DEFRA / AHT / BEVA

EQUINE QUARTERLY DISEASE SURVEILLANCE REPORT

Volume 9, No.4: October – December 2013

Highlights in this issue:

- **Equine influenza in the UK**
- **Equine Herpes Virus-1 Abortion**
- **Focus article: Update on the cause of Atypical Myopathy.**

Important note:
The data presented in this report must be interpreted with caution, as there is likely to be some bias in the way that samples are submitted for laboratory testing. For example they are influenced by factors such as owner attitude or financial constraints or are being conducted for routine screening as well as clinical investigation purposes. Consequently these data do not necessarily reflect true disease frequency within the equine population of the United Kingdom.

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Introduction

Welcome to the fourth quarterly equine disease surveillance report for 2013 produced by the Department for Environment, Food and Rural Affairs (Defra), British Equine Veterinary Association (BEVA) and the Animal Health Trust (AHT). Regular readers will be aware that this report collates equine disease data arising from multiple diagnostic laboratories and veterinary practices throughout the United Kingdom giving a unique insight into equine disease occurrence on a national scale.

National disease occurrence

Equine Herpes Virus-1 (EHV-1)

Equine Herpes Virus-1 (EHV-1) Abortion

On 3rd January 2014, a single case of EHV-1 abortion was confirmed in a vaccinated Thoroughbred mare in Suffolk. The positive diagnosis was made by PCR on fetal tissues. The affected mare was isolated and control measures were undertaken in accordance with the HBLB Codes of Practice.

On 18th February 2014, a single case of EHV-1 abortion was confirmed in a Warmblood mare of unknown vaccination status on a private multi-purpose premises in Nottinghamshire, England. The mare had aborted the previous day and the diagnosis was based on positive qPCR of fetal tissues.

On 12th March 2014, another case of EHV-1 abortion was confirmed in a Thoroughbred mare in the Home Counties of England. Diagnosis was made by histopathological examination of the fetal tissues and placenta and qPCR.

Equine Herpes Virus-1 (EHV-1) Neurological disease

On 5th March 2014, a case of EHV-1 neurological disease was confirmed on a premises in Berkshire, England. The positive horse was a seven year-old Connemara-cross pony that developed recumbancy and nystagmus two weeks after spinal process surgery. Post mortem examination was performed by the referring vet and sections of fixed spinal cord submitted for histopathology. Multifocal areas of haemorrhage, necrosis, localised vasculitis and perivascular mononuclear cell infiltrates were present in white and grey matter of the segments of thoracic spinal cord, strongly suggestive of equine herpesviral myeloencephalopathy. This diagnosis was further supported by positive immunohistochemical staining for EHV antigen. Suitable tissues were not available for PCR analysis or virus isolation.

Equine Herpes Virus-1 (EHV-1) Respiratory disease

On 8th January 2014, a single case of EHV respiratory disease was reported in four year-old Cross-breed gelding in Ayrshire, Scotland. The affected horse presented clinical signs of nasal discharge, submandibular lymphadenopathy and pyrexia. Positive diagnosis was made by qPCR on a nasopharyngeal swab. There was another horse presenting with clinical signs from the same premises of 8 horses but tested negative on qPCR.

International disease occurrence

Equine Herpes Virus-1 (EHV-1)

Four outbreaks of EHV-1 abortion were reported during this quarter in Ireland, Leinster (1), Ulster (1) and Munster (2) with six Thoroughbreds affected. Diagnosis was confirmed at post-mortem examination based on histopathology and virology.

In Japan, an outbreak of EHV-1 abortion commenced on the12th October 2013, with the last reported case on the 28th December 2013. Three Thoroughbreds and non-Thoroughbreds on two premises were affected. Two of the horses were vaccinated.

One case of EHV-1 abortion was reported this quarter by Dr Boese GmBh Laboratory in Germany. The diagnosis was made by PCR on lochia (post parturient vaginal discharge).

On the 24th January 2014 equine herpes virus-1 neurological disease was reported in two linked outbreaks in the Saint Vith region of Belgium. The outbreaks were reported to have commenced on 9th January 2014 with clinical neurological signs with fever and coughing also noted among non-vaccinated horses. The link between the two outbreaks was through a horse moving from the first to the second affected premises.

On 31st January 2014 the World Organisation for Animal Health (OIE) reported an outbreak of EHV-1 neurological disease on a Thoroughbred stud farm near Waikato, New Zeland. On 22nd January 2014, a veterinary pathologist reported to the Ministry for Primary Industries (MPI) findings from a Thoroughbred stud where neurological signs in horses had first been detected on 9th January 2014. The report was based on histopathological lesions of vasculitis on examination of brain tissue and a history of clinical signs consistent with a neurological condition. Over the course of the outbreak eight mares on the stud farm were affected clinically. Four animals have been euthanased due to recumbency and paresis. EHV-1 PCR testing was positive on a range of tissues from two of the euthanased horses. The four remaining clinically affected animals had varying degrees of ataxia and bladder atony. Movements off the stud in the period from 10 days prior to the detection of clinical signs have been investigated, and no cases have been identified on other properties. Equid herpesvirus-1 (EHV-1) is present in New Zealand and cases of abortion and respiratory disease have been recorded in the past. Previous work has confirmed a relatively high sero-prevalence of antibodies to EHV-1 in the New Zealand horse population arising both from natural exposure and vaccination. This disease event is the first confirmed occurrence of the neurological presentation of EHV-1 in New Zealand.

