THE HORSE
YOUR GUIDE TO EQUINE HEALTH CARE

Maladie respiratoire équine - 2e partie : les voies respiratoires inférieures

1er août 1998 • **Publié par** Michael Ball, DVM

Les voies respiratoires inférieures sont constituées des poumons et des bronches qui les alimentent. Les poumons possèdent des mécanismes de protection très intéressants et uniques qui déploient de grands efforts pour prévenir les infections. De toute évidence, les voies respiratoires inférieures

Sujets : Article , BPCO, poussées et RAO , Vermifugation et parasites internes , Herpèsvirus équin (EHV) , Hémorragie pulmonaire induite par l'exercice (EIPH) , Problèmes des voies respiratoires inférieures , Pneumonie (Rhodococcus) , Stress lié au transport

Les voies respiratoires inférieures sont constituées des poumons et des bronches qui les alimentent. Les poumons possèdent des mécanismes de protection très intéressants et uniques qui déploient de grands efforts pour prévenir les infections. De toute évidence, l'air que nous respirons n'est pas stérile et contient de nombreux contaminants tels que la saleté, la poussière, le pollen, les produits chimiques et des particules d'un million d'autres choses ainsi que des bactéries, des virus et des éléments fongiques.


Pleurésie

Un cheval atteint de pleurésie et de drainages internes dans la cavité thoracique permet un

drainage continu du matériel

inflammatoire.

La protection commence en fait dans les voies respiratoires supérieures par la filtration, l'humidification et le réchauffement de l'air inspiré. Les voies respiratoires supérieures, la trachée et les bronches sont tapissées de tissus toujours recouverts d'un mucus humide/collant auquel les contaminants présents dans l'air adhèrent. Pour aller plus loin dans le processus, le tissu qui tapisse la trachée et les bronches contient environ un milliard de cellules dotées de fibres extrêmement petites ressemblant à des poils qui dépassent dans les voies respiratoires (ces fibres ressemblant à des poils sont appelées cils).

Les cils augmentent la surface de filtration et jouent un rôle actif dans la protection des voies respiratoires. Grâce à un processus appelé transport mucociliaire, les débris accumulés à la surface des voies respiratoires sont en fait transportés hors des poumons. Également appelé escalator mucociliaire, les petites fibres « battent » de manière coordonnée pour déplacer la fine couche de mucus qui flotte au-dessus des cils (et les débris qui y sont collés) hors des poumons et vers la trachée, où le cheval (et nous) l'avale. C'est absolument dégoûtant – et vous n'êtes même pas conscient que cela se produit. Mais c'est essentiel au maintien de la santé normale des poumons.

Anything that decreases the effectiveness of the mucociliary escalator increases the chance for the development of respiratory disease. Factors such as cold air, smoke or chemicals in the air (like ammonia fumes from poorly cleaned stalls or because of bad barn ventilation), and inflammatory conditions of the airways (such as bronchitis/asthma) can decrease the defense mechanism of the mucociliary escalator.

Another very important way by which the mucociliary clearance mechanism can be overwhelmed and rendered less effective is forced head posture during transport. In fact, the transportation process can stress the defense mechanism of the lungs in several ways. The exhaust fumes from a poorly maintained or designed truck or van can have a negative effect on the mucociliary escalator. In addition, a trailer or van that has

poor drainage can allow for the buildup of ammonia fumes during the ride, thus adding another negative factor. And finally, if the ventilation within the trailer or van is bad, it can worsen all of the aforementioned negative factors regarding lung health during transportation.

There have been several scientific papers evaluating the effects of transportation and head posture on lung health. One such paper by Dr. S. L. Raidal, from the Department of Veterinary Pathology, University of Sydney, entitled "Effects of posture and accumulated airway secretions on tracheal mucociliary transport in the horse," was published in a 1996 issue of the *Australian Veterinary Journal*. Raidal demonstrated that horses confined with their heads elevated for 24 hours developed an accumulation of inflammatory airway secretions that was associated with increased numbers of bacteria in the lower respiratory tract. These findings "have implications for management practices where horses are prevented from lowering their heads, such as transportation and cross-tying, which may therefore contribute to lower respiratory tract disease in horses."

