

Equine Internal Medicine

Atypical Myopathy

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Background

Atypical Myopathy (AM) is a seasonal condition which occurs in horses at pasture. Ingestion of plant material containing the toxin hypoglycin A (HGA) results in non-exertional rhabdomyolysis. In Europe, seeds and seedlings from *Acer pseudoplatanus* (Sycamore) are the primary source of HGA. It is therefore no surprise that disease incidence peaks in the Autumn and Spring, resulting from ingestion of seeds and seedlings. Relatively more cases occur in Autumn and are attributed to ingestion of samaras. Samaras are winged fruits containing *Acer* seeds. During years when there are a high number of cases in Autumn, cases tend to be seen the following spring as seeds germinate and progress into seedlings.



Photo 1:

Acer pseudoplatanus leaves are palmate with five lobes

HGA concentrations in seeds and seedlings in Spring

HGA concentrations in *Acer pseudoplatanus* seeds and seedlings can vary greatly, even between trees from the same location (Westermann and others 2016). Furthermore, concentrations of the toxin in seeds and seedlings changes over time. A pilot study carried out in 2016 tracked HGA levels in *Acer Pseudoplatanus* seeds and seedlings at fortnightly intervals from early March to June; samples were collected from pastures where AM cases had been recorded in the previous years. HGA levels in seeds increased throughout March, peaking in early April as seeds began to germinate and seedlings appear. HGA levels were highest in very immature seedlings as they appeared in early April and gradually decreased throughout the remainder of the Spring (Votion and others 2019).

Samara remnants in Spring, early germination is just visible in photo 2:

Photo 2:



Photo 3:



Photo 4: Seedlings of various stages emerging amongst samara remnants. This photo was taken late April, Co. Kildare.

Year-to year variation in incidence

As well as a seasonal component, the incidence of disease varies from year to year. The reasons for this are multi-factorial and have not been fully elucidated. Some contributory factors are discussed.

Weather conditions

Weather conditions are likely to impact the degree of pasture contamination; warm Summers the year prior to flowering have been associated with particularly strong flowering and fruiting intensity in Sycamores. Stormy weather in Autumn is an obvious contributor to samara dispersal. Humidity is also implicated, with regions receiving high levels of rainfall found to have increased incidence of AM in Belgium (Votion and others 2009). HGA is a water-soluble amino acid. HGA has been detected in water collected from wet seedlings which is relevant with respect to water sources and grazing of wet pasture during high-risk periods.

Availability of grass and alternative food sources.

The availability of fresh grass as a food source in the spring is one potential explanation for the finding that relatively more clinical cases occur in Autumn, when seeds are on the pasture, compared with Spring when seedlings are plentiful. It has been proposed that ingestion of seedlings is more likely to occur on over-grazed pasture where seedlings protrude above the level of the grass, facilitating their ingestion (Votion and others 2019). The same may be true when climatic conditions lead to slow grass growth in early spring despite the rapid appearance of Acer seedlings.

Individual horse response

Individual susceptibility to HGA is suspected to vary as clinical cases can originate from the same contaminated pasture as unaffected co-grazers. Some apparently unaffected horses have high concentrations of HGA in their blood, further suggesting that some horses are more susceptible to the toxin than others. While there is generally a higher incidence in younger horses, older animals can be affected. Overweight horses have previously been found to be at decreased risk of AM (Votion and others 2009). This could reflect the importance of energy reserves or may simply reflect the fact that very well fed/ overweight animals are at less risk of ingesting or absorbing sufficient levels of toxin.

Other sources of HGA and cumulative exposure

Inflorescences (flowers) from Acer Pseudoplatanus trees can contain HGA, albeit at lower levels than seeds or seedlings. It is therefore possible that ingestion of inflorescences could have a contributory effect in terms of exceeding the maximum tolerated dose of HGA. Chronic low-level exposure e.g., through ingestion of hay or haylage made from contaminated pasture containing seeds, seedlings or saplings is also possible (González-Medina and others 2019). Water sources that have come into contact with plant material containing HGA are another potential source.

Pathophysiology in the horse

The key to the mechanism of disease is alteration in lipid metabolism. Affected horses are unable to utilise lipids which are the most efficient energy source.

Following ingestion, HGA is converted to active metabolites including Methylenecyclopropyl acetic acid (MCA). MCA binds to coenzyme A and induces acquired multiple acyl-CoA dehydrogenase deficiency syndrome. This prevents the oxidation of fatty acids and, therefore the production of energy in mitochondria. Muscle groups containing a large proportion of Type 1 muscle fibres are more dependent on fatty acid oxidation for energy needs and are therefore first affected. These are the cardiac, respiratory, and postural muscles.

