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2015 ACVIM Forum Research Abstracts Program

2015 ACVIM Forum Research Abstract Program Indianapolis, Indiana, June 3–6, 2015
Index of Abstracts

Oral Presentations – Thursday, June 4

Bolded type indicates ACVIM Resident Research Award eligibility

Time	#	Presenting Author	Abstract Title
SMALL ANIMAL - CARDIOLOGY**			
9:00 am	C-1	Junseok Lee	Cardaic Specific Calcium Uptake Genes Expressed in Peripheral Blood Effectively Reflect Myocardial Distress Induced By Hemodynamic Change
9:15 am	**C-2**	**Melanie Hezzell**	**Differentiating Cardiac Vs Non-Cardiac Causes of Pleural Effusion in Cats Using Plasma and Pleural Fluid with a Point-of-Care NT-proBNP Test**
9:30 am	**C-3**	**Melanie Hezzell**	**Pre-Specified Escalation of Medical Therapy Reduces Plasma NT-proBNP Concentrations in Dogs with Stable CHF Due to Mitral Valve Disease**
9:45 am	**C-4**	**Autumn Harris**	**Biological Variability of N-Terminal Pro-Brain Natriuretic Peptide in Adult Healthy Cats**
BREAK			
10:30 am	C-5	SeungWoo Jung	Microrna Signaling Networks in a Canine Model of Mitral Regurgitation
10:45 am	C-6	Tatsuyuki Osuga	Effect of Acute Volume Overload on the Left Atrial Phasic Function in Healthy Dogs
11:00 am	C-7	Caio Nogueira Duarte	Doppler Echocardiographic Assessment Of Left Ventricular +Dp/Dt and -Dp/Dt in Dogs with Chronic Mitral Valve Disease
11:15 am	C-8	Bruno Boutet	Clinical Characteristics in 35 Dogs Over 5 Years of Age Diagnosed with Patent Ductus Arteriosus
11:30 am	C-9	Lee Chang-Min	Evaluation of the Correlation Between Serum Homocysteine Concentrations and the Severity of Mitral Valve Disease
11:45 am	C-10	Justin Thomason	Echocardiographic Diagnosis and Outcome of Constrictive Pericardial Disease in Dogs (18 Cases: 2002-2013)
12:00 pm	**C-11**	**Catherine Gunther-Harrington**	**Timolol Ophthalmic Solution for Diastolic Function Testing in Cats: A Pilot Study of Heart Rate and Echocardiographic Effects**
12:15 pm	C-12	Ilaria Spalla	Changes in the Biomechanics of the Left Ventricle in Healthy Young and Adult Great Danes
BREAK			
4:30 pm	C-13	Kelly Flynn	Plasma L-Citrulline Concentrations in L-Arginine-Treated Dogs: A Pilot Study for the Treatment of Pulmonary Hypertension
4:45 pm	C-14	Fernando Rosa	Left Atrial Volume Obtained By Biplane Simpson Method in Healthy Dogs: Body Weight and Body Surface Area

$P = 0.000$) and La/Ao ratio ($r = 0.280$, $P = 0.042$), which have positive correlation with cardiovascular disease.

This study demonstrates a positive relationship between homocysteine and the severity of heart failure. Thus, we infer that elevated homocysteine level can be used as a biomarker of heart failure risk prediction in dogs with MMVD.

C10

ECHOCARDIOGRAPHIC DIAGNOSIS AND OUTCOME OF CONSTRICTIVE PERICARDIAL DISEASE IN DOGS (18 CASES: 2002–2013).

Justin Thomason[1], Marc Kraus[3], MaryAnn Radlinsky[2], Karen Cornell[2], Elizabeth Howerth[2], Tiffany Fallaw[2], Clay Calvert[2]. [1]Kansas State University, Manhattan, KS, USA, [2]University of Georgia, Athens, GA, USA, [3]Cornell University, Ithaca, NY, USA

Constrictive pericarditis (CP) is the result of inflammation/fibrosis. CP can be secondary to neoplasia, infection, or can be idiopathic. The purposes of this retrospective study were to describe the echocardiographic features and outcomes of dogs with CP.

The study population was comprised of 18 client-owned dogs. In addition to standard echocardiography, the physiology function was used to record respiratory cycles so that M-mode recording of septal motion and blood flow-velocities measured by pulsed-wave Doppler could be correlated to phase of respiration.

