Veterinary Scientists Address Lingering Questions Concerning West Nile Virus

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The National Institute for Animal Agriculture asked a panel of veterinary scientists to address a few lingering questions from the West Nile virus (WNV) epidemic of 2002. The questions originate from practicing veterinarians and horse owners.

NIAA realizes that many unknowns exist with this emerging disease, but hopes posing these questions will spur on more research efforts and funding to battle it.

Q: Based on currently available laboratory tests for West Nile virus infection, what criteria must be met to establish a diagnosis of this infection in a horse displaying neurological signs of acute onset?

Dr. Ostlund:
Clinical signs of West Nile encephalitis in horses are quite variable in severity and can mimic other diseases. Diagnostic criteria for equine West Nile encephalitis must always include a combination of laboratory tests and clinical signs. Depending on the samples available, a number of laboratory tests may be applied.

Laboratory tests detect either the WNV agent (intact virus or a viral component) or antibodies that the infected horse has produced in response to infection.

Because the currently available WNV vaccine is a killed virus product, vaccinated horses should not test positive in assays that detect the WNV agent. Vaccinated horses do mount an antibody response, however. Some WNV antibody tests are positive in WNV vaccinated horses.

Q: Which WNV diagnostic test is best—IgM capture test (MAC-ELISA) or IgG?

Dr. Ostlund:
In the vast majority of clinical cases, testing acute-phase serum or CSF by IgM capture ELISA provides confirmation of recent exposure to WNV. Most horses test positive at the time that clinical signs are first observed and the IgM response persists for a few weeks.

Evidence from testing a number of vaccinated (but not exposed) horses indicates that horses receiving the WNV killed virus vaccine do not develop IgM antibody detectable at the serum dilutions used in diagnostic testing. Therefore, detection of IgM antibody, even in a vaccinated horse, indicates recent exposure to WNV.

Q: Initial West Nile virus symptoms may mimic EPM, equine herpes virus, EEE, VEE, or even rabies. How is it differentiated?

Dr. Long:
Diagnosis should be made through a combination of thorough physical and neurological examination coupled with ancillary diagnostic testing.

Regarding physical examination, 60% to 65% of horses develop fever, anorexia and depression consistent with a viral infection. Skin and muscle fasciculations are apparent in approximately 60% to 65% of horses. Almost all horses demonstrate some degree of weakness and ataxia, which is frequently asymmetrical and diffuse (front can be worse than hind). Cranial nerves vary but facial paresis and a weak tongue are common symptoms.

(continued on page 2)
**West Nile**

In eastern and Venezuelan equine encephalomyelitis (EEE, VEE), spinal signs can occur, but abnormalities of the cerebral cortex are more common and include extreme behavioral changes, head pressing, coma, and seizures. These can occur in WN horses but not as commonly. Rashes can look like any other neurological disease and all encephalitic horses must have a post-mortem to rule out this disease. 

**Computed tomography** is a non-invasive way to see inside the body. Computed tomography is a diagnostic medical technique that combines X-rays and computers. Often called CT scans, CT scans allow imaging of both soft tissue and bone, with much more detail than with traditional X-ray machines. A CT scan gives the radiologist a three-dimensional view inside the body. It is a kind of CT that can rapidly acquire two-dimensional pictures of the animal’s anatomy. Using a computer, these 2-D images can be presented as 3-D images for in-depth clinical evaluations. CT scans are valuable tools to help in diagnosing a variety of conditions from joint problems (e.g., small chip fractures) to brain lesions. For more information, please contact Dr. William E. Blevins, Professor of Diagnostic Imaging, Purdue University School of Veterinary Medicine. (765-494-1307, blevinsw@purdue.edu).

**Rhodococcus Equi Pneumonia in Foals**

Rhodococcus equi pneumonia is usually a farm problem, and can even occur on farms with the best of management programs. Once the organism is on a farm, it is impossible to rid the farm of it, due to its presence in the soil and feces of carrier animals. However, several steps can be taken to reduce the incidence of disease on affected farms. Routine screening for adequate colostrum intake after birth. Administration of hyperimmune plasma within the first month of life is recommended to foals destined for occupations where the risk of exposure is high. Preventive measures are vital to control Rhodococcus equi pneumonia on farms. Once the organism is established on a farm, it is nearly impossible to eradicate it. The disease can be controlled by implementing strict biosecurity measures, such as disinfecting equipment, maintaining a clean environment, and minimizing the exposure of susceptible animals to infected material.

