HEALTH ZONE

Tying-up in Thoroughbred Racehorses

BY HEATHER SMITH THOMAS

MUSCLE PROBLEMS are fairly common in athletic horses. Muscle pain and cramping associated with exercise have been recognized for more than 100 years, and various terms have been used to describe it (azoturia, Monday morning disease, etc.). In recent years veterinary researchers have found several different forms of this syndrome, with different causes.

Dr. Stephanie Valberg, professor and director of the University of Minnesota Equine Center, has been doing research on muscle problems in horses for 40 years.

"When we first started doing research on tying-up, in the 1980s, we assumed that all horses tied up for the same reason," she said. "One of the early theories was that they accumulated too much lactic acid in the muscles, but some of the first research we did in Thoroughbreds, Standardbreds, and Quarter Horses showed that when horses are tying-up, they don't have an accumulation of lactic acid in the muscles. When we took muscle samples from them during tying-up episodes, we didn't find high lactic-acid concentration.

"Recognizing that it wasn't just one syndrome, we used biopsy to examine muscle samples under the microscope," she said. "We did biochemical measurements to figure out whether there were different causes for tying-up, using new knowledge about exercise physiology and high-speed treadmills to do the studies. Horses were donated, so we could maintain research herds. We had Thoroughbred horses from the racetrack (horses that had problems with tying-up) and Quarter Horse pleasure horses that had problems with tying-up, and we searched for the differences."

Genetic study has shown that certain lines of Thoroughbreds are more predisposed than others

Research funding from the Grayson-Jockey Club Research Foundation, the American Quarter Horse Association, the Morris Animal Foundation, and the University of Minnesota Equine Center made these studies possible.

Exertional rhabdomyolysis (ER) is broken down into two categories: sporadic and chronic. The latter is due to specific inherited abnormalities and can be broken down further into two distinct types—polysaccharide storage myopathy (PSSM) in Quarter Horses, warmbloods, and draft breeds (horses with heavy muscles), and recurrent exertional rhabdomyolysis (RER) in Thoroughbreds, Standardbreds, and a few Arabians and warmbloods. The prevalence of RER in Thoroughbred racehorses is about 4.9% in the U.S., 5.4% in Australia, and 6.7% in the United Kingdom.

"Some horses have a sporadic form of tying-up," said Valberg. "There is probably no underlying abnormality or functional defect in their muscles; there's just a temporary imbalance."

In those instances, the horses merely did something out of the ordinary that day, and it was too much for their conditioning. They may have strained muscles.

"If diet isn't balanced (not enough vitamin E and selenium, for example, or enough salts during hot, humid weather), this can also predispose horses to problems," she said. "In these cases, after a tying-up episode, if you make sure the horses have a regular training regime,

COURTESY DR. STEPHANIE VALBERG

A mare from the University of Minnesota's herd experiencing a tying-up episode

the amount of exercise is not excessive, and the diet well-balanced (with electrolytes, vitamins, and minerals) and not too high in grain, these horses do fine if they are rested and then put back into training. Those horses won't have another episode of tying-up."

RECURRENT EXERTIONAL RHABDOMYOLYSIS (RER)

"There are differences between Quarter Horses and Thoroughbreds that tie up repeatedly," said Valberg. "One big difference is that Thoroughbreds usually don't start tying-up until they are quite fit and in race training. They tend to be 2- and 3-year-olds; young horses have more problems than mature ones. It's usually the more nervous ones that are affected, and usually fillies, particularly if they have a nervous disposition."

This tying-up (RER) is often associated with excitement.

"At the racetrack, episodes of rhabdomyolysis commonly occur when these horses are just galloping (rather than racing), because they are being held back and upset at being held back—fighting the rider. If they are coming back to the barn and want to jog instead of walk, and you try to make them walk, they may tie up. Or if something happens that gets them really excited, they may have problems."

In Thoroughbreds exercising on a treadmill, RER most commonly develops with intervals of walk, trot, and canter and is less common at a fast gallop.

MANAGING RER

Management should be closely examined to try to figure out what can be done to decrease excitement.

"It often helps to stall the horse next to one they are compatible with, so they are not fussing with the horse next door," said Valberg. "It also helps if they are stalled in a quiet area—where they are not watching horses going back and forth. They should be exercised first, so they are not watching all the other horses and having to wait their turn. If they are exercising with other horses, choose buddies that can keep them calm.

"Try to limit the amount of time these horses are standing still. In treadmill exercise trials we found that horses tend to have more problems with tying-up if they've been standing in a stall for two days. It's better to get them out every day and not give them days off. Try to provide opportunities throughout the day to get them out of the stall."

Most Thoroughbreds in race training are kept in stalls, but it would be much better for them if they could be in small paddocks, with room to move around.

"Sometimes, if horses have severe problems with tying-up, they must be taken away from the track and trained

at home, where they can be in a different environment, where they can get out more," Valberg said.

The change may help enough that the horses can be trained.

"If you can get them to start racing, we've found that it doesn't affect their racing performance at all—if you can get past the tying-up episodes when starting training," she said. "And much of getting past it is just getting them calmed down and accustomed to being in training—and used to being at the track.

"Another thing that seems to help is diet changes. These horses get very excited when on high grain diets. They tend to be very nervous horses, so they burn calories easily and it's hard to keep weight on them. If you substitute fat for part of the grain, it helps take the nervous edge off and they are calmer.

"In treadmill studies we found that we were able to minimize episodes of tying-up in the horses on a high fat, low starch diet," Valberg continued. "We created Re-Leve (a special feed that's very high in fat) to provide enough energy for these horses.

"The problem with just adding fat to

the grain is that you can't meet their daily energy requirement. Thoroughbreds need a specialized high fat, low starch feed to get enough calories. Feeds have to be very palatable because these horses become finicky when they need to eat that much."