On the 14th February 2014, an outbreak of EHV-1 neurological diseases was reported at a private stable in Lower Saxony, Germany. Twenty horses were reported with fever and two animals had neurological signs. The positive diagnoses were made by qPCR on nasopharyngeal swabs and blood samples.

Equine Infectious Anaemia (EIA)

On 4th November 2013 the Centro di Referenza Nazionale per Anemia Infettiva Equina (CRAIE) in Italy reported that between 11th September and 30th October 2013 six separate cases of EIA have been confirmed in Italy. Two cases were identified for the first time on separate farms in Lazio, one case in Umbria and one case in Campania. In addition, another two cases were confirmed in the same premises in Campania.

The Canadian Food Inspection Agency 34 farms affected by EIA to 20th November 2013' including: Saskatchewan (25 farms), British Columbia (4) and Alberta (5).

Eastern Equine Encephalomyelitis (EEE)

An outbreak of Equine Eastern Encephalomyelitis (EEE) was reported on 18th October 2013, by the OIE based on information provided to them from the Virology Laboratory of the Veterinary School, National University, Costa Rica. The positive horse was kept in a livestock farm with another four horses near a forested area. The positive diagnosis was made by IgM-capture ELISA. The affected premises were isolated with horse movements stopped until further notice.

Since mid-December 2013, the number of confirmed equine cases of EEE in the USA increased by one giving a year-end annual total of 183 cases. The number of EEE cases by state for 2013 was S. Carolina (49), Florida (34), Georgia (25), N. Carolina (13), Mississippi (12), Arkansas and Louisiana (8 each), Alabama, Maine, Massachusetts and Texas (4 each), New Hampshire and New Jersey (3 each), Delaware, Kentucky and Vermont (2 each) and Connecticut, Maryland, Michigan, New York, Rhode Island and Virginia (1 each).

Leptospiral Abortion

On the 5th December 2013 *Réseau d'Epidémio-Surveillance en Pathologie Equine* (RESPE) reported a case of Leptospiral abortion that occurred in Gard, France on 29th November 2013. The positive diagnosis was made by PCR on placental tissues by the Frank Duncombe Laboratory, Normandy. No further information is available at this stage.

West Nile Virus (WNV)

Since late November 2013, the number of confirmed equine cases of WNE in the USA increased by 27 giving a year-end annual total of 373 cases and the number of affected states also increased from 39 to 41. The number of WNE cases by state for 2013 was Texas (60), Oklahoma (41), Montana (27), Wyoming (19), California (17), Illinois (16), Missouri (14), Colorado and New York (13 each), Kentucky (12), Arkansas and Iowa (11 each), Idaho and Kansas (10 each), Georgia (8), Delaware and Utah (7 each), Nebraska, New Mexico and Oregon (6 each), Florida and Minnesota (5 each), Louisiana, Michigan, Mississippi, N. Dakota, S. Dakota and Wisconsin (4 each), Ohio, S. Carolina and Tennessee (3 each), Arizona, Maryland, Massachusetts, N. Carolina, Pennsylvania and Washington (2 each) and Indiana, New Hampshire, Vermont and Virginia (1 each).

Lawsonia enteropathy

The number of confirmed cases of *L. intracellularis* infection increase in the fourth quarter of 2013 with 16 cases identified in Kentucky and one case confirmed in Ohio.

On the 19th February 2014 three cases of equine lawsoniosis were reported in an outbreak in the of Brussells region of Belgium*. The positive diagnoses were confirmed on the* 14th February 2014*, by PCR on faecal samples. Three of 12 yearlings are reported to be affected with signs of colic, depression and fever.*

Defra/ Animal Health and Veterinary Laboratories Agency (AHVLA) business

Proposed removal of notifiable status for CEM and EVA in England

Defra has published a proposal to remove the notifiable status of CEM and EVA in England. The reason for the proposal is that our existing legislation for both diseases goes beyond EU requirements. Unlike most other notifiable diseases in England, the EU does not require us to control these diseases. We have to ask why taxpayers money is spent controlling such preventable or treatable diseases when there is no EU requirement to do so.

Defra carries out this review in the most transparent way possible and even before the formal consultation several letters were received setting out the case for retaining CEM and EVA as notifiable diseases. All of these points will, of course, be taken fully into account, along with the veterinary evidence on the impact of these diseases on animal health and welfare as well as evidence gathered from other countries with significant equine export industries.

A decision is expected later in 2014 – an exact timetable is not yet agreed.

Draft Commission Regulation on Equine identification

Defra expects the new regulation to be voted on at SCoFCAH in the first half of this year but no exact timeline is available as negotiations are still ongoing. The current draft sets an implementation date of 1 January 2015 which may be pushed back if agreement on the text is not reached soon.

In addition to the proposal on horse identification, we have just received a new and separate proposal from the European Commission on zootechnics. Defra is currently evaluating what it means for the equine industry.

Tripartite Agreement

The revised TPA is due to go live on the 18th May 2014.

The new TPA approved bodies for the UK are Weatherbys, the Thoroughbred Breeders Association and the British Equestrian Federation. These have been endorsed by France and Ireland.

The CVOs of the signatory countries are due to meet on the 9th April to agree the French and Irish TPA approved bodies.

Defra is liaising with the signatory countries and approved bodies to agree the new processes and procedures.

