Deworming--To Rotate or Not to Rotate?

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Rotational deworming--dosing horses with different classes of dewormers in rotation--is often recommended for controlling equine internal parasites. The theory is that by using all of the available effective deworming drug classes, we combine their benefits into a maximally effective program. However, some researchers say rotation isn't a good idea because it contributes to parasite resistance and will reduce the effectiveness of available deworming drugs.

At the 2008 American Association of Equine Practitioners convention, held Dec. 6-10 in San Diego, Calif., two different viewpoints on rotational deworming were presented. We've included both here so you can see the evidence for both sides and make your own choices.

Presentation 1: Evaluation of Anthelmintic Rotational Regimens on a Previously Documented Fenbendazole-Resistant Farm

Wade Nichols, PhD, a senior technical services specialist at Intervet/Schering-Plough Animal Health, presented the results of a multiyear Texas Tech University study evaluating the efficacy of various parasite control strategies in a closed herd with documented resistance to fenbendazole.

"Parasite resistance is a real area of concern worldwide," he began. "It was first reported in 1960, and the main problem (in horses) is cyathostomes (small strongyles). Currently there are no new deworming drug classes on the horizon, so it's important that we preserve the use of all of our current drug classes.

"This series of experiments was conducted due to the fact that there is virtually no data concerning the use of anthelmintic (deworming) strategies in the equine animal and their effects on anthelmintic resistance by parasites," he said.

The herd in question included 28 Quarter Horses of mixed gender and age (from weanlings to adult mares when the study began in September 2003). They were initially dewormed with fenbendazole (FBZ) every 90 days for 18 months, after which time cyathostome resistance was documented (as expected). Next, Experiment 1 evaluated the efficacy of three dose levels of FBZ: 5 mg/kg, 10 mg/kg, and the larvicidal dose of 50 mg/kg (10 mg/kg given daily for five days) given every 28 days. Fecal egg count reduction tests (FECRT) showed resistance at all doses for the entire 140-day experiment, with only about 80% fecal egg count reduction (FECR) at even the highest larvicidal initial dose (the 100% target means no eggs after treatment and, thus, few worms left alive). He also noted that resistance was easier to detect in younger horses (which have less natural exposure and immunity to parasites); this group had higher parasite loads before and after treatment than mature horses.

"Regardless of dosage level, there was still some resistance," Nichols summarized. "So we can't get rid of resistant parasites just by using more drug or using it more often."

After three months, Experiment 2 on the same horses (in re-randomized groups) compared the 50 mg/kg larvicidal FBZ dose to moxidectin (0.4 mg/kg) and ivermectin (200 mcg/kg). Moxidectin and ivermectin significantly outperformed FBZ, with FECRs of 99.9% and 98.7%, compared to 84.3% for FBZ. Again, age was a significant factor; adult horses had at least 98.7% FECR even with FBZ, while young horses' FECR was lower, especially with FBZ (only 69.9% FECR).

"The performances of moxidectin and ivermectin were not significantly different from each other, but both were significantly more effective than fenbendazole," Nichols reported.

After another three-month break, the entire Texas Tech farm's equine population went onto a fast quarterly rotational deworming program for Experiment 3 (pyrantel pamoate in June, ivermectin+praziquantel in September, fenbendazole at the larvicidal dose in December, and moxidectin in March).

"Mean FECR in the first year was 95.8% with pyrantel, 100% with ivermectin, 97.8% with fenbendazole, and 100% with moxidectin," Nichols reported. "The majority of horses in 2006 had no or negligible egg counts after every treatment, in contrast to very high loads before. So resistance to fenbendazole can be overcome or drastically reduced by rotation of other classes.

