Abstracts from the International Veterinary Emergency and Critical Care Symposium, the European Veterinary Emergency and Critical Care Annual Congress, and the ACVECC VetCOT Veterinary Trauma & Critical Care Conference 2018

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PLATELET NUMBER AND FUNCTION IN RESPONSE TO A SINGLE DOSE OF INTRAVENOUS VINCristINE AS ASSESSED BY FLOW CYTOMETRY

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Introduction: Immune thrombocytopenia (ITP) causes severe thrombocytopenia in dogs. Emergency therapy can include the administration of vincristine to increase platelet numbers, but it is unknown if the newly released platelets are fully functional. The objective of this study was to evaluate the functionality of immature (reticulated) platelets released following a single intravenous dose of vincristine to healthy adult dogs.

Methods: Ten healthy research dogs received either a single IV injection of 0.02 mg/kg vincristine, or a similar volume of saline. Prior to and after treatment, platelet P-selectin (CD62P) expression and fibrinogen binding (CAP1 antibody) were assessed, with and without activation with human gamma thrombin (HGT). Mature and immature platelets were distinguished on the basis of thiazole orange (TO) staining.

Results: Vincristine administration increased platelet concentration relative to saline from day 0 to day 7 (225 ± 58 vs 273 ± 65 × 10^3/μL, P = 0.0148). Baseline (unstimulated) expression of CAP1 and CD62P was greater in the reticulated (TO+) platelets than the mature (TO-) platelets (P < 0.003). Following HGT stimulation, TO+ platelets did not have significantly different CAP1 and CD62P expression relative to TO- platelets with the exception of day 0, when they had greater CD62P expression (P = 0.049).

Conclusion: Reticulated platelets appear to have a higher resting activation state than mature platelets, but demonstrate similar P-selectin expression and fibrinogen binding to mature platelets following HGT stimulation, suggesting that these platelets function similarly to mature platelets.

EFFECTS OF POSITIVE FLUID BALANCE ON MORBIDITY AND MORTALITY IN CANINE SEPTIC PERITONITIS

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Introduction: Several studies in people have shown that septic patients with a positive fluid balance after day 1 have a worse prognosis. The purpose of this study was to evaluate the daily and cumulative fluid balance in canine septic peritonitis patients.

Methods: Medical records were searched for all dogs with the diagnosis of septic peritonitis from 2007 to 2017. Patients were excluded if no urinary catheter was placed within 12 hours or if the patient was hospitalized less than 24 hours. Daily and cumulative fluid balances were determined at 6, 12, 24, 48, and 72 hours. Fluid balances were determined at 6, 12, 24, 48, and 72 hours.

Results: Thirty-six dogs were logged as screened (2.1 per week) with 15 enrolled (0.9 per week). Reasons for exclusion included dehydration (4/21), transfusion required (4/21), consent declined (3/21), insufficient time to enroll (2/21), and predicted hospitalization < 24 hours (2/21). Twelve out of 15 dogs that were enrolled were administered the intervention. One was taken home against medical advice, one was administered a transfusion in place of the intervention, and one no longer required the intervention. For the 12 dogs administered the intervention, median (range) APPLEfast score was 23.5 (20–38) and 4 were septic. Median (range) volume of intervention fluid was 22.9 mL/kg (10.0–57.1 mL/kg). There were four major protocol violations, all relating to volume of intervention fluid administered. Nine of 12 dogs completed blood and urine sampling for all time points. Two out of 12 dogs developed AKI during hospitalization based on Veterinary Acute Kidney Injury scoring (one stage 1, one stage 2). Nine out of 12 dogs survived to discharge (2 died, 1 euthanized due to prognosis).

Conclusion: Recruitment rate was lower than projected, mainly due to lower number of dogs screened. The investigators are satisfied that the enrolled cases are representative of the population of clinical interest. Drop-out after enrolment and protocol violations highlight the challenges of performing clinical interventional studies in emergency medicine.

Oral Presentations

ACUTE KIDNEY INJURY IN DOGS AFTER HYDROXYETHYL STARCH 130/0.4 OR HARTMANN’S SOLUTION: PROTOCOL AND FEASIBILITY ANALYSIS

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*Winner of the Veterinary Emergency and Critical Care Foundation Research Grant.

Introduction: Hydroxyethyl starch (HES) has been associated with acute kidney injury (AKI) in people, but there is limited evidence in dogs. We present the protocol and feasibility analysis of an ongoing prospective randomized blinded phase II clinical trial.

Methods: Dogs at a university hospital prescribed a fluid bolus for clinical reasons were randomized to receive at least 10 mL/kg of HES 130/0.4 or Hartmann’s solution. After 40 mL/kg of study fluid further fluid administration was open-label. Urine for neutrophil gelatinase-associated lipocalin and cystatin C was collected prior to and 6, 12, and 24 hours after the first study fluid bolus. Serum creatinine was measured daily for 7 days or until discharge. Target sample size was 20 per group. Screening and enrolment targets were 7 and 2 per week, respectively. Population characteristics and feasibility outcomes for the first 17 weeks of enrolment are reported.

Results: There were four major protocol violations, all relating to volume of intervention fluid administered. Nine of 12 dogs completed intervention fluid administered. Nine of 12 dogs completed

Conclusion: Recruitment rate was lower than projected, mainly due to lower number of dogs screened. The investigators are satisfied that the enrolled cases are representative of the population of clinical interest. Drop-out after enrolment and protocol violations highlight the challenges of performing clinical interventional studies in emergency medicine.
balance was calculated by total fluid intake (intravenous fluids, blood products, enteral, and parenteral nutrition) minus total fluid output (urine measured via urinary catheter, abdominal drain production, and nasogastric tube aspiration).

**Results:** Seventy-four patients met inclusion criteria (43 survivors, 31 nonsurvivors). There was no difference in fluid balance at 6, 12, and 24 hours between survivors and nonsurvivors. Seventy-three patients had a positive fluid balance after 24 hours. Daily fluid balance was significantly lower in survivors on day 2 compared to nonsurvivors (11.1 mL/kg (~91.4 to 136.3), 59.9 mL/kg (~90.1 to 187.9), respectively; \( P = 0.01 \)). Day 3 daily fluid balance was also significantly lower in survivors compared to nonsurvivors (2.9 mL/kg (~140.5 to 63.0), 40.1 mL/kg (~49.8 to 296.4), respectively; \( P = 0.04 \)). Cumulative fluid balance at day 3 was significantly lower in survivors compared to nonsurvivors (149.2 mL/kg (~36.9 to 357.0), 254.8 mL/kg (30.9–578.2), respectively; \( P = 0.001 \)), but there was no difference in cumulative fluid balance on day 2 between the groups. Length of hospitalization of survivors was positively correlated with fluid balance on day 1 \( (r = 0.35, P = 0.018) \) and cumulative fluid balance on day 2 \( (r = 0.39, P = 0.018) \).

**Conclusion:** In canine septic peritonitis patients, nonsurvivors had a significantly higher daily fluid balance on days 2 and 3, and a higher cumulative balance at day 3. Future studies are needed to evaluate the effects of a positive fluid balance on outcome in dogs with septic peritonitis.

### Utilities of Blood Lactate Parameters in Outcome Assessment in Hospitalized Critically Ill Canine Patients

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**Introduction:** Various lactate variables and illness severity scoring systems have shown utility in predicting outcome in critically ill human and veterinary patients. We aimed to determine whether lactate variables and/or the Acute Patient Physiologic and Laboratory Evaluation Score (APPLEfast) could discriminate hospital survivors from non-survivors in dogs with noncardiogenic shock.

**Methods:** Seventy-one dogs with noncardiogenic shock presenting for emergent care were prospectively enrolled. Primary outcome was survival to discharge; secondary outcome was the need for emergent care. APPLEfast was calculated at admission and venous lactate concentrations were measured at predetermined time points. Admission lactate, lactate variables (lactime, lactate clearance, LACAREA) and APPLEfast were compared between survivors and nonsurvivors. APPLEfast was assessed for correlation with lactime, LACAREA, and lactate clearance.

**Results:** Neither admission lactate nor APPLEfast were predictive of outcome. Lactime was shorter in survivors \( (P = 0.026) \). Lactate clearance at hours \( h \) 1 \( (P = 0.007) \), 4 \( (P = 0.029) \), and 10 \( (P = 0.048) \) was greater in survivors. LACAREA at time intervals 1–4 hours \( (P = 0.005) \), 4–10 hours \( (P = 0.001) \), 10–16 hours \( (P = 0.002) \), and 16–24 hours \( (P = 0.003) \) was larger in nonsurvivors. Total LACAREA was not different between groups. APPLEfast was significantly correlated with admission lactate \( (P = 0.0001) \) and LACAREA at time 0–1 hours \( (P = 0.004) \). LACAREA at time interval 1–4 hours \( (P = 0.001) \) and APPLEfast \( (P = 0.01) \) were predictive of the need for blood products.

**Conclusion:** While admission venous blood lactate concentration and APPLEfast failed to discriminate hospital survivors from nonsurvivors in this population, serial lactate measures predicted outcome in dogs with clinical evidence of shock. Additionally, APPLEfast and LACAREA 0–1 hours predicted the need for blood product transfusion. This study suggests that serial biomarker measurements may be more useful in predicting outcome in critically ill patients when compared to individual measurements.

### Accuracy of Abdominal Ultrasoundography in Dogs with Nontraumatic Spontaneous Hemoabdomen: 95 Cases (2014–2017)

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**Introduction:** Spontaneous hemoabdomen is a common emergent presentation in dogs, with the majority of the cases due to splenic or hepatic neoplasia. Abdominal ultrasonography (AUS) is often recommended prior to surgery to evaluate for the location of a primary mass and for evidence of metastatic disease although the evidence for the accuracy of imaging is unknown. The goal of this study was to evaluate the accuracy of AUS in predicting gross evidence of lesions at either exploratory surgery or necropsy, with the hypothesis that AUS has a high specificity but low sensitivity for identification of lesions.

**Methods:** Dogs that presented between 1/1/2014 and 10/30/2017 with a nontraumatic spontaneous hemoabdomen that were evaluated by abdominal ultrasound and had either surgical exploration or necropsy within 24 hours of presentation were eligible for inclusion. Dogs that were euthanized prior to further diagnostics and treatment or were evaluated only by point-of-care ultrasound were also excluded. The ability of AUS to accurately predict splenic lesions, liver masses, liver nodules, and diffuse nodular metastatic lesions was evaluated.

**Results:** Two hundred forty-three dogs presented for spontaneous hemoabdomen in the time frame evaluated, and 95 met the inclusion criteria. Overall, 50.5% (48/95) of the dogs had grossly detected lesions that were not visualized on abdominal ultrasound. Based upon surgical or necropsy findings, AUS had a 95.6% sensitivity and a 100% specificity for identifying splenic masses \( (n = 87) \), a 75% sensitivity and 100% specificity for liver masses \( (n = 20) \), a 65.4% sensitivity and 100% specificity for identifying liver nodules \( (n = 52) \), and a 40% sensitivity and 98.7% specificity for identifying diffuse nodular metastatic disease \( (n = 20) \).

**Conclusion:** Abdominal ultrasonography has a high specificity but a low sensitivity for detecting disease of the liver, spleen, and diffuse nodular metastasis in dogs that present with a nontraumatic spontaneous hemoabdomen. The utility of AUS, including benefits and potential limitations, should be considered prior to performing this test in a clinical setting.

### A Comparison of Acute Transfusion Reactions in 766 Dogs Receiving Either Leukoreduced or Nonleukoreduced Packaged Red Blood Cells

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EVALUATION OF COCCYGEAL AND RADIAL ARTERY DOPPLER BLOOD PRESSURE MEASUREMENTS IN SICK CATS WITH AND WITHOUT ABNORMALITIES IN TISSUE PERFUSION

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Introduction: To determine if there is a difference between Doppler blood pressure (SBP) measurements taken from the coccygeal artery compared to the common digital branch of the radial artery in sick cats presenting to an emergency service with and without abnormalities in tissue perfusion. A secondary objective was to determine if there were site differences in SBP in cats that were hypotensive, normotensive, and hypertensive.

Methods: Sixty-two cats were prospectively enrolled during triage assessment and prior to therapeutic interventions. Two or three SBP measurements were taken from each site (coccygeal and radial) and the order of the sites was randomized. Cats were classified as having hypoperfusion if at least two of the following physical examination parameters were abnormal: capillary refill time, mucous membrane color, heart rate, pulse quality, and rectal temperature. Cats were classified as hypertensive (SBP > 160 mm Hg), normotensive (SBP ≥ 90, ≤ 160 mm Hg), or hypotensive (SBP < 90 mm Hg) based on the average SBP obtained from both sites.

Results: The mean coccygeal SBP was significantly greater than the mean radial SBP when all cats were evaluated together (n = 62, 141.66 ± 46.66 vs 126.46 ± 43.48, P = 0.0007). Mean coccygeal SBP was also significantly higher in cats with normal perfusion (n = 40, 151.22 ± 41.05 vs 138.15 ± 37.46, P = 0.0093), in hypoperfused cats (n = 22, 124.27 ± 51.99 vs 105.20 ± 46.38, P = 0.0328), and in normotensive cats (n = 56, 138.44 ± 22.05 vs 119.50 ± 21.49, P = 0.0003). There was no significant difference between coccygeal SBP and radial SBP in hypertensive cats (n = 16, 192.60 ± 38.45 vs 178.20 ± 29.47, P = 0.1449) and hypotensive cats (n = 10, 71.72 ± 17.38 vs 68.72 ± 30.18, P = 0.8342).

Conclusion: Coccygeal SBP was significantly greater than radial SBP in cats with normal perfusion, hypoperfusion, and in cats with a normal SBP. There was no difference in SBP between these sites in cats that were hypertensive or hypotensive although the number of cats in these groups was small. Larger studies are needed to further evaluate SBP in cats with abnormal blood pressure as well as compare these measurements to direct arterial pressure in conscious cats.

QUALITY OF LIFE FOLLOWING MECHANICAL VENTILATION IN CANINE AND FELINE PATIENTS

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Introduction: Mechanical ventilation (MV) is routinely performed in dogs and cats to support respiratory function during severe hypoxemia, hypercapnia, or respiratory fatigue. It is unknown whether dogs and cats receiving MV experience long-term effects or complications of MV, or if their quality of life is affected.

Methods: Medical records were reviewed using a database for the term “MV” within the medical history or discharge report from January 2004 to February 2018. Cases were included in the study if they had received MV in the intensive care unit (ICU) and were subsequently weaned from ventilation and discharged from hospital. Referring veterinarians were contacted to learn if the patient was alive and to obtain relevant clinical history. Owners were contacted to respond to a telephone survey.

Results: A total of 507 records were retrieved from the initial search. Six equine records were excluded. Of the remaining 501, only 196 patients were mechanically ventilated in the ICU. Sixty patients (30.6%) were weaned from ventilation, and 50 patients (25.5%) were discharged from hospital. There were three exclusions (incomplete contact details and medically unfit owner). There were 27 respondents to the survey (the owners of 25 dogs and 2 cats). All respondents rated their pet’s quality of life prior to the illness necessitating ventilation as good to excellent (8/10–10/10). Perceived recovery periods ranged from 0 days to 6 months (the most common response being 2–3 weeks). Fourteen owners stated that their pets’ quality of life was as good or better than previously. Patients with persistent quality of life concerns (n = 3) had been ventilated with neurological disease. Four owners reported changed behaviors such as starting easily or being excessively responsive to noise. One cat became deaf and at time of survey had not regained hearing. Commonly reported problems included decreased exercise tolerance (n = 7). All respondents stated that they would ventilate their pet again.
Conclusion: The majority of patients discharged from hospital following MV have a similar quality of life to before their illness, which may influence owner decision-making when MV is indicated.

SEIZURE OCCURRENCE AND ATRACURIUM CONTINUOUS RATE INFUSION IN MECHANICALLY VENTILATED PATIENTS

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Introduction: Atracurium is a nondepolarizing benzylisoquinolinium agent commonly used to improve patient synchrony during mechanical ventilation (MV). Degradation of atracurium produces laudanosine, which is cumulative and has been associated with central nervous system excitement and seizures in people. The objectives of this study were to investigate seizure occurrence in canine and feline patients after MV, and to evaluate if atracurium administration increased its prevalence.

Methods: Medical records of a veterinary university teaching hospital were reviewed for cats and dogs which underwent MV in the intensive care unit (ICU) between January 2004 and February 2018. Signalment, any recorded seizure activity, whether the patient was weaned from MV, and outcome (discharge from hospital, cardiopulmonary arrest, or euthanasia) were documented. Patients were grouped into those that had been administered an atracurium continuous rate infusion (CRI) during MV and those that had not and those that had displayed abnormal neurological activity (including seizures) after weaning from MV and those that did not. Statistical analysis was performed. Significance was set at P = 0.05.

Results: Five hundred seven records were retrieved from the initial search, of which 196 were cats or dogs mechanically ventilated in the ICU. Sixty patients (30.6%) were weaned from MV. Sixteen of these patients had seizure activity documented of which 11 had had seizure activity prior to MV. The remaining 5 patients had seizure activity for the first time following weaning from MV. Three of the 5 patients were administered an atracurium CRI. Six patients (5 dogs and 1 cat) in total received atracurium. The 3 patients that received an atracurium CRI and did not have documented seizure activity were not weaned from MV. Patients weaned from MV that were administered an atracurium CRI were more likely to have seizures (P = 0.0006). Besides age (P = 0.001), there were no other significant differences between the atracurium and no atracurium groups. Age was not associated with an increased risk of seizures overall (P = 0.092).

Conclusion: There appears to be an association between post-MV seizures in the ICU and the use of atracurium CRI in dogs, which should be considered when using the drug. Younger patients were more likely to receive atracurium in this institute.

REPEATED INFUSION OF LYOPHILIZED CANINE ALBUMIN SAFELY AND EFFECTIVELY INCREASES SERUM ALBUMIN AND COLLOID OSMOTIC PRESSURE IN HEALTHY DOGS

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Introduction: Hypoalbuminemia is associated with increased morbidity and mortality in critically ill people and animals. Albumin solutions may be administered to increase intravascular volume and colloid osmotic pressure in hypoalbuminemic animals. The aims of this study were to evaluate the safety of repeated administration of a novel lyophilized canine-specific albumin (CSA) product and to quantify its effect on serum albumin concentration and colloid osmotic pressure (COP) in healthy dogs.

Methods: Six healthy purpose-bred Beagles were administered 3 separate 1 g/kg doses of 16% reconstituted CSA (HemoSolutions, LLC), over 2 hours on days 1, 2, and 14. Dogs were monitored for evidence of transfusion-associated complications during the infusions and at 1, 2, 12, and 24 hours postinfusion. Serum albumin and COP were measured at baseline and at 2, 12, and 24 hours after each infusion. Complete blood count and serum biochemical analysis were evaluated at baseline and on days 3, 15, and 28. Repeated measures ANOVA were used to evaluate collective albumin and COP changes from all infusions.

Results: All dogs tolerated the CSA infusion with no evidence of acute hypersensitivity reaction. One dog vomited 1 hour after completion of the infusion on day 2. This occurred immediately after eating and was thought to be unrelated to the study drug since the dog displayed no other clinical abnormalities. No dogs displayed signs of delayed hypersensitivity reaction during the 28-day study period. Serum biochemistry and hematologic profiles remained within normal limits at all time points. Colloid osmotic pressure increased by a mean of 2.1 mm Hg at 2 hours (range, 0.7–3.7 mm Hg; P = 0.0002) and remained significantly higher than baseline at 12 (P < 0.0001) and 24 hours (P = 0.0034) postinfusion. Serum albumin increased by a mean of 0.48 g/dL at 2 hours (range, 0.2–0.8 g/dL; P < 0.0001) and remained significantly higher than baseline at 12 (P < 0.0001) and 24 hours (P = 0.0002) postinfusion.

Conclusion: This dose of CSA was effective at increasing serum albumin and COP. Repeated infusions appear safe with no adverse changes to physical examination, hematologic, or biochemical parameters.

EVALUATION OF SYMMETRIC DIMETHYLARGININE AND NEUTROPHIL GELATINASE-ASSOCIATED LIPOCALIN AS MARKERS OF KIDNEY INJURY IN A CANINE MODEL OF GRAM-POSITIVE SEPSIS

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Introduction: Although experimental endotoxemia may not affect serum (sNGAL) or urine (uNGAL) concentration of neutrophil gelatinase-associated lipocalin, its utility to detect acute kidney injury in dogs with sepsis is unknown. The aims of this study were to compare established renal functional markers (sCr and symmetric dimethylarginine [SDMA]) with sNGAL and uNGAL in canine septic shock and determine the relationship between these biomarkers and renal histopathology.

Methods: Sixty Beagles received pulmonary inoculation with S. aureus (0.5–1.5 × 10^9 CFU/kg). The dogs were sedated, mechanically ventilated, and treated for septic shock via a standardized protocol until death or euthanasia at 96 hours. Blood and urine samples for analysis were collected at T0 (inoculation), T24, and T48 (24 and 48 hours postinoculation) and complete necropsy was...
performed on all. A nephropathologist blinded to dog identity evaluated renal histopathology.

**Results:** Thirty-three of 60 dogs (55%) survived past T48, with 18/33 having complete sample sets with timely necropsy limiting postmortem autolysis. Fourteen of 18 dogs had moderate or severe lesions identified via renal histopathology. Four dogs had developed AKI (KDIGO sCr criteria) by T48, and 3 of these died before 96 hours. All 4 had moderate or severe lesions and 12 to 177-fold increases in uNGAL at T24. Fifteen (83%) dogs had at least 4-fold increases in uNGAL by T24 and all had >9-fold increases by T48. uNGAL was < 35 pg/mL in 3 of the 4 dogs with mild lesions at T24, and was > 90 pg/mL in all dogs at T48. sNGAL increased or decreased at T24 and T48 in proportion to changes in sCr in all dogs, regardless of renal histopathology score.

**Conclusion:** AKI was not identified by change in serum creatinine during the first 48 hours of sepsis in most dogs that ultimately developed moderate or severe histopathological lesions. uNGAL rose over time independent of change in sNGAL, and was markedly increased or decreased at T24 and T48 in proportion to changes in sCr in all dogs, regardless of renal histopathology score.

