DEFRA / AHT / BEVA

EQUINE QUARTERLY DISEASE SURVEILLANCE REPORT

Volume 1, No. 1: January-March 2005

Highlights in this issue:

- Focus on atypical equine herpes virus-1 (EHV-1) abortion
- Five-year trends in AHT viral diagnostics
- Confirmed case of contagious equine metritis
- Investigation of suspected adverse reactions to strangles vaccination
- Pathology focus: equine alimentary disease

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 Great Britain.

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Introduction

This is the first full quarterly report to be published by the Department for Environment, Food and Rural Affairs (Defra), the Animal Health Trust (AHT) and the British Equine Veterinary Association (BEVA), following a pilot report produced for consultation in April 2005. It is the product of a collaborative project resulting from the implementation of the Veterinary Surveillance Strategy which aims to enhance veterinary surveillance in the UK, and to do so using the partnership approach promoted by the Government's Animal Health and Welfare Strategy. The report will be produced quarterly in future and will seek to expand its coverage through the recruitment of additional contributors, both to the core laboratory testing data as well as the focus and highlight articles that expand on specific and topical items of interest.

Dr Debby Reynolds, the Chief Veterinary Officer, welcomed the publication of equine specific surveillance reports.

"The Animal Health and Welfare Strategy, launched last year, aims to improve the health and welfare of animals kept by man and to protect public health from animal disease. The UK Veterinary Surveillance Strategy is an integral part of this. The basis for disease surveillance is information, collected from many different sources, and used to assist in earlier detection of potential problems. Earlier detection will allow earlier intervention helping to reduce both the cost and impact of disease spread. This report is an excellent example of how working in partnership to achieve common goals can work. We believe that it demonstrates our ongoing commitment to both better communications and partnership and to an improved understanding of animal welfare issues. The better informed we are, the better we can tackle disease outbreaks if they happen.

In response to the joint initiative, BEVA, through its president, Lesley Barwise-Munro, provided the following statement.

"BEVA welcomes this combined initiative between the AHT, BEVA and Defra as an important step towards improved equine disease surveillance. Defra has extended the quarterly surveillance reports to include horses and donkeys as part of their commitment to improve veterinary surveillance in the UK. Data collection from a broad network of quality assured laboratories, in specialist equine practices, will be co-ordinated and collated by the AHT with quarterly reports issued and disseminated. BEVA would like to encourage its members to support this initiative as it is recognised that the practitioner is pivotal to infectious disease surveillance.

"Disease surveillance and control form the core of the current developments towards a strategy to ensure health and welfare across the equine industry. Increased international travel of horses and climatic change, which may alter the world's insect vector patterns, are emphasising the need for a more vigilant approach to disease detection and control. The development of quarterly equine disease reports is an essential, progressive step towards minimising the incidence of equine infectious diseases."

Virology Disease Report for the First Quarter of 2005

Table 1: Diagnostic virology sample throughput and positive results for first quarter 2005

	Number of Samples Tested	Number Positive	% Positive	Number of Contributing Laboratories
Serological Tests				
EVA VN/ELISA	9157	467	5.1%	2
EHV-1/-4 CF test	1455	113	7.8%	1
EHV-3 VN test	1	1	100%	1
ERV-1/-2 CF test	799	11	1.4%	1
Influenza HI test	832	5	0.6%	1
Virus Detection				
EHV-1/-4 PCR	117	13 EHV-1, 2 EHV-4	12.8%	1
EVA PCR	4	0	0%	1
Influenza NP ELISA	36	1	2.8%	1
Influenza VI in eggs	1	0	0%	1
EHV VI	293	10 EHV-1, 2 EHV-4	4.1%	1

VN = virus neutralisation, ELISA = enzyme-linked immunosorbent assay, CF = complement fixation,
HI = haemagglutination inhibition, PCR = polymerase chain reaction, NP ELISA = nasopharyngeal swab
VI = virus isolation, ERV = equine rhinovirus, # = Seropositives include vaccinated stallions
* = Diagnosed positive on basis of seroconversion between paired sera

