EQUINE DISEASE QUARTERLY

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LLOYD'S

COMMENTARY

With the growing occurrence and unpredictable nature of natural disasters, many horse owners are looking for ways to protect their animals. In addition to disasters, horse theft also is giving horse owners cause to look for guaranteed methods of identifying their horses. Microchip identification is an excellent tool for improving the traceability of horses in disease outbreak scenarios and allows for the rapid and efficient management of investigations to minimize spread of contagious diseases in horses. Diseases such as equine herpesviral myeloencephalopathy, strangles, influenza, salmonellosis, and others can spread rapidly and the ability to quickly identify animals aids veterinarians, farm managers, and other animal health professionals in developing the most appropriate action plan to protect them.

Microchip implantation is safe, simple, and inexpensive and usually will last a horse's entire life. The cost is generally about $50 to $75 and the chips currently being manufactured are functioning for 25 years or longer. The tiny, non-migratory chip is the size of a grain of rice and takes only seconds to implant with a small syringe by a veterinarian or other trained person. The chip is implanted halfway between the horse's poll and withers, just below the mane in the nuchal ligament on the horse's near (left) side. The injection site is cleaned and disinfected prior to injection and sometimes shaved, ensuring little to no occurrence of an adverse reaction.

The microchip is encapsulated in glass and is etched with a unique one-of-a-kind number. The accredited veterinarian will use the unique microchip number to record on official health papers and medical records. It is up to the owner to have that unique code maintained in personal medical records or registered with a commercially available and searchable database. A special handheld scanner is used to read the microchip through the skin of the animal. The scanner reads the number on the chip through radio frequency identification technology. Although there are several different companies manufacturing these microchips, most scanners are now considered universal as they are engineered to read a common frequency.

In the 1990s, Louisiana became the first state to require mandatory unique identification for all horses and annual Coggins testing. Microchips are a unique identifier superior to lip tattoos or brands since brands are not unique per horse and both tattoos and brands can be altered and/or difficult to read. Many breed organizations are now requiring microchipping for registration. Microchipping became especially important in the aftermath of hurricanes Katrina, Rita, Gustave, Ike, and Isaac in Louisiana when many horses were separated from their owners and needed to be identified in order to be reunited. Veterinarians working with affected horses in the recent aftermath and recovery efforts in Texas and Florida from hurricanes Harvey and Irma are finding microchipping invaluable with the massive ongoing sheltering operations. There is really no down-side and no reason that a horse should not have microchip identification.

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INTERNATIONAL

Second Quarter 2017

The International Collating Centre, Newmarket, United Kingdom, and other sources reported the following disease outbreaks.

Outbreaks of African horse sickness were reported in all provinces in South Africa except the Western Cape. Occurrence was as expected for this time of the year.

Equine influenza was reported by the UK and the USA. The UK confirmed two outbreaks. Influenza was recorded in 14 states in the USA, where it is considered endemic.

France, Germany, South Africa, Switzerland, and the USA recorded outbreaks of strangles. The number of confirmed outbreaks includes three in Switzerland, four in Germany, and 16 in France. Whereas the disease was reported as sporadic in South Africa, it is considered endemic in the USA. High clinical attack rates were seen in ponies and horses on a premises in one western state and in corralled wild horses in two states.

Equine herpesvirus 1 (EHV-1) related diseases were reported by France, Germany, Ireland, Japan, Switzerland, the UK, and the USA. Fever with or without respiratory disease was confirmed on two premises in France. Ireland reported four cases of infection. Germany, Switzerland, and the UK recorded one or two outbreaks and the USA reported that the disease was present in various states. Cases of abortion were diagnosed in France (two outbreaks), Germany (three outbreaks), Japan (10 outbreaks), the UK (two outbreaks), and the USA (one outbreak). EHV-1 related neurologic disease was recorded in France (one case), the UK (isolated cases on two premises), and the USA (four outbreaks on facilities in California, Colorado, Maryland, and New Jersey, each involving a single case of the disease).

Equine herpesvirus 4 was reported by France, Germany, Ireland, and the UK. The number of outbreaks varied from one in Ireland, three in Germany, four in the UK, and 14 in France.

The USA recorded multiple cases of equine herpesvirus 2 and/or 5 infection, some associated with respiratory disease, in several states.

Equine infectious anemia was confirmed in Germany, Switzerland, and the USA. The disease was identified on three premises in Germany, one in Switzerland, and two in the USA, both epidemiologically linked, with three cases on each premises.

France and Switzerland reported the presence of equine piroplasmosis. France considered the infection endemic and Switzerland recorded a single case of the disease.

