



Proceedings of the April Meeting of the Veterinary Cardiovascular Society

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Programme Veterinary Cardiovascular Society meeting
Hall 9, International Convention Centre, Birmingham
Wednesday 4th April 2017, pre-BSAVA meeting

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Prof Adrian Boswood MA VetMB DVC MRCVS DipECVIM-CA (Cardiology)

Adrian graduated from Cambridge University Veterinary School in 1989. After graduation he spent a year in mixed practice. He has worked at the Royal Veterinary College, London, since joining as an Intern in 1990. He obtained the RCVS Certificate in Small Animal Cardiology in 1993 and the RCVS Diploma in Veterinary Cardiology in 1996. He obtained the ECVIM Diploma in 2001. Adrian's main research interests lie in the diagnosis, progression and treatment of acquired canine cardiovascular diseases. He is an internationally renowned speaker and excessively keen cyclist.

Chris Booth BSc BVSc CertAVP(VC) MRCVS

Chris graduated from Bristol vet school in 2004 and worked as a mixed practitioner in Somerset for four years. He then moved to the East Midlands and joined Oakham veterinary hospital, which is where he developed his cardiology interest. He received his CertAVP (VC) in 2014 and subsequently became an advanced practitioner in veterinary cardiology. The hospital is also a clinical associate of Nottingham University's vet school and so integrates teaching students into his busy first and second opinion small animal and cardiac work.

Poppy Bristow BVetMed MVetMed MRCVS DipECVS

Poppy is part of the Soft Tissue Surgery Service and is particularly interested in cardiothoracic surgery and portosystemic shunts. She has a particular interest in progressing our understanding of mitral valve disease in dogs. Poppy is also interested in the therapeutic options /management of congenital heart diseases.

Christopher Smith MBChB, MSc (Path), Master of Public Health, MRCEM

Dr Christopher Smith is an Emergency Medicine doctor in Birmingham and a National Institute for Health Research (NIHR) Doctoral Research Fellow. The NIHR are funding his PhD in Health Sciences at the University of Warwick on methods to improve Public Access Defibrillation for victims of out-of-hospital cardiac arrest. He also has volunteer roles as a member of both the Executive committee and Community, Ambulance and Resuscitation subcommittee of the Resuscitation Council (UK). In these roles he is involved in a number of initiatives to improve the community response to cardiac arrest.

Mark Oyama DVM MSCE DipACVIM (Cardiology)

Mark is Professor of Cardiology at the University of Pennsylvania, based in Philadelphia, USA. He is Section Chief in Cardiology at UPENN, as well as an Associate Scholar in Epidemiology and Biostatistics. His particular research interests are cardiac biomarkers, signalling pathways in myxomatous mitral valve disease, and diuretic resistance. He is an internationally respected speaker on cardiology topics, and he is a featured speaker at this year's BSAVA congress.

Hannah Stephenson BVMS CertSAM MRCVS DipECVIM-CA (Cardiology)

Hannah has worked at the Royal Veterinary College and the University of Liverpool prior to launching her own ambulatory cardiology service in the North West of England. He has a particular interest in acquired and inherited heart diseases, and is currently Chair of the VCS Breed-Related Sub-Committee and the Breed Screening Working Party for VCS.

Jo Dukes-McEwan BVMS MVM PhD DVC FRCVS DipECVIM-CA (Cardiology)

Jo graduated from Glasgow in 1986 and since then, she has worked both in academia and in general and referral practice. She was an intern (1986-87) and resident (1989-92) in Glasgow. Here, she gained the RCVS Certificate and Diploma in Veterinary Cardiology and a Masters degree in Veterinary Neurology. She moved to Edinburgh, where she worked as lecturer in cardiology and achieved her PhD in dilated cardiomyopathy, then a Post-doc funded by the British Heart Foundation. Jo is a Diplomate of the European College of Veterinary Internal Medicine (Cardiology) (2003) and has been an RCVS recognized Specialist in Veterinary Cardiology since 1994. She was Senior Lecturer in Veterinary Cardiology at the University of Glasgow between 2002 and 2004, before moving to Liverpool. In 2008, she was awarded the BSAVA Blaine award, for services to veterinary cardiology and cardiology education.