**Cause**

Rhodococcus equi is a common cause of severe pneumonia in foals. This disease can have a great impact on breeding farms and cause major economic losses from expensive treatment and loss of foals. The following article contains information about this disease, how it is treated, and how it can be controlled on the farm.

**Disease Mechanism**

Rhodococcus equi is a prevalent organism in herbivores and the environments in which they live. The widespread nature of this organism is due to its very simple requirements for growth. It is present in herbivore feces and soil contaminated with herbivore feces. Foals usually acquire the infection by inhaling organisms from pasture dust, or from coughing (casing) fever of carrier animals.

**Clinical Signs**

Rhodococcus equi lives and survives in macrophages (white blood cells). This organism has a predilection for the lungs. After infection of these alveolar macrophages, abscesses begin to form and continue to grow. This becomes a chronic condition, and functional lung tissue is lost as abscessed areas of lung increase. The result is severe pneumonia that responds only to antibiotics able to penetrate macrophages. In 50% of cases, the organism spreads to the gastrointestinal tract as well, causing inflammation and diarrhea.

**Diagnosis**

Computed tomography is very important in WNV testing. A serum sample should be sent to the state diagnostic laboratory for testing. A positive result on the WNV IgM capture ELISA test indicates that the horse has been exposed within 30 days.

**Treatment**

The treatment of choice is a combination of erythromycin and rifampin. Erythromycin should be given at a dose of 25mg/kg to three times daily, and rifampin can be dosed twice daily at 5mg/kg or once daily at 10mg/kg. Treatment will be necessary for 4-9 weeks. Potential complications associated with erythromycin therapy are diarrheal and high fever in treated foals and rarely severe diarrhea in the dam of nursing foals presumably from exposure to erythromycin residue in the foal’s feed. Alternatively, therapy with azithromycin has been introduced and appears to be as effective as prior treatments without adverse effects.

**Prevention**

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During Transport it’s Best to Leave Your Horse Loose


The development of respiratory disease is a major concern when transporting horses over distances. The stress of transportation has been implicated as a predisposing factor to the development of respiratory disease, so it is important to minimize stress factors as much as possible. Several studies have shown that a lowered head position with restriction in the range of neck movement can compromise the immune system and increase the number of bacteria in the respiratory system of the horse.

A recent study conducted in the United States aimed to compare physiological stress and immune response to transport when horses were either cross-tied or traveling loose (CL Stull and AR Rockie, Effects of Cross-Tying Horses During 24 h of Road Transport, Equine Veterinary Journal 2002 Vol 34, No. 6 pg 550). It is common practice for horses to be cross-tied during transport.

Ten horses, all experienced travelers, were used in the cross-over design consisting of two 4-day trials investigating the effects on the horses after 24 hour periods of transport. Horses were either cross tied or traveling loose in pairs in enclosed compartments. Horses were measured at various stages of the trial for weight and temperature changes and blood characteristics.

The results showed that blood parameters indicating stress in the horse were significantly raised in the cross-tied group compared to the loose traveling horses. Also, glucose levels were very slow to return to normal for the cross-tied horses. These findings indicate that the athletic performance of these horses would be sub-optimal if they were expected to compete shortly after transport. A comparison of whole blood cell counts showed clearly that cross-tying had a larger impact on the immune system than loose travel, so those horses may be more susceptible to disease, especially those affecting the respiratory system.

The researchers suggest that it takes 2 days for a cross-tied horse to recover from a long journey, whereas only 1 day is needed for loose traveling horses. This is important for both the requirements of athletic performance as well as disease susceptibility of the horse during the recovery period.

