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RESPIRATORY DISORDERS IN FOALS: CONDITIONS WE CAN DEAL WITH IN PRACTICE

For a complete assessment of a foal with respiratory disease, anamnestic information on peripartal management, early respiratory disease on the breeding farm, type and duration of symptoms are crucial. As a result, essential steps of the investigation are recognized and further important treatment measures can be set up specifically for each medical history.

Clinical examination

The general examination reveals signs of dehydration by the skin turgor and the position of the bulb after determination of body temperature (range: 38.0-38.5°C). The respiratory rate in healthy foals is 24 to 40 breaths per minute. Immediately after birth, the respiratory rate is between 60 and 80 breaths/min and drops to 40 breaths/min in the first 2 hours post natum. Breathing type and breathing sounds should also be judged with some distance from the patient.

The nostrils should be dry and clean. Nasal discharge may be visible on one or both sides. The airflow from both nostrils is checked page-by-section by holding both backs of the hands in front of the nostrils of the foal in order to detect any obstruction.
The auscultation of the trachea and lungs results in louder breath sounds than in the adult horse, because the distance between the stethoscope and the respiratory tract is less and therefore the air flow is more clearly heard. In the case of foals with pneumonia or lung abscesses, abnormal noises are barely noticeable, while quiet zones are often diagnostic for the consolidation of the lungs.

Imaging procedures

The **ultrasound examination** is performed on a standing or lying foal. It is non-invasive, not time-consuming and has a high sensitivity in foals with changes in the lung parenchyma. Particularly suitable for testing are linear sound heads with a frequency of 5 to 10 MHz. As in the adult horse, "comet-tailed echoes" are indicative of interstitial pneumopathy and consolidated irregularly demarcated areas as signs of bronchopneumonia. Pleural effusions are very rare in foals and occur predominantly in trauma such as rib fractures or thoracic injuries.

X-ray examination of the foal lung should be performed on a standing foal. Only the latero-lateral views lead to the imaging of a diagnostically sufficiently large lung area. The alveolar pattern is a cloudy, blurred, confluent, focal compression indicating alveolar pneumonia. The interstitial pattern shows like a dense, homogeneous veil over the entire lung image, and vascular margins and bronchial walls are blurred or unrecognizable. These findings are characteristic of interstitial pneumonia.

The **endoscopy** of the respiratory tract is performed in the foal with an endoscope with a maximum diameter of about 10 mm. For this the foal is sedated, standing or examined while recumbent. Endoscopically, the upper respiratory tract and subsequently the color and condition of the tracheal mucosa can be assessed. Secretions can be aspirated for cytological examination and a pathogen detection.

Laboratory findings

Detection of pathogens

In lower respiratory tract diseases only a sample from the distal area of the trachea is meaningful. Although the endoscope is advanced through the nasal passages, the nasal flora seems to have little influence on the test result.
Pathogen detection through cultural isolation lasting two to five days may be a significant disadvantage in a severely ill patient, as the antibiotic selection tailored to the pathogens is crucial. Therefore, it is advisable to ask the laboratory about possible PCR, because some pathogens such as Streptococcus equi ssp. equi or zooepidemicus and Rhodococcus equi are much faster identified this way.

Diseases of the upper respiratory tract

Malformations: narrowing of the nasal passages, cleft palate, choana atresia, airbagema will be suspected at clinical examination and confirmed at endoscopy.

Diseases of the deep respiratory tract

Rib fractures occur in 3 to 5% of foals. They usually arise during a dystocia or by a kick of the mare or another horse. Often several adjacent ribs are broken directly or close to the junction between bone and cartilage. In most foals, no symptoms are registered and the rib fracture is detected later as a chance finding during a lung

examination. Only when a hemothorax or if the lung is injured by the bone edges, the foals show difficulty breathing. The diagnosis is made by careful palpation of both sides of the thorax. The ultrasound examination confirms the clinical suspicion and indicates whether the lung is injured (detection of focal comet-tailed echoes) and whether pleural effusion (evidence of free fluid in the pleural space) is present. Only if the fracture is in the middle thoracic region (from the 7th to the 12th rib), an X-ray will clearly show the findings. In most cases, no treatment is indicated.

Pleural effusions are very rare in foals. Clinical symptoms include dyspnea and apathy. In the ultrasound examination, a fluid accumulation in the pleural space can be detected. But only by puncture of the effusion the type of fluid (blood, transudate, purulent fluid) is detected. For treatment, immobilization is prescribed and drainage of the effusion with administration of broad-spectrum antibiotics.

Acute bronchitis is seen in the foal due to bilateral nasal discharge, coughing, increased respiratory rate and fatigue. Many factors play a role. In particular, insufficient immunoglobulin protection due to a lack of IgG transfer or a weakened immune status due to endoparasites, stress or high population density favors the development of bronchitis. Triggering viruses are influenza, herpes, equine arteritis and adenoviruses. For the treatment of acute bronchitis in foals should be provided for a quiet, stress-free environment and good air. The administration of anti-inflammatory drugs for two to four days is indicated in patients whose general condition is impaired and who therefore stop drinking. To prevent or treat a secondary infection (usually streptococcal), some foal will be treated with beta-lactam (amoxicillin or penicillin) for five to 10 days.

