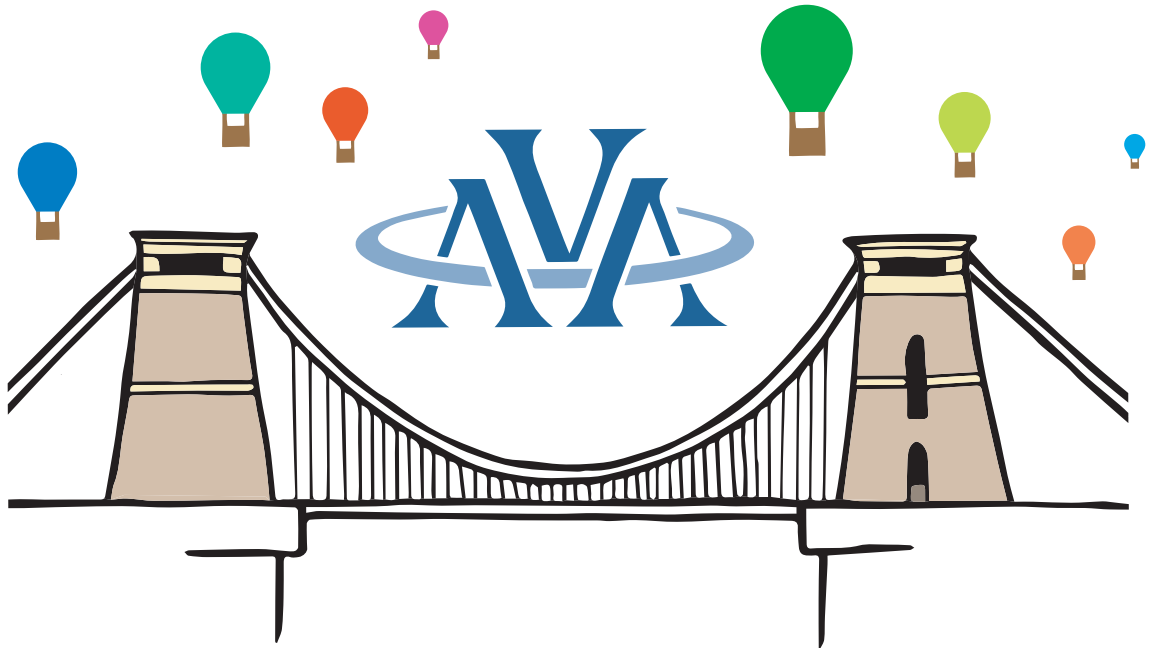
AVA Bristol 2019

March 20th-23rd



Welcome to the Bristol AVA – the 2019 spring meeting of the Association of Veterinary Anaesthetists!

It is our pleasure to welcome you in Bristol from the 20th to 23rd of March 2019 for the AVA's spring conference.

We are very excited to have been able to put together a fascinating program covering Laboratory Animal Anaesthesia and Analgesia, Pain Physiology, controversies in NSAID use during the peri-operative period, and, anaesthesia for patients with respiratory dysfunction.

In addition, we are thrilled to be hosting sessions which aim to develop consensus on the best approach to preparing patients for anaesthesia with a focus on Horses, Ruminants and Companion animals.

Bristol is an ancient trading city which has built on its international links over the years to cement its place as one of the UK's most vibrant cultural centres. It has a strong artistic scene lead by the eponymous Banksy, fantastic music, theatre, and a wide range of excellent international cuisine.

Enjoy your time in the sunny South-West at our stimulating AVA meeting – and don't forget to try the Cider!

AVA Bristol committee

Jo Murrell, Vicky Ford-Fennah, Emma Love, Helen Binge, Patrick Burns, Gwen Covey-Crump, Julia Deutsch, Will McFadzeen, Paul MacFarlane, Delphine Holopherne-Doran.

Index

Section	Page
Timetable	4-6
Social Program	7
Sponsors	8
Speaker Profiles	9-16
Pre - Congress day notes - Wednesday 20th of March	17-25
Pre-Operative preparation - Thursday 21st of March	26-29
Pain day - Friday 22nd of March	30-36
Small Animal abstracts - Thursday 21st of March	37-44
Large Animal abstracts - Thursday 21st of March	45-51
Small Animal abstracts - Friday 22nd of March	52-56
Large Animal abstracts - Friday 22nd of March	57-61
Posters	62-72

Timetable

Wednesday 20th of March - Pre Congress day

Start time	Finish time	Activity	Speaker	Venue
9.00	10.15	Laboratory animal anaesthesia is not "just more species": laboratory animal anaesthesia is not just more species - ethics and legislation	Dr Polly Taylor	Ballroom
10.15	10.45	break		Wessex
10.45	11.30	Anaesthesia of ruminants	Professor Eddie Clutton	Ballroom
11.30	12.15	Mechanisms of anaesthesia, neuroanaesthesia and why they mater	Dr Kathy Murphy	Ballroom
12.15	12.45	Anaesthesia for rodents	Professor Paul Flecknell	Ballroom
12.45	13.45	lunch		Wessex
13.45	14.30	Analgesia for rodents	Professor Paul Flecknell	Ballroom
14.30	15.00	Analgesia and analgesia for primates	Dr Kathy Murphy	Ballroom
15.00	15.30	break		Wessex
15.30	16.15	Anaesthesia of pigs	Mrs Delphine Holopherne-Doran	Ballroom
16.15	17.00	Quiz		Ballroom
19.00	21.00	Welcome reception		SS Great Britain

Other meetings

ECVAA Executive from 9.00, Duchess 4

ECVAA Supervisors meeting from 14.30, Duchess 3

VAA Board meeting from 17.00, Duchess 4

Thursday 21st of March

Start time	Finish time	Activity	Speaker	Venue
8.50	9.00	Opening ceremony	Professor Richard Hammond	Ballroom
9.00	9.45	Pre-operative preparation of Horses	Professor Mark Senior	Ballroom
9.45	10.30	Pre-operative preparation of Ruminants and Pigs	Professor Eddie Clutton	Ballroom
10.30	11.00	break		Wessex
11.00	11.45	Pre-operative preparation of Small animals	Professor Dimitris Raptopoulos	Ballroom
11.45	12.30	poster session		Wessex
12.30	13.30	lunch		Wessex
13.30	15.30	Consensus debate	Chair: John Hird	Ballroom
15.30	1600	break		Wessex
16.00	17.30	Large animal abstracts		Ballroom
16.00	17.30	Small animal abstracts		Marlborough
19.30	late	Gala Dinner		Bristol Harbour Hotel, Sansovino Room

Other Meetings

AVA Trust meeting 11.45, Marlborough

ECVAA meeting 12.45- 13.30, Ballroom

Friday 22nd of March

Start time	Finish time	Activity	Speaker	Venue
9.30	10.15	Noradrenergic control of pain	Professor Tony Pickering	Ballroom
10.15	11.00	Diffuse noxious inhibitory controls	Professor Kate White	Ballroom
11.00	11.30	break		Wessex
11.30	12.15	Assessment of pain in neonates	Dr Anoopam Jain	Ballroom
12.15	13.00	poster session		Wessex
13.00	14.00	lunch		Wessex
14.00	15.30	Controversies in the peri-operative administration of NSAID's – round table discussion	Dr Hannah Gill, Professor Richard Coward, Professor John Innes	Ballroom
15.30	16.00	break		Wessex
16.00	17.00	Large animal abstracts		Ballroom
16.00	17.00	Small animal abstracts		Marlborough
17.00	17.15	close		Ballroom

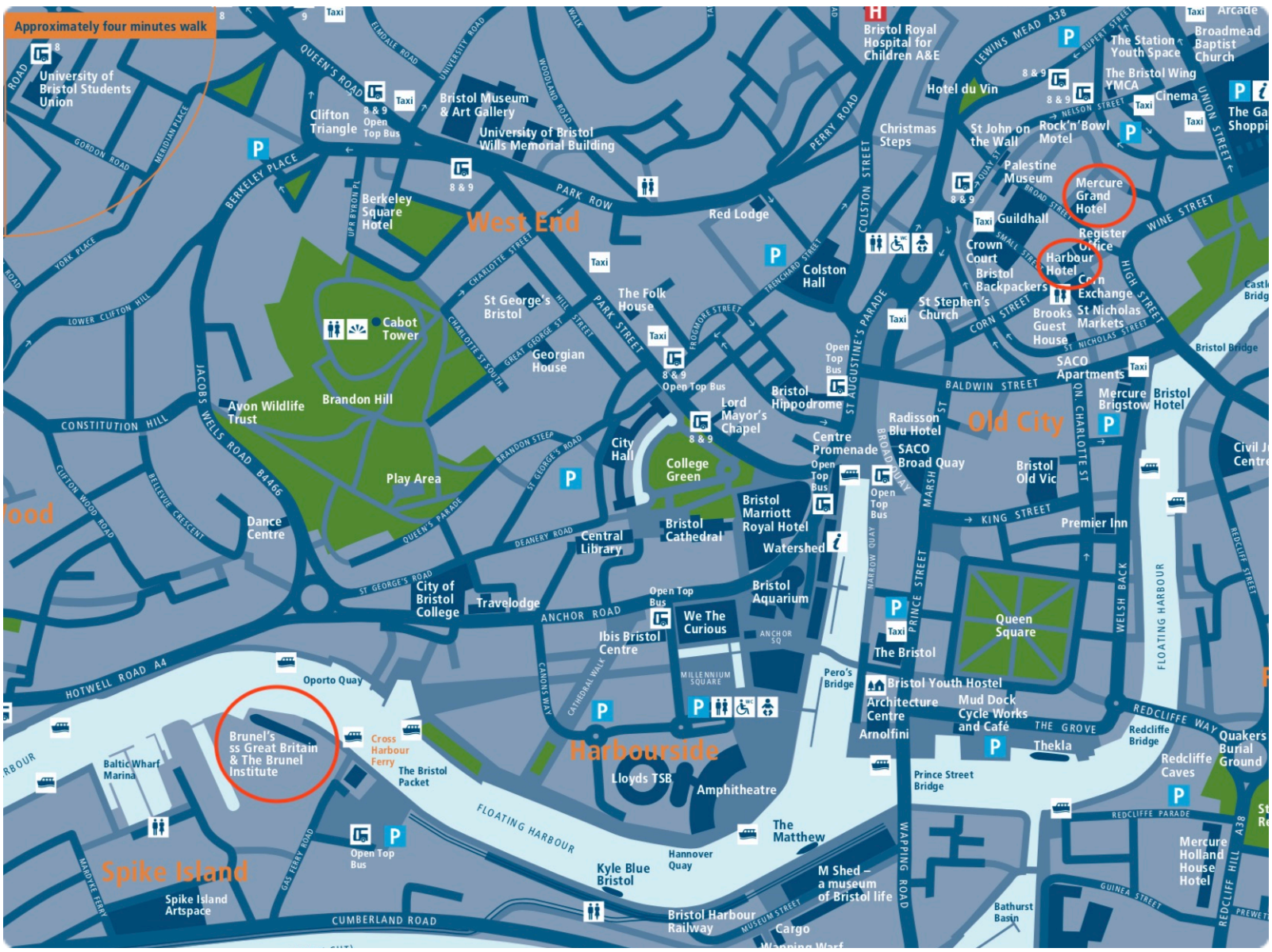
Other Meetings

AVA General meeting 12.30-13.30, Ballroom.