EU Animal Health Regulation

A comprehensive Animal Health Regulation is being negotiated in Brussels by the Member States to set a legal basis for a common EU animal health policy and a single, simplified, transparent, flexible and clear regulatory framework for animal health. The UK is looking for increased regulatory simplicity, a strong focus on outcomes rather than process and greater flexibility to manage disease threats appropriately.

The proposal is being redrafted and a second read in Council is expected to start during the Greek Presidency. Negotiations are expected to be completed during 2015 with implementation starting 2018.

DEFRA is continuously engaging with its agencies, the Devolved Administrations, Industry and other Member States throughout this process.

Focus article

In this report we are pleased to include a focus article written by Sonia Gonzalez-Medina from The Animal Health Trust, Epidemiology Unit. The article provides an update in the cause of Atypical Myopathy (AM) and describes the proposed pathophysiology of this disease.

We reiterate that the views expressed in this focus article are the authors' own and should not be interpreted as official statements of Defra, BEVA or the AHT.

Access to all of the equine disease surveillance reports can be made on a dedicated page on the recently updated Animal Health Trust website at http://www.aht.org.uk/cms-display/DEFRA_AHT_BEVA_equine_reports.html or via the BEVA and Defra websites at http://www.beva.org.uk/news-and-events/news and http://archive.defra.gov.uk/foodfarm/farmanimal/diseases/vetsurveillance/reports/listing.htm, respectively.

We would remind readers and their colleagues that a form is available on the AHT website for registration to receive reports free of charge, via e-mail, on a quarterly basis. The link for this registration form is available via http://www.aht.org.uk/cms-display/equine_disease_registration.html .

Virology Disease Report for the Fourth Quarter of 2013

The results of virological testing for October to December 2013 are summarised in Table 1 and include data relating to Equine Viral Arteritis (EVA), Equine Infectious Anaemia (EIA) and West Nile Virus (WNV) from the Animal Health Veterinary Laboratories Agency (AHVLA), Weybridge. The sample population for the AHVLA is different from that for the other contributing laboratories, as the AHVLA's tests are principally in relation to international trade (EVA and EIA). AHVLA now provides testing for WNV as part of clinical work up of neurological cases on specific request and provided the local regional AHVLA office has been informed.

Table 1: Diagnostic virology sample throughput and positive results for the fourth quarter of 2013

	Number of Samples Tested	Number Positive	Number of Contributing Laboratories
Serological Tests			
EVA ELISA	1681	17#	5
EVA VN	380	83 #	3
AHVLA EVA VN	915	11	1
EHV-1/-4 CF test	335	17*	2
EHV-3 VN test	1	0	1
ERV-A/-B CF test	176	0	1
Influenza HI test	205	0*	1
EIA (Coggins)	79	0	3
EIA ELISA	247	0	5
AHVLA EIA (Coggins)	1786	0	1
AHVLA WNV (cELISA)	3	1[1]	1
Virus Detection			
EHV-1/-4 PCR	151	10	2
EHV-2/-5 PCR	54	22	1
Influenza NP ELISA	45	0	2
Influenza Directigen	145	0	2
Influenza PCR	136	6	1
AHVLA Influenza PCR	183	0	1
Influenza VI in eggs	8	4	
EHV VI	41	6	1
EVA VI/PCR	0	0	1
AHVLA EVA VI/PCR	7	0	1
Rotavirus	14	2	9

ELISA = enzyme-linked immunosorbent assay, VN = virus neutralisation, VLA = Animal Health Veterinary Laboratories Agency, CF = complement fixation,

HI = haemagglutination inhibition, Coggins = agar gel immuno diffusion test, PCR = polymerase chain reaction, NP = nucleoprotein,

VI = virus isolation, EVA = equine viral arteritis, EHV = equine herpes virus, ERV = equine rhinitis virus, EIA = equine infectious anaemia
# = Seropositives include vaccinated stallions, * = Diagnosed positive on basis of seroconversion between paired sera ** = Seropositve due to vaccination
[1]= One serum sample was submitted from a horse which had recently been imported from Cyprus and had presented with neurological signs on arrival. The horse was tested by cELISA with positive results and re-tested using the WNV IgM ELISA with negative results. A repeat sample taken one week later was also positive for total WNV antibody by cELISA yet negative by IgM ELISA. On investigation of the background to this case there was no history of WNV vaccination. These results suggested an older infection and perhaps no relation to the recent disease episode.

Virological Diagnoses for the fourth quarter of 2013

Equine Influenza

The first case was confirmed on the 30th September in a non-vaccinated, non-Thoroughbred horse in Lanarkshire, Scotland. The affected horse came from a dealer's yard in West Scotland and presented mild clinical signs of cough, serous nasal discharge and depression. There are 2 in-contact horses that have not developed signs of disease to date.

Three cases were reported in October.

On the 15th two separated cases were confirmed in the United Kingdom by qPCR on nasopharyngeal swabs. The affected horse in Lanarkshire, Scotland, was an unvaccinated Thoroughbred- crossed mare that presented clinical signs of hyperthermia, mild cough and increased respiratory effort.

The second case was confirmed in Northamptonshire, England. The affected horse was an unvaccinated Irish draft mare presenting clinical signs of depression and mild cough.

It was unknown if this case was linked to the previous outbreaks reported this year in the same county.

The last case was detected in Shropshire, England, on the 23rd October. The positive horse was an unvaccinated showjumper gelding that had travelled to South Wales for a competition 10 days previously. The gelding presented clinical signs of bilateral nasal discharge, severe productive cough and pyrexia.

