In this issue, Dr. Gene Lyons provides a brief review of the history and current status of anthelminthic treatment of important equine gastrointestinal parasites. No new anthelmintics with novel modes of action have been introduced since the early 1980s, and levels of anthelmintic resistance are now increasing in both strongylid and parasitic nematode parasites. While resistance is slow to develop, work by Dr. Lyons has clearly illustrated that once it appears in a given parasite, it is there to stay. Today, we can expect resistance to at least one drug class to be present in every equine operation around the world, and an overwhelming majority will feature multi-drug resistance. With only three classes to choose between, we are running out of treatment options. A pertinent question to ask is how to tackle this emerging crisis and what to expect in the future.

The first step is to acknowledge the extent of the problem. Despite recommendations given during the past couple of decades, a majority of individuals in the industry continue to use old-fashioned parasite control programs based on frequent treatments given year-round without any consideration of treatment efficacy, parasites present, and climatic conditions. If no diagnostic testing is done, resistance will not be identified.

For the long term, we need new anthelmintic drug classes with new modes of action. It is important to learn from the past however, and realize that no drug class is going to remain effective indefinitely, and that reverting back to treatment regimens of the past would be a complete mistake. The pharmaceutical industry is not anticipating developing any equine products in the foreseeable future. Recent pharmaceutical trends are aimed at combination deworming products, i.e. formulations where two or more dewormers targeting the same parasites are combined into the same product. Research in the sheep industry has also highlighted the importance of reducing treatment intensity to avoid development of multi-drug resistance. A recent project by the author highlighted the importance of starting efficacy of the drug combination. If combination treatment efficacy is markedly less than the desired 95 percent or above, resistance may develop quickly. The author’s laboratory is also testing a bacterial biocontrol strain of naturally occurring Bacillus thuringiensis to provide crystal proteins capable of killing worm parasites. If successful, this could become an anthelmintic product in the future.

Perhaps the most important element in future parasite control programs is utilization of good diagnostic tools. Fecal egg counts will remain a cornerstone of control programs, but they have limitations in not providing information about larval stages and specific types (species) of parasites present. Recent collaborations have led to several new diagnostics, including species- and stage-specific serological tests (ELISAs) for identifying parasite species present in a horse. Most recently, we have developed an automated smartphone-based fecal egg-counting system, which allows easier, quicker, and more precise fecal egg counts to be determined. Taking these diagnostic approaches collectively, the goal is to enable veterinarians and their equine clients to make more informed decisions about parasite control. The road to effective and sustainable parasite control is evidence-based, with veterinarians playing a central role.

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Fourth Quarter 2016

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

Isolated cases of African horse sickness were recorded in South Africa, initially in Gauteng Province (October) and subsequently in the North West Province (December), both recognized as endemic areas for the disease.

Equine influenza was reported by the UK and the USA. The UK confirmed three outbreaks of the disease, two involving isolates from the month-old foals and the third to a group of several vaccinated horses. Outbreaks of influenza were recorded in four states in the USA, where the disease is considered endemic.

France, Germany, Ireland, Switzerland, and the USA reported multiple outbreaks of influenza during the period under review. The number of confirmed outbreaks included 12 in France, five in Germany, an estimated one in Ireland, two in Switzerland, and 15 in the USA, where the disease is endemic. Many of the outbreaks involved single cases.

Equine aborted foetal syndrome (EHV-1) related cases were reported by France, Germany, Japan, the UK, and the USA. Respiratory disease was confirmed in France (four outbreaks), the UK (five cases on a premises out of which several cases of neurological disease also occurred), and the USA (widespread in several states).

Cases of EHV-1 abortion were diagnosed in France (single cases on two premises), Germany (one case), Japan (single cases on several premises, involving Thoroughbreds or non-Thoroughbreds), and the UK (single cases on two premises). EHV-1 related neurological disease (meningoencephalitis) was recorded in France (two outbreaks, one of which involved nine cases out of a group of 69 horses), Switzerland (a single case), the USA (two outbreaks, one involving an initial case and subsequently several additional cases), and the USA (two outbreaks, with one involving two cases on a high desert ranch and the other, six cases at an equine centre).