Longitudinal findings of the EPIC study

Adrian Boswood
Royal Veterinary College, London, UK

Background

Changes in clinical variables associated with the administration of pimobendan to dogs with preclinical myxomatous mitral valve disease (MMVD) and cardiomegaly have not been described.

Objectives

To investigate the effect of pimobendan on clinical variables and the relationship between a change in heart size and the time to congestive heart failure (CHF) or cardiac-related death (CRD) in dogs with MMVD and cardiomegaly. To determine whether pimobendan-treated dogs differ from dogs receiving placebo at onset of CHF.

Animals

Three hundred and fifty-four dogs with MMVD and cardiomegaly.

Materials and Methods

Prospective, blinded study with dogs randomized (ratio 1:1) to pimobendan (0.4–0.6 mg/kg/d) or placebo. Clinical, laboratory, and heart-size variables in both groups were measured and compared at different time points (day 35 and onset of CHF) and over the study duration. Relationships between short-term changes in echocardiographic variables and time to CHF or CRD were explored.

Results

At day 35, heart size had reduced in the pimobendan group: median change in (Δ) LVIDDN -0.06 (IQR: -0.15 to $+0.02$), $P < 0.0001$, and LA:Ao -0.08 (IQR: -0.23 to $+0.03$), $P < 0.0001$. Reduction in heart size was associated with increased time to CHF or CRD. Hazard ratio for a 0.1 increase in Δ LVIDDN was 1.26, $P = 0.0003$. Hazard ratio for a 0.1 increase in Δ LA:Ao was 1.14, $P = 0.0002$. At onset of CHF, groups were similar.

Conclusions and Clinical Importance

Pimobendan treatment reduces heart size. Reduced heart size is associated with improved outcome. At the onset of CHF, dogs treated with pimobendan were indistinguishable from those receiving placebo.

The full study is available at:

<http://onlinelibrary.wiley.com/doi/10.1111/jvim.14885/epdf>

Or as an appendix to these proceedings.

Keep in the loop: torasemide from a practitioner point of view

Chris Booth
Oakham Vets, UK

Torasemide is a potent pyridine-sulfonylurea class loop diuretic (Uchida et al 1991) that has recently been licensed for use for the treatment of congestive heart failure (CHF) in dogs (Upcard®, Vetoquinol). Like furosemide it has its main action in the ascending limb of the loop of Henle, acting at the $NA^{+}-K^{+}-2Cl^{-}$ co-transporter, inhibiting sodium, potassium and chloride re-absorption (Caro-Vidello et al 2007). It requires active secretion across the cells of the proximal convoluted tubule in order to reach this site of activity (as does furosemide). For some considerable time, furosemide has been available as a licensed product for CHF treatment (even though there is little published evidence of its effects in veterinary CHF patients, most studies of its diuretic effects have been done in healthy canine patients). Furosemide is still considered by many clinicians as the first-line diuretic of choice and that torasemide should only be used in the face of furosemide resistance. In fact, both drugs are licensed for first-line use (although they should not be used concurrently) and so there should be a therapeutic consideration in selecting the more suitable loop diuretic to use in each individual that presents with clinical signs of CHF, see table 1.

Table 1: A comparison of furosemide and torasemide

	Furosemide	Torasemide
License	Dogs, cats (some forms), and large animals	Dogs only
Half life	1-2 hours	7-8 hours (Upcard® SPC and Paulin et al 2016)
Duration of action (natriuresis)	Approx 6 hours (Harada et al 2015, Uechi et al 2003)	Approx 12 hours (Uechi et al 2003)
Time to peak effect	2-3 hours (Uechi et al 2003)	2-4 hours (Uechi et al 2003)
Dosing interval	At least q12h*	Q24h
Starting dose	1-2mg/kg q12h	0.1mg/kg q24h (Paulin et al 2016)
Bioavailability	77% (Uechi et al 2003)	80-100% (UPcard® SPC, Uechi et al 2003)
Available forms	Oral and injectable (IV/IM/SC)	Oral only
Aldosterone antagonism	None	No veterinary data but evidence in humans (Adam et al 2015)
Cost per 30kg dog	2mg/kg q12h = 30p-51p/day	0.1mg/kg q24h = 86p/day
Cost per 7.5kg dog	10-46p/day	21-56p/day
Diuretic resistance?	Likely after chronic use (Hori et al 2007)	Less likely than with furosemide (Hori et al 2007)
Veterinary data	Traditionally lacking for treatment of CHF	TEST Study (Chetboul et al 2017)

*Although licensed for use once a day, this leads to rebound sodium retention and further stimulation of the renin-angiotensin-aldosterone system and sympathetic nervous system.