On the 30th November a case of equine influenza was confirmed in South Wales, UK. The affected horse was an unvaccinated seven year-old cob stallion that presented clinical signs of pyrexia and mild cough.

The last case of the fourth quarter was reported on the 5th December in Shropshire, England. The affected horse was a seven year-old unvaccinated Shetland pony that showed clinical signs of mucopurulent nasal discharge and dry cough. The affected premises were isolated with horse movements stopped for a period.

Equine Herpes Virus-1 (EHV-1)

On the 22nd November a single case of EHV-1 abortion was confirmed in a vaccinated 4-year-old Thoroughbred mare in East Suffolk, England. The positive diagnosis was made by PCR on fetal tissues. There were three other mares in contact with the aborting mare, all of them vaccinated. The affected mare was isolated and control measures were undertaken in accordance with the HBLB Codes of Practice.

On the 11th December 2013 a case of EHV-1 respiratory disease was in Bridgend, Wales. The affected horse was a five-year-old unvaccinated crossbreed mare that showed clinical signs of mucopurulent nasal discharge and mild cough. There were two other in-contact horses, one of which developed a mild cough. The affected premises were isolated with horse movements stopped for a period.

Bacteriology Disease Report for the Second Quarter of 2013

A summary of the diagnostic bacteriology testing undertaken by different contributing laboratories is presented in Table 2. For contagious equine metritis (CEM) all 29 HBLB approved laboratories in the UK contributed data.

AHVLA CEMO Data for the period October to December 2013

We are again pleased to include data relating to CEM testing from the Animal Health Veterinary Laboratories Agency (AHVLA), in this quarterly report. The sample population for the AHVLA is different from that for the other contributing laboratories as the AHVLA tests are principally in relation to international trade and/or outbreak investigations.

Strangles

Strangles remains endemic in the UK, especially among parts of the non-Thoroughbred horse population. Diagnoses are confirmed in the UK based on traditional culture of *S. equi* and qPCR on respiratory samples and/or seroconversion using a serological ELISA.

Table 2: Diagnostic bacteriology sample throughput and positive results for the fourth quarter 2013

	Number of Samples Tested	Number Positive	Number of Contributing Laboratories
CEMO (HBLB)	**1367**	**0**	**29**
CEMO (AHVLA)	**2329**	**0**	**1**
***Klebsiella pneumoniae*#**	**1413[1]**	**3**	**29**
Pseudomonas aeruginosa	**1359[1]**	**29**	**29**
Strangles*culture	**1373**	**95**	**20**
Strangles PCR	**738**	**35**	**4**
Strangles ELISA	**1529**	**186[2]**	**4**
Salmonellosis	**528**	**39**	**17**
MRSA	**470**	**8**	**12**
Clostridium perfringens	**243**	**12**	**8**
***Clostridium difficile* (toxin by ELISA or immunochromatography)**	**155**	**18**	**10**
Borrelia (by ELISA)	**34**	**5**	**1**
Rhodococcus equi culture/PCR	**454**	**2**	**7**
Lawsonia intracellularis**culture/PCR	**124**	**14**	**5**

CEMO = contagious equine metritis organism (*Taylorella equigenitalis*); HBLB = HBLB accredited laboratories; # =capsule type 1,2,5; AHVLA = AHVLA reference laboratory**; ***Streptococcus equi* subsp*. equi*; MRSA = methicillin resistant *Staphylococcus aureus.* ** *Lawsonia intracellularis* identified using PCR applied to faeces; [1] reproductive tract samples only; [2] seropositivity may be attributed to disease exposure, vaccination, infection and carrier states.

AHVLA *Salmonella* results

49 samples were submitted during the 4th quarter 2013 to the AHVLA and of these forty 43 were positive. From the incidents involving strains typed by the AHVLA, the serovars/phagetypes reported were monophasic Typhimurium variants *S.* 4,12:i:- (9 samples; 4 DT193, 1 U311, 2 untypable and 2 untyped), *S.* 4,5,12:i:- U311 (11 samples), *S.* Anatum (9 samples), *S.* Enteritidis (2 samples; 1 PT11 and 1 PT8), *S.* Typhimurium (8 samples; 4 U302 and single incidents of DT104, DT193 and DT66a and one untyped), *S.* Mbandaka (1 sample) and *S.* Newport (3 samples). Monophasic *Salmonella* Typhimurium DT193 is primarily associated with pigs and U311 with cattle. *Salmonella* Enteritidis PT 11 is a hedgehog type and *S.* Typhimurium DT104 and *Salmonella* Enteritidis PT8 are likely to be of human origin. *S.* Anatum is often associated with wild birds. For more information from AHVLA about Salmonella in the UK, please visit http://www.defra.gov.uk/ahvla-en/publication/salm12/

Toxic and Parasitic Disease Report for the Fourth Quarter of 2013

A summary of diagnostic toxicosis and parasitology testing undertaken by contributing laboratories is presented in Tables 3 and 4, respectively. Results for toxicosis are based on histopathologically confirmed evidence of disease only (where applicable).

