



## European College of Equine Internal Medicine Congress 2016 Abstracts

### ECEIM Congress 2016 Abstracts

#### Schedule for Oral Presentations

##### Lecture Hall Fennia 1

Friday 13.30–14.30

13.30–13.45	Cathcart	Exhaled carbon monoxide as a marker for lower airway inflammation in thoroughbred racehorses
13.45–14.00	Hermange	Cytology of bilateral bronchoalveolar lavage fluids: comparison of pooled and individual samples
14.00–14.15	Losada-Florian	Evaluation of the predictive value of the external laryngeal ultrasound in detecting equine upper airway disease
14.15–14.30	Barba	In vitro cytokine production in response to equine influenza virus and <i>Streptococcus equi</i> subspecies zooepidemicus

Friday 15.00–16.30

15.00–15.15	Medina-Torres	Immune response to intranasal modified-live EHV-1 vaccination in immunised equids
15.15–15.30	Banse	Impact of phenylbutazone on gastric glandular prostaglandin concentration and ulcer score
15.30–15.45	Westermann	Evaluation of a blood sucrose test for the assessment of gastric ulcers in warmblood horses aimed at field conditions
15.45–16.00	Khan	Evaluation of the rectal route of fluid administration in horses
16.00–16.15	Bakos	Effects of fasting on serum concentrations of lipid mobilisation and hepatic parameters in horses
16.15–16.30	Kolk	Acylcarnitine profile in endurance horses with and without metabolic dysfunction

##### Lecture Hall Fennia 1

Saturday 13.45–14.45

13.45–14.00	Cudmore	Blood culture isolates and antimicrobial sensitivities from 863 critically ill neonatal foals (2005–2014)
14.00–14.15	Theelen	Differences in prevalence and susceptibility patterns of bacteria isolated from foals with sepsis cultured at hospital admission and after >48 h of hospitalization: 1990–2015

14.15–14.30	Freccero	Feasibility of echocardiographic subcostal apical view in newborn foals: bidimensional and doppler aortic parameters
14.30–14.45	Hamerlinck	Left ventricular function in the ageing horse
Saturday 15.30–16.30		
15.30–15.45	Broux	Heart rate variability parameters to detect atrial fibrillation in horses
15.45–16.00	Broux	Pharmacokinetics and electrophysiological effects of different dosages of oral sotalol in horses: preliminary results
16.00–16.15	Dufourni	Influence of orally administered sotalol hydrochloride on QT intervals at rest and in anesthetized horses after transvenous electrical cardioversion (TVEC)
16.15–16.30	May	Transcranial magnetic stimulation unravels motor impairment in knuckling horses affected by acquired equine polyneuropathy

## Schedule for Flash Presentations

### Lecture Hall Fennia 2

Friday 10.00–10.30

1. Trachsel Trimethoprim-sulfadiazine has KV11.1 potassium channel blocking activity in horses
2. De Clercq Right cardiac monophasic action potential recordings in standing non-sedated horses
3. Mitchell Plasma homocysteine concentrations in healthy horses and horses with atrial fibrillation
4. Leroux Long term prognosis of moderate or severe left-sided cardiac valvular regurgitations in horses
5. Wittschorek Myocardial function in horses during general anaesthesia evaluated by pulsed-wave tissue doppler echocardiography
6. Wittschorek Origin, laboratory results, therapeutic concepts and outcome of horses diagnosed with borna disease infection in Bavaria, Germany
7. Krägeloh Studies on the absorption of hypoglycin A
8. Cerri Diagnostic value of serologic tests and seroprevalence of borreliosis in horses living in southern Belgium
9. Deniau Clinical, imaging and dynamic abnormalities in 4 cases of laryngeal dysplasia
10. Niedzwiedz Evaluation of serum cytokines levels in equine recurrent airway obstruction (RAO)
11. Pringle Comparison of sample site and diagnostic tests for determination of carrier state in horses recovered from strangles

### Lecture Hall Fennia 2

Saturday 10.00–10.30

1. Sutton The equine acute abdominal pain scale (EAAPS) for horses with colic: is it feasible?
2. Sgorbini Equine gastric ulceration syndrome (EGUS) in donkeys: gastroscopic findings and prevalence
3. Siegers Usefulness of three portable lactate measurement devices in horses

4. Mackenzie Evaluation of a whole blood, point of care coagulometer in horses
5. Mackenzie Effect of sampling technique on coagulation parameters in the horse: needle versus indwelling intravenous catheter
6. vd Brom-Spienburg Usefulness of a hand-held glucometer in horses
7. Morgan Glucocorticoid receptor in the equine pituitary in health and disease
8. Warnken Insulin signaling in various equine tissues under basal conditions and under acute stimulation by glucose and insulin
9. Loschelder Evaluation of heartrate variability and serum cortisol levels during euthanasia in 40 horses

### Accepted Posters

1. Arroyo Leukemia in horses: a case series
2. Barton The influence of cleaning, disinfection and drying methods on endoscope hygiene in equine medicine
3. Bezdekova Chronic pyloric disorders in horses: 47 cases
4. Bonelli Determination of salivary cortisol in donkey stallions
5. Bonelli Blood gas levels in newborn foals after normal and assisted delivery
6. Cesarini Use of a commercial high-fibre equine liquid diet for enteral tube feeding in horses: clinical experience in 9 cases
7. Gehlen Endothelin-1 plasma concentration in horses with cardiac disease at rest and after exercise
8. Klein Targeted hygiene management system: rapid beneficial effects
9. Niedzwiedz Utility of histological examination of the bronchial mucosa in diagnostics of recurrent airway obstruction (RAO) in horses
10. Pihl Non-strangulating intestinal infarction associated with strongylus vulgaris: clinical presentation and outcome
11. Puschmann Final results on the impact of needle size and disinfection protocols on the bacterial contamination of cadaver skin cores
12. Recknagel Does gastric juice ph influence gastric emptying? A preliminary study
13. South Use of anti-müllerian hormone (AMH) for the diagnosis of cryptorchidism in donkeys

## Oral Presentations

**EXHALED CARBON MONOXIDE AS A MARKER FOR LOWER AIRWAY INFLAMMATION IN THOROUGHBRED RACEHORSES.** M.P. Cathcart<sup>1</sup>, S. Love<sup>2</sup>, T.D.H. Parkin<sup>2</sup>, K.J. Hughes<sup>3</sup>, D.G.M. Sutton<sup>2</sup>. <sup>1</sup>School of Veterinary Medicine, Faculty of Health & Medical Sciences, University of Surrey, Guildford, UK, <sup>2</sup>School of Veterinary Medicine, College of Medicine, Veterinary Medicine and Life Sciences, University of Glasgow, Glasgow, UK, <sup>3</sup>School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga, NSW, Australia

The aim of the study was to investigate whether associations exist between established markers of lower airway inflammation (LAI) and biomarkers in exhaled breath (EB), namely exhaled nitric oxide (eNO), exhaled carbon monoxide (eCO) and exhaled breath condensate pH (EBC pH). A convenience sample of Thoroughbred racehorses presenting with poor performance and a clinical indication for respiratory secretion sampling were selected. EB was collected in impermeable bags and EBC was condensed at  $-70^{\circ}\text{C}$ , prior to endoscopic recording of tracheal mucus scores (TMS) and TA/BAL fluid sampling. eNO and eCO were measured offline via chemiluminescence; EBC pH was measured using a standardised pH electrode. Associations between exhaled biomarkers and TA/BAL cytological parameters were investigated via regression analysis and 1-ANOVA where appropriate. 25 horses were sampled. A significant association between eCO and TMS was observed ( $P = 0.019$ ), with horses recording a TMS of 2 or above having significantly higher eCO compared to those with a TMS of 0 or 1 ( $P = 0.0476$ ). eNO was detectable in only 16% of samples. Horses with neutrophilic LAI were found to have a significantly higher EBC pH ( $5.83 \pm 0.52$ ) compared to those without ( $5.06 \pm 0.63$ ;  $P = 0.01$ ). The identification of associations between exhaled biomarkers and established markers of LAI provide support for the application of EB and EBC analysis as non-invasive modalities in the investigation of LAI in Thoroughbred horses. Increasing sample size and inclusion of a control group will be required to provide quantitative and qualitative evaluation of these assays.

**CYTOLOGY OF BILATERAL BRONCHOALVEOLAR LAVAGE FLUIDS: COMPARISON OF POOLED AND INDIVIDUAL SAMPLES.** T. Hermange<sup>1</sup>, S. Le Corre<sup>1</sup>, E. Richard<sup>2</sup>, A. Courouge-Malblanc<sup>1</sup>. <sup>1</sup>Oniris, Atlanpôle, Nantes Cedex 3, France, <sup>2</sup>LABEO Frank Duncombe, Caen Cedex 4, France

It has recently been demonstrated that bronchoalveolar lavage fluid (BALF) cytology from one lung does not forecast the other lung in the same horse. The aim of the study was to determine whether pooled BALF from both lungs was representative of individual samples. Twenty horses referred for respiratory troubles were included. BALF was collected from each lung using 250 mL of warmed isotonic saline. Cytological analyses of each individual BALF and isovolumetric pools were carried out in a blinded manner. Cell proportions were log-transformed and compared using ANOVA, with Dunnett's post-hoc test. For each cell type, correlations between pooled and individual BALF were assessed by Pearson coefficient, and agreement between samples by intraclass correlation coefficient (ICC).  $P < 0.05$  was considered significant. Neutrophil proportions were significantly lower ( $P = 0.02$ ) in pooled ( $22.6 \pm 22.7\%$ ) compared to right ( $26.2 \pm 26.4\%$ ) but not left BALF ( $23.0 \pm 22.8\%$ ). No significant difference was observed for other cell types. Significant correlations were noted between pooled and both right and left BALF for neutrophils ( $R = 0.97$ ) and haemosiderophage/macrophage ratio ( $R = 0.99$  and  $0.86$ , respectively). Mast cell proportions were not significantly correlated ( $R = 0.25$  and  $0.20$ ). Agreement between samples was moderate for mast cells (ICC =  $0.72$  and  $0.66$ , respectively) and good for the other cell types (ICC  $> 0.93$ ). Correlations and agreements for neutrophils and other cell types represent promising preliminary data about the relevance of investigating pooled BALF. Cytological confirmation of equine asthma might however become challenging with regard to the low proportions of mast cells.

**EVALUATION OF THE PREDICTIVE VALUE OF THE EXTERNAL LARYNGEAL ULTRASOUND IN DETECTING EQUINE UPPER AIRWAY DISEASE.** A. Losada-Floriano<sup>1</sup>, A.-C. Doublet<sup>1</sup>, C. Mespoulhès-Rivière<sup>2</sup>, F. Rossignol<sup>2</sup>, A. Lechartier<sup>3</sup>. <sup>1</sup>Clinique Equine – Ecole Nationale Vétérinaire d'Alfort – Maisons Alfort, France, <sup>2</sup>Clinique de Grosbois – Boissy St Léger, France, <sup>3</sup>Clinique Vétérinaire Equine de Méheudin – Écouché, France

Equine Upper Airway Disease (EUAD) is a major cause of poor performance in horses. External Laryngeal Ultrasound (ELU) has been proposed useful for early detection of recurrent laryngeal neuropathy (RLN), with both quantitative and semi-quantitative methods correlating well with Resting Endoscopy (RE) findings. Furthermore, correlation between high-speed-treadmill endoscopy and ELU for RLN has been demonstrated to be excellent. The purpose of this study was to (i) Determine the value of ELU in the early detection of EUAD, especially sub-clinical cases of RLN and (ii) screen horses for laryngeal abnormalities during exercise. One hundred and fifty seven yearlings from two yards entering training were evaluated with both RE and ELU methods, RE findings were interpreted according to the Have-meyer system and ELU findings with a semi-quantitative and quantitative system. A longitudinal follow-up over two years was performed using Overground Endoscopy (OGE) and ELU. OGE was performed to assess any laryngeal dysfunction (RNL and other abnormalities) and ELU was performed using the same method as for recruitment of cases. Ninety-eight follow-up examinations were performed, with the final evaluation scheduled for autumn 2016. None of the horses with normal ELU at recruitment developed RNL, however 25% developed Palatal Instability (PI). In the horses with abnormal ELU at recruitment 32% developed PI, 2% developed RLN and 29% developed others laryngeal dysfunctions. ELU is a useful diagnostic method for evaluation of EUAD, however due to the low prevalence of pathological cases in this population further investigation is required to allow validation of this technique in affected horses.

**IN VITRO CYTOKINE PRODUCTION IN RESPONSE TO EQUINE INFLUENZA VIRUS AND STREPTOCOCCUS EQUI SUBSPECIES ZOOEPIDEMICUS.** M. Barba<sup>1</sup>, J.M. Daly<sup>2</sup>. <sup>1</sup>Facultad de Veterinaria, Universidad CEU Cardenal Herrera, Valencia, Spain, <sup>2</sup>School of Veterinary Medicine and Science, University of Nottingham, UK

Equine influenza virus (EIV) is one of the leading causes of infectious respiratory disease in equids worldwide, and secondary bacterial pneumonia worsens the outcome. The mechanisms of synergy between respiratory viruses and opportunistic pathogenic bacteria such as *Streptococcus equi* subspecies zooepidemicus (SEZ) remain unknown. The purpose of the study was to develop an in vitro model to study cytokine response to EIV and SEZ co-infection. DH82 $\alpha$  cells, a canine macrophage-like cell line, were infected with EIV strains Sussex/89 (full-length non-structural protein 1 (NS1)) or Kentucky/5/02 (truncated NS1) or co-infected with Kentucky/5/02 and SEZ 1 hour or 24 hour apart. The mRNA cytokine expression was measured by quantitative RT-PCR and analyzed by one-way analysis of variance and Tukey's multiple-comparison test. Cells infected with Kentucky/5/02 had higher IFN $\alpha$  expression at 24 hour post-infection ( $P = 0.02$ ) and IFN $\beta$  expression at 48 h ( $P = 0.013$ ) compared to Sussex/89. Expression of TNF $\alpha$  and IL6 was higher after infection with Sussex/89 compared to Kentucky/5/02 at 48 hour post-infection ( $P = 0.046$  and  $P = 0.015$ , respectively). Cells co-infected with Kentucky/5/02 and SEZ showed higher TNF $\alpha$  expression 6 hour post-bacterial infection, especially if co-infected 24 hour apart ( $P < 0.001$ ), compared to cells only infected with Kentucky/5/02 or SEZ. Differences in the cytokine responses observed with different EIV strains agreed with in vivo studies. These preliminary results suggest that DH82 $\alpha$  cells can be used as an in vitro model to investigate the role of the innate immune response in secondary bacterial infection, but the relevance of these results needs further confirmation.