Equine herpesvirus 4 respiratory disease was recorded in France (5 outbreaks, the majority represented by single cases of infection) and Switzerland (one outbreak involving four horses). The USA reported activity with equine herpesvirus 2 and 5 in a number of states, some associated with evidence of respiratory disease.

Equine infectious anaemia was confirmed in Canada (single case in Alberta horses), and the USA (single case in Utah). France and Switzerland reported cases of equine piroplasmosis. Piroplasmosis was considered endemic in France, Switzerland recorded only an isolated case of the disease.

A single case of equine cerebral meningoencephalitis (encephalitis) was diagnosed in Kentucky, USA. Several cases of raccoondiosis-plasmodiosis were recorded in Kentucky, USA.

The USA reported outbreaks of EHV-1 related individual cases of salmonella in a number of states, all of which related with outbreaks in horses, cattle, and humans.

France, Germany, Switzerland, and the USA reported activity with equine herpesvirus 2 and/or 5 in a number of states, some associated with evidence of respiratory disease.

Equine herpesvirus 3 respiratory disease was recorded in France (15 outbreaks, the majority represented by single cases of infection) and Switzerland (one outbreak involving four horses). The USA reported activity with equine herpesvirus 2 and 5 in a number of states, some associated with evidence of respiratory disease.

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The USA reported outbreaks of EHV-1 related individual cases of salmonella in a number of states, all of which related with outbreaks in horses, cattle, and humans.

Fourth Quarter 2016 saw an additional 15 cases of Eastern equine encephalomyelitis confirmed in five states in the USA, cases of which were also reported in Wisconsin. West Nile encephalitis was reported by Spain (two cases) and the USA (20 cases involving six states of which 11 were in Oklahoma). The majority of cases in the USA were in vaccinated horses.

The USA continues to record outbreaks of clostridial enteritis due to Clostridium perfringens Type A/β-2 toxin genotype, were confirmed in Kentucky, USA.

Several cases of proliferative enteropathy (Lawsonia intracellularis) were recorded in Kentucky and Michigan, USA.

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Causes of Mortality in Aged Horses in Kentucky

Over the last century, the place of the horse in society has evolved from that of an absolute necessity, primarily for transportation and war, to that of a pleasure animal. Today, horses are increasingly considered companion animals, housed homes, breeding stock, and sporting competitors, with more limited use for farm and ranch work. This change in usage has resulted in an increasing geriatric horse population, and accordingly, the need to better understand the complex role of geriatric health.

The University of Kentucky Veterinary Diagnostic Laboratory (UKVDL) plays an important role in its support of Kentucky’s horse industry. Between June 1, 2010, and June 30, 2012, one-hundred and thirteen horses aged fifteen years and older were submitted for necropsy to UKVDL. Review of these necropsy cases revealed that the main organ system contributing to the deaths of the group of aged horses was the digestive system, followed rather closely by the cardiovascular system.

Specific diagnoses of the digestive system that were noted in this group of geriatric horses included but were not limited to: strangulating lipoma; necrotizing enteritis and/or rupture; gastric rupture; large colon displacement, obstruction, and tapeworm infection can lead to the formation of adhesions, leading to intestinal torsion, impaction and/or rupture; and necrotizing colitis of bacterial or unknown etiology.

Another unexpected finding was the significant number of cases that were attributed to the cardiovascular system. This statistic appears to be associated with the presence of coronary blemming horses in Central Kentucky. Increased risk of uterine artery rupture is an important issue for owners and veterinarians worldwide to consider when breeding mares over fifteen years of age. Additionally, the potential high risk of uterine artery rupture in older mares may highlight the option of embryo transfer to surrogate mares to obtain offspring from highly valued aged mares. As with any medical procedure however, embryo transfer and surrogacy are not without risk and notices signs of colic and digestive distress, timely veterinary intervention can sometimes improve the outcome for a horse, particularly if correct surgery is warranted by a specific diagnosis.

