EQUINE DISEASE QUARTERLY

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JULY 2005

Volume 14, Number 3

COMMENTARY

THE GOAL OF ARTHROPOD VECTOR MANagement programs is to reduce the number of pests that are capable of transmitting important diseases of animals and humans. Standards for satisfactory vector control are much higher than those designed to provide animal comfort, because a very small number of infective vectors can cause devastating consequences.

Traditional vector control was based upon widespread applications of insecticides to control the adults. Current integrated approaches now include surveillance and assessment of developing vector populations and use of weather data and predictive models to develop treatment strategies. Decisions and allocation of resources, including insecticide applications that are made to protect human health, may not address needs of the equine population.

The three-year sweep of West Nile virus (WNV), a mosquito-borne encephalomyelitis, across the United States demonstrates the speed with which a pathogen can be dispersed by insects. It is now playing havoc in California and other western states. Some of these states have vector management plans and organizations that routinely deal with mosquito management. States without plans and infrastructure have little or no ability to respond in a coordinated or effective manner to break transmission of any vector-borne disease. The role of insecticides in these cases may be moot if appropriate equipment and trained personnel are not available to implement a program.

However, there are several important steps that can be taken to reduce mosquito problems on horse farms without the use of pesticides. Source reduction is the foundation of any mosquito or vector control program. Removal of breeding sites is the goal for mosquito control. *Culex* house mosquitoes, serious potential WNV vectors, breed in small accumulations of water. A half-cup of water is enough to produce several hundred to thousands of mosquitoes in a short time.

Many, but not all, of Kentucky's adult mosquitoes feed during the "low light" periods of the day—around dawn and dusk. The house mosquito, the primary vector of WNV in Kentucky, feeds around dawn, dusk, and at night. True to its name, it will enter structures to feed. Protecting horses from mosquitoes is difficult, but stabling horses in screened areas (16- to 18-mesh) during the mosquito feeding time will help. Also, the use of fans to create an "air curtain" by entryways also may help to reduce mosquito access.

Several insecticides are registered for application to barn and stable walls where mosquitoes rest. Mosquitoes also move to the shade offered by trees, shrubs, and dense vegetation during the heat of the day. Insecticides can be applied to the underside of foliage of shade trees, shrubs, and within shaded areas adjoining foundations and occupied areas.

Horses and livestock should always be removed from the barn prior to pesticide application, and feed and water must be protected from spray drift. Do not return animals to treated stalls until the spray residue is dried, or check product labels for the time limit for re-use of the structure.

CONTACT: Dr. F. W. Knapp, Professor Emeritus, fknapp@email.uky.edu, Department of Entomology, University of Kentucky, Lexington, Kentucky.

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UK UNIVERSITY OF KENTUCKY
College of Agriculture
Department of Veterinary Science

LLOYD'S

INTERNATIONAL

First Quarter 2005

THE INTERNATIONAL COLLATING CENTER, Newmarket, and other sources reported the following disease outbreaks:

Sporadic cases of Borna disease and botulism were reported from Switzerland. Contagious equine metritis (CEM) was confirmed in the United Kingdom in a Warmblood stallion imported from Germany. Since arriving in England six months previously, the stallion had not covered any mares. The streptomycin-resistant strain of *Taylorella equigenitalis* was identified.

Sporadic cases of equine herpes virus abortion caused by EHV-1 were reported from France, Japan, the United Kingdom, and the United States. Ireland reported an increased number of multiple abortions, primarily among unvaccinated mares, and also two cases attributable to EHV-4. Respiratory disease attributable to equine herpes virus was reported from France, Japan, and the United Kingdom. The neurological form of herpes virus infection caused by EHV-4 was diagnosed in a mare in the United Kingdom. In the United States, cases of EHV-1 paralysis were confirmed at Standardbred racetracks in Michigan and Pennsylvania and a boarding premise in New York.