Great attention should be devoted to ensuring that head posture is not restricted to such a degree that the respiratory system is compromised.

In addition to the mucociliary clearance system, there are other protective mechanisms in place to protect the respiratory system against infection. There are millions of special cells deep within the tissues of the lung that can kill bacteria and inactivate viruses. Going back to last year's article on the immune system (*The Horse* of December 1997), you'll remember the special white blood cells that have the ability to engulf and kill invading organisms. These cells are plentiful within the lungs and play a vital role in the local immune system. It should be noted that the normal function of these cells can be impaired by a number of factors. Many of the factors that decrease the effectiveness of the mucociliary transport also can have a negative effect on the cellular immunity within the lungs. In addition, the cellular defense mechanisms can simply be overwhelmed by high concentrations of environmental contaminants. Should infection occur, the respiratory tissue easily can be flooded with extra white blood cells from the blood.

Pneumonia

Pneumonia is a vague term that simply means "inflammation of the lung." It does not define the actual cause of the inflammation. As we will explore here, the causes of pneumonia are numerous.

Viral Pneumonia

We will briefly return to the upper airway when we discuss the viral respiratory diseases since many of the viral entities affecting the lungs also affect the upper airway.

Equine Adenovirus–The equine adenoviruses can be found all over the world. It must be noted that infection with the virus is not always associated with the development of disease. In adult horses, infection is more likely to go unnoticed, whereas foals are more likely to develop clinical signs. Infection with the adenoviruses commonly involve the respiratory tract and conjunctiva of the ocular tissues. Clinical signs can include coughing, nasal discharge, shortness of breath, inflammation of the pink tissue surrounding the eyes, and fever. Infection with the adenovirus, if clinical signs develop, generally does not require any significant treatment. Foals, however, might be more severely affected.

Equine Influenza–The equine influenza virus is in the same family as that which causes the "flu" in people, although it is different enough that human infection with the equine flu virus does not naturally occur. The flu viruses contain a chemical that very effectively damages the mucociliary transport mechanism, allowing for evasion of the immune system. In addition, the damage to the mucociliary transport system can take several days or longer to repair, leaving the defense mechanisms decreased and opening the horse up to the possibility of secondary bacterial infection. The disease can be extremely contagious, especially in conditions of crowding and poor ventilation–some racetracks have an "outbreak" several times per year.

Influenza most commonly affects two- and three-year-olds. Stresses on the respiratory tract's immune system, and inadequate vaccination can be predisposing factors. The incubation period is one to three days, with the virus typically affecting the upper respiratory tract to a greater extent than the lungs. Clinical signs typically appear three to five days following exposure to the virus. The clinical signs include fever, anorexia, depression, a clear nasal discharge, and a deep, dry cough. Some horses experience muscle pain (they might be reluctant to walk) and have swollen legs (edema). The course of infection is typically from two to 10 days if there are no complications; secondary bacterial infection is a common complication of equine influenza. Horses can shed virus for three to six days after the last signs of illness and should be kept in isolation for that period of time.

The treatment generally involves symptomatic care and the use of antibiotics only if a secondary bacterial infection is suspected. One of the greatest risks is that an affected animal will be put back in work too soon. The nature of the virus is to cause a significant amount of tissue damage that requires time to regenerate and heal. Should the horse be placed back in work too soon, the likelihood of complications developing is great. In

some horses with severe infections, there might be the need for one to two months of rest prior to resumption of training–always adhere to your veterinarian's advice regarding the convalescent time.

Young foals can suffer more severely from equine influenza, developing extensive pneumonia that has the potential to be fatal. Foals exhibiting signs of respiratory disease should receive veterinary attention as soon as possible.

