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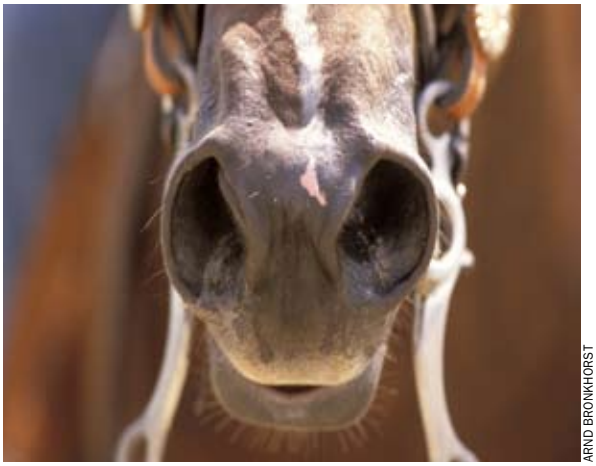
YOUR GUIDE TO EQUINE HEALTH CARE

The Equine Respiratory System

Understand basic anatomy and function of the respiratory system and what can go wrong

Overview

The respiratory system shuttles air to and from horses' lungs where respiration—the exchange of oxygen for carbon dioxide—occurs. The respiratory tract of the horse is a highly specialized organ system that can move extremely large volumes of air in and out of the lungs each minute.[1] Not surprisingly, respiratory system dysfunction is a leading and important cause of exercise intolerance and poor performance in horses.[2] Abnormalities can exist at any point along the respiratory tract, including structural (anatomical), functional, and infectious conditions, all of which can negatively impact performance and quality of life.



ARND BRONKHORST

The horse's respiratory tract is designed to move extremely large volumes of air in and out of the lung each minute.

Structure

The key components of the equine respiratory tract are: the nares (nostrils), nasal passages separated by the nasal septum, the paired paranasal sinuses and guttural pouches, and the nasopharynx (the region extending from the nasal passages to the trachea). The nasopharynx is located dorsal to (above) the soft palate, which is the anatomic extension of the hard palate (the roof of the mouth). The horse's soft palate is long, extending from the end of the hard palate to the base of the epiglottis. Since the epiglottis lies on top of the soft palate, horses are obligate nasal breathers—air cannot enter the mouth to reach the trachea because the soft palate blocks the airflow.

The larynx (voice box) demarcates the junction between the upper and lower airways and is located at the top of the trachea. The epiglottis is one of several cartilaginous structures that make up the larynx. The other cartilages that form the larynx are the cricoid, thyroid, and paired arytenoid cartilages. Other important structures of the larynx include the aryepiglottic folds, the vocal cords, and the glottic cleft (the entrance to the larynx).

The trachea extends from the larynx, down the neck, into the thorax (chest). Within the thorax the trachea divides into two tubes called the chief bronchi. Each of these lead to a lung. In each lung the chief bronchi further subdivide, becoming narrower passages (i.e., the bronchi and bronchioles) in the lungs to ultimately end at the alveoli. Alveoli are microscopic air sacs located at the end of the bronchioles. A well-known analogy for lung anatomy is a bunch of grapes—the stem is the chief bronchi which branches repeatedly, ending at the grape, which represents the alveoli.[3]

Function

Except for the lungs, the respiratory tract is essentially a glorified tube: The upper and lower airways provide a passageway for air to and from the lungs, where respiration occurs. Air enters the nares, passes through the nasal passages (where it is warmed and filtered free of debris), and enters the nasopharynx. Air then passes through the larynx via the glottic cleft and down the trachea to the alveoli.

In the alveoli oxygen in the inspired air diffuses across the extremely thin wall of the alveoli into the bloodstream and carbon dioxide in the blood diffuses into the alveoli. The oxygenated blood in the lungs is then pumped back to the left atrium and ventricle of the heart and circulated through the body.

While the process of respiration appears outwardly simple, the integrated function of many nerves, muscles, cartilage, and other anatomic structures is essential to ensure the unobstructed flow of air to and from the alveoli. This is particularly important in horses exercising at high speeds.

When Things Go Wrong

Considering the complex anatomy of the upper respiratory tract and the tremendous fluctuations in pressure that the upper respiratory tract endures, it is not surprising that respiratory tract dysfunction is common, second only to musculoskeletal abnormalities.[1,2] Some of the more common respiratory tract problems are:

- Infections (e.g., equine herpesvirus, equine influenza, strangles, pneumonia);
- Pharyngeal lymphoid hyperplasia (pimples);
- Dorsal displacement of the soft palate (DDSP, when the soft palate abnormally moves in an upward direction so the end of the soft palate rests above the epiglottis instead of below);
- Nasopharyngeal collapse (narrowing of the nasopharynx);
- Laryngeal hemiplegia (roaring, left laryngeal hemiplegia, caused by weakness or paralysis of the left arytenoid cartilage and vocal fold, resulting in a failure to achieve full abduction of these structures during respiration);
- Epiglottic entrapment by the aryepiglottic fold;
- Exercise-induced pulmonary hemorrhage (EIPH); and,
- Recurrent airway obstruction (RAO,

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also called heaves) and allergic airway disease.

Veterinarians diagnose and treat each of these diseases differently (based on the underlying problem), and the prognosis is highly dependent on the use of the horse.

CONDITION	PREVALENCE
Dorsal displacement of the soft palate (DDSP)	10% to 20% of athletic horses
Laryngeal hemiplegia (roaring)	5% to 8% of racing Thoroughbreds
Epiglottic entrapment	Approximately 1% to 2%
Exercise-induced pulmonary hemorrhage (EIPH or bleeding)	As high as 87% in Standardbreds and 95% for Thoroughbreds
Inflammatory airway disease (AID)	Up to 50% of racing Thoroughbreds and Standardbreds

Diagnostic Tools

One of the most important diagnostic tools for assessing the respiratory tract is the endoscope. In the standing unsedated horse, the veterinarian passes the flexible scope through the nasal passages to the nasopharynx. He or she carefully evaluates the soft palate and larynx, as these are where many of the abnormalities are found (i.e., DDSP, epiglottic entrapment, roaring). In some horses the source of the problem is not readily diagnosed at rest. These cases can be referred to a specialist to undergo testing on a high-speed treadmill and using videoendoscopy. Alternatively, an "overground endoscope" that remains in place while the horse trains can also be used instead of scoping horses at rest. Endoscopy is also a primary diagnostic tool for exercise-induced pulmonary hemorrhage (EIPH) or "bleeders" (horses that rupture small blood vessels deep in the lungs), as it helps the vet identify blood in the trachea that is coming from the lower airway.

Treatment Options

Upper respiratory tract infections such as equine herpesvirus are usually self-limiting, meaning they resolve after running their natural course. Nonetheless, infections result in decreased performance, lost days of training, can spread rapidly to other horses, and can be costly to treat.

In contrast, DDSP, epiglottic entrapment, and laryngeal hemiplegia are usually managed surgically. The success rates for these procedures are variable. There are no drugs currently licensed for the treatment of EIPH, and affected horses are often managed medically (off-label and with variable success) with drugs such as furosemide and devices such as nasal strips to open the airway. The treatment of airway disease is a combination of environmental management and medications such as corticosteroids and brochodilators.[4]

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