In yet another rotation experiment (Experiment 4) with a six time per year rotation (larvicidal fenbendazole in January, moxidectin in March, pyrantel pamoate in May, fenbendazole in June, moxidectin in September, and ivermectin+praziquantel in November) at the same facility, it was further demonstrated that the use of FBZ was effective when used twice in this rotation. All anthelmintics were effective in reducing FEC in the horses with any parasite burdens. The facility and most horses were basically clean by this point in time. In Experiment 4, this rotational program was implemented in combination with good management practices, including pasture rotation, planting annuals such as winter wheat, rotation of species within pastures, as well as quarantine and anthelmintic treatment of all new horses. Currently they're on Year 6 and parasite loads continue to be very negligible.

"Contrary to other reports, this series says you can go back to fenbendazole after prior resistance," he concluded. "There are limited (dewormer) classes available; we need to use all classes of anthelmintics (deworming drugs) to help preserve their efficacy."

Further, it was stressed that more field and clinical trials need to be conducted on farms and ranches where parasite resistance exists, and that there is an important need in the industry to test various theories of parasite control programs in varied environmental and management conditions.

Presentation 2: Rotation Creates Resistance

Cyprianna Swiderski, DVM, PhD, Dipl. ACVIM, assistant professor of veterinary medicine at Mississippi State University, discussed resistance in small strongyles. She stated that studies of anthelmintic resistance confirm that rotating dewormers without documenting that the drug being used is truly efficacious actually propagates resistance to all drugs in the program. "In such a scenario, the more effective drugs in the rotation mask resistance for a time," she said. "The most powerful way to minimize anthelmintic resistance is to minimize the frequency of anthelmintic use, and therefore reduce the selection pressure placed upon parasites to develop resistance. It is now clear that anthelmintic use can be minimized by capitalizing on seasonal changes in the prevalence of small strongyles as well as differences in parasite immunity among individual horses."

Swiderski presented a review of literature on equine parasite control and recommended new paradigms for small strongyle control in adult horses based on several concepts.

- First, the concept of zero tolerance for small strongyles should be abandoned, as some degree of parasitism is necessary to stimulate an immune response. Horses that lack such exposure tend to have more severe health problems when parasite exposure eventually occurs, which is assured in an animal whose optimal health depends upon grazing.
- Preserving refugia--parasite populations that are still susceptible to common deworming drugs--is of paramount importance. Refugia are critical because they lack resistance genes. This "resistance-free" population effectively dilutes the pool of resistance genes contributed by anthelmintic-resistant parasites.
- Anthelmintic overuse depletes refugia to a greater degree than it depletes the resistant worm population, which accelerates the development of resistance. Thus, we should minimize anthelmintic use wherever possible, such as by strategically deworming horses only when infective small strongyle larvae are plentiful on pasture (spring to fall in cooler regions, and fall to spring in warmer regions).
- Individual horses vary greatly in their susceptibility to internal parasites; some limit

infection almost entirely even without deworming drugs, while others carry very high parasite loads even with regular deworming (Swiderski cited reports that found approximately 35% of horses account for 85% of pasture contamination). Thus, we can also reduce anthelmintic use by only deworming the horses that really need it.