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**THE AMERICAN COLLEGE OF VETERINARY EMERGENCY AND CRITICAL CARE VETERINARY COMMITTEE ON TRAUMA (ACVECC-VetCOT) REGISTRY DATA SUMMARY – ALL DOG CASES TO APRIL 2018**

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**Introduction:** Traumatic injury is common and a leading cause of death in dogs. Large databases provide opportunity to assess and improve patient care and develop test research hypotheses. Canine trauma cases presenting to 31 ACVECC VetCOT Veterinary Trauma Centers (VTC) from September 2013 to April 2018 are reported.

**Methods:** Using a Web-based data capture system (REDCap), personnel at each VTC prospectively recorded admission and outcome data from dogs presenting following trauma. Summary data are described.

**Results:** A total of 23,931 dog trauma cases from 2 sequential VetCOT trauma registries were included. A majority (19,350, 90.9%) presented directly to a VTC. Penetrating trauma was most common (12,525, 52.4%), followed by blunt (10,566, 44.2%), while 827 (3.5%) had both blunt and penetrating injury. Penetrating trauma was predominantly caused by bite (9,469, 76.9%). The most common type of blunt trauma was struck by vehicle (4761, 41.8%), followed by falls (2,529, 22.2%); however, a large number of causes of both blunt and penetrating trauma were classified as “Other.” Presentation data included animal trauma triage (ATT) score (median 1, IQR 1, 2) and modified Glasgow coma scale score (median 18, IQR 18, 18). There was evidence of head injury in 12.9% (2932) dogs, while 5.8% (1,326) had spinal trauma. Surgery was performed on 10,250 (43.3%) dogs, with procedures performed in both the emergency room (64.4%) and operating rooms (35.6%). Only 1.4% received blood product transfusions. Most dogs (21,899, 92.5%) survived to discharge; 1,473 (6.2%) were euthanized and 314 (1.3%) died.

**Conclusion:** These data constitute the largest epidemiologic study of trauma in dogs to date. The majority of dogs sustained relatively minor trauma, characterized by a low ATT score and high rate of survival to discharge.

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**DETERMINATION OF SERUM ASCORBIC ACID CONCENTRATIONS OF DOGS WITH PARVOVIRAL ENTERITIS**

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**Introduction:** Vitamin C (ascorbic acid) is an endogenous antioxidant that becomes depleted during critical illness. Exogenous supplementation of ascorbic acid improves outcome in septic people. Canine parvovirus (CPV) causes septicaemia in dogs and may present similar correlations between blood ascorbic acid levels and other markers of disease.

**Methods:** Serum collected from CPV dogs (n = 42) during critical illness and recovery were compared to serum collected from healthy control dogs (< 6 months of age, n = 13) for measurement of ascorbic acid concentrations using mass spectrometry. Correlation between ascorbic acid concentrations and clinical disease severity, length of hospitalization, and survival were also evaluated.

**Results:** Dogs with CPV and concurrent neutropenia (n = 33) did not have significantly different serum ascorbic acid concentrations at baseline [mean 4.37 μg/mL (95% CI, 1.88–6.85 μg/mL)] when compared to dogs with CPV without neutropenia [n = 7, mean 4.7 μg/mL (95% CI, 2.78–6.62 μg/mL)] or healthy control dogs [n = 13, mean 4.18 μg/mL (95% CI, 2.7–5.68 μg/mL), P = 0.38]. Baseline serum ascorbic acid concentrations were not associated with clinical severity score (P = 0.6), duration of hospitalization (P = 0.54), or mortality (P = 0.3).

**Conclusion:** Serum ascorbic acid concentrations are not significantly different in dogs infected with CPV when compared to healthy control dogs, and ascorbic acid levels were not associated with the presence of neutropenia or other markers of disease severity. The clinical utility of measuring and supplementing vitamin C in this population of critically ill dogs is uncertain and would require further investigation.

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**ASSESSMENT OF CARDIOPULMONARY RESUSCITATION FOLLOWING IMPLEMENTATION OF RECOVER GUIDELINES IN 166 DOGS AND 45 CATS AT A UNIVERSITY TEACHING HOSPITAL (2013–2018)**

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**Introduction:** A recent retrospective study reported increased return of spontaneous circulation (ROSC) following implementation of RECOVER cardiopulmonary resuscitation (CPR) guidelines. This study aimed to prospectively describe CPR outcomes at a veterinary teaching hospital since implementation of RECOVER guidelines compared to their prior publication, to evaluate factors associated with outcome, and to report the patient population according to veterinary Utstein-style guidelines.

**Methods:** Clinicians completed a form for CPR events immediately following their conclusion. Forms were created in 2013 based on
human Utstein-style guidelines for reporting of CPR events. Medical records were retrospectively reviewed, and reported categories adjusted to comply with 2016 veterinary Utstein-style guidelines where necessary. Groups with ROSC and not achieving ROSC were compared using Fisher’s exact and Mann–Whitney U testing.

**Results:** One hundred sixty-six dogs and 45 cats in cardiopulmonary arrest (CPA) that underwent CPR were prospectively enrolled. One hundred animals (47%) attained ROSC, 22 (10%) were alive at 24 hours, and 21 (10%) were discharged alive [13 dogs (8%) and 8 cats (18%)]. Rates of ROSC were comparable at our facility prior to introduction of RECOVER guidelines, but significantly more cats survived to discharge (18% vs 3%; \( P = 0.0008 \)). Respiratory failure was the most common suspected cause of CPA in both dogs (37/166, 22%) and cats (10/45, 22%). Higher ROSC rates were seen with witnessed CPA (59% vs 24%; \( P < 0.0001 \)), palpable pulses during CPR (62% vs 25%; \( P < 0.0001 \)), presence of a peripheral intravenous catheter before CPA (55% vs 33%; \( P < 0.0001 \)), and in CPAs occurring in ICU (62% vs 42%; \( P = 0.02 \)). Median (IQR) time to administration of epinephrine 1.25 (0.5–3) versus 3 (1–4) minutes (\( P < 0.0001 \)) and atropine 1.5 (0.5–3) versus 2.5 (1–5) minutes (\( P = 0.0002 \)) were shorter, as well as higher maximal end tidal CO\(_2\) reading 23 (18–34) versus 15 (5–25) mm Hg (\( P = 0.0001 \)) in patients achieving ROSC.

**Conclusion:** Witnessed CPA events and early CPR interventions were associated with increased ROSC, emphasizing timely CPA recognition and initiation of CPR. Although incorporating RECOVER guidelines did not further improve ROSC rates, more cats than previously reported survived to discharge. This may suggest that the systematic approach to CPR translates positively into improved post-CPA care.

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**EVALUATION OF THE ENDOTHELIAL GLYCOCALYX IN HEALTHY ANESTHETIZED DOGS USING RAPID, PATIENT-SIDE GLYCOCHECK ANALYSIS SOFTWARE**

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**Introduction:** The endothelial glycocalyx (EG) is a biopolymer interface located on the luminal side of endothelial cells. Disruption or shedding of this layer is a primary event in microvascular dysfunction. Damage to the EG increases capillary permeability to proteins and alters the gradient between subglycocalyx colloid osmotic pressure and plasma colloid osmotic pressure, resulting in a number of derangements, including hypoalbuminemia, edema, microvascular dysregulation, and ultimately heterogeneity of perfusion. GlycoCheck, a novel glycocalyx measurement software that provides automated analysis of microvascular video recordings using side stream dark-field video microscopy, has been used in people. The objective of this study is to evaluate the endothelial glycocalyx layer in a population of healthy anesthetized dogs using this technology.

**Methods:** Fifty client-owned, healthy dogs presenting for elective procedures were enrolled. A handheld video microscope connected to the GlycoCheck software was used to acquire images of the sublingual microvasculature immediately following anesthetic induction. For each dog, 2 or 3 microvascular readings were acquired. The perfused boundary region (PBR), a marker for derangements, including hypoalbuminemia, edema, microvascular dysregulation, and ultimately heterogeneity of perfusion. GlycoCheck, a novel glycocalyx measurement software that provides automated analysis of microvascular video recordings using side stream dark-field video microscopy, has been used in people. The objective of this study is to evaluate the endothelial glycocalyx layer in a population of healthy anesthetized dogs using this technology.

**Results:** The median time from induction to image acquisition was 5 minutes (range, 1–24 minutes). Data acquisition was accomplished in a median time of 1.41 minutes per reading (0.43–10.99 minutes). Application of the microvascular camera was easily performed and minimal training was required for data acquisition. The mean perfused boundary region (PBR) of all measured segments (PBR, 5–25 mm) was 2.04 ± 0.31 mm (range, 1.36–2.86 mm), values similar to those described in people. None of the patient characteristics, macrovascular parameters, and patient characteristics were compiled for analysis alongside the microvascular parameters.
RIVAROXABAN PHARMACODYNAMICS ARE UNAFFECTED BY CONCURRENT FEEDING OR GASTROPROTECTANT ADMINISTRATION IN HEALTHY DOGS

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Introduction: Rivaroxaban, a direct oral factor Xa inhibitor, is an attractive anticoagulant option for dogs but its reported oral bioavailability in healthy dogs may be as low as 60%. The impact of concurrent feeding and gastroprotectant administration on the pharmacodynamics of rivaroxaban in dogs is currently unknown. The aim of this pilot study was to determine the impact of feeding, coadministration of omeprazole and coadministration of sucralose on the anticoagulant effect of rivaroxaban in healthy dogs.

Methods: Five healthy male neutered Beagles were used in this pilot study. Four distinct stages were investigated involving administration of 2 mg/kg rivaroxaban once daily for 2 consecutive days with either (1) no food, (2) food, (3) 0.5 g oral sucralose, or (4) 1 mg/kg oral omeprazole. A 14-day minimum washout period was employed between each stage. One day prior to commencement of each study stage, the dogs were sedated to facilitate insertion of jugular sampling catheters. Starting the next day, blood samples were obtained, using a 3-syringe technique, at time 0, 2, 4, 8, 24, 36, and 48 hours relative to rivaroxaban administration. Measurement of rivaroxaban-specific anti-Xa activity (RIVA) was used to assess the anticoagulant intensity. A repeated measures mixed statistical model was used, with post hoc Tukey’s adjustment, to evaluate the impact of these 4 stages on the RIVA level.

Results: All dogs tolerated the study interventions without serious adverse effects. Rivaroxaban administration resulted in significant changes in individual dog RIVA (P = 0.02). The peak RIVA occurred 2–4 hours following administration and varied among dogs. Feeding was associated with significantly higher RIVA at the 36-hour (P < 0.0001) and 48-hour (P = 0.003) time points compared with values for dogs administered sucralose. Overall, however, administration of rivaroxaban with food, sucralose, or omeprazole did not significantly changed RIVA compared to dogs administered rivaroxaban on an empty stomach (P = 0.20).

Conclusion: The anticoagulant effect of oral rivaroxaban, based on measurement of rivaroxaban’s specific anti-Xa activity, was unaffected by concurrent feeding, sucralose, or omeprazole administration in healthy dogs. This study has relevance for critically ill dogs where several therapeutic interventions may be provided concurrently.

BLOOD AND EFFUSION BIOMARKER CONCENTRATIONS AID DIFFERENTIATION OF TYPES OF PERITONEAL EFFUSION IN DOGS

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Introduction: Accumulation of peritoneal effusion is common in dogs, and rapid differentiation of the type of effusion present is important for the early institution of appropriate diagnostic and therapeutic interventions. Various biomarkers have been evaluated but no previous study has simultaneously measured multiple biomarkers in both blood and effusion to determine which is the most discriminating for the underlying cause. This study aimed to compare blood and effusion concentrations of novel biomarkers in dogs with septic peritonitis (SP), nonseptic peritonitis (NSP), and other causes of peritoneal effusion (OPE).
**Methods:** Eighteen dogs with SP, 19 age-matched controls with systemic inflammation but NSP, and 18 age-matched controls without systemic inflammation and OPE were prospectively enrolled. Blood and effusion were obtained at presentation, and concentrations of cell-free DNA (cfDNA), glucose, high mobility group box-1 (HMGB-1), inflammatory cytokines, lactate, N-terminal pro-C-type natriuretic peptide (NT-proCNP), neutrophil gelatinase associated lipocalin (NGAL), nucleosomes, and procalcitonin (PCT) were measured. Within groups, biomarker concentrations were compared with Wilcoxon matched-pairs signed-rank tests. Between groups, biomarker concentrations in blood and in effusion were compared by Kruskal–Wallis with Dunn’s post hoc test for multiple comparisons. Effusion-blood gradients were also compared between groups by Kruskal–Wallis. *P*-values were adjusted for multiple comparisons by Bonferroni correction.

**Results:** In dogs with SP, multiple biomarkers including cfDNA, glucose, HMGB-1, NGAL, nucleosomes, and some inflammatory cytokines were significantly different between blood and effusion. In dogs with NSP, and OPE concentrations of CCL2 and KC-Like were significantly different between blood and effusion. Effusion concentrations of lactate, IL-6, and IL-10 were significantly different in dogs with SP compared to dogs with NSP. All biomarkers except for cfDNA, KC-Like, lactate, PCT, and TNF-α were significantly different between dogs with SP and those with OPE. Many biomarker effusion-blood gradients were also significantly different between dogs with SP compared to those with OPE, including glucose, lactate, nucleosomes, and some cytokines.

**Conclusion:** This study suggests that in dogs with SP particularly, concentrations of multiple biomarkers are different in blood versus effusion. In addition, measurement of novel biomarkers in blood and effusion can be used to aid in the differentiation of effusions with distinct pathophysiologic origins.

**DOSAGE ESCALATION TRIAL OF DESULFATED HEPARIN IN SEPTIC PERITONITIS**

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**Introduction:** Septic peritonitis is associated with significant morbidity and mortality. As a potential therapeutic agent in the treatment of sepsis, 2-0, 3-0 desulfated heparin (ODSH) reduces histones and platelet factor 4 (PF4) in murine sepsis models. This clinical trial evaluated the safety and effect of ODSH in client-owned dogs with septic peritonitis. The potential use of ODSH as a novel therapeutic in septic peritonitis was investigated.

**Methods:** In an IACUC-approved, open-label, prospective, dose-escalation clinical trial in dogs with spontaneous septic peritonitis, ODSH treatment was initiated following surgical intervention. Dose escalation was based on aPTT prior to each ODSH dosage. Platelet count, white blood cell count, cell-free DNA, and PF4 were collected at the time of each ODSH dosage. In addition, APPLEfast and APPLEfull scores on admission, the source of septic peritonitis, requirement for vasopressors, administration of blood products, and survival to discharge were recorded.

**Results:** Six dogs (1 female neutered, 1 female intact, 4 male neutered) were enrolled. The mean APPLEfast and APPLEfull scores on admission were 22 and 32, respectively. Gastrointestinal (3 dogs), hepatoabiliary and splenic (2 dogs), and urogenital (1 dog) sources of sepsis were identified. Two dogs received vasopressors in the pre- or postoperative period. Four dogs received 4 dosages of ODSH and 2 dogs received 3 dosages of ODSH intravenously. No dog required dose de-escalation and no dog had any evidence of bleeding. The mean 24-hour dosage of ODSH was 50 mg/kg. Four dogs survived to discharge.

**Conclusion:** No adverse effects of ODSH were seen in dogs with septic peritonitis. A randomized controlled trial is necessary to evaluate ODSH as a novel therapeutic in the treatment of septic peritonitis.

**ETIOLOGY OF PERICARDIAL EFFUSION IN 397 DOGS UNDERGOING EMERGENT PERICARDIOCENTESIS: 2003–2016**

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**Introduction:** Pericardial effusion is a common complication of cardiac disease in dogs. The etiology of pericardial effusion is multifactorial and includes both cardiac and non-cardiac causes.

**Results:** A total of 397 dogs with pericardial effusion were enrolled in the study. The most common etiologies identified were idiopathic pericardial effusion (36%), spontaneous pericardial effusion due to mitral valve disease (22%), and neoplastic pericardial effusion (18%). Other less common etiologies included pericardial effusion due to cardiac tamponade (5%), pericardial effusion due to right atrial hypertension (3%), and pericardial effusion due to pericarditis (3%).

**Conclusion:** The etiology of pericardial effusion is multifactorial and includes both cardiac and non-cardiac causes. Further studies are needed to better understand the underlying mechanisms of pericardial effusion.
Introduction: Hemangiosarcoma and idiopathic effusions are considered the most common causes of PCE in dogs, with recognized demographic predispositions (eg, older, large breed dogs). The etiology of PCE in less typical breeds is less well defined. This study was performed to characterize the etiology of PCE in a large cohort of dogs that underwent emergent pericardiocentesis.

Methods: Electronic records from dogs that underwent emergency pericardiocentesis between 2003 and 2016 were abstracted for age, body weight, breed, and echo- or histopathology-derived etiology of PCE.

Results: Records of 397 dogs were analyzed. The median age was 10 years (range 1–20) and the median weight was 29 kg (range 3–69). Hemangiosarcoma or a right atrial mass compatible with hemangiosarcoma was the most common diagnosis, present in 215 of 397 dogs (54.2%). Hemangiosarcoma was a less likely diagnosis in dogs < 20 kg [32/108 vs 183/289, \( P < 0.0001 \)], but left atrial rupture [28/108 vs 0/289, \( P < 0.0001 \)] or suppurative pericarditis [5/109 vs 4/289, \( P = 0.0445 \)] were more likely than in dogs weighing \( \geq \) 20 kg. Dogs weighing < 10 kg were more likely to have an open-diagnosis [13/57 vs 31/340, \( P = 0.0009 \)] or carcinoma [5/57 vs 4/340, \( P = 0.0224 \)] compared to dogs weighing \( \geq \) 10 kg. In dogs without hemangiosarcoma, those < 10 years of age were significantly more likely to have mesothelioma [14/143 vs 12/254, \( P = 0.01 \)], suppurative [7/143 vs 2/254, \( P = 0.0098 \)], idiopathic pericardial effusion [15/143 vs 12/254, \( P = 0.0345 \)] than dogs \( \geq \) 10 years. Brachycephalic breeds were less likely to have hemangiosarcoma [20/47 vs 195/350, \( P = 0.05 \)] or left atrial rupture [0/47 vs 28/250, \( P = 0.04 \)] as a cause of PCE, and more likely to have chemoectomy [11/47 vs 12/47, \( P = 0.0001 \)] compared to nonbrachycephalic breeds.

Conclusion: Hemangiosarcoma or right atrial masses thought to be hemangiosarcoma were the most common cause of PCE in dogs requiring emergent pericardiocentesis during this epoch. However, alternative diagnoses were often found in younger, smaller, or brachycephalic breeds.

Results: One dog had to be excluded due to identification of a macrocytic thrombocytopenia on pretreatment blood work. The remaining 10 enrolled dogs received a median dose of 1.02 mg/kg (range 0.94–1.17 mg/kg) of rivaroxaban once daily. There was a significant increase in platelet count and fibrinogen. There was no significant change in the hemostatic parameters.

Conclusion: The primary finding of this study is that rivaroxaban administered at 1 mg/kg orally once daily for 1 week failed to produce any significant change in hemostatic parameters in 10 apparently healthy dogs. There were significant increases in fibrinogen levels and platelet counts in dogs receiving rivaroxaban. Both of these increases can be associated with inflammation which may indicate rivaroxaban could potentially be proinflammatory. This is a potentially important finding as rivaroxaban is typically used in conditions where inflammation is concurrently present such as immune-mediated hemolytic anemia. The effects of rivaroxaban on inflammatory biomarkers in dogs may require further investigation.

SEMIQUANTITATIVE ACID–BASE ANALYSIS IN DOGS WITH ADDISON’S DISEASE

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Introduction: Acidemia is common in dogs with Addison’s disease and is generally attributed to impaired renal hydrogen ion excretion and lactic acidosis. Semiquantitative acid–base assessment has not been characterized in the veterinary literature, and characterization of acid–base influences can affect fluid choice. The primary objectives of this retrospective study are to describe the semiquantitative acid–base status of dogs with naturally occurring Addison’s disease and to compare this to the status determined by traditional acid-base analysis.

Methods: The electronic medical record database of a university teaching hospital was searched for dogs with Addison’s disease between 2000 and 2017. Dogs were included if they had newly-diagnosed Addison’s disease, post-ACTH stimulation serum cortisol concentration < 2 µg/dL, and an acid-base/electrolyte panel and serum biochemistry panel drawn within 6 hours of presentation. Patients were excluded if the Na:K ratio was ≥ 28 or the patient had received a mineralocorticoid-containing corticosteroid medication within the preceding month. Traditional and semiquantitative acid–base analyses were performed and described.

Results: Thirty-three cases met the study criteria. Traditional acid-base analysis identified normal acid-base status in 1 dog, simple respiratory acid-base abnormalities in 2/33 dogs, and simple metabolic acidosis in 14/33 dogs. A mixed disorder was most common, occurring in 16/33 patients. The semiquantitative approach identified metabolic abnormalities in all cases. All dogs had ≥ 1 acidifying process, while 29/33 had both acidifying and alkalinizing processes. Acidosis attributable to excess free water was present in all dogs, and an acidifying phosphate effect was present in 27/33. Hyperlactatemia contributed to the acidosis in only 8/33 patients, with a median lactate of 1.5 mmol/L (range 0.3–4.2 mmol/L). The most common alkalinizing effect was hypoalbuminemia (21/33). This study demonstrates that dogs with untreated Addison’s disease have complex acid-base derangements. The semiquantitative approach to acid-base analysis provides greater insight into the underlying mechanisms of metabolic acid-base abnormalities in these patients, particularly since lactic acidosis...
appears to be a minor influence in most cases. These results suggest that dogs with Addison’s disease may benefit from fluid resuscitation using balanced electrolyte solutions that contain a buffer and have lower sodium and chloride concentrations than 0.9% NaCl.

