Large Animal Topics in Parasitology for the Veterinary Technician

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This presentation is designed to review the value veterinary technicians can add to mixed or large animal practices by participating in client education regarding parasite testing and product recommendation for effective parasite management. There is a trend of distancing veterinarians and veterinary technicians from close involvement with decision making when it comes to parasite control and management due to the availability and accessibility of parasiticides that are readily available over the counter. Owners can have misconceptions about parasites and treatments. As resistance increases it is critical for veterinarians and veterinary technicians to be informed and educate producers. Veterinary technicians can provide significant knowledge and value to large animal clients by reducing parasite related costs which will increase animal health and profit. At the same time this creates value to the veterinary practice resulting in an increase in diagnostic testing and appropriate recommendations for parasiticides to be purchased. Topics covered in this discussion will include: a brief review of our current understanding of basic parasites of cattle, horses, and small ruminants, current issues regarding parasite diagnosis and testing, farm management strategies to reduce parasitic infection, parasitic treatment with anthelmintics, and anthelminthic resistance.

Overview of Basic Parasite Life Cycles

The typical life cycle of many gastrointestinal nematodes of grazing animals is similar. The adult nematode lives in the gastrointestinal tract where it reproduces. Eggs are shed in the feces and when conditions are ideal the eggs will hatch into larvae which develop into an infective stage on pastures. The infective stages are ingested while grazing.

There are several important factors to consider regarding infective larvae and pasture contamination. First, approximately 30% of the animals typically will be responsible for 70% of the egg output. This is a crucial concept regarding parasite control. Identification and appropriate treatment of this group will have a huge impact on the overall success of the management plan. Secondly, there are not the same number of infective larvae on pastures at all times. Several factors contribute to when grazing animals are at greatest risk for infection. The season plays an important role in parasite reproduction. There are significant variations in parasite life cycles, but typically the levels of infective parasites on pastures are going to be higher in warm and humid weather from late spring and summer through early fall, and then decrease late fall and winter when the weather is cooler. Knowledge of the specific parasite and life cycle of the parasites in a specific location is essential knowledge for formulating a management strategy. The periparturient egg rise allows for increased egg production by adult female parasites and this serves as an important source of pasture contamination in young animals. These pregnant females have decreased immunity during late pregnancy and an increased rate of egg production in existing worms. This leads to a significant increase in pasture contamination, typically in the spring when young are most commonly born. These young animals in their first grazing season have limited natural immunity to gastrointestinal nematode parasites. The infective stages on pasture serve to infect these naïve young animals. Finally, increased stocking density increases parasite numbers. All of these factors and others must be considered when developing a complete parasite control plan for grazing animals.
Common Internal Parasites of Cattle, Horses, and Small Ruminants

Brief Overview of Internal Parasites of Cattle

*Ostertagia ostertagi* is the most pathogenic internal parasite in most beef herds in the United States. There are two syndromes associated with *Ostertagia*. Type I Ostertagiasis is seen when the parasite follows the typical life cycle where the adult matures in the abomasum, eggs are shed in the feces, and larvae mature on pastures. Parasite numbers increase in animals on pastures which can lead to significant production losses. Type II Ostertagiasis occurs when environmental conditions are not ideal for larvae to survive on pastures. The adult worms go into a hypobiotic stage in the abomasum and accumulate until conditions are optimum for larval survival on pastures. When conditions are appropriate large numbers of accumulated larva suddenly mature and migrate causing severe abomasal damage. Significant weight loss and diarrhea are often seen. This occurs most often in the fall in southern states following the hot summer where larvae cannot survive on pastures, and in the spring in northern states following the cold winter where larvae cannot survive on pastures. *Ostertagia* can be a problem for both cows and calves.

*Ostertagia*, *Cooperia* spp., and *Haemonchus* spp. are potential problems for calves. Young cattle generally have much higher egg counts than adult cattle due to decreased immunity. Stockers and replacement heifers tend to have the highest egg counts due to their age, increased stocking density, and the potential for resistance due to increased treatment. Egg production varies considerably from one species to another. *Haemonchus* spp. and *Cooperia* spp. are prolific egg producers. *Ostertagia* spp. produces few eggs per female by comparison. These are warm season parasites so greater numbers build in summer months. This information and the species of worm present are important when evaluating egg numbers in cattle.

Currently there is less documented parasite resistance in cattle than small ruminants and horses. Resistance seems to be more common in stocker cattle which is likely due to intensive management techniques where large numbers of young stressed animals are kept in smaller areas with more frequent use of anthelmintics.

Brief Overview of Internal Parasites of Horses

Among well managed horse populations, *Strongylus vulgaris* infections are now recognized as the major parasite of concern. Young horses less than three years of age are more susceptible to parasites in general and are more likely to demonstrate parasite-associated clinical disease. Cyathostomes can affect all age groups, but the young and the old are generally more susceptible. Fecal egg counts are valuable, but do not reflect the total worm burden due to the potential for a large number of encysted parasites. Other signs of cyathostome infection include enteritis, weight loss, edema, hypoproteinemia, and death. Approximately 30% of horses carry 70% of the parasites. These are the only horses which should be treated frequently as this will reduce resistance pressure. The low shedders can be controlled typically with as few as one anthelmintic treatment per year. The small number of high shedders typically benefit from approximately 4 treatments per year.