Social programme

Wednesday 20th March
Our welcome reception will be held on the fabulous SS Great Britain – Isambard Kingdom Brunels engineering marvel, widely considered to be first modern ship. Docked in the city dominated by his other pioneering transport creations – the Clifton suspension bridge and the Great Western Railway. We will have full access to the ship and the recently expanded museum which details the ships genesis, eventful career, salvage, and, restoration. The SS Great Britain is a short walk from the conference venue – but if you fancy saving your legs for later in the evening then a river taxi trip will let you absorb the ambience of the historic docks on the way.

Thursday 21st of March
Our Gala dinner will be held in the sumptuous Sansovino hall of the Bristol Harbour hotel – famed across the city for its décor, fine dining and excellent cellar! After enjoying the meal, an AVA first - the Silent Disco! Dancing at our congresses is legendary - how much better can it get when we all dance to a different beat?



Sponsors

We are very grateful for all the companies that have sponsored our meeting - they make having meetings like this one economically possible. The commercial exhibition is always a good focus for discussion around the latest devices, drugs and monitors - do spend some time there during our extended lunch breaks!

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Speaker profiles

Dr Kathy Murphy

BVetMed, CLAS, CVA MRCVS

Kathy is a laboratory animal anaesthetist and holds the positions of Director of the Comparative Biology Centre and Named Veterinary Surgeon at Newcastle University, UK. Having graduated in 1999 from the Royal Veterinary College and spent 5 years in mixed general practice, she moved to the University of Oxford in 2004 to work with laboratory animals; realising that one of the greatest contributions vets with an interest in anaesthesia can make to animal welfare is with laboratory animals. Since then she has completed RCVS Certificates in Veterinary Anaesthesia and Analgesia, and Laboratory Animal Science whilst supporting scientists to refine their anaesthetic regimens and techniques. Her research interest is in anaesthetic neurotoxicity and investigating how anaesthesia acts as a confound for neuroscience experiments. She has worked in New York and Atlanta both as a Wellcome Research Training Fellow for her PhD and latterly as Assistant Professor of Anesthesiology and Neuroscience, before returning to the UK to pursue an alternative residency with the ECVAA.

Professor Paul Flecknell

MA, VetMB, PhD, DECLAM, DLAS, DECVA, (Hon) DACLAM, FRSB, (Hon) FIAT, (Hon) FRCVS

I started my career as a clinical veterinarian and became involved in medical research at the Clinical Research Centre, London, while acting as their laboratory animal veterinarian. After completing a PhD in physiology, I moved to Newcastle, where I was able to develop my major interests in the science underpinning animal welfare.

Roles and Responsibilities: I stepped down as Director of the university research animal facilities in 2017, and now have time to focus on developing e-learning resources, and delivery of training on a range of topics related to animal welfare. I am also continuing to contribute to the work of the Pain and Animal Welfare Science group.Research Interests*:* Welfare of animals used in biomedical research, and in particular issues associated with pain and distress. Comparative aspects of pain assessment and alleviation. Animal anaesthesia and the neurophysiogical effects of anaesthesia.Current Work*:* Our research group aims to develop improved methods of analgesia and anaesthesia for use in animals. We are also interested in comparative aspects of pain and analgesia. We also disseminate this information by developing training materials for research workers.Future Research: We aim to develop the comparative aspects of our research in pain assessment and alleviation. In particular, we are aiming to develop means of assessing the affective component of pain. We also aim to develop more humane methods of euthanasia of laboratory animals.

Dr Polly Taylor

MA VetMB PhD DVA DipECVAA MRCA MRCVS

Graduated from Cambridge University in 1976 and worked in general practice before moving to the Cambridge University Veterinary School where she obtained the RCVS DVA. Became chief of anaesthesia at the Animal Health Trust in 1983 and gained her PhD (Cambridge University) in 1987 for her thesis in equine anaesthesia. In 1994 she became University Lecturer and subsequently Reader at the Cambridge University Veterinary School where she was responsible for the clinical anaesthetic service, teaching undergraduates and post graduates and for research in anaesthesia. She became a Diplomate of the European College of Veterinary Anaesthesia in 1995 and was founding President of the College. She has been awarded the UK Equestrian Outstanding Scientific Achievement Award, the BSAVA Simon Award, the ECVAA Morpheus award, and in 2016 became an honorary member of BEVA. Became FRCVS in 2017 for meritorious contribution to learning. Since 2002 she has worked as an independent consultant in anaesthesia, with work ranging from clinical anaesthesia and teaching to drug registration, as well as research, particularly in analgesia. She has published numerous papers on anaesthesia and analgesia in many species, particularly horses and cats. Since its inception in 2008 she has been a director of Topcat Metrology Ltd, developing and supplying bespoke nociceptive threshold testing systems for a wide range of animal species. She was a member of the Advisory Council for the Misuse of Drugs (2002-2010) and has continued to be an advocate for the veterinary profession in matters concerning drug legislation. Her most recent activity putting her head above the parapet is to join a growing group showing the profession that overtreatment of animals “just because we can” is often not in their best interests.

Dr Delphine Holopherne -Doran

DVM, MSc, PhD, DipECVAA, AFHEA, MRCVS

Delphine graduated from Maisons-Alfort (Paris) vet school in 1998. After a few years spent working as an equine vet, where she discovered her interest for veterinary anaesthesia and analgesia, she returned to vet school in Nantes where she ran the Anaesthesia department for 11 years. During this time, she gained a masters degree and a PhD in cardiovascular pharmacology, with a particular interest in autonomic nervous system pharmacology. She also completed an alternative residency gaining the European board certification in anaesthesia and analgesia, which led her to visit and train in a lot of different universities all over the world, including the University of Bristol. She left France to return to the University of Bristol in 2012, where she worked as a teaching fellow in veterinary anaesthesia and analgesia for 5 years and where, amongst other things, she anaesthetised quite a lot of pigs ! She is now working as an anaesthesia clinician in a small animal and exotics referral center in Bristol.

Professor Mark Senior

BVSc PhD SFHEA CertVA DipECVAA MRCVS

Mark graduated from the University of Liverpool in 1997 and then spent 2 years working in mixed practice. He returned to the University of Liverpool to complete a Residency in Equine Anaesthesia and Cardiology between 1999-2002 and was then appointed Lecturer in Veterinary Anaesthesia in 2002. He holds the RCVS Certificate in Veterinary Anaesthesia is a Diplomate of the European College of Veterinary Anaesthetists. Mark was also awarded a PhD for his thesis 'Complement and Endotoxin in Equine Colic' in 2009.

Mark is an advisor to the Association of Racecourse Veterinary Surgeons and is involved in the teaching of 'Safer Horse Rescues' to regional groups of veterinary surgeons and fire-services. He runs a small farm and has 3 horses.

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Professor Eddie Clutton

BVSc, MRCVS, DVA, DECVAA, MRCA

Eddie graduated (BVSc [hons]) from the University of Liverpool 1981, and then stayed three years in the Department of Anaesthesia, The Royal Liverpool Hospital, with Ron Jones, during which time he was awarded the Cert VA (RCVS) in 1983 and the DVA in 1988.

This was followed by a post in the University of Virginia, Maryland, USA for 5 years as assistant professor in Veterinary Anesthesiology. Eddie has been head of anaesthesia in R(D)SVS (Edinburgh) since 1990 and became a Diplomate of the European College of Veterinary Anaesthesia in 1996.

He was European Editor of Veterinary Anaesthesia and Analgesia (1999-2005), and is a member of the Royal College of Anaesthetists, the Animal Welfare Science, Ethics and Law Veterinary Association, BEVA and the Veterinary History Society.

Eddie was President (2003-2006) of the Association of Veterinary Anaesthetists. Eddie received a personal Chair in 2007.

Professor Dimitris Raptopoulos

DVM, PhD, DVA, Dip & Hon Member ECVAA

Professor Dimitris Raptopoulos graduated from the Aristotle University of Thessaloniki Faculty of Veterinary Medicine (FVMT), Greece, and from 1972 until 2011 he was active in teaching, research, and clinical practice. He completed his Doctoral Thesis at the FVMT, and a 2-year training in anaesthesiology at the School of Veterinary Studies in Bristol, UK, after which, in 1978, he obtained the Diploma in Veterinary Anaesthesia (DVA) of the Royal College of Veterinary Surgeons. He spent another 18 months in Bristol and 6 months in Gainesville, Florida, USA, as Research Fellow and Visiting Assistant Professor, respectively. From 2003 to 2007 he was Dean, and for a number of years Head of the Companion Animal Clinic, and Head of the Department of Clinical Sciences of the FVMT. His research focused primarily on gastro-oesophageal reflux during anaesthesia, and preoperative fasting in dogs. In 1995 he was appointed Invited Specialist and Founding Diplomate of the ECVAA, and served as Secretary, President, Past-President and Chairman of the Credentials & Education Committees. In March 2014 he was granted Honorary Membership of the College. He also served as President of the Association of Veterinary Anaesthetists (AVA), and has been President of the Council of the World Congress of Veterinary Anaesthesiology since 2006. In January 2013 he joined the European Board of Veterinary Specialisation as its Chief Executive Officer and can be reached via the EBVS

Professor Tony Pickering

B.Sc., Ph.D., MB ChB (Birm), F.R.C.A

Professor of Neuroscience and Anaesthesia

Tony Pickering is an expat Geordie Anaesthetist with a research focus on Pain and Autonomic control. His undergraduate Medical training in Birmingham was interrupted by the Award of a Wellcome Prize PhD studentship in the lab of Steve Logan which spawned his interest in sympathetic neurophysiology. After graduating in Medicine he trained in Anaesthesia in London and Bristol before establishing his research lab in the School of Physiology, Pharmacology & Neuroscience at Bristol while funded as a Wellcome Trust Clinical research fellow. His group studies the brainstem and spinal cord circuits that modulate pain perception and bodily homeostatic control. Much of the current work is on neuromodulation with a focus on Noradrenaline and its long range influences on pain perception. He leads the academic foundation program in Severn and the INSPIRE program for Medical and Dental students. He continues to practice as a consultant Anaesthetist and Pain clinician. The goal of his research activity is to identify new targets and methods for therapeutic intervention.