Regular vaccination can significantly reduce the population at risk and is recommended. For younger athletic horses which might be at greater risk, it is suggested that they be vaccinated at four- to six- month intervals as opposed to the older horses, which should receive their boosters at nine- to 12-month intervals.

Equine Herpesvirus (Rhino)–Equine herpesvirus, equine rhino, rhino, and rhinopneumonitis are all synonyms for the equine herpesvirus. Rhino implies the upper airway and rhinopneumonitis means inflammation of the upper airways and lungs. There are four currently known strains of the equine herpesvirus known as 1, 2, 3, and 4. It is strains 1 and 4 that are associated with respiratory disease in the horse.

Respiratory disease related to the herpesvirus most commonly occurs in foals, weanlings, and yearlings. The immunity to herpesvirus infection is short-lived and reinfection is thought to occur; re-exposure generally results in a milder or subclinical (undetected) infection. In broodmares, there can be abortion related to infection. The equine herpesvirus type 1 has the ability to cause respiratory disease, abortion, and neurologic disease. Foals can essentially be born suffering from extensive pneumonia (if they are not aborted) and die within 72 hours. Any signs of respiratory distress in a newborn should be evaluated by your veterinarian immediately.

The infection occurs via the inhalation of the virus. The virus does not tolerate being outside of the body for extended periods of time, so close contact with an infected animal or tissues is probably important for transmission. The clinical signs appear one to three days following infection and include fever, anorexia, depression, a clear nasal discharge, and a deep dry cough–they cannot be distinguished from influenza.

The treatment is largely supportive and, as with influenza, the convalescent period of rest is extremely important for reducing the complication rate. Vaccination will not prevent the disease, but can reduce the severity of the disease. If you have any pregnant mares, they might need to be vaccinated accordingly to prevent abortion. You should check with your veterinarian regarding the vaccination of a pregnant mare for protection against the herpesvirus.

Equine Rhinovirus–There are several equine rhinoviruses that primarily cause mild upper respiratory disease. The equine "rhinovirus" should not be confused with equine "rhino" or "rhinopneumonitis," which is caused by the equine herpesvirus.

Equine Viral Arteritis–The equine arteritis virus, as offered by its name, causes inflammation of the blood vessels. Transmission of this virus can occur via inhalation or sexual contact. The virus rapidly spreads throughout many of the body's organs and the disease can produce signs of respiratory distress. The disease also can cause abortion anywhere from 10 to 34 days following exposure.

The incubation period is three to 14 days (six to eight days if passed by the veneral route). The main clinical signs include fever, anorexia, depression, and potentially a cough. In addition, a clear nasal discharge, a bright reddening of the nasal and ocular tissue, and excessive tear production can be associated with EVA.

The treatment, as with all the other viral diseases, consists mainly of supportive therapy and observation for any secondary bacterial infection. Convalescent rest is extremely important, and isolation should be maintained for three to four weeks past the last observation of clinical signs to prevent transmission. Most horses recover uneventfully, but occasionally young foals suffer a fatality.

Viral Diagnosis

As you now know, the clinical signs for most of the viral respiratory diseases are very similar. In many cases, the exact cause does not have a significant bearing on the treatment, but knowing the specific cause can provide valuable information with respect to management and the future. A nasal swab can be acquired for an attempt to grow and identify the virus in the laboratory. This is the most common way to confirm a diagnosis. In addition, there are several advanced laboratory techniques used in the identification of a virus present in a laboratory sample. Another is to evaluate the concentration of antibodies in the blood for the suspected virus. Remember that the antibodies are proteins manufactured by the body when the immune system is stimulated. These tests unfortunately take time for the antibody levels to rise in response to disease, and therefore require two samples a week or so apart in order to demonstrate a "rise" in the titer proving that the immune system was being stimulated by a particular virus. Vaccination also can increase the antibody titer (concentration), which sometimes makes interpreting the test results more difficult.