An imported Spanish stallion tested serologically positive for equine viral arteritis (EVA) in the United Kingdom. Influenza was reported from Denmark, France, and the United Kingdom. Two cases of Hendra virus infection (one confirmed, the other suspect) were reported among horses in Queensland, Australia, occurring at the end of 2004. A mild outbreak of equine piroplasmosis was reported by South Africa.

In Ireland an outbreak of rotavirus infection was diagnosed on a single stud farm. Cases of strangles were diagnosed in Ireland, South Africa, Sweden involving horses in 22 stables, Switzerland, and the United States. In the United States, strangles was confirmed at Thoroughbred training facilities in Florida and Kentucky and a boarding facility in California.

Worldwide Equine Influenza Surveillance

THE FOLLOWING ARE CONCLUSIONS AND recommendations of the Expert Surveillance Panel meeting held in April 2005:

Outbreaks of equine influenza type-2 (H3N8) virus were confirmed in Argentina, Canada, Croatia, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Sweden, the United Kingdom and the United States during 2004. There were no reports of equine type-1 virus infection. During the period January 2003 to April 2004, H3N8 viruses of the "American" lineage caused widespread outbreaks in Europe, with vaccinated horses frequently affected. Viruses responsible for recent outbreaks in South Africa and North America were antigenically distinguishable from the currently recommended vaccine strains. No viruses belonging to the "European" lineage were characterized in 2004.

It is recommended that vaccines contain the following:

AMERICAN LINEAGE VIRUS

An A/eq/South Africa/4/03 (H3N8)-like virus.*

*A/eq/Ohio/03 is acceptable

EUROPEAN LINEAGE VIRUS

An A/eq/Newmarket/2/93 (H3N8)-like virus.*

*A/eq/Suffolk/89 and A/eq/Borlange/91, currently used vaccine strains, are acceptable.

CONTACT: Dr. Thomas Chambers (859) 257-4757, tmcham1@uky.edu, Maxwell H. Gluck Equine Research Center, University of Kentucky, Lexington, Kentucky, or Dr. Janet Daly 44 8700 502460, janet.daly@aht.org.uk Animal Health Trust, Newmarket, England.

Equine Disease Quarterly

Editors
Roberta Dwyer
David Powell
Neil Williams

Staff
Diane Furry

Correspondence should be addressed to the editors, Department of Veterinary Science, Maxwell H. Gluck Equine Research Center, University of Kentucky, Lexington, Kentucky USA, 40546-0099
Telephone (859) 257-4757
Fax (859) 257-8542

Internet address: http://www.uky.edu/Agriculture/VetScience/gluck1.htm

Maturation of the Neonate's Immune Response

INFECTIOUS DISEASE IS ONE OF THE MAjor economic burdens of the equine industry. Young horses, in particular, frequently suffer from viral and bacterial infections of the respiratory tract. *Rhodococcus equi* is a common cause of subacute or chronic abscessating bronchopneumonia in foals less than 5 months of age. The developmental immaturity of the neonate's immune system is considered contributory to this increased susceptibility. The neonatal period is characterized by first exposures to a vast array of potentially pathogenic microorganisms. While maternal antibodies obtained through colostrum provide some degree of protection, young animals remain at risk for infection. Vaccination of this population is thus a high priority. Unfortunately, there are a number of difficulties associated with vaccination of young animals. Maternal antibodies inhibit the development of immune responses to vaccines. Even in the absence of interfering maternal antibodies, immune responses during neonatal life are typically weak in magnitude and poorly protective.

The ability of the neonatal immune system to confer protection against viral, bacterial, and fungal infection is inadequate when compared to adults. This has been attributed to a defect in the foal's cell-mediated immune (CMI) response. Protection against intracellular pathogens such as viruses and certain bacteria is dependent upon the generation of a CMI response. Instead of producing protective CMI responses against these agents, neonates are heavily biased toward antibody responses. Such a bias towards an antibody response has dire consequences following exposure to intracellular pathogens such as *Rhodococcus equi*.