- Fecal egg counts are used to identify individuals needing anthelmintic therapy. Current recommendations are to deworm horses with at least 150-300 parasite eggs per gram (epg) of feces. Horses managed with this threshold for treatment have not shown ill thrift or an increase in colic. (More information on FEC testing, including how to do it.)
- Anthelmintic class (determined active by the ingredient in the dewormer) influences the interval between deworming times (or FEC testing to determine if deworming is necessary), because the time it takes for worms to reinfect horses and produce eggs that are detectable in the feces (egg reappearance period, ERP) after deworming varies by anthelmintic class. When you are identifying horses for deworming treatment, use FEC tests done after the previous anthelmintic's efficacy has completely waned. Your veterinarian can help you determine how long this takes for your deworming program and can help interpret your FEC tests to see if resistance is appearing (for example, if the ERP is shortening). Typical ERPs for common dewormers are as follows: eight weeks for ivermectin, 12 weeks for moxidectin, four to six weeks for pyrantel, and four weeks for benzimidazoles.
- Anthelmintics are not the only control measures for internal parasites, nor are they even the most effective ones. For example, removing feces from the environment every few days can be even more effective than deworming. Consider that once they leave the horse in feces, small strongyles must live outside the horse for a few days (depending on the temperature) before they can reinfect him or infect other horses. Thus, removing feces from the environment every few days ensures that only noninfective larvae are available on pasture to be eaten. This practice also increases the grazing area as much as 50%, as it removes the manure piles horses tend to avoid when grazing. This technique should be employed to reduce the need for deworming drugs.
- Though small strongyles are the major parasite concern of the adult horse, they're not the only ones. Anthelmintic drugs should be selected based on the parasites found on the premises. For example, macrocyclic lactones such as ivermectin/moxidectin are critical for controlling large strongyles and *Gasterophilus* (bots), while praziquantel is necessary for controlling *Anoplocephala* (tapeworms).

The new paradigm for parasite control Swiderski recommended relies on three basic principles: Preserving refugia, deworming only those horses responsible for significant pasture contamination, and restricting anthelmintic therapy to seasons in which horses can become infected from pasture.

"Preventing anthelmintic resistance will require a more integral role for veterinarians in the planning and monitoring of anthelmintic therapy," she concluded. "We must stop looking at deworming as a formula and start recognizing that parasites are living, changing creatures. We need to employ strategies that can change since the parasites themselves can. We can establish guidelines, but we have to be flexible and always look for the worms to change."

Despite the costs of routine FEC tests, she noted that this approach has been proven effective in controlling both cost and parasites.

Points of Agreement

Regardless of their positions on anthelmintic rotation, Swiderski and Nichols agree that sound management practices should be an integral part of equine parasite control programs. Several recommended practices include the following:

- Keep pens and pastures as free of feces as possible.
- Swiderski recommends the following strategy for new arrivals to the herd: If a horse will be staying less than six weeks, deworm him with ivermectin because it takes six to eight weeks for eggs to reappear in the feces after using this drug, and resistance is rare. If a horse will be staying six weeks or longer, quarantine him and use high-dose fenbendazole to kill encysted small strongyle larvae, followed by ivermectin or moxidectin after two weeks. Release him from quarantine if comparisons of FEC testing from before and two weeks after deworming confirm appropriate reduction in egg counts (at least 80-90% FECR for all nonmacrocyclic lactones, and greater than 98% for the macrocylic lactones).
- Swiderski also recommended singling out horses with high fecal egg counts at the beginning of the deworming season (>500 epg) for treatment with either moxidectin or larvicidal fenbendazole therapy (10 mg/kg once daily for five days), because these individuals tend to mount poor immune responses to small strongyles and harbor large numbers of encysted small strongyle larvae. These are also the individuals primarily responsible for contaminating pastures with parasites.
- Avoid ground feeding.
- Don't overcrowd pastures (avoids forcing horses to graze close to infected manure piles, where worms are usually plentiful) or spread manure on them.
- Disc pastures only when climatic conditions (hot summer temperatures) will kill eggs and when pastures can be left unoccupied for two weeks in warm Southern climates or four weeks in cooler Northern climates. Pastures should not be harrowed after Oct. 1 in the United States because parasite larvae dispersed by harrowing will not undergo the climate extremes required to kill them.
- Rotate livestock species in pastures when possible.
- Leave pastures vacant for at least two months during the warm season when possible, or allow horses to graze fields that have recently produced hay.
- Use scales/weight tapes to prevent inaccurate horse weight estimation and, thereby,

underdosing when anthelmintics are used.
- Run FEC and FECR tests; as Nichols commented, "If you can't measure what you're doing, you can't measure improvement."

Seek the advice of a qualified veterinarian before proceeding with any diagnosis, treatment, or therapy.