Bacterial pneumonia

As has been stated, the air we breathe is not sterile, and neither are many parts of the upper respiratory system. There is a constant source of bacteria that could potentially invade the lung. There are more than a dozen types of bacteria that have been identified

as being involved in pneumonia in the horse. Most of these bacteria either are common to the environment of the horse, or are a normal inhabitant of the upper airway or throat area. In most cases of pneumonia, there is some predisposing cause.

Bacterial pneumonia often follows viral pneumonia due to the damage to the normal protective mechanisms and disruption of the local immune system. This situation often is the result of bringing a horse back into work too soon after suffering from a viral respiratory disease. Other stressful events that can lead to the development of bacterial pneumonia include any intense athletic exercise, transportation, poor nutrition (leading to a decrease in immune function), and overcrowding. Realistically, many horses experience these factors on a daily basis without problem, but they all can potentially contribute to respiratory disease. Also, primary immune dysfunction (such as Arabian foals afflicted with CID), the aspiration of feed material due to neurologic dysfunction or choke, or inflammation due to parasitic disease can contribute to the development of bacterial pneumonia.

The clinical signs associated with bacterial pneumonia include fever, depression, inappetence, nasal discharge, coughing, respiratory distress, and the presence of abnormal lung sounds. In more chronic cases, the onset can be slow and vague, with exercise intolerance and weight loss being the only clinical signs.

In some cases, the infection might be localized and walled off in the form of an abscess. If the development of the abscess is insidious enough, the first recognition of the disease can be severe acute respiratory distress during exercise. The exacerbation of the disease occurs when the lung abscess ruptures or leaks during the stress of exercise.

The diagnosis of bacterial pneumonia often is made based on history, clinical signs, and what the lungs sound like. Ultrasound and radiographs might be necessary to assess completely the extent of the infection. If the clinical signs are severe or antibiotic therapy has been unsuccessful, a transtracheal wash can provide very important information and might help direct therapy. (See article on transtracheal wash in *The Horse* of March 1997.)

The treatment of bacterial pneumonia generally consists of long-term antibiotic therapy, any supportive therapy necessary, and rest. The outcome of bacterial pneumonia can be extremely variable and depends on the predisposing causes, duration of infection, amount of lung tissue involved, the specific type(s) of bacteria involved, and the existence of additional complications. Again, it is important to follow your veterinarian's instructions regarding convalescent time and antibiotic therapy in order to prevent a relapse.

Shipping Fever

With respect to the respiratory system, there are a number of known factors that can predispose an individual horse to respiratory disease. Many of these factors have been heavily researched, and others are just hypothetical but make good sense and have been distilled from the wisdom of generations of horse trainers and people specializing in horse transport.

There have been several studies evaluating the direct effects of transportation on the internal environment of the lungs. In the June 1997 issue of the *Australian Veterinarian Journal*, Dr. S. L. Raidal, et al. from the Department of Veterinary Pathology, University of Sydney, New South Wales, published a paper entitled "Effect of transportation on lower respiratory tract contamination and peripheral blood neutrophil function." The study looked at six horses which had been transported by road for 12 hours. A sample of fluid was obtained from within the trachea (windpipe) both prior to and immediately following transport. When compared to the pre-transport controls, the post-transport tracheal fluid contained signs of inflammation and an increased number of bacteria. The sample also showed that of the bacteria a *Streptococcus* species was the most predominant (*Streptococcus* is a common pneumonia-causing bacteria in the horse).

In addition to the evaluation of the tracheal fluid, the researchers also evaluated the function of a type of white blood cell–the neutrophil. The neutrophil will migrate out of the blood to sites of infection and, in a Pac Man-like way, surround and kill invading bacteria. Raidal demonstrated that after transport, the neutrophils from the blood of these horses had a significantly reduced ability to devour and kill bacteria. The conclusion was that "bacterial contamination of the lower respiratory tract occurs as a routine consequence of transportation of horses and is likely to be an important determinant in the development of transport-associated respiratory disease."