Mucus in the Airways (continued from pg. 5)

Proposed causes of IAD include infectious and non-infectious agents. Contrary to a common belief, respiratory viruses do not appear to play an important role in the disease. Bacteria are isolated in up to 50% of IAD cases and they may play a role in young horses. However, in adult horses several facts suggest that they may be contaminant or opportunist organisms and not causative agents. The role of exposure to dust in the development of IAD is suggested by several studies. For example, healthy yearlings fed hay develop airway inflammation and klebsiella pneumonia when housed in a stall vs. when kept on pasture. Also, horses in training kept on straw bedding experience episodes of IAD that last longer than in horses bedded on low dust material such as shredded paper. Allergy to inhaled particles appears to be responsible for some cases of IAD.

Treatment of IAD should combine environmental changes aimed at decreasing exposure to dust and medical therapy. Improving ventilation in the barn and using alternative feed sources and bedding (e.g. dust-free wood shavings bedding and pelleted diet) can effectively reduce dust exposure. The goals of medical therapy are to control airway inflammation and relieve bronchospasm using mainly corticosteroids and bronchodilators. However, systemic therapy (oral administration or by injection) with these drugs may result in adverse effects because of the dosages required for clinical efficacy. Administration of the medication via inhalation has the advantage of delivering high concentration of the drug directly into the lungs while minimizing the amount absorbed systemically and therefore, reducing the risk of adverse effects. Adjunct therapy with immunostimulants may help in some cases of IAD.

Infectious Arthritis in Horses

Timothy B. Lescun, BVSc, MS, Diplomate ACVS

An infected joint in a horse can be a devastating problem. In many cases the horse will require both intensive treatment to control the infection and long-term antibiotic treatment to ensure that the infection does not recur. The end result may be a joint that has some arthritis and chronic pain even once the infection is treated. Occasionally when infection is uncontrollable, or it has damaged too much of the joint and surrounding bone, or there are serious complications encountered such as lamiartis (founder) in the opposite foot, infectious arthritis may result in euthanasia of the horse.

Joint ill is a term used to describe joint infection in foals, where the bacteria localize in a joint from the blood stream. This is a serious problem and is seen in foals most commonly between 2 weeks and 3 months of age. Joint ill can be a secondry problem in foals with diarrhoea, nasal ill (infected umbilicus), pneumonia, or septicaemia (systemic blood infection). This is because in those foals, bacteria travel in the bloodstream and lodge in the lining of a joint or in the end of a bone next to a joint, resulting in an infection. A joint infection in a foal can also be devastating, and the foal’s long-term soundness may be jeopardized. In approximately half the cases of joint ill, more than one joint is affected, making prompt and aggressive treatment all the more important.

There are several approaches available for treating an infected joint. They are all based upon 2 central requirements of successful treatment. Firstly, the bacteria causing the arthritis need to be eliminated from the joint. Secondly, any damage from the inflammation that occurs during a joint infection needs to be minimized.

Antibiotics are central to treating most infections. One problem we are faced with when treating a joint infection is the inability of some antibiotics given systemically (either in vein, in muscle or by mouth) to actually get to the joint lining or bone ends where the infection is established, at a high enough concentration to kill the bacteria. Another problem is that at the time of initial treatment, the specific bacteria and their antibiotic sensitivities are usually unknown. In an attempt to improve antibiotic delivery to the site of infection, several methods have been devised for delivery of antibiotics into joints. These are as simple as a direct joint injection or as complex as antibiotic impregnated cement beads, collagen sponges or local antibiotic perfusion through a vein or the adjacent bone.

Over the past 4 years we have developed a technique of continuous antibiotic delivery into various joints in an attempt to attain very high drug concentrations within the joint. This technique involves placement of a catheter in a joint pouch and delivery of antibiotics at a constant rate for a period of 4-8 days. This ensures the need to repeatedly inject the joint or surgically implant devices to maintain high antibiotic concentrations. Another advantage of this approach is that it allows high antibiotic concentrations within the joint in the lower level of bacterial resistance that is present at the higher concentration of antibiotic. This often minimizes the problem of not knowing the antibiotic sensitivity of the organism prior to initiating treatment. Using this technique on severe cases (bone involved in infection), chronic cases (infection for more than 7 days), and those cases that were unresponsive to standard treatments, we have been able to resolve the infection in 98% (27/30) of joints treated and 87% (20/23) of the horses treated have survived. We are continuing to investigate and improve this technique of antibiotic delivery for the treatment of infected joints.