Equine Herpes Virus (EHV)

EHV-1 Abortion

Four cases were confirmed on the same stud in Leicestershire. The mares were contained and all said to be vaccinated. Single cases were also confirmed in Warwickshire, North Yorkshire, Northumberland and again in Leicestershire. Two cases occurred in Shropshire (separate locations). All these individual cases were apparently unvaccinated. One atypical EHV-1 abortion (see article below) occurred in West Yorkshire, in a Warmblood mare that aborted at 8½ months gestation. Fetal tissues lacked characteristic histological lesions and were negative for EHV antigen on immunostaining, while the placenta was strongly positive.

EHV-4 Related Disease

In early January a single case of respiratory disease was confirmed on serology in an unvaccinated Thoroughbred- cross mare exhibiting nasal discharge, cough and pyrexia. A highly unusual diagnosis of suspected EHV-4 neurological disease was made in an unvaccinated 4-year-old mare in Dorset. Seroconversion was detected and a nasopharyngeal swab was positive on virus isolation. This case was similar to a suspected EHV-4 paralysis previously reported in the Veterinary Record in 1998 (Verheyen *et al.* 1998).

Equine Influenza Virus

Infection was confirmed in March in a previously vaccinated six-year old Trotter mare. She was depressed and pyrexic with a clinically typical dry, hacking cough and

mucopurulent nasal discharge. Diagnosis was by ELISA on a nasopharyngeal swab although virus isolation in eggs was negative.

Focus on Atypical EHV-1 Abortions

The case above illustrates a recently recognised presentation of EHV-1 related abortion, whereby viral lesions are restricted to the placenta (Figure 2).

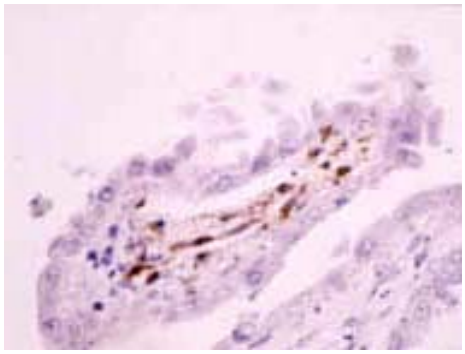


Figure 2: Darkly immunostained EHV-1 antigen in the endothelial cells of a placental villus.

This presentation was first recognised experimentally in vaccination-challenge studies undertaken in Newmarket in the early 1990s (Smith *et al.* 1992). A consistent feature of those studies, designed to optimise vaccination and management strategies for EHV-1 abortion, was the early abortion of virologically negative fetuses, over days 9-14 after intranasal challenge of pregnant pony mares with EHV-1. Detailed histological examination of the endometrium of one of those mares revealed multifocal marked vasculitis and thrombosis affecting endometrial arterioles, and it was concluded that thrombo-ischaemic insult at the uteroplacental junction had resulted in abrupt placental separation before the fetus had become infected. Subsequent diagnostic screening of spontaneous equine abortions at the Animal Health Trust revealed a series of cases of premature placental separation in which EHV-1 antigen was demonstrable by immunostaining in sections of placenta, with the fetus remaining virologically negative. One of those cases was associated with sloughing of a portion of uterine mucosa with the products of abortion, and lesions of viral vasculitis similar to that described above were apparent in that specimen (Smith *et al.* 2004). **These data emphasise the importance of detailed examination of the placenta in all cases of equine abortion.** The epidemiological significance of this novel EHV-1 abortion presentation is the subject of current research: subsequent field investigations have revealed at least one example of an atypical EHV-1 abortion occurring in the early stages of a large abortion epizootic (Irwin *et al.* unpublished data). Such cases are diagnosed by PCR and immunohistology applied to specimens of allantochorion, for the detection of EHV-1 DNA and antigen.