**IMMUNE RESPONSE TO INTRANASAL MODIFIED-LIFE EHV-1 VACCINATION IN IMMUNISED EQUIDS.** C.A. Dumrath<sup>1,2</sup>, L.S. Goehring<sup>1</sup>, C.P. Bartmann<sup>2</sup>, B. Wagner<sup>3</sup>, C.E. Medina-Torres<sup>1</sup>. <sup>1</sup>Ludwig-Maximilians-University, Munich, Germany, <sup>2</sup>EAZ 230 Bundeswehr, Bad Reichenhall, Germany, <sup>3</sup>Cornell University, Ithaca, NY, USA

EHV-1 vaccines provide some protection against disease. We investigated innate and specific, mucosal and humoral immune responses after intranasal modified-live virus (IN-MLV) administration in vaccinated horses (n = 12) and mules (n = 12). We hypothesised IN-MLV induces rapid local and systemic immune responses, which differ in horses and mules. Four months post-immunisation (inactivated vaccine) animals received IN-MLV. Starting on D-2, daily clinical data, q48 h nasal swabs and weekly serum samples were collected. D-2 and D14 virus neutralisation (VN)-titres were significantly higher in mules compared to horses. Mucosal Ig-gB, -gC and -gD were significantly higher in mules than horses on D-2 and D3. Mule Ig-gC and -gD decreased significantly by D1. All Ig increased significantly between D1 and D3. In horses, a rise in mucosal Ig concentration was apparent but not significant. Unexpectedly, on D-2 one mule and one horse were EHV-1 PCR positive and complement fixation assay results were elevated. Strain-analysis demonstrated wild-type (WT)-EHV-1 infection. Therefore, result interpretation was confounded by natural EHV-1 infection. Mucosal immunity was apparently boosted in horses and mules, albeit differently. Absence of an increase in VN-titres and of clinical disease despite EHV-1 infection and IN-MLV could be attributed to an existing solid immunity induced by vaccination. Whether interspecies differences in the immune response were due to heterosis in mules could not be determined, as the exact time point of WT-EHV-1 infection was uncertain. However, findings suggest that regular vaccination could prevent occurrence of clinical signs during EHV-1 infection.

**IMPACT OF PHENYLBUTAZONE ON EQUINE GASTRIC GLANDULAR PROSTAGLANDIN CONCENTRATION AND ULCER SCORE.** S.K. Pedersen<sup>1,2</sup>, A.E. Cribb<sup>2</sup>, E.K. Read<sup>2</sup>, D. French<sup>1</sup>, H.E. Banse<sup>2</sup>. <sup>1</sup>TD Equine Veterinary Group, Calgary, AB, Canada, <sup>2</sup>Faculty of Veterinary Medicine, University of Calgary, Calgary, AB, Canada

In equids, phenylbutazone at high doses has been demonstrated to induce gastric ulceration, primarily in the glandular portion of the stomach. In other species, NSAID-induced ulceration is associated with decreased gastric prostaglandin E concentration. The mechanism of NSAID-induced glandular gastric ulceration in horses has yet to be determined. The purpose of this study was to compare gastric ulcer scores and mucosal prostaglandin concentration in horses before and after administration of phenylbutazone or placebo. Twelve healthy adult horses were enrolled following approval of the study by the institution's animal care and use committee. Horses were randomly assigned to treatment (n = 6; 4.4 mg/kg phenylbutazone q. 12 hour for 7 days) or placebo (n = 6; 20 mL molasses q. 12 hour for seven days) groups. Before treatment and three and 7 days after initiation of treatment, gastroscopy was performed and glandular gastric biopsies were collected and frozen at -80°C. Glandular ulcer scores were retrospectively assigned using a scale of 0-4 by two trained, blinded evaluators. Prostaglandin E concentration in biopsies was measured using a commercially available enzyme immunoassay. Prostaglandin concentrations were compared using repeated measures analysis of variance. Ulcer scores were compared using a generalized estimating equation. One control horse was excluded based on a blinded glandular ulcer score of 3 before treatment. Prostaglandin concentrations increased over time (P = 0.005) but there was no effect of treatment (P = 0.88). Ulcer score did not differ between treatment groups (P = 0.48). These findings suggest that phenylbutazone at this dose and duration did not impair gastric glandular prostaglandin synthesis.

**EVALUATION OF A BLOOD SUCROSE TEST FOR THE ASSESSMENT OF GASTRIC ULCERS IN WARMBLOOD HORSES AIMED AT FIELD CONDITIONS.** C.M. Westermann<sup>1</sup>, L. van den Wollenberg<sup>2</sup>, H. Everts<sup>1</sup>, J.H. van der Kolk<sup>2</sup>, G. Counotte<sup>2</sup>, D.A. van Doorn<sup>1</sup>. <sup>1</sup>Faculty of Veterinary Medicine, Utrecht University, CM Utrecht, The Netherlands, <sup>2</sup>De Gezondheidsdienst voor Dieren, AA Deventer, The Netherlands, <sup>3</sup>Swiss

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Gastro-endoscopy is the gold standard for detecting equine gastric ulcers but its use in practice is limited. Recently, sucrose was put forward as convenient marker to assess gastric permeability. Presence of sucrose in the blood after oral application may serve as indicator for gastro-intestinal damage. Sucrose can be measured by GC-MS analyzing technique, but this analytical approach is not cost-effective. Therefore, the use of an enzymatic test kit (SCA20-1KT, Sigma) was studied as an alternative, indirect, cost-effective approach to analyze sucrose, enabling screening of suspected horses in field conditions. To achieve this, 21 horses that were presented as patients in several equine clinics in the Netherlands, were allocated to 6 groups: gastric ulcer score of 0 vs. ≥2 and in both gastric scoring groups 3 levels of oral sucrose application (0.75, 1.0 and 1.25 g/kg body weight). Gastro-endoscopy was preceded by a non-feeding (12 hour) and a non-drinking period (3 hour). Blood samples (serum tubes) were taken before (T0) and at 45 minutes (T45) after sucrose administration. The enzymatic test showed 90% sensitivity and 82% specificity and these values were even lower when only samples at T45 were considered (73 and 60%, respectively). Blood sucrose concentrations did not differ statistically between groups with and without gastric ulcers and the enzymatic method showed no correlation with the GC-MS method that was used as a control method and should therefore not be used for diagnosis of equine gastric ulcers. In addition, the GC-MS method was also unable to show a difference between groups.

**EVALUATION OF THE RECTAL ROUTE OF FLUID ADMINISTRATION IN HORSES.** A. Khan<sup>1</sup>, G. Hallowell<sup>2</sup>, C. Underwood<sup>1</sup>, A. Van Eps<sup>1</sup>. <sup>1</sup>School of Veterinary Science, The University of Queensland, Gatton, Queensland, Australia, <sup>2</sup>School of Veterinary Medicine and Science, The University of Nottingham, Sutton Bonington Campus, Leicestershire, UK

In horses, the intravenous (IV) route is preferred for rapid and direct fluid administration however is expensive and invasive. Nasogastric (NGT) administration is an alternative in patients without gastrointestinal obstruction, however prolonged tube placement can interfere with feeding and lead to pharyngitis. Fluid administration per rectum (proctoclysis) is widely used in other species including humans. The aim of this study was to evaluate its efficacy and safety in horses. Six clinically normal Standardbred geldings were used in a 4-way crossover study: each received 3 different fluid treatments (intravenous, nasogastric and rectal) at 5 mL/kg/h and underwent a control period (no treatment) with water and feed withheld. Body weight was measured at baseline and 6 hour. Packed cell volume (PCV), total protein, albumin, electrolytes, lactate, urine specific gravity, vital parameters, gut sounds and central venous pressure was measured every 2 hour. Data were analysed non-parametrically and reported as median [IQR]. Rectal fluid administration was well tolerated. All fluid treatments caused changes consistent with haemodilution, including significant (P < 0.05) decreases in PCV with IV (5[2.75-8]%), NGT (5[2.25-7.25]%), and rectal administration (5[3.75-6.5]%), that were not present in the control period. There was a significant bodyweight decrease (4.25[2.1-5.7] kg) in the control period (P < 0.05) but not with any of the fluid treatments. Vital parameters and CVP did not change significantly. Rectal fluid administration may offer an inexpensive, safe alternative to IV fluid administration, particularly when administration via NGT is not possible or contraindicated.

**EFFECTS OF FASTING ON SERUM CONCENTRATIONS OF LIPID MOBILISATION AND HEPATIC PARAMETERS IN HORSES.** Z. Bakos<sup>1</sup>, B. Tóth<sup>2</sup>. <sup>1</sup>Department and Clinic of Equine Medicine, University of Veterinary Medicine, Budapest, Hungary, <sup>2</sup>Equi-Med Ltd., Nyíregyháza, Hungary

The purpose of the study was to evaluate the changes in serum concentrations of lipid mobilisation and hepatic parameters in horses under controlled fasting. Our hypothesis was that the serum concentrations of free fatty acids (FFA), triglycerides (TG), blood urea nitrogen (BUN), total bilirubin (tBIL), gamma-glutamyl transferase (GGT), glutamate dehydrogenase (GLDH) and total bile acids (BA) increase, while the insulin concentration decreases

during fasting. Twelve healthy, adult horses were starved under supervision until they began to show detectable signs of catabolism. Physical examination was performed at 24 hours intervals during the first 72 hours, and then at every 12 hours. The first blood sample was collected when fasting started (T0). The following blood samples were taken 72, 84, 96, 100, 104, 108, 112, 116 and 120 hours later. Variables of interest were measured from every sample. Descriptive statistics and repeated measures analysis of variance were used to evaluate the data. All horses tolerated 96 hours of starvation without complications. They developed only mild to moderate hypertriglyceridaemia between 72 and 96 hours of fasting. TG, FFA and BUN concentrations increased, and later decreased significantly ( $P < 0.05$ ). Insulin concentration also increased significantly, while tBIL did not. Our results show that in contrast with previous assumptions, clinically healthy horses are not prone to catabolic crisis, and severe hyperlipaemia and hypoinsulinaemia does not develop after 96 hours of fasting. Based on these results it also seems that the marked elevation of indirect serum bilirubin concentration in clinically ill horses is not primarily caused by starvation.

**ACYLCARNITINE PROFILE IN ENDURANCE HORSES WITH AND WITHOUT METABOLIC DYSFUNCTION.** J.H. van der Kolk<sup>1</sup>, S. Thomas<sup>1</sup>, N. Mach<sup>2</sup>, A. Ramseyer<sup>1</sup>, D. Burger<sup>1</sup>, V. Gerber<sup>1</sup>, J.-M. Nuoffer<sup>3</sup>. <sup>1</sup>Swiss Institute of Equine Medicine, Agroscope and University of Bern, Bern, Switzerland, <sup>2</sup>INRA, AgroParisTech, Université Paris-Saclay, Jouy-en-Josas, France, <sup>3</sup>Universitätsinstitut für Klinische Chemie UKC, Bern University Hospital, Bern, Switzerland

Beta-oxidation is essential in fat metabolism and can be monitored with acylcarnitine profiling in blood as partly degraded fatty acids accumulate as carnitine esters. The current study was aimed to assess acylcarnitine profile by electrospray tandem mass spectrometry in endurance horses regarded as relying fully on  $\beta$ -oxidation for energy supply with and without metabolic dysfunction. Ten Arabian horses (mean age  $10.5 \pm 1.8$  (SD) years) comprising 5 mares and 5 geldings were sampled prior and post a 160 km endurance race [CEIO or CEI\*\*\*]. Another four Arabian horses ( $10.3 \pm 1.3$  years) all geldings, who failed to finish the endurance race [CEIO/CEI\*\*\*/CEI 90] for metabolic reasons were also sampled before and after abandoning. ANOVA was used for statistical analysis. There was a significant increase ( $P < 0.001$ ) in post exercise acylcarnitine profile for both groups with those from the finishers being significantly higher than those from the non-finishers in 17 out of 27 acylcarnitines in contrast to free carnitine. C10-carnitine reached largest increase (+42 times) in the finishers post exercise. The post exercise values (average  $\pm$  SD) for free and acetylcarnitine were  $28.8 \pm 5.5$  and  $44.2 \pm 11.5$  for the finishers and  $19.2 \pm 9.8$  and  $26.7 \pm 10$   $\mu\text{mol/L}$  ( $P = 0.036$  and  $0.028$ ) for the metabolically compromised horses, respectively. The presence of the whole acylcarnitine profile in serum following extreme endurance exercise indicates a proper functioning  $\beta$ -oxidation of fatty acids in horses with or without metabolic dysfunction. However, the findings in the current study suggest that the bioavailability of carnitine in the former group might limit their performance.

**BLOOD CULTURE ISOLATES AND ANTIMICROBIAL SENSITIVITIES FROM 863 CRITICALLY ILL NEONATAL FOALS (2005–2014).** L.A. Cudmore, N.M. Collins, J.B. Carrick, C.M. Russell. Scone Equine Hospital, Scone, NSW, Australia

The aim of this study was to evaluate the antimicrobial sensitivity results of micro-organisms from blood cultures of critically ill equine neonates in the Hunter Valley, Australia. Retrospective analysis of microbial blood culture results from foals  $\leq 7$  days of age admitted to Scone Equine Hospital's Clovelly ICU between 2005 and 2014 was performed. A total of 1333 foals less than 7 days of age presented to the ICU during the time period; 863 foals had a blood culture submitted. A total of 211 foals returned a positive blood culture result (211/863, 24.4%). A total of 228 organisms were isolated; 59.2% gram positive isolates (135/228), 39% gram negative isolates (89/228) and 1.7% anaerobic isolates (4/228). A total of 58 multiple drug resistant organisms were identified (58/228, 25.7%); 67.2% gram positive organisms (39/58) and 32.8% gram negative organisms (19/58). A total of 36 isolates were sensitive to the combination of penicillin and gentamicin (36/137, 26.3%) and 70 isolates were sensitive to a combination of

ceftiofur and gentamicin (70/144, 48.6%). These results indicate gram-positive organisms are the most common isolate cultured from foals with sepsis in our ICU. These results are in contrast with a previously published study performed at our centre (1999–2004), where a predominance of gram-negative sepsis and higher levels of antimicrobial sensitivity were apparent. These results also indicate reduced anti-microbial sensitivity ( $<50\%$ ) to commonly used first line anti-microbial broad-spectrum combinations. The low sensitivities to commonly used antimicrobials highlights the importance of performing blood cultures in neonatal foals.