Contagious equine metritis was diagnosed in Germany. Ten Icelandic stallions and five mares were confirmed positive on a total of 13 premises.

France diagnosed a case of equine coital exanthema (equine herpesvirus 3) on two premises as well as one case of leptospiral abortion.

Nocardioform placentitis was confirmed in Kentucky, USA, with five cases caused by *Amycolatopsis* spp and two by *Crossiella equi*.

Twenty-three cases of salmonellosis were reported by the USA during the second quarter of 2017; reported serogroups included B (15), C1 (2), and C2 (6).

The USA confirmed three cases of *Clostridium perfringens* Type A genotype in foals in Kentucky, one case of Tyzzer's disease (*C. piliforme*), and isolated cases of *C. novyi* and *C. sordelli* infection.

Three outbreaks of rotaviral diarrhea were recorded in France. The USA reported a case of proliferative enteropathy (*Lawsonia intracellularis*) in a foal.

Rhodococcal related disease was reported as endemic in the USA, with 22 cases recorded during the review period.

Switzerland diagnosed two cases of atypical myopathy and four cases of ehrlichiosis, the latter involving three premises.

West Nile encephalitis was reported by South Africa (44 cases, lineage 2 virus) and the USA (one case). Five of the cases in South Africa represented co-infection with equine encephalosis virus and three others with Middleburg virus.

Equine encephalosis was reported by South Africa and confirmed mostly in Gauteng Province. Encephalitis due to Middleburg virus was reported across South Africa with 41 confirmed cases, two of which were co-infections with equine encephalosis virus.

Equine Disease Quarterly

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Equine Colic Update

There is a prophecy about equine colic: As long as there are horses, they will have colic. Based on reports in the literature over the last 50 years, the incidence of all colic cases has not changed over time and the incidence in a normal horse population ranges from 1 to 10 episodes of colic per 100 horses each year. However, horses that have had one or more previous episodes of colic have an incidence rate up to 5 times higher. Survival varies with the severity of the disease, but the overall mortality rate for all types of colic in horses is approximately 7%-10%, second only to fatalities due to musculoskeletal injuries. Incidence varies from farm to farm based on management, with a higher frequency expected in specific populations of horses such as broodmares near term, horses with small strongyle infection, or those exposed to abrupt changes in management. Horses being treated for eye disease and those hospitalized after general anesthesia for elective procedures also have an increased incidence of colic.

The causes of these acute intestinal diseases remain elusive. Simple colic, commonly diagnosed as "gas colic," "spasmodic colic," or "ileus," makes up approximately 85% of all colic episodes, yet the cause or mechanism for these gastrointestinal abnormalities remains unknown. Similarly, the cause of diseases with a higher morbidity and mortality such as intestinal strangulations have no known cause. Epidemiological research over the past three decades has identified risk factors appearing to have a causal relationship, yet specific mechanisms such as why intestine twists and strangulates on its mesentery is unknown. Alteration in intestinal function is most likely multifactorial, with combined event and environmental factors increasing risk.

Numerous factors are reported to increase colic risk including some basic husbandry and feeding practices (see Table 1). Some of these factors are non-specific, but still are significantly related to increased colic risk.

Over the last four to five decades, survival has improved for the most life-threatening types of colic. During the 1960s to 70s, the survival rate for severe obstructions and strangulations was reported at less than 50%. Although improvements in surgical expertise, anesthesia, and postoperative medical care are associated with improved survival, rapid recognition of the need for surgery or critical care by veterinarians is a major reason for the improvement. With a rapid assessment and decision for specialty care, survival of 80%-90% can now be expected.

Multiple aspects of the pathophysiology of colic have been investigated. Research on intestinal motility, systemic inflammatory response syndrome (also known as endotoxic shock), intestinal injury and inflammation, parasite control, gastric ulcers, surgical techniques, and response to therapy have all improved the understanding of events that occur during colic. There is no question the additional information has changed the veterinarian's ability to improve colic treatment and survival. Still, how intestinal dysfunction and systemic responses are initiated remain to be discovered. More research is needed if we are to change the colic prophecy.

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Table 1.
Factors predisposing to colic

• Breed
• Older age
• Increased time in a stall
• Cribbing/crib-biting
• Recent transport
• Inactivity following injury
• Change in weather
• Diet change
• Round bale hay
• High concentrate feeds
• Decreased potable water
• History of colic
• Absence of deworming
• Absence of dental exams
• Tapeworm infection

Source: *Cohen ND, Epidemiology of risk factors, in The Equine Acute Abdomen, Wiley, 2017 in press.*

Equine Influenza Beyond Equines

The human "influenza season" in North America is now about to begin again, while in South America spring is approaching and their influenza season is almost over. The influenza season happens every year during autumn, winter, and early spring months, and the influenza viruses that circulate each season tend to be the usual suspects: influenza A/H1N1, A/H3N2, and influenza B viruses.

