ABSTRACT

13th Annual European College of Equine Internal Medicine Congress

November 20, 2020

Online Congress

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PROGRAMME ECEIM ONLINE CONGRESS

November 20, 2020

ALL TIMES ARE BASED ON THE CENTRAL EUROPEAN TIME (CET)

08.30-09.30 State-of-the-Art Lecture—Equine Infectious disease + Q&A

Josh Slater—Keynote speaker

09.30-09.50 Abstract—Intragastric pH of foals admitted to the intensive care unit

Jessica Wise (Australia)

09.50-10.10 Abstract—Interobserver and intraobserver reliability for two grading systems of Equine Gastric Ulcer Syndrome

Jessica Wise (Australia)

10.10-10.30 Abstract—The bioavailability and efficacy of a novel omeprazole product

Jessica Wise (Australia)

10.30-10.50 Abstract—A retrospective study on the effect of combined sucralfate and omeprazole therapy compared with omeprazole monotherapy for equine glandular gastric disease

Lieuwke Kranenburg (The Netherlands)

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© 2021 The Authors. Journal of Veterinary Internal Medicine published by Wiley Periodicals LLC. on behalf of the American College of Veterinary Internal Medicine.
10.50-11.00 Break

11.00-11.20 Abstract—Validation of the equine acute abdominal pain scale (EAAPS) for use by horse riders
Gila Abells Sutton (Israel)

11.20-11.40 Abstract—Short- and long-term effect of hospitalization and oral trimethoprim-sulfadiazine administration on the equine fecal microbiome
Mathijs Theelen (The Netherlands)

11.40-12.00 Abstract—Bovine Papillomavirus-subverted cellular microRNA expression in equine sarcoïds
Anna Hollis (UK)

12.00-12.20 Abstract—Estimation of prevalence of acute kidney injury (AKI) in hospitalized neonatal foals based on a multimodal approach including serum neutrophil gelatinase-associated lipocalin (NGAL) concentrations upon admission
Malene Laurberg (Denmark)

12.20-12.40 Abstract—Acetazolamide decreases intra-ocular pressure in healthy horses
Anat Shnaiderman Torban (Israel)

12.40-13.40 Break

13.40-14.40 State-of-the-Art Lecture—Highlights from ACVIM congress + Q&A
Harold McKenzie—keynote speaker

14.40-15.00 Abstract—Endemic flaviviruses in eastern Austria
Phebe de Heus (Austria)

15.00-15.20 Abstract—Treating rhodococcus equi pneumonia in foals: Alternatives to Rifampin/Macrolide
Monica Venner (Germany)

15.20-15.40 Abstract—Intrathoracic pressure measurement in horses during exercise: Validation of the wireless Equivent 300 device
Cornelie Westermann (The Netherlands)

15.40-16.00 Abstract—Amiodarone during transvenous electrical cardioversion of atrial fibrillation in horses to reduce cardioversion threshold or prevent immediate recurrence
Zoé Neuckermans (Belgium)

16.00-16.10 Break

16.10-16.30 Abstract—Ex-Vivo inflation-extension tests show that age affects biomechanical properties of the equine arterial wall
Zoé Neuckermans (Belgium)

16.30-16.50 Abstract—Prolonged hyperinsulinaemia induces differential protein expression of equine cardiac and lamellar tissue
Véronique Lacombe (USA)

16.50-17.10 Abstract 2020 ACVIM Forum—Best resident's oral abstract presentation 1

17.10-17.30 Abstract 2020 ACVIM Forum—Best resident's oral abstract presentation 2

17.30-18.00 Break

18.00-20.00 AGM
RESEARCH ABSTRACTS—ORAL PRESENTATIONS

Intragastric PH of foals admitted to the intensive care unit

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The intragastric pH profiles of neonatal foals hospitalized for intensive care are poorly characterized. The aims of this study were to determine the intragastric pH profiles and clinical parameters associated with intragastric pH in systemically-ill foals admitted to the neonatal intensive care unit (NICU).

Neonatal foals admitted to the NICU and requiring placement of an indwelling nasogastric tube for nutritional management were included in the study. Intragastric pH was measured continuously for 24 hours from the time of admission. History, clinical findings and clinicopathological data recorded at the time of presentation were also collected. Median hourly pH, mean pH, % time < pH 4 and the duration of the recording were determined for each foal.

Forty two foals were included in the study. The mean +/- s.d. pH of all foals was 5.5 +/- 1.8 and median % time that pH was <4 was 6.3% (range: 0-99). A history of placentitis was associated with greater mean pH (P = 0.04) and less % time pH < 4 (P = 0.03). Foals that presented with diarrhea had a greater % time pH < 4 (P = 0.01).

Foals with more alkaline pH profiles had a lower serum creatinine concentration (P = 0.04), lower PaO2 (P = 0.03) and higher PaCO2 (P = 0.02).

The majority of the foals included within this study had intragastric pH profiles of >4 for >80% of the recording time suggesting that the empirical administration of acid suppressive therapy is not warranted.

Keywords: gastric pH, foals, omeprazole, acid-suppression

Interobserver and intraobserver reliability for two grading systems of equine gastric ulcer syndrome

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Clinical grading systems require good inter-observer and intra-observer reliability. The aims of this study were to investigate the interobserver and intraobserver reliability of the Equine Gastric Ulceration Syndrome Council grading system (EGUC) and a novel visual analogue scale (VAS), and to assess differences between experienced and less experienced assessors.

Six observers (three specialists, three residents) graded 60 pre-recorded de-identified gastroscopy videos, three times for each grading system (EGUC and VAS), using a cross-over design with at least one week between each phase of the study.

Interobserver and intraobserver reliability were estimated by calculation of Gwet’s agreement coefficient (AC1), and with ordinal weights applied (AC2), for the EGUC grading system and the intraclass correlation coefficient (ICC) for the VAS.

Reliability was substantial using the EGUC system for both squamous (AC2 = 0.687) and glandular mucosa (AC2 = 0.721), and intraobserver reliability for squamous (AC2 = 0.801) and glandular mucosa (AC2 = 0.804) was substantial to excellent. Interobserver reliability was moderate for squamous mucosa (ICC = 0.635) and poor for glandular mucosa (ICC = 0.353) using the VAS. Intraobserver repeatability for squamous mucosa was moderate to good (ICC = 0.744) and moderate for glandular mucosa (ICC = 0.555). Reliability was greater for experienced observers and improved with time.

The EGUC grading system had acceptable intraobserver and interobserver reliability and performed well regardless of experience. As a continuous variable, the VAS affords some advantages for statistical evaluation, and reliability can be improved with practice. These findings have implications for comparison of results between observers and studies and selection of grading system for monitoring of horses with EGUS.

