Horses are elite athletes and peak performance demands an optimally functioning respiratory system. The respiratory tract delivers oxygen to the cells for cellular respiration and energy production, and excretes carbon dioxide - the waste product.

In this article, Dr Deryck Tan from Valley Equine Veterinary Centre gives an overview of the anatomy of the respiratory tract and the most common respiratory conditions that compromise its optimum performance.

**Overview**

**Respiratory Disease**

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An article by Dr Deryck Tan, BSc, BVMS Hons I, MANZCVS

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**Anatomy of the respiratory tract**

The respiratory tract is made up of the upper respiratory tract and the lower respiratory tract.

The upper respiratory tract consists of the nose and nasal passages, paranasal sinuses, guttural pouch, the pharynx and the larynx.

The paranasal sinuses are made up of seven pairs of sinuses, namely the frontal, caudal maxillary, cranial maxillary, ventral conchal, dorsal conchal, sphenopalatine and ethmoidal sinuses.

The guttural pouch is situated on either side of the pharynx. The function of the guttural pouch is unknown, but it is thought that it is involved in thermoregulation.

The lower respiratory tract is made up of the trachea, bronchi, bronchioles and lung tissues. Tracheal rings, which are made up of cartilage, keep the trachea open for air to move freely in and out.

As it reaches the lungs, the trachea divides into two bronchi at the carina. The bronchi further divide into bronchioles which, in turn, end in alveoli. The alveolar membrane is thin and moist, and facilitates optimal gas exchange with the circulatory system.

There is an intimate relationship between the respiratory system and the cardiovascular system. The respiratory system delivers oxygen to the alveoli where gas exchange takes place. Oxygen enters the capillaries surrounding the alveoli and from there is carried by the cardiovascular system to other organs of the body. Carbon dioxide, on the other hand, is transported by the cardiovascular system to the lungs where it then enters the alveoli and is then breathed out.

**Diseases affecting the respiratory tract**

There are a number of diseases that affect the respiratory system and the clinical signs associated with respiratory disease are very varied. The causes of respiratory disease are just as numerous with some having a parasitic or infectious component.

Veterinarians use many different techniques and tools to ‘work up’ (diagnose) a case of respiratory disease. These diagnostic techniques and tools range from simple clinical examination to advanced imaging, such as CT scans.

Treatment options for respiratory disease depend on the cause of the disease and, once a diagnosis is made, your veterinarian will be able to go into detail with regards to treatment options.

Did you know?

The horse has a lung capacity of about 55 litres (Lekeux and Art, 1994) compared to about 6 litres in humans (Marieb and Hoehn, 2010). This capacity cannot be increased with training, so the respiratory system is the limiting factor in training racehorses to run faster.
Coughs
Coughing is a very non-specific clinical sign in a horse. A dry cough is usually caused by irritation of the respiratory tract. A wet or productive cough is usually caused by mucus or phlegm in the respiratory tract.

Coughing may be due to irritation caused by a dusty environment, a viral or bacterial infection, or inflammatory or reactive airway disease.

Inflammatory Airway Disease (IAD) occurs in up to 50% of Thoroughbreds and Standardbreds, and is a cause of poor performance and exercise intolerance. The most common signs are a mucoid/purulent nasal discharge and chronic cough.

Nasal discharge
Nasal discharge can be unilateral or bilateral, continuous or intermittent, and can be serous, mucoid, purulent, haemorrhagic or feed contaminated.

Serous nasal discharge
A serous (pale yellow and transparent) nasal discharge is usually associated with allergic rhinitis or a viral respiratory infection.

Mucoid, purulent nasal discharge
A mucoid to purulent discharge that contains pus and is yellow or green in colour may point to a bacterial infection. This may be coming from the lower respiratory tract, but in most cases, discharge originating from the lower respiratory tract is swallowed before it has a chance to exit through the nostrils.

Other causes of mucoid/purulent discharge are sinusitides, either primary or secondary. Discharge from a sinusitis is often unilateral and foul smelling.

Primary sinusitis (an inflammation of a nasal sinus) is caused by defective clearance of mucus from the sinuses, usually as a result of viral or bacterial infection. Early primary sinusitis may respond to antibiotics, but some cases may require trephination - a surgical intervention where a hole is drilled into the sinuses to place a lavage system to wash out the mucus.