There were 10 males and 8 females. The mean ages and body weights (median; range) were 7 (6.5; 2–11) years and 24.4 (24.0; 2.3–59.5) kg, respectively. Pleural effusion was present in 15 of 18 (83%) and was accompanied by ascites in 5 (28%). Pericardial effusion was absent in 11.

Echocardiography was consistent with normal systolic function and absence of dilated chambers. Ventricular interdependence was demonstrated by M-mode in 18. Findings consistent with constrictive physiology were present in all 14 dogs examined by pulsed-wave Doppler.

Fifteen dogs were treated by pericardiectomy. In 9 dogs with the etiology of idiopathic pericarditis, 7 (78%) were alive and overtly healthy after at least 2 years. Survival was less than 5 months post-pericardiectomy in 6 dogs with suspected or proven neoplasia.

In conclusion, CP should be considered in dogs with pleural effusion in the absence of or with minimal pericardial effusion and absence of dilated chambers. This suspicion should increase with characteristic echocardiographic findings. The prognosis for non-malignant etiologies is favorable with pericardiectomy.

C11

TIMOLOL OPHTHALMIC SOLUTION FOR DIASTOLIC FUNCTION TESTING IN CATS: A PILOT STUDY OF HEART RATE AND ECHOCARDIOGRAPHIC EFFECTS.

Catherine Gunther-Harrington, Eric Ontiveros, Timothy Hodge, Joshua Stern. Department of Medicine & Epidemiology, School of Veterinary Medicine, University of California Davis, Davis, CA, USA

Echocardiographic assessment of diastolic function can prove challenging in cats, partially due to transmitral flow pattern fusion (EAfusion) secondary to elevated heart rates in the clinic. With reduced heart rate, transmitral flow waveforms may separate. Detection of diastolic dysfunction can aid in the early detection of cardiomyopathies. Timolol, an ophthalmic, non-selective beta-blocker used in cats with glaucoma is demonstrated to be safe and transiently decrease heart rate in clinical trials. Here we hypothesize that topical timolol ophthalmic suspension will decrease heart rate and allow E and A wave separation during echocardiogram, without significant adverse effects. Additionally, timolol may rapidly demonstrate the effect of beta-blockade in cats where oral beta-blockade is being considered.

Fourteen healthy cats were enrolled in the study. Six-lead electrocardiograms and complete echocardiograms were evaluated before, and 20 minutes after, one drop of timolol 0.5% ophthalmic solution was administered to the right eye. Cats with respiratory disease, ophthalmic disease, and cardiac arrhythmias were excluded.

Wilcoxon matched-pairs signed-rank test revealed a significant median heart rate reduction of 25 bpm after timolol ($P = 0.0005$). Of 10 cats with EAfusion, 6 separated after timolol ($P = 0.01$). Four cats without initial EAfusion remained separated after timolol and E:A ratio was not significantly different ($P = 0.23$). No bradyarrhythmias were noted after administration. Resolution of dynamic right ventricular obstruction was observed in 1 of 1 cats.

Ocular timolol safely and reliably reduces heart rate in cats, generates reproducible changes in echocardiographic parameters, may facilitate diastolic assessment, and may rapidly elucidate a cat's response to beta blockade.

C12

CHANGES IN THE BIOMECHANICS OF THE LEFT VENTRICLE IN HEALTHY YOUNG AND ADULT GREAT DANES.

Ilaria Spalla[1], Salvatore Alonge[2], Chiara Locatelli[1], Monica Melandri[1], Paola Brambilla[1], Claudio Bussadori[3]. [1]Università degli Studi di Milano, DIVET, Milano, Italy, [2]Università degli Studi di Milano, VESPA, Milano, Italy, [3]Clinica Veterinaria Gran Sasso, Milano, Italy

The helical ventricular myocardial band is the anatomic basis of left ventricular (LV) fiber architecture and has helped to redefine cardiac motion and function. Recently, the evaluation of myocardial motion can be quantified by means of non-invasive advanced echocardiography (speckle-tracking echocardiography-STE), which provides deformation (strain) and deformation rates (strain rate) in the longitudinal, circumferential and radial planes. LV twisting motion along the long axis is another important key feature in LV systolic function.

In human cardiology there has been evidence of postnatal cardiac maturation of the myofibers as infants grow, with a difference in the contraction profiles of children and adults, both in strain/strain rate values and LV twist.

We sought to evaluate the changes in the biomechanics of the left ventricle in a giant dog breed by performing standard and advanced echocardiography in 2 months old Great Dane puppies and in adult Great Danes older than 1 year.