Equine Viral Arteritis

Jill Franks, D V M student (Class of 2003)

Equine viral arteritis (EVA) is a contagious disease of horses caused by a virus known as equine arteritis virus (EAV). This disease has worldwide distribution but outbreaks are rare in the United States. This disease developed during a national situation during a 1984-1985 epidemic in Kentucky breeding operations. The Standardbred breed has a markedly high infection rate at 70-90%. However, Thoroughbreds and other domestic breeds have a low infection rate around 2-3%. Interestingly, infected Standardbred horses rarely develop clinical disease, while other breeds can develop severe clinical signs. The virus is transmitted from horse to horse through infected body fluids, most likely respiratory secretions but also urine, feces and tears. The virus is also transmitted venereally as virus is shed in semen. Stallions can become persistently infected with EAV and will shed virus indefinitely in the semen but not in other secretions. 30-60% of orneproductive stallions are persistently infected and serve as carriers of the disease.

Horses exposed to EAV are rarely symptomatic. Clinical disease is often mild and self-limiting. Virus replicates in the wall of arteries creating a vasculitis that can result in edema and hemorrhage throughout the body. Horses present with varied clinical signs including decreased appetite, depression, fever, conjunctivitis, nasal discharge, coughing, limb edema and diarrhea. Clinical disease often manifests with respiratory and ocular signs and can be difficult to distinguish from other viral respiratory diseases. Pregnant mares infected with the virus often abort. Death due to clinical disease is rare. Treatment is usually unnecessary. However, severe cases require supportive care in the way of anti-inflammatories and fluid therapy.

EVA can be diagnosed through blood testing (serology). Horses exposed to the virus will have detectable antibody in the serum; however, vaccinated horses will also be positive for serum antibodies. Definitive diagnosis is by virus isolation from white blood, nasal swabs or semen. Persistently infected stallions are identified by virus isolation of semen. In cases of abortion, paired serum samples from the mare and fetus should be submitted for testing.
Infectious Arthritis (continued from pg. 3)

It is often not the direct effects of the bacteria, but the severe inflammatory response that the body mounts to kill the bacteria, that rapidly damages the joint during an infection. Minimizing this inflammation serves to reduce the pain and discomfort associated with an infected joint, as well as the long term joint damage that can result from the infection. The treatments aimed at minimizing inflammation within a joint, during and after active infection, are used in conjunction with an antibiotic regime. These treatments include joint lavage, arthroscopic débridement and lavage, pressure bandaging, open joint drainage, anti-inflammatory and chondroprotective medications.

Both experimental studies and case analysis of many hundreds of joint infections have shown that prompt recognition of the problem and early aggressive treatment to resolve the infection are crucial in minimizing the long term effects of a joint infection. With advancements in treatment techniques and medications the success rate for treating infected joints has improved considerably over the years and only in the most severe cases or those where treatment is delayed are the chances of successful treatment poor. Any delay in treatment may be critical to the final outcome of a joint infection. The cardinal signs of a joint infection are heat, pain, swelling and lameness, though in some joints of the body, lameness may be the only sign we observe easily. Lameness associated with a joint infection is usually moderate to severe. At time delay before treatment is a key factor in the prognosis for joint infections, it is important that prompt and aggressive action is taken when this problem is suspected. 

References

Equine Viral Arteritis (continued from pg. 3)

EVA is most important as a cause of abortion and respiratory disease. Outbreaks can cause significant economic losses through lost foal crops, lost training racing opportunities and the costs of control programs. Therefore, prevention of this disease is an important consideration in any breeding program. A modified live vaccine is available in the United States. Vaccination should only be considered to prevent the spread of EVA from known positive stallions to naïve or showing animals. Therefore, vaccinated animals or their semen may not be exported rules may require seronegative animals. Therefore, vaccinated animals or their semen may not be exported.

The importance of performing a comprehensive evaluation of poorly performing horses can’t be overemphasized. Can Mucus in the Airways Cause Poor Performance?