The recent TEST Study (Chetboul et al 2017) clearly demonstrated torasemide to be at least as equivalent to furosemide in terms of efficacy outcomes, and in the short term appeared to be associated with a significant reduction in the risk of reaching the cardiac endpoint (spontaneous cardiac death, euthanasia due to CHF or CHF class worsening). Whilst this was only a short term study, a larger, longer term, human trial – the TORIC study – also showed significantly less cardiac mortality in the torasemide-treated patients compared to those who'd had furosemide (Cosin et al 2002)

Torasemide given twice daily has been associated with higher serum urea, creatinine and phosphate compared to furosemide (Peddle et al 2012), however this was at a dose of 0.1mg/kg/q12h which is an off-label dosing interval. In the TEST Study, serum creatinine levels were higher in the torasemide group at day 84 (median just above lab ref range). This result may be reflective of the relative potency of torasemide compared to furosemide. However, there is no specific warning on the veterinary datasheet for torasemide on its renal safety compared with alternative diuretic treatments, i.e. both furosemide and torasemide need to be used with caution in the presence of renal disease.

Torasemide does not show mineralocorticoid-receptor antagonism [like spironolactone] but it does appear to have similar properties, i.e. angiotensin II inhibition (in a rat model), inhibition of both aldosterone synthase in mice (reducing atrial fibrosis) and thromboxane A2 mediated vasoconstriction in an isolated canine artery (cited in Gravez et al 2013). The veterinary clinical significance of this is as yet unknown but it may be that these extra effects on the renin-angiotensin-aldosterone system (RAAS) may give extra protection to the canine CHF heart.

The long half-life and length of action of torasemide may be of use in feline CHF. The use of torasemide is off-label in cats but has been trialled (Uechi et al 2003). Compliance is a serious issue preventing cats getting adequate diuresis as medicating with furosemide twice daily can be a serious challenge to many cat owners, who may be able to medicate their cats once daily at most. Once daily furosemide dosing leads to sodium retention due to activation of the RAAS and sympathetic nervous system (SNS) (Lantis et al 2011), which can lead to vasoconstriction and increased afterload on the failing heart. Once daily torasemide dosing appears to avoid these effects to some degree so is likely to provide effective diuresis without rebound RAAS activation (Uechi et al 2003). Most CHF in cats is due to cardiomyopathies that cause diastolic heart failure, and such cases are particularly predisposed to (RAAS mediated) hypovolaemia due to over-diuresis, which will result in deteriorating blood pressure and cardiac output. Therefore, particular care needs to be made to ensure that the minimal effective dose of diuretics is used and that concurrent medication to inhibit the RAAS is given (e.g. ACE inhibitor and spironolactone). Further studies into the use of torasemide in cats would be useful as many cat owners would prefer using a once daily diuretic in this species.

Loop diuretic resistance can occur over time for several reasons. As the course of CHF worsens the gastro-intestinal tract can become oedematous and its blood supply can fall, which reduces absorption of oral medications (including diuretics). Renal perfusion also decreases which reduces the ability of loop diuretics to get to their site of activity. When oral furosemide resistance is suspected the use of torasemide may help as it has superior gastro-intestinal absorption (an alternative is to move to parenteral furosemide). Sequential nephron blockade is an additional strategy that can be used in the face of loop diuretic resistance (i.e. use of amiloride, thiazide diuretics and spironolactone).

There are contrasting properties between these two diuretics and I have found that these have helped to guide my choice of which diuretic to choose. Torasemide is more expensive than furosemide and so this has influenced my choices. Where costs are an issue then furosemide is my loop diuretic of choice. However, when I suspect compliance is an issue then I consider torasemide. Torasemide's proven [in vitro] effects on the RAAS make it potentially a preferred choice for first line loop diuretic therapy in dogs. In cats it should only be used as part of the Cascade (furosemide is licensed for CHF in cats). There is also a lack of injectable torasemide and so in the face of fulminant CHF injectable furosemide is likely to remain the mainstay of treatment.

