

Down on the Farm



Fit to be Tied

by KENTUCKY EQUINE
RESEARCH

Tying-up is a generic term commonly used to describe muscle disease in performance horses. Other terms often used interchangeably with tying-up include exertional rhabdomyolysis, azoturia, and Monday morning sickness. Clinical signs of tying up include a stiff gait, reluctance to move, firm cramping muscles, profuse sweating, accelerated heart rate and increased respiratory rate. In addition to clinical signs, horses that tie-up will have moderate to marked elevations in blood serum levels of muscle proteins including myoglobin, creatine kinase (CK), lactate dehydrogenase (LDH) and aspartate aminotransferase (AST) activities. Such elevations indicate muscle cell damage and are considered a diagnostic tool to detect tying-up.

For years, horses that tied-up following exercise were thought to suffer from the same disease. However, treatment and prevention protocols that worked on some horses did not help other horses. As a result, confusion and controversy developed regarding the cause and treatment of tying-up. Researchers have only recently begun to classify and study the many different disease conditions that result in the common symptoms of tying-up. Initial classification of tying-up is now based on frequency of the disease symptoms following exercise. Horses that tie-up

only a few times in their lifetime are classified as "sporadic," while those horses that tie-up on a repeated basis are termed "chronic." The following is a brief discussion of both sporadic and chronic tying-up and steps that can be implemented to help prevent the disease. Much of the research involving tying-up and treatment/prevention protocols has been conducted at the College of Veterinary Medicine at the University of Minnesota.

Sporadic Tying-Up

Many horses experience some muscle soreness and strain associated with exercise. These horses are often mistakenly thought to be suffering from a specific muscle disease. Inadequate warm-up, preexisting lameness, exercise to the point of fatigue and insufficient training, can result in muscle soreness and injury. A similar human scenario might be overexertion from strenuous physical activity in a person conditioned to sit behind a desk. In horses that actually tie-up, muscle soreness is much more severe and is typically accompanied by elevated blood serum muscle proteins and myoglobinuria (coffee-colored urine). This darkening of the urine is a result of the kidneys filtering myoglobin (a muscle protein) from blood, an indication of severe muscle damage. The most frequent causes of sporadic tying-up are exercise that exceeds a horse's level of training, electrolyte imbalances, hyperthermia, and strenuous exercise

while suffering from a respiratory disease.

Sporadic tying-up should be considered a veterinary emergency if horses are sweating profusely, reluctant to move or have dark urine. Veterinarians may administer medicine to relieve anxiety and muscle pain. In addition, corrections in hydration are made to account for fluid losses and myoglobinuria that may impair kidney function. Further treatment strategies include stall rest, followed by hand walking and turnout once the initial muscle stiffness has been resolved. Grain intake is drastically reduced or eliminated because these horses are likely to be on a reduced exercise program. The amount of time the horse must remain out of training has not been firmly established. However, any training regime following an episode of tying-up should be resumed gradually and consistently, so as to prevent further muscle damage.

Sound management and training practices may help prevent tying-up. Learning not to overexert unfit horses and remembering to fortify their diet with salt on a daily basis, as well as administering electrolytes prior to heavy sweat loss, are logical strategies. Adjusting the amount of grain fed to satisfy the energy needs of the horse is also tremendously important. In other words, one does not want to overfeed carbohydrate (grain) to horses as this may be a potential cause of tying-up. Feeding grain concentrates, fortified

with fat and necessary antioxidant vitamins and minerals, will provide energy while supplying the building blocks to protect muscle tissue. The combination of these strategies will often prevent healthy horses from having another bout of tying-up. In areas where the soil is deficient in selenium, a selenium and Vitamin E supplement may improve muscle health.

Chronic Tying-Up

When horses have repeated episodes of tying-up, the disease is considered chronic. Many different breeds of horses have been reported to have chronic bouts of tying-up, including Quarter Horses, Thoroughbreds, Standardbreds, Paints, Morgans, Arabians, and various breeds of draft and warmblood horses. The proposed causes of chronic tying-up include electrolyte imbalances, hormonal imbalances, hypothyroidism, muscle ischemia with lactic acidosis, and vitamin E and/or selenium deficiency. While chronic episodes of tying-up are frustrating and painful for both the horses and their owners, it is the study of these chronically tied-up animals that has advanced our knowledge of the causes, treatment and prevention of the disease. Recently, two specific causes of chronic tying-up have been identified in the horse. These causes include a muscle contraction disorder (recurrent exertional rhabdomyolysis or RER) and a disorder in carbohydrate storage and utilization (polysaccharide storage myopathy or PSSM).