**DIFFERENCES IN PREVALENCE AND SUSCEPTIBILITY PATTERNS OF BACTERIA ISOLATED FROM FOALS WITH SEPSIS CULTURED AT HOSPITAL ADMISSION AND AFTER >48 HOUR OF HOSPITALIZATION: 1990–2015.** M.J.P. Theelen<sup>1</sup>, W.D. Wilson<sup>2</sup>, B.A. Byrne<sup>3</sup>, J.M. Edman<sup>2</sup>, K.G. Magdesian<sup>2</sup>. <sup>1</sup>Utrecht University, Faculty of Veterinary Medicine, Department of Equine Sciences – Internal Medicine, CM Utrecht, The Netherlands, <sup>2</sup>University of California, School of Veterinary Medicine, Department of Medicine & Epidemiology, Davis, California, USA, <sup>3</sup>University of California, School of Veterinary Medicine, Department of Pathology, Microbiology & Immunology, Davis, California, USA

This study evaluates differences in prevalence and antimicrobial susceptibility patterns between bacteria isolated from foals with sepsis on hospital admission and after >48 hour of hospitalization. Bacteria cultured from protected sites of foals <30 days of age and diagnosed with sepsis were included. The microdilution Sensititre® procedure was used for susceptibility testing. Results of cultures collected on hospital admission were compared to those collected after >48 hour of hospitalization. Cluster robust standard errors and exact logistic regression were used for statistical analysis. In total 267 foals and 445 bacterial isolates were included. After >48 hour of hospitalization we found a significant decrease in bacterial cultures positive for *Actinobacillus* spp. (19.8%:0.0%) and *Streptococcus* spp. (11.6%:4.3%) and a significant increase in bacterial cultures positive for *Acinetobacter* spp. (0.6%:3.3%), *Enterococcus* spp. (4.8%:19.6%), *Pseudomonas* spp. (0.3%:7.6%) and *Serratia* spp. (0.3%:5.4%). Percentages of bacterial isolates susceptible to selected antimicrobial drugs decreased significantly after >48 hour of hospitalization (amikacin 68.6%:42.4%, ampicillin 69.2%:28.6%, ceftiofur 90.9%:49.4%, ceftiozime 92.4%:59.3%, chloramphenicol 85.0%:44.6%, enrofloxacin 87.6%:66.7%, gentamicin 68.6%:30.6%, imipenem 94.1%:77.6%, penicillin 39.5%:13.2%, tetracycline 77.5%:33.3%, trimethoprim/sulfamethoxazole 64.4%:22.4%, amikacin + penicillin 90.9%:58.4%, amikacin + ampicillin 93.7%:57.1%, amikacin + ceftiofur 93.7%:62.4%, gentamicin + penicillin 86.6%:45.5%, gentamicin + ampicillin 87.1%:44.0%). Susceptibility patterns of bacteria cultured at hospital admission were more predictable than susceptibility patterns of bacteria cultured after >48 hour of hospitalization. Repeated bacteriological culturing and susceptibility testing at standard intervals should therefore become routine in hospitalized foals with sepsis to be able to detect ongoing or hospital acquired infections and select effective antimicrobial drugs for treatment.

**FEASIBILITY OF ECHOCARDIOGRAPHIC SUBCOSTAL APICAL VIEW IN NEWBORN FOALS: BIDIMENSIONAL AND DOPPLER AORTIC PARAMETERS.** F. Freccero<sup>1</sup>, A. Cordella<sup>1</sup>, G. Forni<sup>1</sup>, C. Castagnetti<sup>1</sup>, F. Dondi<sup>1</sup>, A. Lanci<sup>1</sup>, K. Niinistö<sup>2</sup>, M. Cipone<sup>1</sup>. <sup>1</sup>Department of Veterinary Medical Sciences, University of Bologna, Bologna, Italy, <sup>2</sup>Veterinary Teaching Hospital, University of Helsinki, Helsinki, Finland

The subcostal view has never been described in echocardiographic examination of foals, nor aortic velocities obtained from this site. Aim of this study was to evaluate feasibility of subcostal transducer site in newborn foals and compare aortic bidimensional and Doppler-derived parameters obtained with conventional echocardiographic views. The study enrolled 18 newborn healthy foals, aged 7 to 134 hours and weighted 40 to 64 kg. Echocardiography was performed in lateral recumbency, using a 1–5 MHz phased-array probe. Subcostal view (SC) was obtained from left recumbency, placing the transducer under the xiphoid and pointing cranially through the liver in order to see the aorta vertically in the image. Pulsed-wave Doppler gate was always positioned just distal to the aortic valve. Aortic diameter (AD) at sinus of Valsava

was measured from right parasternal long-axis and SC views. Peak aortic velocity (PAV), velocity time integral (VTI) and expected pressure gradient (PG) were obtained by pulsed-wave Doppler spectra from left apex (LA) and SC views. Data were analyzed by Wilcoxon test for paired samples. No statistical difference was found in AD between different views ( $P = 0.06$ ). PAV, VTI and PG obtained from SC were significantly greater than from LA position ( $P = 0.0001$ ,  $P = 0.0005$ ,  $P < 0.001$ ). As reported in dogs, SC view provides an optimal alignment with aortic outflow, leading to higher velocities on Doppler examination. We can conclude that subcostal view can be easily applied in newborn foals, and lead more reliable aortic flow velocities than conventional left apical one.

**LEFT VENTRICULAR FUNCTION IN THE AGEING HORSE.** P. Hamerlinck, S. Ven, G. Van Steenkiste, D. De Clercq, A. Decloedt, G. van Loon. Department of Large Animal Internal Medicine, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium

Ageing results in increased left ventricular stiffness and thus impaired relaxation in humans and small animals. The goal of this study was to assess the effect of ageing on echocardiographic measurements of left ventricular function in horses. M-mode, 2D- and tissue Doppler imaging (TDI) echocardiography were used to measure left ventricular dimensions, systolic time intervals and left ventricular systolic (S), early (E) and late (A) diastolic myocardial velocities in 10 young (5–8 years) and 11 old (>17 years) horses without cardiovascular disease. Results of both groups were compared using an independent t-test (significance:  $P < 0.05$ ). The group of old horses showed a significantly higher left ventricular end-diastolic internal diameter measured from a short-axis M-mode image at chordal level ( $P = 0.02$ ). The ratio of pre-ejection period to ejection time was significantly lower in old horses ( $0.17 \pm 0.06$  vs.  $0.22 \pm 0.04$ ,  $P = 0.04$ ). TDI showed a significantly lower E/A ratio in old horses, both at chordal ( $2.44 \pm 0.77$  vs.  $3.58 \pm 1.54$ ;  $P = 0.04$ ) and at papillary muscle ( $1.55 \pm 0.58$  vs.  $2.68 \pm 0.88$ ;  $P = 0.002$ ) level. Aged horses show reduced early diastolic and increased late diastolic left ventricular myocardial velocities, indicating impaired relaxation. Further research in a larger population is needed for a more comprehensive quantification of left ventricular diastolic function in the ageing horse.

**HEART RATE VARIABILITY PARAMETERS TO DETECT ATRIAL FIBRILLATION IN HORSES.** B. Broux, D. De Clercq, L. Vera, G. Van Steenkiste, A. Decloedt, G. van Loon. Department of Equine Internal Medicine, Ghent University, Merelbeke, Belgium

Atrial fibrillation (AF) is the most common clinically important arrhythmia in horses. Diagnosis can be suspected during auscultation, but has to be confirmed with electrocardiography. After successful treatment, relapse is common. Heart rate monitors can be used in horses and may offer basic parameters for heart rate variability (HRV). If HRV parameters can be used to diagnose AF, this would be an accessible diagnostic tool for both veterinarians and horse owners to monitor their horses for AF recurrence. The purpose of this study was to assess if HRV parameters can distinguish between AF and sinus rhythm (SR). Therefore 6 HRV parameters were determined in 20 horses, both in AF and in SR, at rest (2, 5, 60 and 240 minute recordings) and during exercise (walk and trot, 2 minute recordings). Time-domain (SDRR, RMSSD and Triangular Index), frequency domain (LF/HF ratio) and nonlinear parameters (SD1 and SD2) were used. Results for the detection of AF were good ( $AUC > 0.8$ ) for most HRV parameters. RMSSD, SD1 and LF/HF ratio yielded the best results ( $AUC > 0.9$ ). Cut-off values with good sensitivity and specificity were set at 320 ms, 227 ms and 0.896 for RMSSD, SD1 and LF/HF at rest and at 92 ms, 65 ms and 1.126 at walk. Although results improved with longer recordings, short recordings were sufficient. In horses with frequent second degree AV-block, which increased HRV, recordings at walk or trot are recommended. We concluded that HRV parameters can be used to monitor AF recurrence in horses that were successfully treated for AF.

**PHARMACOKINETICS AND ELECTROPHYSIOLOGICAL EFFECTS OF DIFFERENT DOSAGES OF ORAL SOTALOL IN HORSES: PRELIMINARY RESULTS.** B. Broux<sup>1</sup>, D. De Clercq<sup>1</sup>, L. Vera<sup>1</sup>, G. Van Steenkiste<sup>1</sup>, A. Decloedt<sup>1</sup>, A. Watteyn<sup>2</sup>, M. Devreese<sup>2</sup>, S. Croubels<sup>2</sup>, G. van Loon<sup>1</sup>. <sup>1</sup>Department of Large Animal Internal Medicine, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium, <sup>2</sup>Department of Pharmacology, Toxicology and Biochemistry, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium

Arrhythmias are common in horses and sometimes require long term anti-arrhythmic therapy. Unfortunately oral anti-arrhythmic drugs for use in horses are currently scarce. In human patients and small animals, sotalol hydrochloride is often used for long term treatment. Little is known about pharmacokinetics and electrophysiological effects of sotalol in horses. The purpose of this study was to determine oral bioavailability of sotalol at different dosages in unfasted horses, and to investigate the effects on atrial (AERP) and ventricular effective refractory period (VERP). Therefore, 6 healthy, unfasted horses were given either 0, 2, 3 or 4 mg/kg sotalol hydrochloride orally in a cross-over design. Plasma concentrations and AERP and VERP (at 600 and 1000 ms basic pacing cycle length (BCL)) were determined at steady state. Oral availability of sotalol was variable within and between horses. At 2, 3, and 4 mg/kg maximum plasma concentrations of 711, 1016 and 2324 ng/mL were reached. At 1000 ms BCL, VERP increased by 17, 24 and 21% and AERP by 15, 23 and 17% at 2, 3 and 4 mg/kg, respectively. At 600 ms, VERP increased by 6, 15 and 6% and AERP by 15, 13 and 14%. Sotalol increased ERP, but, despite increasing plasma concentrations, higher dosages did not result in a progressive increase in ERP. Besides local sweating, no side effects were noted. We conclude that sotalol increases ERP in horses. Since oral absorption is variable, care should be taken when using high dosages.

**INFLUENCE OF ORALLY ADMINISTERED SOTALOL HYDROCHLORIDE ON QT INTERVALS AT REST AND IN ANESTHETIZED HORSES AFTER TRANSVENOUS ELECTRICAL CARDIOVERSION (TVEC).** A. Dufourni, B. Broux, A. Decloedt, D. De Clercq, G. van Loon. Department of Large Animal Internal Medicine, Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium

Immediately after cardioversion of atrial fibrillation, reverse remodeling takes place and suppression of atrial and ventricular premature beats is important in reducing recurrence rates. Sotalol hydrochloride is a potent, non-cardioselective  $\beta$ -adrenergic blocking agent with class III anti-arrhythmic action which can be used for oral anti-arrhythmic therapy in horses. In human patients, it prolongs repolarization and the effective refractory period with a significant increase in QT interval. A retrospective cohort study was performed on 30 horses that underwent TVEC. Mean QT and RR intervals at heart rates between 35 and 45 bpm were compared between two groups. The first group ( $n = 15$ ) did not receive any medication and measurements were made prior to TVEC and under general anesthesia after cardioversion. In the second group ( $n = 15$ ), measurements were made before and after oral administration of 2 mg/kg of sotalol hydrochloride prior to TVEC and under general anesthesia after cardioversion. Results were analyzed using linear mixed models with Bonferroni correction for multiple comparisons (horse random factor, treatment fixed factor). Baseline mean QT interval ( $n = 30$ ) was  $493 \pm 39$  ms. The mean QT interval did not increase significantly ( $P = 0.219$ ) after sotalol treatment ( $518 \pm 48$  ms). Mean QT intervals increased significantly under general anesthesia ( $688 \pm 46$  ms,  $P < 0.001$ ) and were even significantly longer in horses treated with sotalol ( $771 \pm 61$  ms,  $P < 0.001$ ). Compared to baseline, anesthesia prolonged the QT interval by 39% in untreated horses and 57% in horses treated orally with sotalol hydrochloride. Excessive QT prolongation is often considered to be a risk factor for life-threatening ventricular tachyarrhythmia.