The most common and pathogenic parasite of foals and weanlings is *Parascaris equorum* which can cause respiratory disease, poor growth, colic, and death. Many farms with documented resistance to ascarids share these common traits: receive their first treatment prior to 60 days of
age, deworm at frequent intervals less than 60 days, use ivermectin exclusively, do not monitor
treatments with fecal egg counts. Appropriate treatment strategies are: foals should receive a
minimum of 4-5 dewormings with the first performed no earlier than 2 months of age.
Benzimidazoles or pyrantel is recommended due to their effectiveness against ascarids. The
average interval between these early anthelmintic treatments should range from 8-12 weeks with
the goal of reducing the number of patent ascarid infections among the foal population while
minimizing selection pressure which can lead to resistance. At weaning a FEC should be
performed to determine if the foal’s worm burden is primarily strongyles or ascarids with at least
two additional treatments between weaning and 12 months of age. Perform yearly fecal egg
count reduction tests to monitor drug efficacy.

*Anoplocephala perfoliata* is the tapeworm of horses and should be discussed when considering
parasite management in horses. This tapeworm has a long prepatent period and can cause colic,
diarrhea, small intestinal impactions, and ileocecal intussusceptions. The only treatments
effective against tapeworms are praziquantel and a double dose of pyrantel. Twice a year
treatment for tapeworms is suggested.

Anthelmintic resistance is a significant issue with equine parasites and has been reported for
more than five decades. All management plans must include a strategy to minimize anthelmintic
resistance.

**Brief Overview of Internal Parasites of Small Ruminants**

The most common and most pathogenic parasites of goats and sheep are *Haemonchus contortus*,
*Teladorsagia circumcincta*, and *Trichostrongylus spp*. *Haemonchus contortus* is commonly
called the barber pole worm and lives in the abomasum. It also infects llamas, deer, and
occasionally cattle. It has a short life cycle with a prepatent period of approximately 16-21 days
when conditions are favorable including warm temperatures and high humidity. Development is
delayed in cool conditions and the infective larvae can survive for months on pastures under
moist conditions. The adult females are prolific egg layers and can produce several thousand
eggs every day. The short life cycle and egg production can lead to severe pasture contamination
by early to mid-summer in Tennessee. The adult worm lives in the abomasum and one worm
can ingest 0.05 ml of blood daily. Severe disease can be seen in animals with as few as 500
mature worms. Clinical signs include severe anemia, hypoproteinemia, anorexia, lethargy and
weight loss.

Anthelmintic resistance, including multiple class anthelmintic resistance, is a major issue with
parasites in small ruminants and any treatment and control strategy must incorporate methods of
controlling and reducing anthelmintic resistance.

**Large Animal Parasite Diagnosis and Testing**

Parasite diagnosis and testing has been reduced in some areas due to readily available over the
counter parasiticides. Veterinary technicians can provide valuable information to owners by
providing appropriate and affordable parasite testing. There are both qualitative and quantitative
techniques for diagnosing parasites. Qualitative techniques like simple fecal flotation can be
valuable tests to determine if parasites are present, but they do not give a reliable indication of
the number of parasites present. Quantitative techniques such as the McMaster technique
determine the number of eggs present per gram of feces. These tests can generally determine how heavily parasitized the herd is, with some limitations. In general, when egg counts are low, parasite numbers are low and when egg counts are high, parasite numbers are high. However, there are exceptions, for example, large numbers of parasites may be present, but they are in hypobiotic stages. Other tests which can be helpful in a testing program are the FAMACHA system for small ruminants, and the observation of clinical signs in all species including diarrhea, weight gain or loss, and decreased milk production. Quantitative techniques performed by the veterinary technician can be used to diagnose and treat the relatively small percentage of animals carrying the largest worm burden in a group, determine when treatment should take place, and determine if anthelmintic resistance is an issue on a farm. Veterinary technicians need to educate clients on the importance and value of diagnostic testing.

**General Farm Management Strategies for Parasite Control**

Veterinary technicians can greatly improve parasite control programs by discussing farm management strategies for parasite control. When considering farm management there are several factors to consider. There are many environmental and animal factors involved. The ultimate goal is an integrated management strategy to reduce parasite numbers on the farm to a level that has a minimal effect on animal health and productivity without allowing for the development of anthelmintic resistance. Eliminating parasites is nearly impossible and undesirable as this often selects for parasite resistance. The goal from a farm management strategy is to minimize economic impact, or cost, while allowing some exposure so animals develop immunity and minimize anthelminthic resistance.

The first and most important factor to consider is the management of pasture contamination. The two primary sources of pasture contamination are young animals in mid to late grazing season and adult females in late gestation and lactation. Many factors play a role in pasture management including stocking density, pasture rotation, species rotation, and forage height. Management strategies need to address both the primary source of pasture contamination and environmental management.