Usually you want to find a product that's at least 10-12% fat and relatively low in nonstructural carbohydrates (NSC), which is how the starch is usually measured.

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Biopsy was used to examine muscle samples under a microscope at University of Minnesota's Equine Center

GENETICS OF RER

"Our studies have shown that certain lines of Thoroughbreds are more predisposed to RER than others because they inherit the problem," said Valberg. "The other thing we found is that regulation of muscle contraction and relaxation is abnormal in the horses that have chronic problems. There are many Thoroughbreds that experience the sporadic form of tying-up, but this chronic form is inherited."

Valberg thinks it's a dominant trait.

"This means the affected horse gets it from one parent," she said. "But we've seen some horses in which all of their offspring tie up. Thus, in some horses maybe both genes are affected, (and they inherit) the trait from both parents. These individuals may be severely affected, and when you breed them, all of their offspring will get one of those genes and be predisposed to tying-up."

A breeding trial at the University of Minnesota evaluated the number of offspring of RER horses that had a positive contracture test. Results suggested an autosomal dominant mode of inheritance with an equal ratio of male and female affected Thoroughbred offspring.

Using a clinical diagnosis of RER rather than the contracture test, offspring of RER-affected dams also appeared to inherit the disorder as a dominant trait—with more females than males having clinical signs. But several variances and other potential modifying genes make this hard to evaluate.

Unraveling the genetic puzzle is difficult because other things can influence tying-up. A horse might have inherited that gene but has a very calm disposition naturally and might get by without showing much problem.

"Occasionally, you find a filly that's extraordinarily difficult to train," said Valberg. "You do everything you can, and she still ties up. Many times, those fillies are taken out of training and retired to breeding, and produce offspring that have problems with tying-up."

Yet it's not something most breeders take into consideration when deciding whether or not to breed these individuals, since most of them are very athletic with desirable bloodlines for racing.

"If you can manage this disease, it's not a disadvantage in a racehorse," said Valberg. "They still perform well. The biggest problem could be if a horse inherits a double dose. Rather than having just one copy of the gene, they have two. At this point this is merely speculation. But this might explain why some horses are very difficult. A breeder might try to avoid this if we can get a genetic test in the future. I don't think people will try to completely breed away from it, however, because it's found in some very good bloodlines. They just won't want to double it up."

CALCIUM PROBLEM

RER is believed to be due to an abnormality in regulation of muscle contraction and relaxation.

"One factor involved in muscle contracting and relaxing is movement of cal-

RESEARCH ON DANTROLENE

Dr. Erica McKenzie of Oregon State University has been looking at muscle tying-up problems in Thoroughbreds and other horses, and the use of dantrolene as a treatment. Dantrolene acts on the calcium-release channel in the muscle. In most horses, tying-up is related to a calcium regulation disorder—some sort of dysfunction in the way the muscles handle calcium.

"We started looking at this in 2002," said McKenzie. "Dantrolene works on reducing calcium release within the muscle cells. We performed treadmill trials and did find a positive impact with this drug if we administered it to the horses before exercise.

"Since then I've been looking at dantrolene in terms of how much to give, whether a person should give it before feeding or not, etc. The most important thing to recognize is that the vast majority of research over the past decade has indicated that a lot of these horses can be effectively managed through diet and appropriate exercise regimens. Today this is the basis of what we recommend for treating any of these horses.

"Dantrolene has its niche for treating horses that are severely affected and can't be managed adequately through typical regimes," she said. "It is expensive; the dose for an adult horse is $20 to $40, depending on the size of the horse. It is fairly short-acting, with some degree of action for about four to six hours. We know that it works in Thoroughbred horses but are not sure that it works very well in any other kind of tying-up.

"By blocking calcium, dantrolene can have a protective effect in a fairly non-specific fashion. My recommendation for horses that tie up is to follow the diet and exercise regimes that have been designed for them. Dantrolene is not a drug that should be used as a convenient fix.

"We did a trial looking at whether a person should feed or fast a horse before giving the drug," McKenzie continued. "They need to be fed recently—within the previous four hours of receiving it—in order to absorb the drug adequately. Otherwise, you are basically throwing the drug away." *By Heather Smith Thomas*

cium in the cell," said Valberg. "The calcium is stored in membranous storage sites in the cell. When it is released, it interacts with the proteins to make the cell contract, and then it has to get pumped back into the storage sites so the muscle can relax. This happens many times a second when the horse is moving; as the muscles contract and relax, the calcium is moving in and out of these sites. We think this is where the abnormality lies in these horses, when the muscle cell is moving calcium back and forth.

"The amount of calcium in the muscle is not influenced by dietary calcium. But it is influenced by many different factors and hormones within the muscle tissue itself. We think part of the reason why mares are more predisposed to the problem is because they are so much more easily stressed and upset, particularly when they are in heat.

"One of the medications (Dantrium or dantrolene) used for tying-up can be helpful in alleviating this problem," she said. "It reduces serum calcium activity."

Giving proper dosage one hour before exercise to RER-susceptible horses fed high-grain diets has been shown to lower serum calcium activity significantly for several hours.

"You can't race on this medication, but it works for getting horses into training and settled into the environment at the track," Valberg said.

It can help ease them through the early training period when trying to get a nervous, excitable horse calmed down so it won't experience tying-up episodes. Another thing people sometimes use is a low dose of tranquilizer prior to exercise, during the early phase of training when trying to get the horses settled down. This makes them a little calmer until they adjust to the training.

Some mares show RER during estrus. Hormones to suppress estrous behavior, such as progesterone injections, may be beneficial. Testosterone and anabolic steroids have been used at racetracks to prevent signs of RER, but their use is no longer permitted. BH

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