I am presenting two cases where I used torasemide in dogs with CHF at my first-opinion practice. One case was a Cavalier King Charles Spaniel where using a diuretic once daily helped with compliance. The other was a Golden Retriever who developed such severe polyuria on furosemide that she was making a considerable mess in the house overnight, a switch to torasemide enabled her to get through the night without disturbing the client, i.e. by giving the torasemide in the morning she was mostly polyuric during the day when giving her access to the garden for urination was easy for the client. She was then less polyuric overnight and so would make it through the night without disturbing the owners to allow her into the garden for urination.

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Valve Repair Surgery: an update

Poppy Bristow
Royal Veterinary College, UK

The RVC has increased its capacity to perform open heart surgery over the last 12 months with the addition of new team members, made possible by a generous charitable donation. Currently, we are able to perform open heart surgery 2-3 times a month and the majority of our caseload is surgical repair of degenerative mitral valves. In addition, we continue to operate on dogs with other congenital and acquired heart disease when necessary and appropriate. Conditions such as pulmonic stenosis, double chambered right ventricle, tricuspid dysplasia, mitral dysplasia, septal defects and tetralogy of Fallot, all have potential surgical solutions, in the correct circumstances.

Surgical repair for degenerative mitral valve disease (DMVD).

Whilst we have modified and refined our technique in the last few months, the basic surgical steps remain the same with chordal replacement or augmentation combined with reduction annuloplasty to create a more competent valve. Typically, we use GoreTex sutures as prosthetic chordae tendinae and between four and six are usually required. The annuloplasty in small and toy breeds is a pledgeted "purse string" from annular trigone to annular trigone, whilst for larger dogs, a strip of Gore-tex patch material is sutured in place to create the annuloplasty. As of the summer of 2017 we have also been operating on toy breed dogs in addition to larger breeds with a 2kg Chihuahua being the smallest dog to successfully undergo mitral valve repair at RVC to date.

Results

So far we have performed 22 valve repairs in dogs with DMVD. Five of these dogs were in ACVIM stage "D" and the remaining in stage "C". Through this early experience, we have established several "selection criteria"; the main negative prognostic indicator appears to be clinical stage of disease as none of the 5 stage D dogs survived to discharge, compared to 13/17 dogs in stage C. It is important to realise, however, that most of the stage D dogs preceded the stage C dogs that we have operated on. Professor Uechi also feels that the degree of pulmonary hypertension is an important predictor of outcome, with a pressure gradient of over 80mmHg measured from a tricuspid regurgitation velocity not considered as a surgical candidate by the Japanese team.

Not surprisingly, the quality and durability of the repairs we have performed are improving as our experience grows. Typically, we would expect only trivial mitral immediately post-repair (as assessed by transoesophageal echocardiography). Interestingly, we have also found that even after 48 hours left atrial size reduces, and that further improvement in the mitral valve regurgitation is evident following further reverse remodeling over the weeks to months after surgery. In some dogs this has resulted in complete resolution of any remaining mitral regurgitation and has enabled us to discontinue all heart medications in several dogs.

Congenital valve repairs

Because of the poor medium and long-term results seen in tricuspid valve replacement in dogs, and with our increasing familiarity and success with mitral valve repair, we have recently performed repair of the tricuspid valve in three dogs with tricuspid valve dysplasia, one of these with tricuspid valve stenosis and two with incompetence. Repair for non-stenotic valves is currently a relatively complex procedure requiring “release” of both the septal and mural valve leaflets from their multiple abnormal chordae attachments, followed by resuspension of these leaflets, along with a Gore-tex strip annuloplasty.

We have also performed repair on dogs with a variety of dysplastic mitral valve lesions. Because of the wide spectrum of valve malformations, accurate pre-operative transthoracic and intra-operative transoesophageal echocardiography as well as accurate intra-operative surgical assessment are imperative. A variety of techniques are often required to improve valve function and these patients represent among the most challenging ones to repair. Success is improving with increasing experience with the different techniques, along with the process of cardiopulmonary bypass in general, with 4/8 surviving to discharge to date.