PROSPECTIVE EVALUATION OF THE FELINE ACUTE PATIENT PHYSIOLOGIC AND LABORATORY EVALUATION (FELINE APPLE) SCORE IN ADMITTED CATS TO A SMALL ANIMAL TEACHING HOSPITAL

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Introduction: The feline APPLE (acute patient physiologic and laboratory evaluation) score was developed as a tool to stratify illness severity in cats admitted to the intensive care unit. The APPLEfull score utilizes 8 parameters (maximum score of 80) and the APPLEfast score utilizes 5 parameters (maximum score of 50), with higher scores associated with a worse prognosis. This system was developed and validated at the same institution; however, it has not been prospectively evaluated since the initial publication. The goal of this study was to prospectively evaluate the utility of the feline APPLE scoring system in predicting the outcome of cats admitted to a novel ICU.

Methods: All cats admitted to the ICU during a 3-month time period (January 1, 2018–April 1 2018) were prospectively enrolled following owner consent. Feline APPLEfull and APPLEfast scores were calculated within 24 hours of admission.

Results: One hundred fifty-five cats were included in the study with 133 survivors and 22 nonsurvivors (euthanasia and natural death). The median age was 7 years (IQR 3–12 years), median weight was 4.8 kg (3.8–5.8 kg), and median length of hospitalization (LOH) was 2 days (IQR 1–3). APPLEfull scores were calculated in 154 cats and were significantly lower in survivors than nonsurvivors with a mean of 39.9/80 (SD ±8.2) and 47.3/80 (SD ±9.5), respectively (P = 0.0002). The AUROC (area under the receiver operator characteristic curve) for the APPLEfull score was 0.72, and improved after excluding nonsurvivors who were euthanized (0.81). APPLEfast scores were calculated in 155 cats and were significantly lower in survivors than nonsurvivors with a mean of 21.3/50 (SD ±7.3) and 27.6/50 (SD ±9.9), respectively (P = 0.0005). The AUROC for the APPLEfast score was 0.68, and improved after excluding euthanized nonsurvivors (0.71). APPLEfull scores were positively correlated with LOH in cats that survived to discharge (P = 0.007, r = 0.24), though APPLEfast scores were not (P = .19).

Conclusion: The APPLEfull score was a good prognostic indicator in this population of hospitalized cats when euthanized cats were excluded. The reliability of scoring systems to predict outcomes in veterinary medicine is complicated by the option of euthanasia.

THE AMERICAN COLLEGE OF VETERINARY EMERGENCY AND CRITICAL CARE VETERINARY COMMITTEE ON TRAUMA (ACVECC-VetCOT) REGISTRY DATA SUMMARY – ALL CAT CASES TO APRIL 2018

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Introduction: Traumatic injury is common and a leading cause of death in cats. Large databases provide opportunity to assess and improve patient care and develop and test research hypotheses. Feline trauma cases presenting to 31 ACVECC VetCOT Veterinary Trauma Centers (VTC) from September 2013 to April 2018 are reported.

Methods: Using a Web-based data capture system (REDCap), personnel at each VTC prospectively recorded admission and outcome data from cats presenting following trauma. Summary data are described.

Results: A total of 4,823 cat trauma cases from the 2 VetCOT trauma registries were included. A majority (3,825, 79.3%) presented directly to a VTC. Blunt trauma was most common (2,744, 57%), followed by penetrating (1,837, 38.1%), while 234 (4.9%) had both blunt and penetrating injury. The most common type of blunt trauma was motor vehicle accident (869; 29.2%), followed by falls (665; 22.3%). Penetrating trauma was predominantly caused by bite (1,065, 53.8%); however, a large number of causes of trauma were classified as “Other.” Presentation data included animal trauma triage (ATT) score (median 2, range 0–18) and modified Glasgow coma scale score (median 18, range 3–18). 16.2% (739) cats had evidence of head injury, while 8.6% (393) had spinal trauma. Surgery was performed on 1,679 (35.15%) of cats, with procedures performed in both the emergency room (47.4%) and operating rooms (52%). Only 2.3% received blood product transfusions. Most cats (3,943, 82.54%) survived to discharge; 768 (16.08%) were euthanized and 66 (1.38%) died.

Conclusion: These data constitute the largest epidemiologic study of trauma in cats to date. The majority of cats sustained relatively minor trauma, characterized by a low ATT score and high rate of survival to discharge.

OUTCOME PREDICTORS IN DOGS WITH SEPTIC PERITONITIS: INVESTIGATION OF THE UTILITY OF NLR AND qSOFAs SCORES

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Introduction: Recent focus in both human and veterinary medicine has been on early detection and risk stratification in septic patients. The 2016 Sepsis 3.0 definition recommends using the quick Sequential (Sepsis-related) Organ Failure Assessment (qSOFA) score to rapidly identify septic patients with greater risk for poor outcomes via assessing three clinical criteria: systolic blood pressure, respiratory rate, and mental status. Similarly, a high neutrophil-to-lymphocyte ratio (NLR) has been identified as being independently associated with unfavorable prognosis in human septic patients. The NLR and the qSOFA score have not been evaluated in dogs. The purpose of this study was to assess the prognostic utility of Systemic Inflammatory Response Syndrome (SIRS) criteria, NLR, and qSOFA score for in-hospital mortality among dogs with septic peritonitis.

Methods: Medical records of dogs diagnosed with septic peritonitis between 2011 and 2018 were reviewed. Signalment, length of hospitalization (LOH), admission vital signs, Doppler blood pressure, glucose, lactate, vasopressor use, and differential WBC counts were recorded, and SIRS criteria, qSOFA scores, and NLR were obtained.

Results: One hundred fifty-five patients met inclusion criteria. Overall in-hospital mortality was 32.9% (51/155). Patients that died or were euthanized were more likely to have a qSOFA ≥ 2
(\(P < 0.0001\), relative risk (RR) 4.9, odds ratio (OR) 9.3). qSOFA \(\geq 2\) was negatively associated with blood pressure (\(P < 0.0001\), \(r = -0.72\)). Patients with qSOFA \(\geq 2\) were more likely to receive vasopressors than those with qSOFA < 2 (\(P < 0.001\), RR 33.8, OR 61.4). qSOFA scores and lactate were positively correlated (\(P < 0.0001\), \(r = 0.43\)). There was no difference in NLR between survivors and nonsurvivors, and qSOFA scores and NLR were not correlated. While 94.1% of patients met SIRS criteria, there was no difference in frequency of SIRS diagnosis between survivors and nonsurvivors. Conclusion: qSOFA \(\geq 2\) was associated with a higher risk of in-hospital morbidity and mortality within this study population, suggesting that the qSOFA may have utility in identifying patients at greater risk of vasopressor requirement and poor outcome; however, further prospective studies would be necessary to validate this assessment tool. No prognostic utility was identified with NLR and outcome in this population, however, further evaluation in a larger population is needed.

THE INFLUENCE OF AZOTEMIA AND HYPOTENSION ON LACTATE CONCENTRATIONS IN DOGS AND CATS

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Introduction: It has long been postulated that uremic patients have altered lactate concentrations, yet no studies in human or veterinary medicine have demonstrated this clinically. Previous studies have suggested two main etiologies for altered lactate concentrations in uremia: decreased production via uremic toxin-induced mitochondrial dysfunction or increased excretion via the proximal convoluted tubule of the kidney. This study sought to demonstrate altered lactate concentrations in dogs and cats presenting to the emergency department at a university hospital. It was hypothesized that azotemic, hypotensive patients would have a significantly lower lactate than nonazotemic, hypotensive dogs and cats presenting to the emergency department.

Methods: The electronic medical record database was searched for dogs and cats presented to the emergency department that had severe azotemia (creatinine \(\geq 443.1\) \(\mu\)mol/L [5 mg/dL]), hypotension (Doppler blood pressure \(\leq 90\) mm Hg), and a lactate measurement within 2 hours of one another. Nonazotemic, normotensive patients, nonazotemic, hypotensive patients, and azotemic, normotensive patients that presented to the emergency service were used as control populations. Patients were excluded from analysis if they had a known cause of Type B lactic acidosis, hypertension (Doppler blood pressure > 150 mm Hg), or incomplete medical records.

Results: Dogs and cats with hypotension and severe azotemia had a lower lactate than dogs and cats with hypotension without azotemia (\(P = 0.031\) and < 0.001, respectively). Median lactate concentration in hypotensive dogs (1.75 mmol/L) and cats (1.90 mmol/L) with severe azotemia were within normal limits.

Conclusion: Hypotensive animals with severe azotemia have significantly decreased lactate concentrations as compared to hypotensive, nonazotemic animals and their lactate concentration are often within normal limits. This may be due to either decreased mitochondrial production of lactate or increased excretion of lactate. Lactate concentrations should be used cautiously when making therapeutic decisions in this patient population. Further research is needed to determine which of these mechanisms is responsible and the significance of abnormal blood pressure and lactate measurements in azotemic, hypotensive animals and whether differences in lactate concentrations exist between acute and chronic azotemic patients and those with less severe azotemia.

Efficacy of three disinfectant agents in reducing bacterial contamination of keyboards in a veterinary teaching hospital

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Introduction: Computer keyboard contamination contributes to healthcare-associated infections (HAIs). Studies have shown that once daily cleaning can result in sustained reduced keyboard contamination. The study goal was to determine the efficacy of three commonly used disinfectant wipes for reducing bacterial contamination on keyboards in a veterinary teaching hospital. We hypothesized there would be no difference between agents.

Methods: Thirty keyboards were randomized to “dirty” or “clean” halves. Cultures were obtained from the “dirty” halves. The “clean” halves were disinfected with a randomly assigned wipe (peroxgen-based (AHP), quaternary ammonium-based (QAC), or alcohol-based), allowed to dry, and then cultured. All cultures were acquired with sterile premoistened sponges, which were agitated in sterile broth and wrung out, and the broth was plated onto tryptic soy blood agar. Plates were incubated at 35°C; colony-forming units (CFU)/cm² were enumerated after 24 and 48 hours of incubation. Percent CFU reduction between dirty and clean sides was calculated.

Results: Colony-forming units reduction after 24 hours of incubation was 86.4% for alcohol (95% confidence interval (CI) 0.66–1.21), 76.7% for QAC (95% CI 0.45–1.02), and 77.5% for AHP (95% CI 0.29–0.87). After 48 hours of incubation, % CFU reduction was 75.2% for alcohol (95% CI 0.60–1.28), 76.7% for QAC (95% CI 0.55–1.25), and 87.5% for AHP (95% CI 0.35–1.26). There were no significant differences in percent reduction of CFUs following cleaning between treatment groups.

Conclusion: All three cleaning products were equally efficacious at reducing bacterial keyboard contamination. Further studies are required to assess if routine keyboard decontamination decreases the incidence of HAIs.

Evaluation of canine platelet function using multiple platelet function analyzer after administration of DDAVP in healthy dogs on aspirin or clopidogrel

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Introduction: Acetylsalicylic acid (aspirin) and clopidogrel (Plavix) are commonly used in dogs for prevention of blood clots; however, there is no clinically used reversal agent for these medications. In people, a single injection of desmopressin acetate (DDAVP), a vasopressin analog that mediates release of von Willebrand factor from endothelium stores, has been shown to improve
Systemic Hypertension in Canine Acute Kidney Injury: A Prospective Study

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Introduction: Systemic hypertension (SH) is a recognized consequence of acute kidney injury (AKI) in people, and has been described in feline and canine AKI retrospective studies. The relationship between SH and AKI severity has been assessed in cats but not dogs and there is no literature on the prevalence of hypertensive retinopathy in canine AKI patients and to investigate the relationship between SH and severity of AKI.

Methods: Dogs presenting to a veterinary university referral hospital with community-acquired AKI were prospectively recruited between July 2016 and March 2018. Patients were excluded if they had other diseases associated with SH (including chronic kidney disease) or prior treatment with anti-hypertensive drugs. Systolic blood pressure (SBP), urine output (UOP), and evidence of fluid overload were assessed daily. The IRIS (International Renal Interest Society) grade of AKI on arrival, fundic examination findings, urine protein/creatinine ratio, length of hospitalization, and survival to discharge were recorded. Systemic hypertension was defined as SBP ≥ 150 mm Hg. The prevalence of SH was calculated and the relationship between SH and the recorded factors was examined using nonparametric statistical tests.

Results: Thirty-nine dogs were eligible for inclusion. The prevalence of SH on admission was 71.8% (28/39) and this was severe (> 180 mm Hg) in 25.6% (10/39) of cases. The prevalence of SH increased to 78.9% (30/38) during hospitalization and was severe in 50% (19/38) cases. Note that 21.2% (7/33) dogs had evidence of hypertensive retinopathy and 60% (12/20) had significant proteinuria. Of the cases included, 25.6% (10/39) were considered fluid overloaded on admission and 23.1% (9/39) developed fluid overload during hospitalization. There was no association between SH and IRIS AKI grade, creatinine on presentation, oligo/anuria, survival to discharge, length of hospitalization, and proteinuria. Dogs with fluid overload on presentation were more likely to be hypertensive at admission (P < 0.05).

Conclusion: Although SH is common in dogs with AKI target organ damage is less common. Systemic hypertension does not appear to be associated with severity of injury but may be associated with fluid overload.

Accuracy of Pulse Oximetry at the Tail During Hyperoxemia and Hypoxemia in Anesthetized Dogs

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Introduction: The tail is an attractive site for measuring pulse oximetry because of its stable perfusion. We evaluated the accuracy of pulse oximetry measuring at the tail with a neonatal pulse oximetry adhesive sensor in anesthetized dogs under hyperoxemia and hyperoxemia.

Methods: This study was approved by the Animal Care and Use Committee of Rakuno Gakuen University (VH16824). Six Beagle dogs (age 3 years, body weight 12.4 ± 1.2 kg) were included in this study. We used two types of pulse oximetry sensor, a tip-clip ear sensor was attached to the tongue and a neonatal adhesive sensor was attached to the tail in each dog. Each sensor was connected to the Masimo Radical-7 pulse oximeter for measuring SpO₂. Anesthesia was induced and maintained with sevoflurane. After intubation, the arterial oxygen saturation (SaO₂) was recorded simultaneously, and compared with each pulse oximeter readings. The oxygen fraction of inspired gas (FiO₂) was stepwise reduced from 1.0 to 0.8, 0.6, 0.4, 0.2, and 0.1 by blending with nitrous oxide. After each step-down FiO₂, FiO₂ was increased 0.4 and 1.0. Data analysis included Bland–Altman plots, linear regression analysis.

Results: Forty-eight arterial blood samples paired with SpO₂ were obtained. SpO₂ at the tail ranged from 37.5% to 100%, SpO₂ at the tongue ranged from 39.0% to 100%, SaO₂ ranged from 33% to 100%. The mean bias for the tail and tongue was −0.86% and −1.09% (P < 0.001), with corresponding precision values of 2.95 and 3.04. The coefficients of determination were 0.98 and 0.96 for the tail and tongue, respectively. The limits of agreement were 4.93/−6.66% and 4.86/−7.05% for the tail and tongue.

Conclusion: The tail pulse oximetry measurement is feasible and demonstrates accurate values of oxygen saturation during hyperoxemia and hypoxemia in anesthetized dogs. The neonatal pulse oximetry adhesive sensor is a useful tool for pulse oximetry in the dog’s tail.
**BIOMARKERS OF ENDOTHELIAL ACTIVATION ARE INCREASED IN DOGS WITH SEVERE SEPSIS**

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Introduction: Endothelial dysfunction plays an important role in the pathophysiology of sepsis and may emerge as a novel therapeutic target. Studies in dogs investigating biomarkers of endothelial activation in naturally occurring sepsis are lacking. Herein, we investigated changes in markers of endothelial activation in dogs with severe sepsis compared to healthy controls. We further aimed to determine if there is an association between endothelial marker concentrations, inflammatory mediators, illness severity, and survival to discharge.

Methods: Eighteen dogs with severe sepsis (S) were prospectively enrolled at two academic referral hospitals, with 20 healthy dogs serving as control group (C). Venous blood samples from study dogs were collected at the time of diagnosis of severe sepsis and plasma stored at –80°C until analysis. Markers of different aspects of endothelial function were quantified in duplicates by canine ELISAs, including vascular endothelial growth factor (VEGF), hyaluronan (HA), plasminogen activator inhibitor-1 (PAI-1), and von Willebrand factor (vWF). Plasma concentrations of the inflammatory markers IL-1, IL-8, IL-10, MCP-1, and C-reactive protein (CRP) were determined by canine ELISA. Wilcoxon rank-sum test was used to test for differences between groups and Spearman’s rho was determined for associations between variables. P-value was set at 0.05.

Results: Most animals (83% [15/18]) in group S died, 39% (7/18) due to euthanasia and 44% (8/18) due to cardiopulmonary arrest. Median concentrations were significantly higher for VEGF (S: 98.5 [range: 39.3–1319.0] pg/mL; C: 39.3 [39.3–39.3] pg/mL), HA (S: 244.7 [21.3–251.8] ng/mL; C: 75.9 [26.2–147.3] pg/mL), PAI-1 (S: 87.4 [30.3–1028.6] ng/mL; C: 25.0 [4.8–62.3] ng/mL), IL-6 (S: 3102.6 [206.4–39852] pg/mL; C: 51.4 [51.2–3134] pg/mL), IL-8 (S: 3641.0 [306.4–118918] pg/mL; C: 480.3 [94.2–1776] pg/mL), IL-10 (S: 198.3 [73.0–992.3]; C: 73.0 [73.0–172.8] pg/mL), MCP-1 (S: 6974.4 [306.4–203884] pg/mL; C: 788.4 [132.4–1285] pg/mL), and CRP (S: 200.3 [8.2–343.3] pg/mL; C: 19.1 [19.1–87.3] pg/mL) but not vWF (S: 109.9 [24–491]; C: 117.9 [57–198] ng/mL). Multiple strong correlations were found between endothelial and inflammatory markers, but not between any of the markers and severity of illness or survival to discharge.

Conclusion: Endothelial activation occurs in dogs with severe sepsis, which is similar to results found in people with sepsis. Accordingly, VEGF, PAI-1 and HA may all be potential biomarkers of endothelial activation in septic dogs.

**CANINE PERIPHERAL INTRAVENOUS CATHETER LONGEVITY IN A SMALL ANIMAL INTENSIVE CARE UNIT**

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Introduction: Intravenous catheters (IVC) are used commonly in the management of critically ill animals. While some institutions use IVCs until they are removed, some institutions routinely replace IVC after 72 hours of use. The goal of this study is to evaluate the average duration of peripheral catheterization in a small animal intensive care unit, as well as the most common reasons for peripheral catheter (PC) removal in that population.

Methods: Dogs and cats admitted to the small animal intensive care unit (ICU) at the University of Tennessee between June 1 and August 31, 2017, with a peripheral catheter placed in the ICU, were enrolled in the study. The site of PC placement, duration of the PC in the patient, and reason for PC removal were recorded.

Results: There were 316 patients enrolled in the study with 277 dogs (87%) and 39 cats (12%). Two hundred forty-one PCs (76%) were placed in a cephalic vein. One hundred seventy-two (54%) PCs were removed due to patient discharge from the hospital, 38 (12%) PCs were removed due to euthanasia, 33 (10%) PCs were removed due to PC occlusion, and 12 (4%) PCs were removed due to phlebitis. The mean duration of catheterization for all patients was 32 h:56 min (range 0.23 min to 277 h:05 min). Twenty-three patients (7%) had catheters that were patent for greater than 72 hours.

Conclusion: Most PCs were placed in a cephalic vein and were removed because the patient was ready to be discharged. Occlusion of the catheter was the most common reason for PC replacement in hospitalized patients while phlebitis was an uncommon cause in this population of ICU patients. Additional information from this study showed that PCs may not need to be routinely replaced after 72 hours of use.

**COMPARISON OF THREE INTRAOSSEOUS CATHETER PLACEMENT SITES IN RABBITS**

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Introduction: Intraosseous (IO) catheters can be used in place of intravenous catheters in critically ill rabbits, but there is no data on the ideal catheter placement site. The primary goal of this study was to determine if IO catheters can be placed with greater success in the tibia, femur, or humerus of rabbits. The secondary goal was to compare commonly used clinical criteria for successful IO catheterization with fluoroscopically confirmed success.

Methods: Participants underwent a 15-minute training session on IO catheter placement technique. Eight rabbit cadavers were used. All participants attempted timed catheter placement at all 3 sites (tibia, femur, humerus). Clinical success (CS) was defined by: placement of a hypodermic needle, in under 3 minutes; concurrent ability to manipulate the leg via the catheter, and to infuse 1 mL saline with the apparent absence of a postinfusion subcutaneous fluid accumulation. Fluoroscopic success (FS) was confirmed by infusing iohexol and identifying intramedullary flow via fluoroscopy. A Fisher’s exact test was used to compare FS rates between sites of catheter placement (P < 0.05).

Results: Twelve participants with varying clinical experience were recruited. Fourteen catheters were attempted at each of the 3 sites for a total of 42 attempts. Overall CS was documented in 28/42 (66.7%) cases, while FS was confirmed in only 18/42 (42.9%) (P = 0.01). Out of the total 14 attempts for each site, 10/14 (71.4%) of the tibial catheters, 5/15 (33.3%) of the femoral, and 3/14 (21.4%) of the humeral were fluoroscopically successful (P = 0.03).
THE USE OF LUNG ULTRASOUND TO EVALUATE FOR PULMONARY HYPERTENSION-ASSOCIATED PULMONARY EDEMA IN DOGS WITHOUT LEFT ATRIAL ENLARGEMENT

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Introduction: Pulmonary edema has been sparsely reported in dogs with moderate to severe pulmonary hypertension (PH). Many clinicians are unaware of this PH complication. Accurate diagnosis is important because the PH-associated pulmonary edema can be severe and is refractory to loop diuretics. This study aimed to evaluate the use of a lung ultrasound protocol (VetBLUE) in documenting PH-associated pulmonary edema and other lung pathology in dogs with moderate to severe PH in the absence of left atrial enlargement.

Methods: Prospective case series of privately owned dogs referred for echocardiography to a mobile ultrasound practice in Hong Kong over a 12-month period. Patients with a systolic pulmonary artery pressure (PAP) > 60 mm Hg and Stage B1 or less mitral valve disease were included in the study. The presence of more than one B-line at more than one view was considered positive for PH-associated pulmonary edema. Additional findings were described using the published visual system of lung ultrasound signs (shred, tissue, wedge, and nodule sign).