**Appropriate Parasite Treatment with Anthelmintics**

Veterinary technicians should play an integral role in educating clients on appropriate anthelmintic use. Much has been written about appropriate and inappropriate use of anthelmintics. General strategies to follow to increase effectiveness include following label doses and directions or using doses recommended by scientific literature. Fasting animals for 12-24 hours before giving oral products can lead to increased effectiveness. Consensus suggests not rotating products more frequently than yearly. More frequent rotation is believed to lead to multiple class anthelmintic resistance.

Targeted or selective treatment of animals is a key piece to appropriate use. Only animals that need to be treated should be treated. This can be achieved by monitoring fecal egg counts and clinical signs. Remember 30% of animals typically are responsible for 70% of the eggs on pasture. The challenge is to properly identify these animals by testing. At the same time, the development of anthelmintic resistance can be slowed or even prevented if 30% or more of animals are not treated. This leaves a susceptible refugia which is critical to managing a parasite population. Technicians play a valuable role in educating clients on the value of testing and assisting in making recommendations based on test results. Most clients are open to the idea of
investing in more testing once they realize that fewer animals will be treated and this results in cost savings and better health. It is the job of the veterinary technician to offer this information to clients.

Fecal egg counts should also be used to monitor the effectiveness of anthelmintics. This information can be used to monitor potential resistance, determine animals that carry increased worm burdens, and develop a farm history to assist with future planning for parasite control.

**Anthelminthic Resistance**

Anthelmintic resistance occurs following a change in a parasite’s genetic makeup which allows it to survive exposure to the anthelminthic. Resistance traits are inherited. Resistance requires the presence of resistant genes and the rate of resistance development in a population depends on the selection pressure of the surviving worms to pass genes on. Use of the anthelminthic places selection pressure on the parasite population allowing resistance to increase. Frequent drug therapy subjects parasite populations to selective pressure and allows only resistant isolates to survive, reproduce, and pass on their resistance genes to future generations of parasites. Resistance is demonstrated by reduced effectiveness of an anthelminthic through testing procedures. Typically, once resistance is detected it is widespread on a farm. Many factors are involved in resistance including number of treatments, pharmacokinetics, and parasite biology.

Any discussion of parasite resistance must include a discussion of refugia. Refugia is the parasite population that is not killed by the drug treatment. Refugia can be on pasture or in animals. The larger the refugia, the more the resistance genes will be diluted and the more effective the treatment will be. As the refugia becomes smaller, genes selecting for resistance will spread faster. A good example of the importance of managing refugia can be seen in small ruminants. Historically all animals in a group were treated with a dewormer and then moved to a clean pasture. This decreased the size of refugia on the clean pasture and all of the parasites susceptible to the products were killed. The only parasites that remained were resistant to the treatment. This quickly developed a population of resistant parasites. This is why current recommendations are to only selectively treat animals which will leave a large refugia of non-resistant parasites.

There are only two ways that resistant parasites are acquired on a farm. Resistance is unintentionally developed and selected for on the farm or resistant animals are purchased. Good management programs will include a quarantine and testing program for new additions to the farm. Veterinary technicians must educate clients on anthelmintic resistance when designing parasite control plans.

**Summary**

The key to parasite control is to find the proper balance of environmental control, genetics, and timing of anthelmintics with the goal of minimizing economic impact while at the same time preventing the development of resistance. It is critical to remember that at any time the majority of parasites are in the environment on the pastures and it is important to use a combination of environmental control and anthelmintics. Historically the focus has been primarily on the use of anthelmintics. This is where veterinary technicians can reverse the trend of decreased veterinary involvement in parasite control and become more involved in parasite management.
The key goal for parasite control is to deworm often enough to minimize economic impacts while at the same time preventing the development of anthelmintic resistance. Some important points for technicians to consider when designing parasite control strategies are:

- Deworming recommendations must be tailored to the geographic location and management style of the farm
- Monitor and treat animals selectively
- Management must focus on pregnant and young animals
- Management must focus on the smaller percentage of animals with the most parasites
- Product selection based on appropriate parasite testing
- Understanding of parasite Biology
- Refugia management
- Decreased rotation of products and infrequent use of products
- Proper route of administration and dosing
- Manage pasture contamination
- Use anthelmintics appropriately
- Quarantine and treat new introductions
- Investigate treatment failure

In summary, there are many opportunities for veterinary technicians to use their knowledge and skills to educate clients regarding parasite testing and management. Owners can have misconceptions about parasites and treatments and as resistance increases it is critical for veterinarians and veterinary technicians to be informed and educate producers. Most owners will appreciate the improved health and decreased cost associated with buying fewer products and this will open the door for more veterinary involvement.

Veterinary technicians can provide significant knowledge and value to large animal clients by reducing parasite related costs which will increase animal health and profit. At the same time this creates value to the practice as diagnostic testing is increased and appropriate products are recommended and sold.

Reference list available upon request by providing a self-addressed stamped envelope