What factors in the neonate are responsible for this bias are not known but could include the absence of co-stimulatory molecules necessary for the induction of a CMI response. These co-stimulatory molecules can include soluble cytokines and/or cell surface proteins that serve as co-receptors for the pathogen. Neonatal macrophages and dendritic cells have decreased expression of these co-stimulatory molecules. Since these cells play a key role in the induction of CMI responses, the absence of their co-stimulatory signals could account for the reduced CMI response in the neonate. Neonatal macrophages also produce inhibitory cytokines that can down-regulate CMI responses. This reduced expression of co-stimulatory molecules coupled with enhanced expression of inhibitory cytokines suggests that these cells are intrinsically preprogrammed against the generation of CMI responses. The reason for this bias is unclear but could be the result of the maternal environment during pregnancy. Pregnant females produce factors during pregnancy that inhibit CMI responses, possibly as a means of preventing fetal rejection. These maternal influences may persist in the neonate, leading to the bias against CMI responses.

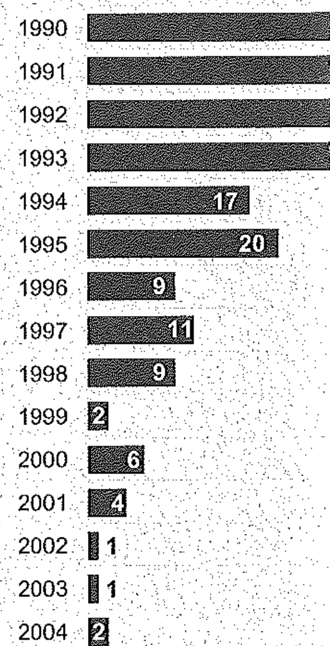
What remains unclear is the process whereby the immune response eventually matures, leading to increased resistance to intracellular pathogens. Current opinion is that encounters with microbial antigens may be required for the maturation of the immune system of neonates. The precise role microbial products play is uncertain but likely involves stimulation of macrophages and dendritic cells by pathogen-associated molecular patterns (PAMPs). PAMPs are found on various bacteria and are recognized by TOLL-like receptors, or TLRs, on the macrophages and dendritic cells. These receptors are involved in the recognition of PAMPs, which leads to activation of cells and the production of various cytokines and other co-stimulatory molecules. Thus, early exposure to PAMPs could overcome the initial bias of the neonate's immune response.

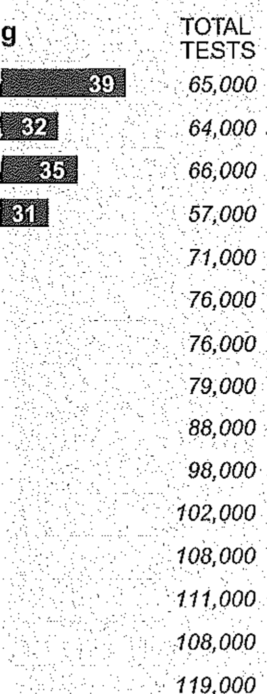
Current research efforts are directed toward understanding this process of immune maturation in the foal. The role PAMPs play in regulating the foal's immune response is also under investigation. Information gained from these studies may enable us to develop improved therapeutics and novel approaches for increasing the resistance of foals to infectious disease.

CONTACT Dr. David Horohov (859) 257-4757, david.horohov@uky.edu, Maxwell H. Gluck Equine Research Center, University of Kentucky, Lexington, Kentucky.

Figure 1

EIA Surveillance Testin





NATIONAL

External Parasite Control for Horses

BITING AND NUISANCE FLIES, MOSQUITOES, ticks, and lice (ectoparasites) can have a tremendous impact on horse comfort, performance, and health. Unfortunately, it often is impractical to approach management through source reduction because pest breeding sites or harborages cannot be eliminated or reduced sufficiently. Protection often must be focused on the animal, usually accomplished by insecticides or repellents.

Both can play a vital role in protecting horses from a wide range of ectoparasites. While only a few active ingredients are labeled for use on horses, they have been formulated into an array of products and application options. The product's active ingredients are listed below the brand name of the pesticide. Pyrethrins, or closely-related pyrethroids, are the most common constituents in commercial equine products. Some are Ready-To-Use (RTU), while others are concentrates that must be diluted before application. The percentage of active ingredients in RTU insecticides can range from 0.1% to 45%; higher concentrations generally should provide longer protection.