Clinical signs

Clinical signs may include the following:

- Reluctance to move and progressive stiffness
- Recumbency
- Tachycardia
- Pigmenturia; dark red/ brown urine due to myoglobinuria
- Respiratory distress
- Hypothermia
- Bladder distension
- Signs of GI dysmotility

Affected animals can be very painful.

Diagnosis

Diagnosis is based on a combination of relevant history i.e., grazing on pasture in proximity to Acer Pseudoplatanus trees, clinical signs, and laboratory findings. Relevant clinicopathological findings include:

- Elevation of muscle enzyme concentrations in plasma: Creatine Kinase (CK), Lactate dehydrogenase (LDH) and Aspartate aminotransferase (AST)
- Hypocalcaemia
- Hyperlipidaemia
- Elevated acyl carnitine concentrations in urine and serum

Hypoglycin A can be detected in blood and urine to confirm exposure.

Prognosis and Treatment

Mortality rates are high (up to 75%) and many animals succumb within 2–3 days. Survival has been positively associated with defaecation, remaining standing most of the time, normal mucous membranes and normothermia (van Galen and others 2008). Non-survivors are more likely to be recumbent (van Galen and others 2008) but recumbent animals can survive and so recumbency alone is not a criterion for euthanasia. Treatment consists of intensive supportive care, including nutritional support to provide alternative energy substrates and vitamin and mineral supplementation. There is no specific antidote or treatment for atypical myopathy, so prevention is key.

Prevention/ Pasture management

Practical advice may include some or all of the following:

- Identify trees within and close to grazed fields, bearing in mind that samaras can disperse a surprising distance from the mother tree.
- Test for HGA in seeds or seedlings from suspect trees. Samples can be sent to the Royal Veterinary College, Comparative Neuromuscular Diseases Laboratory. [RVC Comparative Neuromuscular Diseases Laboratory - Diagnostic Services](#)

- If feasible collect seeds, remove seedlings or prevent equine access to affected areas, using fencing or stabling.
- If attempting to destroy young seedlings be aware that seedlings still contain HGA at significant levels after herbicidal spraying or mowing. HGA levels in seedlings show a temporary but significant increase above baseline two weeks after mowing (González-Medina and others 2019). If possible, a collection system should be used when mowing and the gathered material burnt.
- Be aware that stormy Autumn weather or felling of trees may result in heavy contamination of pasture with seeds.
- Avoid over-grazing and provide supplementary feeding to pastured horses, particularly during Autumn and Spring.
- Where possible, provide access to mains water rather than natural sources of water and ensure that any stationary water source is not situated under a Sycamore canopy.
- If you have had previous clinical cases on a farm/ particular pasture it may be worthwhile to restrict grazing during periods of peak risk to less than 6 hours a day, particularly if weather conditions have been particularly wet and windy.

Some useful resources:

- [Sycamore - Tree Guide UK - Sycamore tree identification](#)
- Royal Veterinary College: <https://www.rvc.ac.uk/equine-vet/information-and-advice/fact-files/atypical-myopathy>
- [RVC Comparative Neuromuscular Diseases Laboratory - Diagnostic Services](#)
- Reporting of cases - Atypical Myopathy Alert Group, University of Liège, Belgium: https://www.myopathie-atypique.uliege.be/cms/c_7997923/en/myopathie-equines

References:

González-Medina, S., et al. "Atypical myopathy-associated hypoglycin A toxin remains in sycamore seedlings despite mowing, herbicidal spraying or storage in hay and silage." *Equine veterinary journal* 51.5 (2019): 701-704.

Van Galen, Gaby, et al. "Atypical myopathy: new insights into the pathophysiology, prevention and management of the condition." *Equine veterinary education* 20.5 (2008): 234-238.

Votion, Dominique-M., et al. "Atypical myopathy in grazing horses: a first exploratory data analysis." *The Veterinary Journal* 180.1 (2009): 77-87.

Votion, Dominique M., et al. "Potential new sources of hypoglycin A poisoning for equids kept at pasture in spring: a field pilot study." *Veterinary Record* 184.24 (2019): 740-740.

Westermann, C. M., et al. "Hypoglycin A concentrations in maple tree species in the Netherlands and the occurrence of atypical myopathy in horses." *Journal of veterinary internal medicine* 30.3 (2016): 880-884.