The population comprised 20 puppies and 14 adult Great Danes (mean age: 29 months). No dog presented cardiac murmur. Dogs older than one year of age underwent 24 hours Holter recording and no dog presented any arrhythmia.

All standard echocardiographic parameters (end-diastolic/systolic volumes indexed to body surface area both in M-mode and B-mode area length, allometric scaling, LA/Ao ratio and EPSS) were within normal ranges for published dog breed.
STE parameters included longitudinal, circumferential and radial strain and strain rate, basal rotation and apical rotation, twist (net difference between apical and basal rotation) and torsion (net twist/ LV diastolic length).

Great Danes puppies and adult had statistically different heart rate (177 bpm vs 108 bpm) and selected standard echocardiographic parameters ($P < 0.001$). Circumferential and radial strain and strain rate and longitudinal strain rate were not different between the two groups, but longitudinal strain, net twist and torsion were significantly different between the two groups ($P < 0.001$). Puppies had a less negative basal rotation as compared to adults (-3.6 ± 1.8 vs -5.3 ± 1.2, $P < 0.03$), while no difference was found in apical rotation between the two groups (6.9 ± 2.8 vs 7.7 ± 2.2, NS).

In conclusion, our study identifies an age dependency effect on longitudinal strain values, twist and torsional mechcanics of the LV in Great Danes, which appears to reflect at least partially the maturation of the myocardial architecture, as already established in human pediatric cardiology.

Standard	LA/Ao	EPSS	EDVIB	ESVIB	AlloD	AlloS	EFB
Puppies	1.16	1.7*	31.4*	12.1*	1.3*	0.7*	63*
Adult	1.17	4.9*	65.6*	32.1*	1.5*	0.9*	56*
Advanced	Circ St	Circ Sr	Long St	Long Sr	Rad St	Rad Sr	Twist
Puppies	-19.8	-2.77	-12.2*	-1.54	32.9	3.17	10.5*
Adult	-20.9	-2.39	-15.0*	-1.50	34.9	2.63	13.1*

* $P < 0.05$ statistical significance (t-test).

C13
PLASMA L-CITRULLINE CONCENTRATIONS IN L-ARGININE-TREATED DOGS: A PILOT STUDY FOR THE TREATMENT OF PULMONARY HYPERTENSION.

Kelly Flynn, Heidi Kellihan, Lauren Trepanier. University of Wisconsin, Madison, WI, USA

The purpose of this study was to determine whether oral supplementation with L-arginine could reach plasma concentrations of L-citrulline, as a surrogate of nitric oxide generation, that are associated with pulmonary vascular hemodynamic improvement in humans with pulmonary hypertension. Three clinically healthy, staff owned dogs were treated in a pilot study with 50 mg/kg q 8 hrs of L-arginine PO for one week. Plasma samples were obtained at pre-treatment baseline (BL), at steady state trough (TR) and 0.5, 1, 1.5, 2, 4, 6 and 8 hours after dosing. Plasma L-citrulline and L-arginine were analyzed by HPLC. Peak concentrations of both plasma L-arginine (median 404.7 uM, range 298.8–552.1) and plasma L-citrulline (median 140 uM, range 92.1–165.4) were consistently seen at 4 hours post dosing (T4 hrs). However, a 33% increase in plasma L-citrulline from BL, which is the target in humans, was not reached in any dogs (median 10.9%, range −9.5 to 25.5%). Eleven clinically healthy, staff owned dogs were then treated with 100 mg/kg q8 hrs of L-arginine PO for one week. Plasma L-arginine concentrations increased from a median (range) of 160.1 uM (100.2–231.4) at BL to 412.7 uM (206.5–807.3) at T4 hrs and plasma L-citrulline concentrations increased from a median (range) of 82.1 uM (59.1–117.1) at BL to 102.2 uM (47.4–188.3) at T4 hrs. While only 2/11 dogs showed a > 33% increase in plasma L-citrulline concentrations, all dogs dosed with L-arginine 100 mg/kg q8 hrs had plasma L-citrulline concentrations greater than those (mean 44 uM) associated with pulmonary vascular hemodynamic improvement in people. Median systemic systolic, diastolic and mean blood pressures were not significantly different between BL (SBP 150 mmHg, 93–173; DBP 93 mmHg, 45–106; MBP 119 mmHg, 57–128), TR (SBP 145 mmHg, 112–179; DBP 85 mmHg, 52–111; MBP 108 mmHg, 86–138) and T4 hrs (SBP 155 mmHg, 121–180; DBP 90 mmHg, 75–112; MBP 115 mmHg, 96–138) (SBP $P = 0.47$, DBP $P = 0.163$ and MBP $P = 0.256$). Median heart rate did not significantly change between the BL (100 bpm, 79–154), TR (112 bpm, 84–132) and T4 hrs (97 bpm, 74–144) ($P = 0.163$). Chemistry profiles were analyzed in 7/11 dogs and there were no changes seen at T4 hrs when compared to BL.