**TRANSCRANIAL MAGNETIC STIMULATION UNRAVELS MOTOR IMPAIRMENT IN KNUCKLING HORSES AFFECTED BY ACQUIRED EQUINE POLYNEUROPATHY.** A. May<sup>1</sup>, S. Hanche-Olsen<sup>2</sup>, G. Gröndahl<sup>3</sup>, L. Walendy<sup>1</sup>, K. Hultin Jäderlund<sup>4</sup>, K. Matiaszek<sup>5</sup>, L. Goehring<sup>1</sup>. <sup>1</sup>Equine Clinic, Centre for Clinical Veterinary Medicine, Ludwig Maximilians University, Munich, Germany, <sup>2</sup>Equine Clinic, Norwegian University of Life Science, Oslo, Norway, <sup>3</sup>Department of Animal Health and Antimicrobial Strategies, National Veterinary Institute, Uppsala, Sweden, <sup>4</sup>Small Animal Clinic, Norwegian University of Life Science, Oslo, Norway, <sup>5</sup>Section of Clinical and Comparative Neuropathology, Centre for Clinical Veterinary Medicine, Ludwig Maximilians University, Munich, Germany

Acquired Equine Polyneuropathy (AEP; Scandinavian knuckling syndrome), is a neurologic disease of Scandinavia that is characterized by extensor weakness in metatarsophalangeal and, less frequently, metacarpophalangeal joints. A specific etiology has not been identified, but AEP appears to be linked to silage feeding. It affects all breeds/age groups and presents with variable outcome ranging from fatal disability to complete recovery over a 5–6 month resting period. Pathologically, AEP is an intermediate neuropathy with conspicuous Schwann cell pathology and loss of large myelinated fibers. As recent findings also suggest degeneration of upper motor neuron (UMN), we obtained transcranial magnetic evoked potentials (TcMEP) from omotransversarius, extensor carpi radialis, gluteus and tibialis cranialis muscles of a cohort of knuckling horses and clinically sound stable mates to clarify 1. the possibility of subclinical disease, 2. the specific contribution of UMN/LMN dysfunction to the extensor dysfunction. Altogether 22 animals were included. All knuckling horses ( $n = 14$ ) showed prolonged TcMEP latency times (LTs) of tibial cranial muscles (left  $48.6 \pm 7.8$ , right  $49.4 \pm 5.4$ ). The non-neurological cohort could be subdivided into 5 animals with likewise increased LT (left  $41.9 \pm 3.7$ , right  $52.2 \pm 7.7$ ) and 3 horses with LTs ranging within reference values (left  $24.0 \pm 8.5$ , right  $24.2 \pm 8.5$ ). In summary, TcMEP results show that AEP has a significant motor component. It further proved feasible to detect subclinical conduction/transmission failure in seemingly unaffected animals and therefore is a sensitive tool to identify horses at risk and to stratify disease development amongst neurologically affected individuals.

## Flash Presentations

**TRIMETHOPRIM-SULFADIAZINE HAS KV11.1 POTASSIUM CHANNEL BLOCKING ACTIVITY IN HORSES.** D.S. Trachsel<sup>1,2</sup>, M.A. Tejada<sup>1</sup>, V. Grøsfjeld Christensen<sup>1</sup>, P.J. Pedersen<sup>1</sup>, J.K. Kanters<sup>3,4</sup>, K. Calloe<sup>1</sup>, R. Buhl<sup>2</sup>, D.A. Klaeke<sup>1</sup>. <sup>1</sup>Department of Veterinary Clinical and Animal Science, Faculty of Health and Medical Sciences, University of Copenhagen, Frederiksberg C, Denmark, <sup>2</sup>Department of Large Animal Sciences, Faculty of Health and Medical Sciences, University of Copenhagen, Taastrup, Denmark, <sup>3</sup>Laboratory of Experimental Cardiology, Department of Biomedical Sciences, Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen N, Denmark, <sup>4</sup>Department of Cardiology, Herlev and Gentofte University Hospitals, Niels Andersen vej, Hellerup, Denmark

Several pharmaceutical compounds, including Trimethoprim-sulfamethoxazole have been shown to increase the QT intervals in humans and therefore predispose to the acquired long QT syndrome (aLQTS), a well-known repolarization disorder associated with severe ventricular arrhythmias. A common mechanism responsible for aLQTS is an interaction between drugs and K<sup>+</sup> channels, e.g. blocking of Kv11.1 channels. Trimethoprim-sulfonamides combinations are large spectrum antimicrobials commonly used in equine medicine. However, these drugs have never been investigated for cardiac side effects in equines, despite the occasional reports of collapse or death following drug administration. The aim of this work is to investigate the effect of a commercially available trimethoprim-sulfadiazine (TMS) combination on equine Kv11.1 channels. For this purpose, Kv11.1 channels cloned from equine hearts were heterologously expressed in *Xenopus laevis* oocytes. Whole cell currents were measured by two-electrode voltage-clamp (TEVC) before and during drug treatment. TMS reduced Kv11.1 steady state-currents measured at  $-20$  mV by 83% at a concentration of 10 mM. The half maximal blocking concentration was 3.74 mM (95% CI 2.9–

4.7 mM). Further, the voltage dependence of activation was affected by the compound, shown as a right shift in the current voltage relationship. The blocking effect was not use-dependent. This data indicates that TMS is a potent blocker of equine Kv11.1 channels and by affecting K<sup>+</sup> currents, TMS might prolong the repolarization in horses. However, further in vivo and in vitro studies are needed to assess the potential of this drug combination to induce aLQTS, associated severe arrhythmias and thus eventually cardiovascular incidents and/or death in horses.

**RIGHT CARDIAC MONOPHASIC ACTION POTENTIAL RECORDINGS IN STANDING NON-SEDATED HORSES.** D. De Clercq, B. Broux, L. Vera, G. Van Steenkiste, A. Decloedt, G. van Loon. Department of Large Animal Internal Medicine, Faculty of Veterinary Medicine, Ghent University, Belgium

In human medicine, monophasic action potential (MAP) analysis by contact electrode gives highly accurate information about the electrophysiological properties of cardiac tissue. It is used to investigate dysrhythmias and the impact of certain drugs on the myocardium. Precise measurement of a total MAP duration is difficult, therefore the MAP duration is usually determined at a repolarization level of 90% (APD90). The aim of the study was to make MAP recordings in the non-sedated, standing horse and to determine the APD90. In 6 healthy Warmblood horses, on two different days, an 8F quadripolar contact catheter (EasyMap MAP, Medfact, Germany) was passed through an introducer catheter in the jugular vein and placed under ultrasound guidance at the level of the tuberculum intervenosum or right atrial (RA) free wall, or in the right ventricular apex (RV). A MAP was recorded during 15 cardiac cycles. The heart rate ranged between 30 and 42 bpm. The amplitude and APD90 were measured semi-automatically with a data analysis software program (LabChart 8, ADInstruments, France). Recording time ranged between 35 and 165 minutes. The catheter displaced easily with horse movements. The mean ( $\pm$ SD) amplitude and APD90 were  $263 \pm 39$  ms and  $5.67 \pm 2.2$  mV in the RA ( $n = 180$ ) and  $472 \pm 26$  ms and  $8.39 \pm 6.62$  mV in the RV ( $n = 180$ ). The day-to-day variability was moderate. RA and RV MAP recordings can be successfully obtained in standing non-sedated horses with a moderate day-to-day variability. Excessive head and neck movements hamper the recording.

**PLASMA HOMOCYSTEINE CONCENTRATIONS IN HEALTHY HORSES AND HORSES WITH ATRIAL FIBRILLATION.** K.J. Mitchell<sup>1</sup>, D. De Clercq<sup>2</sup>, G. van Loon<sup>2</sup>, C.C. Schwarzwald<sup>1</sup>. <sup>1</sup>Equine Department, Vetsuisse Faculty, University of Zurich, Switzerland, <sup>2</sup>Department of Large Animal Internal Medicine, Faculty of Veterinary Medicine, Ghent University, Belgium

Homocysteine (HCY) is an amino acid produced from methionine metabolism. Plasma HCY concentrations ([HCY]<sub>p</sub>) are elevated ( $>15$   $\mu$ M) in some people with atrial fibrillation (AF) and can predict the recurrence of AF after cardioversion. The aim of this study was to validate a commercially available HCY assay for use in horses, to develop a reference interval for [HCY]<sub>p</sub> and to compare [HCY]<sub>p</sub> in healthy horses and in horses with AF before and after cardioversion. Blood samples collected from healthy horses ( $n = 27$ ) and horses with AF ( $n = 57$ ; 32 of which were cardioverted using transvenous electrical cardioversion (TVEC)) were analysed using an automated enzyme cycling assay (Homocysteine Cobas C, Integra, Roche). Linearity and precision of the assay were assessed, reference intervals calculated and [HCY]<sub>p</sub> compared between groups. The assay was precise (coefficient of variation 1.6–4.3%,  $n = 10$  repetitions) and provided linear results ( $r = 0.99$  for spiked and natural samples) for a range of HCY concentrations. The reference interval for [HCY]<sub>p</sub> was 1.7–7.9  $\mu$ M. [HCY]<sub>p</sub> was 4.65 [1.3–8.9]  $\mu$ M (mean [range]) in healthy horses and 4.65 [1.14–10.1]  $\mu$ M in horses with AF ( $P = 0.59$ ); and was 5.38 [1.67–11.9]  $\mu$ M on the first and 4.85 [1.28–10.4]  $\mu$ M on the 4th–12th day after TVEC ( $P = 0.16$ ). [HCY]<sub>p</sub> was not associated with recurrence of AF ( $n = 8$ ) ( $P = 0.86$ ). This assay allows precise measurement of [HCY]<sub>p</sub> in horses. Unlike in people, [HCY]<sub>p</sub> is not increased in horses with AF and cannot predict AF recurrence. This might be due to differences in the underlying pathological mechanisms of AF development in people and horses.

**LONG TERM PROGNOSIS OF MODERATE OR SEVERE LEFT-SIDED CARDIAC VALVULAR REGURGITATIONS IN HORSES.** A.A. Leroux, A. Goudmaeker, A. Fraipont, C. Cesarini, C. Cerri, L. Lecoq, H. Amory. Equine Teaching Hospital, Department of Companion Animals and Horses, Faculty of Veterinary Medicine, University of Liège, Liège, Belgium

Mitral and aortic regurgitations (MR and AR) are common in horses. Unlike mild valvular regurgitations, long-term prognosis of moderate or severe MR and AR is suspected to be guarded since they might induce congestive heart failure (CHF). The aim of this study is to perform a long-term follow-up of horses with moderate or severe MR and/or AR to confirm this prognosis. Firstly medical files of horses with moderate or severe MR and/or AR that had a follow-up, were retrospectively reviewed over a 15-years period (2000–2015). Clinical and echocardiographic data of 25 horses with moderate or severe MR (16/25) or AR (8/25) or both (1/25) were considered. All horses had undergone 2 or more echocardiographic exams 6 months to 10 years apart. Eight horses developed CHF (4 MR and 4 AR) and all died/were euthanized. Diastolic left ventricular internal diameter, left atrial diameter and pulmonary artery diameter were/became above reference values in 17/25 horses but no significant difference was observed between the first and the follow-up measurements (Student's *t*-test,  $P < 0.05$ ). Secondly follow-up data of additional horses with moderate or severe MR was collected by telephone survey. Owners of 27 horses agreed to answer the survey 1 to 6 years after diagnosis. Ten horses with CHF had died, 3/27 had developed CHF, 10/27 had remained clinically stable and 4/27 had died of non-cardiac causes. Results of this study confirm that moderate or severe MR and AR carry a guarded to poor long-term prognosis as 40% (21/52) of the studied horses developed CHF.

**MYOCARDIAL FUNCTION IN HORSES DURING GENERAL ANAESTHESIA EVALUATED BY PULSED-WAVE TISSUE DOPPLER ECHOCARDIOGRAPHY.** J. Wittschorek<sup>1</sup>, H. Gehlen<sup>2</sup>. <sup>1</sup>Clinical Center of Veterinary Medicine, Equine Medicine and Reproduction, Ludwig-Maximilians-University, Munich, Germany, <sup>2</sup>Department of Veterinary Medicine, Equine Clinic, Surgery and Radiology, Freie Universität, Berlin, Germany

The aim of this study was to evaluate myocardial function of the anaesthetized horse by pulsed-wave tissue Doppler imaging (TDI). Twenty-five heart healthy horses were selected that had been admitted for elective surgery. TDI measurements were performed before (T1), during (T2, T3) and after (T4) anaesthesia. A standardized anaesthetic protocol was used, which included sedation with a  $\alpha_2$ -adrenoreceptor agonist combined with an opioid, induction of anaesthesia with guaifenesin and ketamine, and inhaled isoflurane for maintenance. During anaesthesia all horses were kept in left lateral recumbency. The TDI parameters included the isovolumetric contraction (IVC) and the systolic (S) as well as the early (E) and late diastolic (A) maximal velocities. Parameters determined by TDI of the right ventricular wall velocities showed significant reductions comparing T1 to T3: A decreased by  $50.6 \pm 23.1$  % ( $P \leq 0.001$ ), S by  $39.8 \pm 38.6$  % ( $P \leq 0.001$ ) and IVC by  $25.0 \pm 37.2$  % ( $P \leq 0.001$ ). Comparing T1 to T3 on the left ventricular wall A decreased by  $37.8 \pm 24.8$  % ( $P \leq 0.001$ ) and S by  $18.1 \pm 26.2$  % ( $P \leq 0.001$ ). Comparing T2 to T3, significantly reduced parameters were measured, which indicates a negative impact of the duration of anaesthesia on contractility. The results of the study indicate that TDI is a suitable imaging technique during anaesthesia. A direct impact of general anaesthesia on the kinetics of the heart and negative effects on the contractility in heart healthy horses were registered.

