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Clinical Research Abstracts
British Equine Veterinary Association Congress 2014

Foreword and Acknowledgements

This supplement contains a diverse selection of abstracts addressing clinical research from many disciplines. Topics that are particularly well represented this year include endocrinology, laminitis, critical care and spinal disease. The only consistent feature is the very high standard.

This year, BEVA has devoted an extra two sessions to abstracts, but despite this increased time, the selection process was difficult due to the large number of excellent submissions. Over the last 10 years or so, Clinical Research Abstracts have progressively risen in stature and it is now the go-to place for cutting-edge, clinically relevant information delivered in a concise and highly professional manner. This is where Congress attendees will find the snippets of information to take straight back to practice to effect changes in the way of case management. By publishing this supplement in EVJ, BEVA hopes to make this new and relevant research available to those who have not been able to attend the Congress in person. Perhaps, this supplement will inspire some readers to make the trip next year.

This year’s BEVA Congress Clinical Research Abstracts have involved a more detailed review process than in the past. Brief reports on the abstracts under consideration were obtained from two peer reviewers before being graded, and ultimately selected by a subset of the Congress Scientific Programme Guardians: Renate Weller, Tim Barnett, Tom Witte, Neil Hudson and Janny De Grauw. We hope that the authors will find the feedback from reviewers constructive. I am extremely grateful to the peer reviewers, the CRA sub-committee and to James Crabtree and Matt Smith who completed the Programme Guardian team. David Hicks, Jane Woodley, Sue Wright and Anne Catchpole also deserve thanks for their contributions during the submission, appraisal and production phases of this Special Issue of EVJ.

Celia M Marr
Editor-in-Chief, EVJ and Chairman BEVA 2014 Scientific Programme Guardians

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SEDATION AND MECHANICAL HYPOALGESIA INDUCED BY FOUR DIFFERENT DOSAGES OF BUTORPHANOL IN XYLAZINE-PREMEDICATED DONKEYS

I Lizarraga, L and Castillo-Alcala, F
Department of Biomedical Sciences, Ross University School of Veterinary Medicine, PO Box 334, Basseterre, Saint Kitts and Nevis.
Email: ilizarraga@rossvet.edu.kn

Reasons for performing study: Combinations of α2-adenoreceptor and opioid agonists are commonly used in equines, but there is little scientific information on this topic in donkeys.

Objectives: To compare the sedative and hypoalgesic effects of 4 dosages of butorphanol in xylazine-premedicated donkeys.

Study design: In vivo experiment.

Methods: Six donkeys received intravenous treatments: saline and saline (S-S); xylazine (0.5 mg/kg bwt) and saline (X-S); xylazine and butorphanol 10 μg/kg bwt (X-B10); xylazine and butorphanol 20 μg/kg bwt (X-B20); xylazine and butorphanol 30 μg/kg bwt (X-B30); and xylazine and butorphanol 40 μg/kg bwt (X-B40). Sedation score (0–3), head height above ground (HHAG), and mechanical nociceptive thresholds (MNT) of the left metacarpus were assessed before and for 120 min after treatment. Areas under the curve (AUC) for 0–30, 30–60 and 60–120 min post treatment were computed for sedation scores (SS-AUC), HHAG (HHAG-AUC) and MNT (MNT-AUC). Differences between treatments were analysed using the Friedman test followed by Dunn’s test and repeated measures one-way ANOVA followed by Tukey’s test.

Results: All treatments except S-S induced sedation. Butorphanol treatments induced significantly greater SS-AUC0–30 values than those for S-S (P<0.05), but S-S and X-S SS-AUC0–30 values were not significantly different. The HHAG-AUC0–30 values for all treatments were smaller than corresponding values for S-S (P<0.001). For HHAG-AUC30–60, only X-B40 values were significantly smaller than corresponding values for S-S (P<0.05). Compared to S-S, all treatments increased MNT and yielded significantly higher MNT-AUC0–30 values (P<0.001). Treatment X-S yielded significantly lower MNT-AUC0–30 values than those for X-B30 and X-B40 (P<0.05). Only MNT-AUC30–60 values for X-B30 and X-B40 were higher than those for S-S and X-S (P<0.05).

Conclusions: Xylazine induced sedation and mechanical hypoalgesia that were enhanced by adding butorphanol at 40 μg/kg bwt. This drug combination may be suitable for chemical restraint of donkeys undergoing clinical procedures.

Ethical animal research: The study was approved by the Ross University School of Veterinary Medicine Institutional Animal Care and Use Committee. Sources of funding: Ross University School of Veterinary Medicine intramural grant. Competing interests: None.

Differents methods to identify pain after routine surgical castration of equine stallions: Composite pain scale, facial expressions, faecal glucocorticoid metabolites and plasma cytokines

Duck, D., Hall, S., Morrone, B., Große Ruse, M. and Lebelt, D.
Haveland Equine Hospital, Hohenferchesarer Str. 49, 14778 Beetzsee, Germany; AWIN Biomarkers Lab, Scotland’s Rural College (SRUC), Roslin Institute Building, Easter Bush, EH25 9RG, UK; Centre for Mathematical Sciences, Mathematical Statistics, Lund University, Box 118, S-221 00 Lund, Sweden.
Email: lebelt@pferdeklinik-havelland.de

Reasons for performing study: Lack of ‘gold standard’ for pain assessment in horses.

Objectives: To assess different approaches of quantifying pain in horses. Castration was chosen as a pain model because of its wide clinical relevance.

Study design: Exploratory study.

Methods: 51 equine stallions undergoing castration under general anaesthesia were divided in 3 pain-relieving treatment groups: A) single perioperative administration of flunixin (n = 19), B) additional subsequent flunixin administrations (n = 21), D) like A but with intra-operative mepivacaine injections into the spermatic cord (n = 11). All horses were assessed before and 5 times after surgery (up to 44 h) by means of a modified composite pain scale (CPS), a newly developed facial expression pain scale (FEPS), faecal glucocorticoid metabolites (GCMs) and plasma cytokine profiles. The same parameters were measured in a control group C, undergoing general anaesthesia for different nonpainful procedures (n = 6). Data were analysed with nonparametric statistical tests (Wilcoxon, Mann Whitney U).

Results: Time had an influence on CPS and FEPS scores in treatment groups A, B and D but not in C. Scores of groups A and B were higher compared to groups D and C at 4 (CPS, FEPS) and 8 h (CPS), whereas there was no difference between groups A and B nor between groups D and C. Only in group AB was there an increase of faecal GCMs 20 h after surgery. GCMs in group AB were higher compared with groups C and D at 32 h. No effects by time or treatment could be identified for the different plasma cytokines.

Conclusions: CPS and FEPS seem to be able to detect different levels of post castration pain differentiating from possible anaesthesia effect. Additional local anaesthesia of the spermatic cord was associated with lower post surgical pain scores when compared to perioperative flunixin application alone, whereas subsequent applications of flunixin had no obvious effect.

Ethical animal research: This study was registered as an animal experiment by the Brandenburg state authority (V3-2347-A-42-1-2012). Client-owned horses were included with informed consent. Sources of funding: EU-funded FP7-project “Animal Welfare Indicators (AWIN)” (FP7-KBBE-2010-4). Competing interests: None.
THE EFFECT OF DOBUTAMINE AND BOLUS CRYSTALLOID FLUIDS ON THE CARDIOVASCULAR FUNCTION OF ISOFLURANE ANAESTHETISED HORSES

Loughran, C.M., Raisin, A.L., Secombe, C.J. and Lester, G.D. College of Veterinary Medicine, School of Veterinary and Biological Sciences, Murdoch University, South Street, Murdoch, Perth, Western Australia, 6150.
Email: C.Loughran@murdoch.edu.au

Reasons for performing study: Hypotension is the most common cardiovascular complication encountered during equine inhalational anaesthesia, for which a dobutamine intravenous constant rate infusion (DCRI) is often the sole treatment. There is limited literature available on the combined use of crystalloid boluses and inotropic agents during equine hypotensive episodes.

Objectives: To determine the cardiovascular effects of DCRI, alone and in combination with a crystalloid bolus (CB) during controlled ventilation in hypotensive, isoflurane anaesthetised horses.

Study design: Prospective, randomised, cross-over experimental design of 6 healthy Standardbred horses aged 5–13 years weighing 464–578 kg.

Methods: Horses were premedicated with intravenous acepromazine and xylazine. Anaesthesia was induced with intravenous ketamine and diazepam. Isoflurane was used to maintain anaesthesia and achieve a target mean arterial pressure (MAP) of 60 mmHg ± 5%. Sixty minutes post induction (T0) when a stable end tidal isoflurane percentage and target MAP had been achieved for ≥15 min one of 2 treatments was given. Treatment A (TA) was a DCRI, commencing at 0.5 µg/kg bwt/min and increasing in increments of 0.5 µg/kg bwt every 10 min as required to achieve a MAP of 80 mmHg ± 5% by 30 min following initiation of the DCRI. Treatment B (TB) was as for TA plus a 20 ml/kg bwt CB. Cardiac output, haemoglobin concentration, PaO2 and SaO2 were obtained at baseline (T0), 15 min one of 2 treatments was given. and xylazine. Anaesthesia was induced with intravenous ketamine and diazepam. Isoflurane was used to maintain anaesthesia and achieve a target mean arterial pressure (MAP) of 60 mmHg ± 5%. Sixty minutes post induction (T0) when a stable end tidal isoflurane percentage and target MAP had been achieved for ≥15 min one of 2 treatments was given. Treatment A (TA) was a DCRI, commencing at 0.5 µg/kg bwt/min and increasing in increments of 0.5 µg/kg bwt every 10 min as required to achieve a MAP of 80 mmHg ± 5% by 30 min following initiation of the DCRI. Treatment B (TB) was as for TA plus a 20 ml/kg bwt CB. Cardiac output, haemoglobin concentration, PaO2 and SaO2 were obtained at baseline (T0) and 30 min following initiation of the DCRI (T1). Data were analysed with a Wilcoxon matched-pairs signed rank test (P<0.05 considered significant), with data presented as median ± interquartile ranges.

Results: Treatment A was associated with a significant (P = 0.03) increase in oxygen delivery index (DO2I) from baseline (T0 707.78 ± 159.73 ml/min/m²; T1 1260.26 ± 184.56 ml/min/m²), while TB was not (P = 0.09).

Conclusions: In an experimental model of isoflurane induced hypotension, DCRI results in increased DO2I, while the use of DCRI in combination with CB does not.

Ethical animal research: The use of animals in this study was approved by Murdoch University Ethics Committee (AEC Permit No: 2526/12).

Sources of funding: Murdoch University Masters Research Fund.
Competing interests: None.

CLINICAL EXPERIENCES WITH DESFLURANE INHALATIONAL ANAESTHESIA IN HORSES

1Parker, R.A. and 1Hollis, R.A.
1Lipook Equine Hospital, Forest Mere, Lipook, Hampshire, GU30 7IG;
2Scott Dunn’s Equine Clinic, Straight Mile Farm, Maidenhead Road, Wokingham, Berkshire RG40 5RW, UK.
Email: Russell.parker@theleh.co.uk

Reasons for performing study: Equine general anaesthesia carries a higher risk of perioperative fatality compared with humans and companion animals. Multiple studies have examined the risk factors associated with general anaesthesia, most notably the ongoing confidential enquiry into perioperative equine fatalities (CEPEF) studies initially published by Johnston et al. [1]. Desflurane is a modern inhalational anaesthetic with low solubility and potentially beneficial reduced cardiorespiratory effects, but its use in a large number of horses has not been investigated.

Objectives: To evaluate the perioperative mortality rates of horses undergoing general anaesthesia maintained using desflurane.

Study design: Retrospective analysis.

Methods: Anaesthetic records of all horses undergoing general anaesthesia over a 4-year period at a single hospital were retrospectively examined. Horses were excluded if general anaesthesia was not maintained using inhaled desflurane. Outcome variables of death (anaesthetic related), alive or euthanased (for other reasons) were recorded consistent with previous CEPEF studies.

Results: 427 horses met the inclusion criteria, of which 406 (95.1%) were alive at 7 days post operatively, 16 (3.7%) were euthanised and 5 (1.2%) died. Four of the perioperative fatalities suffered cardiac arrest, one suffered a catastrophic fracture. Mean age was 7.6 years (range 1 month–26 years), mean weight was 503.3 kg (range 60–828 kg). Mean duration of anaesthesia was 63.0 min (range 15–200 min). Mean recovery time to standing was 28.3 min (range 5–70 min) with mean recovery score 1.4/5 (range 1–4).

Conclusions: Use of desflurane led to comparable mortality rates to other inhalational anaesthetics in this small number of horses at a single hospital. Further multicentre studies with larger numbers are warranted to examine any potential benefits.

Ethical animal research: Ethical committee approval not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated.

Sources of funding: None. Competing interests: None.

Reference

CYTOKINE CONCENTRATION IN FOALS' SERUM PRE- AND POST SUCKLING

Mariella, J., Castagnetti, C., Prosperi, A., Scaglìarini, A., Adriani, G. and Peli, A.
Department of Veterinary Medical Sciences, University of Bologna, Via Tolora di Sopra 50, 40064 Ozzano dell’Emilia, Bologna, Italy.
Email: jole.mariella@unibo.it

Reasons for performing study: Colostrum acts as a source of immunomodulatory molecules for the neonate. Little information is available about the transfer of cytokines via colostrum in the foal.

Objectives: To investigate the transfer via colostrum of IL-4, IL-13, IL-8 and IFN-γ.

Study design: Prospective observational study.

Methods: Jugular venous blood pre- (T0) and post suckling (T24) and colostrum were collected from 14 healthy foals and their dams. The cytokines’ concentration was measured with an ELISA test. Serum IgG concentration was measured in foals at T24 with an immunoturbidimetric assay. Since data were not normally distributed, nonparametric tests for statistical analysis were used. The Wilcoxon test evaluated the difference in each cytokine concentration between T0 and T24. Spearman rank correlation tested the association between cytokines’ concentration in T24 serum and in colostrum, between T24–T0 (ΔT) serum concentration and colostrum concentration, and between cytokines serum concentration at T24 and IgG concentration.
Results: All the foals had a complete transfer of passive immunity. A statistically significant difference was found between serum IL-4 concentration at T0 and at T24. The significant correlations found were: serum IL-4 concentration at T24 with IL-4 concentration in colostrum, serum IL-13 concentration at T24 with IgG serum concentration, and IL-4 concentration in colostrum with AT serum IL-4 concentration.

Conclusions: The results support the hypothesis that IL-4 is transferred via colostrum to the foal, as reported for TNF-α [1]. The presence of IL-8 in the foal’s serum at T0 suggests an endogenous production. The IL-13 concentration is close to zero for the major part of serum and colostrum samples suggesting a subject-dependent immunologic response. The IFN-γ is present both in colostrum and in T0 serum suggesting that foals are not deficient at birth.

Ethical animal research: Studies approved by the Ethical Committee of the Faculty of Veterinary Medicine, University of Bologna. Oral informed consent was given by the owners. Sources of funding: University of Bologna. Competing interests: None.

Reference

USE OF SQUEEZE-INDUCED SOMNOLENCE FOR ROUTINE PLASMA ADMINISTRATION IN HEALTHY NEONATAL FOALS

Pickles, K.J., Madigan, J.E., Torske, S. and Aleman, M.R.
Department of Medicine and Epidemiology, School of Veterinary Medicine, University of California, Davis, California 95616, USA.
Email: kjpickles@ucdavis.com

Reasons for performing study: A nonchemical method of restraint to facilitate neonatal foal handling and minimally invasive procedures would be highly useful.

Objectives: To investigate squeeze-induced somnolence for providing adequate restraint of healthy neonatal foals for the purpose of plasma administration.

Study design: Prospective clinical study.

Methods: Squeeze-induced somnolence of neonatal foals was performed by use of a soft rope restraint as previously described [1] to allow intravenous catheterisation and plasma administration. Physiological and clinical parameters were monitored pre-, during and post squeeze-induced somnolence.