Equine Viral Arteritis

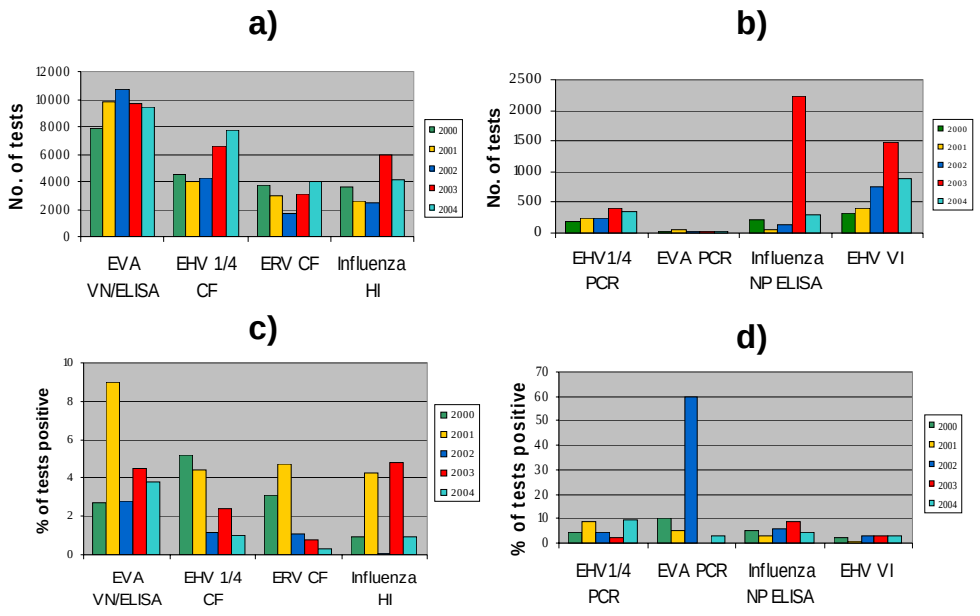
An imported Spanish stallion at stud unexpectedly tested positive for EVA by VN during March. The animal had been in the UK for several years and was thought to have been blood tested, although no record of this was found. The DVM was notified and appropriate control measures applied under the EVA Order 1995. Stallions that are found to be EVA seropositive, without sufficient proof of vaccination as per manufacturers recommendations, must be investigated to determine if they are shedders of the virus. In practice this usually requires semen collection to be undertaken for further testing.

Five-year overview of the AHT Viral Diagnostic Laboratories

The equine virology unit, the precursor of today's diagnostic laboratory services, was established at the AHT in 1981 following an outbreak of paralytic equine herpesvirus-1 (EHV-1) infection on a Newmarket stud and an equine influenza epidemic that disrupted racing, both in 1979. The unit, under Dr Jenny Mumford, was set up to provide dedicated diagnostic services to the United Kingdom's equine industry, a role it continues to play to this day. Research at the AHT has since contributed hugely to many aspects of equine infectious diseases, including improved knowledge of the epidemiology, immunology and pathogenesis of influenza, EHV, equine viral arteritis (EVA), strangles (*Streptococcus equi*) and inflammatory airway disease. This has led to improvements in management of outbreaks of equine infectious diseases and most importantly in preventive strategies, particularly through vaccination.

Figure 1 shows the five-year trends for sample numbers received for specific tests between the beginning of 2000 and the end of 2004.

Figure 1: No's of a) serological and b) virological tests conducted at AHT between 2000 and 2004 and c)/d) corresponding % of tests positive



The increased sample throughput for equine viral arteritis (EVA) testing that was observed during 2001 and 2002 was probably in response to a large outbreak that occurred among French Thoroughbreds in late 2000, with a higher than usual seroprevalence being observed in 2001 in the UK. The higher numbers of serological and virological tests for equine herpesviruses performed during 2003 and 2004 were due to an increase in paralytic EHV-1 outbreaks that was seen during those years. Unlike previous years those outbreaks were observed in non-breeding animals and particularly among Thoroughbred racehorses in training. The large peak in proportion of EVA PCR positive results in 2002 was largely artefactual and related to the very small number of tests done that year. By contrast the very large number of influenza ELISAs performed in 2003 was related to the large outbreak that occurred predominantly in Newmarket (see Pilot issue of this report).

