

“TYING-UP”

Known under various names, equine rhabdomyolysis syndrome (ERS), exertional rhabdomyolysis (ER), exertional myopathy, Monday morning disease, tying-up or set fast, this is a disease of the muscular system which occurs during exercise. It can be sporadic or reoccurring.

I. CLINICAL SIGNS

A horse falling victim to a myopathy during exercise will suddenly shorten his stride, stiffen, then show difficulty moving. If he is forced to continue his effort he will start to sweat profusely, his respiratory (and cardiac) rate will increase and he will finish by becoming totally blocked, the spasms of the dorsal and hind quarter muscles being so painful he will be unable to take another step. He shows signs of discomfort that can be confounded with those of colic.

Furthermore, the destruction of muscular cells leads to the liberation of myoglobin (a protein permitting the transport, and storage of oxygen in the muscle cells) into the blood. This protein is then eliminated in the urine, colouring it dark brown (like coffee).

Finally, a blood test will reveal an increase in muscular enzymes (CK or creatine kinase, LDH or lactate deshydrogenase and AST or aspartate aminotransferase) which will confirm diagnosis.

Even if the clinical signs are similar, there exists many types of exertional myopathy.

II. DIFFERENT TYPES OF EXERTIONAL RHABDOMYOLYSIS

1. SPORADIC

Sporadic types arise without the horse having a particular genetic predisposition. They generally occur during unsuited periods of exercise:

- A return to work after one or more rest days without reducing concentrate feed (thus the name “Monday morning disease”).
- Exercise too severe (too long or too fast) for the physical condition of the horse.
- Prolonged effort (endurance) in extreme climatic conditions (high temperatures and humidity) leading to severe dehydration and electrolytic imbalance.
- Intensive exercise whilst the horse is sick: lameness, fever, viral respiratory infection (Equine herpes virus or flu).
- Over training.

Furthermore, certain feeding imbalances favour the onset of sporadic “tying-up”:

- Excess energy provided in the form of cereals (even if starch is not the primary cause of “tying-up”) notably during rest days.
- Antioxidant deficiencies (vitamin E, selenium, etc.).
- Electrolyte deficiencies (sodium, chloride potassium, magnesium).
- Imbalanced calcium to phosphorus ratio.

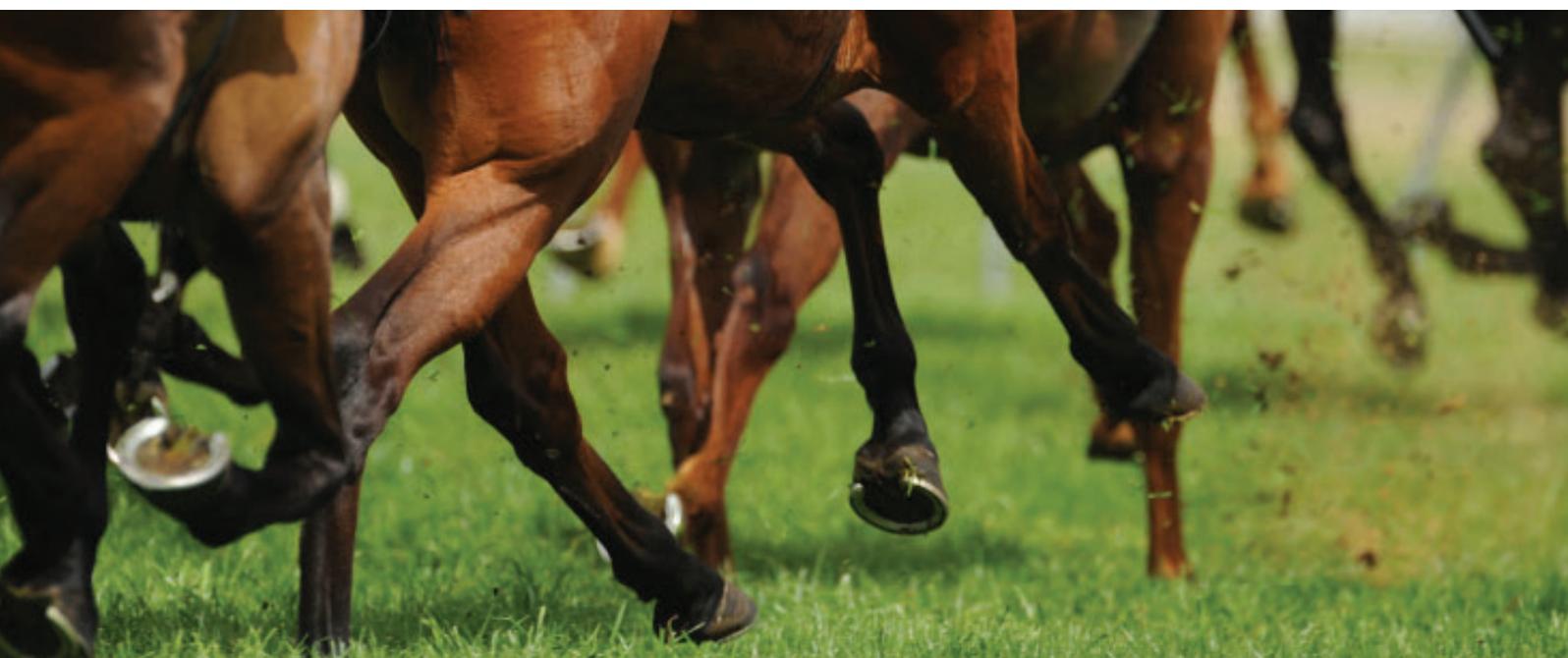
Even dehydration can be at the origin of sporadic myopathies. We can observe this situation in winter, when temperatures are around or below 0°C . In this case water is very cold which puts horses off drinking leading to dehydration. Automatic drinkers can even freeze if they are not heated or insulated. Horses may be totally deprived of water for one or more days if this goes unnoticed. In this case a good number of horses on the yard may fall victim to exertional myopathy.