Results: Squeeze-induced somnolence and plasma administration was performed on 14 foals within the first day of life without any adverse effects. Mean time to recumbency during squeeze restraint was 53 s, mean time to stand and mean time to nurse from dam following release of restraint were 46 s and 163 s, respectively. Over 50% of foals gave some reaction to subcutaneous injection of local anaesthetic but only one foal reacted strongly. The restraint technique was performed without any difficulty in 8/14 foals, 5/14 foals became less somnolent latterly in the procedure (around 17–18 min) and one foal never became fully somnolent.

Conclusions: Squeeze-induced somnolence provides adequate restraint for plasma administration, without the need for sedation, in the majority of neonatal foals. Squeeze-induced somnolence can be used to allow nonchemical restraint of neonatal foals for routine procedures. Further refinement of the technique is required to maximise its potential usefulness.

Ethical animal research: The study was approved by the University of California Institutional Animal Care and Use Committee. Foals were included in the study with informed owner consent. Sources of funding: Private anonymous donation. Competing interests: None.

Reference

AN ONLINE SURVEY TO CHARACTERISE SPENDING PATTERNS OF HORSE OWNERS AND TO QUANTIFY THE IMPACT OF EQUINE LAMENESS ON A PLEASURE HORSE POPULATION

1Uprichard, K.L., 1Boden, L.A. and 1Marshall, J.F. 1Weipers Centre Equine Hospital, School of Veterinary Medicine, and 1Boyd Orr Centre for Population and Ecosystem Health, Institute of Biodiversity, Animal Health and Comparative Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, UK.
Email: kathyu15@hotmail.com

Reasons for performing study: Treatment of equine lameness frequently requires a period of rest and restricted exercise. The financial impact of restricted exercise should be considered when making investigation and treatment decisions.

Objectives: To describe and quantify the cost and time commitment associated with horse maintenance in the UK and to quantify the incidence of lameness and number of days of exercise lost.

Study design: Online survey of UK horse owners.

Methods: An online survey was performed between June and November 2013. The questionnaire contained 35 open and closed questions related to 1) owner age, gender, geographical location; and 2) type and use of horse, purchase price, location, travel, healthcare and maintenance costs; and 3) lameness episodes within the last 12 months.

Results: 560 respondents fully completed the questionnaire, 98.2% were female aged between 16 and 54 years old. Horses (62.5% geldings, 37.1% mares, 0.8% stallions) were of mixed breed with a median age of 13 years. Horses were predominantly used for general purpose riding. Most horses were kept on or within 5 miles of the owner’s residence (77.4%) and 65% of owners spent >10 h per week on horse maintenance. Median basic maintenance cost was £2660 per year or £7.29 per day including routine healthcare, dentistry, farriery, feed, housing, and insurance fees. Most horses (71.3%) experienced an episode of lameness within the previous 12 months. The median duration of restricted exercise (days wasted) was 70 (range 0–880) days.

Conclusions: This unique dataset quantifies the financial and time outlay required with horse ownership. Determining the number of wasted days and basic average cost per day has allowed us to quantify the cost of inactivity. Considerable cost is associated with a period of inactivity following an episode of lameness, which should be taken into account when considering investigation and treatment options.

Ethical animal research: The study was approved by the Ethics Committee of the College of Medical, Veterinary and Life Sciences, University of Glasgow. Sources of funding: The Geoffrey Serth Charitable Trust. Competing interests: None.
Investigation of the plantar pouch is indicated in routine arthroscopy for osteochondrosis dissecans lesions (OCD) in Great Britain, and routine examination of the plantar pouch has not been described. Reasons for performing study: There is limited information on tarsocrural arthroscopy for osteochondrosis dissecans lesions (OCD) in Great Britain, and routine examination of the plantar pouch has not been described.

Objectives: To describe clinical features of cases undergoing tarsocrural arthroscopy for OCD and estimate the prevalence of abnormalities within the plantar pouch.

Study design: Retrospective case review.

Methods: Case records of all horses that had tarsocrural arthroscopy for OCD at Rossdales Equine Hospital between 1 January 2005 and 31 December 2013 were included (n = 99). Descriptive data and 95% confidence intervals (CI) were constructed in Microsoft Excel.

Results: Warmbloods/Warmblood-crosses were significantly over-represented compared to the normal hospital population, comprising 42.4% (CI 32.7–52.2%) of the study (P<0.001), followed by Thoroughbreds/Thoroughbred-crosses (33.7% CI 25.0–43.7%), 22 other horse breeds and one pony. Cases were predominantly male (70.7%, CI 66.5–89.5%) with the remainder used for breeding, general purpose or racing. Reasons for presentation were lameness 41.8%, CI 32.1–51.6%, followed by left hind (35.7%, CI 26.2–45.2%), then right hind (22.4%, CI 14.2–30.7%). Age was 2.9 years (0.1–13.5 years) and median weight was 523 kg (112–919 kg). Most were nonracing sports horses (40.4%, CI 30.7–50.1%), or unbroken (27.0%, CI 18.5–36.0%) with the remainder used for breeding, general purpose or racing. Reasons for presentation were lameness (52.7%, CI 42.5–63.0%), effusion (36.3%, CI 26.4–46.1%), or survey radiographs (11.0%, CI 4.6–17.4%). Tarsocrural arthroscopy was most frequently performed bilaterally (41.8%, CI 32.1–51.6%), followed by left hind (35.7%, CI 26.2–45.2%), then right hind (22.4%, CI 14.2–30.7%). Irrespective of pathology in the dorsal pouch, examination of the plantar pouch was performed in 70 joints (50 horses), and in 78.0% (CI 66.5–89.5%) of horses were noted to have restriction to passage of the arthroscope within the plantar pouch. Twenty-three horses were included in the study. Twenty horses were noted to have restriction to passage of the arthroscope within the digital flexor tendon sheath at the time of surgery. Following the initial 3-month post operative rest period 21 horses were sound. Three horses did not return to their previous level of activity due to unrelated lameness issues and 2 returned to a lower level of competition due to owner preference. Of the remaining 18 horses, 16 returned to their previous level of athletic performance. Two horses had recurrent or persistent lameness associated with the residual PAL desmopathy.

Conclusions: In this case series surgical treatment of primary PAL injury carries a good prognosis (89% return to previous level of exercise) in contrast to a previously reported study (<50% of horses were able to return to athletic function [1]).

Ethical animal research: Ethical committee approval not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated.

Sources of funding: None. Competing interests: None.

Reference

MULTI-CENTRE FIELD TRIAL TO EVALUATE THE EFFECTIVENESS OF CLODRONIC ACID FOR NAVICULAR SYNDROME

Tarsocrural arthroscopy for osteochondrosis dissecans: clinical features of a referral hospital population and prevalence of abnormalities within the plantar pouch

James, O.A., Payne, R.J., Bathe, A.P., Greet, T.R.C. and Wylie, C.E. Rossdales Equine Hospital, Cotton End Road, Exning, Newmarket, Suffolk, CB8 7NN, UK.

Email: oliver_james@live.co.uk

Reasons for performing study: There is limited information on tarsocrural arthroscopy for osteochondrosis dissecans lesions (OCD) in Great Britain, and routine examination of the plantar pouch has not been described.

Objectives: To describe clinical features of cases undergoing tarsocrural arthroscopy for OCD and estimate the prevalence of abnormalities within the plantar pouch.

Study design: Retrospective case review.

Methods: Case records of all horses that had tarsocrural arthroscopy for OCD at Rossdales Equine Hospital between 1 January 2005 and 31 December 2013 were included (n = 99). Descriptive data and 95% confidence intervals (CI) were constructed in Microsoft Excel.

Results: Warmbloods/Warmblood-crosses were significantly over-represented compared to the normal hospital population, comprising 42.4% [CI 32.7–52.2%] of the study (P<0.001), followed by Thoroughbreds/Thoroughbred-crosses (33.7% [CI 25.0–43.7%]), 22 other horse breeds and one pony. Cases were predominantly male (70.7%, [CI 66.5–89.5%]) with the remainder used for breeding, general purpose or racing. Reasons for presentation were lameness (41.8%, [CI 32.1–51.6%]), followed by left hind (35.7%, [CI 26.2–45.2%]), then right hind (22.4%, [CI 14.2–30.7%]). Age was 2.9 years (0.1–13.5 years) and median weight was 523 kg (112–919 kg). Most were nonracing sports horses (40.4%, [CI 30.7–50.1%]), or unbroken (27.0%, [CI 18.5–36.0%]) with the remainder used for breeding, general purpose, or racing. Reasons for presentation were lameness (52.7%, [CI 42.5–63.0%]), effusion (36.3%, [CI 26.4–46.1%]), or survey radiographs (11.0%, [CI 4.6–17.4%]). Tarsocrural arthroscopy was most frequently performed bilaterally (41.8%, [CI 32.1–51.6%]), followed by left hind (35.7%, [CI 26.2–45.2%]), then right hind (22.4%, [CI 14.2–30.7%]). Irrespective of pathology in the dorsal pouch, examination of the plantar pouch was performed in 70 joints (50 horses), and in 78.0% (CI 66.5–89.5%) of horses were noted to have restriction to passage of the arthroscope within the plantar pouch.

Conclusions: Investigation of the plantar pouch is indicated in routine tarsocrural arthroscopy for OCD as it often reveals additional pathology, which may necessitate surgical intervention. Further work will evaluate how plantar pouch pathology may influence prognosis.

Ethical animal research: Ethical approval obtained, project number AHT48:2013. Explicit informed consent for participation in this study was not stated.

Sources of funding: C.E.W. is supported by The Margaret Giffen Trust. Competing interests: None.

MULTI-CENTRE FIELD TRIAL TO EVALUATE THE EFFECTIVENESS OF CLODRONIC ACID FOR NAVICULAR SYNDROME

Nieuwenhuis, G.M., O’Meara, B.J., James, F.M. and Bladon, B. Donnington Grove Veterinary Surgery, Newbury, Berkshire, UK.

Email: garth.nieuwenhuis@gmail.com

Reasons for performing study: Little exists in the literature regarding the outcome of endoscopically-guided desmotomy of the palmar/plantar annular ligament (PAL) where injury to the PAL was the only diagnosis.

Objectives: To report the return to previous level of exercise in horses treated with endoscopically guided PAL resection in which PAL injury was considered to be the primary condition.

Study design: Retrospective case series.

Methods: Medical records of surgical cases at Donnington Grove Veterinary Surgery between 2005 and 2013 were reviewed. The inclusion criteria were cases that had undergone surgical transection of the palmar/plantar annular ligament under general anaesthesia and endoscopic guidance using a No. 12 scalpel blade where annular ligament injury was the only notable finding at surgery. Follow-up was obtained by a telephone questionnaire.

Results: Twenty-three horses were included in the study. Twenty horses were noted to have restriction to passage of the arthroscope within the digital flexor tendon sheath at the time of surgery. Following the initial 3-month post operative rest period 21 horses were sound. Three horses did not return to their previous level of activity due to unrelated lameness issues and 2 returned to a lower level of competition due to owner preference. Of the remaining 18 horses, 16 returned to their previous level of athletic performance. Two horses had recurrent or persistent lameness associated with the residual PAL desmopathy.

Conclusions: In this case series surgical treatment of primary PAL injury carries a good prognosis (89% return to previous level of exercise) in contrast to a previously reported study (<50% of horses were able to return to athletic function [1]).

Ethical animal research: Ethical committee approval not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated.

Sources of funding: None. Competing interests: None.

Reference

MINERALISATION OR OSSIIFICATION OF THE INTEROSSEOUS LIGAMENT OF THE CENTRODISTAL JOINT OF THE HORSE: IS THERE AN ASSOCIATION WITH OSTEOARTHRITIS?

Skelly, E. and Dyson, S.
Centre for Equine Studies, Animal Health Trust, Lanwades Park, Kentford, Newmarket, Suffolk, CB8 7UU, UK.
Email: esther.skelly@aht.org.uk

Reasons for performing study: There have been no detailed descriptions of the radiological appearance of the centrodistal joint interosseous ligament in horses with and without distal hock joint pain.

Objectives: 1) To describe the normal radiological appearance of the region of the centrodistal joint interosseous ligament; 2) to determine the frequency of occurrence of mineralisation or ossification of the interosseous ligament and to describe radiological abnormalities surrounding the interosseous space; 3) to describe concurrent radiological abnormalities in the tarsus. It was hypothesised that ossification of the interosseous ligament will be associated with radiological evidence of osteoarthritis of the centrodistal joint.

Study design: Systematic radiological analysis using a predefined grading system, after a repeatability study, and descriptive statistics.

Methods: Case records and radiographs of all horses which underwent radiographic examination of one or both tarsi over 7 years were reviewed.

Results: There were 700 horses, including 470 examined bilaterally. The normal interosseous space was an oval-shaped radiolucent area surrounded by subchondral bone of uniform opacity and thickness. Changes in the region of the interosseous ligament of the centrodistal joint were evident in 190/1170 (16.2%) tarsi, including 50 horses examined bilaterally. In 33/190 (17.4%) tarsi there was complete loss of the oval-shaped radiolucent area, together with increased thickness of the adjacent subchondral bone. Endosteal irregularity and increased opacity of the adjacent trabecular bone. In addition 157/190 tarsi had patchy increased opacity within the interosseous space and alterations of the adjacent subchondral and trabecular bone. There was radiological evidence of osteoarthritis of the centrodistal joint in 27/33 (81.8%) of tarsi with complete ossification of the centrodistal interosseous ligament, 17 of which (51.5%) had distal tarsal pain, and in 29/157 (18.5%) tarsi with other abnormalities of the centrodistal interosseous ligament.

Conclusions: When evaluating the tarsus radiologically the region of the centrodistal joint interosseous ligament should be assessed.

Ethical animal research: The study was approved by the Ethical Review Committee of the Animal Health Trust and there was informed owner consent. Sources of funding: None. Competing interests: None.
SPORT HORSES WITH INFLAMMATORY AIRWAY DISEASE (IAD) WITH PREDOMINANTLY EOSINOPHILS OR MAST CELLS ARE MORE PREDISPOSED TO POOR PERFORMANCE, EXERCISE INDUCED PULMONARY HAEMORRHAGE (EIPH) AND HAVE SHORTER CAREERS WHEN COMPARED TO HORSES WITH NEUTROPHILIC IAD

1Boshuizen, B., 1de Bruijn, C.M., 1Dewulf, J. and 1Delesalle, C.J. 1Wolvega Equine Clinic, Oldeholtpade, The Netherlands; 1Ghent University, Faculty of Veterinary Medicine, Belgium.
Email: Berit.Boshuizen@gmail.com

Reasons for performing study: Clinical differences and variable response to therapy had been suspected between sport horses with predominantly eosinophils and/or mast cells in the bronchoalveolar lavage fluid (BALF) and horses with predominantly neutrophilia in the BALF.

Objectives: To examine possible differences in performance, response to treatment and prognosis between both groups.

Study design: Retrospective clinical study.

Methods: A total of 174 client-owned sport horses that were presented to the Wolvega Equine Clinic for respiratory problems between 2008 and 2013 were included. A questionnaire was used for follow-up at least 3 months after diagnosis. Cytological BALF counts were considered increased when: neutrophils >5%; eosinophils >1% and mast cells >2%. Data were analysed using SPSS software and Chi square tests.

Results: Cough and highest mucus scores were significantly more associated with neutrophilic IAD (P = 0.009 and P = 0.007). The neutrophilia group was also significantly more responsive to therapy, often including corticosteroid inhalation, and management optimisation (P = 0.001) and had better long-term prognosis when compared to horses from the eosinophilic or mast cell groups (P<0.001). Lowest tracheal mucus scores were reported for the eosinophilic group, followed by the mast cell group. Haemosiderophage scores were significantly higher in the eosinophilic group, followed by the mast cell group. Poor performance was reported significantly more frequently in horses with eosinophils and mast cells as the main inflammatory cell population in their BALF (P = 0.001).