Keywords: EGUS, grading systems, VAS, reliability

The bioavailability and efficacy of a novel omeprazole product

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Omeprazole facilitates gastric ulcer healing through the suppression of gastric acid secretion. In comparison to buffered omeprazole products, enteric-coated formulations have greater oral bioavailability; however, appropriate dosing regimens remains debatable. The current study compared the bioavailability and efficacy of a novel, in-feed, enteric-coated granule formulation of omeprazole (NOV) with an existing, registered enteric-coated paste formulation (REF).

Bioavailability was assessed by comparison of plasma concentrations of omeprazole following administration of a single dose of NOV (2 mg/kg) and REF (1 mg/kg), with intravenous administration of omeprazole (0.5 mg/kg). The study included 9 horses randomly assigned to a three sequence, three period Latin square design, with a 7 day wash out period. Efficacy was assessed by comparison of plasma concentrations, gastric pH and ulcer scores following repeated administration of NOV or REF to 12 horses for seven days in a two period, two sequence blinded randomized controlled trial with sequential cross over.

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The median bioavailability of NOV was 58.2% (range: 11.0-91.1%) and for REF was 21.6% (range: 10.1-82.6%); there was no difference between products ($P = 0.312$). Treatment was associated with increased gastric pH ($P < 0.001$) and reduced squamous ulcer scores ($P < 0.001$), with no difference between products.

Omeprazole treatment was associated with increased gastric pH for both treatments ($P < 0.001$), and no difference was observed between treatments.

Results of the present study indicate that the oral administration of NOV is effective for the treatment of equine gastric ulcer syndrome, and suggest that plasma concentrations and drug dose of omeprazole do not predict clinical efficacy.

Keywords: Omeprazole, enteric-coated, bioavailability, pharmacokinetic, pharmacodynamics

A retrospective study on the effect of combined sucralfate and omeprazole therapy compared with omeprazole monotherapy for equine glandular gastric disease

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Background: Equine Glandular Gastric Disease (EGGD) is a term used to describe lesions of the glandular part of the equine stomach. These lesions differ from squamous lesions in Equine Squamous Gastric Disease (ESGD) in pathophysiology, prevalence, risk factors and treatment responses. Treatment response differences between these different types of gastric lesions might be one of the most important factors in determining the success of the healing process of equine gastric ulcers.

Objectives: The aim of this retrospective study was to evaluate whether the addition of oral sucralfate, combined with omeprazole, in the treatment of EGGD has significant beneficial value.

Methods: One-hundred-and-ten horses, mainly Warmblood pleasure horses, met the inclusion criteria. Gastroscopy was performed in all horses and glandular and squamous lesions were graded using standard scoring systems. Fifty three horses received only omeprazole and fifty seven horses were treated with the combination of omeprazole and sucralfate for four weeks. Gastroscopic grading was repeated after the treatment period. The differences in improvement between sole omeprazole and the combined treatment were tested for statistical significance using the fisher’s exact test.

Results: No significant difference in age and gender existed between treatment groups. Combined therapy was associated with significantly greater improvement of glandular lesions (OR = 3.37, CI: 1.33-9.12, $P = 0.007$), both in horses that only had EGGD (25% greater improvement rate) as well as those that also had squamous lesions (22%).

Conclusions: Glandular lesions treated with omeprazole and sucralfate were significantly more likely to improve than those treated only with omeprazole.

Validation of the equine acute abdominal pain scale (EAAPS) for use by horse riders

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The Equine Acute Abdominal Pain Scale (EAAPS) is a simple descriptive colic pain scale based on behaviors, previously validated by equine veterinarians. The aim was to validate the EAAPS for use by horse riders. Twenty films of horses with colic, 5 of control horses and 5 films randomly chosen from the 20 films (for intraobserver reliability), were presented by computer-generated random order to two groups of people; horse riders ($n = 11$) and equine veterinarians ($n = 10$). Each group graded the degree of pain demonstrated by the horses in the films by a numerical rating scale (NRS) from 0 to 5 and by the EAAPS. The EAAPS interobserver reliability was significantly higher than the NRS in both groups (Riders; Intraclass Correlation (ICC) = 0.85 for EAAPS vs. 95% Confidence Interval (95%CI) of NRS: 0.48-0.77. Veterinarians; ICC = 0.91 for EAAPS vs. 95%CI of NRS: 0.52-0.81). The EAAPS intraobserver reliability (weighted kappa = 0.83) was significantly higher than that of the NRS in the group of riders only (0.45-0.75). The EAAPS was able to differentiate controls from colic cases by both groups, however, only the NRS, used by veterinarians, was associated with mortality and with treatment modality. The agreement between riders and veterinarians when using the EAAPS was significantly higher (kappa = 0.74) than when using the NRS (95% CI: 0.31-0.45). The EAAPS is appropriate for use by horse riders in order to communicate with veterinarians. It is more reliable than the intuitive NRS scale both between riders and within a given rider and it significantly improved agreement between riders and veterinarians.

Keywords: Pain assessment, scale, equine, colic, EAAPS

Short - and long-term effect of hospitalization and oral trimethoprim-sulfadiazine administration on the equine fecal microbiome

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This study aimed to characterize short- and long-term effects of transportation, hospitalization and trimethoprim-sulfadiazine (TMS) administration on the fecal microbiome of healthy equids. In an experimental study design, fecal samples were collected from six Welsh ponies at the farm at day 0 (D0) and D13 after which they were transported to the hospital and re-sampled immediately upon arrival. The ponies were hospitalized from D13 to D27 and received TMS orally from D21 to D25. During hospitalization and the first week after discharge from the hospital fecal samples were collected daily (D13-D34) and subsequently at D41, D48, D58, D88, D119, D149, D180 and D211. Illumina MiSeq 16S sequencing was performed on all samples. Species richness, α-diversity, β-diversity and species composition were compared to identify changes over time. Wilcoxon signed rank tests were used for statistical analysis. Transportation to the hospital resulted in an increase in richness (475 vs. 856; P = 0.046) and Shannon diversity index (5.678 vs. 6.089; P = 0.046) which normalized within 24 h. Hospitalization alone had no significant effect on microbiome composition. TMS administration decreased richness (494 vs. 396; P = 0.046) and Shannon diversity index (5.614 vs. 5.171; P = 0.046), which normalized 2 weeks after discharge. However, the fecal microbiome composition 6 months after antimicrobial treatment differed significantly from pretreatment composition. The number of Ruminococcaceae present in the fecal microbiome was still reduced 6 months after hospitalization and antimicrobial treatment (P < 0.001). Based on this study we conclude that oral treatment with TMS has long-term effects on gut microbiome composition.