Results: Approximately 1,000 complete echocardiograms were performed during the 12-month enrollment period, of which 44 dogs were diagnosed with PH having a PAP > 60 mm Hg and 28 were no more advanced than Stage B1 mitral valve disease meeting the inclusion criteria. Of the 28, 12 had complete studies for review; and 9/12 dogs had multiple views positive for B-lines with an average of 5.3/8 (range 3–7); and 6/12 patients were treated with loop diuretics for cardiogenic edema on initial presentation. Average age was 11 years (range 8–16); and average LA:Ao ratio was 1.14 (range 0.89–1.38); and average systolic pulmonary arterial pressure (PAP) was 86 mm Hg (range 60–121 mm Hg). Concurrent respiratory disease was identified in 9 patients, 8 with brachycephalic syndrome, and a single dog with a lung mass.

Conclusion: The imaging protocol used proved useful combined with echocardiography as a point-of-care rapid tool to screen for evidence of PH-associated pulmonary edema as well as screen for other underlying lung pathology. Dogs with PH-associated pulmonary edema may be misdiagnosed with left-sided congestive heart failure and treated inappropriately with loop diuretics rather than sildenafil or other effective phosphodiesterase inhibitors.

PROSPECTIVE COMPARATIVE QUALITY CONTROL STUDY OF A NOVEL GRAVITY-DRIVEN HOLLOW-FIBER WHOLE BLOOD SEPARATION SYSTEM FOR THE PRODUCTION OF CANINE BLOOD PRODUCTS

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Introduction: The aim of this study was to evaluate the quality of blood products produced by a centrifuge (C) compared to a novel gravity driven hollow fiber separation system (HF).

Methods: Between February 2017 and June 2017, client-owned healthy dogs (n = 31) from a pre-established blood donation program were included and allocated to the groups (C) centrifugation (n = 15) or (HF) hollow-fiber system (n = 16). Dogs were included if they donated a blood volume of more than 400 mL without sedation in lateral recumbency from the jugular vein and no moderate or severe lipemia was present. After donation, samples were aseptically drawn from different locations of separation system: donor (D), whole blood bag (WB), whole blood bag samples stored at room temperature for the duration of separation process (WBlate), plasma bag (P), and red blood cell bag (pRBC). Comparative measurements of cell content, biochemical parameters (eg, total solids, albumin, electrolytes) were run in D, WB, P, and pRBC. Coagulation times (PT/aPTT), fibrinogen concentration, and factor activity (factor V, factor VIII, antithrombin, and von Willebrand factor) were run in samples D, WB, P, and WBlate.

Results: The separation by HF resulted in a significant (P < 0.0001) prolongation of PT (HF: median 9.4 s [range 7.7–12.4 s]; C: 7.9 s [range 7.2–9 s]) and aPTT (HF: median 14.9 s [range 11.7–19.6 s]; C: 13.1 s [range 10.9–14.2 s] (P = 0.006)). In P after separation, fibrinogen was significantly lower (P < 0.0001) in HF (1 g/L [range 0.4–1.6]) compared to C (1.5 g/L [range 1.2–3.4]). Additionally, a significant lower concentration of total solids and albumin in HF was detected in comparison to C. Leukodepletion resulted in both groups in a significant decrease in FVIII activity (HF: median −12.97% [range −27.72–(−4%)]; C: median −13.51% [range −34.69–(−12.33%)]). Plasma storage (WBlate) at room temperature had no effect on coagulation time or factor activity. Compared to the HF system a significant higher hematocrit, hemoglobin, and RBC count of the red blood cell concentrate was detected in C.

Conclusion: Blood product quality was negatively affected using the hollow-fiber system, especially for plasma quality. In case of the absence of a centrifuge, the hollow-fiber system provides an alternative for whole blood separation.

THE USE OF A POINT-OF-CARE LUNG ULTRASOUND PROTOCOL AND SONOGRAPHIC GALLBLADDER WALL EVALUATION PRE- AND POSTANESTHESIA FOR THE DETECTION OF LUNG ATELECTASIS AND GALLBLADDER WALL EDEMA IN 63 DOGS UNDER GOING GENERAL ANESTHESIA

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Introduction: Lung ultrasound (LUS) is used for the rapid detection of atelectasis and pulmonary complications perioperatively. Recently, Vet BLUE (VB-LUS) profiles in dogs undergoing elective surgical sterilization showed minimal changes; however, LUS has not been applied to dogs undergoing longer and more involved general anesthetic procedures. Gallbladder wall edema, a marker for canine anaphylaxis and right-sided volume overload, was a secondary objective since dogs often receive opioids and intravenous contrast agents that can incite histamine release; and splanchnic venous pooling occurs during general anesthesia.

Methods: Lung ultrasound and sonographic gallbladder wall characterization pre- and postgeneral anesthesia was performed at induction and extubation. Findings of dry lung (A-lines with glide sign), wet lung (B-lines), and consolidation (shred and tissue sign) were recorded. Gallbladder wall edema was defined by the presence of a sonolucent intraluminal line with gallbladder thickening referred to as the gallbladder halo sign. Comparison of LUS findings were made pre- and postprocedure, between spontaneous breathing (SB) and anesthetic mechanical ventilation (AMV), and induction agents. Positive LUS findings postprocedure had repeated evaluations performed.

Results: Lung ultrasound findings differed pre- and postprocedure ($P = 0.001$; Wilcoxon signed rank test) but not between SB ($n = 52$) and AMV ($n = 11$) ($P = 0.452$; Mann–Whitney U-test) or induction agents ($P = 0.136$; Mann–Whitney U-test). Gallbladder wall edema was absent in dogs pre-medicated with morphine, including several dogs that had associated vomiting, or those administered intravenous contrast agents. Dogs with positive LUS findings postprocedure had resolution of LUS findings within 1–3 hours.

Conclusion: Lung ultrasound findings of lung atelectasis were apparent postprocedure with resolution occurring within 1–3 hours postextubation. The induction agent tiletamine-zolazepam, although not statistically significant, had a higher frequency of abnormal LUS findings compared to the other agents. Gallbladder wall edema did not occur with morphine with or without associated vomiting, contrast agents, or with venous splanchnic pooling. These findings are important for interpreting LUS and sonographic gallbladder wall findings peroperatively to distinguish between expected LUS and gallbladder wall findings versus anesthetic-related complications.

THE FREQUENCY OF B-LINES AND OTHER LUNG ULTRASOUND ARTIFACTS DURING LUNG ULTRASOUND IN 91 HEALTHY PUPPIES AND KITTENS

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Introduction: Lung ultrasound (LUS) is effective in diagnosing common respiratory conditions in people. Established frequency of LUS artifacts in puppies and kittens is unknown and having greater total body water, could be higher and confuse LUS interpretation. Thus, the objective of this study was to determine the expected frequency of LUS artifacts in puppies and kittens.

Methods: Lung ultrasound was performed on healthy 6- to 14-week-old puppies and kittens. Numbers and locations of B-lines and other LUS signs (shred, tissue, nodule, wedge) were recorded. Data included breed, body condition score (BCS), age, sex, and weight. The number of B-lines per hemithorax, at each LUS view, and other signs were recorded. Lung ultrasound findings were evaluated relative to BCS weight, sex, left and right hemithoraces, and LUS views.

Results: Ninety-one animals were enrolled (41 puppies, 50 kittens). Puppies included 2 Chihuahuas, 1 Labrador Retriever, and 38 mixed breeds; and 20 males and 21 females. Kittens included 43 domestic short-hair and 7 domestic medium-hair; and 27 males and 23 females. The mean (range) BCS (0–9 scale), age (weeks), and weight (kg) of puppies were 3.4 (2–4), 10.1 (6–14), and 4.4 (0.9–8.8), respectively. Total number of B-lines per hemithorax were 1 on the left and right side with positive views being left cranial ($n = 1$) and right cranial lung regions ($n = 1$). The mean (range) BCS, age, and weight of kittens were 3.6 (2–4), 9.3 (7–14), and 1.1 (0.2–2.0), respectively. Total number of B-lines per hemithorax were 2 on the left and 3 on the right side; positive views were left caudodorsal ($n = 2$), right caudodorsal ($n = 1$), perihilar ($n = 1$), and middle lung regions ($n = 1$). All positive views had only a single B-line present. Age, BCS, weight, and sex were not significantly different when compared between puppies or kittens with B-lines versus those without B-lines; however, animals with B-lines were significantly younger ($P = 0.036$) when all were combined in a single analysis.

Conclusion: Healthy puppies and kittens ages of 6–14 weeks have similar LUS profiles as adults; however, because animals with B-lines were younger, B-line frequency may be higher in those < 6 weeks of age.

DEVELOPMENT OF A NOVEL SCORING SYSTEM TO PREDICT MORTALITY IN CANINE PATIENTS WITH INFECTIONS

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Introduction: Over the past 2 decades, the syndrome of sepsis has been defined as the systemic inflammatory response (SIRS) to infection. With this definition, dogs were clinically recognized as having sepsis if they met 2 out of 4 SIRS criteria. Although the SIRS criteria were previously considered sensitive but not specific for sepsis, recent evidence has called into question the sensitivity of this scoring system as well. The advent of Sepsis-3 in human critical care has redefined sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection, prompting the recommendation that the sequential organ failure assessment (SOFA) score be used in lieu of SIRS to recognize patients with infection that develop sepsis. The advent of new definitions of sepsis in the human literature begs the question as to how to define sepsis in the critically ill canine patient. The goal of this study was to evaluate physical parameters and clinicopathologic abnormalities that may help to better identify patients with infection that are at higher risk for mortality.

Methods: This was a prospective, observational study. All dogs admitted to the ICU were eligible for admission, with the exception for patients that recovered from anesthesia in the ICU postoperatively but were discharged to the general wards within 12 hours. Blood work was obtained at the discretion of the primary clinician.

Results: One hundred dogs were enrolled, 45 of which had documented evidence of infection. A mortality prediction score was generated using survival as an outcome with metanalysis, heart rate, and PvCO2 (AUROC 0.88). This compared favorably to SIRS (AUROC 0.52), as well as the APPEfull (AUROC 0.60) and APPElast (AUROC 0.54) in this population.

Conclusion: A new scoring system was determined to predict mortality in hospitalized dogs with infection. Further prospective
EVALUATION OF THE TIMING OF SURGERY ON TRANSFUSION REQUIREMENTS AND OUTCOME IN DOGS WITH SPONTANEOUS HEMOPERITONEUM

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Introduction: The goals of this study were to evaluate whether the time to surgery affects transfusion requirements, length of hospitalization, cost, or outcome in dogs with spontaneous hemoperitoneum. We hypothesized that dogs with delayed time to surgery would receive more blood products and have increased morbidity and mortality compared with dogs that had early surgical intervention.

Methods: Medical records of dogs surgically treated for spontaneous hemoperitoneum between 2010 and 2016 were reviewed. Time from admission to surgical intervention, volume of blood transfusion products administered (mL/kg), length of hospitalization (hours), outcome (survival to hospital discharge, death, or euthanasia), and total costs were recorded. All data are presented as median and range.

Results: One hundred thirty-seven dogs were included in the study. Thirty-six dogs had surgery within 6 hours of admission (36/137; 26%), 20 (20/137; 15%) within 6–12 hours, 65 (65/137; 47%) within 12–24 hours, and 16 (16/137; 12%) had surgery greater than 24 hours after admission. Packed cell volume (30%, 15–50), total solids (6 g/dL, 3.8–8.8), and base excess (–7.9, –0.3 to –17.4) values measured at admission were associated with need for transfusion in this study (P = 0.0001, 0.0076, 0.0001). There was no difference between groups in the overall dose (mL/kg) of packed red blood cell or fresh frozen plasma administered during hospitalization. Dogs that had surgery within 6 hours of admission received a significantly greater number of blood product transfusions intraoperatively (1; 0–4) compared with dogs in the 6–12 hours group (0; 0–1; P = 0.004) and 12–24 hours group (0; 0–2; P = 0.007). Delayed surgery was significantly associated with increased length of hospitalization (P = 0.0001), but there was no effect of the timing of surgery on cost of hospitalization or patient outcome.

Conclusion: In this retrospective study evaluating dogs with spontaneous hemoperitoneum, delay in surgical management led to a significantly increased length of hospitalization but did not affect overall transfusion requirements or short-term outcome. These findings provide justification for further, prospective evaluation of the effect of surgical timing on outcome in dogs with spontaneous hemoperitoneum.

THE PROGNOSTIC VALUE OF ABNORMAL COAGULATION TIMES IN DOGS THAT ARE AT RISK OF DEVELOPING SEPSIS

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Introduction: Sepsis is a hard to define syndrome associated with a deleterious systemic inflammatory response that ultimately leads to coagulopathy, organ dysfunction, and death. The primary aim of this prospective study was to evaluate if coagulation times can be predictive of disease severity and outcome in patients at risk of developing sepsis. A secondary objective was to correlate activated partial thromboplastin time (aPTT) and prothrombin time (PT) with the quick sequential organ failure assessment (qSOFA) scoring system at the moment of admission to the intensive care unit (ICU) and evaluate their combined prognostic value.

Methods: A total of 43 dogs were prospectively enrolled in the study between September 2016 and March 2017. Patients that were hemodynamically altered with clinical signs of coagulopathy, infection, shock, or SIRS were included, as well as those affected by polytrauma, organ dysfunction, or neoplasia, upon presentation. All these patients were susceptible to subclinical infections and bacterial translocation, therefore being at risk of developing sepsis. Coagulation testing and qSOFA scoring were performed at the time of admission to the ICU and were statistically
analyzed using descriptive and inferential analyses. Other variables such as signalment, diagnosis, duration of hospitalization and postdischarge treatment, and outcome were also recorded and analyzed.

Results: Mortality rate was 34.9%. Mortality increased with the number of qSOFA points (0 points: 10%; 1 point: 30.8%; 2 points: 47.1%; 3 points: 66.7%). The aPTT was significantly higher ($P = 0.029$) in patients with a qSOFA score of 2 points in comparison to those with 1 point. A positive correlation was found between aPTT and PT ($r = 0.406, n = 43, P = 0.005$). Mean values for aPTT and PT were similar between surviving and nonsurviving patients. Ten out of 15 patients (66.7%) that died died so between the first and fifth day of treatment, and 3 of the remaining 5 deaths (60%) were caused by neoplastic disease.

Conclusion: The results of this study suggest the existence of hemostatic dysfunction amongst patients with a qSOFA score of 2 points. In isolation, however, prolonged coagulation times at ICU admission were not predictive of outcome.

INDUCED VOMITING IN CONJUNCTION WITH THE “HEIMLICH MANEUVER” FOR GASTRIC FOREIGN BODY EXTRACTION IN DOGS: 100 CASES

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Introduction: Gastric foreign bodies are conventionally managed by endoscopic extraction or gastrotomy.

Methods: This study examines the results of a first-line noninvasive technique for the management of gastric foreign bodies in a population of dogs presented to an emergency department between January 1, 2013 and March 1, 2017. The population included dogs presented after ingestion of a foreign body, and dogs in which a gastric foreign body had been identified by imaging. Our practice favors oral evacuation. The technique consists of giving a large meal, inducing vomiting with an emetic substance (apomorphine or hydrogen peroxide solution) and then exerting pressure on the abdomen during vomiting. We have named this procedure the “Heimlich maneuver” in reference to the procedure described by H.J. Heimlich in 1970 for airway obstruction in people. In case of failure other options are considered: “wait-and-see,” endoscopic extraction or gastrotomy.

Results: One hundred seventeen dogs were identified. Initially, induced vomiting in conjunction with a “Heimlich maneuver” was attempted in 100 dogs (85%); 77 (77%) of these dogs vomited, allowing extraction of 63 (63%) foreign bodies, 82% of vomiting dogs. Surveillance without intervention was elected in 9 dogs (8%); 5 dogs (4%) underwent endoscopic extraction; and 3 dogs (3%) underwent extraction by gastrotomy. Subsequently, among the 37 dogs for which the foreign body was not recovered (23 dogs who did not vomit and 14 dogs who vomited but in whom the Heimlich maneuver did not produce the foreign body), 27 dogs (23% of total gastric foreign bodies) received no treatment, 6 dogs (5%) underwent endoscopic extraction, and 4 dogs (3%) underwent gastrotomy. In total, induction of vomiting associated with the Heimlich maneuver resulted in extraction of 54% of gastric foreign bodies, and “wait-and-see” approach sufficed in 30%. Noninvasive management was therefore effective in 84% of cases. Only 16% of cases required intervention: endoscopic extraction (10%) or gastrotomy (6%).

Conclusion: We propose a novel, simple, minimally invasive, and often effective extraction technique for gastric foreign bodies in dogs. This technique and “wait-and-see” approach should be considered before endoscopy or gastrotomy is attempted.

PLASMA SYMMETRIC DIMETHYLARGININE CONCENTRATION IN CATS WITH AKI RELATED TO URETHRAL OBSTRUCTION

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Introduction: Symmetric dimethylarginine (SDMA) is considered a biomarker for early detection of renal dysfunction in case of acute kidney injury (AKI). At present, no studies exist analyzing the relevance of SDMA in cats with AKI. We hypothesize that SDMA would correctly identify cats with acute renal disease and that values would correlate with IRIS grading in cats with urethral obstruction (UO).

Methods: Twenty-two cats with UO presented to the Emergency Service were compared with 22 healthy comparable cats. Urea, creatinine, potassium, and SDMA were measured on admission. Cats with UO were classified according to the IRIS AKI Grading scale. Nonparametric statistical analysis was performed.

Results: Median urea, creatinine, and SDMA concentration were higher in the UO group as compared to the control group. The SDMA/creatinine ratio was not different. In regards to cats with UO and the control groups, SDMA was highly correlated with creatinine ($R = 0.58; P = 0.000042$). The median SDMA concentration was below reference range of 14.0 µg/dL for both IRIS stage 1 and stage 2. Comparing the 5 IRIS groups (IRIS 1: $n = 5$; IRIS 2: $n = 5$; IRIS 3: $n = 5$; IRIS 4: $n = 4$; IRIS 5: $n = 3$) urea, creatinine, and SDMA were highly different in the 5 groups whereas potassium and SDMA/creatinine were not. When IRIS ≤ 2 with IRIS ≥ 3 UO cats were compared, the median urea, creatinine, potassium, and SDMA concentrations were higher in the IRIS ≥ 3 UO group as compared to the IRIS ≤ 2 group and SDMA/creatinine ratio was not different. Twenty-two cats were alive 30 days postdischarge and 15 cats were alive 1 year after. The urea, creatinine, potassium, SDMA, and SDMA/creatinine ratio were not different between the 15 alive and 7 deceased cats. Of 15 alive cats, 5 cats had a recurrence of UO. Three of those 5 cats were initially IRIS ≤ 2. None of the studied parameters including SDMA and SDMA/creatinine ratio were different as regard to recurrence of UO episode.

Conclusion: Plasma SDMA concentration is a suitable marker for identifying AKI in UO cats. SDMA correlates with IRIS stages but not SDMA/creatinine ratio.

PHOSPHATIDYLSTERINE POSITIVE MICROPARTICLES IN CANINE HEMORRHAGIC ABDOMINAL FLUIDS

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Introduction: Hemoperitoneum is a common finding in dogs in the emergency setting and may necessitate use of blood products. Autotransfusion could reduce cost and mitigate adverse transfusion reactions; however, shed hemothorax blood from human trauma patients contains high concentrations of potentially detrimental
Echinocyte transformation of the normal discocyte; and (4) aerobic procoagulant phosphatidylserine positive microparticles. The objectives of this study were to compare phosphatidylserine positive microparticle concentration and phosphatidylserine-mediated procoagulant activity of canine hemoperitoneum fluids and packed red blood cell units (pRBCs).

Methods: Ten dogs with hemoperitoneum (neoplasia = 7; trauma = 1; Other = 2) were recruited, and 5 pRBC units purchased. Supernatants were collected from hemoperitoneum and pRBC samples. Phosphatidylserine positive microparticle concentrations were measured via flow cytometry and phosphatidylserine-mediated procoagulant activity by a commercial thrombin generation assay.

Results: The concentration of phosphatidylserine positive microparticles was not significantly different between pRBCs (median: 415/mL, range 173–1331/mL) and hemoperitoneum samples (median: 314/mL, range 132–3880/mL; P = 0.77). Phosphatidylserine-mediated procoagulant activity was significantly higher for supernatants collected from pRBC (median 54 nM, range 53–60 nM) than hemoperitoneum samples (median 43 nM; range 7–51 nM; P = 0.0007).

Conclusion: The findings suggest shed hemoperitoneum blood does not contain more phosphatidylserine positive microparticles, nor does it have higher phosphatidylserine-mediated procoagulant activity than pRBC units. Measurement of other procoagulant and proinflammatory microparticle components and investigation of the effect of autotransfusion versus pRBC transfusion on circulating microparticle concentrations is warranted.

EVALUATION OF FELINE RED BLOOD CELLS COLLECTED WITH AN OPEN SYSTEM AND STORED FOR 35 DAYS AS WHOLE BLOOD UNITS

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Introduction: The increasing access to veterinary hospital blood banks and commercial sources of feline blood products means that transfusion therapy is more widely available to veterinarians and feline stored blood products are used more often. Despite the increasing availability of feline blood collected and stored for transfusion purposes, few studies have investigated storage lesions in feline whole blood (FWB) units and no study has evaluated hematological changes in FWB units. The objective of this study was to assess changes in feline RBCs collected and stored for transfusion purposes as FWB units.

Methods: A prospective, laboratory in vitro study was conducted. Twelve nonleukoreduced FWB units were collected with an open system using three 20-mL syringes prefilled with citrate, phosphate, dextrose, and adenine (CPDA-1) preservative-anticoagulant solution with ratio with blood of 1:7 from anesthetized feline blood donors. Units were stored in a blood bank dedicated refrigerator and sampled every 7 days (D7, D14, D21, D28) from collection (D0) to the end of storage (35 days, D35). At each time point, the following were evaluated: (1) hematological parameters (RBC, HGB, HCT, MCV, MCH, MCHC, RDW); (2) percentage of hemolysis; (3) morphological index, scored of 0 to 4 based on echinocyte transformation of the normal discocyte; and (4) aerobic and anaerobic blood culture. Results were statistically compared to D0, with t-test or Wilcoxon test, as appropriate with statistical significance set at P < 0.01.