Bacteriology Disease Report for the First Quarter of 2005

A summary of the diagnostic bacteriology testing undertaken by different contributing laboratories is presented in Table 2. For contagious equine metritis (CEM) 10 of 28 HBLB approved laboratories contributed data. Although none of the 10 contributing laboratories isolated the organism, an infection was confirmed during the quarter. More details are provided below. Among seven laboratories testing for *S. equi*, the causative agent of strangles, there was a 16% isolation rate from almost 1000 samples tested, thereby underlining the relatively high prevalence of this compared with other infections tested for during the same period. Given the importance of strangles in horses, molecular advances through the *S. equi* genome project and the recent release of a vaccine in Britain, we highlight below the development of novel differential diagnostic techniques for this infection.

Table 2: Diagnostic bacteriology sample throughput and positive results for first quarter 2005

	Number of Samples Tested	Number Positive	% Positive	Number of Contributing Laboratories
CEMO	5401	0	0%	10
Strangles (*S. equi*)	970	158	16.3%	7
Salmonellosis	181	7	3.9%	5

CEMO = contagious equine metritis organism (*Taylorella equigenitalis*)

Confirmed Case of Contagious Equine Metritis (*Taylorella equigenitalis* infection)

On 30th March 2005 the Department for Environment Food and Rural Affairs (Defra) announced that a Warmblood stallion that arrived in Great Britain from Germany Europe six months previously has been confirmed as CEMO (*Taylorella equigenitalis*) positive. The organism was streptomycin resistant, which was unusual in this country. The stallion, located in the Frome area of Somerset, England had not been used for breeding purposes and showed no clinical signs of disease but was swabbed on 17th March following advice contained in the Horserace Betting Levy Board (HBLB) Codes of Practice. The swab was submitted to a private HBLB approved laboratory who then sent the suspect culture to the Veterinary Laboratories Agency for confirmation.

Upon confirmation Defra quickly imposed movement restrictions under the Infectious Diseases of Horses Order 1987 on the premises housing the infected stallion and undertook full tracing to identify ‘at risk’ horses. Initial tracing revealed that there were 14 other 'at risk' horses on the premises and that the infected stallion was the only stallion present. The stallion had not been used for breeding purposes and initial assessments were that the risk of lateral spread was low. Screening tests on both the stallion and the possible in-contact horses were undertaken as per the HBLB Codes of Practice and all were found to be negative. The stallion subsequently underwent post-treatment testing and all these test results were also negative and all restrictions were lifted. The investigation was concluded quickly as a result of good co-operation between all parties.

Investigations of Suspected Adverse Reactions Following Strangles Vaccination

As reported in the pilot edition of this report, a licensed strangles vaccine (Equilis StrepE, Intervet UK Ltd) became available for the first time in the United Kingdom during autumn 2004. The modified live vaccine, based on attenuation of a naturally occurring field strain of *Streptococcus equi* (*S. equi* TW928), is administered submucosally in the inside of the upper lip (Jacobs *et al*. 2000) and is recommended for use in horses considered to be at medium to high risk of exposure to *S. equi.* More than 4000 doses of Equilis StrepE were sold into practices within the first 8 weeks that the vaccine was available. Although the appearance of typical clinical signs of strangles (including pyrexia, purulent nasal discharge and/or lymph node abscessation) in horses within several days of vaccination, might initially appear as clear cut vaccine adverse reactions, the possibility that such signs are attributable to concurrent natural infection with wild-type *S. equi* should also be considered. Previous work by the AHT has shown that long-term, subclinical carriage of *S. equi,* predominantly in the guttural pouches, may occur in up to 10% of recovered strangles cases following outbreaks of strangles (Newton *et al*. 1997; 2000). Conversely, the importance of environmental persistence of the pathogen to *S. equi* transmission is now being increasingly questioned due to the relatively poor ability of the organism to survive in the presence of competing soil-borne bacteria (Sweeney *et al*. 2005).