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Over the last few years, a condition called inflammatory airway disease (IAD) has been recognized as a separate entity from other lower airway inflammatory diseases such as infectious and parasitic diseases, interstitial pneumonia, and chronic obstruction pulmonary disease (COPD) or heaves. Clinical signs of IAD have been commonly described in young athletic horses and also include chronic cough, excess mucus in the airways, and poor performance. Otherwise horses have a normal attitude and appetite, are not febrile, and do not exhibit increased respiratory effort at rest.

Airway secretions mucus to the respiratory tract against inhaled irritants or other causes of irritation. Additional means to protect the lungs are the cough reflex and bronchospasm (airway narrowing). The purpose of such responses is to limit further infiltration of irritants and to accelerate their removal from the respiratory tract. Irritant may be infectious agents (e.g. viruses, bacteria), parasites, toxins, molds, dust, or pollutants. If exposure to these agents is of sufficient magnitude, airways may become inflamed. In turn, airway inflammation leads to increased mucus secretion, cough, and bronchospasm. Normally, the inflammation subsides shortly after the initial irritant has been eliminated. In some cases, airway inflammation may persist for prolonged periods of time either because the initiating cause is still present or because the body is unable to ’put the fire out’.

Between 11% and 65% of racehorses suffer from IAD at some point in their career. Horses with IAD usually have a history of decreased performance, mild exercise intolerance, cough, and increased respiratory secretions (i.e. mucus). Feals and older horses may also suffer from IAD. The possibility of IAD should be considered in horses with signs of respiratory disease including tracheobronchial mucopurulent exudate that do not respond, or relapse, after antimicrobial therapy and further diagnostic tests should be pursued (e.g. bronchoalveolar lavage). Duration of IAD is seven weeks on average with a range from 4 to 22 weeks, which is longer than most infectious respiratory diseases. IAD appears to be more common in young athletic horses and decreases in frequency with increasing age. IAD is particularly common in thoroughbred and standardbred racehorses, but has been also reported in a variety of other breeds such as Quarter Horse, Warmblood, Appaloosa, and American Saddlebred.

Endoscopy is a good way of estimating the quantity of mucus present in the trachea. Horses free of respiratory disease have either no mucus or a few isolated flecks and horses with IAD have a pool of mucus at the thoracic inlet or a continuous stream of variable width. In addition, the severity of IAD is related to the amount of mucuscop and the percentage of neutrophils in tracheal wash or in bronchoalveolar lavage (BAL) fluid. Cough is only present in 38% of horses with IAD, however 85% of coughing racehorses have IAD. Other clinical signs of respiratory disease such as nasal discharge and fever do not appear to be associated with the disease. Thoracic auscultation is usually normal, however some horses may exhibit increased lung sounds or wheezes. Horses with IAD may have a slightly increased respiratory rate and abdominal contraction on expiration. For the most part, IAD is subclinical and may go undetected unless coughing is present or tracheal exudate is detected by endoscopy.

Poor performance in racehorses has associated with IAD and increased percentage of neutrophils in BAL fluid. Other signs associated with poor performance are delayed recovery of normal respiratory rate after exercise and respiratory embarrassment. The latter signs are more likely to be recognized in athletic horses other than racehorses because most of their activities do not require exercising at or above maximal aerobic capacity. The mechanism of decreased performance is speculative. Horses with heaves exhibit marked airway obstruction largely due to bronchospasm resulting in abnormal gas exchanges at rest as illustrated by low blood oxygen levels. Exercise induces further deterioration in lung function. Horses with IAD have only a mild degree of airway obstruction and gas exchanges are normal at rest. However, during exercise blood oxygen levels drop significantly in comparison to healthy horses.

Poor performance may result from a variety of causes such as larnemoses, respiratory diseases, tying up, cardiac and neurologic diseases. More importantly, it is common to diagnose several problems in the same horse. In a retrospective study performed on 163 horses presented for poor performance evaluation at Purdue’s Equine Sports Medicine Center, twenty percent of cases were diagnosed with a combination of respiratory disease and at least one other problem involving a different body system. These findings underscore the importance of performing a comprehensive evaluation of poorly performing horses.