Keywords: antimicrobial treatment, gut microbiome, hospitalization, transportation, trimethoprim-sulfadiazine

Bovine papillomavirus-subverted cellular microRNA expression in equine sarcoids

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Sarcoids are common in horses, but their pathogenesis is unknown. MicroRNAs are non-coding RNAs that control cellular processes. MicroRNA dysregulation is associated with tumor development and progression. Work on equine fibroblast cell lines (EFCL) reported bovine papillomavirus (BPV)-associated changes in microRNA expression1, but the role of BPV remains controversial. The study objective was to describe changes in microRNA expression associated with BPV status in equine sarcoids.

DNA and RNA were isolated from fibroblasts dissected from formalin-fixed paraffin-embedded biopsies of 19 histologically-confirmed periorbital fibroblastic sarcoids and 19 normal periorbital skin (from horses without sarcoids). Quantitative PCR detected BPV DNA presence. MicroRNA microarrays measured microRNA expression. MicroRNAs displaying differential expression between sarcoid and normal fibroblasts were identified using t-tests. Differential expression of selected microRNAs was validated by quantitative RT-PCR.

100% of sarcoids and 50% of normal biopsies assayed contained BPV, although viral DNA was present in significantly fewer normal fibroblasts. Seventy-three microRNAs were differentially expressed between 6 sarcoids and 8 normal skin biopsies. The altered expression of miR-214, miR-103/107a, and miR-4429 was validated by RT-qPCR. All 3 microRNAs are associated with known cancer pathogenesis pathways, and 2 of the microRNAs exhibited differential expression in the EFCL study1. MiR-4429 has not previously been reported in the horse.

MicroRNAs differentially expressed in sarcoids are associated with known cancer pathogenesis pathways, including viral carcinogenesis. The presence of BPV in extremely low copy number in normal fibroblast populations does not preclude the possibility that BPV contributes to sarcoid pathogenesis by dysregulation of host cell microRNA expression.

Estimation of prevalence of acute kidney injury (AKI) in hospitalized neonatal foals based on a multimodal approach including serum neutrophil gelatinase-associated lipocalin (NGAL) concentrations upon admission

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AKI in neonatal foals is poorly documented. The objective was to retrospectively determine AKI prevalence, and to establish and test a multimodal diagnostic approach to assess different types of azotemia on admission in hospitalized neonatal foals. Foals <14 days old with admission blood analyses were included (n = 91). NGAL was measured on stored admission serum by ELISA*. AKI prevalence was assessed based on 1) serum creatinine concentrations at 2 different cut-off values (140 and 180micromol/L) and 2) a newly proposed multimodal algorithm including creatinine, NGAL and inflammatory parameters (sepsis score and categorization, white blood cell count and serum amyloid A). The algorithm classified cases as no-AKI, non-azotemic AKI, azotemic AKI, postrenal azotemia, inflammatory postrenal azotemia and inflammatory azotemic AKI, and was assessed against medical records. Dependant on the method, AKI prevalence was 14.3-25.3%.

In 86 foals, the algorithm matched medical records and allowed foals to be categorized as no-AKI (n = 62), non-azotemic AKI (n = 6), azotemic AKI (n = 7), postrenal azotemia (n = 4), inflammatory postrenal azotemia (n = 4) and inflammatory azotemic AKI (n = 3). The algorithm never showed a medical record mismatch. However, in 5 cases no final categorization was reached; this involved postrenal azotemia and the inflammatory categories (n = 5), foals <2 days (n = 4) and having AKI based on the low cut off value for creatinine (>140micromol/L;
Acetazolamide decreases intra-ocular pressure in healthy horses

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*Equal contribution.

In equine glaucoma, only topical treatment with CAI (Carbonic Anhydrase Inhibitors) is indicated, whereas in humans and small animals, systemic CAIs are used as well. Acetazolamide, a systemic CAI, given orally, is being used in horses with HYPP (Hyperkalemic Periodic Paralysis), with an established dosage (4.4 mg/kg) but information regarding its effect on IOP (Intra Ocular Pressure) has not been reported. We aimed to determine the effect of acetazolamide on IOP in horses.

Ten healthy horses were treated with an oral dose of acetazolamide BID (4.4 mg/kg) for a week. Serum acetazolamide levels (liquid chromatography/tandem mass spectrometry) and IOP were measured before treatment, daily during the treatment, 48 and 72 hours after treatment. In a mixed effect model logistic regression, there was a significant decrease in IOP on the third treatment day, of 2.39 mmHg (95% CI -4.24, -0.53, P = 0.012) in the left eye, as well as a significant decrease of 2.7 mmHg (95% CI -4.6, -0.78, P = 0.006) in the right eye and a significant increase in both eyes 48 hours after treatment was stopped.

The determined AUC(0-10 hours) was 1.1 ± 0.5 μg/mL*h, MRT 6.7 ± 4.3 hours, Cmax 0.39 ± 0.37 μg/mL and tmax 1.8 hours. On the last treatment day, there was a significant increase of 0.125 μg/mL (95% CI 0.2, 2.31, P = 0.02) in acetazolamide serum levels and a significant decrease 72 hours after treatment was stopped. These findings suggest acetazolamide is a potential systemic treatment in equine glaucoma.

Keyword: equine glaucoma, acetazolamide, IOP.

Endemic flaviviruses in eastern Austria

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West Nile virus (WNV) is an arthropod-borne flavivirus with near global distribution, circulating between mosquitoes and birds. Humans and horses are dead-end hosts, susceptible to infection by mosquitoes. We aimed to investigate flavivirus seroprevalence and WNV RNA prevalence in Austrian equines, as well as to identify risk factors for seropositivity. This cross-sectional prevalence study, with risk factor analysis, included convenience samples and samples from hospitalized equines in eastern Austria collected during 2017. Owners and caretakers provided the equine passports and completed questionnaires. Sera were analyzed for WNV RNA with RT-qPCR and for flavivirus-specific antibodies with commercial IgG and IgM ELISAs (ID Vet, Grabels). ELISA-reactive samples were further analyzed with 80% plaque reduction neutralization tests, to differentiate WNV, tick-borne encephalitis virus (TBEV) and Usutu virus (USUV) infections. Logistic regression was used for statistical analysis.

348 equines (334 horses, 14 donkeys) were sampled. Excluding vaccinated equids, seroprevalence values were 5.3% for WNV (autochthonous infections = 1.2%), 15.5% for TBEV, and 0% for USUV. Donkey TBEV seroprevalence was 28.6%. No IgM and WNV RNA were detected and no risk factors were identified.