**ORIGIN, LABORATORY RESULTS, THERAPEUTIC CONCEPTS AND OUTCOME OF HORSES DIAGNOSED WITH BORNA DISEASE INFECTION IN BAVARIA, GERMANY.** J. Wittschorek<sup>1</sup>, K. Matiassek<sup>2</sup>, A. May<sup>1</sup>, L.S. Goehring<sup>1</sup>. <sup>1</sup>Clinical Center of Veterinary Medicine, Equine Medicine and Reproduction, Germany, <sup>2</sup>Institute for Veterinary Pathology and Neuropathology, Ludwig-Maximilians-University, Munich, Germany

Borna Disease Virus (BDV) is an enveloped negative-stranded non-segmented RNA virus able to cause lethal encephalitis in equids. Occurrence is restricted to regions of continental Europe, specifically, Southern Germany, Switzerland, Austria and the

Czech Republic. In recent months we observed an increase in case admission possibly linked to habitat changes of the sylvatic reservoir and vector, the bicolored shrew (*Crocivura leucodon*). Aim of this retrospective study is to raise awareness; to summarize clinical signs; diagnostics; laboratory results; possible therapeutic approaches and present outcome of horses diagnosed with BD. Between April 2013 and July 2016 BD was diagnosed in 15 horses (8 female, 1 stallion, 6 geldings) aged 3 months to 21 years (median: 8 years) of various breeds. Cases originated from premises around Munich within a 120 km radius. A presumptive diagnosis was based on history and presentation with fever; lengthening periods of somnolence and stupor, with severe gait abnormalities (incoordination). Diagnosis was made by measuring BDV-specific serum (13/15) and in the cerebrospinal fluid antibodies (15/15), with CSF commonly displaying a lymphomonocytic pleocytosis. 9/15 horses were treated with dexamethasone (0.1–0.2 mg/kg once daily) resulting in a dramatic, short-lived improvement. 3/9 horses stabilized and were discharged. However, with time and lowered corticosteroid concentrations reappearance of clinical signs were noted with maximal survival of 10 weeks. All horses were euthanized a definitive diagnosis was made by hippocampal immunohistochemistry. In conclusion, BD is currently our most prevalent cause of encephalopathy in the horse with rare differential diagnosis of hepatoencephalopathy and cholesteatoma.

**STUDIES ON THE ABSORPTION OF HYPOGLYCIN A.** T. Krägeloh<sup>1</sup>, J.-M.V. Cavalleri<sup>2</sup>, J. Ziegler<sup>3</sup>, M. Terhardt<sup>4</sup>, J. Sander<sup>4</sup>, G. Breves<sup>1</sup>, A. Cihak<sup>1</sup>. <sup>1</sup>Department of Physiology, University of Veterinary Medicine Hannover, Foundation, Germany, <sup>2</sup>Clinic for Horses, University of Veterinary Medicine Hannover, Foundation, Germany, <sup>3</sup>Leibniz Institute of Plant Biochemistry, Halle, Germany, <sup>4</sup>Screening Labor, Hannover, Germany

Hypoglycin A (HGA) was detected in blood of horses affected by atypical myopathy (AM). After oral uptake, degradation to the toxic metabolite methylenecyclopropylacetic acid (MCPA) is considered as a prerequisite for the pathogenesis of AM. This study aimed to characterize the absorption of HGA along the intestinal axis and potential degradation within the intestine. Duodenal, jejunal, ileal and caecal mucosal tissues from five adult healthy horses were incubated in Ussing chambers in the presence of HGA. Mucosal disappearance, tissue uptake and serosal release of HGA were determined. Potential microbial degradation of HGA was investigated by Colon-simulation technique (Cositec). HGA concentrations were analysed by LC-ESI-MS/MS with Fmoc-Cl derivatization and those of MCPA by UPLC-MS/MS after butylation. Furthermore, the effects of paraffinum perliquidum and different adsorbents on HGA absorption were investigated. HGA was absorbed in the jejunum and the ileum. In the caecum and the duodenum, no significant mucosal uptake of HGA was detectable. Epithelial uptake of HGA in the jejunum was significantly reduced by addition of an adsorbent containing medicinal charcoal, kaolin, silica and oak bark. HGA metabolites were neither detected in samples of the Ussing chamber experiments nor in samples of the Cositec trial. Findings of the present study indicate that the major sites for intestinal HGA absorption are the jejunum and the ileum. The equine intestine might not be the predominant site for degradation of HGA. Furthermore, results indicate that oral administration of an appropriate adsorbent may be useful to prevent AM in horses and their co-grazers.

**DIAGNOSTIC VALUE OF SEROLOGIC TESTS AND SEROPREVALENCE OF BORRELIOSIS IN HORSES LIVING IN SOUTHERN BELGIUM.** S. Cerri<sup>1</sup>, C. Meersschaert<sup>2</sup>, R. Houben<sup>1</sup>, P.H. Pitel<sup>3</sup>, H. Amory<sup>1</sup>. <sup>1</sup>Faculty of Veterinary Medicine, Department of Companion Animals and Equids, University of Liège, Liège, Belgium, <sup>2</sup>Laboratoires Réunis, Fléron, Belgium, Caen, France

The aim of this study was to compare the sensitivity and specificity of two commonly used borreliosis serologic tests in horses in Europe, i.e. an immunofluorescence (IF) and an ELISA test, using a Western blot (WB) as reference standard, and to evaluate the seroprevalence of borreliosis in healthy horses living in the southern Belgium. In the first part of the study, the serum of 100 horses with a clinical suspicion of borreliosis was tested using the 3 techniques. Using 1/512 as positive threshold, the sensibility and sensitivity of the IF test were 83 and 74%, respectively, and the

sensibility and sensitivity of the ELISA test were 83 and 78%, respectively. The ELISA test was therefore used to test 303 serums collected between April 2014 and April 2016 from healthy horses living in southern Belgium. A seroprevalence of 22% was observed in those horses with an evidence of age related effect ( $P$ -value = 0.02) on the presence of *Borrelia burgdorferi* antibodies. These results are in good agreement with previously reported results in other European countries and in northern Belgium. In conclusion, taking in account (i) the high seroprevalence of borreliosis in healthy horses living in southern Belgium, as it is the cases in other European countries, and (ii) the low diagnostic values of the two most commonly used borreliosis serologic tests used by equine practitioners, this study illustrates the high need to convince Belgian equine practitioners to confirm the positive results of *Borrelia burgdorferi* before administration of an antibiotic treatment.

**CLINICAL, IMAGING AND DYNAMIC ABNORMALITIES IN 4 CASES OF LARYNGEAL DYSPLASIA.** V. Deniau<sup>1</sup>, O. Brandenberger, F. Rossignol. Clinique Veterinaire de Grosbois, Domaine de Grosbois, Boissy Saint Leger, France

Laryngeal dysplasia linked to 4th branchial arch defect is a recognised syndrome in various breed of horses, recently documented with MRI studies. We describe the clinical, imaging, and exercise endoscopy findings in 4 cases diagnosed between 2012 and 2016. One jumping warmblood (case 1) and 3 racing thoroughbred (cases 2 to 4) mares, aged 3 to 7 years, were presented with complaint of poor performance and respiratory noise. Laryngeal dysplasia was suspected by palpation in 2 cases based on the detection of a unilateral gap between the upper cricoid and thyroid cartilages. Resting endoscopy revealed a rostral displacement of the palatopharyngeal arch in two cases and a grade 3 reduced arytenoid abduction either right-sided (case 1) or left-sided (cases 2 and 3). Radiography of the larynx in case 1 demonstrated the presence of air in proximal oesophagus. Ultrasound performed in cases 2 to 4 confirmed the absence of cricothyroid articulation and dorsal extension of the thyroid, either left-sided (cases 2 and 3) or bilateral (case 4). Exercise endoscopy performed in cases 2 to 4 revealed a collapse of the aryepiglottic and vocal folds, mild rostral-ventral displacement of the palatopharyngeal arch, and either left-sided (cases 2 and 3) or bilateral (case 5) grade C impaired arytenoid abduction. Dorsal displacement of the soft palate occurred in case 5. Right-sided laryngeal dysfunction was not the main endoscopic finding in this series compared to previous reports and association with left recurrent laryngeal neuropathy may represent a diagnostic challenge. In bilateral dysplasia, palpation can be confusing.

**EVALUATION OF SERUM CYTOKINES LEVELS IN EQUINE RECURRENT AIRWAY OBSTRUCTION (RAO).** A. Niedźwiedz<sup>1</sup>, H. Borowicz<sup>1</sup>, K. Kubiak<sup>1</sup>, Z. Jaworski<sup>2</sup>, M. Cegielski<sup>3</sup>, J. Nicpoń<sup>1</sup>. <sup>1</sup>Department of Internal Diseases with Clinic for Horses, Dogs and Cats; Wrocław University of Environmental and Life Sciences, Wrocław, Poland, <sup>2</sup>Department of Horse Breeding and Riding, University of Warmia and Mazury, Olsztyn, Poland, <sup>3</sup>Department of Histology and Embryology, Medical University of Wrocław, Wrocław, Poland

Recurrent airway obstruction (RAO) represents a serious health problem and is classified as an allergic disease, where contact with an antigen induce airway inflammation, bronchial hyper-responsiveness and airway obstruction. Previous studies have demonstrated the presence of the Th2 response in the lungs of human patients with asthma and horses with heaves. These cells are involved in the production of cytokines that regulate the synthesis of immunoglobulins. A total of 40 horses were evaluated: 30 horses with RAO and 10 healthy animals. The expression levels of IFN- $\alpha$ 1, IFN- $\gamma$ , IL-1 $\beta$ , IL-2, IL-4, IL-13 and tumor necrosis factor alpha (TNF- $\alpha$ ) were measured in the serum obtained from both groups during crisis, using commercially available ELISA tests. A comparison of quantitative variables was carried out using the Kruskal-Wallis test. The median level of IFN- $\gamma$  in the control horses was 36.4 pg/mL. In RAO-affected horses, the median IFN- $\gamma$  level was statistically different, and was 78.9, respectively ( $P < 0.0001$ ). The median level of IL-13 in the control horses was 10.2 pg/mL, and there was a statistical increase in the level of IL-13 in RAO-affected horses. The median level of IL-13 in the study

group was 65.55 pg/mL ( $P < 0.0001$ ). The serum median IFN- $\alpha$ 1, IL-1 $\beta$ , IL-2, IL-4, and TNF- $\alpha$  levels were similar in both groups. These results indicate a low variability of the levels of cytokines and a high frequency of their detection in serum samples from horses with RAO. Immune mechanisms involved in equine RAO are more complex than those defined by a simple Th1/Th2 dichotomy.

**COMPARISON OF SAMPLE SITE AND DIAGNOSTIC TESTS FOR DETERMINATION OF CARRIER STATE IN HORSES RECOVERED FROM STRANGLES.** J. Pringle<sup>1</sup>, M. Venner<sup>2</sup>, L. Tscheschlok<sup>2</sup>, M. Riihimäki<sup>1</sup>. <sup>1</sup>Swedish University of Agricultural Sciences, Uppsala, Sweden, <sup>2</sup>Equine Veterinary Clinic, Destedt, Germany

Approximately ten percent of horses recovering from strangles reportedly carry *S. equi ssp equi* (*S. equi*) silently in their guttural pouches (GP) for months to years. These silent carriers are a nidus for new outbreaks. Carrier detection requires analysis for *S. equi* in nasopharyngeal or GP lavages. As yet there are no data comparing the carrier detection ability of these two methods; in particular with introduction of improved diagnostic sensitivity by qPCR for *S. equi*. Two strangles outbreaks including 98 weanlings and 38 Icelandic horses were monitored for five and ten months respectively to detect silent carriers, using bacterial culture and qPCR on lavage samples from the nasopharynx and both GPs. Overall carrier state and yield from the test method and sampling site were identified. Descriptive statistics were calculated. McNemars test was used to assess for differences in carrier detection between sampling sites with  $P < 0.05$  deemed significant. Culture positive carriers were 3–13% (3/98 and 5/38 respectively), whereas qPCR positive carriers were 15–37% (15/98 and 14/38 respectively). Significantly more culture positives were from GP. All culture positives were also PCR positive. Based on qPCR results both nasopharyngeal lavage and GP lavage detected similar proportions of carriers. However, each were occasionally the sole positive sample for carrier identification. The qPCR findings suggest a higher level of strangles carrier state and that carriage of *S. equi* is not restricted to the GP. However, whether horses only qPCR positive to *S. equi* can infect naïve animals is unknown.

**THE EQUINE ACUTE ABDOMINAL PAIN SCALE (EAAPS) FOR HORSES WITH COLIC: IS IT FEASIBLE?** Y. Maskato<sup>1</sup>, A. Dugdale<sup>2</sup>, E.R. Singer<sup>2</sup>, G. Kelmer<sup>1</sup>, G.A. Sutton<sup>1</sup>. <sup>1</sup>Koret School of Veterinary Medicine, The Hebrew University of Jerusalem, Rehovot, Israel, <sup>2</sup>Philip Leverhulme Equine Hospital, School of Veterinary Science, University of Liverpool, Leahurst campus, South Wirral, UK

Clinical decision making in cases of colic requires pain assessment. Visual Analog Scale (VAS) is considered the gold standard. The Equine Acute Abdominal Pain Scale (EAAPS), a behavior-based scale, has been shown to be significantly more reliable and equally valid in comparison to the VAS, in studies using film clips. In this study, the EAAPS was evaluated in clinical cases for the first time. Consensual, discriminant and predictive validity, as well as usability and feasibility were examined. Pain in 56 horses, presenting with colic at one of two referral hospitals, was assessed by veterinarians, veterinary students, and technicians, by using both the VAS and the EAAPS. The EAAPS demonstrated both good usability and feasibility: 78% of the participants replied that pain scoring was easy or very easy [Confidence Interval (95%CI): 40–97] and 67% that pain scoring was quick or very quick (95%CI: 30–93). Discriminate validity (between extreme groups of strong pain versus weak pain; as defined by the VAS score) of EAAPS was good (AUC = 0.87; CI: 0.77–0.97). Predictive validity was similar to the VAS regarding outcome (dead or alive) as well as regarding surgical or medical treatment. Regarding predictive validity for outcome, EAAPS [Area Under the Curve (AUC) = 0.69, CI: 0.54–0.84] versus the VAS (AUC = 0.80). Predictive validity for surgical or medical treatment, EAAPS (AUC = 0.68, CI: 0.54–0.81) versus the VAS (AUC = 0.69). Consensual validity of EAAPS compared to the VAS (agreement) was moderate (Weighted Kappa = 0.57; 95%CI: 0.44–0.69). In conclusion, the EAAPS demonstrated good usability, feasibility and validity in the referral hospital setting.