However, there are many other influenza viruses in the world. The 'H' and 'N' varieties (called "subtypes") of influenza A viruses now go up to H18 and N11 with the recent discovery of new subtypes in bats. Most of these subtypes are rare in mammals but common in wild waterfowl. The only influenza subtypes that have been confirmed to infect horses naturally are H3N8 and H7N7, and the horse-adapted H7N7 viruses appear to have disappeared from horses nearly 40 years ago.

Does this mean that horses cannot be infected by influenza viruses from other species of animals? The answer is no, possibly they can be. Transmission of influenza viruses between different species definitely occurs. Humans, swine, dogs, cats, whales, seals, and sometimes other mammals

such as mink have occasionally been infected by influenza viruses from birds. This was long thought to happen only rarely, but since 1997 in southeast Asia there have been annual occurrences of humans contracting bird flu subtypes such as H5N1 or H7N9 and these cases are often lethal. Almost all of these cases have been dead-end transmissions, meaning that each case appears to be a separate event with very little sign that they are capable of spreading from human to human.

Can bird flu viruses infect horses? The answer is most likely yes. One piece of evidence is that the H3N8 subtype was not always circulating in horses; it first appeared in 1963, and its genetic ancestors seem to have been bird flu viruses. In 1989 in northern China a strain of bird flu was positively confirmed to cause a large-scale disease outbreak in horses. Its subtype was also H3N8. Was that coincidence or is there some unique characteristic of the H3N8 subtype that makes it more apt to infect horses? Those questions remain unanswered. It is known that the molecular receptors present on the surface of horse tracheal respiratory cells are a little different from other species, which could be a contributing factor to the specificity of the influenza viruses that infect horses. Work in the author's laboratory suggests that this is not the entire explanation and other factors must be involved.

A related question is whether influenza viruses can be transmitted from horses to other mammals. That answer is definitely yes. About 15-20 years ago, H3N8 horse flu infected dogs in the USA and has persisted in dogs ever since. Can it jump from dogs back into horses?—maybe, although once the virus adapted to dogs, it became much less adapted to horses.

Are humans at risk of infection from equine influenza viruses? Experimental infection of human volunteers conducted 50 years ago suggests that infection can happen but the result is mild or even sub-clinical. Humans with horse exposure do sometimes develop antibodies against equine influenza virus. The only report of a suspected naturally occurring clinical disease from equine influenza virus in a human never actually demonstrated the presence of equine influenza virus in that patient.

The message for readers is: Transmission of influenza viruses from one species to another can happen and sometimes does happen. If your horse is sick with the flu, take elementary biosafety precautions such as washing hands and clothes or equipment that came in contact with that horse, as soap will kill influenza viruses. And if you are sick with the flu, it is probably best not to cuddle your pets.

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NATIONAL

Equine Identification in the United States

The need for horse identification spans back to the 1800s, when branding cattle and horses was commonplace for tracing these animals to specific ranches or owners. Historically, horses were identified by physical description. With many solid horses without unique identifying markings, this identification modality had limited usefulness. For example, it would be challenging to individually describe a group of yearling Friesian fillies in a field. The transition to utilization of individual animal brands and lip tattoos aided in the identification of equine in the United States. Unfortunately, the recognized disadvantages of these identification modalities include inducing pain and stress in the animal, potential transmission of disease agents, and inherent safety issues associated with the procedures. Additionally, brands can be considered unsightly, difficult to read, and altered.Over the years, the industry has researched innovative ways to uniquely identify horses. Iris scanning was developed by Japanese researchers in 2000, but the expense of this process and limited access to reading equipment made this a non-viable option. The recent advances in microchip technology has made this procedure the desired identification modality of the future. Today, the international standards for acceptable microchips are:

- ISO 11784/11785 compliant and ICAR certified
- 15-digit numeric, no letters format
- 134.2 kHz frequency

Concerns have been raised regarding impact of the invasive procedure and longevity of the microchip. However, subsequent microchip implantation studies have proven that microchip administration yields minor transient pain and inflammation at the injection site and minimal microchip migration following the correct implantation in a horse.

Recently, improved microchip temperature sensing technology has enabled accurate body temperature recording. Not only does this type of chip provide a unique individual identification, but it also provides a value added health monitoring benefit. For example, should an equine herpesvirus myeloencephalopathy incident occur at a large boarding facility, management could easily and rapidly monitor temperatures via the biothermal microchip and move horses with elevated temperatures to isolation before the horses start shedding virus.