WNV seroprevalence in Austria is lower than in neighboring Slovakia (8.3%). TBEV seroprevalence is high, compared to non-outbreak situations reported in Germany (2.9%) and Slovakia (3.4%). Equids can serve as sentinels for flavivirus activity. An increase in flavivirus-related disease and the importance of continuous surveillance are highlighted by the 2018 European outbreak, which resulted in a 7.2-fold increase in human WNV cases. Optimal climatic conditions likely exacerbated this epidemiological scenario.

Keywords: Flavivirus, West Nile virus, Tick-borne encephalitis virus, Usutu virus, seroprevalence

Treating rhododoccus equi pneumonia in foals: Alternatives to rifampin/macrolide

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The objective of both following studies was to evaluate alternatives to the usual treatment protocol: macrolide and rifampin. On a breeding farm with endemic R. equi pneumonia foals were submitted to a screening program including weekly clinical examination, hematology...
and ultrasound examination of the lung. In the first study, doxycycline was evaluated as an alternative to a macrolide. Foals with ultrasonographic evidence of pulmonary abscesses (5.0-10 cm in diameter (n = 108) were randomly allocated in five treatment groups: 1) tulathromycin IM; 2) doxycycline monotherapy orally; 3) doxycycline with rifampin orally; 4) azithromycin with rifampin orally and 5) saline IM as a placebo. Physical examination and thoracic ultrasonography were performed weekly by individuals unaware of treatment group assignment. Foals that worsened were removed from the study and treated with azithromycin-rifampin. Three foals in the DOX-RIF group developed severe hemolytic anemia and icterus 17-20 days after initiating therapy. Overall, 22/25 (88%) foals in the placebo group recovered without the need for therapy, 24/24 (100%) of the Doxycyclin group, 19/25 (73%) of the Tulathromycin group, 20/21 (95%) of the Rifampin/Azithromycin group recovered without the need for change of therapy. The proportion of foals that worsened did not differ significantly between treatment groups. Although the median duration of therapy was significantly shorter in foals treated with azithromycin-rifampin (46 days) compared to foals treated with the placebo (73 days), the kinetics ultrasonographic lesion resolution did not differ significantly between treatment groups. In the second study, doxycyclin was evaluated as an alternative to rifampin. In a controlled, randomized, and double blinded clinical trial, foals with ultrasonographic pulmonary lesions (lesion score 10-15 cm) were allocated to 3 groups: azithromycin-doxycycline orally (n = 81); azithromycin-rifampin orally (n = 81); or untreated controls (n = 78). Physical examination and thoracic ultrasonography were performed by individuals unaware of treatment group assignment. Foals that worsened were considered treatment failures and removed from the study. The proportion of foals that recovered was significantly higher for foals treated with azithromycin-doxycycline (80 of 81) or azithromycin-rifampin (81 of 81) compared to that of control foals (57 of 78). The difference in the percentage of efficacy of azithromycin-rifampin versus azithromycin-doxycycline was 1.2% (90% CI = -0.78 to 3.5%) which did not cross the predetermined noninferiority limit of 10%. Therefore, azithromycin-doxycycline was noninferior to azithromycin-rifampin within the predetermined noninferiority limit. The antimicrobial combination Rifampin/Doxycyclin cannot be recommended as in 9 foals of the Rifampin/Doxycyclin group three developed a severe hemolytic anemia and one died of it. As presently some reflection rise on the use of Rifampin, because of its use in critical human diseases as tuberculosis, an alternative was investigated. Our results show that doxycyclin in combination with azithromycin is a good treatment option in foals with R. equi moderate pneumonia.

Keywords: antimicrobials, doxycycline, treatment protocols

Intrathoracic pressure measurement in horses during exercise: Validation of the wireless equivent 300 device

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Low-grade respiratory disease is a potential cause for reduced athletic performance. Increased intrathoracic pressure amplitude (IP) indicates impaired respiratory function but measurements at rest are insensitive diagnostics to abnormally elevated respiratory effort during exercise. A purpose-designed device (Equivent 300) for continuous telemetric measurement of IP during exercise was validated and reference ranges of exercising IP in warmblood horses were established. Twenty healthy Dutch warmblood mares underwent resting IP measurements using a standard method and the Equivent. With the device in place, horses underwent a standardized lunging exercise test (four minutes trot, four minutes canter, five minutes trot, five minutes’ walk) on four consecutive days. Heart rate and mean IP for each stage and ambient temperature and humidity for each session were recorded. All data were checked for normality and a mixed linear model was used to determine mean IP for each stage and the intraclass correlation coefficient (ICC) of IP for each stage with horse, SET stage, and session as explanatory variables. Reference values were calculated as mean IP ± 2SD. The device was well tolerated by the horses. There was no significant effect of session day; the ICC for ‘horses was 0.11 and the ICC for ‘stage’ was 0.77. Mean IP was 21.1 ± 4.9 (ref 11.4-30.9), 33.9 ± 7.9 (ref 18.2-49.7), 24.3 ± 5.6 (ref 13.1-35.6) and 10.5 ± 3.1 (ref 4.3-16.6) cm H2O for trot-1, canter, trot-2 and walk respectively. Reliable telemetric exercising IP measurement is possible but swallowing, coughing, head- and neck position, location of the esophageal balloon, G-force associated with locomotion were possible artifact-causing factors.

Amiodarone during transvenous electrical cardioversion of atrial fibrillation in horses to reduce cardioversion threshold or prevent immediate recurrence

Ingrid Vernemmen1, Zoé Neuckermans1, Annelies Decloedt1, Gunther van Loon1

Amiodarone, a class III anti-arrhythmic drug, has been used in equine and human medicine to treat atrial fibrillation (AF). The aim of this retrospective study was to report the effect of amiodarone administered IV during transvenous electrical cardioversion (TVEC) in case of failure to restore sinus rhythm (SR) or immediate recurrence of AF (IRAF). Data from 11 Warmblood horses with AF receiving amiodarone (5 mg/kg over 30 minutes) during the TVEC procedure were reviewed. Mean age was 9.5 years. AF duration varied from two weeks to 1.5 year. Mild, moderate or severe mitral (n = 8), tricuspid (n = 10) and aortic (n = 4) valvular regurgitations were present. Five horses had left atrial dilatation. TVEC was performed using ‘Guelph’
catheters (n = 5) or ‘Gaeltec’ catheters (n = 6). When TVEC, using energy levels of 150 to 360 J with 50 J increments, failed to restore SR (n = 7), amiodarone was administered. SR could be restored (Figure 1) in 4 horses where initial TVEC failed, with a median of 1 (range 1-6) shock at 360 J. In IRAF cases (n = 4), amiodarone was administered after a median number of 3.5 (range 3-4) relapses within a median of 9 (range 0.05-30) minutes after initial cardioversion. All IRAF cases were discharged in SR. No side effects were noted except for a transient decrease in blood pressure during amiodarone infusion (n = 8). These results suggest that the combined use of IV amiodarone with TVEC can increase success rates in case of treatment failure or IRAF.