Conclusions: Inflammatory airway disease with predominantly mast cells or eosinophils is associated with low endoscopic tracheal mucus scores. These horses are more predisposed to EIPH, poor performance and responded unfavourably to therapy when compared to horses with neutrophilic IAD.

Ethical animal research: Ethical committee oversight not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated.

Sources of funding: None. Competing interests: None.

Reference

CHANGES IN ADIPOSE mRNA EXPRESSION BETWEEN PREVIOUSLY LAMINITIC PONIES AND NONLAMINITIC PONIES IN SUMMER AND WINTER

1Timpson, A.J., 1Elliott, J., 1Harris, P.A., 1Cheng, Z., 1Rainbow, L., 1de Mestre, A.M. and 1Menzies-Gow, N.J. 1Royal Veterinary College, Hawkshead Lane, North Mymms, Hertfordshire, AL9 7TA; 1Equine Studies Group, Waltham Centre for Pet Nutrition, Freeby Lane, Waltham-on-the-Wolds, Leicestershire, LE14 4RT; 1Centre for Genomic Research, Institute of Integrative Biology, University of Liverpool, Biosciences Building, Crown Street, Liverpool L69 7ZB, UK.
Email: atimpson@rvc.ac.uk

Reasons for performing study: Some ponies are predisposed to recurrent pasture-associated laminitis, but the mechanisms underlying this remain unclear. Adipose tissue is a highly metabolically active tissue that secretes mediators which affect vascular function, insulin signalling and inflammation, all of which are potentially implicated in the pathogenesis of laminitis.

Objectives: To determine whether the gene expression of adipose tissue from previously laminitic ponies (LP) differs from nonlaminitic ponies (NL).

Study design: Subcutaneous adipose tissue was collected by biopsy from the neck region of healthy LP and NL (n = 6 each group) in the summer and winter.

THYROID GLAND TUMOURS IN THE HORSE: CLINICAL DIAGNOSTIC, TREATMENT AND HISTOLOGICAL CHARACTERISATION

Trolliet, A., Brehm, W. and Scharner, D.
Large Animal Clinic for Surgery, Veterinary Faculty, University of Leipzig, An den Tierkliniken 21, Leipzig, Germany.
Email: lempe@vetmed.uni-leipzig.de

Reasons for performing study: Tumours of the thyroid gland are rare in the equine species. In literature varying clinical signs and diagnostic findings are described in single reports and case series. Reported clinical signs are related to upper airway compression or thyroidal metabolic activity. A considerable risk of laryngeal hemiplegia is described when horses were treated with hemithyroidectomy [1].

Objectives: To review 11 horses referred with a unilateral thyroid neoplasia in order to describe clinical presentation, diagnostic findings, treatment and outcome. Histopathology was performed on all resected thyroid lobes.

Study design: Retrospective case series.

Methods: Records from horses with histologically confirmed thyroid tumours treated with unilateral thyroid lobe resection were reviewed (2003–2013). Short-term outcome was defined for 2 weeks after surgery. Owners’ questionnaire was performed for evaluation of long-term outcome defined as a minimum of 6 months.

Results: Affected horses were aged between 6 and 21 years. In contrast to literature the majority of tumours were adenocarcinomas (9/11), mainly found in mares (8/9). Histology revealed follicular and parafollicular (C-cell) mixed growth pattern of the carcinomas. Tumour size, growth rate and sonographic appearance did not correlate to histological characteristics. Ventral displacement of the thyroid lobe and close preparation along the thyroid capsule during surgical resection are inevitable to avoid damage to laryngeal nerves. Seroma formation was the only observed short-term complication. No long-term complications occurred.

Conclusions: Hemithyroidectomy is regarded the treatment of choice in horses with a unilateral thyroid lobe neoplasia with excellent long-term prognosis. High incidence of malignant tumours particularly in mares has to be considered. Tumour characteristics can only be derived from histopathology and immunohistochemistry.

Ethical animal research: Ethical committee oversight not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated.

Sources of funding: None. Competing interests: None.

Reference
Methods: Gene expression was determined using a 44 K equine expression microarray. Data were analysed using GeneSpring and Ingenuity Pathway Analysis. Genes with >2-fold difference, P<0.01 were considered significant using a t test to analyse group and/or season.

Results: The most significant differences in global gene expression in adipose tissue were observed between summer and winter in both groups, with 244 (NL) and 174 (LP) genes differentially expressed. There was a significant difference between LP and NL groups in the summer (141 genes differentially expressed), whereas the 2 groups were more similar in the winter (40 genes differentially expressed). Eight of the top 10 upregulated genes and 3 of the top 5 canonical pathways that differed between LP and NL in the summer were associated with inflammation and/or immunity.

Conclusions: Laminitic ponies appear to have a different adipose tissue gene expression profile to NL, particularly in the summer. Inflammatory genes and pathways were significantly upregulated in the LP group suggesting higher levels of inflammation or priming of inflammatory pathways which may contribute to a predisposition to laminitis.

Ethical animal research: The study was completed under Home Office Project Licence approved by the RVC Ethics and Welfare Committee.

Sources of funding: This study was funded by Waltham®. A. Timpson is funded by the Mellon Equine Endowment Fund. Competing interests: Dr P. Harris is employed by Waltham. The other authors have declared no competing interests.

EVALUATION OF REGIONAL ADIPOSEITY IN THE NECK AREA OF ANDALUSIAN HORSES

†Martin Gimenez, T., †de Blas Giral, I., †Aguilera Tejero, E., ‡Diez de Castro, E. and §Aguirre Pascasio, C.N.

†Department of Animal Pathology, Faculty of Veterinary Sciences, University of Zaragoza, Spain; †Department of Animal Medicine and Surgery, Faculty of Veterinary Sciences, University of Cordoba, Spain; ‡Veterinary Teaching Hospital, Universidad de Murcia, Spain; §Veterinary Teaching Hospital, Universidad de Murcia, Spain.
Email: Tamara.martin.gimenez@gmail.com

Reasons for performing study: Adipose tissue deposited along the crest of the neck has been associated with altered metabolic states and with an increased risk of laminitis in equids. Thickness of the neck is a phenotypic characteristic in Andalusians; however, there are no studies evaluating this condition in this breed.

Objectives: To evaluate morphometric and ultrasonographic measurements in the neck area for assessment of neck adiposity and its associations with adiposity scores and biochemical variables.

Study design: A sample of 115 Andalusian horses (46 barren mares and 69 stallions, 2–15 years old) was evaluated in a cross-sectional study.

Methods: Cresty neck score (CNS) was determined. Two groups were created: cresty neck (CNS ≥ 3) and noncresty neck (CNS<3) horses. Neck circumference (NC) (cm) and ultrasonography (US) of subcutaneous fat (mm) at 25% (US0.25–US0.50), 50% (US0.50–US0.75) and 75% (US0.75–US0.75) of neck length were measured. Middle neck circumference (NC), neck length and height at the withers were taken to calculate neck ratios (NC0.50:height, NC0.50:neck length). Plasma was analysed for insulin and leptin. Hyperinsulinaemia was defined as insulin ≥20 μg/ml. Correlations using Pearson and Spearman coefficients were evaluated. Mean comparisons were carried out with Student’s t or Mann-Whitney tests.

Results: Cresty neck condition was present in 73.9% (n = 85) of the horses and 2.6% (n = 3) were hyperinsulinemic. Cresty neck horses had significantly higher plasma leptin, morphometric and ultrasonographic measurements. NC0.50:height was the most correlated parameter with CNS. Insulin was correlated with leptin levels and all morphometric measurements. Insulin and leptin were correlated only with US0.75.

Conclusions: Andalusian horses’ neck score, despite their thick necks in the majority of individuals, does not have a good correlation with plasma insulin and leptin levels. Since in Andalusian horses, neck scores may be overestimating obesity, further studies on ultrasonographic fat measurements are needed.

Ethical animal research: The university committee for the ethical use of animals approved all procedures. Owners gave informed consent for their horses’ inclusion in the study. Sources of funding: None. Competing interests: None.

REPEATABILITY OF AN IN-FEED SUGAR TEST IN PONIES

1de Laat, M.A., 1Pollitt, C.C. and 1Sillence, M.N.

1School of Earth, Environmental and Biological Sciences, Queensland University of Technology, Brisbane, 4001, Queensland, Australia; 2School of Veterinary Science, The University of Queensland, Gatton, 4343, Queensland, Australia.
Email: melody.delaat@qut.edu.au

Reasons for performing study: Insulin resistance (IR) can be difficult to diagnose from basal insulin and glucose concentrations, so a field-based oral sugar test (OST) is preferred. However, the repeatability of this test has not been reported.

Objectives: To determine the repeatability of an in-feed OST in ponies.

Study design: A repeated measures, longitudinal study.

Methods: Eight mixed-breed ponies received an in-feed OST at 08.00 h, after an overnight fast, once weekly for 3 weeks. D-glucose powder (0.75 g/kg bwt), wheat bran (200 g) and water (500 ml) were combined, and mixed with lucerne chaff (0.3% bwt). Blood samples were taken before, and 90 and 180 min after, feeding. All meals were consumed. Blood glucose concentration was determined immediately and serum was obtained for insulin determination by equine-specific ELISA. Fasting glucose, insulin and glucose:insulin ratios were used to classify ponies as IR, compensated IR or normal on each occasion and the results were compared to the OST.

Results: Diagnosis of IR from basal values was consistent in only 3/8 ponies, with a large mean coefficient of variation (CV) of 51% for baseline insulin, across tests. The OST results were repeatable in 7/8 ponies, with mean CV at 25% for the 90 min insulin sample (CV for 7 ponies: 19%). The OST was repeatable on 2/3 occasions in the eighth pony, however, resting hyperinsulinaemia meant that IR was diagnosed on 3/3 occasions using ultrasonographic fat measurements in this pony. There was significant (P<0.05) variability in insulin concentration at 180 min, but not 90 min, across tests.

Conclusions: An OST is more repeatable when assessing IR in ponies than basal values/ratios. Both resting hyperinsulinaemia and insulin responses to oral sugar can be assessed with the OST, which increases the likelihood of accurately diagnosing IR. Blood sampling at 90 min post feeding is recommended for more consistent results.

Ethical animal research: The experimental protocol was approved by the Animal Ethics Committee of the University of Queensland (SVS/QUT/109/13/QUT). Sources of funding: This study was funded by Queensland University of Technology. Competing interests: None.
SOAKED-HAY: IT’S NOT ALL SWEETNESS – MASS MATTERS!

McG Argo, C., Dugdale, A.H.A. and McGowan, C.M.
University of Liverpool, UK.
Email: c.m.argo@liverpool.ac.uk

Reasons for performing study: Soaked grass hays are recommended for the nutritional-management of equine metabolic syndrome (EMS). Forage provision is commonly restricted to promote weight-loss and insulin-sensitivity. When EMS animals were fed hay at ~1.25% body mass (BM) as daily dry matter (DM) (presoaking) animals lost weight at 1.1% of outset BM weekly. This doubled weight-losses recorded when horses were fed fresh/un-soaked hay to the same level [1].

Objectives: To compare the composition and digestibility of fresh/soaked grass hays to improve nutritional-guidance for the management of EMS.

Study design: Following 6 weeks of dietary restriction to 1.25%BM as hay-DM, 6/12 horses which had participated in an earlier study [2], were used to determine the digestibility of the soaked (n = 3) and fresh (n = 3) hays.

Methods: Samples of fresh grass-hay (n = 6) and hay from the same batch which had been water-soaked overnight (16 h, n = 6) or by day (7 h, n = 6) were dried for the measurement of DM content, pooled and ground. Nutrient and gross energy (GE) compositions were determined by proximate analyses. Animals were fed hay as 2 daily meals. Soaked-hay was equal-parts long/short-soaked. Apparent digestibilities were determined after total faecal collection for 72 h.

Results: Soaking hay; did not alter GE (17.6 MJ/kg DM), increased acid detergent fibre (ADF) (30–35%), neutral detergent fibre (NDF) (68–74%) and crude protein (CP, 8.4–10.6%), decreased water soluble carbohydrate (WSC, 18.2–12.2%), and mineral contents (5.7–4.2%). Digestibilities of GE, DM, ash, NDF and WSC were unaltered by soaking. Conversely, soaking increased CP (55.6–66.8%) and ADF (37.5–50%) digestibility. However, hay-soaking elicits un-quantified losses of DM. Previous studies report hay ADF and CP as ‘water-insoluble’. When DM losses were retrospectively calculated from the ADF and CP content of fresh and soaked-hays, daily DM provision decreased from 1.25 to 1.14%. Consequently DE decreased by 25% (119.5–89.7 kj/kg BM/day).

Conclusions: Dry matter losses from hay-soaking have marked impacts on energy/nutrient provision and increase the severity of dietary restriction.

Ethical animal research: The study was approved by the University of Liverpool, Veterinary Research Ethics Committee. Owners gave informed consent for their horses’ inclusion in the study. Sources of funding: Personal research account. Competing interests: None.

References

‘RIDING THE ROLLEROASTER’: VETERINARY EXPERIENCES OF MANAGING LAMINITIS IN PRACTICE

1Scantlebury, C.E., ²Perkins, E., ³McGowan, C., ¹Pinchbeck, G.L., ¹Christley, R.M. and ¹Archer, D.C.
¹Department of Epidemiology and Population Health, School of Veterinary Science, University of Liverpool, Leahurst Campus, CH64 7TE, UK; ²Health Services Research Department, Institute of Psychology Health and Society, University of Liverpool, UK.
Email: claire.scantlebury@liv.ac.uk

Reasons for performing study: Little is reported about the successes and challenges experienced by veterinary surgeons while managing cases of laminitis. Such information could enhance the effectiveness of communication of management and preventive health strategies for laminitis.

Objectives: To explore veterinary surgeons’ experiences of dealing with laminitis and examine how veterinary–client communication influences the treatment and management of cases.

Study design: Focus group discussions conducted among first-opinion equine veterinary surgeons.

Methods: First-opinion ambulatory veterinary practices from Cheshire (n = 15), Lancashire (n = 14) and the Rutland region (n = 14) were identified. Letters of invitation were sent and all practices were telephoned to invite veterinary surgeons to participate in the study. Key questions relating to laminitis were explored within semi-structured focus group discussions: veterinary perceptions of laminitis information, reasons for horse-owners’ seeking veterinary advice, veterinary perceptions of horse-owners’ knowledge, attitudes and practices, situations where the advice of other professionals may be sought. All discussions were recorded and transcribed verbatim. A thematic analysis was conducted using NVivo software.

Results: Three focus group discussions were held with veterinary surgeons with a range of experience; 2 in the North West (9 vets) and one in Rutland (4 vets). Emerging themes relating to veterinary surgeons’ experience of dealing with laminitis included; veterinary–client communication, challenges faced by vets, managing clients perceptions and expectations, client recognition and management of laminitis, feeding and obesity management, issues of compliance, causes of laminitis, strategies to prevent laminitis, diagnosing, treating and prognosticating in laminitis cases, sources of veterinary information and collaboration with other professionals.

Conclusions: The findings illustrate key features of the veterinary–client relationship in supporting owners through the variable course of this disease. This study demonstrates the complexity of issues that veterinary surgeons may encounter when managing cases of laminitis and communicating healthcare messages to the client.

Ethical animal research: This project was approved by the University of Liverpool Ethics Committee. Sources of funding: The authors gratefully acknowledge support and funding from the BVA Animal Welfare Foundation charitable trust. Competing interests: None.
TRANSCRANIAL ELECTRICAL STIMULATION (TES) AS A POSSIBLE NOVEL ALTERNATIVE TO TRANSCRANIAL MAGNETIC STIMULATION (TMS) TO ASSESS THE MOTOR FUNCTION OF THE SPINAL CORD FOR CLINICAL DIAGNOSIS IN HORSES

Journée, S.L., Delesalle, C.J.G., de Bruijn, C.M., Bergmann, W. and Journée, H.L.