Future direction

Continued aims of our programme are to increase case capacity and further improve success. Additional goals include generating evidence to confirm the suitability of the surgical techniques that are being used as well as using the case material to aid the identification of potential risk factors that influence outcome. The latter will be possible when larger case numbers have been collected and this will only be possible if we can raise awareness of this potential surgical option for DMVD, in particular.

How to Save a Life: the community response to cardiac arrest

Dr Christopher Smith
University of Warwick, UK

There are approximately 28,000 out-of-hospital cardiac arrests in England each year and fewer than 1 in 10 victims will survive to hospital discharge. Cardiac arrest can be difficult to recognise but victims will be unresponsive and not breathing normally, or at all. Agonal breathing (irregular, slow and deep breathing) is itself a sign of cardiac arrest.

There are two interventions that have a huge impact on whether or not a cardiac arrest victim survives and ultimately goes home. These are chest compressions as part of cardiopulmonary resuscitation (CPR) and early defibrillation. Both of these can be delivered by members of the public before an ambulance arrives. Public Access Defibrillation is the term used to describe defibrillation by a bystander using an Automated External Defibrillator (AED). AEDs can be used effectively even by those with **no** prior training.

In out-of-hospital cardiac arrest it is improvements to the **community** response, and not what hospital doctors and paramedics do, that has the biggest potential to save lives. People who receive good-quality CPR and Public Access Defibrillation have up to three times greater chance of surviving than those who do not.

So, is there something that those of you attending this conference can do? This talk describes how to use an AED, why you might consider obtaining one and how you could make it publicly-accessible for use in cases of nearby cardiac arrest. You will hear about other issues including information about buying and maintaining AEDs, insurance and concerns regarding legal liability.

You might also be interested to hear of the 'GoodSAM' mobile-phone app. This is a volunteer first-responder system that allows CPR-trained bystanders to be alerted to nearby cases of cardiac arrest and to provide assistance if they are able to. For those of you just wishing to learn or refresh your CPR skills (on people!) you will hear about 'LifeSaver'. This is a CPR/AED training app, featuring immersive and interactive video in which you can practice chest compressions and the use of an AED from the comfort of your home or workplace.

Whatever else you take from today's talk, remember that for those cardiac arrest victims who survive, their survival will often be due to actions taken by members of their community.

A Variety of Statistical Pearls

Mark Oyama
University of Pennsylvania, USA

This presentation will discuss 3 different statistical principles in the context of previously published clinical trials with an eye towards how these principles might affect the day-to-day treatment of patients in clinical practice.

The following “pearls” will be discussed:

Proportional hazards assumption: This concept affects the interpretation of how a treatment benefits patients over time. Is the benefit of a particular treatment ongoing and durable or does it fade over time? Many studies that utilize “time-to-event” analyses, such as Kaplan-Meier survival curves or Cox proportional hazards regression to report results are affected by the proportional hazards assumption. A better understanding of this assumption will improve interpretation of study results and application to individual patients.

Number needed to treat: This concept offers a way to assess the clinical impact of a treatment. Simply put, the number needed to treat is exactly that, how many patients do I need to treat to in order to gain benefit in 1? Not all patients respond to treatment, a fact that is sometimes overlooked when considering the average treatment response that is reported in clinical trials. A small number needed to treat suggests that a treatment substantially lowers the absolute risk of a morbid or fatal outcome, while a large number implies the opposite. The number needed to treat is also a crude way to compare the relative efficacy of different treatments from different clinical trials.

Multiple comparisons: This concept acknowledges the fact that likelihood of achieving of a “significant” result is dependent on the number of tests performed. Studies with many endpoints risk finding false positive results if the concept of multiple comparisons is not accounted for. In some instances, such as in pilot studies, this might be completely appropriate, while in others that perform many analyses, such as genomic studies, multiple comparisons becomes a critical factor. This presentation will discuss when and how to account for this concept.

