Preventing and Managing Respiratory Disease

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The health and well being of horses depends on healthy lungs. Poor air quality can contribute to various respiratory disorders in horses and in the people who care for them.

The Costs and Demands of Respiratory Function

Athletic performance puts extra demands on the equine respiratory system. At rest, the horse will breath approximately 12 times in 1 minute. Each breath is approximately 5 litres in volume. Therefore, at rest, the horse will inhale and exhale approximately 60 litres of air per minute. However, during competition, the horse will increase the volume of air per breath to between 12 and 15 litres taking over 150 breaths per minute. The lungs now have to move over 2,250 litres of air per minute, with less than half a second for each breath. The breathing patterns of equine athletes are closely linked with locomotion. The cantering or galloping horse has respiration and locomotion locked into a 1:1 phase. With each stride the horse will be taking a breath. The galloping horse takes over 150 breaths per minute. This is in contrast to a trotting or pacing horse, which takes upwards of 70 breaths per minute with between 20 and 25 litres of air per breath. Thus, the galloping horse takes shallower and more frequent breaths than the trotter or pacer. However, both athletes have to move large volumes of air efficiently to compete successfully. Even a small increase in the amounts of mucus in the airways, and minor degrees of airway spasm will adversely affect performance.

The Respiratory System

The horse's respiratory system can be divided into the upper and lower airways. The upper airways consist of the nasal passage, pharynx, larynx and the trachea or windpipe. Air enters the nostrils and is warmed and humidified by the wafer thin, blood rich scrolls of bone known as turbinates prior to entering the trachea. Large particles in the air are trapped here as a first line of defence of the lungs. The air then travels through the trachea to the lower airways. The lower airways consist of the lungs, including the smaller branching airways (Figure 1.). The next line of defence against inhaled irritants is provided by cilia, tiny hair-like projections that line the airways. In addition to cilia, there are mucus-producing cells in the linings of the airways. Cilia normally beat in a thin layer of mucus, directing movement up the airways, much like an escalator. Groups of lymphoid cells are scattered throughout the airways. These form and maintain the lung's immunity to many infectious agents.

The inward journey of air through the airways comes to an end at the alveolar sacs. It is within these sacs and across a very fine membrane, known as the alveolar membrane, that gas exchange occurs. Oxygen passes across the membrane into the red blood cells and carbon dioxide passes back across the other way. Oxygen is necessary for the survival of the tissues and carbon dioxide is a by-product of energy production. The journey of this stale air back out of the lungs then commences as the horse exhales.

A final defence barrier exists in the alveoli. Tiny inhaled particles, which get passed through the turbinates and airways land in the air sacs and are cleaned up by cells, called macrophages. These cells engulf material ranging from tiny particles of dust to bacteria. However, they can be overloaded. For example, heavy burdens of dust can decrease the ability of those cells to fight infectious agents such as bacteria. A horse in a dusty environment will therefore be more prone to infection than a horse in a cleaner environment.

The lung evolved to deal with air. To maintain a healthy lung, it is important to minimise pollutants it is exposed to.

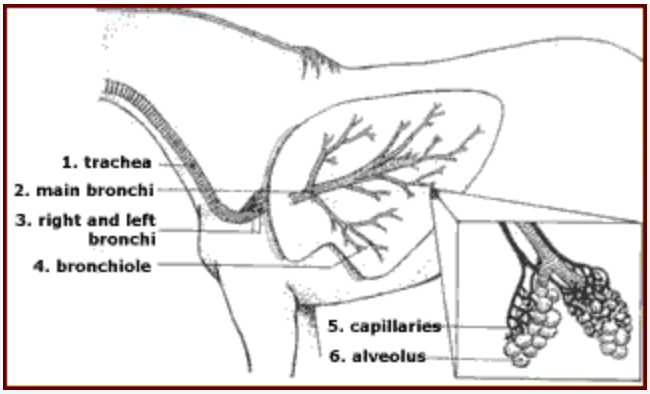

Figure 1. Lower Respiratory System of the Horse

Inflammation of the Small Airways

Poor air quality can contribute to respiratory disorders ranging from the allergic condition known as “heaves” or Chronic Obstructive Pulmonary Disease (COPD) to an inflammatory condition known as Small Airway Disease. Heaves is an allergic disorder believed to be triggered by irritants in the horse’s environment. Heaves can manifest in many degrees of severity. At worst, a horse suffering from heaves will show obvious symptoms while at rest. These include a chronic cough, flared nostrils and forced abdominal breathing.