Equine Diagnostics, Burdaard, The Netherlands; Ghent University, Faculty of Veterinary Medicine, Department of Large Animal Internal Medicine, Belgium; Wolvega Equine Clinic, Wolvega, The Netherlands; Department of Pathobiology, Faculty of Veterinary Medicine, Utrecht University, The Netherlands; University Medical Center, Department of Neurosurgery, Groningen, The Netherlands.

Email: sjournee@hotmail.com

Reasons for performing study: To introduce and assess the feasibility of multipulse transcranial electrical stimulation (TES) in horses.

Objectives: To assess latency times of muscular motor evoked potentials (MEP) in the m. extensor carpi radialis (ECR) and the m. tibialis cranialis (TC), elicited by transcranially applied multipulse stimulation in 12 healthy horses.

Study design: Prospective observational study applied in 12 healthy horses.

Methods: Horses with a mean age of 11.0 (range 3.6–20.5) years and a height of 160 (s.d. 10.0) cm were studied. Horses were sedated with detomidin (1.5 μg/kg bwt) and butorphanol (1.5 μg/kg bwt) i.v. Subcutaneous ring block with lidocaine 2% + adrenaline was placed on the forehead. TES was performed using biphasic high frequency multipulse voltage trains (pulse width: 0.1 ms, interpulse interval: 1.3 ms, 3 pulses/train) applied to 2 subcutaneous needle electrodes bilateral from the centre of the forehead. Latency times (30 V above motor threshold) and amplitude of MEP were recorded bilaterally at the ECR and the TC muscles. Motor latency times are expressed as mean ± s.d.

Results: Mean latency times (at MT + 30 V) for the ECR muscles were respectively 20.18 ± 1.85 ms (left side) and 19.7 ± 1.69 ms (right side) and for the TC muscles respectively: 34.6 ± 2.01 ms (left) and 34.9 ± 2.43 ms (right).

Conclusions: TES is well tolerated. Interestingly, recorded motor latency times at the level of front and hind legs appear to be shorter for TES when compared to TMS from literature data [1].

Ethical animal research: Ethical approval was granted by the animal ethics committee of the Groningen University. Sources of funding: J5 Center and Wolvega Equine Clinic. Competing interests: None.

Reference


PREVALENCE OF OSSEOUS PATHOLOGY IN THE ARTICULAR PROCESS ARTICULATIONS IN THE EQUINE CERVICAL AND CRANIAL THORACIC VERTEBRAE

Rombach, N., Stubbs, N.C. and Clayton, H.M.

Department of Large Animal Clinical Sciences, College of Veterinary Medicine, Michigan State University, East Lansing, Michigan 48910, USA.

Email: office@equinenergy.com

Reasons for performing study: Osteoarthritis (OA) of the articular processes (APs) is recognised as a clinical condition in the equine cervical spine, but there is little information on the prevalence and distribution of OA in the APs of the cervical and cranial thoracic vertebrae.

Objectives: To determine the prevalence and distribution of OA in the APs of the equine cervical and cranial thoracic vertebrae in relation to vertebral level, age and size of the horse and side of the neck.

Study design: A post mortem longitudinal randomised study of 53 horses.

Hypotheses: OA is more prevalent and more severe in the APs of the cervicothoracic junction, the prevalence and severity of OA increases with horse age and size, and OA is equally distributed on left and right sides.

Methods: The cervical (C1–C7) and cranial thoracic (T1–T7) vertebrae of 53 horses were removed at necropsy and boiled out. Based on the size (percentage) of the joint margin that was affected, OA of the 4 APs of each vertebra was graded on a scale of 0 (no osseous lesions) to 3 (severe osseous lesions). Based on these grades, a 3-factor ANOVA was used to test the random effects of horse, age (young, old) and size (small, large), and the fixed factors of side (left, right) and vertebral level (C1 to T7).

Results: OA lesions were most severe in the mid-cervical vertebrae (C3–C4) followed by the cervicothoracic curvature (C5–T1). Severity of OA increased with age and size of the horse but there was no difference between left and right sides.

Conclusions: OA is symmetrically present with higher severity in the mid-cervical and cervicothoracic regions and with higher prevalence in older and larger horses. These factors support bilateral injections in specific APs for clinical treatment of OA in the equine cervical spine.

Ethical animal research: Approval for this study was obtained under Institutional Animal Care and Use Committee number 02-11/020-00. Explicit owner informed consent for participation in this study was not stated but general permission for post mortem examination was given.

Sources of funding: Supported by the CVM Endowed Research Funds and the McPhail Endowment at Michigan State University. Competing interests: None.

LATERO-OBLIQUE RADIOGRAPHY AS A DIAGNOSTIC TOOL FOR EQUINE CERVICAL OSTEOARTHRITIS

Tambaschi, M., Dunkel, B., Mullard, J., Wood, R., Piercy, R.J. and Weller, R.

Royal Veterinary College, North Mymms, Hertfordshire, UK.

Email: mtambaschi@rvc.ac.uk

Reasons for performing study: Equine cervical osteoarthritis is a common disease known to contribute to both neck pain and cervical vertebral compressive myelopathy. There are no published studies demonstrating the usefulness of latero-oblique radiography as a diagnostic tool for cervical osteoarthrits.
Objectives: To determine the sensitivity, specificity and positive and negative predictive values of latero-oblique radiography as a diagnostic tool for cervical articular process joint osteoarthritis.

Study design: Prospective cadaver study.

Methods: Latero-oblique radiographs and CT images were collected, and post mortem examinations performed, on 27 cadaver necks from Thoroughbred-type horses of various ages and sexes. Two equine clinicians independently reviewed each set of images for the presence of osteoarthritis. The authors, under the guidance of a veterinary pathologist, reviewed all articular process joints for bony changes indicative of osteoarthritis.

Results: The prevalence of osteoarthritis identified on CT images was 57.9% (Assessor A) and 23% (Assessor B). The prevalence of lesions identified on post mortem examination was 25.6%. Latero-oblique radiography showed a low sensitivity for identifying osteoarthritis when compared to both CT imaging (6.3–16.1%) and post mortem examination (2.2–4.4%). However, it showed a high specificity when compared to both CT imaging and post mortem examination (92.1–97.8%) and (87.2–95.0%). The positive predictive value for identifying osteoarthritis was moderate (40.9%–78.8%) when compared to CT imaging and low (4.2–18.2%) when compared to post mortem examination. The negative predictive value was moderate when compared to both CT imaging (42.9–76.3%) and post mortem examination (78.0–79.8%).

Conclusions: Latero-oblique radiography has low sensitivity, but high specificity for the detection of cervical osteoarthritis when compared to both CT imaging and post mortem examination. Further investigation comparing the sensitivity, specificity and positive and negative predictive values of latero-oblique radiography vs. laterolateral radiography would determine whether taking latero-oblique radiographs, which can be more difficult to obtain and interpret, is necessary for the diagnosis of cervical osteoarthritis in practice.

Ethical animal research: Ethical committee oversight not currently required by this congress: The study was performed on material obtained from an abattoir. Sources of funding: None. Competing interests: None.

CERVICAL COMPUTED TOMOGRAPHY (CT) AND CT MYELOGRAPHY IN LIVE HORSES: 16 CASES

1Kristoffersen, M., 2Puchalski, S., 3Skog, S. and 4Lindegaard, C.
2Evidensia Equine Hospital Helsingborg, SE-25023 Helsingborg, Sweden; 3Wellington, Florida, USA
Email: mads.kristoffersen@me.com

Reasons for performing study: Cervical spine lesions are often suspected in horses with neurological signs, abnormal head/neck position and obscure forelimb lameness. Computed tomography (CT) has the potential to image the cervical spine in 3 dimensions in superior anatomical detail; e.g. lesions that cause compression of the spinal cord and nerve roots, small fragments, and osteoarthritis of the articular process joints may be more easily detected.

Objectives: To investigate if CT and CT myelography of the entire cervical spine is possible in horses, describe the technique used, the type of horses and distribution of cervical lesions detected.

Study design: Retrospective case series.

Methods: Horses undergoing cervical CT and CT myelography from June 2013 to February 2014 were reviewed. The horses were anaesthetised in left lateral recumbency using continuous intravenous anaesthesia. A Philips Brilliance Big Bore 16 slice scanner and a custom made equine CT table (Solving, Finland) were used.

Results: Cervical CT was performed on 16 horses, 11 of which also had CT myelography: 12 Warmblood, 2 ponies, 1 Standardbred and 1 Paint Horse. Horses ranged in age from 1 to 21 years, and in weight from 406 to 670 kg. Presenting complaints were: neurological symptoms (n = 8), abnormal head/neck position (n = 5), forelimb lameness (n = 4), Horners syndrome (n = 1). In all cases (n = 16) the cervical spine from the skull to C7 could be imaged, in 3 cases T1 was imaged and in one case T3. Significant lesions were detected in 14 horses. The sites of the most significant lesions were: C4–C5 (n = 3), C5–C6 (n = 2), C6–C7 (n = 5) and C7–T1 (n = 2), cervical stenosis C5–T2 (n = 1) and muscle injury (n = 1). Length of anaesthesia ranged from 35 to 70 min (median 60 min), with one complicated recovery.

Conclusions: Cervical CT and CT myelography can be performed in large adult horses. CT may be the future gold standard to evaluate equine cervical lesions. Further studies are needed.

Ethical animal research: Ethical committee oversight not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated. Sources of funding: None. Competing interests: None.

COMPARISON AND CLINICAL APPLICATION OF CT AND MRI FOR EVALUATION OF THE EQUINE CRANIAL NERVES

Dixon, J., Lam, R., Weller, R., Smith, M. and Piercy, R.J.
Equine Referral Hospital, Department of Clinical Sciences and Services, Royal Veterinary College, London, UK.
Email: jjdixon@rvc.ac.uk

Reasons for performing study: Advanced imaging modalities enable assessment of the equine skull and brain. Horses are susceptible to neurological dysfunction of the cranial nerves; however, our understanding of these structures imaging anatomy is limited.

Hypothesis: Magnetic resonance imaging (MRI) will be superior to computed tomography (CT) for the identification of cranial nerves, but optimal assessment may depend on both modalities.

Objectives: Identify cranial nerves and compare and contrast the utility of MRI and CT images of cadaver and clinical material. Interpret images from both modalities and determine the cranial nerve imaging anatomy.

Study design: Prospective cadaver anatomical study combined with retrospective clinical case study.

Methods: The head of a neurologically normal 9-year-old Thoroughbred gelding was scanned immediately following euthanasia (performed for reasons unrelated to this study). High resolution MRI (1.5 Tesla) and CT examinations were conducted over a 12 h interval following euthanasia. Images obtained were compared with selected clinical cases which were scanned during anaesthesia (MRI; approximately 30–60 min) or standing sedation (CT; approximately 30 s).

Results: On a high resolution MRI scan of a cadaver equine skull, each of the 12 cranial nerves and their topographic location was readily appreciated. Cranial nerves 1, 2, 3, 5, 7 and 8 were more easily identified in clinically relevant MRI scans. CT allowed visualisation of the stylomastoid foramen, the inner and middle ear and cranial nerves 2, 3, 5 and 7.

Conclusions: High field MRI allows for excellent visualisation of equine cranial nerves. CT allows for detailed visualisation of the osseous canals and foramina. This study advances anatomical knowledge of the normal equine cranial nerves to aid interpretation in horses that display neurological dysfunction localising to the brain and brainstem.

Ethical animal research: Horse owners gave their consent for their animals to be included in the study. Sources of funding: Institutional. Competing interests: None.
THE PREVALENCE OF OCULAR DISEASES IN ARABIAN HORSES IN POLAND

1Paschalis-Trela, K., 1Cywińska, A., 1Witkowski, L., 1Czopowicz, M., 1Trela, J. and 1Kita, J.
1Laboratory of Veterinary Epidemiology and Economics, 1Department of Pathology and Veterinary Diagnostics, Faculty of Veterinary Medicine, Warsaw University of Life Sciences, Poland; 1Veterinary Medical Teaching Hospital, School of Veterinary Medicine, University of California, Davis, USA.

Email: anna.cywinska@sggw.pl

Reasons for performing study: Ocular diseases in horses often require long-lasting and costly therapies. Without proper treatment they may lead to partial or full blindness, excluding horses from intended use, and thus pose a serious veterinary and economic problem.

Objectives: No epidemiological data on equine ocular pathologies in Poland was available. The aim of this study was to evaluate their type and prevalence in pure-bred Arabian horses.

Study design: The study involved 615 horses (15% of Arabian population) bred and owned by 3 Arabian state stud farms in Poland. All horses underwent standard clinical and ophthalmic examination and medical history from the previous 5 years was analysed.

Methods: The medical history was based on the data from farms’ veterinary archives in the stables and epidemiological interview given by the resident veterinarian. Every horse underwent general clinical and ophthalmic examination.

Results: The prevalence of ocular diseases was 9.8% (95% CI: 7.7–12.4%). The following pathologies were diagnosed: equine recurrent uveitis (ERU) – prevalence of 5.5% (95% CI: 4.0–7.6%), non-ERU related cataract – 3.3% (95% CI: 1.9–4.7%), post traumatic lesions – 0.8% (95% CI: 0.4–1.9%), glaucoma – one case. Seven horses had one nonvisual eye, one was bilaterally blind.

Conclusions: Equine recurrent uveitis was the most common ocular disease in this Polish population of Arabian horses. Its prevalence is lower than usually reported in Europe (8–10%) and in the United States (8–25%). However, severe ocular pathologies were observed confirming that they remain an important clinical problem.

Ethical animal research: The study was approved by the Local Ethics Committee. Explicit owner informed consent for participation in this study was not stated. Sources of funding: The research was supported by a grant from National Science Centre on the basis of the decision No DEC-2011/03/B/NZ6/04682. Competing interests: None.

A RETROSPECTIVE STUDY ON EQUINE HERPESVIRUS-1 ASSOCIATED MYELOENCEPHALOPATHY IN FRANCE (2008–2011)

1Yan Galen, G., 1Leblond, A., 1Tritz, P., 1Martinelle, L., 1Pronost, S. and 1Saegerman, C.
1Research Unit of Epidemiology and Risk Analysis applied to Veterinary Science (UREAR-ULg), Department of Infectious and Parasitic Diseases, Faculty of Veterinary Medicine, University of Liege, Belgium; 1UR 346 Animal Epidemiology INRA Theix, Vetagroup, Equine Department, University of Lyon, France; 1Réseau d’Épidémio-Surveillance en Pathologie Equine (RESPÉ), Mondeville, France; 1Veterinary Clinic of Faulquemont, France; 1Frank Duncombe Laboratory, Caen, France; 1Normandie Université, Unité Risques Microbiens (U2RM), 14000 Caen, France.

*Current address: Large Animal Clinic, Internal Medicine and Surgery, Faculty of Health and Medical Sciences, University of Copenhagen, Højkøgegaard Allé 5, 2630 Tastrap, Denmark.

Email: gaby@equinespecialists.eu or gaby@sund.ku.dk

Reasons for performing study: Diagnosis of equine herpesvirus-1 associated myeloencephalopathy (EHM) can be troublesome, but early recognition and knowledge of risk factors are primordial for prevention and control.

Objectives: 1) Improvement of early clinical recognition, and 2) identification of factors potentially of importance for spread.

Study design: Retrospective descriptive study of EHM cases and statistical comparison to acutely neurologically affected horses negative for EHM.

Methods: Files from a French epidemiosurveillance programme for equine infectious neurological diseases (2008–2011) were reviewed. Cases were considered EHM (n = 26) based on presence of acute neurological signs and laboratory confirmation. Cases were considered control cases (n = 29) when reported to be suffering from acute neurological diseases, but negative for EHM. A subgroup of controls was created that excluded cases with peripheral neuromuscular diseases (n = 21). Univariate and multivariate analysis and classification and regression tree analysis between groups were performed to identify diagnostic markers and risk factors.