Pyrethrins are a mixture of materials with insecticidal properties that are extracted from certain *Chrysanthemum* flowers. They affect the nervous system of insects and other arthropods by disrupting ion channels so that nerve cells cannot return to their normal "resting" state after transmitting an impulse. Pyrethrins work against a wide spectrum of arthropods, provide a quick "knockdown" of the pest, and have a very low toxicity to mammals and humans. They are unstable in light or air, so they are degraded very quickly following application. Usually, pyrethrins are formulated with piperonyl butoxide, a synergist that enhances the activity of the pyrethroid. Skin sensitization, rash, or inflammation can occur in some individuals following the initial exposure to any insecticide.

Pyrethroids are synthetic insecticides with chemical structures based upon the natural pyrethrins. They are more stable, so there is a significantly longer period of residual protection. Positive features of the pyrethrins, such as quick knockdown and low mammalian toxicity, are retained. Early pyrethroids, often referred to as "first generation" products, include resmethrin and permethrin. Continued research and development have produced subsequent "generations," such as cypermethrin and *zeta*-cypermethrin, which can be used at much lower concentrations.

The repellents diethyltoluamide (DEET) and oil of citronella are the active ingredients in some equine products. Oil of citronella is a volatile liquid that is extracted from some dried grasses. Both appear to work by blocking sensors that some pests use to locate hosts.

Application of an insecticide or repellent to horses will not reduce their attractiveness to ectoparasites but will have an impact only when the pest gets very close or contacts the animal. Therefore, re-infestation pressure will always be high, and feeding will begin as soon as the treatment drops below a minimum effective level. Rain, sweat, or dust can quickly reduce normal protection levels.

Discovery of new insecticide and repellent active ingredients may improve animal protection, but the challenge is formidable. Understanding current technology, environmental constraints, and management philosophies will continue to make animal protection an art that is improved through individual experience.

CONTACT: Dr. Lee Townsend, (859)-257-7455, ltowsen@uky.edu, Department of Entomology, University of Kentucky, Lexington, Kentucky.

KENTUCKY

Liver Disorders in Horses

THE LIVER IS THE LARGEST ORGAN IN THE body and has a multitude of roles, including metabolism, detoxification, excretion, storage, synthesis, and defense (phagocytosis of microbes). Approximately 60% of its mass consists of hepatocytes.

Liver disease can be the result of a process directly affecting the liver, or it can become secondarily injured by diseases originating in other sites. Clinical signs commonly associated with liver disease include depression, loss of appetite, weight loss, colic, and icterus. In addition, signs of central nervous system dysfunction can occur, which is referred to as hepatic encephalopathy.

Liver disease is classified as acute, chronic, or congenital. Acute diseases are caused by bacteria, viruses, parasites, obstructions, and toxins (plants, chemicals, or drugs). Chronic liver diseases can result from toxins, obstructions, neoplasia, chronic hypoxia, infections (abscesses), and immune system disorders. Congenital liver diseases include vascular shunts that bypass the liver and failure of development of a portion of the liver (atresia).

A review of cases submitted to the University of Kentucky Livestock Disease Diagnostic Center (LDDC) over the past 10 years revealed the most commonly diagnosed liver condition to be hepatitis (six to 10 cases/year). Hepatitis indicates inflammation of the liver, often with degeneration or necrosis of hepatocytes. Most cases were seen in foals related to bacterial infection and sepsis caused by salmonellae, rhodococcus, corynebacterium, and actinobacilli. Another common condition in foals was rupture of the liver, leading to rapidly fatal internal hemorrhage observed from the day of birth to 4 months of age. Rupture of the liver was typically associated with trauma at delivery or being stepped on or kicked by another horse.

