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Diseases involving the respiratory system are common clinical problems encountered by an equine practitioner, with two common presentations including nasal discharge and a cough. Since proper treatment is dependent on adequate diagnosis of the disease, with early recognition and effective management key factors involved in a horse’s recovery, it is essential to have a strong understanding of how to approach a horse presenting with common complaints in order to have an organized diagnostic and therapeutic plan. The following notes summarize ways to approach these types of presentations.

**Nasal discharge**
It is important to consider the source of the discharge, whether it is likely to represent something life threatening, infectious or non-infectious and whether it may indicate a contagious situation. Noting the character of the discharge can be extremely informative as well as whether the discharge is unilateral or bilateral. If the discharge is haemorrhagic, it should be considered an emergency. Although bilateral epistaxis following exercise is most likely due to exercise-induced pulmonary haemorrhage, bilateral epistaxis can also originate from both guttural pouches so it is important to consider whether or not epistaxis is associated with exercise. Unilateral discharge most commonly indicates an upper airway disorder whereas bilateral discharge likely indicates a lower airway problem. Considering any associations such as changes in environment, exercise, transport and/or recent exposure to new horses can be important pieces of information. Diagnostically, a complete physical examination along with an endoscopic examination of the respiratory system can be extremely informative, especially in determining the source of the nasal discharge.

**Cough**
This is an extremely common abnormality and can be a challenge to assess since there are numerous causes of mechanical and/or irritant stimulation of cough receptors. It is important to approach this problem in a systematic manner; initially differentiating between infectious and non-infectious causes based on the presence or absence of a fever can be a helpful guide for the clinician. As stated previously, considering any associations such as the environment, exercise, transport and/or recent exposure to new horses can be helpful in forming a differential list. Diagnostically, a complete physical examination including a re-breathing evaluation of the lower airway are important tools to avail of as well as endoscopy of the upper and lower airway, ultrasonography and/or radiography of the thorax and transtracheal wash and/or bronchoalveolar lavage of the lower airway.

**Common diagnostic tools for evaluation of nasal discharge and/or cough**

**Endoscopy**
Endoscopy allows visualization of the upper and portions of the lower airway; diagnostic samples can be obtained from the guttural pouch, trachea and lower airway. If obtaining a sample for culture, sterile double or triple-sheathed plugged catheters should be used to avoid pharyngeal contamination. It is often easier to visualize the nasal chambers last, after the pharynx and trachea, since most horses react to the initial passage of the endoscope.

**Radiography**
This modality has limited use in the field although some units can take satisfactory images of the head.

**Ultrasonography**
This is extremely useful, especially when evaluating the lung for peripheral abscesses or pleural effusion. Deep lesions covered by aerated lung will be missed. Good contact between the skin and probe is essential; ideally the hair should be clipped but if not possible, then the hair should be as wet as possible. A 3.5 MHz sector probe is best for visualizing the lung in an adult horse, although a 7.5 MHz linear probe may identify pleural effusion.
Tracheal aspirate/wash
Tracheal washes/aspirates collect secretions that represent both the central and peripheral airways, ideal if the suspected lung condition is not diffuse. The transendoscopic wash technique should be performed using sterile double- or triple-sheathed and plugged catheters to avoid pharyngeal bacterial contamination. If used properly obtaining samples transendoscopically with a double-sheathed, protected catheter is as sensitive as transtracheal aspiration for detecting and identifying bacterial pathogens, (Darien et al., 1990; Christley et al., 1999). In healthy horses, the trachea harbours bacteria, so one needs to recognize respiratory pathogens and interpret results in conjunction with clinical and cytological findings. Neutrophil counts for thoroughbreds reported to be <20% of the total cell population; pleasure horses reported to have neutrophil counts >20%.