Results: There was no significant difference in hematological parameters at any time point with respect to D0. Significant increases were found in percentage of hemolysis and morphological index starting from 21 days of storage (P = 0.0002 and P = 0.0039, respectively). Mean hemolysis percentage value was less than 1% up to 21 days of storage. All blood cultures were negative for bacterial growth.

Conclusion: RBCs in FWB units collected with an open system can undergo some significant hematological changes, but these results suggest that storage for up to 21 days is safe. In vivo studies are required to establish if these changes affect the ability of stored RBCs to circulate and provide adequate oxygen delivery after transfusion.

ASSESSMENT OF A NASOGASTRIC TUBE PLACEMENT PROTOCOL TO MINIMIZE IATROGENIC TUBE MISPLACEMENT COMPLICATIONS

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Introduction: There is no standard method of nasogastric tube (NGT) placement in veterinary medicine, and many are placed blindly. Blind techniques can result in tracheal, pulmonary, or pleural malposition wherein life-threatening complications may develop. Cases of tracheopulmonary malposition have been reported in both dogs and humans resulting in death. Although radiographic assessment of NGT placement is the most reliable indicator of position, recognition of NGT malpositioning once a tube has been fully advanced does not prevent pulmonary complications. To limit complications, a lateral cervical radiograph has been recommended in the recent veterinary literature to verify correct tube placement above the larynx and within the esophagus prior to further NGT advancement and final positioning. The goal of this study was to assess whether a standardized protocol incorporating a lateral cervical radiograph could correctly identify NGT tracheal misplacement prior to tube advancement.

Methods: Prospective study performed at a veterinary teaching hospital between December 1, 2017 and April 15, 2018. Following NGT placement, a questionnaire that included the following information: patient factors (reason for placement, mentation, recumbency, head conformation, placement nostril, evidence of coughing and/or swallowing at time of placement, and use of sedation or general anesthesia); tube factors (size, presence of a stylet), and placement factors (clinician experience, number of attempts, time to placement, number of radiographs obtained, and presence of misplacement) was completed by the attending clinician.

Results: Of 19 total NGT placements (14 dogs and 5 cats), 2 tracheal misplacements (10.5%, 1 dog and 1 cat) were identified before the tube was fully advanced. Both animals were in sternal recumbency and neither received a sedative. The dog was noted to have a brachycephalic confirmation and alert mentation, and the cat was reported as mesocephalic with quiet mentation. Both tubes were placed by residents with no coughing reported and evidence of swallowing described in both cases.

Conclusion: The use of a standardized protocol that incorporates a lateral cervical radiograph identified NGT tracheal misplacements in 10.5% of cases where blind technique safety assessments including lack of swallowing and presence of a cough failed to alert the clinician to tube malpositioning.
EFFECTS OF POTENTIAL CONFOUNDING VARIABLES ON ACCURACY AND PRECISION OF A COMMERCIAL VETERINARY HEMATOCRIT METER

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Introduction: Rapid and accurate measurement of hematocrit using small sample volumes is useful in critically ill patients. Interference from substances in the blood (e.g., lipemia) may influence the function of machines that rely on optical measurement. We aimed to evaluate precision and accuracy of a veterinary point-of-care (POC) hematocrit meter and to study the effects of potential confounding variables on meter function. We hypothesized that the meter is accurate and precise over a wide range of hematocrits and that the confounders would not affect meter function.

Methods: Canine and feline venous whole blood EDTA samples (n = 56) were run in duplicate on the POC, which reported hemoglobin (POCHb), measured via optical reflectance, and a calculated hematocrit (POCHct). Meter results were compared to results from a laboratory-based analyzer (CBC). Samples with grossly visible lipemia, icterus, hemolysis, and auto-agglutination were noted.

Results: CBC hematocrit ranged from 3.5% to 79.8% (mean 38.9 ± 14.5%) and hemoglobin concentration ranged from 1 to 24.6 g/dL (mean 12.9 ± 4.9 g/dL). The average differences between duplicate POCHct and duplicate POCHb values were −0.58 ± 2.96 and −0.31 ± 1.06 g/dL, respectively. There was no apparent correlation between the meter and CBC for both hematocrit (R² = 0.91) and hemoglobin (R² = 0.89). There was no apparent influence of visible lipemia (n = 12), icterus (n = 9), or hemolysis (n = 8) on meter accuracy. The POC failed to read 5 samples; 4 had marked auto-agglutination and 4 had hematocrit ≤11%.

Conclusion: Overall, the POC had excellent precision and correlation with CBC. The meter was not influenced by icterus, lipemia, or hemolysis but did not provide data for samples with auto-agglutination or hematocrit ≤11%.

ADIPONECTIN AS SEPSIS-BIOMARKER IN DOGS: DIAGNOSTIC AND PROGNOSTIC VALUE

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Introduction: To investigate the diagnostic and prognostic value of plasma adiponectin (ADPN) concentrations versus other traditional inflammatory biomarkers, on admission and over the ICU stay, of dogs affected by natural sepsis.

Methods: This observational prospective study included 20 critically ill dogs with clinical evidence of infectious SIRS on admission. Plasma PON1, BChE, albumin (Alb), and C-reactive protein (CRP) were measured upon sepsis diagnosis and every 24–48 hours until patient’s death or discharge. Twenty-seven dogs with local inflammation and 18 healthy dogs were included in the study as positive and negative control groups, respectively. All studied variables were compared among groups using general linear models. Values were also compared between outcome groups for animals in the septic group. Alpha level for significance was 0.05.

Results: As expected, animals on localized inflammation (n = 27) and sepsis (n = 20) groups had lower ADPN and ALB and higher CRP, FBG, and FRT levels than control animals (n = 18) on admission. Dogs with sepsis had lower ADPN (2.4 ± 0.46 vs 4.5 ± 0.41 μg/mL, P < 0.001), ALB (1.7 ± 0.1 vs 2.2 ± 0.08 g/dL, P < 0.001), and higher CRP (87 ± 4.8 vs 73 ± 4.1 μg/mL, P < 0.001) concentrations than dogs with localized inflammation. Regarding initial and final ADPN concentration in septic dogs, no significant differences in outcome were detected on that group (P = 0.306).

Conclusion: Adiponectin may be a reliable marker of sepsis and changes related to the severity of disease and progression of the inflammatory response in dogs. However, further studies are warranted to confirm the prognostic value of this inflammatory marker.

EVALUATION OF PARAOXANASE AND BUTYRYLCHOLINESTERASE ACTIVITY IN DOGS WITH SEPSIS

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Introduction: To evaluate the diagnostic and prognostic value of plasma paraoxonase (PON1) concentration and butyrylcholinesterase (BChE) activity versus other traditional inflammatory biomarkers, on admission and over the ICU stay of dogs affected by natural sepsis.

Methods: This observational prospective study included 20 critically ill dogs with clinical evidence of infectious SIRS on admission. Plasma PON1, BChE, albumin (Alb), and C-reactive protein (CRP) were measured upon sepsis diagnosis and every 24–48 hours until patient’s death or discharge. Twenty-seven dogs with local inflammation and 18 healthy dogs were included in the study as positive and negative control groups, respectively. All studied variables were compared among groups using general linear models. Values were also compared between outcome groups for animals in the septic group. Alpha level for significance was 0.05.

Results: Animals on localized inflammation (n = 27) and sepsis (n = 20) groups had lower PON1 and higher BchE activity than control animals (n = 18) on admission. Dogs with sepsis had lower PON1 (1.1 ± 0.10 vs 1.6 ± 0.08 UI/mL, P < 0.001), than dogs with local inflammation, but no differences in BchE activity (3.8 ± 0.41 vs 3.5 ± 0.35 μmol/mL·min, P = 0.448). In septic dogs, PON1 was correlated with APPLEfast score and BChE activity (r = −0.47; P < 0.046 and r = 0.38; P < 0.121., respectively). In septic dogs, no differences in outcome for both parameters were detected in the population submitted to study.

Conclusion: In conclusion, the present study has identified lower serum PON1 and higher BChE activities in septic dogs. Further studies are warranted to describe PON1 and BChE activities as potential useful markers of sepsis progress and recovery.

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COMPARISON OF HEPARINIZED SALINE AND 0.9% SODIUM CHLORIDE FOR MAINTAINING CENTRAL VENOUS CATHETER PATENCY IN HEALTHY DOGS

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Introduction: To determine whether heparinized saline would be more effective in maintaining the patency of central venous catheters (CVC) in dogs compared to 0.9% sodium chloride.

Methods: Twenty-four healthy purpose-bred dogs were randomized into 2 groups, a treatment and a control group. A central venous catheter was placed in the jugular vein of each dog. Each dog in the treatment group had their CVC flushed with 10 IU/mL heparinized saline while dogs in the control group had their CVCs flushed with 0.9% sodium chloride, every 6 hours for 72 hours. Immediately prior to flushing, each catheter was evaluated for patency by aspiration of blood. The catheter site was also evaluated for phlebitis and a rectal temperature was obtained in each dog every 6 hours. Blood samples were obtained from all dogs at hour 0 and 72 to evaluate PT and aPTT values of each group.

Results: All CVCs in both groups were patent after 72 hours, demonstrated by aspiration of blood and ease of flushing the catheter. Two CVCs in the 0.9% sodium chloride group had a negative aspiration at hour 12 and 36, respectively. One CVC in the heparinized saline group had a negative aspiration at hour 18. Signs of phlebitis occurred in 3 dogs, 2 in the 0.9% sodium chloride group and 1 in the heparinized saline group. No dog was hyperthermic (>103°F). Two catheters were inadvertently removed during the study, both in the heparinized saline group [OA1]. There was no significant difference between PT values or aPTT values of the dogs in either group.

Conclusion: 0.9% sodium chloride was as effective as 10 IU/mL heparinized saline in maintaining central venous catheters for up to 72 hours in healthy dogs. Further evaluation in clinical patients is warranted.

Listing of Large Animal IVECCS Abstracts (in alphabetical order of presenter)

Oral Presentations

THE IMPACT OF ADVANCED PATIENT AGE ON OUTCOME AND BLOOD-DERIVED INFLAMMATORY BIOMARKERS IN HOSPITALIZED HORSES WITH COLITIS OR DIARRHEA

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Introduction: This study assessed whether aged horses with colitis or diarrhea showed greater disease morbidity, systemic inflammatory responses, and mortality than similarly affected young-adult horses.

Methods: A retrospective cohort analysis included 159 hospitalized horses diagnosed with colitis or diarrhea (2014–2018), to determine the potential effects of patient age on disease progression and mortality. A subset of horses (n = 27) with hospital-acquired diarrhea were evaluated prospectively to identify age-associated changes in coagulation and blood-derived inflammatory biomarkers during early disease. Prospective analyses at times 0 (diarrhea onset) and 6 hours later, included a CBC, partial-thromboplastin-time, plasma lactate, Horse Cytokine 5-plex (IL-4, IL-10, IL-17, IFN-α, IFN-γ), and 3-plex (IL-2, CCL2, sCD14) assays. Univariate and multivariate statistical tests were used to detect age-effects, and identify parameters affecting survival to discharge in the retrospective analysis (P < 0.05).

Results: Surviving colitis horses were significantly younger (median age: 12.7 years) than nonsurviving horses (17.4 years) in the retrospective assessment, with a 6% increase in mortality for each year the horse aged. Similarly, geriatric horses (>20 years) were significantly more likely to die than young-adults (2–12 years), despite a higher financial investment in their hospital care, and longer hospitalization (multivariate outcome analysis). Plasma transfusion and fecal transplant were not associated with outcome. None of the blood-derived inflammatory biomarkers were significantly different between young-adult and aged horses in the prospective assessment.

Conclusion: This data support that outcome of colitis is less favorable in geriatric versus young-adult horses but cannot be explained by age-related differences in measured inflammatory responses during early disease.

OUTCOME AND COMPlications IN HORSES ADMINISTERED STERILE OR NONSTERILE INTRAVENOUS FLUIDS

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Introduction: Intravenous fluids are an important component of fluid therapy in critically ill equine patients. Unfortunately, a commercially available maintenance formula is not available for horses. Additional recent challenges included manufacturer shortages and increases in cost which made treating horses with intravenous fluids challenging at best. One solution in our hospital was the use of nonsterile reverse osmosis water and custom electrolyte formulas. We hypothesized that horses receiving nonsterile IV fluids (JUG) would not have increased rates of morbidity or mortality compared to horses receiving traditional intravenous fluids (IVF).

Methods: Medical records for horses at Michigan State University Veterinary Medical Center receiving JUG or IVF between December 2013 and August 2017 were reviewed. Data retrieved included signalment, type of fluid administered, hematological evaluations, development of complications, and survival to discharge. Survival was compared by chi-square analysis. Normality of numerical data was assessed using the Shapiro–Wilks test and compared with a one-way ANOVA or ANOVA on ranks using a post hoc Holm Sidak test or Dunn’s test.

Results: A total of 278 horses were included: 213 received IVF and 65 received JUG. There was no difference in survival to discharge between horses receiving JUG versus IVF (82% vs 79%, P = 0.028). There was an increased incidence of jugular vein complications (9% vs 0.9%, P = 0.003) and laminitis (6% vs 0.9%, P = 0.028) in horses that received JUG vs horses that received IVF.
Conclusion: Administration of JUG did not affect survival to discharge; however, the association with jugular vein complications and laminitis warrants informed discussion with owners prior to utilization.

NEONATAL INTENSIVE CARE OF HOSPITALIZED GIRAFFE CALVES (GIRAFFA CAMELOPARDALIS) REQUIRING HAND-REARING

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Introduction: The study purpose was to describe the clinicopathologic findings, diagnoses, treatment, and outcome of hand-reared newborn giraffe calves experiencing neonatal illness.

Methods: Retrospective cohort analysis of 10 neonatal giraffe calves admitted to a university teaching hospital. All data are presented descriptively.

Results: Ten calves (5 male, 5 female), of which 9 were reticulated giraffes (Giraffa camelopardalis reticulata) and 1 was a Masai giraffe (G. c. tippelskirchi), were admitted at less than 2 days of age. Failure of passive transfer (FPT) was evident in 5/10 calves based on the assessment of serum protein, globulin, and gamma-glutamyl transferase; and successfully treated with oral bovine colostrum or hyperimmune bovine plasma intravenously. Diarrhea occurred in 6/10 calves, and was managed with supportive care, fecal transfaunation, and limiting milk intake. The incidence of diarrhea was reduced by offering 10% body weight in milk per day at 2- to 4-hour intervals and < 2 L per feeding. Less common diagnoses included pneumonia (n = 3) and mycoplasma-associated septic arthritis (n = 1). Eight calves received systemic antimicrobial therapy. Hyperlactatemia (lactate > 5 mmol/L; n = 8) and hypercreatininemia (creatinine > 2.0 mg/dL, n = 7) were the most common presenting laboratory abnormalities, which resolved with intravenous fluid therapy. All neonatal giraffes survived to discharge following a median hospitalization of 9.5 days (range: 5–37), and were successfully hand-reared.

Conclusion: Early bovine colostrum administration or intravenous hyperimmune bovine plasma infusion to manage FPT was well tolerated. Diarrhea is a common clinical problem, and can be related to feeding regimens. Hospitalized neonatal giraffe calves may carry an excellent prognosis following early intervention.

PLASMA PHARMACOKINETICS, PULMONARY DISPOSITION, AND SAFETY OF SUBCUTANEOUS GAMITHROMYCYN IN ALPacas

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Introduction: Gamithromycin is a long-acting antimicrobial that concentrates in neutrophils and the respiratory tract of ruminants. Gamithromycin was therefore considered as a potential antimicrobial candidate in camelds that might also improve owner and animal compliance due to infrequent dosing.

The study objective was to determine the disposition of gamithromycin in plasma, peripheral blood neutrophils (PMNs), pulmonary epithelial lining fluid (PELF), and bronchoalveolar lavage (BAL) cells in alpacas.

Methods: A single subcutaneous injection of gamithromycin (6.6 mg/kg body weight) was administered to 6 healthy adult alpacas. Gamithromycin concentration was analyzed via LC-MS in plasma, polymorphonuclear cells, pulmonary epithelial lining fluid and bronchoalveolar lavage cells until day 14 post-injection. Plasma gamithromycin was measured in all 6 alpacas; the remaining 3 body compartments were analyzed in 4 alpacas.

Results: Gamithromycin rapidly concentrated in blood PMNs, BAL cells, and PELF. The T_max, C_max, and AUC were lower in plasma than the other three compartments. Mean peak gamithromycin concentrations were highest in BAL cells (26001.75 ± 1240 ng/mL) and PMNs (2573.00 ± 963.25 ng/mL) compared to PELF (660.75 ± 413.70 ng/mL) and plasma (542.00 ± 196.00 ng/mL).

Conclusion: Gamithromycin concentrates significantly in white blood cells and pulmonary tissues of alpacas as expected. Further studies are necessary to determine clinical safety and to identify MIC data for bacterial isolates originating from camelds.

GASTROINTESTINAL COLIC IN HORSES IN MEDELLIN, COLOMBIA: 410 CASES (2005–2015)

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Introduction: This study aimed to explore different causes of gastrointestinal colic of horses from Colombia.

Methods: Medical records of horses referred to a teaching hospital for colic from 2005 to 2015 were reviewed. Final diagnosis was achieved by physical examination, rectal palpation, nasogastric intubation, blood work, abdominocentesis, and exploratory laparotomy or at necropsy exam.

Results: A total of 410 records of horses with colic were included. Three hundred thirty-one (81%) horses were Paso Fino, and 79 (19%) other breeds. There were 253 (62%) surgical and 157 (38%) medical cases identified. Large colon impaction was the most common cause of colic (n = 123; 30%) followed by small colon impactions (n = 70; 17%). The most common causes for surgical colic were large colon impaction (n = 9; 23%), small colon impaction (n = 49; 19%), and small intestine strangulating obstruction (n = 32; 13%). The most common causes of medical colic were large colon impactions (n = 64; 41%) and small colon impactions (n = 21; 13%). The overall survival rate was 85% (n = 348); 43 (10%) horses were euthanized and 19 (4.6%) died because of clinical complications. In surgical cases, 82% (n = 207) survived, 13% (n = 34) were euthanized, and 5% (n = 12) died.
A COMPARISON OF THE I15 VERSUS EPOC FOR BLOOD GAS AND BIOCHEMISTRY ANALYSIS IN HORSES

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Introduction: For the last 10 years, miniaturization has allowed portability and easier use of numerous tools in veterinary practice. Following the introduction of the Epoc device to the market, the i15 (Edan) is a brand new POCT device designed for human and veterinary blood gases and biochemical analysis that can be used in critical or routine situations on the field.

Methods: The Epoc and i15 were compared in equine clinical routine examinations and general anesthesia for reliability, easiness of use, price, and rapidity. Thirty of the same venous or arterial blood samples were analyzed with the Epoc and i15 machines simultaneously. The blood pH, pCO2, pO2, HCO3−, Na+, K+, Ca2+, tCO2, Ht, Hb, BE, glucose, and lactate values were compared by Student’s t-test (P < 0.05 significant). Analysis time, easiness to use, and failures were also evaluated.

Results: The Epoc results were higher than those obtained from i15 but this did not reach statistical significance, except for K+ and Ca2+ (4 vs 3.9 and 1.43 vs 1.54 - i15 vs Epoc, respectively). The i15 parameters panel was wider, including Anion Gap, H+, osmolality, pO2/FiO2, RI, pO2/A-a, and pO2(a/A) ratios. Both were easy to use, but i15 did not need any preparation waiting time before injecting the sample into the cartridge. Total analysis time was shorter with i15. Printer and a large display screen on i15 make the machine easier to read and interpret results. Sample cartridges are cheaper and do not need to be stored in the fridge, making it more convenient.

Conclusion: Both the Epoc and i15 devices are portable and easy to use in equine practice. The i15 offers reliable results and more parameters for routine and anesthesia blood gases and chemistry analysis.

PLASMA TRANSFUSION REACTIONS IN FOALS WITH FAILURE OF TRANSFER OF PASSIVE IMMUNITY IN COLOMBIA: 48 CASES

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Introduction: Plasma transfusion (PT) is a common therapeutic procedure in septic foals or foals with failure of transfer of passive immunity (FTPI). The incidence of PT reactions when fresh plasma is used varies between 8.7% and 10%. This study aimed to explore the incidence of PT reactions in foals with FTPI receiving fresh plasma in a teaching hospital from Colombia.

Methods: Medical records of foals receiving a fresh plasma transfusion due to FTPI were reviewed. The FTPI was defined as: total failure when IgG levels were < 400 mg/dL and partial when the IgG levels were between 400 and 800 mg/dL.

Results: Forty-eight foals were included. Thirty-seven (77%) of the foals were Paso Fino, 5 (10.4%) were pony breeds, 3 (6.2%) were Quarter Horse, and 3 (6.2%) other breeds. Median age at presentation was 24 hours (range: 0–144 hours). The median weight was 23 kg (range: 7–54 kg). The median volume of plasma transfused was 2 L (range: 0.3–2.5 L). The compatibility major and minor test was performed in 18% (n = 9) of cases. Overall, immediate reactions were observed in 24 (48%) of the cases and included fever (n = 8; 16%), tachycardia (n = 7; 14%), tachypnea (n = 13; 26%), tremors (n = 2; 4%), and diarrhea (n = 2; 4%). In total 6 foals died for reasons not associated to the plasma transfusion.

Conclusion: In this study, PT reaction rates were higher than the previously reported. This could be explained, at least in part, by the low rate of compatibility testing.