Impedance and Afterload in Mitral Regurgitation

Mark Oyama
University of Pennsylvania, USA

Conventional wisdom frames mitral regurgitation (MR) as a condition characterized by low afterload. Ejection of blood through the mitral regurgitant orifice and into the low-pressure atrium is more easily achieved than ejection forward into the high-pressure aorta. Thus, left ventricular afterload is uniformly reduced in dogs with MR, and arterial vasodilators, such as hydralazine or amlodipine, can help improve forward output by lowering arterial afterload in relation to the low pressure MR pathway. This traditional view of MR might not be entirely correct. This presentation will present and discuss a model by which to consider the relative impedances of MR vs. forward flow and to consider the potential benefit (or lack thereof) of arterial vasodilators on flow. The blanket statement that MR produces low afterload is probably incorrect and a better understanding of the hemodynamics of MR will open the way to better therapies and outcomes.

The Diuretic Resistance Dilemma

Mark Oyama
University of Pennsylvania, USA

Diuretic resistance (DR) is a clinical problem that eludes easy description, understanding, detection, and treatment. The questions surrounding DR far outnumber the available answers, and one approach is to frame the problem of DR as a series of questions as follows:

What is DR? There is no single accepted answer. In general, DR is the failure to alleviate congestion despite sufficient doses of diuretics. What constitutes a “sufficient” dose? Is this a dose based on your clinical experience, on a specific amount of natriuresis per mg of drug, or on the failure of an increased dose to produce greater amount of relief? One might consider a more individualized definition that compares the amount of natriuresis achieved early in the course of therapy vs. late in therapy in any particular animal.

How is DR diagnosed? I believe we have all treated cases with DR. Consider a dog with end-stage mitral valve disease that is receiving 8 mg/kg furosemide daily and continues to have congestion. When the owner is asked if the dog has extreme polyuria and polydipsia, the answer is no. When furosemide is further increased to 10 mg/kg a day, the congestion is not alleviated. Aside from this clinical experience, is there a more standardized way to diagnose DR? One might collect and measure the total urine volume and natriuresis caused by a dose of diuretic, but this is impractical in the client-owned animal. Thus, a variety of surrogate measures, including electrolyte free water excretion, the ratio of fractional excretion of Na to K, and more complicated formulas involving estimated GFR are being studied.

What effect does DR have on morbidity and mortality? If DR does indeed occur, the clinical result is persistent congestion, which certainly decreases quality of life. It also stands to reason that the presence of persistent congestion would negatively affect longevity. Studies in humans strongly suggest that DR is a negative prognostic factor. A recent trial of furosemide vs. another other loop diuretic torsemide, offered tantalizing clues that diuretics with less resistance might offer survival benefit to dogs with heart failure.

How to treat DR? Strategies in humans include increasing bioavailability, countering downstream distal tubular hypertrophy, and co-administration of agents that improve diuretic responsiveness. This presentation will discuss these and other aspects of DR.

The ACE2 System in Heart Disease

Mark Oyama
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The renin-angiotensin-aldosterone system (RAAS) is an important and well-described feature of heart disease in veterinary species. A key step within the RAAS is the conversion of angiotensin I to angiotensin II by angiotensin converting enzyme (ACE). Angiotensin II is an octopeptide consisting of 8 amino acids and AT₂ (1-8) mediates many of the maladaptive effects of RAAS including vasoconstriction, sodium and water retention, and cardiac and vascular remodeling. A cornerstone of heart disease treatment involves blockade of AT₂ (1-8) formation by ACE-inhibitors.

Angiotensin converting enzyme-2 (ACE2) is part of the growing body of molecules found to be part of a larger and much more complex RAAS. ACE2 converts AT₂ (1-8) from an 8 amino acid molecule to one with only 7 (angiotensin 1-7 [Ang1-7]). Remarkably, the cleavage of the carboxy-terminal phenylalanine from AT₂ (1-8) dramatically changes the biological effects of Ang1-7 vs. those of AT₂ (1-8). Ang1-7 elicits its effect not by binding to the conventional AT₂ receptors, but instead to a MAS receptor. Activation of this receptor by Ang1-7 causes effects that are diametrically opposite of AT₂ (1-8). Ang1-7 is vasodilatory, antifibrotic, antioxidative, and cardioprotective. Thus, ACE2-mediated production of Ang1-7 counterbalances the detrimental actions of the conventional RAAS. ACE2 is known to be present in the proximal convoluted tubule of the nephron as well as in the lung tissue where it is thought to bestow a tissue-protective effect. Increased activity of ACE2 is potentially beneficial in chronic CHF, pulmonary hypertension, systemic hypertension, and chronic kidney disease. Proof-of-concept studies in human patients strongly suggest that therapy to increase activity of ACE2 is beneficial. This presentation will review the ACE2 pathway, discuss its importance in heart disease, and present preliminary data from the author's laboratory regarding ACE2 and Ang1-7 in dogs with heart disease.