Secondary sinusitis may be a result of a tooth root abscess or oro-antral fistula where an empty tooth socket has a direct connection into the sinuses. Where the cause is a tooth root abscess, the offending tooth must be extracted before the sinusitis can be resolved. In the case of an oro-antral fistula, the fistula must be closed, which is a procedure fraught with difficulty and requires expert veterinary dental care.

A foul smelling nasal discharge could also be caused by neoplasia (tumour).

Guttural pouch enpyema is an accumulation of purulent, septic fluid in the guttural pouch. It can present as bilateral purulent nasal discharge. The guttural pouch is a diverticulum of the eustachian tube, a narrow passage leading from the pharynx to the cavity of the middle ear. In this case, there is a decrease in the clearance of mucus from the guttural pouch and secondary bacterial infection results in pus formation. The pus eventually turns into solid chondroids.

Did you know?
The average maximum oxygen consumption during incremental exercise test is 142ml/kg/min for Thoroughbreds and can be as high as 190ml/kg/min. This represents an up to 30 fold increase from resting state. (Hinchcliff et al 2007).

Sinus cysts, abnormal fluid filled sacs that form in the sinuses, can also be accompanied by facial swelling and nasal obstruction.

Haemorrhagic nasal discharge
A bloody nasal discharge could be due to an ethmoidal haematoma, guttural pouch mycosis or head trauma.

Ethmoidal Haematomas originate from the ethmoidal bones and can be visualised by endoscopy. They can also reside in the maxillary sinuses, in which case radiography or sinuscopy will be needed for diagnosis. Treatment is by formalin injection or surgical removal.

Guttural Pouch Mycosis is a fungal infection in the guttural pouches that surround the pharynx. This is a life-threatening condition because major blood vessels and nerves traverse the pouch.

Brown coloured, foul smelling discharge can be a sign of pneumonia or lung abscess.

Fresh blood from one or both nostrils after exercise could be due to Exercise Induced Pulmonary Haemorrhage. EIPH occurs when horses bleed from the lungs after exercise and blood appears at the nostrils. Up to 60% of racehorses bleed from the lungs, but only a minority show blood at the nostrils.

Feed contaminated nasal discharge
If a feed contaminated nasal discharge is present in small amounts, the horse could be suffering from dysphagia (swallowing difficulty) or feed aspiration. This could be a complication of ‘roarer’ or ‘tie back’ surgery.

Feed contaminated nasal discharge could also be caused by an oro-nasal fistula where there is a direct communication between the oral and nasal cavity.

A cause of cogitos nasal discharge contaminated with feed is ‘choke’ or ossephagal obstruction. Although not a respiratory disease, it can result in a secondary pneumonia from inhalation of saliva and food material. Choke is caused by food getting obstructed in the horse’s oesophagus, which is the connection between the mouth and the stomach. The nasal discharge is usually feed-contaminated. Horses choke due to a variety of reasons. Some bolt down their food without chewing properly due to being fed later than usual (hunger) or if they feel threatened of robbery by a more dominant horse.

Commonly, a horse does not chew properly due to oral or dental pain, hence the importance of proper and regular veterinary dentistry. Horses that are used to being fed a wet feed and are suddenly fed a dry feed may also choke. Most horses eventually swallow the obstructed bolus of food by themselves, if left in a quiet place with food withheld. Offering water to a choked horse is a double-edged sword. Since the horse cannot swallow, attempts at drinking may result in water being inhaled into the lungs and causing a secondary pneumonia. However, water in the oesophagus may help soften the obstruction. If the obstruction is not cleared in one to two hours, veterinary intervention is advised.
Respiratory noise

Horses are obligatory nasal breathers, which means they are unable to breathe through their mouths.

Laryngeal hemiplegia (roaring) is a disease where one-half of the larynx becomes paralysed. When one side is paralysed, the affected flap is sucked into the airway when the horse inhales, thus obstructing airflow. Laryngeal hemiplegia usually occurs on the left side. The affected arytenoid cartilage is collapsed and during expiration, a ‘roaring’ noise is heard upon expiration.

Dorsal Displacement of the soft palate occurs when the soft palate goes above the epiglottis. A noise is produced during expiration.

Other causes of respiratory noise are Epiglottic entrapment, Subepiglottic, Pharyngitis and Palatal cysts, Arhythmoid chondropathy, Fourth Brachial Arch Defects and Epiglottic Flickidity.

Airway obstruction

Airway obstruction can be caused by Recurrent Airway Obstruction (RAO), also known as ‘heaves’, by lungworms and collapsed trachea.