Professor Kate White

MA VetMB PhD CertVA DVA DipECVAA MRCVS

Professor of Veterinary Anaesthesia and Analgesia; Clinical Director of SVMS, Faculty of Medicine & Health Sciences, University of Nottingham.

Kate graduated from the University of Cambridge and after time in general practice returned to Cambridge vet school to undertake a Horserace Betting Levy Board Residency, gaining her CertVA, DVA and Dipl ECVAA. Following this she worked for 10 years as a self-employed consultant in referral practices, pharmaceutical companies, academia, zoos and biomedical research establishments providing anaesthesia services. In 2009 she joined Nottingham University and currently holds the position as Professor of Veterinary Anaesthesia and Analgesia and the Clinical Director role at the School of Veterinary Medicine and Science. Her role combines teaching undergraduates and postgraduates across the curriculum in physiology, pharmacology, anaesthesia and analgesia in domestic, farmed, wild captive and laboratory animals. Her research areas are in pain and analgesia, anaesthesia, safety culture. Her PhD studies focus on diffuse noxious inhibitory controls (DNIC) in a rodent model of chronic pain. She holds departmental, faculty and university management roles. She is past President of AVA, and just finishing her term as Senior Vice President of AVA. Kate is also anaesthesia consultant on the ape health project – a pan European project investigating great ape health and disease. Outside of work her time is devoted to her two children, and she enjoys gardening, cycling and skiing.

Dr Anoopam Jain

Clinical Director & Consultant in Neonatal Medicine

Anoo was appointed to the role of Consultant in Neonatal Medicine in 2003 and as Clinical Director in 2015. He completed a Doctor of Medicine thesis from University of Nottingham on Topical Amethocaine Gel in 2001 and has 14 peer reviewed publications to date. He worked with the Association of Paediatric anaesthetists to author the neonatal pain part of their Good Practice in Postoperative and Procedural Pain Management 2012 and subsequently to develop an e learning package. He taught on the MSc Pain course in the University of Leicester from 2003-2010. Anoo introduced a pain assessment tool for babies on NICU in 2008 and is currently working with the nursing and multi disciplinary teams to review how to review and update that.

He works closely with The Grand Appeal and the Cots for Tots Appeal to ensure that the needs of neonatal parents and their vulnerable babies are met to the best of our abilities. In addition, Anoo is the chair of the Board of Trustees for Frankwater to advocate that marginalised communities in India and Nepal have access to safe water, hygiene and sanitation. Anoo enjoys open water swimming, cycling, Tae Kwon Do and Tai Chi.

Dr Hannah Gill

BSc(Liv.), MBChB(Liv.), FRCA, PhD

Hannah is a Clinical Lecturer in Anaesthesia and Paediatric Anaesthetist in Bristol. She trained in Truro and East London before coming to Bristol in 2011 to work as a Research Fellow on a RCT on neonatal intensive care and obtained her PhD in 2015. Her research now focuses on improving anaesthesia during early brain development. In her spare time she enjoys open water swimming.

Professor Richard Coward

M.B.,Ch.B., Ph.D.(Bristol), M.R.C.P.

Richard did his undergraduate training at Bristol University and then specialised in Paediatrics gaining his MRCP in child health. His clinical training was undertaken in the South West of England, Great Ormond Street, London and the Starship hospital in Auckland, New Zealand. It was during this time that he decided to specialise in Paediatric Nephrology. In 2001 he was awarded a PhD fellowship funded by the Royal College of Paediatrics and Wellchild to study the molecular biology of the podocyte. After this he was appointed as a consultant in Paediatric Nephrology at the Royal Hospital for Children in Bristol.

In 2006 he was awarded an MRC Clinican Scientist fellowship enabling him to work in the world leading glomerular laboratory in Toronto, Canada with Professor Susan Quaggin to extend his studies.

In 2013 he secured a prestigious MRC Senior Clinical Fellowship to develop his laboratory and research interests further, whilst continuing to have a clinical commitment in Paediatric Nephrology. In 2011 Richard was promoted to Reader and then in 2014 to Professor of Renal Medicine.

From 2011-2014 Richard was the head of research for the School of Clinical Sciences and co-lead for developing and delivering undergraduate paediatric teaching in the University. He has been the chair of the national clinical study group for paediatric nephrology and the lead for research for the British Association of Paediatric Nephrology (2012-2016). Richard is an active member of several scientific grant committees including the MRC Populations Systems Medicine board, Kidney Research UK board, MRC Stratified Medicine board, MRC College Newton fund and MRC Genome Editing Mice for Medicine (GEMM) panel. He reviews for multiple scientific journals and is the Associate Editor for Nephron Experimental Nephrology. In 2017 Richard was part of the scientific organising committee for the American Society of Nephrology and the Scientific Chair of the 50th Anniversary meeting of the European Society of Paediatric Nephrology.

John Innes BVSc PhD CertVR DSAS(Orth) FRCVS

Born in London, John graduated from University of Liverpool in 1991. He was then at the Bristol Veterinary School for 10 years where he completed his postgraduate surgery training and a PhD in canine osteoarthritis at Bristol Medical School, becoming a recognised specialist of the Royal College of Veterinary Surgeons in 2001. At the age of 33, he was appointed Professor of Small Animal Surgery at University of Liverpool where he led the development of the new Small Animal Teaching Hospital at Leahurst.

John has published more than 85 peer-reviewed papers and several textbook chapters. He is co-founder of 'Veterinary Tissue Bank', Europe's only tissue transplant provider and 'Fusion Implants', a University of Liverpool spin-out company manufacturing veterinary orthopaedic implants using '3-D printing in metal' technology. John was President of the European Society of Veterinary Orthopaedics (ESVOT) 2014-2016.

In 2013, John joined the Executive of CVS Vets, one of the UK's largest corporate veterinary groups, to develop the company's specialist services across the UK.

Pre-congress Day

Laboratory animal anaesthesia is not "just more species":

Ethics and legislation

Dr Polly Taylor
Taylor Monroe, Ely

Anaesthesia for all species of laboratory animal undergoing research is challenging and makes maximum use of the specialist anaesthetist's skills and fundamental understanding of the art and science of anaesthesia. Designing appropriate protocols and administering high quality anaesthesia have the potential to benefit far more animals than individual clinical cases.

First rate anaesthesia that causes as little physiological upset as possible is necessary for scientific research. As well as ensuring the best care of each individual animal, the anaesthetic process must not interfere with the conduct of and data from the investigation. If animals are to be used for research it is essential that not only do they suffer as little pain, distress or lasting harm as possible, but also that they are not wasted. Ensuring that there is no interference with the investigation as well as providing the best possible experience for the animal is challenging.

The fundamental difference between anaesthesia for laboratory animals and clinical cases is the purpose for which the animal is undergoing the procedure. For a clinical case, the purpose is to treat the animal for its own benefit. The laboratory animal, however, is undergoing a procedure not for its own benefit but for the purposes of scientific investigation which benefit other individuals, most commonly humans. The harm:benefit (harm to the animal, benefit to society) of the procedure(s) forms part of the review process which decides whether the investigation is permitted.

Legislation under democracy is based on the wishes and beliefs of society which are made into law. UK legislation illustrates the general principles of European regulation of scientific research using animals. Each European country has its own legislation based on the same underlying concepts. Anyone working with animals in scientific research must be familiar with the legislation as it relates to the country where they are working. Treatment and care of animals is highly regulated in Europe and national legislation is based on EU regulations and directives, as in the UK's Animal Welfare Act (AWA). Scientific research using animals is further regulated under directive 2010/63/EU, with subsequent revisions. This manifests in in the UK as the Animals (Scientific Procedures) Act (ASPA) under Home Office control. ASPA covers the protection of animals used for scientific purposes, whereas the AWA covers animal

protection in all other circumstances. Veterinary legislation, in the UK the Veterinary Surgeons Act (VSA), covers procedures carried out by licensed veterinarians with the intended benefit to the animal although they may cause pain, distress and discomfort. Recognised Veterinary Practice (RVP) includes all such procedures if they are carried out for the benefit of the individual and have been shown to be, or have become accepted as, appropriate treatment. It is of note that the same procedure may be carried out under either ASPA or the VSA; it is the purpose of the treatment that determines under which legislation it falls. Only procedures that are RVP may be performed under the VSA. Experimental procedures for the purposes of scientific research must be performed under ASPA. Non-RVP procedures performed outwith the VSA would constitute animal cruelty and be subject to prosecution under the AWA.

In the light of current day technological advances there is a potential anomaly. A novel procedure may be devised to treat a patient who previously would most likely either be euthanised immediately or be given palliative care until euthanasia was indicated. “Life saving” heroic surgery that is complex and novel (frequently highly publicised) may not be RVP and is often actually experimental. Such treatment should at least undergo ethical and peer review, and arguably falls under ASPA. However, individual cases do not fit either category and may be wrongly labelled as RVP. The anaesthetist enables such procedures to be performed, and may have serious reservations on ethical and welfare grounds. Fast track ethical review of such cases should be carried out before treatment; if the treatment is considered not to be RVP the anaesthetist has grounds for recommending euthanasia. Appropriate licensing under ASPA should then be considered for future similar cases.

Under the UK’s ASPA each individual must hold a Personal Licence which describes all the procedures that the individual may undertake. Training and certification of competence is required before such a licence is issued. All investigations must be carried out under a Project Licence which must have received formal approval by the establishment’s Animal Welfare and Ethical Review Body (AWERB). The Project Licence normally contains clear conditions and limits which, if exceeded, may require euthanasia of the affected animal and review of the project. The establishment where the work is carried out must also be licensed; this licence is held by a senior official of the establishment.

Regardless of the detail of the individual nation’s legislation it is essential that the anaesthetist who is taking part in the research, even if only supplying anaesthesia for preparatory surgery, reads and fully understands the project protocol and any limitations or conditions placed on it.

Veterinary clinical trials are usually performed outwith ASPA as long as they are in accordance with the VSA. However, they still require ethical review; particularly if treatment includes a placebo and/or is randomised. In the UK an Animal Test Certificate (ATC) issued by the Veterinary Medicines Directorate (VMD) is required for clinical trials of unlicensed drugs. This is often for pharmaceutical companies seeking Market Authorisation, but small personal clinical trials (often the subject of a Resident’s investigation) also require a small ATC (sATC)

if unlicensed medicines are involved. Regulations in other European countries follow the same general principles. Clinical Ethical Review Committees are present in all universities, and for those working outside such institutions the Association of Veterinary Anaesthetists, the Animal Health Trust and the Royal College of Veterinary Surgeons also provide this service.

Although details of legislation vary between different European nations, the underlying principles protecting animals used in scientific research are the same.

Anaesthesia of ruminants

Professor R. Eddie Clutton
University of Edinburgh

Animals which are, or are to become ruminants are used in: 1) “agricultural” studies related to food production, animal welfare and disease prevention; and 2) “biomedical” research which may be regulatory, developmental, or translational.