Another study that carried this research a little deeper was reported in the May 1997 issue of the *American Journal of Veterinary Research*. A paper by S. Hobo, et al. from the Equine Research Institute, Japan Racing Association, Tokyo, Japan, entitled "Effect of transportation on the composition of bronchoalveolar lavage fluid obtained from horses" presented research evaluating the pulmonary effects of 41 hours of transport in 20 horses.

The bronchoalveolar lavage is a technique that evaluates the state very deep within the lung. This technique, therefore, reflects the health of a small portion of lung tissue itself. What Hobo demonstrated was that there were four times the number of cells indicating inflammation in the samples from transported horses as compared to controls. In addition, the research also demonstrated a decrease in the concentration of a protein that "may reduce the pulmonary defense mechanisms in the alveolar region, possibly resulting in infection."

Pleuropneumonia

Remember that the pleura is the thin covering of the lung or the thin lining of the thoracic cavity. Pleuritis is an inflammation of the pleura (essentially the space between the body wall and the lung). Pleuropneumonia is inflammation both within the lung and within the pleural cavity. In most cases, pleuritis is secondary or occurs in conjunction with pneumonia or a ruptured lung abscess that infects the pleural space.

All of the factors that predispose to the development of pneumonia also are thought to predispose to the development of pleuritis, but anything specific leading to the development of pleuritis is unknown. The development of pleuritis in conjunction with pneumonia can greatly complicate and prolong treatment; successful treatment can take up to six months, and there can be fatalities. A variety of bacteria can infect the pleural space. The type of individual bacteria that cause disease can have a great impact on the overall outcome.

The clinical signs of pleuritis/pleuropneumonia include fever, depression, nasal discharge, and being off feed. In addition, pleuritis is an extremely painful disease process–these horses often hurt between the ribs. There also will be a reluctance to walk with some of these horses, presumably due to the chest pain. In chronic cases, weight loss can be a prominent clinical sign.

One of the hallmark clinical signs of pleuritis is the buildup of fluid within the thoracic cavity. This fluid muffles the lung sounds in such a way that there is a straight line (a fluid line) of silence parallel to the ground at the junction between fluid and lung. There also are "sandpaper rubbing" sounds heard with the stethoscope called pleural friction rubs. These abnormalities can be confirmed and further defined with the aid of ultrasonography. The fluid within the pleural cavity generally is cultured and evaluated microscopically for the presence of bacteria; there are some forms of thoracic cancer that can produce all of the clinical signs associated with pleuritis.

The treatment of pleuritis can be very difficult and relies on long-term antibiotics, supportive therapy, and drainage of the fluid from the thoracic cavity should it become necessary. There are numerous complications that can occur on the road to recovery for these horses, but if no complications occur, treatment can be successful. In a 1996 issue of the *Journal of The American Veterinary Medical Association*, Krista Seltzer, DVM, Diplomate ACVS, and Doug Byars, DVM, Diplomate ACVIM, from Hagyard-Davidson-McGee in Lexington, Ky., reported on the "Prognosis for return to racing after recovery from infectious pleuropneumonia in Thoroughbred racehorses: 70 cases (1984-1989)." Their study indicated that 61% of horses having suffered from pleuropneumonia raced following recovery.

Parasitic Pneumonia

There are several different parasites that can end up in the lung. The first of these is the common intestinal roundworm–the ascarid. The ascarid is a unique little creature that has a life cycle that goes something like this. After being swallowed, the worms migrate out of the intestine and into the abdominal cavity, where they migrate through the liver and the lung. Once they have finished the lung migration, they come out in the airways, get coughed up and swallowed, where they end up back in the intestine. There they become adults and produce eggs.

If the parasite infection is great and the number of worms within the lungs is high, you will see clinical disease. This case scenario is most typically seen in young horses (four to six months of age), with the main clinical sign a moist cough.