Small Airway Disease is not a full blown allergy as in the case of heaves but is an inflammatory process. It usually becomes apparent when the horse is put under extreme exertion. This inflammation may not become apparent in the horse that is used for pleasure although the disease can become more severe with time until even light exercise becomes distressing.

Poor air quality may also compound respiratory tract infections and contribute to transportation stress.

Common Causes of Small Airway Disease

There are three common causes of small airway disease:

1. 1. Infectious agents (including bacteria and viruses)
2. 2. Airborne dust (including “nuisance” dust and allergens)
3. 3. Noxious gases (including ammonia)

It should always be highlighted that the above causes can interact in many ways. For example, dust can increase a horse’s susceptibility to infection. Equally, a horse suffering a respiratory tract infection in a dusty environment will take a lot longer to recover than if it was breathing fresher air.

Turn Out

Most horses can tolerate winter outdoors given enough fresh food and water, a shelter with southern exposure and a heavy hair coat or sufficient blanketing. A run-in-shed can help keep them dry and provide shade for those hot days. Ideally, run-in-sheds should slope towards the entrance (for drainage) and open down-wind. Windbreaks can also help create more shelter. Check wind directions and use evergreens or manmade designs. If blanketing your horse, make sure the blankets are clean and in good repair. Remember that eating hay will generate heat for your horse, therefore, if possible increase the amount of forage your horse is receiving. Generally grass hay has a higher fibre content than alfalfa and, therefore, will generate more heat and provide more “chew time”.

When horses cannot be turned out managing the indoor air quality becomes critical. Remember, prevention is the best cure.

Dust
Dust in the stable can be irritative, infectious or allergenic. Each particle can play more than one role. Dust can be divided into two groups, “nuisance dust” and allergens. “Nuisance dust” includes plant particles that can irritate the respiratory tract. Allergen sources include mould spores, pollen and mites. The chance of a dust particle inducing disease as an irritant or an allergen is dependent upon the amount retained in the respiratory tract. Deposition and clearance of particles are dependent on the size, shape and type of particle that is inhaled. The smaller dust particles have a higher chance of reaching the lower airways.

Forage
Hay is the single most common source of dust and mould spores for the horse. Climatic conditions can make it difficult to properly cure field-dried hay. There are many types of fungi living in the field where our crops are grown and all hay will have some mould spores present. The spores from these types of mould (“field fungi”) are usually large and do not have a good chance of reaching the lower airways. The mould spores that are cause for concern are associated with hay that has been baled damp, as can happen after a summer with a large amount of rain. The high moisture content influences the fungi in the hay and metabolic activity of the organisms causes the temperature to rise. The moulds that thrive in this high moisture and heat are very prolific. The spores from these moulds are very small and when inhaled can travel deeply into the lungs. Also, in heavily moulded hay the nutritional value can decrease. Research has shown that mouldy hay cannot always be visually judged.

Management Methods

The soaking of hay is a time-proven method of minimising our horse’s exposure to mould spores and dust. If you soak, it is essential that the hay is thoroughly wet. Dry areas of hay in a poorly soaked bale can release enough spores to cause problems. Ideally, hay should not be soaked for more than a ½ hour or else water-soluble nutrients leach out and fresh water should be used each time. Hay that is fed indoors should be soaked and fed close to or on ground level. One last point: if you soak your hay, don’t forget to do so when you trailer your horse as well.

Alternative Forage Products
Soaking hay is a very effective method to reduce dust exposure but can be labour intensive or impractical in colder climates. Alternatives to hay such as hay cubes or haylage can be fed.