The provision of effective anaesthesia and analgesia in all research animals is necessary on ethical, legal, medical and scientific grounds. Challenges with ruminant anaesthesia and analgesia largely arise from the anatomical, physiological and metabolic adaptations required to convert plant material to energy. Other problems arise from the paucity of information (pharmacological and algalogical) in ruminants undergoing laboratory *vs* agricultural procedures, e.g. castration. In comparison to laboratory rodents, little is known about the unique requirements of agricultural species in the laboratory environment, particularly those commercially sourced. Pain recognition in ruminants is complicated by their proclivity to freeze, rather than fight or flee. Factors affecting anaesthetic and analgesic techniques are: species; age, mass, breed, reproductive status, source and the experiment itself, i.e. recovery *vs* terminal, severity, duration, translational *vs* developmental.

This presentation will elucidate these challenges without going into technique details.

Mechanisms of anaesthesia, neuroanaesthesia and why they matter

Dr. Kathy Murphy
University of Newcastle

Anaesthetic drugs have a remarkable level of intra and inter-species reliability, and one of the reasons for this is that the majority are 'dirty drugs', acting on multiple targets concurrently. However, this same clinical advantage is a potential mine field when it comes to research anaesthesia, as this multiplicity greatly complicates the establishment of defined animal models and therefore the interpretation of resulting data. This is particularly true in the field of neuroscience where it must also be remembered that anaesthetic drugs are both neuroprotective and neurotoxic. An overview of the mechanisms of anaesthesia will be given along with some case examples demonstrating how this knowledge is utilised when designing protocols for neuroscience studies.

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Anaesthesia and analgesia for rodents

Professor Paul Flecknell

Many research workers, and many veterinarians, seem to consider that anaesthetizing laboratory rodents needs only a dose rate table or an anaesthetic machine and isoflurane vaporizer. This approach ignores the impact that inappropriate or suboptimal anaesthetic protocols can have on research outcomes and on animal welfare. Anaesthetising small rodents successfully in a research environment requires a careful evaluation of:

- the agents to be used
- the peri-operative management of the animal
- the facilities and expertise available in the research institution

Veterinary anaesthetists can contribute to improvements in anaesthetic practice in research institutes, and this can benefit both animal welfare and the quality of research data obtained. However, providing effective advice and assistance requires more than a recipe book….

Rodent analgesia – How do can we manage pain effectively in laboratory rodents?

Professor Paul Flecknell

So long as it is still necessary to use animals in biomedical research, it is a legal and ethical requirement that we minimize any pain and distress that may be caused by this research. Despite legislation in the EU and elsewhere requiring use of analgesics or other methods to control pain, current use of analgesics in laboratory rodents is unacceptably low. Almost all analgesics were developed in small rodents, prior to use in man, so that safety and efficacy data in laboratory assays are available. Greater use of analgesics would be encouraged by critical evaluation of the potential interactions of these compounds with the outcomes of specific research studies.

However, as in other species, effective post-procedural analgesia requires reliable 'cage-side' methods of assessing pain. Recent advances in pain assessment could lead to both more extensive and more effective use of analgesics in these species. Veterinary anaesthetists should engage with the research community to contribute to the development of pain management strategies in laboratory species.

Anaesthesia and analgesia for primates

Dr. Kathy Murphy
University of Newcastle

Nonhuman primates are used in an extremely wide range of studies in the areas of fundamental biology, applied research, and toxicology. The majority of procedures carried out during the course of these studies do not require anaesthesia. However, when required, it is essential that the most appropriate and effective methods of anaesthesia and analgesia be employed. As in other species, refining research procedures by careful selection of anaesthetic and analgesic methods not only contributes to improving animal welfare, but also improves the quality of scientific data that is obtained, thereby maximizing the benefit from the use of nonhuman primates in biomedical research. Species specific considerations and appropriate drug and management regimens will be presented, along with some practical tips and traps.

Anaesthesia of pigs

Dr. Delphine Holopherne-Doran
Highcroft Veterinary Referrals, Bristol.

The many anatomic, physiologic and pathologic similarities they share with human beings have made pigs one of the most popular large animal models in biomedical research, They are used nowadays in a large variety of translational studies, ranging from transplant medicine to cardiovascular surgery. Anaesthetising pigs in experimental settings can be challenging for many reasons. Having a good knowledge and understanding of the species specificities in terms of anatomy, physiology and pharmacology, is essential but far from sufficient. A comprehensive approach to each model/study design is absolutely necessary, from knowing the animal itself (specificities of the breed, ranging from farm pigs to micropigs ; specificities of the strain or even the individual) to understanding the specific objectives of the study, and beyond that the potential interactions of the anaesthetist's interventions with the expected results. Appropriate/tailored anaesthesia and pain management are not only necessary, they are often the key to a successful experimental study in pigs, As in other species which are used in animal research, especially the most sentient ones, the experimental anaesthestist has a key role to play and should be regarded as a 3R champion.

Thursday 21st March 2019

Pre-operative preparation of horses

Professor Mark Senior
University of Liverpool

How much of what we do, as veterinary anaesthetists, is based on evidence? How much is based on what we have been taught? How much is based on experience and observation?
If you were to look for recommendations on pre-operative preparation of horses; a quick scan through the relevant chapters of several veterinary anaesthesia textbooks would reveal a lack of consensus and advice. Additionally, the number of times theses texts refer to primary studies is minimal. In defence of all the authors of these textbooks, in many cases, there is little or no strong evidence available to justify recommending any particular aspect of practice over another. In the void left, it is not surprising that recommendations are often based on a combination of experience, common sense, or dogma.

The risks of lack of consensus include; practicing in sometimes conflicting and contradictory ways to each other, potentially confounding the interpretation of audit and research, and providing ammunition for the motivated owner, or their legal representative, who seek to undermine peri-anaesthetic case management.

Pre-operative food and water deprivation (POFWD) in horses illustrates these points. In people, and many other veterinary species, the primary role of POFWD is stated to be in reducing the risk of regurgitation/ aspiration of gastric contents during anaesthesia. Bearing in mind that POFWD, like most other interventions, is not a benign intervention, the fact that horses cannot normally regurgitate gastric contents into their oesophagus would seemingly remove the justification for practicing POFWD in horses.

Despite this, contemporary veterinary anaesthesia textbooks still recommend some form of POFWD with the majority of justifications for doing so being related in some way to improving respiratory mechanics and oxygen content of the blood.

I will provide my appraisal of the literature to discuss the justifications and contra-indications for POFWD in horses, with the intention of informing discussions to develop consensus on POFWD recommendations in horses.

Pre-operative preparation of ruminants and pigs

Professor R. Eddie Clutton
University of Edinburgh

Pre-operative food and water deprivation (POFWD) is usually justified to avoid potential (though often illusory) problems associated with anaesthesia and surgery. Its practice is rarely tempered in light of the post-operative metabolic effects of major surgery on wound healing and other features of convalescence. POFWD may also be stressful and have adverse physiological and metabolic effects *per se*.

Pigs

There is considerable range in the published recommendations for POFWD in pigs as well as the reasons for doing so - some of which are groundless (Bradbury & Clutton 2016)

Particular attention is required with respect to POFWD in neonatal pigs (which are prone to hypoglycaemia) and animals in which a residue-free gastro-intestinal (GI) tract is required for endoscopic studies.

Ruminants

The GI tract of ruminants has adapted to derive metabolizable energy from the near-constant intake low-quality forage followed by microbial degradation in the rumen. Disruption of this process by POFWD in conjunction with anaesthesia and surgery, can have major adverse metabolic and physiological effects. These are more likely in animals under production stress, e.g., lactating or pregnant animals, and probably, ruminants recovering from major surgery. However, *not* imposing POFWD can commonly cause equally undesirable though different problems.

The reviewed literature will be presented and critiqued in order to inform a consensus on appropriate POFWD protocols in ruminants.

Review of Practices Reported for Preoperative Food and Water Restriction of Laboratory Pigs (Sus scrofa).
Bradbury AG, Clutton RE.
J Am Assoc Lab Anim Sci. 2016 Jan;55(1):35-40.

Pre-operative preparation of small animals

Professor Emeritus D. Raptopoulos

Animals that are to undergo an elective operation under general anaesthesia should be appropriately prepared so as to minimize any effects potentially detrimental to their well-being.

Gastro-oesophageal reflux (GOR) is one of the major complications of general anaesthesia in both humans and small animals. Its incidence during anaesthesia has been reported to be up to 67% in dogs. Clinically, GOR during anaesthesia is rarely observed, as most of the times the gastric content does not reach the pharynx (silent reflux).

In dogs, intraoperative GOR is considered to be the main cause of oesophageal stricture, which may lead to death or euthanasia.

Aspiration of acid gastric contents into the lungs during anaesthesia is another complication that may have potentially devastating consequences. However, for aspiration to occur, gastric contents must reach the entrance of an unprotected larynx. Regurgitation (i.e. return of gastric contents from the stomach to the mouth or the nares,) has been reported to be observed only rarely in both dogs and cats, although it seems that its incidence may be increased under specific conditions.

Following the publication of Mendelson in 1946 on high incidence of pulmonary aspiration during general anaesthesia in obstetric patients, prolonged preoperative fasting standards to ensure an empty stomach at induction has been of imperative importance for the patient safety, in order to reduce the volume of stomach contents, and thus reduce the risk and severity of aspiration pneumonitis. However, the concept that prolonged fasting produces an empty stomach in humans has been shown to be incorrect, and dogs given a light meal 3-4 hours before induction of anaesthesia did not have increased gastric content volume. Moreover, prolonged preoperative fasting results in increased gastric content acidity, which, in turn, by lowering lower oesophageal sphincter pressure, may increase the incidence of reflux.

Moreover, a long starvation may lead to thirst, general discomfort and dehydration, while it may have detrimental effects on postoperative glucose and protein metabolism (i.e. reduced response to surgical stress).

Based on experimental and clinical data, many national medical anaesthesiology societies now recommend the consumption of clear liquids up to 2 hours before anaesthesia, a light breakfast up to 6 hours, and a heavier meal 6-8 hours beforehand.

Similarly in dogs, there is evidence that in healthy animals undergoing elective surgery, allowing the consumption of water up to 2 hours prior to induction of anaesthesia and a light meal 3-4 hours beforehand may be beneficial. These findings

have not been used in a sufficiently large number of clinical cases, however it seems that the time has come to abandon the traditional “nil per os after midnight”, and adopt more liberal guidelines for preoperative fasting in adult healthy dogs undergoing elective procedures, similar to those recommended for humans.

The guidelines may not apply to or may need to be modified for patients with coexisting diseases or conditions that can affect gastric emptying or fluid volume.