In response to a small number of recent suspected adverse reactions occurring shortly after vaccination with Equilis StrepE, the AHT, using information from both the *S. equi* and *S. zooepidemicus* genome sequencing projects, has developed and successfully applied several differential diagnostic methods.

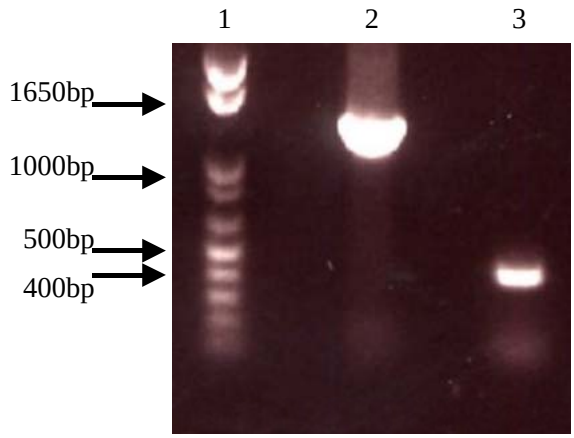


Figure 3: *S. equi* from a discharging abscess that generated an *aroA* PCR product of 1364bp (lane 2) compared with an *aroA* gene PCR from the Equilis StrepE vaccine that yielded a 432bp product (lane 3).

These methods include:

i) PCR assays to differentiate gene-deleted vaccine from non-deleted field strains of *S. equi* (Figure 3),
ii) DNA sequencing of the deleted gene to differentiate *S. equi* from *S. zooepidemicus* forms, thereby ruling out possible reversion to virulence through genetic recombination of the deleted gene from commensal *S. zooepidemicus*,
iii) DNA sequencing of regions of the M-protein to subtype and differentiate strains of *S. equi* where differences occur (Chanter *et al*. 2000).

Case reports:

In one recent case, a horse developed pyrexia and painful swelling of the submandibular lymph nodes 7 days after being administered Equilis StrepE, with S. equi being isolated from a nasopharyngeal swab at this time. S. equi was also subsequently isolated from the discharging lymph node 4 days after the end of a 7-day course of penicillin given to alleviate distress associated with the developing clinical signs. The differential PCR applied to both S. equi isolates showed that the initial nasal isolate was the gene-deleted vaccine strain, whereas the isolate from the lymph node abscess was a non-deleted field strain. DNA sequencing confirmed that the field strain had not repaired the deleted gene via recombination with S. zooepidemicus and the M-protein region was different to that of the vaccine strain. ***This confirmed that abscessation was associated with infection with a field S. equi strain and was very unlikely to have been due to genetic reversion of the vaccine strain.***

In another incident, an 8-month-old foal developed abscessation of a parotid lymph node following vaccination from which S. equi was isolated. Shortly after this a non-vaccinated horse in the next-door box also developed clinical signs of strangles with S. equi being isolated from mucopurulent nasal discharge. PCR and DNA sequencing applied to these S. equi isolates demonstrated that they were both non-deleted field strains that had not repaired the deleted gene by recombination with S. zooepidemicus but, although they had different M-protein region sequences, these were both distinct from the vaccine strain. ***This again indicated that clinical signs in these cases were not apparently associated with infection with the Equilis StrepE strain of S. equi.***

The AHT can now provide veterinary colleagues in practice differential diagnostic techniques for the thorough investigation of suspected adverse reactions to strangles vaccination following administration of Equilis StrepE. In conclusion, veterinary surgeons dealing with continuing cases of strangles on premises using vaccination, should consider the possibility that subclinically infected carriers might be contributing to such persistence and that this should be thoroughly investigated if further strangles is to be prevented. All such reactions should also be reported to the Veterinary Medicines Directorate.