The second lung parasite is the true "lungworm" of horses. Donkeys and mules are carriers for the equine lungworm and do not show any clinical signs. The horse develops pneumonia and will show clinical signs (chronic coughing) two to three months after being infected. Horses with chronic coughs which have been exposed to donkeys or mules should be evaluated for the presence of lungworms.

COPD

The term COPD stands for chronic obstructive pulmonary disease, otherwise known as "heaves." Other names for this disease include "chronic pulmonary disease," "chronic airway reactivity," "hyperactive airway disease," "hay sickness," and "broken wind." This disease is characterized by airway obstruction at the level of the bronchi, primarily due to airway constriction similar to asthma in people.

The specific causes of heaves are as yet unknown. There are suspicions that a variety of allergic reactions might be involved. Many clinicians consider heaves to be a hypersensitivity reaction to dusts and molds. The incriminated molds, *Aspergillus* and *Micropolyspora*, are commonly found in poorly cured hay. There appear to be two categories of affected horses. One group appears to be reacting to allergens within the barn and gets better when kept outside; another group (more commonly located in the Southeast) appears to be reacting to allergens in the pasture and gets better when kept inside.

The clinical signs include a chronic cough, a cloudy nasal discharge, and difficulty in expiring air; these horses usually take in air relatively well–it is on exhalation where there is difficulty. Because COPD is primarily an allergic reaction without the presence of infection, there is generally no fever (unless there is the development of a secondary bacterial infection). In addition, exercise intolerance, weight loss, and not eating are additional clinical signs. Sometimes these horses can get into trouble because they are so focused on breathing they will not (cannot) take the time out from the effort of

breathing to eat or drink. Sometimes older horses with chronic heaves will have a hypertrophy of the external abdominal oblique muscle noted along the body wall as an indication of the long-standing disease process.

The diagnosis of heaves generally is based on history and examination of the respiratory system. Sometimes other diagnostic tests, including a transtracheal washing, might be necessary to rule out other secondary problems. However, a bronchoalveolar lavage is preferred to a transtracheal wash for diagnosis of COPD.

The treatment of heaves involves altering the horse's environment. If a horse is worse outside, then keep him inside, and vice versa. Often wetting of the hay (or occasionally complete removal of hay from the diet) is necessary, along with bedding on non-dusty wood chips or newspaper. Should it become necessary to remove hay completely from the diet, there are several fermented hay products and other complete feed products on the market (see the Nutrition column on haylage and processed hay feeds in *The Horse* of July 1998, article #513). In my experience, the management changes are very important and must occur in addition to the medical management of heaves. Approximately 50% of the horses I have worked on which had heaves respond favorably to management changes.

Medical therapy typically involves making sure there is no secondary bacterial infection either by diagnostic testing or by a short course of antibiotic therapy. The main focus of therapy is to decrease the inflammation associated with the allergic reaction going on within the lungs. The drugs of choice for this–as it is for people with asthma–are corticosteroids and/or bronchodilators. Steroids decrease inflammation and bronchodilators relieve respiratory distress by opening obstructed airways. During a severe crisis, the main problem is the constricted small airways within the lungs. The use of drugs that function to dilate the airways can be a great benefit, if not lifesaving. With respect to systemic therapy, caution must be used as these drugs can have significant side effects. The corticosteroids suppress the immune system and can predispose to infection. Their use also has been associated with the development of founder (laminitis).

One of the most potent bronchodilator drugs, atropine, can have great and negative impact on gastrointestinal motility and can induce colic if used in excess or if the horse is sensitive to it. Many of the other bronchodilator drugs have a narrow range between therapeutic and toxic and have to be administered frequently, making them less useful in the horse. The drug albuterol (common human asthma drug) has been used in the horse, but our clinical pharmacology laboratory has just recently determined that albuterol is not absorbed well out of the horse's gastrointestinal system and therefore has no benefit when given orally.