Table 3: Diagnostic toxicosis sample throughput and positive results for the fourth quarter of 2013

	Number of Samples Tested	Number Positive	Number of Contributing Laboratories
Grass Sickness	15	7	5
Hepatic toxicoses	34	8	3
Atypical myopathy	19	14	2*

*Includes contributing laboratories with no cases submitted

Table 4: Diagnostic parasitology sample throughput and positive results for the fourth quarter of 2013

	Number of Samples Tested	Number Positive	Number of Contributing Laboratories
Endoparasites			
Ascarids	**3333**	**61**	**19**
Cyathostomes	**2257**	**384**	**13**
Dictyocaulus	**1218**	**20**	**11**
Strongyles	**3606**	**871**	**21**
Tapeworms (ELISA based testing)	**116**	**25**	**8**
Tapeworms (Faecal exam)	**1951**	**26**	**11**
Trichostrongylus	**433**	**10**	**1**
Strongyloides	**2552**	**360**	**18**
Oxyuris equi	**197**	**10**	**5**
Fasciola	**100**	**6**	**3**
Coccidia	**249**	**5**	**5**
Cryptosporidia	**9**	**0**	**1**
AHVLA *Theileria equi* (CFT)*	**118**	**1**	**1**
AHVLA *Theileria equi* (IFAT)**	**364**	**17**	**1**
AHVLA *Theileria equi* (cELISA)***	**541**	**1**	**1**
AHVLA *Babesia caballi* (CFT)*	**117**	**2**	**1**
AHVLA *Babesia caballi* (IFAT)**	**364**	**8**	**1**
AHVLA *Babesia caballi*(cELISA)***	**541**	**0**	**1**
Ectoparasites			
Mites	**31**	**0**	**17**
Lice	**424**	**2**	**17**
Ringworm	**547**	**135**	**22**
Dermatophilus	**180**	**22**	**17**
Candida	**9**	**0**	**2**

*Complement Fixation Test; CFT suspect/positive samples are tested in IFAT test
**Indirect Fluorescent Antibody Test; ***competitive Enzyme-linked immunosorbent assay; positive cELISA results are not undergoing confirmatory testing

Grass sickness surveillance data (http://www.equinegrasssickness.co.uk/)

Seven cases of equine grass sickness (EGS) have been reported during the fourth quarter of 2013 (October – December), of which four occurred in England and one occurred in Wales. Location was not reported for the remaining three cases. Only one affected premise had a history of previous EGS cases.

Cases comprised four geldings and one stallion (sex was not reported for the remaining two cases), with a median age of 15 years (range 2 – 21 years). Affected breeds were Welsh breeds (2 cases), Warmblood, Dale , Shetland and Irish Draught cross (1 each).

Four cases were reported to have acute EGS and three were diagnosed with chronic EGS, of which survival status was only reported for one chronic case that was reported to have survived to date. Diagnostic information was provided for four cases (two acute and two chronic cases), of which three were diagnosed based on veterinary assessment of clinical signs alone. Diagnosis of the remaining acute case was confirmed by histopathological examination of an ileal biopsy obtained via laparotomy, and subsequent *post mortem* including histopathological examination of ganglia.

The nationwide EGS surveillance scheme was established in spring 2008 to facilitate the investigation of changes in geographic distribution and incidence of the disease in Great Britain. Data gathered by this scheme is collated in a strictly confidential database, and will be an invaluable resource in the development of proposed vaccination field trials of a *Clostridium botulinum* type C toxoid vaccine. **Unfortunately, the number of cases reported to the scheme each year is decreasing. Therefore we would encourage both horse owners and veterinary surgeons to report any cases of EGS by contacting Jo Ireland at the Animal Health Trust (email jo.ireland@aht.org.uk).**

Further information is also available at http://www.equinegrasssickness.co.uk/ where questionnaires, collecting data on both affected premises and individual cases, can be viewed and completed online.

Focus Article: Update in the cause of Atypical myopathy

Sonia Gonzalez-Medina MVDr, CertAVP(EM), MRCVS. Epidemiology Unit, Centre of Preventive Medicine. The Animal Health Trust, Newmarket, UK

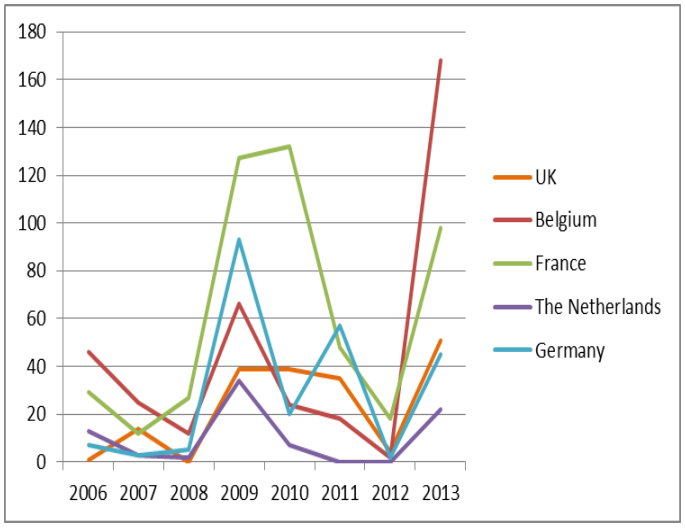
Introduction

Atypical myopathy (AM) was first recognized in grazing horses in 1934 in East Scotland and first reported in the literature in 1985. The condition was named as Acute Myopathy or Atypical myoglobinuria due to clinical signs noticed in the first identified cases. Early reports described recumbent and weak horses that often died within the first 12 -72h. Suspected cases sporadically occurred in several countries such as the USA, Canada and Australia, although it was named as seasonal pasture disease in these locations. The first major outbreak, which raised awareness of the condition worldwide, occurred in Germany in 1995. Since 2000, numbers of outbreaks and affected animals increased considerably in central Europe, triggering the beginning of epidemiological investigations into the mechanisms of disease and methods for its prevention.