Death due to disease or dysfunction of the cardiovascular system may be somewhat unexpected. However, after delving more deeply into necropsy records, a not-so-surprising story emerged. Uterine artery rupture was responsible for approximately half of the cases where the main cause of death was attributed to the cardiovascular system. The statistic appears to be associated with the presence of coronary bleeding horses in Central Kentucky. Increased risk of uterine artery rupture is an important issue for owners and veterinarians worldwide to consider when breeding mares over fifteen years of age. Additionally, the potential high risk of uterine artery rupture in older mares may highlight the option of embryo transfer to surrogate mares to obtain offspring from highly valued aged mares. As with any medical procedure however, embryo transfer and surrogacy are not without risk and notices signs of colic and digestive distress, timely veterinary intervention can sometimes improve the outcome for a horse, particularly if correct surgery is warranted by a specific diagnosis.

Parasite Control: An Update

Internal parasites of horses have been recognized for centuries. Until the early 1960s, methods for the control of equine endoparasites lacked a scientific basis. For example, in the 1860s one recommendation was to incise the horse’s palate with the intent that the ingested blood would kill any internal parasites. Beginning in the 1940s and continuing in the 1980s, new classes of antiparasitic drugs rapidly emerged as scientific basis. For example, in the 1600s one recommendation was to incise the horse’s palate with the intent that the ingested blood would kill any internal parasites. Beginning in the 1940s and continuing in the 1980s, new classes of antiparasitic drugs
Figure 1. Nocardioform placentitis cases seen at UKVDL from 1991 to Feb 21, 2017, by foaling season.

Figure 2. Nocardioform placentitis cases seen at UKVDL by month for 2011 and 2017 foaling seasons.
compounds were developed approximately every 10 years. Currently in the USA, only benzimidazoles (fenbendazole and oxibendazole), tetrahydropyrimidines (pyrantel and praziquantel), and niclosamide (niclosamide and niclosamide) alone or combined with fenbendazole are commercially available for parasite control in horses.

The major endoparasites of horses include bots, large strongyles, small strongyles or cyathostomes, ascarids, and tapeworms. Large strongyles (Strongylus spp.) are one of the most significant equine parasites. The larval stages of this parasite do not migrate in the food vessels and abdominal organs. Drug resistance is not evident in the case of large strongyles. Cyathostome larvae do not migrate passively like Strongyle spp., but enter in the intestine and submucosa of the large intestine of the horse. Intestinal damage can be induced by cyathostome-hookworm stages of parasites from the lining of the large intestine, a condition called "larval cyathostomiasis." Resistance to fenbendazole, endostrongyloids and pyrantel is now common among cyathostomes. Also, both niclosamide and niclosamide have become less effective on immature (L4) cyathostomes in the lumen of the large intestine; thus the life cycle is shortened. Heavy infections with adult ascarids (Parascaris spp.) can cause intestinal blockage and impaction because of their bulk. These two have become resistant to niclosamide, oxibendazole, and pyrantel. The final group of equine endoparasites, which also result in intestinal hyperplasia, blockage, hemorrhage, and impaction, drug resistant. Thus, the larval stages can cause disease due to the presence of bacteria. The most common organisms have been identified as various Amycolatopsis spp. and Gymnospirillum spp. Other factors such as the causative agents led to the term "nocardioform."