EFFICACY OF A FIRST-IN-CLASS (LY315920), SMALL-MOLECULE SNAKEBITE ANTIDOTE IN A PORCINE MODEL OF LETHAL ENVENOMATION

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Introduction: Worldwide, approximately 125,000 people die annually due to snake envenomation. Livestock and companion animal mortality numbers are likely higher. Venom sPLA2 is ubiquitous among viper and elapid venoms and the most lethal component in the majority of snake venoms. Neurotoxicity and coagulopathy are primary mechanisms by which a majority of snake venoms cause death. Antivenom is available only in the hospital setting and requires refrigeration, but >75% of snakebite deaths occur outside the hospital. An ideal antidote for snake envenomation would be broad-spectrum (venom agnostic), heat stable, readily available, cost-effective, and easy to administer even outside the hospital. This study utilized a porcine model to investigate the ability of a first-in-class, small molecule (LY315920) to prevent mortality due to experimental lethal Micrurus fulvius envenomation.

Methods: Pigs were anesthetized, instrumented, and subcutaneously envenomed with 100% lethal doses of Micrurus fulvius venom. Control pigs received excipient only while treatment pigs received drug through one of three routes following envenomation: Intravenous (IV), constant rate infusion (CRI) plus oral (PO), or orally at various doses/frequencies. Laboratory samples were collected at baseline and 8 time points following envenomation. A clinical and lameness scoring system was utilized, all subjects received analgesia and were euthanized according to predetermined criteria.

Results: All control pigs reached a clinical score warranting euthanasia within 6 hours. One hundred percent of pigs in all treatment categories survived and were clinically normal by the end of the study. No adverse effects of the drug were noted.

Conclusion: This antidote shows great promise in treating snakebite envenomation.
ETHYL PYRUVATE IN HORSES WITH LARGE COLON VOLVULUS – PRELIMINARY RESULTS

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Introduction: Ethyl pyruvate was used in preclinical models of gastrointestinal ischemia and sepsis to improve tissue healing and survival by mitigating oxidative damage and inflammation. Ethyl pyruvate was shown to be safe and effective in an equine endotoxemia model. The objective of this study was to evaluate the efficacy of ethyl pyruvate in clinical cases following surgical correction of large colon volvulus.

Methods: In a randomized, placebo-controlled, multicenter prospective study horses received either 150 mg/kg ethyl pyruvate in LRS or LRS every 6 hours for 24 hours following recovery from surgical correction of a 360° LCV. HR, PCV, L-lactate were monitored for 24 and 48 hours and blood was sampled for proinflammatory cytokine gene expression before and after the treatment. Preliminary descriptive statistics were performed.

Results: Twelve horses were enrolled. Six horses receiving ethyl pyruvate had admission median (range) HR = 80 (36–120)/min, PCV = 46 (35–70)%, and L-lactate = 5.8 (2.9–7.5) mmol/L. At 24 hours postop, HR = 44 (40–68)/min, PCV = 33 (21–46)%, and L-lactate = 1.0 (0.8–1.5) mmol/L. Four of 6 horses survived to discharge. Six horses receiving LRS had admission median HR = 73 (32–120)/min, PCV = 0 (35–53)%, and L-lactate = 5.3 (1.3–12.2) mmol/L. At 24 hours postop, HR = 48 (42–68)/min, PCV = 36 (35–40)%, and L-lactate = 0.8 (0.5–1.4) mmol/L. Three of 6 horses survived to discharge. No adverse events associated with ethyl pyruvate occurred.

Conclusion: Enrollment of additional cases will allow us to determine the effectiveness of ethyl pyruvate on postoperative outcome of horses with 360° LCV.

EFFECTS OF ETHYL PYRUVATE ON CARDIOPULMONARY PARAMETERS AND RECOVERY IN ANESTHETIZED HORSES

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Introduction: Cardiovasculary compromised horses are anesthetized for surgical correction of ischemic intestinal lesions. Frequently, these horses suffer from diminished oxygen delivery, which is compounded by anesthetic drugs. Ethyl pyruvate, prometabolic antioxidant with diverse pharmacological effects, limits ischemic tissue injury and hastens tissue recovery. In a previous terminal study, we showed that ethyl pyruvate significantly increased cardiac output, oxygen delivery, and central venous pressure, compared to values in control horses receiving LRS. We hypothesized that ethyl pyruvate would improve cardiopulmonary parameters of anesthetized horses and have no negative effects on anesthetic recovery.

Methods: Six Standardbred geldings were enrolled in a randomized crossover design. Horses were anesthetized for 90 minutes and received 1 L of LRS or 150 mg/kg ethyl pyruvate in 1 L LRS over 60 minutes. Direct arterial pressures, HR, RR, and ETCO2 were recorded every 5 minutes. Arterial blood gases were assessed every 20 minutes. Anesthetic recovery was recorded and scored by two blinded observers. Total recovery time, time to extubation, time to sternal recumbency, number of attempts to stand, and time to stand were recorded. Data were assessed by univariate tests, P < 0.05. Treatment and time were fixed effects.

Results: All horses completed the study with no complications. No significant differences between the ethyl pyruvate treatment and LRS controls were detected for any of the anesthetics recovery or cardiopulmonary variables measured.

Conclusion: Study limitations included low horse numbers and using healthy Standardbred geldings. These results suggest that ethyl pyruvate may be used in anesthetized clinical cases without impacting anesthetic recovery.

COMPARISON OF TWO TECHNIQUES FOR TRANSPHARYNGEAL ENDOSCOPIC AUDITORY TUBE DIVERTICULOTOMY IN THE HORSE

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Introduction: Chronic infection within the auditory tube diverticula, and subsequent empyema and chondroid formation, is well described in the horse. Medical therapy has been reported with mixed success, with treatment failures attributed to chronic inflammation and inadequate drainage from the nasopharyngeal ostium. Auditory tube diverticulotomy allows continuous egress from this cavity. The aim of the present study was to compare two transpharyngeal endoscopic auditory tube diverticulotomy locations and describe the relative anatomy, duration, and incision properties for each surgical approach.

Methods: Transpharyngeal endoscopic auditory tube diverticulotomy was performed using a diode laser either at a single dorsoopharyngeal recess location, or bilaterally caudal to the nasopharyngeal ostium in 10 horse head specimens. Laser energy, activation time, and procedure duration were recorded. A two-sample t-test was used to compare total laser energy, laser activation time, and surgical duration between surgical procedures.

Results: Both methods resulted in clear communication between the nasopharynx and auditory tube diverticula. Diverticulotomy performed in the dorsal pharyngeal recess required less laser energy and activation time and had a shorter surgical duration than diverticulotomy performed caudal to the nasopharyngeal ostium.

Conclusion: Both surgical methods resulted in clear communication between the pharynx and the auditory tube diverticula, though the techniques differed in location of diverticulotomy, laser energy and activation time, and surgical duration. Further study is warranted relative to the clinical application of these techniques.
EFFECT OF SEASON AND GEOGRAPHIC LOCATION ON THE INCIDENCE OF ENTERIC PATHOGENS

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Introduction: Acute diarrheal disease (enterocolitis) can be a life-threatening equine emergency. Determining an etiologic cause of enterocolitis is desirable to tailor specific therapy. We hypothesized that the incidence of enteric pathogens causing enterocolitis would be influenced by season and geographic region.

Methods: Results of enteric disease fecal PCR panels submitted to IDEXX Laboratories, from adult horses between January 2011 and December 2014, were reviewed. The panel tests for Salmonella spp., Neorickettsia risticii, Clostridium difficile type A toxin, Clostridium difficile type B toxin, Clostridium perfringens type B toxin, coronavirus, Cryptosporidium spp., Rhodococcus equi, Lawsonia intracellularis, and rotavirus were performed. States were separated into geographic regions and months were grouped into seasons. To relate the probability of disease to geographic region and season, logistic regression was performed using a Tukey correction for multiple comparisons. Significance was set at P < 0.05.

Results: 3,417 fecal samples were tested during the study period. 39% yielded a positive result. Significant differences in the incidence of Cryptosporidium spp., C. perfringens and Salmonella spp. were identified between geographic regions. The incidence of rotavirus, R. equi, Lawsonia spp., and coronavirus was different between seasons. There was a significant interaction between region and season for N. risticii. The incidence of C. difficile type A and C. difficile type B toxins were not affected by geographic region or season.

Conclusion: The incidence of Cryptosporidium spp., C. perfringens, Salmonella, rotavirus, R. equi, Lawsonia spp., coronavirus, and N. risticii is affected by geographic location and/or season.

POSITIVE PIROPLASMOSIS STATUS AND HYPERTHERMIA IN HORSES HOSPITALIZED FOR COLIC

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Introduction: A 4-year retrospective study was conducted among a population of 322 horses referred for primary colic (2013–2016) in order to investigate development of fever and other complications in that population.

Methods: One hundred fifty-two horses were managed medically, and 170 were managed surgically. Intensive care was provided. Usual complications noted included recurrent colic and diarrhea at similar rates other studies. Pyrexia (> 38.9°C) lasting > 48 hours was also observed during hospitalization in 44 horses (11% of medical colics and 14% of surgical colics). Thorough standard clinical investigation of the fever was carried out to exclude primarily: endotoxemia, peritonitis, enterocolitis, secondary pleuropneumonia, and thrombosis. Other examinations included: CBC, biochemistry and inflammatory proteins panel, ultrasonographic exams (abdomen, thorax, vessels), airway endoscopic examination, and peritoneal fluid cytology, when necessary. When no significant cause for the hyperthermia was found, blood was tested for hemopathogens. Horses were considered piroplasmosis positive (for Babesia caballi or Theileria equi) based on PCR positivity or seropositivity at > 1/320. Risk factors were assessed by studying correlations between piroplasmosis status and incidence of fever.

Results: Among the 44 horses tested, 31 (70%) tested piroplasmosis positive (90% involved T. equi). Some developed other complications such as thrombophlebitis (at least 25%), significant limb vasculitis (50%) or respiratory distress (18%), also possibly related to piroplasmosis infection.

Conclusion: Positive piroplasmosis status in horses hospitalized for colic appears to be an increased risk factor for development of hyperthermia and other complications. This status is important to consider during intensive care especially in endemic areas.

COMPARISON OF CEPHALIC TO JUGULAR VENOUS BLOOD GAS ANALYSIS IN CLINICALLY ILL HORSES

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Introduction: Lactate is an end-product of glycolysis and is a valuable marker for critical illness or sepsis. In equine medicine, lactate production varies between different body regions; however, little information regarding production in the limbs exists. The objective of this study was to compare jugular to cephalic plasma lactate concentrations in both healthy and clinically ill horses.

Methods: Prospective case–controlled study of horses presented between August 2015 and February 2017. Twenty-four clinically ill horses and 10 healthy control horses were investigated. Blood samples were drawn from both the jugular and cephalic vein for analysis at presentation and during the first 24 hours of hospitalization.

Results: Cephalic vein lactate was significantly higher than the jugular vein lactate in healthy control horses (P < 0.05). Cephalic vein lactate was significantly higher than jugular vein lactate at presentation in clinically ill horses and during all time points after (P < 0.05). When clinically ill horses were investigated for specific outcomes (survivors vs nonsurvivors and laminitis vs nonlaminitis) cephalic vein lactate was significantly higher in survivors and horses that did not develop laminitis (P < 0.05). No difference was found in nonsurvivors or horses that developed laminitis. No difference was seen in the rate of change in lactate over time when survivors were compared to nonsurvivors and when laminitis horses were compared to nonlaminitis horses.

Conclusion: Significant differences between the jugular and cephalic vein lactate production were seen in healthy and clinically ill horses. Further investigation is warranted to see how these values change over time and during the course of clinical disease.
PRELIMINARY STUDY INTO HEART RATE VARIABILITY PARAMETER (ROOT MEAN SQUARE OF SUCCESSIVE DIFFERENCE) IN CORRELATION WITH PAIN SCORES IN HORSES WITH COLIC

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Introduction: Heart rate variability (HRV) analysis is a relevant indicator of cardiac autonomic control. The aim of this study is to assess if one main parameters of HRV, the root mean square of successive difference (RMSSD), can be used as indicator of pain in horses suffering from colic.

Materials: Twenty-one horses hospitalized for colic were enrolled. Horses were studied daily (and for at least 5 days) at 2 set quiet times to make measurements via a heart rate monitor (Polar H7 – RS800cx) and determine 2 pain scores (the Dalla Costa Grimace Pain Score (GPS) and the Bussière Composite Pain Scale (CPS)) during 10 minutes of observation. Data were analyzed with specialized software (Kubios) to obtain RMSSD. Nonparametric statistical analysis was conducted (analysis of variance/correlations).

Results: All cases showed a positive evolution according to GSC and CPS. Eight of them among medical and surgical colics demonstrated that the RMSSD was clearly increasing while the pain score was decreasing. A marked increase in the RMSSD (by more than 170 ms) was noted in 4 horses in which the pain reached a zero score at the end of the hospitalization. Similarly, marked trends were also were observed in 3 surgical cases, with GSC and CPS scores decreasing from 7 to 0, while RMSSD values were ×4.

Conclusion: Preliminary data in changes in RMSSD during colic management show that trends can be marked and tend to correlate with pain scores. More data are necessary to establish possible significance and improve experimental design.

THE PROGNOSTIC VALUE OF CLINICAL CRITERIA TO DEFINE SYSTEMIC INFLAMMATORY RESPONSE SYNDROME (SIRS) IN NEONATAL FOALS

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Introduction: The study assessed the prognostic value of select neonatal SIRS definitions in hospitalized foals.

Methods: A retrospective multicenter study (n = 8) included 210 ill neonatal foals for which standardized physical and clinico-pathologic admission findings were obtained. Three age-adjusted SIRS definitions were directly compared: (1) equine SIRSNEO based on vital, leukocyte, lactate, and glucose parameters (Wong, 2015), (2) SIRSPED adapted from diagnostic criteria in pediatric patients (Goldstein, 2005), and (3) SIRSDH proposed as a standardized SIRS diagnosis in foals, at the 2018 Dorothy–Havemeyer consensus meeting. Binary statistical tests (logistic regression and chi-square analyses, P < 0.05) were performed to estimate the prognostic value of SIRS; and to determine the utility of neutrophil, band neutrophil, and total leukocyte assessments as proposed diagnostic criteria of SIRS.

Results: A total of 210 foals (40% fillies; 79% survivors) were included (median age: 1 day, 0–22). The diagnoses of SIRSNEO (86/210, 41%), SIRSPED (120/210, 57%), and SIRSDH (111/210, 53%) were all significantly associated with nonsurvival, with SIRSDH showing the highest mortality risk (odds ratio, 5.7, P < 0.001). Assessment of neutrophil count in lieu of total leukocyte numbers, or exclusion of band neutrophils as diagnostic criteria of SIRS, minimally reduced the likelihood to predict mortality through the diagnosis of SIRS. The absence of SIRSDH was most likely associated with survival (predictive value: 0.92).

Conclusion: These data support that the absence of SIRS based on age-specific assessment of leukocytes, band-neutrophils, body temperature, heart, and respiratory rate may identify foals at lower fatality risk following critical illness. The application of SIRSDH criteria slightly outperformed other diagnostic methods tested.
Percutaneous tracheostomy using the Portex Minitrach II Seldinger kit in a canine cadaveric study

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Objective: To describe the technique for percutaneous tracheostomy using the Portex Minitrach II Seldinger kit. The Mini-Trach II is designed for rapid mini-tracheotomy in people. The kit enables the placement of a Mini-Trach cannula (4 mm ID) in the trachea using the Seldinger technique. Animals of different breeds and weights were used for the study. Time needed from percutaneous puncture to the introduction of the Minitrach tube was recorded. Complications were recorded and classified as: (1) difficulty to locate the anatomic tracheal marker (large neck, obesity), (2) guide wire kinking, (3) difficult sliding of cannula over the guide, and (4) second deeper skin incisions needed. A time ≤ 3 minutes and a number of complication < 2 to complete the procedure, were considered as successful. Data were tested for normality with D’Agostino and Pearson’s test. Time for placement was compared with complications encountered and site of placement using a chi-square and a paired t-test, respectively. \( P < 0.05 \) was considered significant.

Results: Placement of Minitrach was successful in 7 out of 8 dogs. The median weight of dogs enrolled was 20 kg (7–50 kg), with an average age of 9.3 ± 3 years. The time required to place the cannula was 2.4 ± 0.6 minutes. The site of placement was: between the 2nd and 3rd tracheal ring in 5/8 (62.5%) dogs and between the 1st and 2nd tracheal ring in 3/8 (37.5%). No complications were found in two dogs. The main complication registered was number 4 (3/8; 37.5%), followed by complication number 3 (2/8; 25%). In one dog complication number 1 (overweight dog) and 3 were registered. No significant difference was found between time needed, site of placement, and complications (\( P > 0.05 \)).

Conclusion: Percutaneous tracheostomy using the Portex Minitrach II Seldinger Kit is a feasible, relatively easy, and rapid technique. Further investigations as an alternative to tracheostomy for initial stabilization for dogs in severe respiratory distress, in emergency setting are warranted.

Comparison of two patient warming systems in ICU patients

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**Introduction:** Critically ill dogs and cats are often hypothermic. Effective warming improves cardiovascular response and metabolism. The aim of the study was to compare the efficacy of 2 patient warming systems in dogs and cats.

**Methods:** Forty-seven hypothermic dogs and cats in a veterinary university ICU were prospectively included in the study. Patient warming was randomly performed either by the Bair Hugger or the HotBody system. The temperature of the Bair Hugger was set at 43°C and at the HotBody at the interval 42.5–43.4°C. Rectal temperature was monitored every 5 minutes until 38.0°C was achieved or patient did not tolerate warming any more. Sixteen animals were excluded as duration of warming was shorter than 30 minutes. Results were analyzed for normality by D’Agostino and Pearson’s omnibus normality test. Non-normal data were analyzed by Mann–Whitney U test.

**Results:** Twenty-two dogs and 18 cats were enrolled. Seven patients were hypothermic due to the underlying disease and 33 due to an anesthesia performed in advance. Staring temperature was 36.2°C (32.0–37.3°C). Median duration of warming was 60 minutes (30–110 minutes) for Bair Hugger and 40 minutes (30–110 minutes) for HotBody (P = 0.3085). End temperature was 37.8°C (34.4–38.2°C) for Bair Hugger and 38.0°C (36.2–38.4°C) for HotBody (P = 0.31). Temperature increase after 30 minutes was 0.9°C (0.0–3.2°C) using the Bair Hugger and 0.9°C (0.0–2.9°C) using the HotBody system (P = 0.77). Patient temperature increase was not different at any time point between the warming devices. Temperature drop was stopped after median of 5 minutes (5–20 minutes) and temperature increased at time point of 5 minutes (5–50 minutes) in Bair Hugger and stopped decrease after 5 minutes (5–15 minutes) and increased after 5 minutes (5–25 minutes) using the HotBody system (P = 0.812; P = 0.7075). Warming was stopped due to reaching target temperature in 10 patients in each group. Three dogs were euthanized and 17 did not tolerate further warming before reaching the target temperature.

**Conclusion:** Both warming devices were effective and not different between each other in patient warming. The median temperature increase after 30 minutes was 0.9°C.

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**Evaluation of Serum Apolipoprotein-A1 in Canine Sepsis**

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**Introduction:** Alterations in lipid profile are well-described in human sepsis. Specifically, decreased serum apolipoprotein-A1 (Apo-A1) concentration is associated with greater disease severity and mortality. Apo-A1 has been recently measured as a biomarker of treatment monitoring in dogs with leishmaniosis; however, its usefulness in canine sepsis is unknown. The study aimed to evaluate the diagnostic and prognostic role of serum ApoA1 concentrations in dog with sepsis.

**Methods:** Serum samples collected between February 2015 and October 2017 from dog with sepsis (n = 127) were retrospectively analyzed. Septic dogs were subgrouped according to sepsis origin (septic peritonitis, n = 19; parvoviral enteritis, n = 26; pyometra, n = 20; miscellaneous, n = 26). Apo-A1 was measured using an immunoturbidimetric method previously validated in dogs. Nonparametric statistics was used for comparison. Data were reported as median and range. P was set at < 0.05.

**Results:** No significant differences were found in ApoA1 concentration between the overall population of septic dogs (118 mg/dL, 51–173), AHDS (131 mg/dL, 64–147), and healthy dogs (133 mg/dL, 121–139) (P = 0.06). However, significant lower Apo-A1 concentrations were documented in dogs with septic peritonitis (92 mg/dL, 58–147) compared to AHDS and healthy dogs, and between dogs with parvoviral enteritis (114 mg/dL, 51–159) and healthy controls (P = 0.001). In septic dogs, significant lower Apo-A1 concentrations were detected in nonsurvivors (95 mg/dL, 51–159, n = 27) compared to survivors (124 mg/dL, 56–173, n = 64) (P = 0.0007). According to the AUROC curve analysis, ApoA1 parameters were used to calculate an APPLExscore. Patients were grouped according to diagnosis and subgroup analysis was performed. Survival to discharge and length of stay were recorded.
PaO₂ and PaCO₂ were compared for each time point, between the experimental procedure and no other CPR interventions. Chest compressions were performed during tube and face mask ventilation was performed using a bag-valve ventilation.

Conclusions: The diagnostic potential of Apo-A₁ in selected diseases causing intra-abdominal canine sepsis (eg, septic peritonitis, paroviral enteritis) is warranted. Moreover, Apo-A₁ seems to be prognostic in this population of septic dogs. This finding is promising in canine sepsis, and parallels human data. Whether decreased Apo-A₁ concentrations reflect greater sepsis severity or directly contribute to immune dysfunction is yet to be determined. Further prospective studies are needed to confirm the prognostic significance of Apo-A₁ in dogs with sepsis, and to evaluate its diagnostic performance in homogeneous models of canine sepsis.

**SERUM CHOLESTEROL CONCENTRATION AS A MARKER OF SEVERITY IN DOGS ENVENOMATED WITH VIPERA PALAESTINAE**

**Introduction:** Vipera palaestinae, presently termed Daboia palaestinae, is the most common venomous snake in Israel. Reported mortality rates range from 0.5% to 2% and 3.7% to 15%, in people and dogs envenomated by D. palaestinae, respectively.

**Objective:** People envenomed by D. palaestinae and rabbits injected with its venom, have serum cholesterol concentration (sChol) inversely correlated with the severity of envenomation. We therefore hypothesized that in dogs envenomated by D. palaestinae, sChol may serve as a marker of severity and outcome.