Bronchoalveolar lavage
This is useful for diagnosing diffuse lung diseases, with samples representative of fluid from a localized region of the small airway. This can be done endoscopically or blindly using a double-lumen catheter. Most horses need to be sedated, with a minimum of 250-500 ml sterile isotonic saline infused. The volume of fluid infused will impact on the total and differential cell counts of the collected sample (Sweeney et al., 1992). Smaller volumes result in a bronchial wash and a higher percentage of neutrophils, larger volumes yield samples representative of the alveoli with a smaller percentage of neutrophils. If refrigerated at 4°C then the sample processing time can be up to 24 hours post-collection (Pickles et al., 2001). Samples are not ideal for culture since the tube lumen will be contaminated with bacteria normally found in the airway. It has been suggested that BALF from normal horses should contain approximately 50-60% macrophages, 35% lymphocytes, <5% neutrophils, <2% mast cells and <0.1% eosinophils.

Thoracocentesis
This is used to collect fluid from the pleural spaces for cytology, culture and sensitivity. The best way to choose a site is to use ultrasonography. If not available then the thoracocentesis should be done at the 6th-7th intercostal space about 10cm above the elbow.

Assessing a complete blood count, differential and fibrinogen can also help distinguish infectious from non-infectious diseases.

Differentials for nasal discharge
Upper airway: sinusitis, guttural pouch empyaema, guttural pouch mycosis, progressive ethmoid haematoma.
Lower airway: bronchopneumonia (bacterial, viral, fungal), equine multinodular pulmonary fibrosis, pleuropneumonia, recurrent airway obstruction, inflammatory airway disease, exercise-induced pulmonary haemorrhage.

Differentials for cough with fever
Bronchopneumonia (bacterial, viral, fungal), equine multinodular pulmonary fibrosis, pleuropneumonia.

Differentials for cough with no fever
Recurrent airway obstruction, inflammatory airway disease, pharyngeal/laryngeal disease, cardiac-induced pulmonary oedema.

References
MANAGEMENT OPTIONS FOR COMMON AIRWAY DISEASES IN HORSES

Diseases involving the respiratory system are common problems encountered by an equine practitioner. The following notes summarise some of the typical treatment options as well as more recent advances for treatment of common respiratory tract diseases in equine patients.

Infectious airway diseases

1. Endoscopic bronchial lavage (Ito et al. 2001; McKenzie 2005).
   Endoscopic bronchial lavage can be useful for treatment of focal pneumonia and abscesses, especially in cases with limited-to poor response to parenteral antibiotics. A 2-3m endoscope is required, preferably with an outer diameter <10mm. Horses need to be sedated and pre-treated with an aerosolised bronchodilator; infusion of an anaesthetic as the endoscope is passed may help reduce coughing. The trail of exudate needs to be followed with the endoscope tip wedged into the affected airway and approximately 120-140ml sterile saline infused and aspirated. After removing exudate, antibiotics can be infused into the area; it is recommended to use 25% of the systemic dose with 100-300% dilutions. Gentamicin, amikacin and ceftiofur have been successfully used. When evaluated in racehorses being treated for transport-acquired pneumonia, this was found to reduce the duration of treatment and increase the recovery rate and percentage of horses returning to racing.

   Nebulization has been shown to be an effective supplement to parenteral antibiotics in refractory cases of bronchopneumonia through enhanced drug delivery to the site of disease. It is recommended to bronchodilate using aerosolised preparations prior to nebulisation of the antibiotic. Ceftiofur (1mg/kg using 25mg/ml in sterile water, every 12 hours), gentamicin (2.2mg/kg using 50mg/ml in 0.45 % NaCl, once a day), cefquinome (225mg/inhalation with 0.9 % saline, once) and marbofloxacin (2mg/kg, 300mg, once) have been evaluated.