A New Heart Testing Scheme for UK Cavalier King Charles spaniels

Hannah Stephenson
Hannah Stephenson Specialist Cardiology, UK

Panel discussion: The Treatment of Heart Failure

Adrian Boswood, Mark Oyama, Jo Dukes-McEwan

Chair: Malcolm Cobb

Appendices

1. Boswood *et al* – to accompany lecture by Adrian Boswood on the longitudinal results of the EPIC trial cohort

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Standard Article

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Longitudinal Analysis of Quality of Life, Clinical, Radiographic, Echocardiographic, and Laboratory Variables in Dogs with Preclinical Myxomatous Mitral Valve Disease Receiving Pimobendan or Placebo: The EPIC Study

A. Boswood , S.G. Gordon, J. Häggström, G. Wess, R.L. Stepien, M.A. Oyama , B.W. Keene, J. Bonagura, K.A. MacDonald, M. Patteson, S. Smith, P.R. Fox , K. Sanderson, R. Woolley, V. Szatmári , P. Menaut, W.M. Church, M.L. O'Sullivan, J.-P. Jaudon, J.-G. Kresken, J. Rush, K.A. Barrett, S.L. Rosenthal, A.B. Saunders, I. Ljungvall, M. Deinert, E. Bomassi, A.H. Estrada, M.J. Fernandez Del Palacio, N.S. Moise, J.A. Abbott , Y. Fujii, A. Spier, M.W. Luethy, R.A. Santilli , M. Uechi, A. Tidholm, C. Schummer, and P. Watson

2. Birkegard *et al* – to accompany lecture by Hannah Stephenson on the new mitral valve screening scheme in the UK

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Breeding Restrictions Decrease the Prevalence of Myxomatous Mitral Valve Disease in Cavalier King Charles Spaniels over an 8- to 10-Year Period

A.C. Birkegård, M.J. Reimann, T. Martinussen, J. Häggström, H.D. Pedersen, and L.H. Olsen

Background: Cavalier King Charles Spaniels (CKCS) are predisposed to myxomatous mitral valve disease (MMVD). Studies have indicated a strong genetic background.

Objective: The aim of this study was to evaluate the effect of a breeding scheme involving auscultation and echocardiography.

Animals: In the Danish Kennel Club mandatory breeding scheme, 997 purebred CKCS were examined during the period 2002–2011. Each dog was evaluated 1–4 times with a total of 1,380 examinations.

Methods: Auscultation and echocardiography were performed to evaluate mitral regurgitation murmur severity and degree of mitral valve prolapse (MVP). The odds of having mitral regurgitation murmur or MVP > grade 1 in 2010–2011 compared to 2002–2003 were estimated using logistic regression analysis including age and sex as covariates. Odds were estimated for dogs that were products of the breeding scheme (defined as dogs with both parents approved by the breeding scheme before breeding) and non-products of the breeding scheme (defined as dogs with at least 1 parent with unknown cardiac status).

Results: In 2010–2011, the odds of having mitral regurgitation murmur were 0.27 if dogs were a product of the breeding scheme compared with dogs in 2002–2003, reflecting a 73% decreased risk ($P < .0001$). If non-products of the breeding scheme examined in 2010–2011 were compared with dogs in 2002–2003, no difference in odds was found ($P = .49$).

Conclusion and Clinical Importance: A mandatory breeding scheme based on auscultation and echocardiography findings significantly decreased the prevalence of MMVD over the 8- to 10-year period. Such a breeding scheme therefore is recommended for CKCS.

Key words: Dog; Genetics; Inheritance; Mitral valve prolapse.