Results: EHM had a fatality rate of 46% and occurred often in isolated cases. They frequently showed ataxia, paresis and cauda equina affection, but the clinical picture was variable. Univariate analysis identified the following variables as more associated to EHM than to control groups: new horse introduced in herd, vaccination, cauda equina affection, larger herd size, and saddle horses. In the multivariate analysis, new horse introduced in herd and cauda equina affection could be retained. CART analyses identified herd size, month of occurrence, new horse introduced in herd and cauda equina affection as main predictors for EHM.

Conclusions: Isolated EHM cases occur frequently, accentuating the diagnostic difficulty. History and clinical examination of acutely neurologically affected horses can potentially improve early recognition of EHM. Risk factors were in accordance with other studies, although in a different geographic location and study setup, and therefore strengthen their importance for spread of EHM.

Acknowledgements: Christel Marcillaud-Pitel and Charlène Daix are gratefully acknowledged for their help with data collection.

Ethical animal research: Ethical committee oversight not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated. Sources of funding: RESPE. Competing interests: None.
SALES CONSIGNMENT AND NASAL SHEDDING OF EQUINE HERPESVIRUS-1 (EHV-1) AND 4 (EHV-4) IN YOUNG THOROUGHBRED HORSES IN SOUTH AFRICA

1Badenhorst, M., 2Page, P.C., 1Ganswindt, A., 1Guthrie, A.J. and 1Schulman, M.L.
1Equine Research Centre; 2Department of Companion Animal Clinical Studies, 1Endocrine Research Laboratory, Department of Anatomy and Physiology; and 5Section of Reproduction, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Ondersteport, 0110, South Africa.
Email: marcha.badenhorst@up.ac.za

Reasons for performing study: Commingling of horses from various populations, together with stress associated with transport and confinement at a sales complex, may predispose horses to EHV-1 and -4 shedding and transmission. Current information on the prevalence and associated risk factors of EHV-1 and -4 in South Africa is limited. Relevant research could enhance scientific-based risk management strategies for horses attending sales events.

Objectives: Detect nasal shedding of EHV-1 and -4 at a sales event. Identify the temporal pattern of viral shedding. Investigate the association between clinical signs and EHV-1 and -4 shedding. Identify risk factors for EHV-1 and -4 shedding and transmission.

Study design: Prospective cohort study.

Methods: Data was collected over a 9 day period during August 2013 at the National Two Year Old Sales in Germiston, South Africa. The study population included 90 Thoroughbreds (51 colts, 39 fillies) in their second year of life that originated from 8 studs situated in 3 provinces. Nasal swabs were collected from each horse on arrival and on departure from the event. During their stay horses were monitored twice daily for pyrexia and once daily for nasal discharge. Nasal swabs were collected daily from the event. During their stay horses were monitored twice daily for pyrexia and once daily for nasal discharge. Nasal swabs were collected daily from any horse with nasal discharge and/or pyrexia. Nasal swabs were submitted for qPCR to detect EHV-1 and -4.

Results: No EHV-1 shedding was detected; however, 14.4% of the population shed EHV-4. A biphasic shedding pattern with peaks one day post arrival and on the first day of auction was observed. Pyrexia, with or without nasal discharge, was observed prior to first shedding in 61.5% of EHV-4-positive horses. Province, associated longer travel duration and smaller resident horse populations on farms of origin were associated with increased risk of EHV-4 shedding.

Conclusions: Young Thoroughbreds consigned to a South African sale shed EHV-4. Pyrexia proved useful to identify impending EHV-4 shedding.

Ethical animal research: The study was approved by the Animal Ethics Committee (AEC) of the University of Pretoria (Study V040-13). Informed, written consent for participation was obtained from the owners of each of the studs included in the study.

Sources of funding: Funding for this study was provided by Racing South Africa and the Departments of Companion Animal Clinical Studies and Production Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria. Competing interests: None.

EHV-5 ASSOCIATED WITH RESPIRATORY DISEASE IN A SURVEY OF ALPHA- AND GAMMAHERPESVIRUSES IN 409 AUSTRALIAN HORSES

El-Hage, C.M., Mekuria, Z.H., Hartley, C.A. and Gilkerson, J.R.
Equine Infectious Diseases Laboratory, Faculty of Veterinary Science, The University of Melbourne, Victoria 3010, Australia.
Email: cmeh@unimelb.edu.au

Reasons for performing study: To determine the prevalence of EHV-1, -2, -4 and -5 in respiratory samples from a large number of horses using quantitative PCR methods. Samples from horses with, and without mild signs of respiratory disease provided an opportunity to examine associations with single or multiple herpesviral infections.

Objectives: To determine any correlation between quantitative detection of these equine herpesviruses and mild clinical respiratory disease in horses.

Methods: Nasal swabs were taken from horses with, and without, clinical respiratory disease. Nucleic acid was extracted from all swabs prior to PCR testing for EHV-1, -2, -4 and -5. Clinical signs of respiratory disease included coughing, fever (temperature >38.5°C) or nasal discharge.

Results: Of the 409 horses, 250 (61%) were clinically normal, 121 (30%) presented with clinical signs consistent with mild respiratory disease and 38 (9%) horses had no traceable clinical history. One-fifth (83/409) of horses sampled were infected with EHV-2 and almost two-thirds 249/409 (60.9%) with EHV-5. Infection with EHV-5 was significantly associated with mild respiratory disease (85/121; 70.2%) compared to nondiseased horses (137/249; 55%) P = 0.005. The proportion of EHV-2 infected horses, however, did not differ significantly between those in the diseased (18/121) and nondiseased (61/250) groups. Too few horses were detected with alphaherpesviruses to determine any association with clinical signs of disease. Mean nasal shedding loads of herpesviruses were not significantly different between diseased and nondiseased horses.

Conclusions: There was a significant association between horses displaying clinical signs of mild respiratory disease and infection with EHV-5, however, no such association was evident for neither horses with EHV-2 nor the alphaherpesviruses EHV-1 and -4. The clinical significance of respiratory gammaherpesvirus infections in horses remains yet to be determined; however, these findings add to the mounting body of evidence incriminating EHV-5 in association with equine respiratory disease.

Acknowledgements: The authors are grateful to veterinarians and animal health staff who took samples. Garry Anderson provided valued and erudite statistical assistance.

Ethical animal research: Ethical committee oversight not currently required by this congress: the study was performed on archived material collected for the Victorian Department of Environment and Primary Industries’ Equine Influenza surveillance programme. Explicit owner informed consent for participation in this study was not stated.

Sources of funding: Special Virology Fund at the University of Melbourne and the Chief Veterinary Officer’s unit DEPI Victoria. Competing interests: None.
DEVELOPMENT AND EFFICACY OF THE RECOMBINANT CANARYPOX-BASED EQUINE INFLUENZA (EI) VACCINE UPDATED ACCORDING TO THE LAST OIE EXPERT SURVEILLANCE PANEL RECOMMENDATIONS

1Paillot, R., 1Lemaitre, L., 1Dancer, A., 1Thibault, J-C. and 1Minke, J.
1Animal Health Trust, Newmarket, UK; 1Merial SAS.
Email: romain.paillot@aht.org.uk

Reasons for performing study: Since 2010, the OIE expert surveillance panel (ESP) recommends that EI vaccines contain representative equine influenza virus (EIV) strains from the Florida clade 1 and 2 sub-lineages for optimal protection against EIV currently circulating worldwide. To date, no EI vaccine commercially available in the EU meets this recommendation.

Objectives: This report summarises the development process of a fully updated recombinant canarypox-based EI vaccine, including clinical efficacy results against EIV strain A/eq/Richmond/1/07.

Study design: The EI vaccine ProteeqFlu containing 2 recombinant canarypox viruses expressing the haemagglutinin of EIV strains was updated by replacing the A/eq/Newmarket/2/93 strain with the A/eq/Richmond/1/07 isolate (Florida clade 2 sub-lineage) and keeping A/eq/Ohio/03 (Florida clade 1 sub-lineage), to meet the last OIE recommendations. The updated EI vaccine was tested for efficacy in the Welsh mountain pony model.

Methods: The mode of action, production steps and efficacy of the updated EI vaccine will be presented. Efficacy was tested in a group of 7 ponies vaccinated twice, 5 weeks apart. Protective antibody response were measured and challenged by experimental infection with the A/eq/Richmond/1/07 EIV strain. Clinical signs of disease and virus shedding were compared with control unvaccinated ponies (n = 7).

Results: Significant protection was measured in vaccinated ponies, which supports the vaccine registration.

Conclusions: The recombinant canarypox-based EI vaccine was already the first EI vaccine to meet the 2004 OIE ESP recommendations and was successfully used in Australia during the 2007 EI outbreak. This new version will be the first fully updated EI vaccine available in the EU, which will help to minimise the increasing risk of vaccine breakdown due to constant EIV evolution through antigenic drift. EI vaccination remains one of the most effective tools to prevent or limit the impact of EI, as clearly illustrated by the limited frequency and scale of EI outbreaks.

Ethical animal research: All animal work received ethical approval.

Sources of funding: The study was funded by Merial SAS.

Competing interests: R.P. reports no conflict of interest. L.L., A.D., J.L.T. and J.M. are employed by the study sponsor.

INVESTIGATION OF EQUINE ENCEPHALITIS CASES DURING THE WEST NILE VIRUS (WNV) EPIDEMICS IN GREECE

1Diakakis, N., 1Chaintoutis, S.C., 1Bouzalas, I., 1Breilou, G.D., 1Vlemmas, I., 1Papanastassopoulou, M. and 1Dovas, C.I.
1Equine Unit, Companion Animal Clinic, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, 11 StavrouVoutyra str., 54627, Thessaloniki, Greece; 1Laboratory of Microbiology and Infectious Diseases, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, University Campus, 54124, Thessaloniki, Greece; 1Laboratory of Pathology, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, 11 StavrouVoutyra str., 54627, Thessaloniki, Greece.
Email: Diakakis@vet.auth.gr

Reasons for performing study: Clinopathological and laboratory investigation of horses showing severe neurological signs during the 2010 WNV-lineage 2 human epidemic in Central Macedonia (Northern Greece). Implementation of preventive measures was also addressed.

Objectives: To describe the clinical signs, supportive treatment and outcome in WNV cases and report the use of an inactivated WNV vaccine used for the protection of horses during the following epidemic periods.

Study design: Clinical study.

Methods: Laboratory testing included serology, real-time RT-PCR and histopathology. All affected animals received supportive treatment (furosemide, dexamethasone, B-complex vitamins and NSAIDs). The Equip WNV vaccine was used for immunisation of horses.

Results: WNV-specific IgM antibodies were detected in 17 horses with neurological signs. The specificity of the detected antibodies was confirmed by seroneutralisation tests. The maximum duration of IgM was determined to be 60 days. Clinical signs included weakness of hindlimbs, ataxia and tremors (17/17), altered mental state (10/17), hypersensitivity (7/17), inability to swallow (3/17), recumbency (3/17) and convulsions (3/17). Supportive treatment was successful in 14/17 horses. The 3 recumbent horses died as a result of the infection, or were subjected to euthanasia. Histopathological findings observed in the CNS were mild perivascular cuffing of mononuclear cells, axonal swelling, glial nodules, microhaemorrhages and neuronal necrosis. None of the vaccinated horses showed clinical signs. Three unvaccinated horses showed clinical signs and developed WNV-specific IgM antibodies.

Conclusions: The Nea Santa-Greece-lineage 2 strain responsible for the massive human epidemic of 2010 was also highly pathogenic for horses. Timely administration of supportive treatment is important to the prognosis of the cases. WNV infection should be included in the differential diagnosis of horses with encephalitis in Greece. Vaccinations can effectively protect horses, especially in areas of Greece where the virus seems to have become endemic.

Ethical animal research: All owners gave their consent prior to the commencement of the study.

Sources of funding: Funding for this project came from Zoetis.

Competing interests: None.
**Abstracts**

**DURATION OF TETANUS IgG TITRES FOLLOWING BASIC IMMUNISATION OF HORSES**

†Kendall, A., †Domeij, K., †Gånheim, A. and †Bergström, K.  †Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Palmerston North, New Zealand; †The Equine Clinic Bollerup, Tomelilla, Sweden; †National Veterinary Institute, Uppsala, Sweden.  Email: a.t.kendall@massey.ac.nz

**Reasons for performing study:** Recommendations for prophylactic vaccination against tetanus in horses vary greatly between countries and have scarce scientific support in the peer-reviewed literature. In human medicine, recommended booster vaccination intervals are also very variable, but are considerably longer than for horses.

**Objectives:** To investigate if the duration of antibody titres previously determined to be protective against tetanus are likely to be longer than indicated by several recommended vaccination intervals for horses.

**Study design:** Prospective clinical trial.

**Methods:** Thirty-four horses were enrolled for basic immunisation with an ISCOM Matrix-combination vaccine (Equilis® Prequenza TE). Horses received the first vaccination at 5–11 months of age, and the second dose 4 weeks later. A third vaccine dose was given 15–17 months after the second dose. Serum tetanus antibody titres were analysed by ToBI ELISA 2 weeks as well as 14–16 months after the second dose. After the third vaccine dose, titres were checked once yearly for 3 years.

**Results:** Two weeks after the second dose all horses (34/34) had antibody levels that exceeded 0.03 iu/ml. After 16 months the levels were below 0.03 iu/ml in 5/33 horses. After the third vaccine dose antibody levels remained above 0.03 iu/ml in 25/26 horses for 1 year, 17/17 horses for 2 years, and 9/9 horses for 3 years.

**Conclusions:** Horses that undergo basic immunisation with 3 doses of vaccine after the age of 6 months are likely to have serum antibody titres consistent with protection against tetanus for more than 3 years.

**Ethical animal research:** This study was approved by the Uppsala Ethical Committee on Animal Experiments and informed owner’s consent was obtained prior to enrolment of horses. **Sources of funding:** This study was funded by the Intervet Research Foundation. **Competing interests:** None.

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**VACCINATION WITH VIRUS-LIKE PARTICLES INDUCES LONG LASTING PROTECTION FROM EXPERIMENTALLY INDUCED SARCOID-LIKE TUMOURS IN HORSES**

†Hainisch, E.K., †Harnacker, J., †Shafti-Keramat, S., †Kimbauer, R. and †Brandt, S.  †Research Group Oncology (RGO), Equine Clinic, Veterinary University Vienna, Austria; †Laboratory of Viral Oncology (LVO), Division of Immunology, Allergy and Infective Diseases (DIAID), Department of Dermatology, Medical University Vienna, Austria.  Email: edmund.hainisch@vetmeduni.ac.at

**Reasons for performing study:** We have already demonstrated that vaccination with empty BPV1 capsules termed virus-like particles (VLP) protects horses from experimental infection with BPV1 virion. Long-term monitoring of antibody titres in experimental horses and data from other species suggest that this protection is long lasting.

**Objectives:** To test protection against experimental infection with BPV1 virion in horses that were vaccinated with BPV1 L1 VLP approximately 5 years earlier.

**Study design:** Controlled experiment.

**Methods:** Seven horses, vaccinated 3 times (boosters after 4 weeks and 6 months) in 2007/2008 with doses of BPV1 L1 VLP ranging from 50 μg to 150 μg/dose and 3 unvaccinated control horses were challenged by intra-dermal inoculation with cow wart derived BPV1 virion (5 x 10² BPV1 virions per wheal, 10 wheals per horse). Inoculation sites were monitored for 10 weeks. Blood for serum antibody titre determination by pseudovirion neutralisation assay was taken on the day of challenge and after 6 months.