   For treatment of guttural pouch empyema due to organisms susceptible to penicillin, infusion of penicillin following lavage has been advocated. Adding gelatine to the mixture is effective for maintaining the medication within the pouches. The following is a published recipe:
   a. Two grams of gelatin with 40ml of sterile water
   b. Heat gelatin to dissolve, then cool to 45-50°C
   c. Add 10ml sterile water to 10MU of sodium benzylpenicillin G
   d. Mix the penicillin solution with gelatin to make a total of 50ml
   e. Place the mixture into syringes and leave overnight at 4°C to set
   f. Insert the mixture into pouches through a large-bore catheter

4. Guttural pouch catheter production and placement (Gelbmann et al. 1997):
   In addition to commercial products, guttural pouch catheters can be made. Material includes polyethylene tubing (size 240), uterine pipette (22in), 18-gauge cerclage wire, screw driver (or pen light), wire cutter, pliers and heat gun (or boiling water). Approximately 8-10in of cerclage wire is fed into polyethylene tubing leaving 1in at the end. The wire-filled tubing is wrapped around the screw driver to create 6 coils, heated then cooled in cold water. Keep the wire in the tubing until placement.

   Catheter placement:
   A 30° bend is made ½ inches at the end of a uterine pipette. The non-coiled end of the tubing is threaded into the pipette until the coiled end reaches the end of the pipette with the bend. The wire is removed and tubing backed into the pipette until ⅛ inch remains on the outside. Using an endoscope, pass the pipette into the guttural pouch and feed the tubing into the pouch while withdrawing the pipette. Cut the excess tubing and sew to the nostril. A 16-gauge needle can be placed at the end of the tubing and secured with super glue.
5. **High-volume guttural pouch lavage** (Carmalt 2002)
This has been evaluated as an alternative to repeated lavage for treatment of guttural pouch empyema. A total of 3.6 litres per pouch at a rate of 1.5 litres per minute has been reported to successfully treat guttural pouch empyema in adult horses, negating the need for catheter placement and repeated lavage. If the exudate is thick, instillation of acetylcysteine has been advocated to try to break up the material (Bentz et al. 1996).

**Non-infectious airway diseases**

1. **Aerosol delivery devices: metered-dose inhalant (MDI) systems**
   Inhalation therapy for non-infectious inflammatory airway diseases predominantly involves delivery of bronchodilators and corticosteroids. There are multiple devices (Equine AeroMask, Equine Haler) which utilise MDI canisters. Owner compliance, percentage of drug deliverance to the lower airway and cost all dictate which device to use. When using aerosol delivery devices to administer multiple medications, it is recommended to treat initially with a bronchodilator followed by the drug(s) to be delivered.

2. **Steaming hay** (Blackman & Moore-Colyer 1998, Clements & Pirie 2007)
   Exposure to dust is a key player in inducing allergic airway diseases. Feeding untreated hay results in larger dust exposure than pelleted feed. Respirable dust concentration (RDC) is the amount of small particles (<5µm diameter) that are able to enter the peripheral, small diameter airways. Steaming hay reduces RDC by up to 93% while conserving nutrients.

   Furosemide reduces pulmonary vascular pressures and incidence of exercise-induced pulmonary haemorrhage, although it is suggested that diuretic weight loss benefits performance. Flair nasal strips are hypothesised to mechanically reduce resistance and work of breathing, resulting in changes in capillary transmural pressures and reduction in bleeding. There are conflicting results as to the efficacy of these strips.

   Oral administration of low-dose interferon alpha (IFN-α, 50-150 U every 24 hours for 5 days) in conjunction with rest has been shown to reduce pulmonary inflammation (potentially by immunomodulation and/or elimination of viral infection) and reduce relapse of clinical signs. Equine concentrated serum (Seramune, 20ml intratracheal & 10ml IV once a day for 5 days, then every week or 24-48 hrs before racing) contains concentrated immunoglobulins and may be a therapeutic option for chronic bleeders.

**References**

TREATMENT STRATEGIES: CLINICAL RESEARCH UPDATE

There are three common causes of small (lower) airway disease: infectious agents including bacteria, viruses and parasites; airborne dust (including “nuisance” dust and allergens); and noxious gases (including ammonia). Treatment strategies for lower airway disease consist of medical and/or environmental measures. Medical therapy can consist of several drugs, like bronchodilators, mucociliary clearants, anti-inflammatory drugs and antibiotics. Examples of environmental measures are dust- and allergenfree bedding, roughage with low contents of dust, good ventilation and feeding from the floor.