Antibiotic resistance

Table 3 summarises data related to antibiotic resistance for a broad range of sample types and/or sites spanning many different bacterial species as judged by antibiotic sensitivity discs.

It should be noted that the table entries represent summary data from 5 different reporting laboratories rather than resistance patterns for individual bacterial isolates. As such the data may be of limited clinical usefulness and should be interpreted with extreme caution. Proposed changes in future data collection from laboratories contributing to these reports should allow developing trends to be monitored in subsequent reports.

None of the submitting laboratories this quarter reported isolation of methicillin resistant *Staphylococcus aureus* (MRSA) from equine samples.

Table 3: Antibiotic resistance patterns observed among 5 contributing laboratories during the first quarter 2005 (R denotes antibiotic resistance recorded this quarter)

Sample Type/Site	Antibiotic													
Bacterial spp.	**Amik**	**Amp**	**Ceft**	**Enro**	**Eryth**	**Fucid**	**Gent**	**Marbo**	**Neom**	**Oxyt**	**Pen**	**Strep**	**TMPS**	**Tica**
Wound/Abscess														
Staphylococcus	R	R	R		R		R	R	R		R		R	
Pseudomonas		R			R							R		
E. coli		R			R		R		R	R			R	
Burkholderia			R							R			R	
Tracheal Wash														
Staphylococcus		R								R	R			
Streptococcus				R					R			R		
Sinus Swab														
Burkholderia													R	
Pseudomonas										R			R	R
Nasal Swab														
Staphylococcus												R		
Streptococcus							R							
Proteus					R									
Synovial Fluid/Membrane														
Acinetobacter							R			R			R	R
Burkholderia							R			R			R	R
Chryseomonas							R			R			R	R
Staphylococcus											R			
Corneal Scrape/Conjunctival Swab														
Streptococcus						R			R					
Clitoral/Penile Sheath Swab														
Streptococcus		R			R		R					R		
Klebsiella										R	R		R	
Pseudomonas			R								R		R	
Endometrial Swab														
E.coli													R	
Streptococcus		R												
Vaginal Swab														
Proteus		R												

Antibiotic Abbreviations: Amik = Amikacin, Amp = Ampicillin, Ceft = Ceftiofur, Enro = Enrofloxacin, Eryth = Erythromycin, Fucid = Fucidin, Gent = Gentamicin, Marbo = Marbocyl, Neom = Neomycin, Oxyt = Oxytetracycline, Pen = Penicillin, Strep = Streptomycin, TMPS = Trimethoprim Potentiated Sulphonamide, Tica = Ticarcillin.

Note: The frequency of resistance to different antibiotics represented here may simply reflect differences in numbers of tests performed and not be a true reflection of resistance in a single bacterial isolate.

Toxic and Parasitic Disease Report for the First Quarter of 2005

A summary of the diagnostic toxicosis and parasitology testing undertaken by a small number of the contributing laboratories is presented in Tables 4 and 5, respectively.

The data presented for diagnostic toxicosis testing are based on information from a combination of *post mortem* examinations and allied laboratory tests, including histopathology.

Table 4: Diagnostic toxicosis sample throughput and positive results for first quarter 2005

	Number of Samples Tested	Number Positive	% Positive	Number of Contributing Laboratories
Grass Sickness	16	11	68.8%	2
Tetanus	1	1	100%	1
Botulism	2	0	0%	1
Ragwort	3	3	100%	2

Grass sickness, for which there is evidence for it being a toxicoinfectious form of botulism (*Clostridium botulinum*) was the main toxicosis that was investigated during the quarter, with approximately 70% of clinically presumptive cases being confirmed by laboratory testing.