The outbreak of nocardioform placentitis in Kentucky’s 2011 foal crop was concerning to the equine industry. While not on as large a scale as in 2017, it is still common among cyathostomes. Also, both fenbendazole and oxibendazole are currently considered the drugs of choice to establish a strongyle EPG profile. Thus, drug resistance is not evident in the case of large strongyles, small strongyles or cyathostomes, ascarids, and tapeworms. Large strongyles (Strongylus spp.) can cause intestinal hyperplasia, hemorrhage, hemorrhage, and impaction, drug resistant. Thus, the larval stages can cause disease due to the presence of bacteria. The most common organisms have been identified as various Amycolatopsis spp. and Gymnospirillum spp. Other factors such as the causative agents led to the term "nocardioform."
Equine Cardiac Disease

Equine cardiac disease is an uncommon but potentially serious condition. Clinical signs range from poor performance to sudden death. Causes of cardiac disease in horses include congenital malformation, chronic valvular degeneration, cardiomyopathy, inflammatory or infectious disease, ruptured chordae tendineae, and cardiotoxins. This article describes common cardiotoxins that have been implicated in affecting horses in Central Kentucky.

Ionophores (e.g., monensin and lasalocid) are common feed additives and supplements intended for cattle, pigs, or chickens. Exposure occurs when horses have access to concentrated mineral pre-mixes containing ionophores formulated for cattle or through a feed-mixing error. Acute ionophore intoxication causes anorexia, muscle tremors, rapid heart rate, and respiratory distress due to heart failure. Chronic exposure results in unthriftiness, poor performance, emaciation, tachypnea, and sudden death from cardiac damage.

Lister beetles can be found in alfalfa hay, and are toxic to horses because they contain a highly irritating substance called cantharidin. Small amounts of cantharidin cause irritation to the gastrointestinal and urinary tracts. Moderate amounts cause cardiac muscle damage, low calcium, and synchronous diaphragmatic flutter (“thumps”). Large amounts cause shock and death within hours.

Taxus is a common cause of poisoning of horses in Central Kentucky. Taxus, or yew, is a popular evergreen ornamental shrub. Almost all parts of the plant, including the seeds, contain highly toxic compounds called taxanes. In the winter, the concentration of taxanes is at its highest within the plant. Even a small amount of plant material can cause rapid heart failure. Because taxanes act so quickly, horses ingesting yew are often found dead without signs. When present, signs include weakness, incoordination, slow heart rate, and difficulty breathing.

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White snakeroot is a perennial woodland plant common throughout the Eastern United States. It contains a mixture of compounds called “tremetol.” Intoxication is sporadic because the concentration of tremetol in the plant varies depending on location and prevailing growing conditions. Tremetol causes congestive heart failure and cardiac degeneration in horses. Tremetol can pass into the milk, poisoning nursing foals.

Rhododendrons, azaleas, laurels, mountain pines, and fetterbush all contain grayanotoxins. Grayanotoxins cause either slow or rapid heart rate, abnormal rhythm, weak pulse, and cardiac arrest. These plants are particularly attractive in winter because their leaves remain green.

Milkweeds, or butterfly weeds, are wildflowers as well as cultivated ornamentals. Some milkweeds contain cardiotoxins called “cardenolides.” Signs can begin within hours of plant ingestion and include slow or rapid heart rate, low blood pressure, and arrhythmias. Fresh cardiotoxic plants are generally unpalatable. They are more edible as clippings or baled with hay, but are no less toxic than fresh material.

Venomous snakes native to North America include the pit vipers—rattlesnakes, water moccasins, and copperheads. In Central Kentucky, timber rattlesnakes and copperheads are the most common. Most pit-viper venoms contain dozens of different components, some of them as yet unidentified. Snakebites in horses most often occur on or near the muzzle and can result in severe swelling and ulceration. If the nasal passages become so swollen that labored breathing ensues, a tracheostomy may be necessary. Bleeding, tissue necrosis, and secondary bacterial infection around the bite wound are common sequelae. Some venoms contain cardiotoxins that damage the heart. Antivenins are available but must be administered in a timely manner, as they cannot reverse tissue damage that has already occurred.

Many other substances can be cardiotoxic, including a number of medicinal plants, medications (e.g. xylazine and theophylline), and illicit drugs (e.g. amphetamines and cocaine).

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