The results of this study show that BL plasma L-citrulline concentrations are apparently higher in dogs (median 160.1 uM, range 100.2–231.4) compared to humans (mean 33 uM, SEM ± 3) and that an L-arginine dosage of 100 mg/kg PO q8 hrs exceeded peak human target concentrations of 44 uM in all dogs treated. Studies are underway to dose L-arginine in client-owned dogs with pulmonary hypertension to see whether peak L-citrulline concentrations, or a specific % change in L-citrulline concentrations, are associated with clinical and hemodynamic improvement in pulmonary hypertension.

C14
LEFT ATRIAL VOLUME OBTAINED BY BIPLANE SIMPSON METHOD IN HEALTHY DOGS: BODY WEIGHT AND BODY SURFACE AREA.

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The left atrial volume (LAV) can be obtained echocardiographically determined by biplane Simpson method and is considered a prognostic marker in the evaluation of left atrial enlargement in heart diseases. In dogs, the Simpson method for atrial measurement is still rarely used and therefore there are no reference values, in most cases, the assessment of left atrial enlargement is by the left atrial Performed-to-aortic diameter ratio (LA: Ao). Thus, the aim of this study was determined to LAV as the body weight and the body surface area (BSA), using the Simpson biplane method in healthy dogs.

For this purpose, were evaluated 107 healthy dogs, subdivided into four groups, being G1 (≤10Kg), G2 (>10 Kg and ≤ 15Kg), G3 (>15Kg and ≤20 kg) and G4 (>20Kg). Dogs were considered healthy when showed no abnormalities in clinical features, including cardiac auscultation, systolic blood pressure and also in complete blood count, serum biochemistry, electrocardiographic and echocardiography evaluation. LAV en diastole (d) and systole (s) was obtained by atrial measurement using the biplane Simpson method obtained by left parasternal long-axis four and two chamber view. Values from the groups were compared by analysis of variance (ANOVA) and Tukey post hoc test. Subsequently, values from LAV and body weight were submitted to Pearson correlation test and in the presence of statistical significance, these values were indexed to BSA (VAE-Dixd and LAV-Sixd). The results are shown in Table 1.

Table 1. Mean and standard deviation of LAV obtained from healthy dogs ($n = 107$), divided into 4 groups based on body weights.

PARAMETERS ($n = 107$)	G1 - ($n = 35$)	G2 - ($n = 39$)	G3 - ($n = 19$)	G4 - ($n = 14$)	p
LAV-d (ml)	5.61 ± 0.4^{A}	8.9 ± 2.4^{B}	13.0 ± 1.7^{C}	13.8 ± 2.4^{C}	0.0001
LAV-s (ml)	2.80 ± 0.9^{A}	5.5 ± 1.7^{B}	7.8 ± 0.6^{C}	7.7 ± 1.0^{C}	0.001

Because of the significant differences observed and the presence of significant correlation (LAV-d = $r > 0.77$ and LAV-s = $r > 0.73$) with body weight, the values of VAE were corrected by BSA identifying LAV-Dixd = 16.3 ± 3.4 ml/m^2 and LAV-Sixd = 9.5 ± 2.0 ml/m^2, both approved in normality test.

Thus, it was possible to determine the LAV based on different body weights, as well as the values indexed in canine BSA.

C15
DETERMINATION OF LACTATE THRESHOLD IN DOGS WITH DEGENERATIVE MITRAL VALVE DISEASE SUBMITTED TO INCREMENTAL EXERCISE TEST.

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Exercise became widely used as a diagnostic tool, prognostic and therapeutic in human cardiology. Studies in dogs are scarce and the determination of the lactate threshold in dogs with heart disease is nonexistent in the literature. The aim of this study was determined the lactate threshold in incremental exercise test in dogs with degenerative mitral valve disease (DMVD).

The animals were divided in groups based on left atrial to aortic root ratio (LA/Ao): Group 1 (LA/Ao < 1.4 – $n = 5$); group 2 (LA/