Table 5: Diagnostic parasitology sample throughput and positive results for first quarter 2005

	Number of Samples Tested	Number Positive	% Positive	Number of Contributing Laboratories
Endoparasites				
Strongyles	118	38	32.2%	3
Tapeworms	72	3	4.2%	2
Cyathostomes	458	93	20.3%	4
Ectoparasites				
Lice	171	5	2.9%	3
Ringworm	210	8	3.8%	2
Mites	185	2	1.1%	4
Dermatophilus	12	0	0%	1

Relatively small proportions (<5%) of samples tested were positive for tapeworms, lice, ringworm, mites and/or dermatophilus whereas larger proportions (>20%) of faecal samples were positive for strongyles and/or cyathastomes. In subsequent reports these data should allow seasonal and/or developing trends to be monitored and specific data will be requested relating to anthelminitic resistance as judged by post treatment faecal sample testing.

Equine *Post Mortem* Examinations

Reports on gross *post mortem* examinations were received from 6 laboratories. Reports are presented regionally below:

East Anglia

Ten *post mortem* examinations were reported during the first quarter of 2005 and comprised two cases of alimentary tract disease (cyathostomiasis [Figure 4] and acute gastric rupture), two cases of orthopaedic disease (sacro-iliac disease causing chronic lameness), two cases of cardiac disease (sudden cardiac death in an adult horse and ventricular septal defect in a foal), two cases of cerebral disease (an intracerebral dermoid cyst and an idiopathic encephalitis suspected as being due to listeriosis), and two cases of traumatic disease (dystocic rupture of the urinary bladder in a foaling mare, and acute traumatic fracture of the second cervical vertebra in a captive zebra). This list excludes the post mortem examination of aborted fetuses and neonates, for which data for the 2004-2005 breeding season will be the subject of a future report.

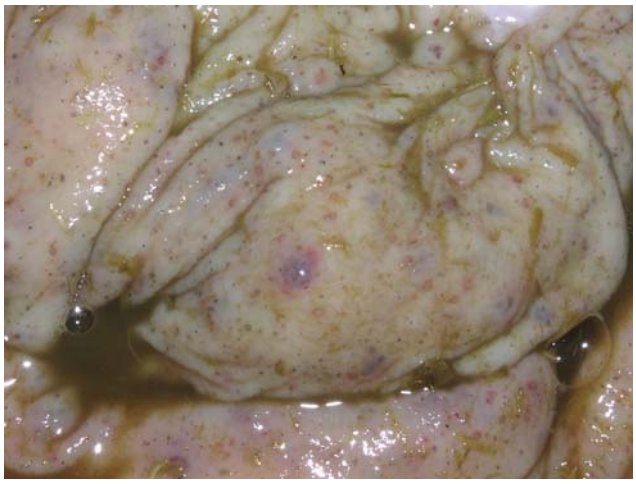


Figure 4: Equine large intestine with pin-prick appearance of encysted cyathostomes.

South West Region

Eight *post mortem* examinations were carried out on horses at Bristol University Veterinary School during the first quarter of 2005. These included three trauma cases (one pelvic fracture, one suppurative arthritis and a penetrating wound) and two intestinal cases (a caecal tip intussusception associated with tapeworms and a colonic torsion with peritonitis). Another animal that had been showing signs of heart failure and chronic hepatopathy was found to have focal nodules, thought to be the result of parasite migration, associated with the aortic valves and caudal vena cava in addition to chronic hepatic fibrosis. One case of acute interstitial pneumonia was also seen.

Home Counties

Six *post mortem* examinations were carried out by participating practices during this quarter. These included three cases of sudden death, two due to uterine artery rupture and a single case of pulmonary haemorrhage.

Scotland

Twenty-five *post mortem* examinations were carried out on horses at Edinburgh University during the first quarter of 2005. Of these 12 were confirmed cases of equine grass sickness. The remainder were cases euthanased due to musculoskeletal problems (seven cases), tumours or non-specific enteritis (six cases).