**Results:** Six of 7 vaccinated horses had measurable serum antibody titres (1:50 to 1:400). These titres were boosted by inoculation (about one step of dilution). Two of 3 unvaccinated controls remained sero-negative. One control horse showed sero-conversion. All control horses developed tumours at all 10 inoculation sites. Tumours appeared approximately 2...
weeks after inoculation and reached maximum sizes of up to 8 mm. Regression was complete by 8 weeks after their first appearance in all horses. All vaccinated horses remained completely free from tumours. No influence of dose rate or antibody titre on the level of protection could be determined.

Conclusions: BPV-1 L1 VLP vaccination proves to be fully effective in protecting horses from experimental infection and tumour formation 5 years post immunisation. The protection was complete even in horses with low or unmeasurable antibody titres. This is another step towards establishing a vaccination against equine sarcoids.

Ethical animal research: This experiment was approved by the institutional ethics committee and the national authority under license No: GZ: 68.205/0144-II/3b/2012. Sources of funding: Veterinary University Vienna, Austrian Research Fund (FWF). Competing interests: None.

IS LUTEAL BLOOD FLOW A USEFUL INDICATOR OF MARE SUITABILITY AS A RECIPIENT IN AN EMBRYO TRANSFER PROGRAMME?
†Brogan, P.T., †van Nieuwenhuisen, J., †Necchi, D., †Stout, T.A.E. and ‡de Ruijter-Villani, M.
Departments of 'Equine Sciences and †Farm Animal Health, Faculty of Veterinary Medicine, Yoleiaan 114, 3584 CM Utrecht, The Netherlands. Email: p.t.brogan@uu.nl

Reasons for performing the study: Embryo transfer (ET) is an increasingly common component of commercial sport-horse breeding. While many variables affect the success of ET, optimal selection of recipient mares is essential. Ideally, adequate corpus luteum (CL) function would be evaluated by measuring plasma progesterone (P4) concentrations (≥2.0 ng/ml). In practice however, P4 is rarely measured because it would increase costs, and there is a delay to obtaining a result. Colour-flow Doppler sonographic (CF) has been described as a rapid means of assessing CL function because luteal blood flow correlates with circulating P4 concentrations.

Objectives: To use CF to assess luteal blood flow at the time of ET in recipient mares, and assess its relationship to P4 concentrations and pregnancy outcome.

Study design: Cohort study.

Methods: Fifty-eight Day 8 horse embryos were transferred as part of a commercial programme. B-mode and CF sonographic examinations were performed immediately prior to ET (ET+0), and blood was collected to measure plasma P4. Measurements were repeated at 4, 11, 18 and 25 days after ET in pregnant mares. Mares scanned not pregnant at Day 4 were re-checked 2 days later. The CF image of each CL was frozen at peak total area of flow, and repeated 3 times. The cross-sectional area (corrected for presence of lacunae) and the total area of colour pixels within the CL were analysed using ImageJ software.

Results: Plasma P4 correlated positively (P<0.05) with area of colour pixels (range r = 0.40–0.55) and total CL area (range r = 0.41–0.51) at all time-points. None of plasma P4, CL area, or CF pixel area were predictive of pregnancy outcome.

Conclusions: CL blood flow is not predictive of pregnancy outcome but should help identify mares with an inadequate CL and not therefore suitable for receiving an embryo.

Ethical animal research: Data collected during procedures performed as part of routine management. Explicit owner informed consent not stated. Sources of funding: Institutional owner research funding. Competing interests: None.

LIGATION IN CASTRATION OF THE MALE HORSE USING A TA-30 STAPLER
Riemersma, D.J.
Pferdepraxis Den Heyberg, Im Auwelt 45, 47624 Kevelaer, Germany. Email: pkheyborg@aol.com

Reasons for performing the study: Most complications in equine castrations result from insufficient ligation and contamination.

Objectives: Stapling instruments reduce tissue handling, decrease surgical time, minimise contamination and provide secure visceral and vascular closure when used correctly. Using a stapler device might therefore increase ligation security and decrease contamination, and by this, reduce the complication rate seen in routine castration.

Study design: The applicability and safety of a TA-30 premium stapler as a ligation method in castration of the horse was tested in 15 horses under
general anaesthesia in dorsal recumbency. Three horses were cryptorchids, one horse suffered a scirrhus chord, and one horse suffered an infectious orchitis.

Methods: The vaginal process was approached inguinally. A noncutting emasculator was applied to compress the closed vaginal process. Consecutively a TA-30 Premium stapler was applied to the compressed site. The distal part of the vaginal process was then removed, the stapler device was released and the incision was closed. The TA-30 stapler accommodates 3 different staple cartridges of 30 mm width, accommodating 1.0 to 2.5 mm tissue thickness. The thickness of the vaginal process after compression was measured to be 1.0 mm (0.9–1.1 mm) in 10 fresh specimens. The 30-V3 cartridges (triple row, 1 mm closed diameter) were chosen in 9 horses with smaller vaginal processes and the 30.3 cartridge (double row 1.5 mm closed diameter) in 6 other horses with larger vaginal processes.

Results: All horses recovered without intra- or post operative complications.

Conclusions: A TA-30 stapler is a safe ligation instrument in equine castrations. The use of titanium staples may reduce infection rate in routine castrations, even more in ligation of precontaminated vaginal processes in cases of post operative haemorrhage control after practice castrations or in closing the vaginal process after the removal of an infected testis or scirrhus chord.

Ethical animal research: Ethical committee oversight not currently required by this congress: procedures were performed as part of clinical investigations. Explicit owner informed consent for participation in this study was not stated. Sources of funding: None. Competing interests: None.

ASSOCIATION BETWEEN ‘WIND-TEST’ FINDINGS AND RESTING ENDOSCOPIC ASSESSMENT OF LARYNGEAL FUNCTION AT THOROUGHBRED PUBLIC AUCTION IN THE UK

Palmer, L. and Ramzan, P
Rossdale and Partners, Beaufort Cottage Stables, High Street,
Newmarket, Suffolk, UK.
Email: lorraine.palmer@rossdales.com

Reasons for performing study: Despite ongoing advances in diagnostic imaging, ‘wind-testing’ remains the most common screening test for upper respiratory tract obstructions and is an important condition of sale at Thoroughbred public auctions in UK/Europe. Correlations between abnormal respiratory noise and resting laryngeal function have been incompletely investigated to date.

Objectives: To determine whether associations exist between respiratory noise at lunge and subsequent diagnosis of recurrent laryngeal neuropathy (RLN).

Study design: Retrospective analysis of records for all post sale wind-testing undertaken by a single veterinary practice at Tattersalls Newmarket yearling, breeze-up and horse-in-training sales between 2009 and 2013.

Methods: Descriptions of abnormal respiratory noise were categorised as ‘inspiratory whistle’, ‘inspiratory harsh’ or ‘pan-respiratory harsh’, and included lunge direction during which noise was evident. Concurrent examination by 2 veterinary surgeons was a criterion for inclusion of cases. All horses making abnormal respiratory noises underwent resting endoscopy with a consensus score (Lane scale) given for laryngeal function.

Results: 2972 horses underwent post sale wind-testing and 418 horses (14.1%) underwent resting endoscopic examination due to abnormal respiratory noise. Likelihood of making an abnormal respiratory noise differed significantly between groups (yearlings 10.8%, ‘breeze-up’ 2-year-olds 20.6%, horses-in-training 30.1%). Yearlings were significantly more likely (P<0.0001, Chi-squared/Bonferroni test) to make a ‘harsh’ respiratory noise than horses-in-training. Type of noise (whistle) was significantly associated with resting endoscopic evidence of RLN in yearlings (P = 0.009); specificity of ‘whistle’ for RLN in this group was 38.6%. There was no association between lunge direction noise (left, right or both) and RLN.

Conclusions: These results support the widespread belief that harsh respiratory noise when lunged of presumed ‘palatal/pharyngeal’ origin is more likely in yearlings than horses-in-training, possibly due to upper respiratory inflammation or immaturity. Inspiratory whistle in both lunge directions is no stronger an indicator of RLN than unidirectional whistle.

Ethical animal research: Ethical committee oversight not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated. Sources of funding: None. Competing interests: None.

USE OF LARYNGEAL COMPUTED TOMOGRAPHY FOR NONINVASIVE ASSESSMENT OF LARYNGEAL FUNCTION IN HORSES WITH RECURRENT LARYNGEAL NEUROPATHY

Tulloch, L.K., Piercy, R.J., Troester, S., Carruthers, R., Tast, V., Grimes, L. and Perkins, J.D.
The Royal Veterinary College, Hawkshead Lane, North Mymms, Hatfield, Hertfordshire, AL9 7TA, UK.
Email: ltulloch@rvc.ac.uk

Reasons for performing study: Recurrent laryngeal neuropathy (RLN) is a common equine distal axonopathy associated with neurogenic atrophy of intrinsic laryngeal muscles. The term RLN is widely used but the condition is not fully understood. Non-invasive methods of assessing structure that correlates with RLN are necessary.

Methods: A retrospective study of clinical records. Horses with RLN from 2001-2013 were identified. Laryngeal CT scans were performed at 0.5-1.0 mm intervals. Measurements of muscle thickness and tissue density were made. Results: 30 horses were selected. 18 horses were included in the study: 4 grade A, 5 grade B, 6 grade C, 3 grade D, 2 grade E and 2 grade F. CT morphology was significantly associated with % collagen/fat and tissue density in RLN. CT measurements of left CAD muscles were significantly (P<0.05) smaller left CAD muscles and reduced nerve fibre density than right in horses with RLN.

Conclusions: CAD muscles and nerve morphology correlated with laryngeal function.

Ethical animal research: Ethical committee oversight not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated. Sources of funding: None. Competing interests: None.
DIMENSIONS OF 65 EXTRACTED EQUINE FIRST PREMOLAR (WOLF) TEETH

Hole, S.L.1, Manfredi, J.M. and Clayton, H.M.1
Pool House Equine Clinic, Crown Inn Farm, Lichfield, Staffordshire, UK; 1Large Animal Clinical Sciences Department, College of Veterinary Medicine, Michigan State University, East Lansing, Michigan, USA; 1Sport Horse Science, LC, 3145 Sandhill Road, Mason, Michigan, USA.

Ethical animal research: Ethical committee oversight not currently required by this congress: material was collected as part of clinical procedures. Explicit owner informed consent for participation in this study was not stated. Sources of funding: None. Competing interests: None.

RESULTS:

Dimensions expressed as median (range) were total length: 21 (12–34) mm; root length: 13.2 (0–19.6) mm; crown height 7 (2–20) mm; and crown width 7 (2.6–16) mm. Root length was longer than crown height in 61/65 teeth. Total length was poorly correlated with crown height (r = 0.443) but had a good correlation with root length (r = 0.799). Crown height and crown width were poorly correlated with root length (r = -0.093 and r = 0.463), respectively.

Conclusions: The dimensions of 65 first premolar teeth indicate that the root is usually longer than the crown but that the dimensions of the clinical crown of the tooth do not provide a good estimate of the length of the root.

HOW DO STUDENTS APPROACH LAMENESS? A CASE STUDY

Starke, S.D., Pfau, T. and May, S.A.
The Royal Veterinary College, Department of Clinical Science and Services, Hatfield, Hertfordshire, AL9 7TA, UK.

Email: sstarker@rvc.ac.uk

Reasons for performing study: The relationship between pelvic hindlimb lameness pointers remains unclear.

Objectives: To examine sacrum and tubera coxae (TC) based movement asymmetry across different lameness degrees, patterns and changes in pelvic rotation.

Study design: Parameter regression and rigid body model.
dedicated more time to looking at limb movement, while the experienced cohort focused on head and pelvis movement. Students judged their expected task performance realistically, on average underestimating themselves slightly by around 8%. The task difficulty was rated as a mean (s.d.) of 4.10 (0.48) out of 5 by the inexperienced and 3.35 (0.47) by the experienced cohort.

Conclusions: Lameness detection skills evolve and improve over the course of the curriculum, with a shift from limb assessment to upper body assessment. Students must learn to reliably determine soundness, and hindlimb lameness proved more difficult than forelimb lameness. Students find lameness detection comparatively difficult, but have a realistic understanding of their skill level, suggesting that they can determine their needs for further practice.

Ethical animal research: No animals were used in the study. Video recordings were selected from the archive of R.K. Smith collected during clinical investigations. Explicit owner informed consent for participation in this study was not stated. Sources of funding: S.D. Starke’s PhD was funded by the Mellon Trust via the Royal Veterinary College. Competing interests: None.

COMPREHENSIVE PROTEIN PROFILING OF SYNOVIAL FLUID IN OSTEOARTHRITIS

‡Peffers, M., ‡Riggs, C., †McDermott, B. and †Clegg, P.
†Institute of Ageing and Chronic Disease, University of Liverpool, Liverpool, UK; ‡Hong Kong Jockey Club, Hong Kong.

Email: peffs@liv.ac.uk

Reasons for performing study: Synovial fluid (SF) is located in joint cavities, tendon sheaths and bursae. In joints it comprises a serum filtrate with additional contributions from articular cartilage, synovium and bone. It represents a potential source of disease specific proteins that could aid in the understanding of the pathogenesis of joint disease and be used in the early diagnosis of disease.

Objectives: To comprehensively profile the protein complement of SF in health and osteoarthritis (OA) using liquid chromatography mass spectrometry (LC-MS/MS) and identify potential OA biomarkers.

Study design: SF was used from the metacarpophalangeal joints of 9 normal and 9 OA Thoroughbred horses following macroscopic, microscopic and synovitis scoring.

Methods: Samples were analysed with LC-MS/MS using a NanoAcquity LC coupled to a LTQ Orbitrap Velos. ProgenesisTM LC-MS software was used for label-free quantification with data searched using Mascot in the Ensembl database for horse. Adjusted ANOVA values of P<0.05 and regulation of >2-fold were regarded as significant.

Results: 754 proteins were identified in SF. Thus Proteominer™ beads concentrated the lower abundance proteins enabling the most comprehensive SF proteome to date. Proteins identified included those relating to matrix proteins, inflammatory factors, complement activation proteins and proteases. A subset of 10 proteins was identified which were differentially expressed in OA SF.

Conclusions: A number of proteins were identified for the first time in SF which may be involved in the pathogenesis of OA. We identified a distinct set of proteins that may act as potential biomarkers to distinguish between normal and OA joints. S100-A10, a calcium binding protein has upregulated in OA. This may have a role in the synthesis and activation of matrix degrading proteases. CD109 is a TGF-β co-receptor, released from the chondrocyte cell surface that inhibits TGF-β signalling. Its contribution to the disregulation of TGF-β is unknown.

Ethical animal research: Ethical committee oversight not currently required by this congress: the study was performed on material collected during post mortem examination. Explicit owner informed consent for participation in this study was not stated. Sources of funding: Horserace Betting Levy Board, Wellcome Trust. Competing interests: None.

VALIDATION OF A TECHNIQUE FOR MEASURING MUSCLE PROTEIN SYNTHESIS IN VIVO IN THE HORSE

†Naylor, R.J., †Smith, K., †Blake, V., †Rankin, D., †Atherton, P. and †Piercy, R.J.
†Royal Veterinary College, London, UK; †University of Nottingham, Derby, UK.

Email: maylor@rvc.ac.uk

Reasons for performing the study: Measurement of incorporation of stable isotope-containing amino acids into muscle is the gold-standard technique for measuring muscle protein synthesis (MPS), but its use in horses has not been evaluated.

Objectives: 1) To establish a technique for measuring MPS in vivo in the horse using a labelled amino acid tracer and 2) to determine basal MPS in the horse using this technique.

Methods: Three mature Thoroughbred geldings received 0.1 mg/kg bw D5-phenylalanine (D5-Phe) i.v. and plasma D5-Phe enrichment was measured over 3 h. Pharmacokinetic modelling determined the rate of appearance and phenylalanine pool size, from which a loading dose and infusion rate that would achieve a steady 5–10% plasma enrichment were calculated. Subsequently, steady-state was confirmed by measuring plasma enrichment during 6 h of infusion and the effect of treadmill exercise and sedation (0.4 mg/kg bw) were also determined. Horses subsequently received the calculated D5-Phe infusion rate and skeletal muscle biopsy samples were collected after 1 and 3 h, allowing basal MPS to be calculated. Precursor intramuscular phe labelling was measured by GC-MS and tracer phe incorporation into muscle myofibrillar protein was determined using GC-pyrolysis-IRMS to calculate fractional synthetic rate.