Recurrent Exertional Rhabdomyolysis (RER)

RER is common in nervous fillies of Arabian, Standardbred and Thoroughbred descent. These individuals often develop the condition when they are excited, stressed and/or experiencing a period of stall rest preceding the occurrence of some exercise. Preliminary genetic research and breeding trials point to this condition being an inherited trait in Thoroughbred horses.

The exact cause of RER in horses has challenged scientists for several years. RER in racing horses was believed to be similar to lactic acidosis. However, recent research has shown

muscle lactate concentrations to be low, not high, in these horses when tying-up occurs. Most recently RER is thought to be an abnormality in the way muscle contraction is regulated in the horse. Muscle biopsies from horses with RER have revealed an increased sensitivity to contraction when exposed to various chemicals, as compared to normal horses. The altered contraction and relaxation of muscle suggests that abnormal intracellular calcium regulation is the cause of RER.

Treatment of horses experiencing RER requires veterinary assistance. Management designed to make the horse comfortable and prevent further stress and muscle damage is warranted. The use of sedatives prior to exercise to calm a nervous horse is also a common practice. Other drugs designed to regulate intracellular sodium and calcium are now being prescribed for horses. Daily exercise for horses diagnosed with RER is essential. Beginning approximately 24 hours after an RER episode, horses should be hand walked or turned out on a daily basis. Prolonged stall rest seems to be counterproductive and may predispose the horse to further episodes of RER once training resumes. A gradual return to full training can begin once serum muscle protein CK has returned to normal. Prevention of further episodes of RER is difficult. Controlling the environment of these horses is essential. An environment that is not stressful with a well-established daily routine seems to help. Reduction in the amount of carbohydrate (grain) and increases in the amount of fat (vegetable oil and rice bran) and fiber in the diet, reduce excitability and enhance tractability in horses with RER. Furthermore, a high fat diet will help provide essential calories to assist nervous horses in maintaining their body weight.

Polysaccharide Storage Myopathy (PSSM)

PSSM is a glycogen (muscle sugar) storage disorder that is characterized by the accumulation of an abnormal polysaccharide in muscle. Horses with PSSM are able to quickly clear sugar from their blood and store 1 1/2 to four times the normal amount of muscle

glycogen. Accumulation of an excessive amount of muscle glycogen is not due to the inability of these horses to utilize muscle glycogen for energy production, but instead appears to be the creation of more glycogen as well as an abnormal form of muscle glycogen. The abnormal filamentous polysaccharide may be utilized at a much slower rate by the horse, and thus accumulates in the muscle.

PSSM has been identified in Quarter Horses, Paints, Appaloosas, draft horses, warmbloods and a few Thoroughbreds. Horses with PSSM are different from horses with RER in that they have a calm, instead of a nervous, demeanor. Horses with PSSM typically have a history of tying-up problems, associated with the onset of training while the animal is still relatively unfit. Horses with PSSM exhibit classic tying-up symptoms including long-term elevation of muscle enzymes in serum. A confirmed diagnosis is based on an examination of muscle biopsies with the distinctive feature of abnormal glycogen storage. Treatment of horses with PSSM following a tying-up episode involves many of the same veterinary procedures as with other causes of tying-up. Treatment protocols also attempt to minimize the occurrence of future episodes through dietary manipulation.

Horses with PSSM should be fed diets low in sugar (grain) and high in fiber and fat. It is important to completely eliminate grain or sweet feed from the diet of horses with PSSM. The combination of high quality grass hay, a vitamin/mineral supplement and a fat supplement (rice bran and/or vegetable oil), allows many horses with PSSM to work successfully in pleasure activities. Daily activity, riding or longeing, along with pasture turnout, is essential in minimizing the occurrence of PSSM tying-up episodes. Confinement in box stalls for more than 12 hours per day appears to increase the incidence of tying-up.

Research is still being conducted on factors involved in the cause and treatment of tying-up. With careful attention to feeding and exercise programs, many horses with this condition can be managed to allow an active and useful life.