The factors affecting the incidence of GOR and regurgitation, as well as the pros and cons of the current guidelines for pre-operative fasting will be addressed, and possible strategies for revision will be suggested.

Friday 22nd March 2019

Noradrenergic control of pain

Dr. Tony Pickering

University of Bristol

Noradrenergic drugs acting at alpha2-adrenoceptors, like clonidine, medetomidine and xylazine are in routine use in veterinary anaesthesia where they have useful properties of being analgesic and sedative (both mediated centrally). The analgesia produced by these drugs is comparable in magnitude to that of opioids but without the respiratory depressant effects. The similarities with opioids extend to their neurobiology where they both form part of built in pain control mechanisms – so called endogenous analgesic systems.

In the setting of chronic pain it is noradrenergic drugs (predominantly re-uptake inhibitors) that have the best evidence base. Most of the central noradrenaline in the brain and spinal cord originates from a small cluster of neurons in the pons called the locus coeruleus. This extends long axonal projections to the spinal cord thought to form a descending control system for nociceptive information. Although this actions of this system on acute pain have been well documented whereby noradrenaline released at a spinal level inhibits both primary afferents and also second order projection neurons (via alpha2 adrenoceptors). However, in the context of chronic pain there has been a lot of contradictory evidence about the role of the noradrenergic system.

Using novel viral vector-based strategies and opto- / chemo-genetics we have been able to target and genetically define the operating principles of the noradrenergic analgesic circuit in both acute and neuropathic pain models in rats (Hickey *et al.*, 2014; Li *et al.*, 2016; Hirschberg *et al.*, 2017). We have shown that the descending system exerts a lateralised, potent influence on nociception and that this control fails in neuropathic pain models (Hughes *et al.*, 2013; Hughes *et al.*, 2015; Hirschberg *et al.*, 2017). It may be that this failure explains some of the variable vulnerability to the development of chronic pain seen between individuals (Xu *et al.*, 1999; De Felice *et al.*, 2011). This control can be restored pharmacologically (intrathecal re-uptake inhibitors) and chemogenetically and animals show attenuated sensitisation and exhibit a positive affective bias. However, attempts to globally boost noradrenergic transmission with systemic re-uptake inhibitors or by interventions aimed at the ascending noradrenergic system produce anxiety and aversion limiting the utility of the current treatment strategies. I will outline some strategies that we are exploring in models and in man to better understand the descending control system and the nature of the failure in chronic pain with a view to developing novel treatments.

References

De Felice M, Sanoja R, Wang R, Vera-Portocarrero L, Oyarzo J, King T, Ossipov MH, Vanderah TW, Lai J, Dussor GO, Fields HL, Price TJ & Porreca F. (2011). Engagement of descending inhibition from the rostral ventromedial medulla protects against chronic neuropathic pain. *Pain* **152,** 2701-2709.

Hickey L, Li Y, Fyson SJ, Watson TC, Perrins R, Hewinson J, Teschemacher AG, Furue H, Lumb BM & Pickering AE. (2014). Optoactivation of locus ceruleus neurons evokes bidirectional changes in thermal nociception in rats. *J Neurosci* **34,** 4148-4160.

Hirschberg S, Li Y, Randall A, Kremer EJ & Pickering AE. (2017). Functional dichotomy in spinal- vs prefrontal-projecting locus coeruleus modules splits descending noradrenergic analgesia from ascending aversion and anxiety in rats. *eLife* **6**.

Hughes S, Hickey L, Donaldson LF, Lumb BM & Pickering AE. (2015). Intrathecal reboxetine suppresses evoked and ongoing neuropathic pain behaviours by restoring spinal noradrenergic inhibitory tone. *Pain* **156,** 328-334.

Hughes SW, Hickey L, Hulse RP, Lumb BM & Pickering AE. (2013). Endogenous analgesic action of the pontospinal noradrenergic system spatially restricts and temporally delays the progression of neuropathic pain following tibial nerve injury. *Pain* **154,** 1680-1690.

Li Y, Hickey L, Perrins R, Werlen E, Patel AA, Hirschberg S, Jones MW, Salinas S, Kremer EJ & Pickering AE. (2016). Retrograde optogenetic characterization of the pontospinal module of the locus coeruleus with a canine adenoviral vector. *Brain Res* **1641,** 274-290.

Xu M, Kontinen VK & Kalso E. (1999). Endogenous noradrenergic tone controls symptoms of allodynia in the spinal nerve ligation model of neuropathic pain. *Eur J Pharmacol* **366,** 41-45.

‘Sex, drugs and descending controls’

Professor Kate White

University of Nottingham

For centuries we have been aware of a phenomenon in the body where one type of pain is capable of inhibiting a second pain. This interactive lecture will summarise experiments in both human beings and animals which show that this phenomenon can be explained by diffuse noxious inhibitory controls (DNIC); a powerful endogenous descending inhibitory pathway in the body.

Diffuse noxious inhibitory controls can be easily evoked, quantified and studied. The spinal pharmacology of DNIC are complicated and still being unravelled and normally these descending controls produce an inhibitory effect through the actions of noradrenaline at spinal α_2 adrenoceptors (and to a lesser extent serotonin, acting on spinal 5-HT_3 receptors) (Bannister and Dickenson, 2016). What has become apparent across many different persistent painful conditions (e.g. migraine, irritable bowel disease, and idiopathic pain states) is that some humans have been shown to have impaired DNIC thereby suggesting that a DNIC paradigm could be used in prediction of chronic pain susceptibility (Yarnitsky et al., 2008). Impaired DNIC can be restored in some cases with pharmacological interventions (Bannister et al., 2015) or salvage surgery to halt or treat the painful disease and furthermore the DNIC paradigm has also uncovered extensive sex differences, evident in both humans and animals (Popescu et al., 2010). The story is far from complete with exact role of the descending pathways and downstream transmitters for different pain states as yet unknown but the consensus is that progress in these areas will lead to improvements in pain management (White et al., 2018).

References:

Bannister, K., Dickenson, A.H., 2016. What do monoamines do in pain modulation? Curr. Opin. Support. Palliat. Care 10, 143–148.

Bannister, K., Patel, R., Goncalves, L., Townson, L., Dickenson, A.H., 2015. Diffuse noxious inhibitory controls and nerve injury: Restoring an imbalance between descending monoamine inhibitions and facilitations. Pain 156, 1803–1811.

Popescu, A., LeResche, L., Truelove, E.L., Drangsholt, M.T., LeResche, A., Truelove, E.L., Drangsholt, M.T., 2010. Gender differences in pain modulation by diffuse noxious inhibitory: A systematic review. Pain 150, 309–318.

White, K., Targett, M., Harris, J., 2018. Gainfully employing descending controls in acute and chronic pain management. Vet. J. 237, 16–25.

Yarnitsky, D., Crispel, Y., Eisenberg, E., Granovsky, Y., Ben-Nun, A., Sprecher, E., Best, L.A., Granot, M., 2008. Prediction of chronic post-operative pain: Pre-operative DNIC testing identifies patients at risk. Pain 138, 22–28.

Assessment of pain in neonates

Dr. Anoopam Jain

Clinical Director & Consultant in Neonatal Medicine

University Hospital Bristol NHS Foundation Trust

Pain assessment and its treatment in human newborn intensive care remains sporadic in the United Kingdom. One of our challenges is that pain assessment in newborn infants requires non verbal methods. There are many available pain assessment tools but what works in a research environment does not necessarily translate to the cotside. Within this talk I will discuss pain in the newborn infant, short and long term consequences of pain and methods to assess pain in a non verbal patient. There are places where similar assessments have been used in or adapted for use in animals. In light of the current proposals regarding animal sentinence legislation, it would be prudent for vetinary anaesthetists to consider if there methods of pain assessment in the human newborn infant that could be used in animal practice.

Key references;

1. Reynolds ML, Fitzgerald M. Long-term sensory hyperinnervation following neonatal skin wounds. Journal of Comparative Neurology 1995;358(4):487-98.

2. Ruda MA et al. Altered nociceptive neuronal circuits after neonatal peripheral inflammation [see comments]. Science 2000;289(5479):628-31.

3. Campana G et al; Mechanical nociception measurement in mice and rats with automated Von Frey equipment;Methods Mol Biol. 2015;1230:229-31

4. Franck LS. Measurement of neonatal responses to painful stimuli: a research review. Journal of Pain & Symptom Management 1997;14(6):343-78.

5. Fitzgerald M et al. Cutaneous hypersensitivity following peripheral tissue damage in newborn infants and its reversal with topical anaesthesia. Pain 1989;39(1):31-6.

6. Ambuel B et al; Assessing distress in pediatric intensive care environments: the COMFORT scale; J Pediatr Psychol. 1992 Feb;17(1):95-109.

7. van Dijk M et al; Taking up the challenge of measuring prolonged pain in (premature) neonates: the COMFORTneo scale seems promising. Clin J Pain. 2009 Sep;25(7):607-16

8. Jain A, Rutter N. The local anaesthetic effect of topical amethocaine gel in the newborn: A randomised controlled trial. Archives of Diseases in Childhood Fetal and Neonatal Edition 2000;82:F42 - 45.

9. Jain A, Rutter N. Does topical amethocaine gel reduce the pain of venepuncture in newborn infants? A randomised double blind controlled trial. Archives of Disease in Childhood Fetal and Neonatal Edition 2000;83(3):F207-210.

Controversies in the peri-operative administration of NSAIDs

1.Professor Richard Coward
Professor of Renal Medicine and Consultant Paediatric Nephrologist
University of Bristol

As a paediatric nephrologist Richard has seen first hand some of the renal complications of inappropriate NSAID use. In this presentation he will relay his human experiences and the lessons that he has learnt which may be helpful for Veterinary practice. This will be from both a clinical and mechanistic perspective.

1. Dr Hannah Gill
Clinical lecturer in anaesthesia
University of Bristol

I am a Paediatric Anaesthetist at Bristol Royal Hospital for Children. I frequently administer and prescribe NSAIDS in the peri-operative period as part of a multimodal approach to pain relief, but I am acutely aware of the risks from chronic usage of NSAIDS, acute use of particular ones and the specific circumstances where they are contra-indicated. I will attempt to outline these, opening up the debate with a renal physician and an Orthopod, and hope it leads to a lively discussion.