In foals found dead, necrotizing hepatopathy was often diagnosed. These cases were associated with infection by *Clostridium piliformis* (Tyzzer's disease) or equine herpes virus 1 (EHV-1). At the LDDC, an average of five cases of Tyzzer's disease per year were seen in foals 5 days to 5 weeks of age. EHV-1 was diagnosed during the first days of life, with an average of one case a year.

An uncommon but severe liver disease seen in adult horses is characterized by acute hepatic necrosis. This has features similar to Theiler's disease, which has been associated with the use of live virus vaccines and equine-origin antiserum (serum sickness). Acute hepatic necrosis usually occurs sporadically, but small outbreaks may occur. Affected horses die unexpectedly or exhibit a short course of icterus and anorexia, with nervous signs commonly observed. The LDDC typically receives three to four cases each year among horses whose ages range from 2-17 years. While the condition is readily diagnosed, the precise cause is obscure. Occasionally, there is a history of recent vaccination; however, with cases occurring most commonly in the summer, possible exposure to toxic plants is a potential explanation. Cases at the LDDC over the last 10 years have involved a variety of breeds. Of 26 cases where breed was known, only two were Thoroughbreds.

Another common cause of liver disease in adult equines is hepatic lipidosis (fatty liver), most commonly seen in pony breeds including Miniature horses and donkeys (91% of cases). Twenty-two cases were diagnosed over 10 years, the ages ranging from 3 to 27 years. Hepatic lipidosis is a sequela to primary hyperlipemia, and the animals are often obese and commonly have another illness or form of stress.

Chronic fibrosing hepatitis in adult horses (average age 15 years) was occasionally diagnosed, with 15 cases over the 10-year period. This condition results from chronic liver disease with secondary scarring to the extent that there is cirrhosis, and diminished hepatic function. The cause is usually unknown.

Two rarely diagnosed conditions of the liver included biliary disease (seven cases) and neoplasia. Primary neoplasia of the liver was diagnosed rarely (two cases). Metastatic neoplasia in the liver was more common and included cases of lymphosarcoma, malignant melanoma, and hemangiosarcoma.

Congenital anomalies were extremely rare, with only a single case of portosystemic shunting in a Rocky Mountain Horse.

CONTACT: Dr. Neil Williams (859) 253-0571, nmwillia@uky.edu, Livestock Disease Diagnostic Center, University of Kentucky, Lexington, Kentucky.

Kentucky's 2004 EIA Surveillance Program

DURING THE YEAR, A TOTAL OF 118,692 samples were tested for Equine Infectious Anemia (EIA), identifying two positive animals. Private testing accounted for 95,496 samples to comply with state regulations regarding the sale and exhibition of equine in Kentucky or to meet interstate transportation requirements. An additional 23,196 samples were collected through the Market Surveillance Program and identified two animals. Both were transported to Kentucky from other states in September and November and offered for sale at approved auction markets. Blood samples collected at the markets identified both animals as positive. Both animals had been 'traded or sold' multiple times during the preceding weeks.

As illustrated in Figure 1, the number of samples tested has increased steadily during the past 15 years, with a decreased prevalence of EIA within the population. In response, the Kentucky Department of Agriculture amended the Administrative Regulations in November 2002 from requiring a negative test within six months to a negative test within 12 months for equines changing ownership or being offered for sale.

During 2004 an opportunity arose to reaffirm that a serology result "does not a diagnosis make."

In October a 3-year old Standardbred colt racing in Kentucky was tested for export in Canada. An ELISA test gave a positive result, which was confirmed by another laboratory. It was difficult to identify where or how this animal became exposed. Further extensive testing determined the animal was not infected, and the original ELISA was a false reaction. A summary of this investigation can be found on our Internet site.

For more information on these or any of our other equine programs visit www.kyagr.com/state_vet/ah/index.htm.

CONTACT: E.S. Rusty Ford, (502) 564-3956, rusty.ford@ky.gov; Equine Programs Manager, Kentucky Department of Agriculture.

Equine Disease Quarterly Newsletter

Department of Veterinary Science
Maxwell H. Gluck Equine Research Center
University of Kentucky
Lexington, Kentucky 40546-0099

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