Results: The mean rate of whole body phenylalanine appearance in the horse was 56 μmol/kg bw/h (s.d. 24) and mean phenylalanine pool size 41 μmol/kg bw (s.d. 8). From this a priming dose of 3.3 μmol/kg bw and an infusion rate of 4.5 μmol/kg bw/h D5-Phenylalanine was calculated and subsequently confirmed to achieve steady state tracer enrichment from 5.6–9.1 APE in sedentary horses. Exercise caused a transitory, and sedation a more prolonged reduction in plasma enrichment (up to 20%). D5-Phe incorporation revealed a basal FSR of 0.029%/h (s.d. 0.013) in the horse.

Conclusions: D5-Phenylalanine is a suitable amino acid tracer for measurement of MPS in the horse yielding rates of MPS in line with other large mammals.

Ethical animal research: The study was performed with local Ethics Committee approval and Home Office project license (PPL 70/7523) under the UK A(SP)A Act 1986. Sources of funding: This work was generously funded by Boehringer Ingelheim. Competing interests: None.

THE RELATIONSHIP BETWEEN FOOT CONFORMATION, FOOT PLACEMENT AND MOTION SYMMETRY IN THE EQUINE HINDLIMB

The Royal Veterinary College, Hawkshead Lane, North Mymms, Hatfield, Hertfordshire, AL9 7TA, UK.

Email: ragass@rvc.ac.uk

Reasons for performing study: The relationships between hind foot conformation, placement and motion symmetry in the equine hindlimb are poorly defined. Little research has been carried out into the potential
interactions between these variables despite the commonality of hindlimb lameness in sports and leisure horses.

**Objectives:** To determine hind foot placement and describe the relationships between hind foot conformation, placement and motion symmetry.

**Study design:** Observational study.

**Methods:** Overall foot placement of 43 horses was determined from simultaneous orthogonal filming at walk and trot, foot conformation was measured from digital photographs and motion symmetry data was collected using horse mounted inertial sensors.

**Results:** Left and right hind foot conformation differed significantly (P = 0.001–0.036). Foot placement was not significantly different between left and right feet, despite these conformational differences. Foot placement was significantly different between walk and trot (P<0.001). Lateral heel landing was the most common landing pattern observed at walk (55.8%) and trot (43.12%). Lateral and lateral toe landings were more common at trot, though relatively uncommon at both gaits. Foot conformation was significantly associated with motion symmetry (P=0.001–0.007) and with placement at trot (P = 0.002–0.005) but not walk.

**Conclusions:** Hind feet land preferentially laterally and heel first at both the walk and trot. Foot conformation appeared to be associated with landing patterns at the trot but not walk. Foot conformation was also associated with motion symmetry, although it is difficult to say whether conformation affects symmetry or vice versa. Multiple factors contribute to equine locomotion, foot conformation, landing patterns and the maintenance of orthopaedic health.

**Ethical animal research:** This study was granted approval by the Royal Veterinary College Ethics Committee. Informed consent was obtained from all owners involved. **Sources of funding:** None. **Competing interests:** None.

### THE EFFECT OF HINDLIMB STUDS ON MOVEMENT SYMMETRY IN HORSES DURING LUNGEING

**Sharp, H., Pfau, T. and Hopkins, S.**
The Royal Veterinary College, Hawkshead Lane, North Mymms, Hatfield, Hertfordshire, UK.

**Email:** hsrsharp@rvc.ac.uk

**Reasons for performing study:** Horseshoe studs are commonly used to increase traction between the foot and the ground in competition horses. Here we investigate the question of how hindlimb studs alter limb function by quantifying upper body kinematics during circular motion (lungeing).

**Objectives:** This study quantified the effects of studs placed in the hind shoes on head and pelvic movement symmetry parameters commonly used for objective assessment of lameness.

**Study design:** Prospective longitudinal interventional study.

**Methods:** 15 horses were trotted on the straight and lunged on left and right circles on turf with/without a pair of studs in both hind shoes. Movement symmetry was assessed using inertial sensors mounted on poll, os sacrum and left and right tuber coxae. To eliminate the influence of the number of left/right asymmetrical horses in the sample, symmetry values were standardised to show left fore and/or right hind asymmetry on the straight. Differences in standardised head and pelvic symmetry index (SI) with and without studs were calculated and paired t tests were used to compare SI values with and without studs on the straight and on both reins.

**Results:** Use of studs resulted in a significant difference (P = 0.02) in pelvic SI on the right lunge only but no difference for straight line and left lunge (both P>0.05). No significant difference was found for head movement symmetry (all P>0.05).

**Conclusions:** Pelvic movement was altered with the ‘weaker’ right hindlimb (based on the calculation of standardised SI values) on the inside of the circle creating an increased ‘hip hike’. In general, horses showed increased limb angles and lower peak vertical force with the inside limb; our kinematic results show that this effect is exacerbated with studs. Future studies should investigate whether this ‘intervention’ is of diagnostic potential in sub-clinically hindlimb lame horses.

**Acknowledgements:** The authors would like to thank the owners and trainers whose horses were used in this study.

**Ethical animal research:** The Royal Veterinary College Ethics and Welfare Committee approved this study and all procedures were performed with informed owner consent. **Sources of funding:** Funding was provided by The Royal Veterinary College for Harriet Sharp and Sophie Hopkins’ research projects. **Competing interests:** None.

### THE RELATIONSHIP BETWEEN WORKING EQUIDS AND WOMEN IN DEVELOPING COUNTRIES

**Upjohn, M. and Valette, D.**
The Brooke, 5th Floor, Friars Bridge Court, 41-45 Blackfriars Road, London, SE1 8NZ, UK.

**Email:** Melissa.upjohn@thebrooke.org

**Reasons for performing study:** There are approximately 100 million working equids in developing countries worldwide. These animals’ role in impoverished communities is generally unrecognised by national and international policy makers and their needs are overlooked in national animal health systems. Additionally, despite increased international development attention on women and livestock, the specific contributions of equids to poor women’s lives are also unquantified and overlooked.

**Objectives:** This study aimed to document the relationship between working equids and women in equine owning communities in Ethiopia, India, Kenya and Pakistan.

**Study design:** Qualitative semi-structured focus group discussions elicited opinions from small groups of women (up to 12/group) in selected rural and peri-urban areas in each country.

**Methods:** An experienced local language-speaking community facilitator guided each discussion using a standardised questionnaire based on UK Department for International Development sustainable livelihoods framework asset categories. Women’s experiences of working equids’ roles in their lives were audio-recorded, transcribed in local language and key themes summarised in English.

**Results:** Twenty-two discussions (7 in India, 5 each in Ethiopia, Kenya and Pakistan) comprising 259 women took place between February and October 2013. When asked to rank their livestock, all 12 groups in India and Kenya and 17 out of 22 groups overall ranked equids most important, due to their income generation and contribution to household chores, including transporting feedstuffs and water for other livestock species. Whilst specific responsibilities varied between communities, women reported undertaking many equine husbandry activities but lacked access to equine-specific knowledge and skills training.

**Conclusions:** The study findings can inform development of targeted training interventions for female working equid owners and users. Further work is required to quantify the contribution to livelihoods of working equids in developing countries to underpin engagement with government stakeholders on the benefit of providing for their needs in animal health and welfare systems.

**Ethical animal research:** Not applicable, no animals were involved in this study. **Sources of funding:** The Brooke UK. **Competing interests:** None.
SYSTEMATIC REVIEW OF RISK FACTORS FOR EQUINE COLIC

School of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington, Loughborough, Leicestershire LE12 5RD, UK.
Email: sxvx1l1@exmail.nottingham.ac.uk

Reasons for performing the study: There are several epidemiological studies that have reported on risk factors for colic, this data has not been systematically reviewed.

Objectives: To systematically review the current evidence on risk factors for colic in the horse.

Study design: Systematic review in compliance with PRISMA guidelines.

Methods: The primary literature search was conducted in CAB Winner of Voorjaarsdagen Award 2014 (1910–2012), Web of Science (1950–2012) and MEDLINE (1946–2012) (between 23–26 November 2012), using the following terms: (horses OR horse OR equine OR equines OR equus OR equidae OR equids OR equid) AND colic. Publications were assessed independently against inclusion criteria (peer-reviewed articles relating to risk, causes, aetiology or predictors of colic) and exclusion criteria (nongastrointestinal or specific conditions, <3 cases) by LC and SF. Those selected were reviewed using a specifically developed quality assessment criteria (QAC) scoring system. Articles were ranked according to the QAC with those scoring greater than a specific critical threshold considered to be of the highest level of evidence.

Results: The search identified 1385 publications; 90 related to risk factors, 36 met the inclusion criteria and were assessed using the QAC selected were reviewed using a specifically developed quality assessment system. Articles were ranked according to the QAC with those scoring greater than a specific critical threshold considered to be of the highest level of evidence.

Conclusions: Evidence for many risk factors is weak and inconsistent, with a variety of confounders and interactions across the studies. There is strong evidence for age, breed, management changes and recent clinical history as risk factors.

Ethical animal research: The study was reviewed and approved by the School of Veterinary Medicine and Science, University of Nottingham Ethics Committee. Sources of funding: Laila Curtis was funded by the School of Veterinary Medicine and Science, University of Nottingham.

Competing interests: None.

EQUINE GRASS SICKNESS IN SCOTLAND: A CASE–CONTROL STUDY OF ENVIRONMENTAL GEOCHEMICAL RISK FACTORS

1*Wylie, C.E., 1Shaw, D.J., 1Fordyce, F.M., 1Lilly, A. and 1McGorum, B.C.
1Royal (Dick) School of Veterinary Studies and The Roslin Institute, Easter Bush Veterinary Centre, The University of Edinburgh, Roslin, EH25 9RG, UK; 2British Geological Survey, West Mains Road, Edinburgh, EH9 3LA, UK; 3James Hutton Institute, Craigiebuckler, Aberdeen, AB15 8QH, UK. 4*Current address: Rossdales Equine Hospital, Cotton End Road, Exning, Newmarket, Suffolk, CB8 7NN, UK.
Email: Claire.wylie@rossdales.com

Reasons for performing study: Epidemiological investigations suggest that soil macro- and micro-nutrients may be a trigger for the occurrence of equine grass sickness (EGS). However, there is limited information regarding relationships between exposure to geochemical elements and the occurrence of EGS.

Objectives: To determine whether the geographical distribution of EGS cases referred to the Royal (Dick) School of Veterinary Studies was associated with the presence or absence of particular geochemical elements in the environment.

Study design: A retrospective time-matched case–control study.

Methods: 455 EGS geo-referenced cases were identified between 1 January 1990 and 1 June 2006. Each case had 2 time-matched geo-referenced controls (n = 910). For study purposes, cases or controls originating outwith Scotland were excluded. Environmental concentrations of a range of elements, most with known biological function, were collated from 2 geochemical point datasets and spatially extrapolated giving continuous cover across Scotland: the British Geological Survey (BGS) Geochemical Baseline Survey of the Environment (G-BASE) stream sediment dataset and the James Hutton Institute (JHI), National Soil Inventory of Scotland (NSIS). Data were analysed using multivariable conditional logistic regression.

Results: Statistically significant associations were obtained between the distribution of EGS cases and (i) higher environmental levels of Ca, K, Na, Se and Ti, and (ii) lower environmental levels of Al, Cd, Co, Cr, Cu, Ni and Pb. This study identified no association between EGS cases and the environmental concentrations of Ba, Fe, Mg, Mn, P or Sr.

Conclusions: A number of statistically significant associations were identified between EGS cases and element concentrations in the spatially extrapolated stream sediment and soil data. This information will assist future studies on the aetiology of EGS, with further research suggested to focus on those identified significant associations with greatest biological plausibility such as reduced levels of Cu and Zn, and higher levels of K and Se.

Ethical animal research: Informed client consent was obtained for the use of clinical records. Sources of funding: Part-funded by The BGS University Funding Initiative. A.L. is funded by the Scottish Government’s Rural and Environment Science and Analytical Services Division. C.E.W. is supported by The Margaret Giffen Trust. F.F. is funded by the Natural Environment Research Council (NERC). Competing interests: None.

IDENTIFYING A CRITICAL CASE OF EQUINE COLIC AT PRIMARY EXAMINATION – RESULTS FROM A PROSPECTIVE MULTI-CENTRE STUDY

School of Veterinary Medicine and Science, University of Nottingham, College Road, Sutton Bonington, Loughborough, Leicestershire LE12 5RD, UK.
Email: svyjt@exmail.nottingham.ac.uk

Reasons for performing study: There is no current evidence on how mild and critical cases of colic can be differentiated at primary examination. Previous research has focused on clinical variables assessed post referral.

Objectives: To identify features of the primary clinical presentation which differentiate between a critical and mild-medical colic.

Study design: Prospective multi-centre cross-sectional study.

Methods: Paper-based and online questionnaires were distributed to 850 practices which treat horses, to collect data on the primary presentation of colic cases over 13 months. Critical cases were defined as horses which died, were subjected to euthanasia, had surgery, or required intensive care. Mild-medical cases were defined as those resolving with medical treatment on a single visit. Descriptive analysis was used to evaluate the data. Univariable analysis was performed using Mann-Whitney U tests and
Chi-squared tests to assess the degree of association between clinical variables and the dependant variables ‘critical’ and ‘mild-medical’.

**Results:** 161 veterinarians submitted 1048 colic case forms; 240 critical cases and 535 mild-medical cases were identified. There was evidence of difference (P<0.0001) for cardiovascular variables (heart and respiratory rates, capillary refill time, and mucous membrane colour), signs of pain and abdominal borborygmi between mild-medical and critical cases. Critical cases had a higher mean heart rate (60 beats/min [range 21–125]) than mild-medical cases (42 beats/min [range 18–120]). The median total abdominal borborygmi score was lower at 3 (range 0–12) for critical, compared with 7 (range 0–12) for mild-medical cases. The use of diagnostic tests were significantly different (P<0.0001), with more tests performed in critical cases. Rectal examination and nasogastric intubation were not performed in 17.5% and 52.6% of critical cases, respectively.

**Conclusions:** There were significant differences in the primary presentation of critical and mild-medical colic cases. Veterinary surgeons’ diagnostic approach varied between cases.

**Ethical animal research:** The study was reviewed and approved by the School of Veterinary Medicine and Science, University of Nottingham Ethics Committee. Explicit owner informed consent for participation in this study was not stated. **Sources of funding:** This study was funded by a grant from the Grayson-Jockey Club Research Foundation.

**Competing interests:** The manufacturers of Gastrozol (GZ), Abgard (AG) and BOVA (BO) have previously funded research by B.W. Sykes. None of the companies contributed to the present study.

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**THE CHANGING COSTS OF HOSPITAL TREATMENT FOR COLIC: A PRELIMINARY AUDIT**

**Objectives:** This study investigated how the costs of treatment for equine colic at a single university referral hospital have changed over a 10-year period between 2003 and 2013. The aim was to analyse which costs have changed excessively or disproportionately between different treating services, consumables and professional fees, which may render treatment of colic financially prohibitive.

**Study design:** Retrospective study.

**Methods:** All charges billed against cases undergoing treatment for colic between 2003 and 2013 were accessed from hospital records. Horses were identified as having surgery or purely medical management. Charges were categorised by service (medicine, surgery, anaesthesia), type (consumable, livery, professional fee), and consumable type (e.g. NSAID, opiate, antibiotic, fluid therapy, lab fee, surgery consumables).