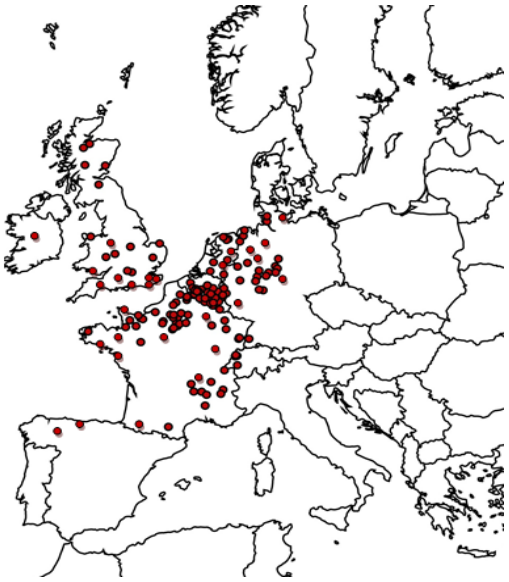
Surveillance in Europe

As a leading group, The University of Liege (Belgium) established an informal epidemiosurveillance network known as the Atypical Myopathy Alert Group (AMAG) that in 2006 expanded their national recording of cases to all european cases. Currently, this network consists of worldwide equine veterinarians, national epidemiological networks, and other collaborators such as universities. AMAG's aim is to exchange information about the occurrence of outbreaks of this disease and to initiate collaborative research.

Number of cases reported to AMAG from 2006 to



Location of European cases 2006-2013



A real breakthrough identifiying the cause

Factors linked to environmental toxins were considered as potential causative agents for AM from the beginning. Consistent findings in pastures where AM cases were reported contained presented dead leaves and wood, they were usually surrounded by trees and had frequently contained wet areas. However, epidemiological studies and particularly the histopathological examination of muscle sections from affected animals have furthered the understanding the AM pathophysiology guiding investigations towards mitochondrial

disorders of toxic origin. Several environmental toxins, including Clostridium sordellii toxins *or Rystisma acerinum* mycotoxins, which lead to dysfunction of mitochondrial metabolism, were subsequently investigated with inconsistent results.

Subsequent research was informed by similar conditions in human medicine that may share common clinical signs and histopathological features with AM. Morphopathological examination of AM cases showed an acute and degenerative process as a result of intracellular accumulation of lipids in the slow oxidative type I-muscle fibers, which are more prevalent in postural and respiratory muscles.

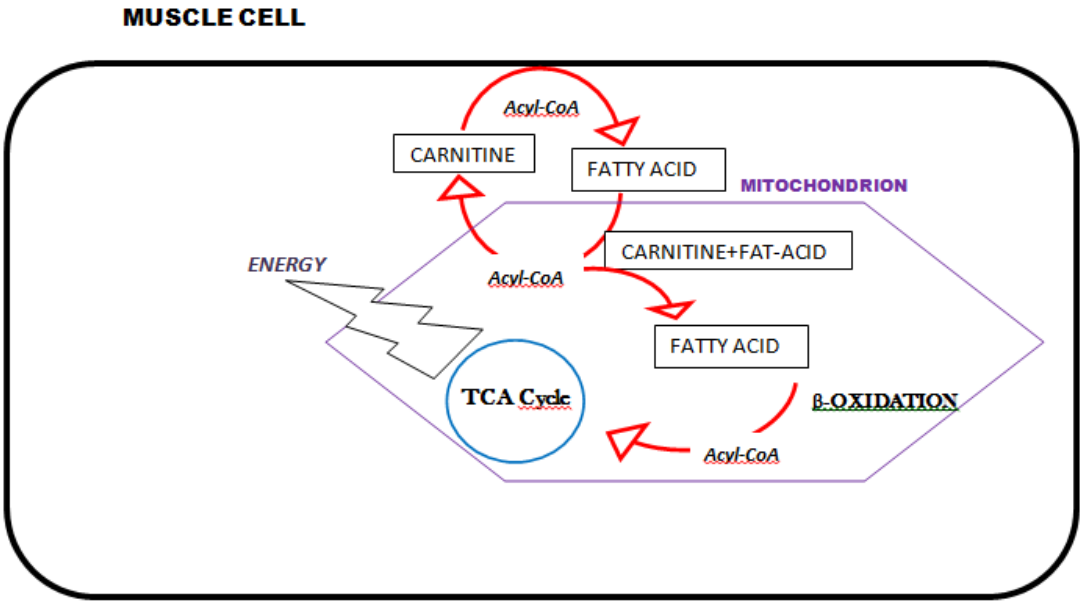


Figure 1: Simplified mechanism of β-oxidation during in the muscle cell. The picture shows the importance of carnitine and different acyl-coA enzymes in the transport of fatty-acids into the mitochondria and their contribution to lipid metabolism.

