing dust levels in the horse's breathing zone. The hay must be thoroughly soaked, preferably by immersing the hay in a large tub of water for a 10-15 minute period. Dry areas in a poorly soaked hay portion can release enough mold spores to cause an allergic reaction. This process should be done no sooner than 20 to 30 minutes before feeding to avoid leaching of water-soluble nutrients from the hay.

A much less labor intensive approach involves use of alternative forages such as hay cubes, haylage, or complete pelleted feeds. Clinical experience has shown that these hay alternatives are necessary in severely affected horses. Haylage and silage are becoming more popular in the industry. Owners should be advised not to use broken or damaged haylage/silage bags and to use open bags within two to three days of opening; mold counts in haylage or silage can increase rapidly after exposure to air.

Bedding is the other major source of dust and mold spores in a barn. COPD horses should not be bedded on straw. Shredded paper, wood shavings, rubber mats, or peat moss should be used. It is also preferable to bed the stalls adjacent to the one used by the affected horse with the same bedding, although recent studies have demonstrated that clinical improvement occurs even when management changes are made only in the stall of the affected horse (Jackson et al., 2000). Horses should be turned outdoors during stall cleaning and re-bedding to minimize exposure to respirable dust. Barn ventilation is another consideration in optimizing the horse's environment. The build-up of ammonia, endotoxins, and other noxious agents can worsen the disease and delay recovery, even when other treatment measures have been instituted.

In mild cases, environmental management alone may effectively control the disease. However, horses with moderate to severe signs of COPD will also require medical treatment, at least initially. Treatment will often involve combined use of bronchodilator and corticosteroid drugs. Bronchodilator drugs (e.g., clenbuterol) are particularly indicated for horses experiencing an acute "heaves" attack – relief of bronchospasm will result in marked clinical improvement. However, this relief is short-lived and longer term drug therapy must be directed at reducing airway inflammation. This is achieved through use of corticosteroid drugs. Although environmental management will always be the most important factor in the control of COPD, some horses will require long-term treatment with corticosteroids to control the underlying airway inflammation.

Inflammatory Airway Disease

As mentioned, IAD is a term used to describe a much less severe form of chronic lower airway disease that is commonly diagnosed in young racehorses in training (Moore, 1996; Hoffman et al., 1998). These horses exhibit clinical signs of low-

grade airway obstruction, including cough and mild nasal discharge. Furthermore, this syndrome is regarded as an important cause of poor exercise performance. At present, the relationship between IAD and COPD is unknown; however, it is possible that IAD can progress to the more severe syndrome of COPD with advancing years. The cause of IAD is also uncertain. Preceding viral infection, the inflammatory effects of repeated episodes of exercise-induced pulmonary hemorrhage ("bleeding") and hypersensitivity responses to inhaled environmental pollutants (including organic stable dusts, ammonia, and endotoxin) all may play a role in the development of this condition. Regardless of cause, the therapeutic measures recommended for the management of COPD, particularly environmental control, are also indicated in the treatment of IAD.

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