**EQUINE GASTRIC ULCERATION SYNDROME (EGUS) IN DONKEYS: GASTROSCOPIC FINDINGS AND PREVALENCE.** M. Sgorbini<sup>1</sup>, F. Bonelli<sup>1</sup>, S. Busechian<sup>2</sup>, A. Briganti<sup>1</sup>, F. Laus<sup>3</sup>, F. Zappulla<sup>2</sup>, V. Faillace<sup>3</sup>, F. Rueca<sup>2</sup>. <sup>1</sup>Department of Veterinary Sciences, Veterinary Teaching Hospital "Mario Modenato", via Livornese snc, 56122 San Piero a Grado PI, Italy, <sup>2</sup>Department of Clinical Sciences, University of Perugia, Perugia, Italy, <sup>3</sup>School of Biosciences and Veterinary Medicine, University of Camerino, Matelica, MC, Italy

The aim was to present the findings of gastroscopy in a population of adult donkeys. Thirty-nine donkeys (16 jennies, 23 jacks), aged 1–18 years ( $5.7 \pm 5.0$ , median 3 years) underwent gastroscopy to evaluate the presence of lesions. Inclusion criteria: not athletes and non-working donkeys, breeding animals, no administration of NSAIDs or corticosteroids for at least 20 days immediately prior gastroscopy. Gastroscopy was performed after 15 hour of fasting, under sedation using a portable processor Gastropack and a 300 cm long scope. ESGD lesions were scored 0/4, EGGS was described as presence or absence, anatomical location, distribution, and appearance of lesions. Chi square test and Fisher's exact test were applied to verify differences in the prevalence of ESGD in relation to sex and age ( $\leq 4$  years and  $> 4$  years). Gastric lesions were not present in 19/39 (49%) donkeys, while 20/39 (51%) donkeys showed EGUS; 19/20 (95%) donkeys were affected by ESGD, while 1/20 (5%) donkey showed both ESGD and EGGS. ESGD was 0 in 19/39 (48.7%), 1 in 5/39 (12.8%), 2 in 10/39 (25.6%), 3 in 4/39 (10.2%) and 4 in 1/39 (2.7%) donkeys, respectively. EGGS lesion was a mild depression in the ventral glandular fundus. Statistical analysis showed no differences in relation to sex or age. To the authors' knowledge this is the first report on alive donkeys. Our prevalence was higher than in dead/euthanized donkeys, but similar to sports and pleasure horses. No statistical differences in the prevalence of ESGD in relation with sex or age were detected, in line to literature.

**USEFULNESS OF THREE PORTABLE LACTATE MEASUREMENT DEVICES IN HORSES.** C.C.B.M. Munsters<sup>1,2</sup>, J. van den Broek<sup>3</sup>, E.W. Siegers<sup>1</sup>, M.M. Sloet van Oldruitenborgh-Oosterbaan<sup>1</sup>. <sup>1</sup>Department of Equine Sciences, Faculty of Veterinary Medicine, Utrecht University, CM Utrecht, the Netherlands, <sup>2</sup>Moxie Sport Analysis & Coaching, SR Erp, the Netherlands, <sup>3</sup>Department of Farm Animal Health, Utrecht University, Utrecht, the Netherlands

Since one of the validated hand-held lactate (LA) measurement devices (Lactate Pro) is now out of production, an alternative instrument is needed to be found for equine exercise testing and for use in horses with gastrointestinal disorders. The aim of this study was to evaluate three hand-held LA analyzers (Lactate Pro, Lactate Pro-2 and StatStip Lactate Xpress), and to compare these with the gold standard laboratory assay (sla-LA; DXC-600 Analyser - Beckman Coulterlab). A total of 220 blood samples were collected from the jugular vein of 44 eventing horses during standardized exercise testing. Immediately after collection each blood sample was parallel tested using the three lactate analyzers. The rest of each blood sample was placed in NaF tubes and centrifuged within 8 hours. The plasma was stored at  $-20^{\circ}\text{C}$  for laboratory assay. The lactate concentrations for each instrument were compared with the laboratory analysis. All data were statistically evaluated using a linear mixed effect model (Akaike's Information criterion;  $t > 2.00$ ). The Pearson correlations between sla-LA and Lactate Pro, Lactate Pro-2 and StatStip Lactate Xpress were 0.974, 0.981 and 0.828 respectively. Of the 3 instruments the Lactate Pro 2 provided the closest correlation with the laboratory assay. The predicted values were derived from the formula:  $\log(\text{sla-LA}) = 0.27175 + 0.94567 * (\text{Lactate Pro-2})$  or  $\text{sla-LA} = 1.3226 * (\text{Lactate Pro-2})^{0.94567}$ . The predicted value for sla-LA values using the Lactate Pro-2 was 0.992 for an average horse. The Lactate Pro-2 appeared to be a good alternative for the Lactate Pro that is no longer in production.

**EVALUATION OF A WHOLE BLOOD, POINT OF CARE COAGULOMETER IN HORSES.** C.J. Mackenzie<sup>1</sup>, G. Pinchbeck<sup>2</sup>, C. McGowan<sup>1</sup>, H.B. Carslake<sup>1</sup>. <sup>1</sup>Philip Leverhulme Equine Hospital, School of Veterinary Science, University of Liverpool, Veterinary Science, Neston, Wirral, UK, <sup>2</sup>Department of Epidemiology and Population Health, Institute of Infection and Global Health, University of Liverpool, Neston, Wirral, UK

Monitoring of coagulation status offers valuable diagnostic and prognostic information in critically ill horses, but is rarely used in practice. A point of care (POC) coagulometer could offer a rapid and convenient method of evaluating coagulation and enable more routine use. The aim of this study was to evaluate a whole blood POC coagulometer (CoagHD, Diagon) for measurement of prothrombin time (PT) and detection of wider disseminated intravascular coagulation (DIC) in critically ill horses. This prospective observational study evaluated blood samples from 60 horses admitted to an intensive care unit and 20 healthy control horses. PT was measured using the POC coagulometer and compared to measurements from two conventional plasma coagulometers. aPTT, platelets, fibrinogen, ATIII and D-dimers were measured using conventional laboratory analysers and used to determine DIC status. Conventional statistical tests were applied to continuous and binary outcomes. Repeatability of the POC PT assay was good ( $\text{CV} = 3.7\%$ ). There was strong to very strong positive correlation ( $r = 0.60\text{--}0.81$ ) and moderate agreement with fixed and proportional biases between the POC and other plasma PT analysers. All PT assays showed a fair level of agreement with a diagnosis of DIC. The whole blood POC coagulometer displayed high sensitivity (91%) and moderate negative predictive value (73%) but poor specificity (30%) for a diagnosis of DIC. Compared to conventional PT analysers, the POC unit is rapid and convenient, and provides results which could aid in the early detection of DIC in critically ill horses. Further studies examining association with diagnosis and outcome are warranted.

**EFFECT OF SAMPLING TECHNIQUE ON COAGULATION PARAMETERS IN THE HORSE: NEEDLE VERSUS INDWELLING INTRAVENOUS CATHETER.** C.J. Mackenzie<sup>1</sup>, C. McGowan<sup>1</sup>, G. Pinchbeck<sup>2</sup>, H.B. Carslake<sup>1</sup>. <sup>1</sup>Philip Leverhulme Equine Hospital, School of Veterinary Science, University of Liverpool, Veterinary Science, Neston, Wirral, UK, <sup>2</sup>Department of Epidemiology and Population Health, Institute of Infection and Global Health, University of Liverpool, Neston, Wirral, UK

Evaluation of coagulation status is an important component of critical care. Previous studies have demonstrated that sequential monitoring of coagulation status can provide useful prognostic information. To allow ongoing monitoring, patients in veterinary hospitals are often subjected to serial venipuncture. Adverse effects such as increased patient anxiety and trauma to the sampled vessel could be avoided by the use of an indwelling intravenous catheter (IVC) for repeat blood sampling. This has previously been avoided due to concerns that sampling directly from an IVC may alter the accuracy of the results. The aim of this study was to compare coagulation parameters from blood obtained via a needle and via an IVC in critically ill horses. This was a prospective observational study. Blood samples were obtained by both direct venipuncture and from an indwelling IVC in 55 horses admitted to an intensive care unit. Both samples were analysed for the following coagulation parameters: plasma PT, aPTT, ATIII, fibrinogen and D-dimers and whole blood PT. Agreement was assessed using Bland-Altman analysis and Lin's concordance correlation coefficient. There was no fixed bias detected for any of the coagulation parameters. With the exception of ATIII and D-dimers, agreement between sampling methods was good, correlation was substantial ( $\text{Rc} \geq 0.95$ ) and clinically comparable outcomes were obtained. IVC blood samples are suitable for the measurement of routine coagulation parameters, apart from ATIII and D-dimers.

**USEFULNESS OF A HAND-HELD GLUCOMETER IN HORSES.** A.J. van den Brom-Spienburg, M.M. Sloet van Oldruitenborgh-Oosterbaan, E. Roelfsema. Department of Equine Sciences, Faculty of Veterinary Medicine, Utrecht University, CM Utrecht, the Netherlands

The demands for validity and repeatability of glucose measurements inside and outside the physiological range are much higher for research than for clinical purposes. The aim of this study was to evaluate the use of the g-Pet® (Woodley Equipment Company Ltd.) blood glucose monitor with species-chip for horses. In 167 venous blood samples glucose concentrations were determined immediately after collection with g-Pet®. The rest of the blood was stored for a 'standard measurement', in heparin for Siemens RapidLab® (n = 95) or in NAF for Beckman Coulter® (n = 72). The 95% limits of agreement (Bland Altman) were -0.1 to +4.0 mmol/L for g-Pet® versus RapidLab® (ranges 4.4–29.0 mmol/L and 3.2–28.6 mmol/L respectively) and +0.6 to +3.9 mmol/L for g-Pet® versus Beckman Coulter® (ranges 3.9–17.3 mmol/L and 2.8–12.6 mmol/L respectively). Glucose concentrations measured on the RapidLab® (n = 26) and on the Beckman Coulter® (n = 25) within reference range (3.9–5.6 mmol/L) had 95% limits of agreement of +1.2 to +2.3 mmol/L and +0.6 to +2.4 mmol/L respectively. To determine repeatability, 6 samples with varying concentrations (RapidLab® 4.9, 9.1, 14.3, 16.9, 21.4 and 28.6 mmol/L) were determined 8 times on the g-Pet® resulting in (mean±SD): 5.4 ± 0.2, 10.3 ± 0.2, 14.3 ± 0.2, 19.2 ± 0.3, 23.0 ± 0.6 and 28.0 ± 1.6 mmol/L respectively. The overall repeatability coefficient was 2.0 mmol/L and for the sample within reference range (mean 5.4 mmol/L) it was 0.5 mmol/L. In conclusion: gPet® appeared acceptable for some clinical indications but unsuitable for research purposes (e.g. glucose tolerance tests) where high accuracy is required in an extraordinary wide range of blood glucose concentrations.

**GLUCOCORTICOID RECEPTOR IN THE EQUINE PITUITARY IN HEALTH AND DISEASE.** R.A. Morgan<sup>1,2</sup>, S. Davis<sup>1</sup>, J. Moses-Williams<sup>1</sup>, J.A. Keen<sup>1</sup>. <sup>1</sup>Royal Dick School of Veterinary Studies, University of Edinburgh, Midlothian, UK, <sup>2</sup>University/BHF Centre for Cardiovascular Science, The Queen's Medical Research Institute, University of Edinburgh, Edinburgh, UK

Pituitary pars intermedia dysfunction (PPID) is common in aged horses. Adenomatous or hyperplastic growth of the pars intermedia (PI) results in excessive production of ACTH and an apparent failure of the normal control mechanisms. It has been suggested that the absence of glucocorticoid receptor (GR) induced negative feedback in the PI may contribute to this dysregulation. The aim herein was to determine if GR is present in the equine PI and whether its expression is altered by disease. Pituitary glands from 8 healthy horses and 8 with PPID were harvested post-mortem, bisected along the midline, with half cryo-embedded and half formalin-fixed. The pars distalis (PD) and PI were identified microscopically in the frozen sections and tissue collected from each area. RNA was extracted and qPCR used to quantify GR mRNA transcripts. Immunohistochemistry for GR was performed on the formalin-fixed sections and the signal scored by two observers blinded to disease status. GR mRNA transcripts were present at similar levels in both the PD and PI. There were no significant differences between healthy horses and those with PPID. GR protein was identified in all areas of the pituitary. Less GR protein was present in the PI compared to the PD but there was no effect of disease. This study demonstrates that GR is expressed in the PI of the equine pituitary and its expression is not altered by disease. An absence of GR is not responsible for the apparent failure of the negative feedback response of the diseased PI.

**INSULIN SIGNALING IN VARIOUS EQUINE TISSUES UNDER BASAL CONDITIONS AND UNDER ACUTE STIMULATION BY GLUCOSE AND INSULIN.** T. Warnken<sup>1</sup>, K. Feige<sup>1</sup>, K. Huber<sup>1</sup>. <sup>1</sup>Clinic for Horses, University of Veterinary Medicine, Hannover, Germany, <sup>2</sup>Institute of Animal Science, Faculty of Agricultural Sciences, University of Hohenheim, Stuttgart, Germany

The objective of the study was to determine key proteins of the equine insulin signaling cascade and their extent of

phosphorylation in biopsies from muscle tissue, liver tissue and nuchal (NUAT), subcutaneous (SCAT) and retroperitoneal (RPAT) adipose tissues, under unstimulated (B1) and intravenously stimulated (B2) conditions, which were achieved by injection of glucose (150 mg/kg bwt) and insulin (0.1 IU/kg bwt). Twelve warm blood horses were included in the study, aged 15 ± 7 years and weighed 560 ± 81 kg with a mean body condition score of 4.8 ± 1.6. In unstimulated and stimulated biopsy samples taken from each horse consecutively within three weeks, selected key proteins of the insulin signaling cascade were semi-quantitatively determined using Western Blotting. Modulation of the cascade was assessed by demonstration of respective phosphorylated proteins. The basal expression of proteins was almost not influenced within the experimental time. Insulin induced a high extent of phosphorylation of insulin receptor (InsR) in liver but not in muscle. Protein kinase B (PKB) and mammalian target of rapamycin (mTOR) expressed a higher extent of phosphorylation in all tissues in B2 biopsies. Adenosine monophosphate protein kinase (AMPK) as a component related to insulin signaling, expressed enhanced phosphorylation in adipose tissues, but not in liver and muscle tissue. To summarize, we were able to show tissue-specific variations in acute response of compounds of insulin signaling to intravenous injection of insulin. In conclusion, insulin sensitivity in healthy horses is based on a complex concerted action of different tissues by their variations in the molecular response to insulin.