These observations along with the biochemical changes present in AM cases suggested an impairment of fatty acid oxidative metabolism, especially the β-oxidation, therefore sharing multiple similarities with acyl-CoA dehydrogenase deficiencies (MADD) in man, and particularly an acquired MADD condition called Jamaican vomiting sickness. This disease is triggered by the ingestion of ackee fruit that contains hypoglicyn A that is metabolised into the mitochondria of the muscle cell to methylenecyclopropyl acetic acid (MCPA). This metabolite decreases the production of nicotinamide adenine dinucleotide (NADH) and acetyl CoA. Studies conducted in the USA and then in Europe found increased levels of MCPA in AM affected horses.

In human studies, once hypoglycin A is activated in the mitochondria, it irreversibly inhibits medium and short acyl-CoA dehydrogenases, which are essential for β-oxidation of fatty acids and boosting the accumulation of fatty acids and other metabolites and key enzymes of mitochondrial energy metabolism. Furthermore, MCPA may also binds acyl-CoA and carnitine, disrupting the carnitine-acyl-CoA transferase system by impairing the transport of long-chain fatty acids into the mitochondrion. As a result of this inhibition, fatty acids are not only acummulated in the mitochondria but also in the cell cytosol leading to the intracellular accumulation of fatty acids characteristic of AM.

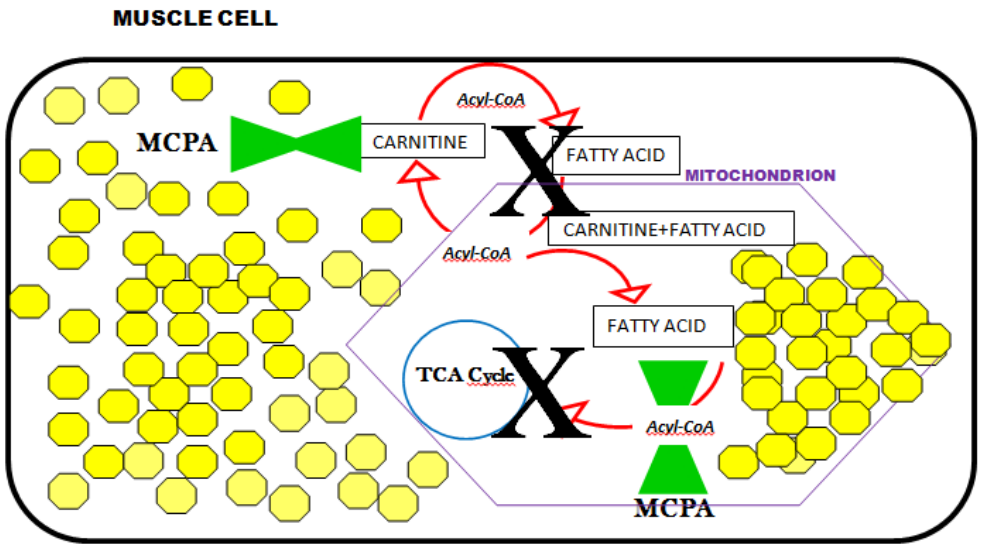


Figure 2. Proposed mechanism of action of MCPA: accumulation of fatty acids (showed in yellow) within the mitochondrion followed by excessive lipid storage in the myocite (showed in yellow). The imparment of the lipid metabolism leads to myocite degeneration and Zenker necrosis of the muscle.

Type I myofibrils depend largely on fatty acids as their primary energy source, and are the predominant fibre type in postural, cardiac and respiratory muscles explaining the profound muscular weakness and respiratory dyspnoea seen in AM horses. As lipid metabolism is blocked and oxygen delivery impaired by failing cardiac and respiratory muscles, metabolism becomes more reliant on anaerobic glycolysis resulting in muscle glycogen depletion and lactic acidosis.

Although great similarity exists between AM cases and human MADD cases some differences should be acknowledged. Horses with AM show hyperglycemia and increased free serum carnitine levels, whereas humans with MADD have hypoglycemia and decreased free carnitine levels. These differences may be explained by species-specific steps in energy metabolism although further research in horses is required to confirm this. It is believed that the hyperglycemia in horses might reflect higher hepatic glucose mobilization from liver glycogen stores and possibly insulin resistance.

Finding hypoglycin A

The presence of trees in or around the pastures where AM cases are reported is a commom feature in Europe and the USA, although the species found vary considerably between countries and even between outbreaks in the same country. Several trees from the family Sapindaceae produce fruit or seeds containing hypoglycin A, although it might be other families involved. *Acer negundo* (box elder) has being linked recently to cases of atypical myopathy in the USA and its seeds found to contain different concentrations of this substance. This particular tree is not usually present in Europe and it has not been encountered in pastures where AM were reported. However *Acer Pseudoplatanus* (sycamore maple) was consistently found on AM pastures in some European studies and mentioned in botanical surveys of European pastures. Other Acer species such as *Acer platanoides* (Norway maple) and *Acer campestre* (field maple) have also been found on some pastures but theirs seeds do not seem to content hypoglycin A. The level of hypoglicin A in the seeds is variable and can be affected by a number of environmental factors. For example, dry conditions, compacted soil, wind strength among others may affect the seed load, seed dispersal and concentration of different substances in fruits and

seeds. In other plant species, abiotic stress can significantly increase biochemical defenses and increase the concentration of certain aminoacids.

Unfortunately, accurate botanical surveys are not widely available in the areas where AM cases have been reported and detection of Hypoglicin A in seeds encountered in these pastures has not been performed to date in Europe. Thus this opens a new route of investigation for AM evaluating correlations between the presence of disease and plant species and the interactions between horses and maple species.