There are two basic forms of hay cubes. One is produced from previously baled hay, therefore, the quality of the cubes is dependent on the quality of the bales used. The other method is to take the plants directly from the field and cube it. This approach minimises nutrient loss and moulding that can occur.

Haylage is grass or legume that is baled with a high moisture content but sealed in airtight plastic bags. Haylage and silages are being used with increasing success as alternatives to hay. They rely on a fermentation process to increase acidity and inhibit the growth of mould and bacteria. When the bags are opened to feed, they should be fed within a few days as this product moulds very quickly once it has been exposed to air. Broken or damaged bags should not be used, nor should bags that smell of ammonia or contain dirt. There have been some problems of botulism associated primarily with big-bale silage. Studies at the Equine Research Centre have shown that the dust challenges faced by horses is lower when fed alfalfa cubes, haylage, a complete pelleted feed or soaked hay, as compared to dry hay (Figure 2).

Preservatives and drying agents, such as propionic acid or salts, have been used to shorten drying time and preserve nutrients when producing hay. However, if not treated uniformly, moulding can still occur. Palatability and feed intake can also be affected.

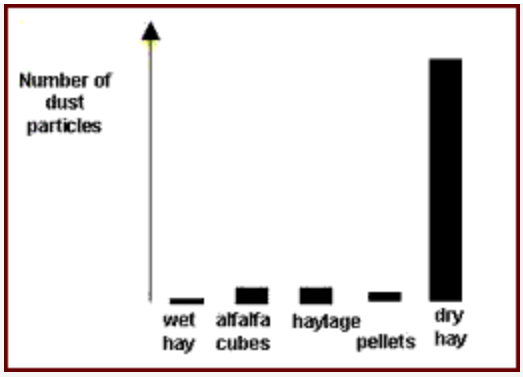

Figure 2. Dust particles associated with five forage products during feeding.

Mycotoxins

Another danger that mouldy hay poses is the presence of mycotoxins. Mycotoxins are substances naturally produced by some types of mould. They may contribute to reproductive, immunological, respiratory, gastrointestinal and other disorders in the horse. Mould and subsequent mycotoxin contamination of forage can increase in extreme environmental conditions such as droughts or heavy rain followed by cold weather, or from mechanical damage to the forage.

Bedding

Bedding is another common source of dust and mould spores in the stable. Typically, even the cleanest of straw contains significantly more small, respirable fungal spores than alternative beddings, such as wood shavings, paper, peat or the new synthetic beddings (Figure 3). Your choice of bedding will depend on a combination of personal preference, cost effectiveness, local availability and type of horse housed. Bedding should be dust and mould free, absorbent, supportive and easy to use and dispose of (Figure 4). A barn with proper ventilation and floors with proper drainage are as important as your choice of bedding.

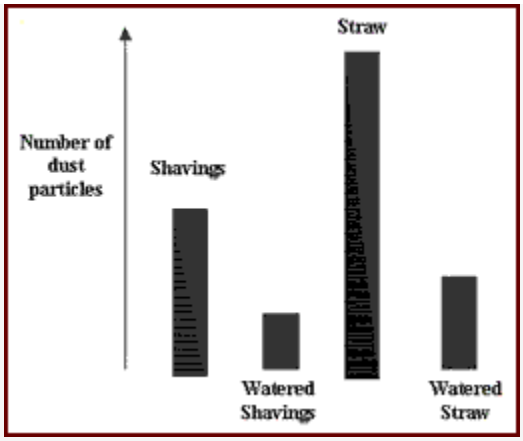

Figure 3. Dust particles present in a stall during mucking.

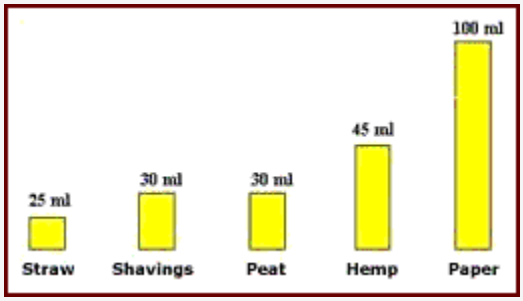

Figure 4. Bedding Absorbency – the amount of water (ml) each bedding (10 g) can absorb.