2. CHRONIC FORMS

When horses have recurrent episodes we talk about chronic exertional rhabdomyolysis. They are due to hereditary genetic abnormalities and met with in certain breeds and even in certain bloodlines.

Even if there are many types of chronic myopathies, we will only look at the type best known in France - recurrent exertional rhabdomyolysis (RER), (other types, such as Polysaccharide storage myopathy (PSSM) being more rare in this country).

Recurrent exertional rhabdomyolysis (RER), is met with principally in thoroughbreds, trotters and arabs. The exact cause is not known. It was thought for a long time that the increase in lactic acid during muscular effort could be at the root of these chronic myopathies. However recent experimental studies have shown that muscular lactate concentrations were low at the offset of RER in predisposed horses. The symptoms very often appearing 15 to 30 minutes after moderate effort (aerobic). The most probable hypothesis is an anomaly of the intra cellular calcium regulation responsible for muscular contraction. This results in a dysfunction of the contraction / relaxation cycles. Thus during exercise (mainly long and slow), this anomaly can explain the occurrence of excessive muscular contractions, leading to the destruction of the affected cells and the neighbouring ones if the effort is not immediately stopped.



In practice, we observe that:

- Females are more affected (67% of females versus 33% of males) and in particular, 2 year olds in training. Even though it has not been scientifically proven, many trainers have observed more frequent cases of myopathies when fillies are in heat.
- Nervous / stressed horses have 5 times more chance of suffering from RER.
- Horses having a predisposition to RER have four times more chance of a myopathy when lame.
- Horses suffering from RER have more chance of a myopathy when they are very fit.

Furthermore, a diet too rich in starch and sugars is likely to trigger a myopathy in a predisposed horse. A meal too rich in starch and sugar leads to a large absorption of glucose in the blood stream (principally from the digestion of starch or sugar by-products such as molasses). This trigger a more or less marked secretion of insulin depending on the horse (notably greater in fit horses). This hormone, whose role is to permit glucose to enter the cells, also increases the production of a neurotransmitter the serotonin in the central nervous system. It has been proven that a hyperserotonemia (an excess of cerebral serotonin) shows itself by physical and mental hyperactivity, disorganised behaviour and mood change.

To sum up, in those horses predisposed to RER, ingesting a feed too rich in starch and sugar will be at the root of behavioural troubles (nervousness, excitement, stress, etc.) which then has repercussions at a peripheral level, leading to malfunctioning of muscular contractions responsible for bouts of myopathies.

III. WHAT TO DO WHEN FACED WITH “TYING-UP”

When a horse shows all the clinical signs of a myopathy, the first thing to do is to stop exercise immediately and to move the horse the minimum possible! If the horse is far from the stables he must be brought back in a lorry or trailer.

Whilst waiting for the vet, offering him a drink and putting a rug on are recommended.

Once arrived, the vet may put in place a treatment based on rehydration, pain relief, reducing anxiety and the muscular spasms, improving the peripheral blood supply and supporting renal and hepatic functioning.

After suffering a myopathy episode, it is not recommended leaving the horse stabled for long periods. Indeed prolonged stabling can favour the onset of a new episode when work is resumed. Thus, resuming light activity 24 hours to a few days after an attack (depending on the type and severity of the myopathy) is recommended. The horse can first be walked in hand for a few minutes once or twice a day in a calm environment, then turned out daily in a small paddock for a good many hours. It is important that periods of stabling do not exceed 12 hours. Concerning feeding, only feeding hay to the horse during a few days is recommended.