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**EVALUATION OF HEARTRATE VARIABILITY AND SERUM CORTISOL LEVELS DURING EUTHANASIA IN 40 HORSES.** M. Walther<sup>1</sup>, J. Loschelder<sup>1</sup>, R. Merle<sup>1,2</sup>, H. Gehlen<sup>1</sup>. <sup>1</sup>Clinic for Horses, Freie Universität Berlin, Berlin, <sup>2</sup>Institute for Veterinary Epidemiology and Biostatistics, Freie Universität Berlin, Berlin

Euthanasia is one of the greatest responsibilities for veterinarian surgeons and should be done with the least possible stress for the patient and its owner. In this prospective study serum cortisol and heartrate variabilities were measured during euthanasia in 40 horses to assess stress levels. Euthanasia was performed by sedating the horses with xylazine (0.8 mg/kg), inducing anesthesia using ketamine (2.2 mg/kg) and diazepam (0.02 mg/kg) and euthanizing the horse using pentobarbital (100 mg/kg). Cortisol levels were measured before sedation and after time of death. An ECG was performed during the process. Heartrate variabilities were assessed using Kubios® software. Cortisol levels significantly increased ( $P = 0.001$ ; Wilcoxon-Test) in all horses between sedation and time of death. Analyzing the data using different groups (horses with colic, orthopedic problems or other diseases; presence or absence of the owner; acute or chronic diseases, and location of euthanasia) there was a smaller increase of cortisol levels when owners were present ( $P = 0.04$ ; Mann-Whitney test). Furthermore there were significant higher values at both measurements of serum cortisol in horses suffering from colic than in all other horses (before  $P = 0.01$ , after  $P = 0.01$ ; Mann-Whitney test). There was no significant difference whether the horse was euthanized in the stable or in the surgical induction area. Heartrate variabilities showed a significant difference ( $P < 0.001$ ; Friedman test) during three phases of euthanasia. It was higher during induction, lower during anesthesia and highest during injection of pentobarbital. These results indicate a stress response to the process of euthanasia especially at the time of injecting pentobarbital. \*Kubios Programm HRV Version 2.0, der Biosignal & Medical Imaging Group, Department für Physik, Universität Kuopio, Finland.

## Accepted Posters

**LEUKEMIA IN HORSES: A CASE SERIES.** C. Cooper<sup>1</sup>, S. Keller<sup>2</sup>, L.G. Arroyo<sup>1</sup>, J. Hewson<sup>1</sup>, D. Kenney<sup>1</sup>, H. Stämpfli<sup>1</sup>, D. Bienzle<sup>2</sup>. <sup>1</sup>Department of Clinical Studies, University of Guelph, Guelph, ON, Canada, <sup>2</sup>Department of Pathobiology, University of Guelph, Guelph, ON, Canada

Leukemia, a neoplasm of hematopoietic cells, is divided in lymphoid and myeloid type with acute and chronic forms based on duration of illness, severity of cytopenia and cell composition. The objectives of this study were to describe clinical, hematological,

morphological and immunohistochemical properties of leukemia in horses. Review of medical and laboratory records over 17 years identified 16 horses diagnosed with leukemia. Horses included 9 males and 7 females ranging from 0.2 to 25.9 years (median 6.5) in age. All horses with acute lymphocytic leukemia (ALL) were below 4 years, and all horses with myelodysplastic syndrome (MDS) were above 13 years of age. Fifteen horses (93%) had thrombocytopenia ( $7-68 \times 10^9/L$ ), eleven (69%) had anemia (hematocrit 0.08–0.27 L/L), and all had atypical leukocytes on blood films. Six cases were classified as ALL based on immunohistochemical detection of CD3, CD20 and/or CD79a antigens; six as acute myeloid leukemia (AML; 4 myelomonocytic, one basophilic, one eosinophilic) by >20% blast cells with expression of Iab antigen and partial leukocyte differentiation; and four cases as MDS with refractory thrombocytopenia ( $n = 3$ ) or neutropenia ( $n = 1$ ) with excess blasts based on ineffective hematopoiesis and dysplasia. Postmortem examination identified leukemia involving lymph nodes ( $n = 8$ ), liver ( $n = 8$ ), lung ( $n = 4$ ), gastrointestinal tract ( $n = 4$ ) and kidney ( $n = 3$ ) in addition to hematopoietic tissue. Horses with ALL or AML survived <42 days while two horses with MDS had historical cytopenia exceeding one year, and two are alive 342 and 80 days after diagnosis. These findings indicate variable features and prognosis of leukemia in horses.

**THE INFLUENCE OF CLEANING, DISINFECTION AND DRYING METHODS ON ENDOSCOPE HYGIENE IN EQUINE MEDICINE.** A.K. Barton<sup>1</sup>, N. Roschanski<sup>2</sup>, R. Merle<sup>3</sup>, U. Rösler<sup>2</sup>, H. Gehlen<sup>1</sup>. <sup>1</sup>Equine Clinic, Berlin, <sup>2</sup>Institute for Animal Hygiene and Environmental Health, Berlin, <sup>3</sup>Institute for Veterinary Epidemiology & Biostatistics, Department of Veterinary Medicine, Freie Universität Berlin, Berlin

In times of increasing numbers of infections caused by multiresistant bacteria, sufficient, but feasible cleaning and disinfection of veterinary endoscopes is of great importance. In the here described study, two cleaning- and disinfection methods (manual vs. automated) as well as two different drying techniques (air-drying vs. pressurized air) were compared. Therefore, 4 groups of 40 endoscopic examinations were investigated by sampling of working channel, endoscope tip and shaft at 3 time-points. Microbiologic swab results were evaluated for total bacteria counts, successful cleaning and disinfection was defined as total bacteria of 0 or at least 4 log reduction. Overall, the percentage of successful cleaning, disinfection and drying over the different groups varied from 74 to 82%. A significant influence of the method of drying and the examined organ system was found for the working channel, while no significant factors were found for tip and shaft. Disinfection was most successful after examinations of the lower airways ( $P = 0.003$ ), while odds ratios for the gastrointestinal tract and upper airways were 0.073 and 0.115, respectively. There was also a trend towards a positive effect of pressurized air drying, but this remained insignificant ( $P = 0.095$ ). Overall, modern methods of disinfection and drying were found to be superior for the localizations working channel and endoscope tip ( $P < 0.05$ ), but not for the shaft. In conclusion, careful cleaning and disinfection is essential in particular after endoscopic examinations of the upper airways and the gastrointestinal tract. Pressurized air drying seems preferable.

**CHRONIC PYLORIC DISORDERS IN HORSES: 47 CASES.** B. Bezdekova<sup>1</sup>, P. Wohlsein<sup>2</sup>, M. Skoric<sup>3</sup>, M. Venner<sup>4</sup>. <sup>1</sup>Equine Medical, Skalce nad Svitavou, Czech Republic, <sup>2</sup>Department for Pathology, School of Veterinary Medicine of Hannover, Hannover, Germany, <sup>3</sup>Department of Pathology and Parasitology, University of Veterinary and Pharmaceutical Sciences Brno, Brno, Czech Republic, <sup>4</sup>Equine Clinic Destedt, Destedt, Germany

Pyloric pathologies in horses have little evidence in scientific literature. Forty seven cases of chronic pyloric disorder were identified from retrospective analysis (1996–2015; CZE, GER). Mean and median ages were 4 years  $\pm$  3.3 and 3 years (0.8–16 years) respectively. Five geldings, 22 mares and 17 stallions were presented with the majority being Warmbloods. Most of the horses presented clinical signs of a chronic disorder including poor body condition (40; 87%), slow eating (39; 83%), recurrent colic (35; 74%), selective appetite (30; 64%) and frequent recumbency (27; 57%). The most consistent laboratory abnormality was hypoalbuminemia (10; 36%). Slow gastric emptying was confirmed in 29

individuals during gastroscopy and/or ultrasonography. Endoscopy revealed distal esophagitis in 9/47 horses, severe secondary ESGD in 47/47 cases and chronic disorder was seen in 45/45 pyloruses. Depressed, flat or raised fibrinosuppurative pyloric ulcer/ulcers were presented. Pyloric motility was absent or severely altered in all but one case. Treatment was applied in 32 cases, with 28 responding well. All treated cases received antiulcer medication and four underwent surgical therapy. The clinical signs recurred after the end of medical treatment in at least 11 cases. The outcome was known in 44 cases from which 18 (41%) survived long term (observation period 6 month – 6 years). Horses diagnosed up to three years of age were significantly less likely to survive ( $P = 0.0007$ ). This study extends the evidence on equine chronic pyloric disorders and supports the suggestion of a poor prognosis for young individuals.

**DETERMINATION OF SALIVARY CORTISOL IN DONKEY STALLIONS.** F. Bonelli<sup>1</sup>, A. Rota<sup>1</sup>, C. Aurich<sup>2</sup>, N. Ille<sup>2</sup>, P. Baragli<sup>1</sup>, D. Panzani<sup>1</sup>, F. Camillo<sup>1</sup>, D. Gatta<sup>1</sup>, V. Meucci<sup>1</sup>, M. Sgorbini<sup>1</sup>. <sup>1</sup>Department of Veterinary Sciences, via Livornese snc, San Piero a Grado PI, Italy, <sup>2</sup>Vetmeduni Vienna, Vienna, Austria

The aim was to validate a commercial enzyme immunoassay for the determination of salivary cortisol in donkeys. Seven stallions were included. Saliva samples were collected at 8:30 AM on thirteen not consecutive days by a cotton-based swab (Salivette®, Germany). The swab was grasped with a clamp, inserted at the angle of the lips into the mouth of the donkey and placed gently under the tongue for 1 minute and afterwards returned into a polypropylene tube. Tubes were then centrifuged for 10 min at 700 g and the obtained saliva was frozen at  $-20^{\circ}\text{C}$  until analysis. A commercial enzyme immunoassay without extraction (Demedtec Diagnostics, Kiel-Wellsee, Germany) was used for cortisol saliva determination. The assay was validated for donkey saliva by measuring recovery of cortisol standard, serial dilution curve parallelism, intra-assay and inter-assay coefficient of variation and limit of detection. Cortisol mean levels and standard deviation were calculated for each day of sampling. One-way ANOVA for repeated measures and Tukey's test were performed. The ELISA method was found to be sensitive and reproducible for cortisol concentration determination in donkey saliva. Recovery of cortisol standard to donkey saliva was 107.9% and serial dilution of saliva samples with assay buffer resulted in changes in optical density parallel to the standard curve. The intra-assay coefficient of variation was 10.7%, the inter-assay variation was 8.0% and the minimal detectable concentration was 0.01 ng/mL. No statistical significant differences were found among cortisol levels in each animal on the 13 different days of collection.

**BLOOD GAS LEVELS IN NEWBORN FOALS AFTER NORMAL AND ASSISTED DELIVERY.** F. Bonelli<sup>1</sup>, A. Lanci<sup>2</sup>, J. Mariella<sup>2</sup>, F. Freccero<sup>2</sup>, C. Castagnetti<sup>2</sup>, P. Marmorini<sup>1</sup>, M. Sgorbini<sup>1</sup>. <sup>1</sup>Department of Veterinary Sciences, Veterinary Teaching Hospital "Mario Modenato", Pisa, Italy, <sup>2</sup>Department of Veterinary Medical Sciences, University of Bologna, Italy

Umbilical cord blood gas analysis can provide important information about conditions of the newborn and its use is common in human medicine for diagnosis of perinatal diseases. The aim of this study was to evaluate the blood gas levels and acid-base status in newborn foals after normal and assisted delivery. Fifteen foals were included and were divided into 2 groups: 12 healthy foals (Group 1) with gestational age  $\geq 320$  days, normal delivery, and APGAR score  $\geq 8$  five minutes after birth and 3 foals (Group 2) with gestational age  $\geq 320$  days, assisted delivery and APGAR score  $< 8$ . Blood samples were drawn from an umbilical artery (Group 1) and from jugular vein (Group 2). The pH, pCO<sub>2</sub>, pO<sub>2</sub>, SO<sub>2</sub>%, HCO<sub>3</sub> and base excess were assessed using a standard laboratory blood gas analysis. Blood lactate concentration was also evaluated in 6 foals of Group 1 and in all foals of Group 2 with a hand-held analyzer. Mares' age and parity, gestational age, and length of stage II labor were also recorded. Shapiro-Wilk normality test was applied. Whitney test for unpaired data and Student's *t* test were used for statistical analysis. Statistical differences were obtained for pH (Group 1:  $7.4 \pm 0.1$ ; Group 2:  $7.3 \pm 0.0$ ), HCO<sub>3</sub> (Group 1:  $31.5 \pm 6.2$  mmol/L; Group 2:  $30.1 \pm 2.1$  mmol/L), lactate (Group 1:  $5.4 \pm 1.9$  mmol/L; Group 2:  $13.0 \pm 8.0$  mmol/L), and base excess (Group 1:  $5.7 \pm 6.2$ ;

Group 2:  $3.3 \pm 1.3$ ), while no differences were obtained for the other data collected. Our results showed acidosis in foals born after assisted delivery, as reported in human neonatology.

**USE OF A COMMERCIAL HIGH-FIBRE EQUINE LIQUID DIET FOR ENTERAL TUBE FEEDING IN HORSES: CLINICAL EXPERIENCE IN 9 CASES.** C. Cesarini, S. Cerri, A.A. Leroux, L. Lecoq, S. Grulke, A. Saliccia, H. Amory. Faculty of Veterinary Medicine, Department of Companion Animals and Horses, University of Liège, Liège, Belgium

Enteral tube-feeding of hypophagic/dysphagic horses can be challenging due to the limited availability of liquid diets formulated for the equine species. Human products are expensive and lack fibre, whereas slurries made from pelleted horse feedstuffs are difficult to pass through nasogastric tubes. Enteral recipes for horses combining specific components have been described but they are cumbersome and time-consuming to prepare. The aim of this retrospective study is to describe the use of a commercial high-fibre equine liquid diet (Equigel™) to provide nutritional support to 9 hospitalized adult horses. The diet was prepared following the manufacturer's recommendations and administered through a nasogastric tube by gravity flow. An oesophagostomy was performed in 2 horses to facilitate long term tube-feeding. Reasons justifying tube-feeding included dysphagia (5/9), oesophageal rupture (1/9), temporo-mandibular fracture (1/9) and hyperlipidemia and weight loss secondary to prolonged fasting (2/9). Duration of tube-feeding ranged from 36 h to 56 days. The volume administered ranged from 3–6 L/meal given in 6–12 meals/day. Despite an abrupt introduction, the new diet was well tolerated by all horses. The production of faeces was reduced but consistency was normal, and no detrimental behavioural effects were noted. Three horses presented minor complications that were transient and associated to prolonged nasogastric tubing (purulent rhinitis (2/9), pharyngeal ulcers (2/9), gastric reflux and ulcers (1/9)) or non-related to diet. In conclusion, the commercial liquid diet Equigel™ is a user-friendly product, well tolerated and easy to administer by gravity flow through large-medium nasogastric tubes, providing a useful alternative for enteral tube-feeding in horses.