Ammonia

Ammonia is an irritant and is a recognised concern of stable management. The horse's urine and faeces is the source of ammonia. Ammonia is released by the action of bacteria that degrade organic matter. Ammonia inhibits the ability

of the defence mechanisms in the airways to remove particles from the lung. Ammonia can also increase mucus production. Ammonia can be particularly high when stalls are being mucked out (Figure 5). If the horse is left in the stall during mucking, it will be subjected to high levels of ammonia and high levels of dust. The more absorbent a bedding is, the lower the levels of ammonia will be.

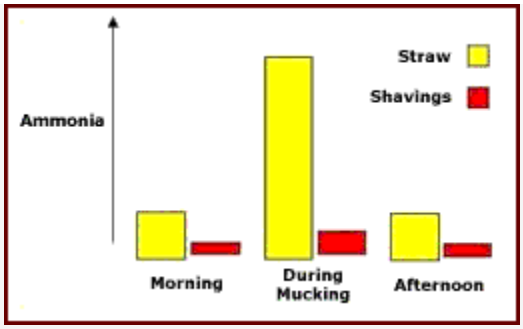

Figure 5. Ammonia measured in a stall 1 foot above floor level.

Barn Ventilation

A well-ventilated stable will help to minimise the horse's exposure to a wide range of irritants. In a naturally ventilated barn air will move, mainly in one of two ways (or a combination of the two), thermal buoyancy or wind. Air movement by thermal buoyancy or the "stack effect" is driven by temperature differences (Figure 6). Air enters the barn through lower openings (inlets). This air is then mixed with the warmer air inside the barn. The air inside the barn is warmed from heat coming from the horses or activities in the barn. Warm air rises and exits the barn from higher outlets. This displacement of air causes more air to be drawn in the inlets, thus the air changes in the barn. Wind will increase the ventilation rate from that due to temperature differences alone. During the winter the barn still needs to be ventilated but not draughty. Ideally, air should move slowly through small openings and circulate throughout the barn.

Insulation and proper ventilation work very well together. The barn interior needs to be warmer then the outside temperature for ventilation purposes. The temperature differential causes air movement (remember: warm air rises) and the warmer air holds more moisture than cooler air, carrying it back outside. Ideally, walls and ceilings should be insulated. Heat? Heating is usually not necessary in a horse barn but if you find your barn cold and clammy it is better to add supplemental heat than to reduce ventilation. There are a number of infrared heaters on the market that are safe for barn use.

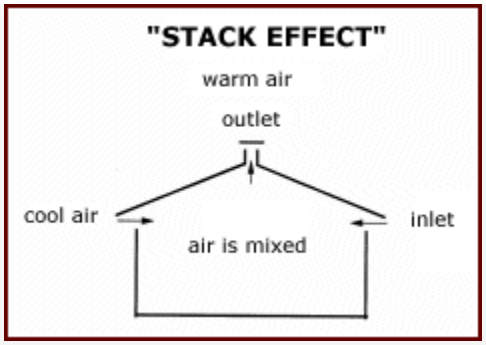

Figure 6. The Stack Effect.

Barn Management Tips

Considerable short and long-term demands are placed on the equine lungs. Special attention must be paid to the quality of the air, which our horses breathe. Pharmaceuticals will continue to play an important role in the treatment of respiratory problems but prevention is better than cure.

For consideration in everyday stable management:

- wet all hay that is fed indoors and feed close to ground level or feed a good quality, low dust alternative forage product
- remove the horse from the barn when mucking
- sprinkle the barn aisle with water when sweeping or raking
- use a quality bedding and muck out daily (avoid deep litter systems)
- consider barn ventilation for all seasons
- increase turnout time with shelter