The return to work will vary depending if the horse has had the sporadic type or suffers from a chronic form of myopathy:

- **Sporadic forms:** a return to training is not possible until the clinical signs have disappeared and the muscular enzymes (principally the CK) have returned to their normal levels. The return to work must be gradual and controlled, notably by a regular monitoring of the muscular enzymes.
- **Chronic forms:** the muscular lesions being moderate and recurrent, it is best to put the horse back into work rapidly as soon as the clinical signs cease. The aim is to return to a daily work routine. Ideally the daily exercise in the first three weeks will be on the lunge. During this period, the objective is to progress from sessions in walk lasting few minutes, to sessions of 30 minutes in walk and trot without a new episode occurring. Unless a new episode arises during this period it is not necessary to re-control the CK during the first month. Driven or ridden work can then be resumed in a progressive manner.

IV. PREVALENCE OF “TYING-UP”

1. SURROUNDINGS

As stress, excitement and nervousness have all been implicated in the onset of episodes of myopathies, every effort must be taken to ensure horses stay calm and relaxed. For those horses predisposed to chronic myopathies, it is advisable to stable them next to quiet horses in a calm part of the yard. A daily routine where they are fed and worked (always by the same rider) first and at fixed times is very often an effective means of managing the most sensitive horses.

2. EXERCISE

Firstly, in order to prevent the onset of “tying-up”, it is advisable to **avoid rest days, in the stable without exercise**. Indeed it has been proven that levels of CK are higher following exercise the day after a rest day.

Secondly, during work it is advisable to:

- Warm-up properly.
- Allow the horse to loosen up and relax during the session.
- Cool-down actively after intensive efforts (at a brisk active walk or a slow trot).
- Use an exercise sheet (at least at the start of a work session) to cover the back of predisposed horses during cold weather.

More specifically, jockeys riding thoroughbreds predisposed to myopathies should avoid “fighting” with their mounts in order to keep to a moderate pace, it is often at this occasion that the onset of a myopathy is seen. In trotters that have a tendency to “tying-up”, the start of an episode is generally seen after 15 to 30 minutes work at below maximum speed. Thus, rather than working for long periods of time it is preferable to use interval training for predisposed subjects.

3. WATERING

A horse at rest generally drinks between 20 and 40 L of water a day in a temperate climate. A horse weighing 500 kg, worked during hot and humid weather may drink up to 90 L per day! Consequently **it is primordial that horses have permanent access to temperate good quality water.**

About watering methods. Buckets are the best means of controlling the quantity and quality of the water drunk. If for practical reasons the yard is equipped with automatic drinkers, checks should be made to ensure that the water distributed is satisfactory, with sufficient pressure, and in a clean drinker (not contaminated by muck, straw, or bird droppings). **Particular attention must be paid in winter as soon as temperatures drop.** If the water is too cold the horse will reduce his intake and can become dehydrated. At the extreme, if water pipes freeze, and it is not noticed, horses can be deprived of water for a day or more. In this case a number of horses on the yard may fall victim to an episode of tying-up.

4. FEEDING

Rigorous feeding management is indispensable if we wish to avoid the onset of “tying-up”.

a - Forage

Forage plays a primordial role in managing the psychological well being of nervous and stressed horses. Above all it is **an occupational and calming element** for stabled horses. Ideally a horse should be able to consume meadow hay (not lucerne hay) ad-lib. Furthermore, hay is a **significant energy source**. Indeed, 2 kg of good hay provides as much energy as 1 kg of barley. So, providing a sufficient quantity of hay allows us to reduce the cereal contribution and thus the starch in the concentrate ration.

b - Concentrate ration

From a general viewpoint, the energy supplied in the daily ration must be divided between a **moderate quantity of cereals, fats and oils, and fibre**. Furthermore, it must not exceed the daily energy requirements of the horse. Particular attention must be made on rest days without exercise. In this case, it is advised to reduce the concentrate ration by 30 to 50%. **For horses predisposed to chronic forms it is imperative to reduce starch and sugars** in the concentrate ration.



Furthermore, It is inadvisable to provide molasses and sources of rapidly digested starch (ex. wheat, oats, flaked cereals, etc.). Energy must be chiefly provided by oils/fats, fibre and a small quantity of slowly digested starch (ex. barley). ADULT SPECIFIC ENERGY is a suitable feed in this case. It contains:

- A small amount of slowly digested starch from barley, thus the take up of glucose into the blood stream is low, provoking only a moderate secretion of insulin. The risk of behavioural troubles appearing and the disturbance of muscular contractions is therefore greatly limited.
- Extruded linseed, both the oil and the seeds which are rich in omega 3s, and also extruded soya beans rich in omega 6s. Fats and oils provide on average three times more energy than cereals. **Therefore they represent a very interesting alternative to starch.** Furthermore, lipids reduce the absorption peak of glucose seen 1 to 2 hours in the blood after the ingestion of a cereal feed. **Oils and fats therefore have a “calming” effect.** Finally, the high level of essential fatty acids in ADULT SPECIFIC ENERGY is beneficial to maintaining the fluidity and integrity of the membranes in muscle cells.
- Soluble and insoluble fibres, notably provided by lucerne (alfalfa), extruded linseed and chicory pulp. These are slowly fermented in the large intestine into volatile fatty acids which are then transformed into glucose in the liver. Providing fibres therefore allows progressively supply glucose throughout the day without disturbing the glycaemia (blood sugar level).

c - Supplements

They can be provided via the feed or by nutritional supplements.