1.Professor John Innes
Referrals Director, CVS(UK) Ltd, ChesterGates Veterinary Specialists, Chester, CH1 6LT

Historical perspective

I graduated in 1991 and worked at Bristol Veterinary School as an intern. At that time, with the exception of phenylbutazone, there were no licensed NSAIDs for dogs. The Pain Group at Bristol Veterinary School, led by Professor Waterman-Pearson, was heavily involved in clinical research around NSAIDs. Importantly, clinical trials with a new molecule, carprofen, were undertaken by Duncan Lascelles in collaboration with Grampian pharmaceuticals (Lascelles, Butterworth et al. 1994, Lascelles, Cripps et al. 1998). As a junior surgeon, I was involved in those trials in that the case population were elective orthopaedic cases admitted to the Bristol Veterinary School. Safety of carprofen in those studies appeared good. Subsequently, carprofen was licensed and then sold on to Pfizer (now Zoetis). It is interesting to reflect that, in the early 1990s, carprofen was considered a weak COX inhibitor (Lees, McKellar et al. 1994, McKellar, Delatour et al. 1994) and the mode of its analgesic actions were elusive. However, during and after the licensing of carprofen by Pfizer in the USA, carprofen transformed in to a traditional NSAID although serious adverse events appeared to exhibit a somewhat different

pattern (MacPhail, Lappin et al. 1998). Have we lost something during that commercial journey of carprofen?

Around the same time, meloxicam, a more traditional NSAID, was licensed for dogs including for peri-operative analgesia (Tatari, Schmidt et al. 2001, Budsberg, Cross et al. 2002). Since then, we have seen other NSAIDs licensed for peri-operative use.

An orthopaedic surgeon's perspective

The majority of elective canine orthopaedic patients are otherwise healthy. In that situation, NSAIDs have brought huge benefits to our patient population. Concerns have been raised from experimental studies regarding the effects of NSAIDs on bone healing (Sivaganesan, Chotai et al. 2017, Borgeat, Ofner et al. 2018, Lisowska, Kosson et al. 2018). I will discuss this controversial area from a veterinary orthopaedics perspective.

References

Borgeat, A., C. Ofner, A. Saporito, M. Farshad and J. Aguirre (2018). "The effect of nonsteroidal anti-inflammatory drugs on bone healing in humans: A qualitative, systematic review." Journal of Clinical Anesthesia **49**: 92-100.

Budsberg, S. C., A. R. Cross, J. E. Quandt, L. S. Pablo and A. R. Runk (2002). "Evaluation of intravenous administration of meloxicam for perioperative pain management following stifle joint surgery in dogs." American Journal of Veterinary Research **63**(11): 1557-1563.

Lascelles, B. D. X., S. J. Butterworth and A. E. Waterman (1994). "Postoperative analgesic and sedative effects of carprofen and pethidine in dogs." Veterinary Record **134**(8): 187-191.

Lascelles, B. D. X., P. J. Cripps, A. Jones and A. E. Waterman-Pearson (1998). "Efficacy and kinetics of carprofen, administered preoperatively or postoperatively, for the prevention of pain in dogs undergoing ovariohysterectomy." Veterinary Surgery **27**(6): 568-582.

Lees, P., Q. McKellar, S. A. May and B. Ludwig (1994). "Pharmacodynamics and pharmacokinetics of carprofen in the horse." Equine Veterinary Journal **26**(3): 203-208.

Lisowska, B., D. Kosson and K. Domaracka (2018). "Positives and negatives of nonsteroidal anti-inflammatory drugs in bone healing: the effects of these drugs on bone repair." Drug Design Development and Therapy **12**: 1809-1814.

MacPhail, C. M., M. R. Lappin, D. J. Meyer, S. G. Smith, C. R. L. Webster and P. J. Armstrong (1998). "Hepatocellular toxicosis associated with administration of carprofen in 21 dogs." Journal Of The American Veterinary Medical Association **212**(12): 1895-+.

McKellar, Q. A., P. Delatour and P. Lees (1994). "Stereospecific pharmacodynamics and pharmacokinetics of carprofen in the dog." Journal Of Veterinary Pharmacology and Therapeutics **17**(6): 447-454.

Sivaganesan, A., S. Chotai, G. White-Dzuro, M. J. McGirt and C. J. Devin (2017). "The effect of NSAIDs on spinal fusion: a cross-disciplinary review of biochemical, animal, and human studies." European Spine Journal **26**(11): 2719-2728.

Tatari, H., H. Schmidt, A. Healy, H. Philipp and L. Brunnberg (2001). "Efficacy and safety of Meloxicam (Metacam((R))) in controlling perioperative pain in dogs undergoing orthopedic surgery." Kleintierpraxis **46**(6): 333-+.

Abstracts

Thursday 21st of March

Small animal stream

Time	Title
16.00	Influence of anaesthesia on the acetaminophen pharmacokinetics in Beagle dogs
16.15	The opioid-sparing effect of medetomidine constant rate infusion during thoraco-lumbar hemilaminectomy in dogs
16.30	Prevalence and management of pain in dogs in the emergency service of a veterinary teaching hospital
16.45	Effect of two different doses of butorphanol on propofol induction dose in dogs with suspected intracranial pathology undergoing brain MRI scan
17.00	Alfaxalone-midazolam anesthesia in Egyptian fruit bats (Rousettus aegyptiacus) and the effectiveness of flumazenil administration on recovery
17.15	Anaesthesia of zebrafish (Danio rerio): a comparison to two drugs for anaesthesia for caudal fin clipping.
17.30	Halothane minimum anaesthetic concentration determined for rock pigeons (Columbia livia) with a hybrid bracket methodology using stepwise electrical stimulation cycles

Influence of anaesthesia on the acetaminophen pharmacokinetics in Beagle dogs.

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To determine if the anaesthesia procedure could influence the intravenous acetaminophen pharmacokinetics (PK) in dogs as previously described with other drugs (Karademir et al., 2016).

Nine Beagle dogs were used twice one month apart. Acetaminophen PK was determined in awake (AW group) and anaesthetized (AN group) healthy dogs. Blood samples were collected before and 5, 10, 15, 30, 45, 60, 90 minutes and 2, 3, 4, 6, 8,12 and 24 hours after 20 mg kg^{-1} IV acetaminophen administration. Haematocrit, total proteins, albumin, alanine aminotransferase, aspartate aminotransferase, urea and creatinine were determined at baseline and 24 hours post-acetaminophen in both groups. Dogs were undergoing general anaesthesia (90 minutes) for dental cleaning. After dexmedetomidine (3 mcg kg^{-1} IM), anaesthesia was induced with propofol to effect, followed by acetaminophen administration. Anaesthesia was maintained with isoflurane in 50% oxygen (Et Iso 1.3-1.5%). $FE´CO_2$ was maintained 35-45 mmHg using mechanical ventilation and mean AP 65-80 mmHg using dopamine. A Wilcoxon test was used to compare PK data between groups and laboratory parameters data between groups and before *vs* 24 hours after administration.

No significant differences were found for volume of distribution 1.64 (0.92-3.55) and 1.75 (0.91-2.53) L kg^{-1}, clearance 1.65 (0.73-2.24) and 1.60 (0.80-1.90) L kg^{-1} $hour^{-1}$ or elimination half-life 2.41 (1.14-8.35) and 3.34 (1.92-6.34) hours between awake and anaesthetized dogs. Clinical laboratory parameters were within normal range and no significant differences were found. No side effects were registered.

Intravenous pharmacokinetics of acetaminophen was similar in awake and anaesthetized dogs under the study conditions.

1.Karademir U, Aksit D, Kum C, Erdogan H et al. (2016) The effect of surgery (ovariohysterectomy) on the plasma disposition of meloxicam following intravenous administration in dogs. BMC Veterinary Research 12:33.

The opioid-sparing effect of medetomidine constant rate infusion during thoraco-lumbar hemilaminectomy in dogs

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The opioid-sparing effect of a medetomidine constant rate infusion (CRI) during thoraco-lumbar hemilaminectomy in dogs was evaluated.

Forty-four client-owned dogs randomly received saline (SAL, n = 22) or medetomidine (MED, n = 22) 1 μg kg^{-1} loading dose, followed by 1.7 μg kg^{-1} $hour^{-1}$ CRI 10 – 20 minutes before surgical incision. Otherwise, all dogs received a standardised anaesthetic and analgesic protocol. Multiparametric monitoring, including invasive arterial blood pressures, was performed. The same investigator, unaware of the treatment, evaluated pain scores for 4 hours postoperatively. Rescue analgesia intraoperatively was with fentanyl if invasive SAP increased by ≥ 20% (first two boluses 5 minutes apart, followed by infusion if SAP did not return to baseline) or postoperatively with methadone if Glasgow pain score ≥ 5/20. Data was tested for normality (Shapiro-Wilk) and analysed with Fisher's exact test, Mann-Whitney U test, ANOVA and a mixed effects regression model.

The total amount of fentanyl administered (μg kg^{-1} $hour^{-1}$) was significantly lower with MED [0 (0 – 5.6)] compared to SAL [3.01 (0 – 9.4)]. Fewer dogs in MED (n = 1) required a fentanyl infusion compared to SAL (n = 12) (p = 0.001). There were no statistically significant differences between groups for intra- and postoperative rescue analgesia lag times, postoperative pain scores or amount of postoperative methadone. No differences were found for the cardiovascular data collected.

The addition of a medetomidine infusion to the anaesthetic protocol decreased the intraoperative opioid requirements and the need for a fentanyl infusion in dogs undergoing hemilaminectomy.

Prevalence and management of pain in dogs in the emergency service of a veterinary teaching hospital

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The prevalence and management of acute pain in dogs presenting to veterinary emergency services is sparsely described.
A prospective, cross-sectional study was designed to document: 1. prevalence of pain in dogs presenting to the emergency service of a veterinary teaching hospital, 2. provision of analgesics to painful dogs and 3. if treatment was instituted more quickly in painful dogs. Dogs were independently evaluated (Glasgow Composite Measure Pain Scale-short form) before (PRE) and after (POST) examination by the duty veterinarian and identified as painful/ non-painful based on pain scale intervention threshold (≥ 5/20). Time from initial veterinary examination to treatment was recorded. Comparisons between painful and non-painful dogs were performed with a Mann-Whitney test ($p < 0.05$ considered significant).
Complete PRE and POST data collected for 95 dogs. 36/95 (38%) were identified as painful. Approximately half of painful dogs (19/36) were provided analgesia in the clinic, the remainder were prescribed an analgesic for administration at home (11/36, 31%) or did not receive analgesics (6/36, 17%). Of those receiving analgesia in the clinic, the majority (12/19) showed a decreased pain score, below the intervention threshold. A smaller proportion of painful dogs not given analgesia in the clinic (3/17) showed a similar reduction in pain scores. There was no significant difference in the time from examination to treatment between painful and non-painful dogs ($p = 0.73$, 95%CI -14 to 20 minutes).
Pain assessment and management was suboptimal. Focused training in pain assessment, analgesic use and timely intervention is warranted and deserves further investigation.

Effect of two different doses of butorphanol on propofol induction dose in dogs with suspected intracranial pathology undergoing brain MRI scan.

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Butorphanol is a sedative commonly used as pre-anesthetic medication in dogs prior to non-invasive procedure (Girard et al. 2010).