**ENDOTHELIN-1 PLASMA CONCENTRATION IN HORSES WITH CARDIAC DISEASE AT REST AND AFTER EXERCISE.** H. Gehlen, I. Hofheinz. Clinic for Horses, Freie Universität Berlin, Berlin

Cardiac biomarkers simplify diagnosis and staging of cardiac disease, can provide prognostic information and help in monitoring therapy in humans and small animals. In horses with cardiac disease plasma ET-1 concentration has not been evaluated. Influence of physical exercise on ET-1 plasma concentration has been studied in healthy horses but not in horses with cardiac disease. The objective of this study was to evaluate plasma ET-1 concentration for its value as a possible diagnostic and prognostic biomarker in horses with cardiac disease before and after exercise. Fifty-four equine patients from the Equine Clinic of Free University of Berlin including 15 horses with no evidence of cardiac disease, 22 horses with evidence of cardiac disease and normal heart dimensions and 17 horses with evidence of cardiac disease and altered heart dimensions. Diagnosis was based on history, clinical examination, electrocardiography and echocardiography. Plasma samples were collected at rest and after longing exercise and stored at  $-80^{\circ}\text{C}$ . Analysis were performed by using a commercial endothelin-1 ELISA kit. Plasma levels of endothelin-1 in horses with cardiac disease were not significantly higher than plasma levels in horses without cardiac disease. But a significant correlation could be observed between the plasma levels of endothelin-1 in horses with cardiac disease and the left atrial diameter at rest as well as post exercise. This suggests a relation between the severity of disease and the ET-1 plasma levels. Therefore ET-1 may be useful for detecting horses with left atrial enlargement, but further studies are necessary to improve this hypothesis.

**TARGETED HYGIENE MANAGEMENT SYSTEM: RAPID BENEFICIAL EFFECTS.** K.-S. Klein<sup>1</sup>, B. Walther<sup>2</sup>, A. Lübke-Becker<sup>2</sup>, H. Gehlen<sup>1</sup>. <sup>1</sup>Equine Clinic, Surgery and Radiology, Freie Universität Berlin, Germany, <sup>2</sup>Department of Microbiology and Epizootics, Freie Universität Berlin, Germany

To achieve an effective hygiene management within equine clinical environments, an objective assessment of given hygiene structures, work flows and patient-associated risk factors is imperative together with a continuing surveillance of multi-drug resistant (MDR) pathogens frequently associated with nosocomial infections. In the first part of this interventional study, critical hygiene areas and procedures were identified and assessed with respect to their distinct risks for both, the equine patients and the veterinary personnel during an observation period of six months. In addition, a continuing surveillance of site infections (SI) associated with MDR pathogens was implemented for two important distinct medical indications (colic surgery, open injuries). Then, the intervention process started with practical hygiene education of the personnel including a strong focus on hand hygiene compliance. A bundle of further actions was implemented, including standard operation procedures (SOPs) for bandage change, wound- and catheter management and application of drugs. Horse owners were informed about correct behavior in the stables, regular room cleaning plans were accomplished and an appropriate mandatory hygiene instruction for students, residents and guests was introduced. An increase of 190% was documented for consumption of alcoholic hand disinfection in the second study phase, while the overall rate of recorded SI in colic- and injury patients decreased by 12.1 and 6.6%, respectively. Noted cases of MDR pathogens in SI decreased by 9.5%. Here we provide strong evidence for the necessity of continuing surveillance of defined site infections and the beneficial effects of a targeted hygiene management implemented and evaluated in a large equine clinic, given that all structural measures and responsible authorities act in concert.

**UTILITY OF HISTOLOGICAL EXAMINATION OF THE BRONCHIAL MUCOSA IN DIAGNOSTICS OF RECURRENT AIRWAY OBSTRUCTION (RAO) IN HORSES.** A. Niedźwiedz<sup>1</sup>, Z. Jaworski<sup>2</sup>, H. Borowicz<sup>1</sup>. <sup>1</sup>Department of Internal Diseases with Clinic for Horses, Dogs and Cats; Wrocław University of Environmental and Life Sciences, Wrocław, Poland, <sup>2</sup>Department of Horse Breeding and Riding, University of Warmia and Mazury, Olsztyn, Poland

Equine recurrent airway obstruction (RAO), is one of the most common respiratory problems in older horses. It is characterized by airway obstruction, excessive mucus accumulation and influx of neutrophils into the bronchial tree. History, clinical examination and result of bronchoalveolar lavage (BALF) cytological assessment has been recognized as a "gold standard" in RAO diagnostics. However, pathological features of the bronchial mucosa and its utility in diagnostics of equine RAO is poorly characterized. A total of 40 horses were evaluated: 30 horses with RAO and 10 healthy animals. An acute crisis of RAO was induced by placing all horses in a poorly ventilated stable, bedding them on straw and feeding them hay with a visible mold growth for 48 hours prior to the examination. At each bronchoscopy, at least three or more biopsies were obtained from both right and left first segmental bronchi. The samples were fixed by perfusion with 10% formal saline and then stained hematoxylin and eosin (HE). Samples were scored in respect to surface epithelium, lamina propria, smooth muscle, glands, inflammation type, hyperemia and additional findings. Statistical differences in means were determined by one way analysis of variance (ANOVA) with Tukey's test. Material obtained from 6 horses (1 control and 5 RAO-affected) has been evaluated as non-diagnostic. The statistical analysis revealed no statistical differences for any of the assessed variables in the two groups. In conclusion, abnormalities found in biopsy samples from bronchial mucosa do not seem to help in diagnostics of RAO in horses.

**NON-STRANGULATING INTESTINAL INFARCTION ASSOCIATED WITH STRONGYLUS VULGARIS: CLINICAL PRESENTATION AND OUTCOME.** T.H. Pihl<sup>1</sup>, M.K. Nielsen<sup>2</sup>, S.N. Olsen<sup>1</sup>, P.S. Leifsson<sup>3</sup>, S. Jacobsen<sup>1</sup>. <sup>1</sup>Department of Large Animal Sciences, Medicine & Surgery, Faculty of Health and Medical Sciences, University of Copenhagen, Taastrup, Denmark, <sup>2</sup>M.H. Gluck Equine Research Center, Department of Veterinary Science, University of Kentucky, Lexington, Kentucky, USA, <sup>3</sup>Department of Veterinary Disease Biology, Faculty of Health and Medical Sciences, University of Copenhagen, DK

The objective was to describe the clinical presentation, laboratory findings, treatment and outcome of horses with non-strangulating intestinal infarction (NSII) associated with *Strongylus vulgaris* to improve awareness of the disease. Data were collected retrospectively from medical records of 30 horses diagnosed with NSII at surgery and/or necropsy at the University of Copenhagen during 2008-2016. Most cases presented with mild signs of colic of >24 hours duration and with few signs of shock. The most consistent findings at admission were peritonitis based on an increased leukocyte count in the peritoneal fluid (90%) and systemic acute phase inflammatory reaction with increased serum amyloid A (79%). Some horses had a hard mass palpable (33%) and/or were painful at rectal examination (27%). Medical treatment was attempted in 9 horses with none surviving. Exploratory laparotomy was performed in 21 horses. Three of 9 horses undergoing intestinal resection survived to discharge. Sixteen (53%) and 4 horses (13%) had single intestinal and multiple infarcts, respectively. Infarcts were most often located in the ascending colon (69%) or in the caecum (20%). The majority of the horses (87%) had infarcts with severe ischemia, whereas 4 horses (13%) exhibited mild ischemia. Chronic verminous lesions were observed in branches of the cranial mesenteric artery in all 25 necropsied horses, with *S. vulgaris* larvae encountered in 12 of these (48%). NSSI is an important differential diagnosis in horses presenting with mild colic signs and peritonitis. The prognosis is grave, but surgical resection of the infarcted intestine can be successful.

**FINAL RESULTS ON THE IMPACT OF NEEDLE SIZE AND DISINFECTION PROTOCOLS ON THE BACTERIAL CONTAMINATION OF CADAVER SKIN CORES.** T. Puschmann<sup>1</sup>, J.-D. Haeger<sup>2</sup>, N. Hambruch<sup>2</sup>, J. Verspohl<sup>3</sup>, K. Rohn<sup>4</sup>, C. Pfarrer<sup>2†</sup>, B. Ohnesorge<sup>1†</sup>. <sup>1</sup>Clinic for Horses, University of Veterinary Medicine Hannover, Foundation, Hannover, Germany, <sup>2</sup>Institute of Anatomy, University of Veterinary Medicine Hannover, Foundation, Hannover, Germany, <sup>3</sup>Institute for Microbiology, University of Veterinary Medicine Hannover, Foundation, Hannover, Germany, <sup>4</sup>Department of Biometry, Epidemiology and Information Processing, University of Veterinary Medicine Hannover, Foundation, Hannover, Germany. <sup>†</sup>equal contributors

The aim of this study was to investigate the impact of needle sizes/types and skin disinfection and preparation protocols on the bacterial load of skin cores, to determine their role in infection complications after intramuscular injections. Skin cores were obtained from punctures of skin specimens (no.clip-no.dis: unprepared; no.clip.dis: disinfected, clip.dis: clipped and disinfected, as.clip: clipped, antiseptically washed; n = 16), using 18G, 18G with stylet (18GM) and 22G needles. Needles were flushed using sterile saline solution, which was collected in test tubes containing phosphate buffered saline (semi-quantitative results; sqt) or culture medium (qualitative results; ql). To compare the bacterial load to the incidence and size of skin cores histologic evaluation was performed. The incidence of bacterial contamination after 18G punctures (ql), was reduced significantly from no.clip-no.dis (81%) by skin disinfection (37%) and antiseptic washing (12%) ( $P < 0.5$ ). Clipping did not cause a significant difference (19%). Result tendencies were equal to swabs and biopsies taken prior to needle punctures to assess disinfection efficacy. Sqt results revealed fewer samples containing bacteria. The highest isolation rate of bacteria was observed with 18G in no.clip-no.dis (40%). The difference to other disinfection protocols was not significant. Comparing needle

types after punctures of no.clip-no.dis (ql), most bacteria were detected with 18GM and fewest with 22G (not significant). We conclude that skin cores are regularly produced through needle punctures. They may contribute to the initiation of infections after intramuscular injections. Their bacterial load can be reduced by using smaller needle sizes without stylet, and appropriate skin disinfection methods.

**DOES GASTRIC JUICE PH INFLUENCE GASTRIC EMPTYING? A PRELIMINARY STUDY.** S. Recknagel, G. Köller, C. Ademeit, G.F. Schusser. Department of Large Animal Medicine, Faculty of Veterinary Medicine, University of Leipzig, Leipzig, Germany

A poor response of equine glandular gastric disease (EGGD) to long term omeprazole treatment is often reported. Little information is available on the pharmacokinetic data of omeprazole in those horses. We hypothesized that raising gastric juice pH to levels where mucosal healing can occur (pH >4.0), results in delayed gastric emptying and therefore leads to a poor enteral resorption of omeprazole. In a cross-over design, four normal fasted horses received 0.5 g/kg d(+)-xylose as a 10% aqueous solution adjusted to two different pH values (pH 2.0 and pH 5.0). Serum d(+)-xylose concentrations were measured according to the standard xylose-absorption-test every 15 minutes for two hours post administration, followed by 30 minute intervals up to five hours in total. Although not statistically significant, the xylose solution adjusted to pH 5.0 resulted in a higher  $T_{max}$  (median 150 min) compared to the more acidic solution (median 90 minute;  $P = 0.20$ ). The overall xylose resorption tended to be higher when the horses received the pH 5.0 xylose-solution (median AUC 17.45; median  $c_{max}$  1.87 mmol/l) compared to the pH 2.0 solution (median AUC 13.38; median  $c_{max}$  1.40 mmol/l). Raising the gastric juice pH to levels above 4.0 might result in delayed gastric emptying. It seems reasonable to administer omeprazole after brief fasting periods to enhance the enteral resorption of the prodrug in the small intestine. The diagnostic value of the xylose-resorption-test could be limited when performed on horses treated with proton pump inhibitors.

**USE OF ANTI-MÜLLERIAN HORMONE (AMH) FOR THE DIAGNOSIS OF CRYPTORCHIDISM IN DONKEYS.** V.E.N. South, A.E. Durham. Liphook Equine Hospital, Forest Mere, Liphook, Hants, UK

In the horse, AMH is expressed in Sertoli cells of foetal, neonatal and prepubescent testes, and cryptorchid testes, Sertoli tumours and male intersex gonads. Recently, AMH concentrations were compared in stallion, geldings, and cryptorchid horses and was significantly higher in cryptorchid stallions compared with intact stallions, and was undetectable in geldings. Hence, AMH is a reliable and specific test for the presence of testicular tissue in horses of any age. Historically, the only dependable test for cryptorchid donkeys was the hCG stimulation test which requires multiple jugular needle punctures. AMH has not been validated in male donkeys at this time but there are practical benefits to a single sample test such as AMH over the hCG stimulation test. In this study, an AMH assay was validated for use in donkey serum samples and performed satisfactorily. AMH concentrations in serum samples from neonatal, prepubescent and adult entire male donkeys, true geldings and cryptorchids were measured. AMH was significantly elevated in stallions and cryptorchids and undetectable in geldings (<0.014 ng/mL). Following castration AMH concentrations decreased rapidly (undetectable in approximately <2 days) making AMH a useful test if there is doubt over the success of a recent castration. This study proposes AMH concentration as the test of choice for the diagnosis of cryptorchidism in donkeys, with welfare and practical advantages over the hCG stimulation test.