Keywords: equine, arrhythmia, anti-arrhythmic drugs, early recurrence, atrial premature beats

Ex-vivo inflation-extension tests show that age affects biomechanical properties of the equine arterial wall

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The reasons why older horses are predisposed to arterial rupture are still unclear. The aim of this study was to analyze the effect of age on the biomechanical properties of the proximal and distal aorta, common carotid artery and external iliac artery. Entire circular...
samples of 5-10 cm long were collected from 6 young (3-6 years) and 14 older horses (≥15 years). Vessels were mounted in a custom-made water tank and gradually pressurized from 15 to 300 mmHg. For each pressure point, longitudinal B-mode ultrasonographic images were collected for off-line measurement of arterial diameters. Rupture occurred in a minority of arteries (8.9%) at high pressures (200-300 mmHg), and mostly occurred in older horses (85.7%). Pressure-diameter results were fitted to the arctangent model1 and pressure-area-compliance curves were constructed. Pressure significantly influenced the pressure-area curves of the distal aorta (P = 0.04), common carotid artery (P < 0.001) and external iliac artery (P < 0.001). At same pressures, larger areas were found in old horses compared to young horses. Also the pressure-compliance curve of the proximal aorta was significantly influenced by age (P = 0.015): maximal compliance was lower and occurred at lower pressure in old horses (16mm²/mmHg at 100 mmHg) compared to young horses (18mm²/mmHg at 125 mmHg) (Figure 1). No significant differences were found for distal aorta, common carotid artery and external iliac artery. These results demonstrate an age effect on the biomechanical properties of the arterial wall. These changes are likely to contribute to central as well as peripheral arterial rupture in older horses.

Keywords: horse, arterial rupture, compliance, pressure, aging

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Prolonged hyperinsulinemia induces differential protein expression of equine cardiac and lamellar tissue

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Insulin resistance, the hallmark of equine metabolic syndrome, predisposes horses to laminitis. However, the pathogenesis of endocrinopathic laminitis is not well elucidated and remains without an effective treatment. In addition, whether equine metabolic syndrome predisposes to cardiovascular diseases remains not well known. This study aimed to investigate novel proteins and metabolic pathways underlying hyperinsulinemia-induced laminitis. Healthy horses were given an electrolyte infusion or a 48-hour euglycemic-hyperinsulinemic clamp. Both lamellar and cardiac tissues were analyzed by mass spectrometry (FDR = 0.05). All hyperinsulinemic horses developed laminitis despite being previously healthy. We identified 709 and 514 unique proteins in the lamellar and cardiac proteomes, respectively. In the lamellar tissue, we identified 14 and 13 proteins which were significantly upregulated and downregulated, respectively, in the hyperinsulinemic group as compared to controls. A STRING analysis of protein-protein interactions revealed that the upregulated proteins were primarily involved in coagulation and complement cascades, platelet activity, and ribosomal function, while downregulated proteins were involved in focal adhesions, spliceosomes, and cell-cell matrices. qRT-PCR confirmed downregulation of vinculin, talin-1 and cadherin-13, and upregulation of HSP90, fibrinogen β and α-2-macroglobulin in the lamellae of hyperinsulinemic vs. control horses. In contrast, no proteins were found to be significantly differentially expressed in the heart of hyperinsulinemic vs. control horses. These data indicated that hyperinsulinemia induced microvascular damage in the lamellae, but not in the heart. Insights from this study could lead to the discovery of molecular biomarkers and/or therapeutic targets for endocrinopathic laminitis, as well as novel cardioprotective mechanisms.

Keywords: laminitis, endocrinopathic, proteomic, equine metabolic syndrome, heart, lamellar

RESEARCH ABSTRACTS—POSTER PRESENTATIONS

Immune response to equine hepacivirus E2 recombinant protein vaccine may accelerate recovery after experimental infection

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Equine hepacivirus (EqHV), the closest known genetic homologue of hepatitis C virus (HCV), has been associated with clinical hepatitis in horses and a potential influence on athletic performance cannot be excluded. A robust, immunocompetent animal model is lacking in HCV vaccine development. Therefore, the investigation of hepacivirus host/pathogen interactions and induction of a protective immune response against hepacivirus infection, could benefit horses and humans alike. Test ponies (n = 4) were vaccinated with EqHV E2 recombinant protein and adjuvant. Control ponies received either adjuvant only (n = 2) or phosphate buffered saline (n = 1). Vaccination was done twice, 4 weeks apart, followed by intravenous inoculation with EqHV-positive plasma of all seven ponies, 4 weeks after the second vaccine.
Utilization of cardiac variability parameter RMSSD in the evaluation of pain in horses suffering from colic

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Monitoring animal pain is always a challenge for the clinician. Some pain scores have been validated for the grading of pain in horses demonstrating acute colic. Even though these scores (Horde Grimace Score and Composite Pain Score) are considered reliable, they remain a subjective tool. Our aim is to investigate if Heart Rate Variability (HRV) can be used by the clinician as a more objective and precise tool for the evaluation of pain in colicky horses. RMSSD (Root Mean Square of the Successive Difference) is a parameter of HRV more specifically related to parasympathetic nervous system activity. This system is inhibited if stress is present, such as organic response to pain as seen during abdominal pain. We hypothesized that RMSSD measurements would vary with abdominal pain and would be inversely correlated with pain assessed via clinical judgment and pain scores.

Twenty-eight horses presented for colic at the equine clinic were recruited for a 3 months study. HRV was recorded and analyzed 3 to 5 times a week during hospitalization. A simplified multiple linear statistical model was created to evaluate the correlation between the evolution of individual RMSSD and pain scores, including random factors. Based on the horses presented for multiple causes of colic included in this study, there were trends toward an increase in HRV with clinical improvement and resolution of colic, but we could not show a statistical correlation between RMSSD and abdominal pain intensity (P = 0.26). Results and limitations are discussed, as well as artifacts in HRV measurements that could have significantly impacted results.