**Results:** There was a significant association between year and the frequency of medically and surgically treated colic (Chi-square test, P<0.001). Between 2003 and 2012, median total treatment costs increased in both medically (42%) and surgically treated (46%) cases. Costs attributable to consumables increased (surgical cases 28%, medical cases 14%), while those attributable to livery (surgical -19%, medical -21%) and professional fees decreased (surgical -22%, medical -8%). The greatest increase in consumable cost was attributable to fluids (surgical 94%, medical 182%).

**Conclusions:** This study demonstrates areas where the cost of colic treatment are disproportionately changing and thus highlights potential targets where business models may be optimised in the interest of patient survival. The substantial increase in costs attributable to fluids correlates with increasing emphasis on fluid therapy in the management of colic.

**Ethical animal research:** Ethical committee oversight not currently required by this congress: retrospective study of clinical records. Explicit owner informed consent for participation in this study was not stated. **Sources of funding:** Not stated. **Competing interests:** None.
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A POTENTIAL NOVEL ANTHelmINTIC? THE CYSTEINE PROTEASES SHOW POTENT ANTHelmINTIC ACTIVITY AGAINST CYATHOSTOMINS IN VITRO

1Peachey, L., 1Matthews, J., 1Pinchbeck, G., 1Behnke, J., 2Burden, F. and 1Hodgkinson, J.
1University of Liverpool, Liverpool, UK; 2Moredun Research Institute, Penicuik, UK;
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Reasons for performing study: Anthelmintic resistance is a global problem and constitutes a major threat to the welfare of equids worldwide. The cyathostomes are the most numerous and pathogenic gastrointestinal nematode (GIN) of equids in the developed world. Cyathostomins show widespread resistance to 2 out of 3 of the major classes of anthelmintic and recently there are reports of reduced efficacy to the potent macrocyclic lactones (MLs). None of the 3 novel classes of anthelmintic that have emerged in the last decade are licensed for use in equids. The cysteine proteases (CPs) are plant proteins that have shown potent activity against GINs in vivo in sheep and pigs.

Objectives: This study aimed to evaluate the anthelmintic effect of the CP papain on cyathostomins in vitro using the egg hatch assay (EHA) and larval migration inhibition test (LMIT).

Methods: Samples of cyathostomin eggs and third stage larvae were collected and cultured from a population of equids that have recently shown reduced ML efficacy in vivo. The EHA and LMIT were performed on repeated samples with increasing concentrations of papain. Dose–response curves were plotted and PROBIT analysis performed on the data to give EC-50 values (concentration that gives 50% of the maximal response).

Results: Papain caused a dose dependent inhibition of both egg hatch and larval migration. The EC-50 values were 2 μmol/l and 100 μmol/l in the EHA and LMIT respectively, indicating a more potent effect on egg hatch.

Conclusions: The CP papain shows potent anthelmintic activity against cyathostomins in vitro. Good evidence of anthelmintic effect against GINs in other host species is supportive of its potential use in equids. Further work is indicated to evaluate safety and in vivo efficacy.

Ethical animal research: The study was approved by the University of Liverpool and Donkey Sanctuary Ethics Committee. Explicit owner informed consent for participation in this study was not stated. Sources of funding: The Donkey Sanctuary, Sidmouth, UK.

Email: peach14@liv.ac.uk

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TOPOICAL OPHTHALMIC ATROPINE IN HORSES – AN EXPERIMENTAL STUDY

Ström, L., Dalin, F., Domberg, M., Haubro Andersen, P. and Ekesten, B.
Department of Clinical Sciences, Faculty of Veterinary Medicine and Animal Science, Swedish University of Agricultural Sciences, PO Box 7054, SE-750 07 Uppsala, Sweden.

Email: lena.strom@slu.se

Reasons for performing study: Topical administration of atropine is an important part of the treatment of equine uveitis. However, very high doses of topically administered atropine have been associated with decreased gut motility and colic in horses.

Objectives: To evaluate systemic effects of topical atropine in doses used clinically in horses, with emphasis on gut motility and ability to induce colic.

Study design: Randomised, blinded, controlled crossover study.

Methods: Four horses received placebo eye drops (saline) and 2 different protocols of topical atropine administration during 120 h with 35 days washout periods in between different treatments. One drop of 1% atropine solution was administered unilaterally at 3 h intervals for 48 h and at 12-h intervals for another 72 h (high dose), whereas the low dose group was given alternating treatment with atropine and saline according to the same protocol. In the placebo group, saline was administered at 3 h intervals for 48 h and at 12 h intervals for another 72 h. All horses were walked for 10 min 3 times a day. Pupillary light reflexes, heart rate, respiratory rate, gut sounds and clinical signs of abdominal pain were monitored every 3 h and faecal output once daily.

Results: None of the horses showed any signs of abdominal pain. Gut sounds were present at every auscultation in all horses. Gut sound scores were significantly lower during the high dose regime (P = 0.0007) compared to placebo, but not during the low dose regime (P = 0.17).

Conclusions: Topically administered atropine in clinically relevant doses temporarily reduced gut motility, but did not cause ileus or colic in healthy horses receiving a small amount of daily exercise. However, this effect may be additive to other factors that reduce gut motility in horses with uveitis, such as pain and stress in relation to hospitalisation.

Ethical animal research: The regional Ethical Committee (Uppsala Djurförsöksöverdomstols nämnd, Sweden, Dnr C372/12) approved the use of the horses in this study. Sources of funding: None. Competing interests: None.

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CAN REAL-TIME TISSUE ELASTOGRAPHY BE USED TO ASSESS THE HEALING PROCESS OF INJURED SUPERFICIAL DIGITAL FLEXOR TENDON IN HORSES?

1Tamura, N., 1Asano, H. and 1Kasahima, Y.
1Equine Research Institute, Japan Racing Association, 321-4, Tokami-cho, Utsunomiya, Tochigi, Japan; 2Rehabilitation Research Center, Japan Racing Association, 71, Uenohara, Jobashiratori, Iwaki, Fukushima, Japan.

Email: tamura@center.equinist.go.jp

Reasons for performing study: Real-time tissue elastography (RTE) can provide objective information associated with mechanical properties of tendon tissue and add value to the structural information obtained by greyscale ultrasound. Serial RTE assessment would be useful for monitoring and optimising safe rehabilitation for horses with tendon injury.

Objectives: To test the hypothesis that RTE could measure change in tissue stiffness in the healing process of injured superficial digital flexor tendon (SDFT) of horses.

Study design: Prospective field study.

Methods: Six Thoroughbred horses with SDFT injury and standardised rehabilitation were used. Both greyscale and RTE images were recorded approximately every 4 weeks up to 40 weeks from occurrence. Greyscale ratio (GR: dividing the grey-value of injured area by it of surrounding noninjured area) and strain ratio (SR: dividing the strain value of stand-off gel pad, which can be a standard, by it of injured area) was calculated at each examination. Tissue strain is displayed by colour which suggests hard (blue), intermediate (yellow), soft (red) on RTE image. Strain of injured area was evaluated by colour-scale grade (CSG) of 1 to 3 (1: blue to green, 2; yellow and 3; red) by 3 veterinarians who didn’t know the case history.

Results: GR was returned to nearly 1 quickly within 8 weeks and it was unchanged thereafter. This continuous change of GR was best-fitted to logarithmic trendline (r² = 0.66). SR increased gradually up to the last examination and was best-fitted to linear trendline (r² = 0.89). CSG was decreased gradually and it was best-fitted to linear trendline (r² = 0.84). Both change of SR and CSG suggested that an injured tissue would gradually increase in stiffness.

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Conclusions: RTE could provide useful information regarding monitoring and optimising restoration of the tissue stiffness of tendon, even if GR was unchanged by progress of scar formation, for safer and more effective rehabilitation.

Ethical animal research: All animal procedures were approved by the Ethics Committee for Laboratory Animals of the Japan Racing Association Equine Research Institute. Explicit owner informed consent for participation in this study was not stated. Sources of funding: Japan Racing Association Equine Research Institute. Competing interests: None.

ULTRA-HIGH FIELD MRI CLINICAL ANATOMY OF THE EQUINE FETLOCK TO AID CLINICAL IMAGE INTERPRETATION

Al Mohamad, Z.A., Voute, L.C. and Marshall, J.F. Weipers Centre Equine Hospital, School of Veterinary Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, 464 Bearsden Road, Glasgow, G61 1QH, Scotland, UK. Email: z.al-mohamad.1@research.gla.ac.uk

Reasons for performing study: Interpretation of clinical diagnostic imaging of the equine musculoskeletal system requires accurate reference anatomical materials. In the case of MRI, this includes images acquired from low and high field systems. Using ultra-high field MRI, higher resolution images with small slice thickness and gap suitable for reconstruction in any anatomical plane can be produced.

Objectives: To describe the normal equine metacarpophalangeal joint using ultra-high field MRI and compare ultra-high and high field MR images.

Study design: Limbs (n = 14) from horses (n = 5) with no history of orthopaedic disease were frozen at -20°C until imaging. Fetlock joints were scanned using an ultra-high field (7T) MRI unit. T1 (280 slices, thickness = 0.356 mm) and T2 (140 slices, thickness = 0.713 mm) weighted sequences were acquired. Limbs were scanned using a 1.5T MRI unit in transverse, sagittal, and dorsal planes using T1 (60 slices, thickness 2.2–3.5 mm) and T2 (60 slices, thickness 2.2–3.5 mm) sequences. Images were analysed using OsiriX software.

Results: Ultra-high field MR images visualised the fine detail of trabecular and subchondral bone, the articular cartilage surface of P1 and McIII, the short, oblique, straight and oblique sesamoidean ligaments including origins and insertions, the fasicular structure of superficial digital flexor tendon, deep digital flexor tendon and ligaments and the regional neurovascular structures. Whilst T1 high field images visualised the majority of tissues, structural detail was reduced compared to ultra-high field imaging; margins were less well defined in some instances, e.g. articular cartilage, and a number of smaller structures were indistinct, e.g. short and cruciate sesamoidean ligaments.

Conclusions: 7T MRI produced images of the fetlock with excellent anatomical detail. Future publication of open-source ultra-high field MRI files could aid the interpretation of 0.3T and 1.5T field MR images, especially with the capacity to reconstruct image slices orientated exactly to match those of interest.

Ethical animal research: The study was approved by the Ethics Committee of the School of Veterinary and Life Sciences, University of Glasgow. Explicit owner informed consent for participation in this study was not stated but permission was given for post mortem examination and the use of materials in research. Sources of funding: The Royal Saudi Arabia Cultural Bureau. Competing interests: None.

USE OF STANDING MRI AND A NEW MRI GRADING SYSTEM OF THE SUBCHONDRAL BONE OF THE DISTAL THIRD METACARPAL BONE TO IDENTIFY BONE CHANGES IN THE THOROUGHBRED RACEHORSE WHEN COMPARING 21 CASES OF CATASTROPHIC BIAXIAL PROXIMAL SESAMOID BONE FRACTURE WITH 53 CONTROLS

Peloso, J.G., Vogler, J.B., Cohen, N.D., Marquis, P. and Hilt, L. Equine Medical Center of Ocala, 7107 W Hwy 326, Ocala, Florida 34482; The Orthopedic Institute, 4500 Newberry Road, Gainesville, Florida 32607; Texas A&M University College of Veterinary Medicine, College Station, Texas 77843; Senior Track Veterinarian, Gulfstream Racecourse, Miami, Florida; Equine Medical Center of Ocala, 7107 W Hwy 326, Ocala, Florida 34482, USA. Email: jpeloso@emcocala.com

Reasons for performing study: Biaxial fracture of the proximal sesamoid bones (PSB) is the leading cause of fetlock failure resulting in euthanasia in Thoroughbred racehorses in California, Kentucky and Hong Kong. Identifying alterable risk factors to reduce biaxial PSB fractures could have a significant impact on reducing the occurrence of catastrophic failure of the fetlock (CF).

Objectives: We hypothesised that standing MRI (sMRI) would identify a greater degree of bone change in Thoroughbred racehorses with CFF from biaxial PSB fracture when compared to controls.

Study design: Retrospective cohort study.

Methods: Bone changes from Florida Thoroughbred racehorses with CFF due to biaxial fracture of the PSB (n = 21) were compared to controls (n = 53) using the sMRI. Data for control limbs were Florida racehorses that were subjected to euthanasia for reasons other than CFF (enteritis, pneumonia, etc.). All forelimb fetlocks underwent sMRI imaging within 72 h of euthanasia. Bone scores were assigned to the subchondral bone (SCB) on the distal palmar aspect of the lateral and medial condyle of the third metacarpal bone (McIII) and the lateral and medial PSB. All information for analysis from sMRI images for cases and controls for all Thoroughbred racehorses was reviewed and collected by the lead author. The association between the dichotomous outcomes of PSB fracture with independent variables was assessed using bivariable and multivariable logistic regression analysis with significance set at P < 0.05.

Results: The proportion of cases with >75% sclerosis of the ipsilateral lateral PSB (43%, 9/21) was significantly greater than that among controls (6%, 3/53). The proportion of cases with SCB lesion grade >3 of the contralateral palmar lateral condyle (29%, 6/21) was significantly greater than that among controls (0%, 0/53).

Conclusions: The sMRI identified a significantly greater degree of bone change in racehorses with PSB fracture compared to control horses. These identified changes may be useful as a screening tool to identify horses at increased risk of fetlock fracture during racing.

Ethical animal research: Explicit owner informed consent for participation in this study was not given but permission for post mortem examination was given by the Racing Authority. Sources of funding: None. Competing interests: No competing interests have been declared.
INTEROBSERVER AGREEMENT OF STANDING MAGNETIC RESONANCE IMAGING FOR ASSESSMENT OF DEEP DIGITAL FLEXOR TENDON PATHOLOGY

Whitmore, J.K., Dakin, S.G., Weller, R., Mair, T.S. and Sherlock, C.E.
Royal Veterinary College, Hawkshead Lane, North Mymms, Hertfordshire, AL9 7TA, UK; Bell Equine Veterinary Clinic, Mereworth, Maidstone, Kent, ME18 5GS, UK. *Current address: University of Oxford, Botnar Research Centre, Headington, Oxford, OX3 7LD, UK. Email: jwhitmore@rvc.ac.uk

Reasons for performing study: Standing magnetic resonance imaging (sMRI) is commonly used to evaluate the distal aspect of the deep digital flexor tendon (DDFT) of lame horses. There is paucity of information comparing interobserver agreement of this imaging modality.

Objectives: To determine the interobserver agreement for assessment of the DDFT on sMRI using a newly developed grading system. It was hypothesised that different lesion types would be more frequently observed at different anatomical locations of the DDFT, and that interobserver agreement would be better for the presence of a lesion compared to lesion grading.

Study design: A retrospective study assessing interobserver agreement.

Methods: sMRI studies of 40 equine front feet were retrospectively graded by 2 observer teams using a newly developed grading system based on previous studies. Individual DDFT parameters and an overall DDFT grade were scored. A Pearson’s Chi-square test quantified the association between anatomical location and lesion type and interobserver agreement was quantified by calculating weighted-kappa statistic.

Results: Observer team B found a statistically significant association between anatomical location and lesion type but observer team A did not. Interobserver agreement was fair to moderate for the majority of individual DDFT parameters. For most parameters, better interobserver agreement was found for presence of a lesion than for lesion grading. Interobserver agreement was fair for the overall DDFT grade.

Conclusions: Interobserver agreement was acceptable for overall DDFT grade and was better for the presence of an overall grade. Interobserver agreement was also acceptable for most DDFT parameters and was better for assessing whether a lesion was present compared to the grading of lesions. This study highlights the value of a standardised grading system for assessing the DDFT on sMRI, and provides a method to improve the repeatability and reliability of future studies using sMRI.

Ethical animal research: This project was granted ethical approval by the RVC Ethics and Welfare Committee as part of James Whitmore’s final year research project. Explicit owner informed consent for participation in this study was not stated. Sources of funding: None. Competing interests: None.