Pathology focus: equine alimentary disease

The cases of alimentary tract disease diagnosed at various participating institutes during this quarter illustrate the need for good communication between equine internal medicine clinicians and specialist pathologists in this area. In particular, there is a need for objective data on normal cellular populations at different levels of the equine gastro-intestinal tract. Veterinary scientists in London, Hampshire and Newmarket have recently published data on normal immune cell populations in the equine small intestine (Packer *et al.* 2005). These data establish a baseline against which diagnoses of equine inflammatory bowel disease may be made. Further data on age- and breed-related variations in these parameters are now required, and veterinary practitioners dealing with cases of alimentary tract disease are encouraged to submit appropriate biopsy submissions with full clinical histories and accompanying clinical biochemistry. Accumulation of these data is fundamental in establishing the true incidence and subtypes of inflammatory bowel disease in equids, now that parasitic disease affecting the alimentary tract is relatively uncommon, at least in the Thoroughbred population.

References for further reading

Chanter N., Talbot N.C., Newton J.R., Hewson D. & Verheyen K. (2000) Streptococcus equi with truncated M-proteins isolated from outwardly healthy horses. *Microbiology* **146**, 1361-9.

Jacobs, A.A., Goovaerts, D., Nuijten, P.J., Theelen, R.P., Hartford, O.M. & Foster, T.J. (2000) Investigations towards an efficacious and safe strangles vaccine: submucosal vaccination with a live attenuated *Streptococcus equi*. *Veterinary Record* **147**, 563-567.

Newton, J.R., Wood, J.L., Dunn, K.A., DeBrauwere, M.N. & Chanter, N. (1997) Naturally occurring persistent and asymptomatic infection of the guttural pouches of horses with *Streptococcus equi*. *Veterinary Record* **140**, 84-90.

Newton, J.R., Verheyen, K., Talbot, N.C., Timoney, J.F., Wood, J.L., Lakhani, K.H. & Chanter, N. (2000) Control of strangles outbreaks by isolation of guttural pouch carriers identified using PCR and culture of *Streptococcus equi*. *Equine Veterinary Journal* **32**, 515-526.

Packer, M., Patterson-Kane, J.C., Smith, K.C. and Durham, A.E. (2005). Quantification of immune cell populations in the lamina propria of equine jejunal biopsy specimens. *Journal of Comparative Pathology* **132** 90-95.

Smith, K.C., Whitwell, K.E., Binns, M.M., Dolby, C.A., Hannant, D. and Mumford, J.A. (1992). Abortion of virologically negative foetuses following experimental challenge of pregnant pony mares with equid herpesvirus 1. *Equine Veterinary Journal* **24** 256-259.

Smith, K.C., Whitwell, K.E., Blunden, A.S., Bestbier, M.E., Scase, T.J., Geraghty, R.J., Nugent, J., Davis-Poynter, N.J. and Cardwell, J.M. (2004). Equine herpesvirus-1 abortion: atypical cases with lesions largely or wholly restricted to the placenta. *Equine Veterinary Journal* **36** 79-82.

Sweeney, C.R., Timoney, J.F., Newton, J.R. & Hines, M.T. (2005) *Streptococcus equi* infections in horses: guidelines for treatment, control and prevention of strangles. *Journal of Veterinary Internal Medicine.* **19,** 123-134.

Verheyen, K., Newton, J.R., Wood, J.L.N., Birch-Machin, I., Hannant, D. & Humberstone, R.W. (1998) Possible case of EHV-4 ataxia in warmblood mare. *Veterinary Record* **142,** 456.

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Oakham Veterinary Hospital
Ratley Lodge Laboratory
Three Counties Equine Hospital
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All laboratories contributing to this report operate Quality Assurance schemes. These schemes differ between laboratories, however, all the contagious equine metritis testing reported was accredited by the Horserace Betting Levy Board.

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

Animal Health Trust

Lanwades Park, Kentford, Newmarket, Suffolk, CB8 7UU

Telephone: 01638 750659

Fax: 01638 555659

E-mail: richard.newton@aht.org.uk

Website: www.aht.org.uk