The aim of this blinded, randomized trial was to compare 0.2 (L) and 0.3 (H) mg kg^{-1} of IV butorphanol as pre-anesthetic medication in dogs with suspected intracranial pathology undergoing brain magnetic resonance imaging (MRI). The hypothesis was that dose H would result in larger sparing effect on propofol induction dose than L.

Dogs received IV butorphanol 10 minutes prior to induction of general anesthesia (GA) with propofol. Subjects were mechanically ventilated to maintain normocapnia and GA was maintained with isoflurane. Scores for mentation, neurological status and sedation were obtained; dose of propofol, quality of induction, ease of intubation and recovery quality were also recorded. Monitoring included: heart rate, arterial blood pressure, FE'CO_2 and inspired and expired fractions of isoflurane and oxygen.

Data were analyzed using two sample Wilcoxon test, Student t-test and ANOVA for repeated measures.

Thirty-two dogs were enrolled. No difference between groups was detected in gender, body mass and age; mentation and neurological scores were similar between groups. Sedation score was significantly different (p = 0.017), with score of 3 (2 – 4) and 2 (1 – 4) in groups H and L respectively. Propofol induction dose was similar between groups. Monitored physiologic variables and recovery times were not statistically different.

The administration of 0.3 mg kg^{-1} butorphanol IV prior to brain MRI resulted in higher sedation scores but no propofol sparing effect or other significant differences were observed.

Girard NM, Leece EA, Cardwell JM et al. (2010) The sedative effects of low-dose medetomidine and butorphanol alone and in combination intravenously in dogs. Vet Anaesth Analg 37, 1e6

Alfaxalone-midazolam anesthesia in Egyptian fruit bats (*Rousettus aegyptiacus*) and the effectiveness of flumazenil administration on recovery

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The objectives of this study were to describe the use of alfaxalone-midazolam anesthesia in Egyptian fruit bats (*Rousettus aegyptiacus*), and to evaluate the effect of flumazenil antagonist on recovery time and quality.

Using a randomized, blinded, crossover trial, ten male Egyptian fruit bats were anesthetized with 15 mg kg^{-1} alfaxalone and 2 mg kg^{-1} midazolam administered subcutaneously. During anesthesia, vital signs and anesthetic depth were monitored every 10 minutes. Sixty minutes following anesthetics administration, 0.3 mg kg^{-1} flumazenil or saline 0.9% at an equivalent volume were administered subcutaneously. Time to induction (recumbency), time to first movement, and recovery time (flying) were measured, and quality of induction, anesthesia and recovery were assessed on a three-point scale (1 = poor, 2 = good, 3 = excellent). Student t-test and Wilcoxon signed-rank test were used for analysis, with p-value ≤ 0.05.

Mean ± SD induction time was 4.2 ± 1.9 minutes, with median quality score of 2 (range 1-3). Anesthetic depth indicators and heart and respiratory rates decreased significantly until 40-60 minutes. Time to first movement was 50 ± 12 minutes, with anesthesia quality score of 3 (1-3). Flumazenil administration significantly reduced mean recovery time compared to saline (10 ± 5 versus 45 ± 17 minutes, respectively), and significantly improved recovery quality (2.5 [2-3] versus 1 [1-2], respectively).

Combination of alfaxalone-midazolam provides smooth induction, muscle relaxation, and sufficient anesthesia in Egyptian fruit bats to perform non-painful procedures for at least 40 minutes. It is recommended to administer flumazenil for quicker and better recovery.

Anaesthesia of zebrafish (*Danio rerio*): a comparison to two drugs for anaesthesia for caudal fin clipping.

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Anaesthesia of zebrafish is required during the performance of procedures including caudal fin clipping. Buffered tricaine methanesulfonate (MS-222) is commonly used. The aim of this study was to compare the safety and efficacy of MS-222, at a commonly reported dose, with isoeugenol, according to the manufacturer's guidelines, for anaesthesia for caudal fin clipping.

Eighty zebrafish (AB strain, 5 months of age) were divided into 2 groups: MS-222 0.168 g L^{-1} (n=40) and isoeugenol 18.5 mg mL^{-1} (n=40). Within each group there were equal numbers of male and female fish. After the induction of anaesthesia the fish were removed from the bath for 30 seconds for caudal fin clipping. The times to induction of anaesthesia and the time to recovery from anaesthesia were recorded, the fish were monitored for 24 hours and euthanised the following day. Data were compared with an unpaired t-test.

The time to induction of anaesthesia was shorter with isoeugenol (141 ± 70 seconds) compared to MS-222 (207 ± 103 seconds) ($p = 0.0015$). The time to recovery from anaesthesia was shorter with MS-222 (372 ± 125 seconds) compared to isoeugenol (491 ± 176 seconds) ($p = 0.001$). There was no difference in either of these parameters between male and female fish. Two female fish in the MS-222 group were not adequately anaesthetised for the procedure within 10 minutes so anaesthesia was not continued. One male fish in the MS-222 group died.

Isoeugenol was a safe and efficacious alternative to MS-222 for anaesthesia of zebrafish.

The project was approved by the Animal Ethics Committee of the University of Western Australia (RA/3/100/1558).

Halothane minimum anaesthetic concentration determined for rock pigeons (Columbia livia) with a hybrid bracket methodology using stepwise electrical stimulation cycles

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Halothane is often used during electrophysiological studies of anaesthetised animals (Murrell and Johnson 2006). The aim was to describe the minimum anaesthetic concentration (MAC) of halothane in domestic rock pigeons.

Seven pigeons were anaesthetised with halothane in oxygen (FiO_2 >95 %). Following intubation mechanical ventilation was instigated to maintain stable anaesthesia and normocapnia (ET_{CO2} 30 – 40 mmHg). Electrical stimulation (30 Hz, 30 V, 7.5 ms duty-cycle) was used to determine MAC in a stepwise fashion as described by Valverde et al. (2003). Electrode impedance and delivered current were measured continuously using a digital oscilloscope. Paired electrodes were placed subcutaneously on the medial aspect of both left and right tibia and femur in a standardised pattern. The MAC of halothane was assessed starting at a predicted value (ET_{halo} 1.1 %). If gross purposeful movement was observed following stimulation, ET_{halo} was increased by 10 %, or if no movement was observed the ET_{halo} was decreased by 10%. Following a 15-minute period of stabilisation, the stimulation cycle was repeated. Each bird was subjected to a maximum of eight periods of electrical stimulation. Results are displayed as mean ± SD.

Seven birds completed the study with a mean of 7.4 ± 1.5 periods of stimulations per bird. The minimum anaesthetic concentration of halothane was determined to be 1.59 ± 0.19 %.

This determination of halothane MAC is the first to be reported in rock pigeons and also the first use of a step-wise stimulation methodology to determine MAC in birds.

Murrell, J. C., and C. B. Johnson. 2006. 'Neurophysiological Techniques to Assess Pain in Animals'. *Journal of Veterinary Pharmacology and Therapeutics* 29 (5): 325–335.
Valverde, Alexander, Timothy E. Morey, Jorge Hernández et al. 2003. 'Validation of Several Types of Noxious Stimuli for Use in Determining the Minimum Alveolar Concentration for Inhalation Anesthetics in Dogs and Rabbits'. *American Journal of Veterinary Research* 64 (8): 957–62. https://doi.org/10.2460/ajvr.2003.64.957.

Abstracts

Thursday 21st of March

Large animal stream

Time	Title
16.00	Caudal cervical nerve root perineural injection under ultrasonographic guidance: a pilot cadaveric descriptive study in horses
16.15	Comparison of lithium dilution cardiac output measurements when using the jugular or cephalic vein for lithium chloride administration in isoflurane anaesthetised goats
16.30	Validation of the UNESP-Botucatu composite pain scale for assessing postoperative pain in sheep
16.45	Complication-related variables in equine anesthesia: a retrospective study on 1161 cases undergoing colic and non-colic surgery
17.00	Does positive end-expiratory pressure (PEEP) influence the relationship between total impedance change measured by electrical impedance tomography (EIT) and tidal volume?
17.15	Behavioural and cardiovascular effects of constant rate infusion of medetomidine compared to detomidine for standing sedation in horses

Caudal cervical nerve root perineural injection under ultrasonographic guidance: a pilot descriptive study on equine cadavers

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Cervical radiculopathy has been identified in horses as a consequence of articular process joint arthropathy of the caudal cervical spine (Dyson 2011). Selective cervical nerve root injections are used in humans and dogs for therapeutic purposes and confirmation of cervical pain localization (Giambuzzi et al. 2016, Yamauchi et al. 2011).
The study aimed to describe the feasibility and the dye diffusion of selective perineural injection of the 7th and 8th cervical nerve *ramus ventralis* (C7 and C8) under ultrasonographic guidance in horses.
Perineural C7 and C8 injections on equine cadavers of similar lean neck conformation were performed under ultrasonographic guidance. Five C7 and five C8 were injected with a dye solution (7 or 14 mL randomly assigned for each root). Anatomic dissections including vertebral canal opening were conducted to confirm nerve dye staining and describe the extent of color diffusion.
The *ramus ventralis* of the spinal cervical nerves was visualized in all cadavers and had a portion stained for all 10 injections. Eight *rami* had a uniform transversal staining covering longitudinally a distance greater than 2 cm. One C7 and one C8 showed incomplete transversal staining with a more concentrated color on its cranial aspect and a longitudinal coverage of less than 2 cm. Five injections resulted in dye extending proximally and medially into the epidural space. Volume had no appreciable effect on the extent of nerve staining.
Ultrasonography-guided perineural injection of C7 and C8 *ramus ventralis* is a potentially reliable technique that may have multiple applications in multimodal analgesia.

Dyson SJ (2011) Lesions of the equine neck resulting in lameness or poor performance. Vet Clin North Am Equine Prac 27, 417–437.
Giambuzzi S, Pancotto T & Ruth J (2016) Perineural injection for treatment of root-signature signs associated with lateralized disk material in five dogs (2009–2013). Frontiers Vet Sci 3, 829–7.
Yamauchi M, Suzuki D, Niiya T et al. (2011) Ultrasound-guided cervical nerve root block: spread of solution and clinical effect. Pain Med 12, 1190–1195.

Comparison of lithium dilution cardiac output measurements when using the jugular or cephalic vein for lithium chloride administration in isoflurane anaesthetised goats

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Peripheral rather than central administration of lithium chloride (LiCl) for cardiac output (CO) measurement has been described as a valid alternative route in pigs and dogs (Kurita el at, 1999; Mason et al, 2002). The aim of this study was to compare CO measurements in goats when LiCl was administered via the cephalic and the jugular vein.