Recently three clinical research projects have been performed on the subject.

The first project studied the added value of broncho alveolar lavage (BAL) in determining a correct diagnosis of lower respiratory disease. With a correct diagnosis a specific therapy strategy can be made. A group of Equine Internal Medicine Diplomates was asked to make a diagnosis in 42 ‘paper’ cases with and without extra BAL results. With BAL results the percentage of correct diagnosis increased from 42 to 74%. A differentiation could be made between RAO, SAID, EIPH and other lower airway respiratory diseases. Of each type of disease the optimal therapy will be discussed as well as the percentages of longterm success of the therapy. The latter was studied retrospectively in all 42 cases.

In the second project the effects of a nebulizing stable were studied. The Equine University Clinic in Utrecht possesses a special stable that can be filled with nebulised saline containing very small particles. Horses are stalled in it for 1-2 hours per day after which they are exercised. A group of healthy horses and a group of patients received a nebulising treatment regime for two weeks. A control group did not undergo nebulising treatment. Clinical score, pO2, O2-saturation, endoscopy score, intrathoracal pressure and percentage of neutrophils in the BAL were analysed before and after the treatment period. Acceptance was good and there was a significant improvement of clinical score, endoscopy score, intrathoracal pressure and percentage of neutrophils in the BAL.

The third project studied the methods to create a dustfree environment. Four units of six stables each were filled with horses during six weeks. Two units used straw as bedding and hay as roughage, the other two used dustfree woodshavings as bedding and silage as roughage. In each unit a negative ionising device was set up and used at specific times. Air in the units was collected and filtered and the amount of dust, endotoxins and moulds in each unit at specific moments was measured. The study was set up double blind and controlled and results will be discussed at the presentation, showing the effect of the ionising device and the effect of dustfree shavings and silage versus straw and hay. Differences in the amount of dust and moulds during night and day and location in the units will be presented as well.

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LESS COMMON RESPIRATORY PROBLEMS; ALSO RELEVANT TO THE GENERAL EQUINE PRACTITIONER!

Although some respiratory problems usually need referral, it’s important to know the clinical presentation and diagnostic possibilities concerning these illnesses, because quick recognition and treatment leads to a better prognosis.

In this presentation four cases will be discussed, regarding different respiratory problems in horses and a donkey. In this abstract there is some background information on the diseases that will be discussed.

EMPF

In horses with Equine Multinodular Pulmonary Fibrosis (EMPF) fibrotic nodules and interstitial fibrosis are found in the lungs, (often) related to an infection with equine herpes virus-5 (EHV-5), a gamma-herpesvirus. Recently Williams et al. showed that it is possible to induce EMPF in healthy horses by infecting them with EHV-5 (1).

Cases usually present with fever, lethargy, anorexia, weight loss, cough, nasal discharge and dyspnea. Sometimes concurrent symptoms originating from other organ systems are present. Bloodwork usually shows leucocytosis, hyperfibrinogenemia and hypoxemia and sometimes hypergobulinemia and anemia. Radiographs reveal a multifocal or generalized nodular interstitial pattern. On ultrasound a roughened pleura with nodular lesions is described, as well as superficial lung consolidations. In a broncho-alveolar lavage (BAL) usually a neutrophilia is found, and in all cases PCR on EHV-5 in BAL-fluid was positive. A positive PCR however, does not prove EMPF, because the virus also can be found in BAL-fluid of unaffected horses. In BAL-fluid intranuclear inclusion bodies might be found in the macrophages. Histopathology of lung biopsies can confirm the diagnosis. Lung biopsies can also be used for PCR or immunohistochemistry to detect viral presence. Therapy often consists of antibiotics, antiviral drugs and/or corticosteroids, but in general the prognosis seems to be fairly poor. A recent case report though, describes one horse that recovered after treatment with valacyclovir (2).