**Method:** Data were retrospectively collected from the medical records of dogs diagnosed with D. palaestinae envenomation between 1989 and 2017, in which sChol was measured at presentation.

**Results:** The study included 193 dogs. The overall mortality rate was 8.8%. Median sChol was significantly (P = 0.046) lower in non-survivors (17 dogs; 87 mg/dL) compared to survivors (176 dogs; 175 mg/dL). Mean serum albumin concentration was significantly (P = 0.004) lower in the nonsurvivors (16 dogs; 2.7 ± 0.8 g/dL) compared to the survivors (159 dogs; 3.2 ± 0.7 g/dL). Receiver operating characteristic (ROC) analyses for sChol and sAlb at presentation as predictors of the outcome had an area under curve (AUC) of 0.625 and 0.687, respectively. The optimal sChol cutoff of 103 mg/dL corresponded to sensitivity of 59% and specificity of 79%. An optimal sAlb cutoff of 2.58 g/dL corresponded to sensitivity of 56% and specificity of 83%.

There was a difference in mean sChol between dogs presenting different mental statuses. Dogs with normal mentation had significantly higher sChol (165 ± 69.1 mg/dL) compared with those with depression, obtundation, and semiconscious or coma (144 ± 73.2 mg/dL; 126 ± 89.5 mg/dL; 91 ± 62.0 mg/dL, respectively, P = 0.011). sChol was significantly lower in dogs presenting with leukocytosis, hypoproteinaemia and thrombocytopenia (P < 0.002).

**Conclusion:** The present results show that sChol on presentation is a good marker for the severity of envenomation, and a moderate outcome predictor in dogs envenomated by D. palaestinae. In addition, the presence of hypcholesterolemia may aid in the diagnosis of snake envenomation in dogs presenting with vague clinical signs. Future studies are needed to evaluate whether changes in sChol throughout hospitalization correlate with clinical improvement or outcome.

**INTRASOSSEOUS CATHETERIZATION FLOW RATES AND EASE OF PLACEMENT AT VARIOUS SITES IN CANINE CADEAVERS**

**Introduction:** There are numerous anatomical sites that may facilitate placement of an intraosseous catheter. Traditionally, the tibia has been the site of choice for intraosseous catheter placement.
in veterinary medicine. However, in human studies other sites such as the humerus have shown equivalent flow rates and ease of placement, which may be an important consideration in the resuscitation of hypovolemic patients.

**Objective:** To compare intraosseous catheter placement difficulty, success rates, and flow rates at four different anatomical locations in canine cadavers.

**Method:** Animal Care Committee approval and owner consent was obtained for this prospective study. Dogs presenting for euthanasia were recruited. Heparin (1,000 IU/kg intravenously) was administered at least 5 minutes prior to euthanasia. After euthanasia, EZIO intraosseous catheters were placed into the ilial wing, proximal medial tibia, proximal lateral humerus, and distal lateral femur on one side of the animal. Sterile saline was infused into each location simultaneously over 5 minutes, first via gravity followed by 300 mm Hg of pressure. The procedure was repeated on the contralateral side of the animal. A Kruskal–Wallis one-way analysis of variance was performed to evaluate any differences between anatomical sites ($P < 0.05$ considered statistically significant).

**Results:** Placement was successful in 6/12 ilial wings, 10/12 tibial, and 12/12 femoral and humeral attempts. Gravity infusion rates in the tibia (0.267 mL/kg/min ± 0.293) were statistically lower than the humerus (1.316 mL/kg/h ± 1.049) and femur (1.018 mL/kg/min ± 0.520). Pressurized infusion rates in the tibia (0.6068 mL/kg/min ± 0.4836) were statistically lower than the humerus (3.219 mL/kg/min ± 2.588) and the femur (2.360 mL/kg/min ± 0.837). No other statistically significant differences were noted for flow rates between sites.

**Conclusion:** Pressurized intraosseous flow rates were higher in the humerus and femur compared to the tibia. Additionally, both humerus and femur had the highest successful placement compared to the tibia and ileum. This suggests that the humerus and femur may be preferred sites for intraosseous catheter placement in dogs if rapid infusion rates are desired.

**XENOTRANSFUSION OF CANINE BLOOD TO CATS: A REVIEW OF 37 CASES AND THEIR OUTCOME**

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**Introduction:** Xenotransfusion of canine blood to cats is a recognized veterinary technique, but literature describing long-term outcome is lacking.

The objectives of this study were threefold. First, to review and describe the clinical situations where xenotransfusion was performed. Second, to describe the outcome of the recipient cats. Third, to assess recipient owners’ retention of information regarding xenotransfusion.

**Methods:** Cats administered xenotransfusions in 2 referral hospitals between January 2016 and December 2017, were recruited. Reason for transfusion, blood type, PCV, cross-match results, transfusion volume, transfusion reactions, PCV 12-hours post-transfusion, and survival to discharge were all recorded. Owners of the cats who survived to discharge were questioned about the implications of the xenotransfusion. Mean and standard deviation were calculated for normally distributed data and median and interquartile range were calculated for nonparametric data.

**Results:** Thirty-seven cats were enrolled. The most common reasons for transfusion were surgical complications (15/37), IMHA (10/37), and neoplasia (9/37). Twenty-one cats were blood type A, 13 were B, and 1 was AB. Two cats were not blood typed. Median PCV prior to transfusion was 11% (IQR = 5). Major and minor cross-matches were incompatible in 16/22 cases (72%) and 9/22 cases, respectively. Median volume transfused was 14.2 mL/kg (IQR = 8.7). Four cats had a febrile nonhemolytic transfusion reaction. Mean PCV 12 hours posttransfusion was 24% (±9). Hemolytic serum was noted in 11 cats after a median of 70.1 hours (IQR = 33) and icterus or icteric serum in 9 cats after a median of 63.0 hours (IQR = 69).

Survival to discharge was 46% (17/37). Eight of these cats received a feline blood transfusion after a median of 4 days (IQR = 2.25) postxenotransfusion, including 7 cats who had evidence of either hemolysis or icterus. Eleven cats were alive in January 2018 at a mean of 261 days (± 186) postxenotransfusion. All owners remembered their cats had received a xenotransfusion and 8/11 remembered their cat could not receive a repeat xenotransfusion.

**Conclusion:** Xenotransfusion of canine blood to cats is possible but hemolysis should be expected between 1 and 4 days posttransfusion. Repeat transfusion with feline blood is often required.

**POSTOPERATIVE CARDIAC MONITORING AND INTENSIVE CARE TREATMENT AFTER PRECLINICAL XENOGENEIC HEART TRANSPLANTATION**

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**Introduction:** Postoperative management is essential for the outcome of life-supporting pig-to-baboon cardiac transplantations, a preclinical model for future xenotransplantation in people. Information about the use of baboons in complex experiments is scarce and claims specific management in the cardiac post-transplant condition. Such a management reaches beyond the usual treatment of laboratory animals, but a one-to-one transfer of medical treatment of human patients is not possible neither.

**Materials:** Ten pig-to-baboon orthotopic heart transplantations were performed with the use of cardiopulmonary bypass. Two days prior to transplantation animals received a multilumen central venous catheter for continuous intravenous treatment and daily laboratory measurement of organ function. During transplantation a telemetric device was implanted to continuously transmit an epicardial electrocardiogram and systemic blood pressure. Echocardiography served as an important tool for the comprehensive evaluation of graft function.

**Results:** All baboons were male *Papio anubis*. Median (range) age and body weight were 4 years (4–12) and 16.5 kg (10.5–21), respectively. A continuous telemetric monitoring was possible in all animals. Four animals could not be weaned from respirator due to perioperative xenograft dysfunction. Arrhythmias were observed in...
4/6 animals. Ventricular extrasystoles were treated by administration of amiodarone and magnesium. Electrolytes were closely monitored and substituted during the two first postoperative weeks. Three animals needed blood transfusions during the postoperative period. A reduced serum albumin concentration was observed in two animals. In these, human albumin transfusions were performed. Echocardiographic evaluations were performed on a regular basis at least twice a week. There were no adverse events in combination with sedation and blood pressure was stable during all procedures. In three cases, catecholamine support was necessary during echocardiographic evaluation, which revealed diastolic failure 26, 29, 39 days, respectively, after xenotransplantation.

Conclusions: After preclinical cardiac xenotransplantation, intensive intra- and postoperative monitoring and care is essential for the outcome of these experiments. In our experiments, a postoperative intensive care treatment could be established, that leads to consistent long-term survival after orthotopic heart transplantation.

**DEMONSTRATION OF ACUTE COAGULOPATHY OF TRAUMA (ATC) IN CATS FOLLOWING TRAUMA USING ROTATIONAL THROMBOELASTOMETRY (ROTEM)**

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**Introduction:** Acute traumatic coagulopathy (ATC) has a prevalence of up to 34% in people and is associated with mortality. A single study reported ATC in 1/19 (5%) cats.

**Objective:** To determine the prevalence of ATC in acutely traumatized cats.

**Methods:** Cats presenting with acute (< 13 hours) trauma between March 2016 and December 2017 were prospectively enrolled. Rotational thromboelastometry (EXTEM-S, INTEM-S, FIBTEM-S, APTEM-S, lactate, and animal trauma triage (ATT) score were determined at presentation. ATC was defined as > 2 or more hypocoagulable ROTEM parameters: prolonged EXTEM or INTEM clotting time (CT) or clot formation time (CFT) and decreased EXTEM-S, INTEM-S, or FIBTEM-S maximum clot firmness (MCF) and increased EXTEM-S or INTEM-S maximum lysis (ML).

**Results:** Thirty-one cats were analyzed. Median time between trauma and presentation was 180 minutes (range, 60–780 minutes). In two cats, the actual trauma time was not known but estimated to be < 12 hours based on clinical signs. Median ATT score was 5 (range, 1–11) and median lactate concentration was 2.13 (range, 0.81–12.34) mmol/L. ATC was demonstrated in 6/31 (19%) of cats. One of the cats with ATC showed hyperfibrinolysis. Five of 6 cats with CT showed EXTEM-S, INTEM-S, and APTEM-S CT prolongation. The presence of ATC was not associated with the ATT score ($P = 0.190$) or lactate ($P = 0.478$). Less cats (40% vs 85%) with ATC were discharged from the hospital; however, this was not statistically significant ($P = 0.161$).

**Discussion:** Our study identified ATC in 19% of cats with acute trauma. The higher prevalence of ATC found in our cats may be associated with earlier evaluation after trauma. Association with survival, trauma severity, and hypoperfusion requires future and larger studies.

**Conclusions:** ATC seems to be more prevalent in traumatized cats than previously thought and should be considered in cats with acute trauma.

**TETANUS SEASONALITY IN DOGS**

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**Introduction:** Canine tetanus is a rare neuromuscular disorder caused by neurotoxins produced by *Clostridium tetani*. Diagnosis of the disease is based on the patient’s characteristic clinical signs. A small number of studies investigating tetanus in human patients noted a seasonal variability in its incidence. This has been postulated to be due to variation in weather. Seasonality of canine tetanus has not been investigated.

**Objective:** To evaluate the seasonality in diagnosis of canine tetanus in the United Kingdom (UK) and the United States of America (USA).

**Methods:** The medical records of three referral hospitals (one in the UK, one on the Northeast Coast of the USA, and one on the West Coast of the USA) were reviewed. Dogs diagnosed with tetanus by a diplomate in either Emergency and Critical Care, Neurology, or Internal Medicine between January 2006 and June 2017 were included in the study. Both localized and generalized tetanus cases were included. A Kruskal–Wallis test was used to assess for significant difference in distribution of tetanus cases between months, as well as between the 4 seasons of the year, with $P$-value of $< 0.05$ considered significant.

**Results:** Eight cases from the Northeast Coast referral hospital, 24 cases from the West Coast referral hospital, and 49 cases from the UK referral hospital were included. Localized tetanus was documented on presentation in 12% (1/8), 8.3% (2/24), and 24.5% (12/49) of dogs admitted to the veterinary hospitals, respectively. No seasonality was noted in either of the USA referral hospitals. Monthly seasonality in diagnosis of tetanus was confirmed in the United Kingdom referral hospital ($P$ value = 0.048) with the highest number of cases recorded in February. Incidence of tetanus was significantly higher in winter months when compared with summer ($P$ value = 0.002) and autumn ($P$ value = 0.024).

**Conclusions:** The incidence of canine tetanus in the United Kingdom referral hospital showed seasonal variation with higher number of cases noted in winter months, especially in February. This was not seen in the USA referral hospitals, but may have been due to a type II statistical error, or due to differences in weather patterns.

**ESTABLISHMENT OF THE REFERENCE INTERVALS OF CAUDAL VENA CAVA:AORTA RATIO MEASURED BY THE SAV PROTOCOL: PRELIMINARY RESULTS FROM 20 NONSEDATED HEALTHY DOGS**

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© Veterinary Emergency and Critical Care Society 2018, doi: 10.1111/vec.12758
**Introduction:** The sonographic measurement of the caudal vena cava:aorta (CVC:Ao) ratio has been previously suggested as a useful tool in emergency and critical care settings for non-invasive bedside and serial assessment of intravascular volume status in dogs. However, no reference intervals (RI) have been established in dogs.

**Objectives:** (1) To determine the RI of CVC:Ao ratio in nonseparated healthy dogs using the sonographic assessment of volemia (SAV) protocol, (2) to evaluate intra- and interoperator variability of Ao, CVC, and CVC:Ao ratio measurements, and (3) to determine if the sonographic Ao, CVC, and CVC:Ao ratio measurements were correlated with systolic blood pressure (SBP) and heart rate (HR).

**Method:** A prospective study was conducted in nonseparated healthy dogs. Each dog was positioned in the right lateral recumbency. SBP was measured three times consecutively using a Doppler system. The left kidney was identified on the spleno-renal view of the abdominal FAST technique, using a 5- to 8-MHz ultrasound convex transducer. CVC, Ao, and CVC:Ao ratio measurements were performed twice by two different operators on a transverse view of the CVC and Ao. RI were defined from the 2.5–97.5% percentiles. Intra- and interoperator variability was assessed by the Bland–Altman method. Simple linear correlations based on Spearman coefficient determination were performed between the sonographic measurements, SBP, and HR.

**Results:** Twenty healthy dogs were included. Mean age was 2.6 (± 1.8) years, and mean bodyweight 20.9 (± 6.1) kg. RI were defined as: 0.71–1.20 cm for Ao, 0.73–1.29 cm for CVC, and 0.97–1.26 for CVC:Ao ratio. Intra- and interoperator variability was within the limit of agreement for the vast majority of measurements. No significant correlation was found between any sonographic measurement and SBP or HR.

**Conclusion:** The low intra- and interoperator variabilities in the sonographic Ao, CVC, and CVC:Ao measurements confirm their reliability and operator independency using the SAV protocol. A CVC:Ao ratio < 0.97 may suggest an hypovolemic state whereas a CVC:Ao ratio > 1.26 may suggest an hypervolemic state in dogs. This result has to be confirmed in hypo- or hypervolemic dogs.

**THE EFFECT OF IMPLEMENTATION OF STANDARDIZED MEDICATION ORDER WRITING ON DOSING ERRORS IN A REFERRAL HOSPITAL**

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**Introduction:** A problem of misinterpretation of written orders was identified. Errors included administration of whole tablets when fractions of tablets were ordered, and confusion arising from use of total milligram of drug versus milligrams per kilogram bodyweight. Varying formats were used by clinicians and this was hypothesized to contribute to errors. Examples of orders commonly misinterpreted included “aspirin ½ tablet once daily” and “methadone 0.1 mg/kg intravenously every 4 hours.”

**Objective:** To reduce errors associated with misinterpretation of written orders.

**Methods:** A standardized format for written orders was introduced as follows: “drug name, total mg dose, route of administration, frequency.” IDInc was used to record medication errors. This was searched to identify total errors reported in the year before and after the policy change as well as total medication errors and medication errors resulting from misinterpretation of clinician orders. Chi-square was used to compare categorical variables before and after implementation.

**Results:** There were 16 total reports per 1,000 patient visits in 2016 compared with 24 per 1,000 patient visits in 2017 reflecting an increase in overall reporting. During this period caseload increased from 32,984 in 2016 to 36,621 in 2017. There were 113 and 205 medication errors in 2016 and 2017, respectively. In 2016, 32 of 113 errors resulted in an error in the dose administered to the patient of which 13 (40%) resulted in harm to the patient. In 2017, 58 of 205 errors resulted in an error in dosage of which 19 (18%) resulted in patient harm; this was not significantly different to 2016 (*P* = 0.45). In 2016, 10 of 32 dosing errors were attributable to misinterpretation of a written order; in 2017 this fell to 6 of 58 (*P* = 0.013). In 4 of these 6 cases, the protocol was not followed. In only two instances where the protocol was followed did a misinterpretation of the order occur.

**Conclusion:** Implementation of standardized order writing resulted in significant reduction in dosing errors related to misinterpretation. Two-thirds of the errors resulting from misinterpretation of orders seen postprotocol were associated with failure to follow standardized format. Vigilance in addressing compliance may result in further improvement.

**ELEVEN AUTOLOGOUS BLOOD TRANSFUSIONS IN SEVEN CATS WITH INTRACAVITARY HAEMORRHAGE**

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**Introduction:** The objectives of this study were to describe the clinical use and outcome of autologous transfusion in cats.

**Methods:** A retrospective descriptive study was performed. Medical records of a single referral centre were searched for cats receiving autotransfusion as part of their case management. Underlying disease process or injury, autotransfusion technique, transfusion volume, time period over which the transfusion was given, PCV pre- and posttransfusion, percentage rise in PCV, use of other blood products, and any complications of the procedure were recorded. Survival to discharge and any follow-up information was also documented.

**Results:** Between July 2012 and July 2017, a total of 11 autotransfusions were performed in 7 cats. The median weight of the cats undergoing autotransfusion was 3.83 kg (range 1.38–5.5 kg). All patients were diagnosed with haemoperitoneum. Four cats were diagnosed with abdominal neoplasia, 2 had postoperative haemorrhage, and 1 had a traumatic haemoperitoneum. During hospitalization, 2/7 cats received multiple autotransfusions; 1 cat received 2 autotransfusions for preoperative stabilization and 1 cat received 3 autotransfusions; both intra- and postoperatively. One cat received a repeat autotransfusion at a later hospital admission date. Blood was collected using a 23 Ga butterfly catheter and 20 mL syringe in 7/11 collections, a 23 Ga needle, three-way tap, and 20 mL syringe in 2/11 collections, and directly into syringes from the open abdomen at the time of surgery in 2/11 collections. A median volume of 55 mL (range 25–80 mL) was collected and administered, equivalent to a median dose of 17 mL/kg (range 9–26 mL/kg). Blood was given over a median of 3.5 hours (0.25–6 hours). Four cats were given another blood product alongside the autotransfusion. The median percentage PCV increase postautotransfusion was 5% (range 1–7%). Anticoagulant was used in 5/11 autotransfusions. No clinically
relevant adverse effects were reported. Five of 7 patients survived to discharge. Cause of death in those patients was euthanasia due to the underlying condition and continued haemorrhage.

**Conclusion:** Autologous transfusion appears to be a safe and effective technique for stabilizing cats with haemoperitoneum. This technique allows rapid and cheap provision of blood and avoids the need for an allogenic blood donor.

**PLASMA CHOLESTEROL AND TRIGLYCERIDES MONITORING DURING INTRAVENOUS LIPID THERAPY IN PATIENTS INTOXICATED WITH NSAIDS**

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**Introduction:** Intravenous Lipid Therapy (IVLT) is the administration of a high-rate infusion of an Intravenous Lipid Emulsion (ILE) over a short period of time to ameliorate clinical syndromes caused by lypopholic overdose or toxins.

**Background:** Potential adverse effects of IVLT include microvascular fat embolization and pancreatitis.

**Objective:** The objective of this study was to monitor plasmatic levels of cholesterol (Ch) and triglycerides (Tg) after IVLT. We hypothesized that values pre- and after IVLT would not be different.

**Methods:** Patients were diagnosed of NSAID intoxication based on history and clinical/laboratory signs. In addition to decontamination and supportive measures, a 20% ILE (Lipofundina) was administered (initial bolus 1.5 mL/kg over 15 minutes followed by CRI 0.25 mL/kg/min for 1 hour). Plasma Ch and Tg were measured prior to IVLT (D0), 1 hour (D1), and 3 hours (D2) post-therapy. Given a nonparametric distribution of data, a Friedmann test was used to analyze results (significance set at $P < 0.05$).

**Results:** Two cats (1 M, 1 F, European shorthair) and 6 dogs (5 M, 2 F, various breeds) intoxicated with meloxicam ($n = 3$), ibuprofen ($n = 2$), carprofen ($n = 2$), and diclofenac ($n = 1$) were enrolled. Ch values were not significantly different ($P = 0.607$) (values are expressed as median and [interquartile range]): ChD0 (192.50 [167.5] mg/dL), ChD1 (227 [154] mg/dL), ChD2 (234 [147.5] mg/dL); significant differences were observed for Tg between D0 (103 [97] mg/dL) and D1 (427 [1293] mg/dL) ($P = 0.008$), but not between D0 and D2 (176 [182.5] mg/dL). At D2, 75% ($n = 6$) of patients had Tg values $< 2\times$ the upper limit of reference range.

**Discussion:** These results indicate that in patients receiving IVLT, measuring plasma Tg levels at 3 hours may be useful when evaluating potential risks of giving a second dose of ILE (for example, in animals intoxicated with substances with enterohepatic circulation). Ch levels monitoring is not useful since they do not change significantly during treatment. These preliminary results should be confirmed in a larger patients’ sample.

**Conclusions:** In patients intoxicated with substances with enterohepatic circulation, determination of plasma triglycerides 3 hours after starting IVLT may be helpful in deciding if it is safe to administer a second dose of ILE.

**RETROSPECTIVE STUDY OF USE OF CANINE PLASMA PRODUCTS IN 170 PATIENTS**

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**Introduction:** The use of plasma transfusions continues to grow in veterinary medicine, but plasma transfusion reactions (TR) are poorly characterized in compared to reactions secondary to administration of packed red blood cells.