Keywords: horse, colic, pain scores, heart rate, parasympathetic nervous system

Longitudinal study of RMSSD as a tool to monitor fitness in elite endurance horses Agnès benamou-smith

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Heart Rate Variability (HRV) analysis is a relevant indicator of cardiac autonomic control and can reflect either parasympathetic or sympathetic activity. In human athletes, assessment of Root Mean Square of Successive Differences (RMSSD), an index of HRV indicative of parasympathetic activity in humans, can be used to evaluate fitness, training intensity and early detection of overtraining.

The aim of our study is to evaluate correlation between RMSSD and HF (High frequency band on spectral analysis of HRV), in elite endurance horses with training intensity. We hypothesized that HF measurements are correlated with RMSSD as in human athletes, and that RMSSD variations are correlated with training intensity.

Seven Elite Arabians horses trained for international races were recruited for a 3 months study. HRV was recorded and analyzed 3 to 5 times a week before training session using Polar Heart Rate Monitor. A linear regression was done to pair RMSSD with HF. Training intensity was evaluated by a score (Rating of Perceived Exercise Score) and a linear regression was done to pair RMSSD with training intensity.

Correlation between RMSSD and HF was good (R² = 0.82). Training intensity variation was not correlated with RMSSD (R² < 0.4) in our horses but several limits were identified that can explain that observation. These preliminary results suggest that parasympathetic activity in horses can be evaluated with HRV indicators in horses. Experimental constraints in our studies can explain the absence of correlation and warrant further studies to investigate the impact of training intensity on HRV.

Keywords: heart rate variability, RMSSD, training quantification, fitness, parasympathetic activity

The repeatability of a thyrotropin-releasing hormone stimulation test for the diagnosis of pituitary pars intermedia dysfunction

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Pituitary pars intermedia dysfunction (PPID) is a common equine endocrine disorder. In subclinical case, a diagnosis of PPID can be determined by the thyrotropin-releasing hormone (TRH) stimulation
ABSTRACT

Effect of oral aleurone supplementation on glucose and insulin dynamics of horses in training

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Aleurone is known to have positive effects on energy metabolism in pigs and mice. Our aim was to study the effect of oral aleurone supplementation on glucose and insulin dynamics in healthy trained horses in a cross-over training trial. Sixteen Standardbreds mares (3-4y) were trained for 2 periods of 8 weeks, fed iso-energetic diets with and without 200 g/day aleurone. A frequently sampled intravenous glucose tolerance test (FSIGTT) and an oral glucose tolerance test (OGTT) were executed before and after each training period. For the OGTT outcome variables included: Maximum glucose, AUC glucose, Maximum insulin, AUC insulin, and Time to peakinsulin; for the FSIGTT: acute insulin response to glucose (AIRg), insulin sensitivity (SI), glucose effectiveness (Sg) and disposition index (DI). Either a paired T test was applied or a paired Wilcoxon test. Training without aleurone induced significant OGTT variable changes, which were not seen in the FSIGTT. OGTT Maximum insulin was significantly lower (P = 0.005): Time to peakinsulin was higher (P = 0.03) and AUC insulin was lower after training (P = 0.001). Training with aleurone decreased AIRg (P = 0.03) and increased Sg (P = 0.02). When comparing the FSIGTT variables after training with aleurone to those after training without aleurone AIRg was significantly lower in the aleurone fed group (P = 0.004). Aleurone has a beneficial effect on glucose and insulin dynamics on top of training in healthy horses. This is attributable to increased tissue glucose uptake capacity. However, more research is needed to elucidate the mode of action of aleurone at the level of the skeletal muscle and the gut.

Keywords: endurance, exercise, nutrition

Combined Streptococcus equi subsp equi antigens a and c serological response in arabs prior to exportation

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An unofficial equine importation requirement for United Arab Emirates includes negative serology for antibodies to Streptococcus equi subsp equi (S. equi) Antigen A and Antigen C. If found positive, a negative guttural pouch lavage (GPL) S. equi qPCR is required for entry to detect carriers. The aim of this study was to determine how many serologically positive horses were defined as S. equi carriers. This is a retrospective observational cohort study performed from 2017-2019. 31 two year old Arabians had a single serum sample measured for Antigen A and Antigen C at the Animal Health Trust, Newmarket, UK prior to exportation to United Arab Emirates. Horses with a positive value (OD450 nm ≥0.5) of one or both antigens underwent guttural pouch endoscopy examination and lavage specimen was submitted for S. equi SEEI qPCR. 12 females and 19 males born and raised on the farm had no known exposure of strangles nor S. equi vaccination. 5/31 horses were positive for S. equi antigens, but negative on guttural pouch endoscopy examination and qPCR. Serological results suggest that 16% had some degree of unknown S. equi exposure, possibly in the form of shared handlers with a separate, but open herd population including five S. equi vaccinated horses. The combined Antigen A and Antigen C serology overestimated S. equi carrier status in this healthy population. To appropriately evaluate sensitivity and specificity of this test determining carrier status in healthy horses, a broader population should be tested with all animals undergoing GPL qPCR and endoscopy.

Keywords: S. equi; serology, strangles; carriers
Equine arterial wall histology: Topographical and age-related differences

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Arterial rupture is a well-recognized cause of sudden death in horses which mostly affects old horses. The underlying age-related vascular changes are still unclear. The purpose of this study was to analyze vessel wall architecture at seven arterial locations and to investigate the effect of aging on its histological composition. Samples of cranial and caudal common carotid artery, proximal and distal aorta, median artery, external iliac artery and femoral artery were collected from 14 old (≥ 15 years) and 6 young (3-6 years) Warmblood horses, euthanized for non-cardiovascular reasons. Histology was performed to measure the intima-media thickness (IMT). Immunohistochemistry was used to determine the area % of smooth muscle cells (SMC), elastin and collagen type I and III. There was a significant (P < 0.001) effect of arterial location on area % of elastin and collagen type III (Figure 1). The highest area % of elastin was found in the proximal aorta (34 ± 8%) and the lowest in the median artery (8 ± 5%). As for collagen type III, the highest area % was found in the femoral artery (28 ± 15%) and the lowest in the proximal aorta (17 ± 7%), median artery (17 ± 7%) and cranial common carotid artery (18 ± 4%). Irrespective of arterial location, old horses showed a significantly larger IMT and a significantly higher area % of SMC (P = 0.01) compared to young horses. We conclude that significant differences in arterial wall composition exist between central and peripheral arteries. Irrespective of location, IMT and area % of SMC increased with age, indicating arterial wall remodeling in older horses.