Chronic interstitial fibrotic pneumonia in the donkey

Chronic interstitial fibrotic pneumonia is frequently diagnosed post-mortem in donkeys. Not much research has been published on this subject, but the asinine herpesviruses 4 and 5 (AHV-4 and AHV-5) were found in lungs of affected donkeys (3). Because AHV-4 and AHV-5 are closely related to EHV-2 and EHV-5, this suggests a possible relation with EMPF in horses, as does a case report of a gelding with EMPF in which both EHV-5 and AHV-5 were found in the tracheal wash (4).

Clinical signs and blood test abnormalities are dependent on the severity of the lung-pathology and are progressive. They resemble the symptoms of RAO, also because often bronchitis is concurrently present. Radiographs showing an interstitial pneumonia can be helpful in diagnosing this condition, besides the clinical findings and often a lack of response to therapy. Whether presence of herpesviruses in BAL-fluids or lung-biopsies is helpful in making the diagnosis has not been investigated. Probably, histopathology of a lungbiopsy would be diagnostic. Therapy should be aimed at optimizing remaining lung function and if present, treating secondary bacterial infections. Prognosis is dependent on the stage of disease in which the donkey is presented and the response to therapy.

Mycotic pneumonia

Mycosis as a cause of pneumonia is uncommon in horses. If fungi cause problems in the respiratory tract, usually they affect the guttural pouch. Usually Aspergillus spp. is the causal agent, although some other fungi were reported. In almost all of the cases published, an underlying illness or risk factor was identified (5), for example: respiratory disease (eg. EMPF), enterocolitis or other diseases compatible with loss of gastrointestinal mucosa integrity, immunodeficiency; (eg. Pituitary Pars intermedia Dysfunction (PPiD)) or long-term use of antibiotics or corticosteroids. Cases present with atypical respiratory symptoms, like fever, cough, tachypnea and adventitious lung sounds on auscultation. Bloodwork reveals signs of inflammation. Endoscopy can be unremarkable, or show signs of inflammation. Radiographs might show interstitial or alveolar pneumonia. The diagnosis can be made by culture, cytology or histopathology on BAL-fluid, transtracheal wash or lung biopsies. Interpretation of presence of a small amount of fungi can be difficult, because some fungi can be present in the lungs of...
healthy horses. In conclusion; in horses with pneumonia, not responding to therapy, a mycotic cause should be considered, especially if other risk factors are present!

Pleuropneumonia
An important risk factor in developing pleuropneumonia is long-distance transportation. This is mostly because the head is elevated for a long period, which causes a decreased mucociliary clearance, leading to an increase in the number of bacteria. Other risk factors include viral respiratory infection, general anesthesia, racing, dysphagia and other conditions associated with higher risk of aspiration of oropharyngeal bacteria and/or reduced clearance of the lungs. Of course, wounds penetrating the thoracic wall are another possible cause of pleuropneumonia. Cases usually present with fever, lethargy, anorexia and pleural pain, causing guarded (respiratory) movements en reluctance to cough. Auscultation of the thorax typically reveals diminished respiratory sounds ventrally because of pleural effusions and adventitious lung sounds in the dorsal part of the thorax. Percussion is painful. In the blood, signs of acute or more chronic inflammation can be found, depending on the stage of the disease. In case of severe pleural effusion, hypoalbuminemia will be present. On ultrasound, pleural effusion, adhesions, atelectasis, consolidation or abscessation can be identified. Ultrasound findings not only confirm the diagnosis, but are also a helpful tool to determine the best site for thoracocentesis. Radiographs can provide information of the non visible parts on ultrasound (preferably after removal of fluids). Fluids aspirated from the thorax can be used for culture and cytology.

Treatment consists of thorax drainage, antibiotics, anti-inflammatory drugs, analgesics, bronchodilators and maybe mucolytics. Aspirin or heparin can be used to try to prevent thrombus and fibrin formation. Surgical intervention is an option in severe progressive cases. Prognosis is fairly good in case of early recognition and treatment but rapidly decreases with time. To ensure early recognition, a thorough clinical exam and a good history to identify risk factors is very important.