Infectious bronchopneumonia caused by specific pathogens are the most common diseases in foals besides diarrhea. The causes are primarily viruses and bacteria and secondarily fungi.

In influenza-associated pneumonia, symptoms are acute with high fever (41-42°C), depression, anorexia, dyspnoea and rattling sounds in the lung and trachea auscultation. It follows in some cases the exitus after six to eight days. Similarly, EHV-1 pneumonia occurs in suckling foals with inadequate antibody supply. The diseased foal is depressed and anorexic and shows a dyspnea. However, herpes virus infection rarely causes life-threatening respiratory diseases.

Bronchopneumonia is initially treated with broad-spectrum antibiotics in foals. These include cephalosporins, beta-lactam antibiotics (penicillin or amoxicillin) alone or in combination with aminoglycosides (amikacin, gentamicin: max. 4 days). Once a pathogen is detected, the choice of antibiotic should be adapted to the resistance test. The prognosis for bacterial pneumonia is good to bad and depends on the primary disease (eg, omphalitis or septicemia) and the time the treatment is started.

***Rhodococcus equi* pneumonia**

Rhodococcus equi (R. equi) is the most common cause of severe, often life-threatening pneumonia in foals.

R. equi is a gram-positive bacterium that can survive well in the soil in dry and high temperatures, but is sensitive to prolonged periods of cold weather.

For the diagnosis of rhodococcosis the anamnesis is particularly important. The following information points to a R. equi pneumonia: R. equi pneumonia in foals has already occurred on the premisses before, and the disease progresses rapidly after recognizing the first symptoms. The foals then show fever to 41°C, cough, purulent nasal discharge, tachypnea and dyspnea. Frequently such seriously ill foals die within a few days despite intensive treatment. The early symptoms, however, are very discreet and therefore often overlooked: high respiratory rate after exercise, coughing or purulent nasal discharge. Already one of these signs should cause the owner to have the foal examined by a veterinarian. In case of early detection of R. equi pneumonia, treatment is usually successful and the prognosis is very good if treated appropriately. The ultrasound examination of the lung is very sensitive even in the early stage of the rhodococcosis and provides a reliable assessment of the extent of the lung changes. The radiographic findings in R. equi pneumonia vary, ranging from solitary to multiple, distributed throughout the lung field.

NEONATOLOGY AND DISEASES IN FOALS

The definitive diagnosis of a R. equi disease can only be made by cultural pathogen detection or PCR in the tracheobronchial secretion or faeces. In the faeces, the pathogen is detected as frequently as in tracheobronchial secretions, but the cultural process is somewhat more complicated due to the large number of other bacteria in the faeces. The sensitivity of the culture is only about 50% of the foals where R. equi is detected from lung abscesses. The PCR method gives a much faster result, but unfortunately is not more sensitive than the culture.

R. equi pneumonia is treated with antibiotics for 4 to 8 weeks. Numerous studies have shown that combinations of rifampicin with one of the following antibiotics can successfully treat azithromycin, gamithromycin or tulathromycin.

Acute interstitial pneumonia is a relatively rare disease of the foal. It occurs in newborn to several months old foals. The cause is probably multifactorial and seems to be related to warm weather. Various bacterial agents, viruses and fungi have been detected in respiratory secretions and in lung tissue from dead affected foals. However, the triggering factor is not always detected.

Affected foals show a sudden fever, a high-grade dyspnea, are depressed and anorexic. Mostly neither nasal discharge nor cough are detectable. The auscultation is only loud bronchial noises, but neither rattles nor wheezes. The results of the blood tests are little specific with leukocytosis and neutrophilia and increased fibrinogen.
The chest radiograph reveals a diffuse interstitial pattern over a large area of the lung field. The edges of the pulmonary vessels and the bronchial walls are only blurred. The ultrasound examination in these patients shows a large number of "comet's tails" over the entire affected lung area.

The treatment of foals with acute interstitial pneumonia is based on symptomatic measures. Broadband antibiotics and glucocorticoids (prednisolone: 1-4 mg, initially i.v. and then p.o., once or twice daily) are used. The oxygen insufflation helps to a clinical improvement. However, the mortality in such patients is very high.

Pneumocystis carinii pneumonia
Pneumocystis carinii (*P. carinii*) is a fungus of foals that are immunosuppressed or already suffering from pneumonia. The history of the disease is often that of a foal that is treated with antibiotics for bacterial pneumonia and during or after ending this treatment shows a sudden worsening of the condition with high fever up to 41°C, acute dyspnoea and cyanotic mucous membranes. Radiographic and sonographic findings correspond to interstitial pneumopathy. For the detection of P. carinii a cytological examination of bronchoalveolar lavage fluid is necessary because the organism can rarely be displayed in the tracheal secretion and the silver staining of the cytological smear allows the safe diagnosis of the fungus.

For the treatment of *P. carinii* pneumonia, high-dose glucocorticoids are used to control the inflammatory response and trimethoprim-sulfadimethoxine has been successfully administered to the foal.

However, the overall prognosis of acute interstitial pneumonia in foals is unfavorable.