Acer negundo

Acer pseudoplatanus

Therefore the general recommendation for owners should be to keep the horses away from pastures surrounded by these trees during the risk season or reduced the amount of seeds in the pastures. Feed supplementation in sparse pastures might also help to avoid foraging during the risk season.

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We encourage reporting AM cases through: www.myopathieatypique.fr/espace-professionels/veterinary-form/

List of references is available on author request

Report on Post-mortem Examinations for the Fourth Quarter of 2013

East Anglia

A total of 92 cases were examined including 68 aborted fetuses and foetal membranes.

Of the aborted fetuses examined, Equine Herpes Virus-1 (EHV-1) was isolated in one case and aspiration meconium was identified as the likely cause of the abortion in another case. There were 45 cases of umbilical cord torsion, 5 cases of placentitis, 2 cases of twin pregnancy, 2 cases of placental insufficiency and 2 cases of congenital disease. The cause of abortion could not be determined in 10 cases.

Two neonatal deaths were reported this quarter, one foal presented with severe consolidatin pneumonia and multiple abscesses in the lungs, the second foal presented ruptured intestine and subsequent peritonitis.

Two case of yearling death were investigated. One of them presented a severe bronchopneumonia due to *Streptococcus zooepidemicus* and the other one presented with severe intestinal parasitism and emaciation.

Ten horses were examined following gastrointestinal disease. Two cases presented Typhlocolitis. Diaphragmatic hernia with colonic entrapment was identified in two cases. One case suffered from severe colon torsion and peritonitis and another presented with a colon volvulus. In addition, single cases of strangulated small intestine, caecal impaction, caecal rupture and ileal diverticulum were also identified.

Two musculoskeletal cases were examined this quarter. One horse presented multiple pelvic fractures with rupture of local vessels and a single pelvic fracture and subsequent colon impaction were identified in the second examined horse.

Four neurological cases were reported. Examination of the first case revealed a traumatic thoracic vertebral fracture (T8 and T9) and spinal cord compression. In the second case, multiple rib fractures and severe segmental fracture of thoracic vertebrae with severance of spinal cord were determined as the cause of death.

Two neoplastic cases were reported this quarter, one lymphoma and one adrenocortical adenoma.

Two respiratory cases were examined this quarter. EHV-4 from lung tissues was identified in one horse as a likely cause of disease and pleuropneumonia with subsequent endotexemia was identified in the second one.

One horse was investigated for acute collapse and sudden death while competing in handicap steeplechase. The examination revealed exsanguination and coagulation disorders.

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Home Counties

Twenty cases were reported.

Nine cases of gastrointestinal disease were reported. Three cases of acorn poisoning and single cases of idiopathic ileus, peritonitis, caecal impaction, strangulating small intestinal lipoma, gastric rupture and nephrosplenic entrapment were also identified on post-mortem.

A single case of neoplasia was investigated; rhabdomyosarcoma in the brachial region was the final diagnosis.

One neurological case was reported; post-mortem revealed a cervical stenotic myelopathy.

Six musculoskeletal cases were examined, a single case of penetrating injury to the right forelimb and five cases of atypical myopathy were diagnosed.

A case of hepatopathy due to pyrrolizidine alkaloid poisoning confirmed in a horse.

Two welfare cases were reported this quarter, one presented emaciation and the other one cyathostomiasis and poor dentition.

Northern England
Three cases were reported

Three gastrointestinal cases were examined. The cause of death in one donkey was undermined on post-mortem examination and caecum rupture was pointed as the cause of death in another donkey. The last case was small intestine strangulation that occur after colic surgery.

South West
Twelve cases were examined.

A single case of aborted fetus was reported this quarter in which umbilical vascular compromise was identified as the most likely cause of abortion.

Two gastrointestinal cases were reported, of which one was related to oesophageal abscesation and subsequent oesophageal necrosis and the other one was a donkey with dental problems and cythostomiasis.

Two neurological cases were examined this quarter. The first one presented a diffuse perivascular lymphoplasmocytic cuffing of brain white matter compatible with Borna disease, although this hypothesis is still being investigated. The second case was a donkey with suspected EHV infection.

A single case of respiratory decompensation after racing was examined this quarter.

One case of fibrotic hepatopathy was determined in a donkey on post-mortem examination.

Three welfare cases were examined although no other details were available.

Scotland
Eight post-mortem examinations were carried out.

Four gastrointestinal cases were reported. Single cases of colon displacement, strangulating lipoma and small intestine entrapment into a mesenteric rent along with two cases of gastric rupture were identified in post-mortem examinations.

Two neoplasia cases were identified this quarter, an intestinal lymphoma and a multicentric lymphoma respectively.

Two musculoskeletal cases were examined, of which one was an atypical myopathy case and the other suffered a fractured ulna.

Northern Ireland

One post-mortem examinations was carried out.

One gastrointestinal case was investigated; Gastric impaction secondary to intestinal atony was found on the seven month-old foal. Botulinum toxins were not detected.

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JSC Equine Laboratory
Lab Services Ltd
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All laboratories contributing to this report operate Quality Assurance schemes, which differ between laboratories. However, all contagious equine metritis (CEM) testing reported was accredited by the Horserace Betting Levy Board (HBLB) with the exception of AHVLA, which acts as the reference laboratory.

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We would welcome feedback including contributions on focus articles and / or case reports to the following address:

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