Keywords: horses, aging, vascular remodeling, arterial rupture, sudden death

Validation of a new LMS (lactate minimum speed) exercise test for optimal assessment of the aerobic window of sport horses

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ABSTRACT

Validation of a new LMS (lactate minimum speed) exercise test for optimal assessment of the aerobic window of sport horses

Lorie De Maré1,3, Berit Boshuizen1,2, Constance De Meeus1, Lukas Plancke1, Carmen Vidal Moreno de Vega1, Jean De Oliveira4, Yannick Gansemans5, Filip Van Nieuwerburgh5, Dieter Deforce5, Catherine Delesalle1
ABSTRACT

Objectives: To characterize the frequency, distribution and antimicrobial susceptibilities of equine bacterial pathogens in South Australia and regional New South Wales.

Methods: One hundred and eighty-three bacterial isolates from clinical cases presenting between 2010-2019 in two university practices, were identified using matrix-assisted laser desorption/ionization-time of flight mass spectrometry. Minimum inhibitory concentrations were determined using Sensititre system; including 20 antimicrobials spanning 10 antimicrobial classes and interpreted using veterinary and human standards produced by the CLSI. Isolates showing resistance to one or more drugs in three or more, or five or more antimicrobial drug classes, were classed as multi-drug resistant (MDR) or extensive drug-resistant (XDR), respectively.

Results: Resistance to one or more antimicrobial (AMR) was found in 91.3%, MDR in 26.8% and XDR in 10.9% of isolates. Enterobacteriaceae, Pseudomonas and Streptococcus species displayed the most frequent AMR of 100%, whilst Enterococcus and Enterobacteriaceae species exhibited the most frequent XDR of 37.50% and 29.79% respectively. Methicillin resistance (MRSA) was observed in 16.7% of Staphylococcus aureus isolates.

Discussion & conclusion: Significant resistance was noted to commonly used and critically important antimicrobials. Resistance patterns differed from previous reports external to Australia, highlighting the importance of accurate local data.

Clinical significance: Rapid and accurate identification and determination of antimicrobial susceptibility will ensure improved diagnosis and treatment of bacterial disease in horses.

Keywords: MALDI-TOF, MIC, broth microdilution, surveillance, clinical laboratory standards institute

Neutrophil gelatinase-associated lipocalcin (NGAL) as a potential biomarker for equine asthma

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The objective of the study was to evaluate if Neutrophil gelatinase-associated lipocalcin (NGAL) measured in Bronchoalveolar lavage (BAL) fluid with a previously validated porcine ELISA kit could be used to differentiate between healthy horses, horse with mild-moderate equine asthma (EA) and horses with severe EA, using BAL cytology as gold standard.

Equine BAL samples from 205 horses was included in the study. The horses were divided into groups based on clinical examination and BAL cytology. Group 1 consisted of 51 healthy horses (BAL cytology <5% mast cells and <10% neutrophils). Group 2 consisted of 38 horses with neutrophilic EA (>10% neutrophils, <5% mast cells). Group 3 consisted of 57 horses with mastocytic EA (>5% mast cells <10% neutrophils). Group 4 consisted of 18 horses with mixed EA. Group 5 consisted of 55 horses with severe EA (>25% neutrophils in BAL).
A significant difference in NGAL concentration (µg/L) was found between the severe EA horses and all other groups (P < 0.001). A significant positive correlation was found between NGAL and BAL neutrophils (r = 0.6, P = <0.001).

NGAL can be used as a biomarker for horses with severe EA. NGAL is a marker of inflammation known to be in neutrophil granules. The NGAL marker was able to distinguish only severe EA from healthy. The NGAL marker was unable to detect an increase in BAL mast cells, which makes it unreliable to be used as a sole biomarker as mastocytic EA subtypes would be missed. Further studies are needed to evaluate the potential for NGAL in EA.

Keywords: equine asthma, NGAL, biomarker

A dose escalation study to evaluate the tolerability of high dose brachytherapy in horses undergoing treatment for periocular sarcoids

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The objective was to evaluate the short and long-term effects of increasing doses of high dose rate brachytherapy (HDRB) to treat equine periocular sarcoids, aiming to use an increased, potentially more effective dose.

Horses undergoing HDRB treatment with owner consent were enrolled in a ‘3 + 3 phase 1 study design’ with a 26Gy starting dose, 30Gy target dose, and an increase of 1Gy for each 3-horse cohort.

Dose-limiting toxicity (DLT) was defined as grade 3 skin toxicity. If DLT was observed, an additional 3 horses would be given the same dose. If DLTs developed in ≥1 of 6 subjects no further dose escalation was performed. If no DLTs occurred, 3 horses were administered the next dose, repeated until the target dose was achieved. Response to treatment was evaluated using the cRECIST criteria.

21 horses were enrolled; 3 in the initial cohorts and 9 in the target cohort. The target dose was reached without DLTs. Complete resolution of disease was achieved in 86% of cases, with follow-up of 24 to 30 months. 2 horses were euthanased due to progressive disease, 1 had no response to treatment, 4 of 9 horses given 30Gy experienced grade 1 skin toxicity at time of treatment, late side effects occurred in 88% of cases. No grade 2 or 3 late side effects were observed.

No significant toxicity was observed at a dose of 30G, therefore an increased HDRB dose can be safely administered. Further work is required to investigate efficacy of the increased dose.

References:
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²La Due, T. and Klein, M.K.(2001) Toxicity criteria of the veterinary radiation therapy oncology group. Vet Rad Ultra 42 (5):475-476.
Asthma is common in many equine populations and airborne particles are recognized as potential predisposing factors in disease pathogenesis. The aim of our study was to compare the effects of different bedding materials on equine airway health. Thirty-two clinically healthy adult riding school horses were stalled on different bedding materials for 35 consecutive days during December 2018 - May 2019. Wood pellet, straw pellet and loosely stored peat (Peat 2) were compared to peat stored in plastic bales (Peat 1). The horses remained healthy during the study period. BALF neutrophil percentage was higher after the straw pellet period (3.1 ± 2.7, P = 0.001) and Peat 2 period (4.9 ± 16.2, P = 0.033) compared to Peat 1 period (1.6 ± 1.1). There was no difference between wood pellet period and Peat 1 period.

These preliminary results suggest that straw pellet and loosely stored peat increase airway neutrophilia detected in BALF compared to baled peat bedding. The result might be helpful in choosing bedding material for horses prone to neutrophilic airway inflammation.

Keywords: equine asthma, BALF, cytology, neutrophils, bedding material

Assessment of urinary N-Acetyl-B-D-glucosaminidase (NAG) and NAG index activities in clinically normal adult mares

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N-acetyl-beta-D-glucosaminidase urine level increases with proximal tubular cell injury and is considered helpful in the early diagnosis of acute kidney injury. This study aimed to assess urinary NAG and NAG index activity in 17 clinically normal draft mares (1.5-7 y. old). Blood and urine samples were collected simultaneously; blood on clot activator and EDTA from jugular vein, and urine in clean capped containers via urethral catheterization. Each mare underwent physical examination. CBC, serum creatinine and urea determination and urinalysis were also performed. NAG activity was determined in urine and NAG index was calculated by dividing urine NAG (U/l) to the urine creatinine concentration (mg/dl).