One drug that recently was approved by the FDA should offer a needed therapy for horses with heaves. The drug "clenbuterol" (trade named Ventipulmin Syrup) has been used outside of the United States for some time now with reported success–the drug can be given orally and is absorbed well from the gastrointestinal tract. (See *The Horse,* July 1998, pg. 19 for more information on Ventipulmin.)

Another method of therapy is the use of inhalers. The inhaler is probably the main line of defense for the maintenance of asthma in people and has, until recently, posed a unique problem with respect to use in the horse. The development of the Aeromask, by Trudell Medical in Ontario, Canada, now allows veterinarians effectively to utilize inhalant medication in the horse. The system is quite unique and allows for the use of some great human asthma drugs in the form of inhaled steroids, bronchodilators, and other drugs to control allergic inflammation. These drugs have been used successfully with minimal effort to control advanced cases of COPD, but the main drawback is the expense. Without the $5 insurance co-pay offered by human insurance, many of these drugs cost in excess of $50 per inhaler, which might only last a few weeks in the horse. Nonetheless, these provide another option for the effective treatment of heaves. As newer inhalant drugs are developed for people, the cost of some of the older drugs has become significantly less.

See more on COPD in article #618.

EIPH

Exercised-induced pulmonary hemorrhage is a disease of athletic horses in which there is hemorrhage originating from within the lungs (the exact location is unknown). The hemorrhage can be subtle enough to be seen only by microscope evaluation of a bronchial aspirate, or frank enough to be observed pouring from the nostrils.

Some additional clinical signs include exercise intolerance, respiratory distress, coughing, and excessive swallowing. The diagnosis generally is made by evaluation with the endoscope within 90 minutes of exercise; examination of aspirates from the trachea or bronchi allow the veterinarian to look for white blood cells that have ingested red blood cells as evidence of EIPH.

Le traitement de l'hypertension artérielle pulmonaire aiguë implique d'exclure la présence d'une infection. L'utilisation du médicament diurétique Lasix (furosémide) pour combattre l'hypertension artérielle pulmonaire aiguë chez les chevaux de sport peut être limitée par l'autorité qui régit les activités de chaque cheval ; les différents États ont également des réglementations différentes.

Michael Ball, docteur en médecine vétérinaire

Michael A. Ball, docteur en médecine vétérinaire, a effectué un stage en médecine et chirurgie et un stage en anesthésie à l'Université de Géorgie en 1994, une résidence en médecine interne et des études supérieures en pharmacologie à l'Université Cornell en 1997, et a fait partie du personnel de Cornell avant de créer Early Winter Equine Medicine & Surgery à Ithaca, New York. Il était vétérinaire FEI et a travaillé à l'international avec l'équipe équestre des États-Unis. Il est décédé en 2014.

PLUS D'ARTICLES DE CET AUTEUR

PRÉCÉDENT
Mise à jour VS du 28/07/98

SUIVANT
Des jumeaux lipizzans nés à Tempel Farms

Douleur et comportement anormal chez les chevaux

De la stérilisation aux points de suture : le traitement des plaies du cheval

La valeur des radiographies des sabots

Reconnaître et gérer les chevaux en surpoids

Contenu sponsorisé

Demandez à un pro : les bananes vertes, un super aliment pour le système digestif des équidés

Médicaments, dispositifs et décisions : comprendre vos options dans la gestion de la maladie articulaire dégénérative équine (DJD)

Identifier les égratignures et stratégies de traitement efficaces et innovantes

Catégories principales

Cavalier pratique

Gestion de l'écurie

Journal de l'équipe de rodéo

Le cheval

Cavalier américain

Corde américaine

RESSOURCES

À propos de nous

Contactez-nous

Informations sur les freelances

Aide

Réseau de radios équestres

ENTREPRISE

Rencontrez le personnel

Énoncé de mission

Conditions d'utilisation

Politique communautaire

Faites de la publicité avec nous

Vos choix en matière de confidentialité

Demande d'accès aux données personnelles

Consentement aux cookies

politique de confidentialité