RAO varies in clinical signs, from exercise intolerance to difficulty breathing at rest. Affected horses are sensitive to dusts and allergens.

Tracheal collapse occurs in Shetland ponies and Miniature horses. It is a congenital condition and there is no treatment. Some affected ponies make a honking, respiratory sound.

Infectious respiratory diseases

Strangles is a highly contagious respiratory disease caused by Streptococcus equi subspe equi. Lymph nodes become abscessed and enlarged, and may obstruct the airway—hence the name ‘Strangles.’

Equine Herpesvirus 1, 2 and 4 are also contagious respiratory diseases. EHV-2 is thought to cause Pharyngeal Lymphoid hyperplasia in young horses, and EHV-1 may also result in neurological signs and abortion in mares.

Equine Influenza Virus is another contagious respiratory disease. It spreads rapidly by direct contact and renders the infected horses susceptible to secondary bacterial infections.

Aerobic respiration is where energy is produced utilizing oxygen. Where oxygen supply is exhausted, anaerobic exercise occurs where energy is produced in the absence of oxygen. Lactic acid buildup with anaerobic exercise, together with depletion of glycogen results in fatigue.

Did you know?

Equine viral arthritis is a venereal disease which produces signs of respiratory disease, as well as abortion and limb swelling.

Hendra virus causes a fatal pneumonia in horses and is well known as a zoonotic disease.

Rhodococcus equi and Streptococcus zooepidemicus cause bronchopneumonia in foals. Other organisms are Bordetella bronchiheptica, Actinobacillus, Pasteurella, Klebsiella, Escherica coli, Aspergilus and Pneumocystis carinii.

Lungworms, Dictyocaulus arnfieldi, are parasites of Donkeys and Donkey crosses. They can spread to horses, and cause airway obstruction and cough.

Diagnostics

To investigate respiratory disease, your veterinarian will need a history of the disease progression. He will also conduct a general clinical examination and may perform additional procedures.

The lung fields may be percussioned using a large spoon and rubber hammer. Normal lungs will give off a resonant sound.

A re-breathing procedure may be performed using a large bag over the muzzle of the horse: This is useful to work out the borders of the lung, as well as to intensify any abnormal lung sounds.

Endoscopy can be performed at rest or with the horse exercising on a treadmill. The respiratory tract up to the end of the trachea can be visualised using an endoscope.

To examine the parasal sinuses, trephination into the sinuses is necessary. This procedure involves drilling a hole (trephination) into the sinuses to allow passage of the endoscope.

Broncho-Alveolar Lavage is where a tube is inserted into the trachea and sterile fluid is injected, and the wash collected. The collected sample is sent for cytologic examination.

Transtethal aspiration is a procedure which involves collecting a sample from the trachea using a cathether via a cannula through the trachea.

REFERENCES:


Throatocentesis is the collection of a sample from the pleural space using a trocar and chest tube.

Samples collected are submitted for cytology, gram stain and culture.

The lungs can be imaged using ultrasound or radiography. Nuclear scintigraphy, CT imaging or MRI of the head region can also be performed to identify tooth root abscesses not detected by radiography.

Surgical exploration and biopsy is sometimes required when there is a disparity where neoplasia is suspected. The biopsy sample is sent for histopathology.

Prevention

Prevention of respiratory disease consists of vaccination where vaccines are available, for example Strangles, EHV and Hendra Virus, and hygiene measures to minimise risk of picking up an infection from an infected horse. Quarantine measures may be necessary where the disease is highly contagious.

Keeping the environment as dust and ammonia-free as possible will also help keep your horse’s respiratory system healthy.

Regular identity by a trained equine dental veterinarian will also help prevent respiratory diseases associated with teeth and sinuses.

An appropriate de-worming program will ensure that lungworms will not invade your horse’s respiratory tract.

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Dr Deryck Tan, BSc, BVMS Hons I, MANCVS

Deryck is a partner of Valley Equine Veterinary Centre in the Swan Valley of Western Australia. Previously, he was a Senior Veterinary Surgeon at the Singapore Turf Club. A member of Equine Dental Vets and ANCVS (Australian and New Zealand College of Veterinary Scientists) in Equine Veterinary Dentistry, he spends most of his time working with horse owners to keep their horses comfortable in their mouths. He still does general equine veterinary work, drawing from his 20 years’ experience as an Equine veterinarian. Outside work, Deryck enjoys Classical Music and often reads offline in his kayak in search of the big ones that keep getting away. For more: www.facebook.com/valleyequineveterinarycentre

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