The values for urine NAG index fell between 11.25-67.85 U/g using a 90% prediction interval based on the 5th and 95th percentile (by removing outliers).

Reference values for urine NAG index in horses can be used as a tool for early detection of renal tubular injury and accordingly adjust clinical management. Routine use of urine NAG index in admitted horses can have an impact on the morbidity and death rates in horses. Further studies are required to investigate gender and breed influence on reference values.

Keywords: horse, urine, NAG index, acute kidney injury

Retrospective study of misoprostol treatment of equine glandular gastric disease

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Misoprostol has been recommended for treatment of equine glandular gastric disease (EGGD) [1] however worsening of equine squamous gastric disease (ESGD) has been observed with its use in our practice. This retrospective study investigated ESGD during misoprostol use. The practice database was searched for horses prescribed misoprostol (5 μg/kg PO BID) for EGGD between 1/2/2016-1/2/2020. Details of gastroscopic findings, treatment, and follow-up gastroscopic findings were recorded. Thirty-two horses received misoprostol during the search period. One case record was missing and seven horses did not have repeat gastroscopy, leaving 24 horses with useful data. Eleven horses (46%) received misoprostol alone; 13 horses (54%) additionally received omeprazole (4 mg/kg PO SID, n = 7), sucralfate (12 mg/kg PO BID, n = 3), or sucralfate and omeprazole (doses as previously given, n = 3). EGGD resolved uneventfully in 14/24 horses (58%); 6/11 (55%) horses receiving sole misoprostol and 8/13 (62%) receiving combination therapy. In 10/24 horses (42%) ESGD developed, failed to improve, or increased severity during misoprostol treatment: 5/11 (45%) with sole misoprostol and 5/13 (38%) with combination therapy (Table 1). Median (+ range) ESGD score [2] pre-treatment and post-treatment were 0 (0-1) and 2 (1-3) respectively for sole misoprostol treatment and 0 (0-3) and 2 (2-3) for combination therapy. In this limited subset of horses, ESGD did not resolve, or had the potential to worsen, with misoprostol treatment alone, or in combination therapy. Investigation of inferior acid suppression of misoprostol compared to omeprazole is warranted.

Table 1: Number (N) of horses with and without equine squamous gastric disease (ESGD+; ESGD- respectively) following treatment with misoprostol or misoprostol combination therapy.

|                  | Misoprostol (N) | Combination (N) | Total (N) |
|------------------|----------------|----------------|-----------|
| ESGD-            | 6              | 8              | 14        |
| ESGD+            | 5              | 5              | 10        |
| Total (N)        | 11             | 13             | 24        |

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Inflammatory bowel disease (IBD) is a well-recognized disease associated with weight loss, recurrent colic, and/or diarrhea. Diagnosis is challenging and prognosis value of intestinal biopsy is lacking. The objectives of this study were to propose a histological severity score of intestinal biopsies, and to report parameters associated with long-term survival.

A multi-centric retrospective study was performed and included 97 horses diagnosed with IBD through intestinal biopsies between 2006 and 2020. Signalment, case history, clinical signs, diagnostic test results including intestinal biopsies, therapy and long-term survival were studied. Available histological slides (58) were scored from 0 to 3 for each cell type infiltration and for edema. Survival data were displayed graphically as a Kaplan-Meier plot, and were analyzed with a Cox’s proportional hazards model and a Gehan-Bresloz-Wilcoxon test ($P < 0.05$ were considered significant).

Type of cells infiltration was associated with survival: 63.7% of horses with mixed or alone lymphoplasmocytic infiltration survived after one year contrary to 100% of horses with eosinophilic infiltration ($P = 0.0073$, HR = 3.106, 95% CI 1.313-7.347). However, histological severity score was not associated with survival. Long-term survival was poorer for horses older than 9 years old (HR = 2.479), those with hypoproteinaemia (HR = 8.015), diarrhea (HR = 2.314), or with increased wall thickness at abdominal ultrasound (HR = 2.668).

This study reports a poorer prognosis for lymphoplasmocytic infiltration. Histological severity score is not associated with survival here, which warrants further studies to determine optimal cut-off between healthy and IBD horses.

Keywords: inflammatory bowel disease, intestinal biopsy, histology

A longitudinal follow-up of the thermal response to the metabolic heat load in endurance horses and standardbreds during field exercise

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Monitoring body temperature by a gastrointestinal pill could be used to formulate vital competition guidelines for horses in the face of global warming. This study aimed to evaluate the thermal response to metabolic heat loading during field exercise. Eight endurance horses (EnduH) and twelve Standardbred trotters (ST) were equipped with a gastrointestinal pill for continuous recording of GI temperature (GT). EnduH were exercised during 4 competitions (40 km, 2 horses; 80 km, 11 horses) (14.6 ± 3.4 km/h) with a total of 16 GT periods mapped out. Twelve ST were exercised at 40.8 ± 4 km/h (1540 m). Skin
temperature (Equivital belt) (only EnduH), GPS (Garmin Forerunner-910XT) and heartrate (Polar) were monitored. Thermal load was 36.9 ± 4.8°C/min and 40.8 ± 6.5°C/min during exercise and 35.1 ± 9.2°C/min and 31.3 ± 14.8°C/min during recovery, in EnduH and ST, respectively. All EnduH reached their maximum GT (38.70 ± 0.15°C) within 113 ± 13 minutes during exercise. However, all ST reached maximum GT (38.90 ± 0.32°C) within 40 ± 32 minutes post-exercise. The majority of EnduH (9/16) reached ≥39°C while 4/12 ST reached ≥39°C. None of the ST-GT reached 38°C except one while EnduH-GT returned to 38°C within 37 ± 13 minutes post-exercise in 7/16. Maximum skin temperature was 32.39 ± 4.27°C. No association was found between GT and skin temperature.

The thermal load was higher for ST when compared to EnduH. However, ST may reach their maximum GT after one-hour post-exercise which should be taken into consideration when organizing post-training and post-competition transportation.

Keywords: thermoregulation, GI-pill, metabolic heat load, endurance

ABSTRACT

The thermal load was higher for ST when compared to EnduH. However, ST may reach their maximum GT after one-hour post-exercise which should be taken into consideration when organizing post-training and post-competition transportation.

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