In the last five years, the equine industry in the United States has embraced the use of microchips for equine identification. In 2008, the Jockey Club began offering microchips for sale to its members. The Jockey Club began mandating that thoroughbred foals have an ISO 11784/11785 compliant microchip implanted starting with the 2017 foal crop. Impressively, Jockey Club members embraced microchipping technology and two-thirds of the 2016 foal crop were voluntarily microchipped. Recognizing the need and benefit of microchipping, the United States Hunter Jumper Association (USHJA) passed a regulation change requiring microchips starting in the 2018 competition year. During that competition year, any horse wishing to participate in the USHJA points program will require a microchip and for the 2019 competition year, a microchip will be required for all horses competing in USHJA competitions. At the recent Equine Identification Forum in January 2017, the industry recognized the great strides that have been taken related to equine identification but agreed that additional efforts are necessary for industry wide acceptance of microchipping. For more information on the Forum discussions visit http://www.animalagriculture.org/proceedings/equineidforum.

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KENTUCKY

Clostridium Perfringens and Necrotizing Enterocolitis in Neonatal Foals

Necrotizing enterocolitis (damage and death of cells in small intestine and colon) is a serious disease of sudden onset in foals less than 4-6 days of age associated with a high death rate, despite therapeutic interventions. Clinical manifestations of enterocolitis in foals vary from being found dead to a spectrum of clinical manifestations. The most common of these include failure to suck, fever, depression, severe colic, and diarrhea. Although the association of *Clostridium difficile, Neorickettsia risticii* (Potomac horse fever) and *Salmonella* infection with enterocolitis in adult horses is clearly established, many cases of fatal necrotizing enterocolitis in foals have no known risk factors.

Clostridium perfringens is the most commonly isolated clostridial species worldwide and is part of the normal intestinal flora. Following acquisition of this bacterium by the foal from the mare's teats or the environment, the organism multiplies rapidly in the stomach and intestines. *C. perfringens* numbers are reduced fairly quickly, so that by the time foals are several months of age, the organism is found in relatively low numbers within the large intestine. The almost universal presence of *C. perfringens*, belonging to the type A group, in the intestine of healthy young animals has complicated the understanding of its role in enterocolitis. Although most strains don't cause intestinal disease, there are two types that do so in foals.

One of these, *C. perfringens* type C, is a well-established but relatively uncommon cause of necrotizing enteritis. The other is *C. perfringens* type A, which includes a small subset that produces a novel pore-forming toxin called NetF (Necrotizing enteritis toxin, Foal). This novel toxin is related

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to the beta toxin of type C strains that causes severe enteric disease in foals, other species, and in humans. We found *netF*-positive *C. perfringens* in 74% (11/15) of foals with necrotizing enteritis but not in 11 foals with undifferentiated diarrheal illness. In another study, *netF*-positive *C. perfringens* was identified in 6 of 23 isolates from foals in Kentucky with severe enteritis. In adult horses with undifferentiated diarrhea, the detection rate of *netF* among *C. perfringens* isolates was low (4/58). This would suggest this toxin is primarily associated with severe enteritis in neonatal foals.

One explanation why type C and *netF*-positive type A *C. perfringens* cause necrotizing enteritis in very young foals is because of the trypsin inhibiting effect of colostrum. Trypsin is a protein-degrading enzyme secreted by the pancreas during digestion, and its inhibition by colostrum prevents the breakdown of protein toxins, such as NetF. The reservoir for NetF-producing *C. perfringens* is not yet known.

Real-time PCR can be used to rapidly diagnose necrotizing enteritis caused by *netF*-positive *C. perfringens*. An alternative but slower approach is to culture *C. perfringens* and confirm the presence of toxin genes (*cpb* for type C and *netF* for type A) by PCR.

In terms of prevention, an autogenous bacterin-toxoid vaccine has been used for mare immunization in Kentucky in an attempt to prevent type A *C. perfringens* enteritis in foals. This vaccine likely includes NetF toxin since mares immunized with the vaccine have antibodies to NetF. Hyperimmune plasma is commercially available for the prevention or treatment of necrotizing enteritis in foals caused by *C. perfringens* types A (including NetF), C, and D.

Although the discovery of NetF has furthered our understanding of *C. perfringens* enterocolitis in foals, further work is required to fully understand how NetF-producing type A *C. perfringens* causes disease. Research studies are slowly chipping away at *C. perfringens* enterocolitis, and the discovery of NetF has been another important step forward.

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