ANTIOXIDANTS

First of all, rations rich in oils and fats require a sufficient supply of antioxidants, notably vitamin E. Next, in order to ensure **optimal protection of cell membranes**, the daily ration must be well supplied with antioxidants, the principal two being vitamin E and selenium.

Furthermore, it is possible to provide other antioxidants which complete the action of vitamin E and selenium. For example, in addition to optimal doses of vitamin E and organic selenium, the feeds in our range intended for horses in very hard work (ADULT MIX ENERGY, ADULT SCIENCE ENERGY and ADULT SPECIFIC ENERGY for horses predisposed to myopathies) provide also at optimal levels, stable forms of vitamin C and natural superoxide dismutase (SOD) extracted from a particular variety of melon.

In case of traditional feeding (straights), or if the concentrate feed provides insufficient vitamin E, it is possible to provide it separately via REVERDY NATURAL E. This supplement contains natural vitamin E which is better absorbed and more effective than the synthetic form (but it is more fragile, so difficult to incorporate into feeds).

ELECTROLYTES AND MINERALS

In order to assure optimal functioning of the neuromuscular system, it is essential to cover all the horses' requirements in macro elements. Thus:

- Providing a **salt block** associated with a feed enriched in salt fulfils the daily requirements of chloride and sodium ions.
- Providing meadow hay allows a sufficient supply of potassium and is equally a source of magnesium, the latter being of primary importance in managing tying-up. Indeed, it acts as a sedative (tranquilliser) of the central and peripheral nervous system. It therefore has calming properties and participates in muscle relaxation (the opposite of calcium). It is therefore interesting to reinforce the supply provided by forage by providing a feed enriched in magnesium.
- Calcium requirements are covered by a concentrate feed enriched in this element provided in a Ca/P ratio close to 2.

However, **during efforts leading to abundant sweating** (intense effort, during a long period, in very hot weather, etc.), **it is advisable to punctually reinforce the daily supply of certain macro elements by distributing suitable supplements such as REVERDY ELECTROLYTES.** Given after an effort, this supplement compensates for the loss of the three principal electrolytes eliminated by sweating (chloride, sodium and potassium).

TO SUM-UP

Preventing “tying-up” passes by strict management of the surroundings, training, watering and feeding. As for reoccurring exertional rhabdomyolysis (RER), putting into place a routine, which has the aim of avoiding annoyance to predisposed horses is fundamental. Next, in addition to the normal feeding precautions (ad-lib hay, temperate clean water, electrolytes, antioxidants, etc.), horses subject to myopathies should be fed with a feed such as ADULT SPECIFIC ENERGY, poor in starch and high in oils/fats and fibre. If all these measures are respected there is no reason to condemn a horse predisposed to reoccurring exertional rhabdomyolysis (RER).

BIBLIOGRAPHY

Couroucé-Malblanc A., Deniau V et coll., L'entraînement, la prophylaxie et le traitement des myopathies d'exercice, Pratique Vétérinaire Equine, 2009 ; Vol.41: n°161, 41-49.

Finno C. J., McKenzie E., Valberg S. J. et Pagan J., Effect of fitness on glucose, insulin and cortisol responses to diets varying in starch and fat content in Thoroughbred horses with recurrent exertional rhabdomyolysis, Equine Vet. Journal, Novembre 2010 ; 38: 323-328.

Huntington P. and Valberg S., Fit to be tied: part one, EQUINEWS, 2 mars 2011.

Huntington P. and Valberg S., Fit to be tied: part two, EQUINEWS, 7 mars 2011.

Kentucky Equine Research staff, Feeding and managing to reduce Recurrent Exertional Rhabdomyolysis in horses, EQUINEWS, 27 décembre 2013.

Kentucky Equine Research staff, Can high-fat or Low-starch diets minimize muscle cramping in horses, EQUINEWS, 5 juin 2014.

Virevialle H., Myosite d'effort: adapter le traitement à chaque cas, La dépêche vétérinaire, Décembre 2007 ; Cahier pratique n°5.

Valberg S. J., The management of tying-up in sport horses: challenges and successes, In: Proc. 17Th, Equine Nutr. and Physiol. Soc. Symp., 2010.