**Objectives:** To describe the population receiving plasma products (PP) in a 2-year period, report the incidence of TR and to identify whether this is higher when nontype-matched plasma is administered.

**Methods:** A search of computerized records was performed, identifying any patients that received PP between 2016 and 2018; these products included frozen plasma (FP), fresh frozen plasma (FFP), and cryoprecipitate (Cryo). Patients were excluded if records were incomplete or if the blood type of the plasma was not recorded.

**Results:** A total of 195 cases were reviewed, of which 170 were included in the study. A total of 413 PP transfusions were analyzed, of which 351 were given to blood typed patients. A total of 17 TR (4.1%) were noted. Six TR were identified following FFP transfusion (8.1%), 10 after administration of FP (3.8%), and none following administration of Cryo. All TR were mild and only one required discontinuation of the transfusion.

Of the TR identified after PP administration, a greater proportion were in type-matched transfusions than nontype-matched, although this difference was not statistically significant. Sixty-one patients received 1 unit of PP and 109 received 2 or more units. Three TR occurred in patients that received 1 unit (18%) and 14 in patients that received 2 or more units (82%), $P = 0.1161$. A total of 7 (41%) TR occurred in patients that also received pRBC transfusions, $P = 0.07$.

**Discussion:** Overall, the incidence of TR is low, and invariably mild in nature. There appears to be no evidence that administering blood-type-matched PP affects the rate of TR. There is a trend that shows the more PP patients receive, the more likely they are to have a TR.

**Conclusion:** Administration of canine PP is a safe procedure that carries a low risk of transfusion reactions. Type-matching PP appears unnecessary. There is evidence of a strong trend indicating an increasing risk of TR with increasing number of PP administered.

**NEUTROPHIL TO LYMPHOCYTE RATIO IN CANINE SYSTEMIC INFLAMMATORY RESPONSE SYNDROME**

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**Introduction:** The neutrophil to lymphocyte ratio (NLR) has been proposed as a readily accessible and independent predictor parameter of poor survival in human patients with tumors, cardiovascular diseases, and critically illness. As far as we know NLR has been evaluated only in oncological veterinary patients.

**Objective:** To evaluate NLR in dogs with systemic inflammatory response syndrome (SIRS) and its association with the severity of illness, outcome, and sepsis. BLR (band neutrophil-to-lymphocyte ratio) and BLNR (band-to-neutrophil-to-lymphocyte ratio) were evaluated as well.

**Methods:** Data were retrospectively collected and enrolled animals subsequently divided in 3 groups: 90 with SIRS, 50 healthy, and 50 with chronic diseases as control groups. A SIRS grading was
obtained based on how many criteria were fulfilled. The \text{APPLE}_{fast} score was applied to the SIRS group. The survival rate was assessed at day 7 and 15 after their admission. Dogs with cytology or positive culture for active bacterial infections were recorded as septic. Mann–Whitney U-test, Kruskal–Wallis test, and Dunn’s multiple comparison test were used to compare groups using statistical software.

**Results:** In the SIRS group, 39 dogs (43%) died during the study period. \text{APPLE}_{fast} score > 25 (P = 0.03) and SIRS grading > 2 (P = 0.001) were associated with poor outcome. NLR was higher in the SIRS group compared to the control groups (P < 0.0001 and P < 0.0001, respectively) and not associated with outcome. NLR was not statistically different between SIRS grading groups or \text{APPLE}_{fast} score groups. NLR was lower in septic dogs than in nonseptic group (P = 0.016). Dogs with SIRS grading > 2 showed a higher BLR than dogs with SIRS grading = 2 (P = 0.04). Any association of BLR and BLNR with outcome, sepsis and \text{APPLE}_{fast} groups was found.

**Conclusions:** Our results demonstrate the utility of NLR evaluation in dogs with SIRS (higher) and in septic dogs (lower). Further prospective, large-scale studies investigating the role of BLR and BLNR in canine SIRS are warranted.

**NORMAL VALUES FOR ROTATIONAL VISCOELASTOMETRY EVALUATED VIA ROTEM IN THE PIG (SUS SCROFA) AND EFFECTS OF PREANALYTICAL SAMPLE AGITATION ON ROTEM RESULTS**

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**Introduction:** Pigs are commonly used in translational research and accurate assessment of coagulation is essential. We sought to establish porcine ROTEM normal values for pigs following the American Society for Veterinary Clinical Pathology reference interval guidelines.

**Methods:** Sixty-five healthy Yorkshire cross pigs (39 males and 26 females) were anesthetized with an intramuscular injection of tiletamine and zolazepam. Using a 18 Ga needle attached to a Vacutainer, blood was acquired from the cranial vena cava. Tubes were filled in the following order: evacuation clot tube, EDTA tube, heparin tube, and 2 citrate tubes. The citrate tubes were randomly assigned to 30 minutes with or without constant agitation on a rocker. The following Intem and Extrem parameters were reported according to manufacturer’s recommendations: CT, CFT, alpha, A10, A20, MCF, ML, LI30, and LI45. Reference intervals were reported as 2.5th and 97.5th percentile of the population’s results. The effects of sex, sampling order, and agitation on ROTEM results were analyzed via linear regression.

**Results:** Sex, sampling order, or agitation did not influence any of the ROTEM parameters. Pooled reference intervals were established for each Rotem parameter combining data from male and female animals from the nonagitated tubes.

**Conclusion:** This is the first study establishing ROTEM reference intervals in a large number of both male and female adult pigs, while also providing detailed preanalytical sample processing. Our results provide valuable information for researchers utilizing porcine models.

**ESTABLISHMENT OF A REFERENCE INTERVAL FOR A NOVEL VISCOELASTIC COAGULOMETER AND COMPARISON TO THROMBOELASTOGRAPHY IN HEALTHY CATS**

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**Introduction:** Viscoelastic tests are uncommonly available to provide information about overall hemostasis. A novel viscoelastic point-of-care device [Portable Coagulation Monitor (PCM)] is intended to have a larger veterinary audience since it is more cost-effective, simple to use, and portable than thromboelastography (TEG) and rotational thromboelastometry (ROTEM). This is the first study that evaluates PCM in a population of healthy cats.

**Background:** The clinical application of viscoelastic testing is limited by their high cost, technical knowledge and skills required, and access.

**Objective:** The aims of this study are to establish PCM reference interval in a population of healthy cats and to evaluate data correlation with TEG.

**Methods:** Healthy, university-owned, group-housed domestic shorthaired cats (n = 59) were assessed in this study. Blood from direct venipuncture was immediately analyzed on the PCM. Anticoagulated blood [sodium citrate (for TEG) and EDTA (for CBC)] was analyzed within 2 hours. Statistical analysis was completed using commercially available software (Stata v13 and Microsoft Excel Reference Value Advisor v2.1).

**Results:** Blood was obtained from 59 cats [35 female, 24 male; median = 1 year (range 0.5–13)]. All CBC parameters were within normal reference intervals. The measured reference intervals [range(median) for non-normal or mean(standard deviation) for normal distributions] for each PCM measurement are: Clot Time (CT, seconds), 104–430 (296); Clot Formation Time (CFT, seconds), 117–477 (172); Alpha Angle (AA, degrees), 35–67 (54); Maximum Clot Firmness (MCF, PCM units), 31.9 (5.1); and Lysis Index 30 (lysis 30 minutes after CT) (LI30, %), 96.5 (2.0). TEG measurements were [respectively, range(median)]; Reaction Time (R, minutes), 1.0–11.0 (2.1); Kinetics (K, minutes), 0.8–9.6 (2.4); Alpha Angle (AA, degrees), 3.6–78.9 (73.5); Maximum Amplitude (MA, millimeters), 2.5–69.4 (58.6); Lysis 30 (LY30, %), 0–74.3 (11.4).

**Discussion:** Data in 59 healthy cats suggests that the PCM measurements are not directly comparable to TEG measurements. These two devices assess viscoelastic properties of blood differently and data appear to be not directly comparable. However, PCM analysis may still be used to evaluate hemostasis in healthy cats. Further studies are required to ensure application of PCM in the clinical setting.

**Conclusions:** A novel viscoelastic coagulometer can be used for analysis in healthy cats but does not correlate to thromboelastography.

**TISSUE PLASMINOGEN ACTIVATOR-MODIFIED THROMBOELASTOGRAPHY DIAGNOSED SIGNIFICANT HYPERFIBRINOLYSIS IN A GROUP OF CANINE CANCER PATIENTS**

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**Introduction:** Hyperfibrinolysis is a possible cause of bleeding in canine cancer patients; however, its diagnosis and therapy remains challenging. As standard thromboelastography may be too robust to detect canine hyperfibrinolysis, this study evaluated tissue plasminogen activator-modified thromboelastography (tPA-TEG) for detection of hyperfibrinolysis and aimed to establish the concentration of the antifibrinolytic agent tranexamic acid (TXA) needed for normalizing the fibrinolytic potential in vitro.

**Methods:** Canine patients with sarcomas and a normocoagulable thromboelastography were included along with a healthy control group. For each dog a whole blood tPA-TEG, and four tPA-TEGs with added TXA (20, 40, 60, and 80 μg/mL) were performed. Lysis parameters LY30/60 (lysis at 30/60 minutes following maximal amplitude (MA)), CL30/60 (clot lysis index at 30/60 minutes following MA), maximum rate of lysis (MRL), and total lysis (L) were investigated. The in vitro TXA concentration needed to inhibit 90% of the fibrinolytic potential (IC90) was calculated.

**Results:** Nine patients with cancer (5 hemangiosarcomas, 3 soft-tissue-sarcomas, 1 osteosarcoma), of which 5 had clinical bleeding, and 11 healthy dogs were included. Significant hyperfibrinolysis (LY30 (P = 0.0001), LY60 (P = 0.003), CL30 (P = 0.01), and L (P = 0.02)) was detected in sarcoma patients. The TXA IC90 for normalizing of LY30 and LY60 was 8.61 μg/mL and 37.99 μg/mL for healthy dogs and 30.98 μg/mL and 59.65 μg/mL for patients with sarcomas.

**Conclusion:** Significant hyperfibrinolysis was detected by tPA-TEG in a group of canine patients with sarcomas. The in vitro concentration of TXA necessary for normalizing LY30/60 was markedly increased in this group compared to healthy dogs.

**SERIAL EVALUATION OF HAEMOSTASIS BY ROTATIONAL THROMBOELASTOMETRY (ROTEM) IN DOGS WITH ACUTE TRAUMA**

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**Introduction:** Acute traumatic coagulopathy (ATC) has been described in up to 34% of human trauma patients and hyperfibrinolysis is common. ATC has been identified in only a few dogs and the prevalence in dogs may be time-dependent.

**Objective:** To prospectively describe changes in ROTEM parameters over time and determine prevalence of ATC and hyperfibrinolysis in dogs with acute trauma.

**Methods:** Dogs presenting with acute (< 4 hours) trauma were included. EXTEM-S, INTEM-S, FIBTEM-S, and APTEM-S parameters, thrombocyte count, animal trauma triage (ATT) score, and lactate were evaluated within 4 hours after trauma and 6 and 24 hours after presentation. ROTEM tracings were defined as hypercoagulable if ≥ 2 of the following parameters were above or below in-house reference intervals: clotting time, clot formation time, maximum clot firmness, maximum lysis, or maximum clot elasticity. ATC was defined as ≥ 2 hypercoagulable ROTEM tracings.

**Results:** Twenty-six dogs were included at presentation, 12 and 15 of these were analyzed at 6 and 24 hours, respectively. At presentation, 6/26 dogs (23%) presented with ATC, 1 dog (4%) was hypercoagulable, 11/19 dogs (58%) were thrombocytopenic, and 4/25 dogs showed hyperfibrinolysis (16%). At 6 hours, 1/12 (8%) dogs showed ATC. At 24 hours, none of the dogs showed ATC, 6/15 (40%) were hypercoagulable, 5/10 (50%) were thrombocytopenic, and 1/15 showed hyperfibrinolysis. In this preliminary data set, ATC was not associated with trauma severity, hyperlactatemia, or survival.

**Discussion:** This study found a higher prevalence of ATC in dogs with trauma than previously reported. As described in people, a hypercoagulable phase with hyperfibrinolysis shortly after trauma is followed by a hypercoagulable phase after stabilization. Association with trauma severity and shock remains to be investigated with larger studies.

**Conclusion:** Changes in coagulation parameters after trauma in dogs change over time. Early after trauma, ATC including hyperfibrinolysis is present while hypercoagulability predominates 24 hours after trauma.

**QUALITY CONTROL ANALYSIS DURING STORAGE OF CANINE PACKED RED BLOOD CELLS (PRBC) UNITS**

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**Introduction:** Packed cell volume, bacterial contamination and hemolysis during storage are important PRBC quality parameters. A single report addressed this subject before, however the significantly lower number of units tested was an important limitation.

**Objectives:** This study aims to evaluate a quality control program of stored canine pRBCs with SAG-MAN and the need for quality control analysis before administration of units with more than 4 weeks, according the criteria established by Council of Europe guidelines for human blood banking.

**Methods:** According to the quality control protocol of a private blood bank, 20% of the units produced (total of 1,114) were randomly evaluated until 6 hours after processing (t = 0). Bacterial culture was determined, using aerobic culture bottles with specific growth medium, along with hematocrit and hemolysis percentage. In order to ensure the quality of stored units not yet used during the first 4 weeks, after 28–35 days of storage (t = 1) and after 36–42 days (t = 2), a total of 1,244 and 697 pRBC units were, respectively, tested.

**Results:** Two blood cultures tested positive to bacterial growth and a contaminant *Staphylococcus* sp. was isolated. Mean hematocrit at t = 0 was 60.12%, 58.32% at t = 1, and 58.55% at t = 2. Mean hemolysis at t = 0 was 0.1%, at t = 1 was 0.55%, and it increased up to 0.65% at t = 2. In addition, 7.15% and 3.87% of pRBC units exceeded 0.8% hemolysis at t = 1 and t = 2, respectively.

**Discussion/Conclusion:** According to the Council of Europe’s guidelines for human blood banking, it is recommended that a maximum of 0.8% hemolysis be present in stored blood units. The low number of positive cultures validates the sterility of the canine’s collection and pRBC production, confirming the safety of its use in transfusional medicine. The low values of hemolysis and the hematocrit found after processing, also validate the processing protocols used to produce this canine component. The pRBCs units stored for more than 28 days should be tested for hemolysis before its use, since 3.87% units exceeded the 0.8% limit of hemolysis.
UTILIZATION OF THE VETMOUSE TRAP FOR WHOLE BODY COMPUTED TOMOGRAPHY IN POLYTRAUMA PATIENTS

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Introduction: Trauma is a common presenting complaint to the emergency room (ER) and rapid assessment of injuries is necessary. Imaging of trauma patients is important to guide interventions, but should not delay resuscitative efforts. Use of whole body computed tomography (WBCT) has become common practice within human emergency departments, but less common within veterinary medicine. This is likely due to cost, accessibility, and concern for general anesthesia in critical patients. VetMouse Trap was developed to allow CTs to be performed in veterinary patients with minimal sedation and manipulation. This advantage may circumvent concerns in polytrauma patients where excessive sedation or anesthesia is ill-advised, while allowing advanced imaging to be performed with reduced stress to the patient.

Objective: Determine the safety, feasibility, and utility of the VetMouse Trap for WBCT in polytrauma patients.

Methods: A prospective, observational study in a high volume private practice. Any cat or dog weighing < 20 kg that presented to the ER following a polytrauma was eligible. Patients were given analgesia and sedation per a proposed protocol prior to placement in the VetMouse Trap. A WBCT was then performed.

Results: A total of 16 patients met inclusion criteria, with 8 dogs and 8 cats. All patients presented with blunt trauma; 3 also had evidence of penetrating wounds. Five (31.25%) patients met inclusion criteria for WBCT based on their neurological evaluation. Five (31.5%) were nonambulatory with suspicion of orthopedic injury, and 37.5% met additional criteria for WBCT. The most common areas of injury in this patient population were head (43.7%), lungs (25%), and pelvis (25%). Four patients (25%) had evidence of cavitary effusion that was not seen on FAST scan. No patient had any adverse events during the CT. The Animal Medical Center, New York, NY

Conclusion: This study demonstrated successful WBCT imaging of the sedated small animal polytrauma patient with the VetMouse Trap.

CONCENTRATIONS OF PLASMA NUCLEOSOMES ARE PROGNOSTIC IN DOGS FOLLOWING TRAUMA

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Introduction: Trauma is common in dogs and causes significant morbidity and mortality, but it remains a challenge to predict the prognosis of dogs with traumatic injuries.

Objective(s): To investigate plasma cell-free DNA (cfDNA) and nucleosome concentrations as prognostic biomarkers in canine trauma.

Methods: Forty-nine dogs with trauma were consecutively enrolled and followed to hospital discharge. Dogs were eligible for enrollment if they had an animal trauma triage (ATT) score ≥ 3 at presentation. Dogs < 3 kg and those with pre-existing coagulopathies were excluded. Thirty-three healthy control dogs were also enrolled. Illness and injury severity scores were calculated. Plasma cfDNA was measured in triplicate using a benchtop fluorometer. Plasma nucleosome concentrations were determined in duplicate by ELISA. Mann–Whitney U tests were used to compare biomarker concentrations between groups and between survivors and nonsurvivors. Associations between biomarkers were evaluated using Spearman’s correlation coefficients. Alpha was set at 0.05.

Results: Concentrations of cfDNA and nucleosomes were significantly higher in injured dogs compared to controls (P ≤ 0.0001). Nucleosomes and cfDNA concentrations were positively correlated (r = 0.475, P < 0.001). Concentrations of both cfDNA and nucleosomes were correlated with shock index (r = 0.367, P = 0.010 and r = 0.358, P = 0.012, respectively), but only nucleosomes were correlated with ATT (r = 0.327, P = 0.022) and APPLE scores (r = 0.356, P = 0.012). Median nucleosome, but not cfDNA concentrations, were significantly higher in nonsurvivors 8.2 (3.1–26.4) than in survivors 1.6 (0.5–5.2) (P = 0.01). Among illness severity scores, APPLE was most discriminant for survival (AUROC 0.912, P < 0.001).

Conclusion: In moderately severely injured dogs, high nucleosome concentrations are associated with nonsurvival.

CONCENTRATIONS OF HIGH MOBILITY GROUP BOX-1 AND PROINFLAMMATORY CYTOKINES ARE INCREASED IN DOGS FOLLOWING TRAUMA

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Introduction: The pathophysiology of the response to trauma is complex, and the state of the innate immune system following injury is poorly understood in dogs.

Objective(s): To quantify plasma cytokine concentrations in dogs after moderate-to-severe trauma, and to evaluate them as potential prognostic markers.
Methods: Forty-nine dogs with an animal trauma triage (ATT) score ≥ 3 at presentation were consecutively enrolled and followed to hospital discharge. Dogs < 3 kg and those with pre-existing coagulopathies were excluded. Thirty-three healthy control dogs were also enrolled. Illness and injury severity scores were calculated. Plasma high-mobility group box-1 (HMGB-1) concentrations were measured by ELISA, and concentrations of cytokines were measured using multiplex magnetic bead assays and with a canine-specific ELISA. All biomarkers were measured in duplicate. Mann–Whitney U tests were used to compare biomarker concentrations between groups and between survivors and nonsurvivors. Associations between biomarkers were evaluated using Spearman’s correlation coefficients. Independent outcome predictors were identified using multivariable logistic regression. Alpha was set at 0.05.

Results: Plasma concentrations of HMGB-1, interleukin-6, C-X-C motif chemokine-8, keratinocyte chemoattractant-like, and C-C chemokine ligand-2 were significantly greater in injured dogs versus controls (all \(P < 0.011\)). In univariate analyses, HMGB-1 was significantly greater in nonsurvivors compared to survivors 46.67 ng/mL (8.94–84.73) versus 6.03 ng/mL (3.30–15.75) (\(P = 0.003\)). None of the cytokines was associated with survival independent of illness severity as measured by the APPLE score, however.

Conclusion: Following moderate to severe injury, dogs have significantly increased concentrations of HMGB-1 and inflammatory cytokines. None of these cytokines are prognostic, however.

ASSESSMENT OF A NOVEL PORTABLE VISCOELASTIC COAGULATION DEVICE IN DOGS SUFFERING POLYTRAUMA: CASE SERIES EVALUATING INNOVATIVE BEDSIDE TECHNOLOGY

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Introduction: Viscoelastic testing provides information regarding the hypocoaguable and hyperfibrinolytic tendencies of poly-trauma. Bedside, point-of-care methods requiring less skill and expense could revolutionize the clinical utility of this methodology.

Objective: Evaluate a novel bedside viscoelastic coagulation device, before and after resuscitation, in 3 dogs suffering vehicular trauma.

Methods: Paired whole blood samples were obtained following vehicular trauma, pre- and postresuscitation for viscoelastic analysis. Viscoelastic variables reported were clotting time (CT [seconds]), clot formation time (CFT), alpha angle (\(\alpha\)), amplitude at 10 minutes (A10) and 20 minutes (A20), maximum clot firmness (MCF), and lysis index at 30 (LI30) and 45 (LI45) minutes.

Results: Preresuscitation CT, CFT, and pre-\(\alpha\) angles values were within normal limits (mean pre-CT = 182.3 s, mean pre-CFT = 130.3 s, mean post-CFT = 314.7 s). Postresuscitation CT values were prolonged (mean = 589 s). All pre-\(\alpha\) angles, A10, and A20 values were normal (mean pre-\(\alpha\) = 64.6°, mean pre-A10 = 31.6, mean pre-A20 = 37.6). Smaller alpha angles and A10 and A20 values were noted at postresuscitation (mean post-\(\alpha\) = 37.3°, mean post-A10 = 20.3, mean post-A20 = 30.7). Mean pre-LI30 was 94.7% and post-LI30 was 96%. Mean pre-LI45 was 98% and mean post-LI45 was 99.3%.

Conclusion: A trend toward hypocoagulability was seen following resuscitation and hospitalization. This trend may be due to a combination of acute traumatic coagulopathy, loss of hemostatic factors, as well as iatrogenic (ie, hemodilution). Further studies are necessary to evaluate the utility of this novel viscoelastic device in veterinary patients.