Paired cardiac output measurements were taken between 1 and 5 minutes apart during stable conditions in ten goats undergoing bilateral stifle arthrotomy. Normality was assessed with Kolmogorov-Smirnov test. Intraclass coeficient correlation (ICC) and 95% confidence interval (CI) and Bland-Altman method were used to analyze the agreement between the two routes of administration. Statistical analysis was performed using Stata 12.0. Significance was set at 0.05.

Forty-two paired CO measurements were included. The mean (SD) CO using the cephalic and jugular vein was 5.28 (1.29) L min^{-1} and 5.20 (1.24) L min^{-1} respectively. The ICC was 0.894 (95% CI 0.812; 0.941). The bias (cephalic-jugular) was 0.077 L min^{-1} (95% CI -0.104; 0.258). The Bland-Altman graphical method confirmed high test-retest reliability. When the CO was 5 L min^{-1}, ICC was 0.854 (95% CI 0.658, 0.942) and, if CO was > 5 L min^{-1}, ICC was 0.709 (95% CI 0.441; 0.862).

There was no statistical difference in CO measurements between the administration of LiCl using the cephalic or the jugular vein. Administration of LiCl via the cephalic vein when measuring CO with LiDCO in goats is a reliable alternative route.

References

Kurita T, Morita K, Kato S et al. (1999) Lithium dilution cardiac output measurements using a peripheral injection site: comparison with central injection technique and thermodilution. J Clin Monit Comput 15, 279 – 285.

Mason DJ, O'Grady M, Woods JP et al. (2002) Comparison of a central and peripheral (cephalic vein) injection site for the measurement of cardiac output using the lithium-dilution cardiac output technique in anesthetized dogs. Can J Vet Res 66, 207 – 210.

Validation of the UNESP-Botucatu composite pain scale for assessing postoperative pain in sheep

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The elaboration of valid tools to evaluate pain is required to diagnose pain and determine when analgesics are necessary. This study aimed to validate a tool to measure postoperative pain in sheep.

Laparoscopy was performed in 48 sheep, which were filmed preoperatively (M1) and postoperatively, before (M2) and after rescue analgesia (M3) and at 24 hours (M4). Four blinded observers evaluated the randomized edited footages twice with one-month interval. Intra- and inter-observer reliability was investigated by *kappa* coefficient. Criterion validation was evaluated by Pearson's correlation against the visual analogue scale (VAS), numerical (NS) and simple descriptive scale (SDS). Internal consistency was evaluated by Cronbach's α coefficient. Responsiveness (construct validity) was established according to the total scores (Friedman). Determination of the optimal cut-off point for rescue analgesia (CUT) was calculated by the Youden index and discriminatory ability of the CUT was estimated by the area under the curve (AUC), based on the Receiver Operating Characteristics curve.

Intra- and inter-observer reliability varied from 65 to 83% and 55 to 72% respectively. Correlations with VAS, NS, and SDS were 0.84, 0.82 and 0.78 respectively. Internal consistency was 0.77 in M2. Specificity and sensitivity were < 30% and > 70% for each item of the scale, except appetite. Total median scores in M2 were higher (8; 0 -11) than M1 (2), M3 (2) and M4 (0). CUT was > 4 of 12. AUC (0.98) showed excellent discriminatory ability.

The scale showed good criterion validation, moderate to very good reliability, responsiveness, and excellent internal consistency.

The Institutional Animal Research Ethical Committee approved this study under the protocol number 27/2017.

Acknowledgments: CAPES and São Paulo Research Foundation (FAPESP) provided funding to support this study (thematic project 2017/12815-0).

Complication-related variables in equine anesthesia: a retrospective study on 1161 cases undergoing colic and non-colic surgery

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A retrospective analysis was performed to determine the 48h post-surgery mortality and morbidity rates for elective and emergency cases in an equine university teaching hospital. It investigated the effect of horse-, anesthetic-, timing and clinician experience-related variables on anesthetic complications.

In total, 1161 horses undergoing general anesthesia between January 2012 and December 2016 were included in the study. Patient information and details of the anesthetic, recovery period and immediate complications were retrieved from an archival database. Statistical analysis of qualitative and quantitative factors affecting anesthetic complications was performed using an univariable and multivariable ordinal logistic regression. Odds ratio of variables primarily affecting mortality and complications were calculated. Statistical significance was set at $p < 0.05$.

General anesthesia-related global mortality rate was 1.29% but only 0.96% for non-colic cases. The overall anesthesia-related complication rate was 17%: neuromuscular (47%), respiratory (23.5%), systemic (17.5%) and cardiovascular (12%) problems. Ninety two percent of complications occurred during recovery. On overall complications fractures accounted for 0.5% and myopathies for 2%. Non-fatal major complications included postanesthetic paralysis, pulmonary edema, muscular weakness and myopathy.

Major risk factors for mortality and complications included increasing age (OR=1.7) and high weight (OR=1.6), ASA status (OR=2.1), lateral recumbency (OR=4.9), orthopedic surgery (OR=9.8), surgeon experience (OR=5.5), anesthesia length (OR=1.5) and hypotension (OR=1.2). In these models, colic surgery did not influence the rate of any complications.

This study reports similar mortality rates to Johnston (1995) for elective surgeries showing no evolution over the years.

Johnston GM, Taylor PM, Holmes WA et al. (1995) Confidential enquiry of perioperative equine fatalities (CEPEF-1): preliminary results. Equine Vet J 27(3) 193-200

Dugdale AH, Obhrai J, Cripps PJ (2016) Twenty years later: a single-centre, repeat retrospective analysis of equine perioperative mortality and investigation of recovery quality. Vet Anaesth Analg 43(2) 171-178

Does positive end-expiratory pressure (PEEP) influence the relationship between total impedance change measured by electrical impedance tomography (EIT) and tidal volume?

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The aim of this study was to determine the influence of positive end-expiratory pressure (PEEP) on V_T estimation using electrical impedance tomography (EIT) technology, and spirometry (L/breath).

In ten cows, premedicated with xylazine 0.1 mg kg^{-1}, anaesthesia was induced with ketamine 2 mg kg^{-1} and maintained with halothane in oxygen. An EIT belt was applied around the thorax at the level of the sixth intercostal space. Volume controlled ventilation was used. Tidal volume was measured using a spirometer connected to a flow-partitioning device. PEEP levels were increased in a stepwise manner 0,5, 10 and 15 cmH_2O respectively. At each PEEP level the V_T was increased stepwise at 5, 10 and 15 ml kg^{-1} respectively. After a minute of stabilisation total impedance change (delta Z), measured using EIT and V_T measured using spirometer data were recorded for the following minute before changing ventilator settings. Pearson's correlation between delta Z and L/breath was tested at each PEEP level, with a *P* value < 0.05 considered significant.

Both delta Z and L/breath increased with each step-wise increase in V_T in a linear manner. At PEEP 0, delta Z was significantly correlated with L/breath ($r = 0.83$, $P < 0.001$), however this correlation weakened with each increase in PEEP (PEEP 5, $r = 0.80$, $P < 0.001$; PEEP 10, $r = 0.67$, $P < 0.001$; PEEP 15, $r = 0.73$, $P < 0.001$).

Further evaluations of spirometry data are necessary to elucidate if physiologic factors or technical interactions account for the weakening of the correlation.

Behavioural and cardiovascular effects of constant rate infusion of medetomidine compared to detomidine for standing sedation in horses

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Due to its shorter elimination half-life, medetomidine may be preferable to detomidine for providing prolonged sedation for horses.

To facilitate high dose rate brachytherapy treatments, fifty horses were sedated with intravenous acepromazine (0.02 mg kg^{-1}), followed 30 minutes later by an alpha-2 agonist and then 5 minutes later, butorphanol (0.1 mg kg^{-1}). A constant rate infusion (CRI) of the same alpha-2 agonist commenced 10 minutes after butorphanol administration and maintained for the duration of treatment. Each horse received detomidine (bolus dose, 10 µg kg^{-1}; CRI, 6 µg kg^{-1} $hour^{-1}$) and medetomidine (bolus dose, 5 µg kg^{-1}; CRI, 3.5 µg kg^{-1} $hour^{-1}$ given one week apart in a blinded, randomised, cross-over study (Valverde 2013, Bettschart-Wolfensberger et al., 1999). Heart rate was measured via electrocardiography, and sedation and behaviour evaluated using a previously published scale (Marly et al., 2014). Behavioural scores were compared with Wilcoxon signed-rank test, frequencies of arrhythmias with Chi-squared tests, and heart rates with two-tailed paired t-tests.

There were no significant differences in the heart rate or number of arrhythmias between infusions ($p \geq 0.09$). Treatment time for medetomidine was longer [86 minutes (56 - 210) versus 80 minutes (46 - 243)], and ear movements were more numerous than with detomidine, suggesting there may be a difference in the sedation level. Fifteen horses had arrhythmias other than second degree atrioventricular block. One horse showed violent behaviour with medetomidine, necessitating removal from the study.

There was no demonstrable superiority of medetomidine compared to detomidine CRI at the dose rates used.

[1] Valverde A (2013) Balanced anaesthesia and constant-rate infusions in horses. Vet Clin Equine 29, 89-122

[2] Bettschart-Wolfensberger R, Clarke KW, Vainio O et al. (1999) Pharmacokinetics of medetomidine in ponies and elaboration of a medetomidine infusion regime which provides a constant level of sedation. Research in veterinary science 67, 41-46.

[3] Marly C, Bettschart-Wolfensberger R, Nussbaumer P et al. (2014) Evaluation of a romifidine constant rate infusion protocol with or without butorphanol for dentistry and ophthalmologic procedures in standing horses. Vet Anaesth Analg 41, 491-497.

Abstracts

Friday 22nd of March

Small animal stream

Time	Title
16.00	Development and initial evaluation of a manual slide rule based system for target controlled infusion of propofol in dogs
16.15	Influence of Incisional Block with Bupivacaine Pre- or Post- Surgery on Opioid Consumption in Dogs Undergoing Hemilaminectomy
16.30	Perianesthetic mortality in English bulldogs: a retrospective analysis between 2010 and 2017
16.45	Preliminary results for the comparison of topical treatment of gastro-oesophageal regurgitation in dogs under general anaesthesia

Development and initial evaluation of a manual slide rule based system for target controlled infusion of propofol in dogs.

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The clinical use of target-controlled infusion (TCI) may be restricted by limited availability of software controlled infusion pumps. A manual slide rule based system would allow TCI to be performed using any syringe driver.

The methodology described by Bruhn et al. (2002) was used to construct a slide rule calculating infusion rate from elapsed time, body mass and plasma target and a table giving the intravenous bolus required to achieve a desired plasma concentration. Elapsed time was divided into epochs of increasing duration (15-120 minutes) over four hours in total. Infusion rate for each epoch was calculated using pharmacokinetic simulations based on an established propofol TCI model (Beths 2001). Performance of the manual system was evaluated with pharmacokinetic simulations utilising bolus dose and infusion rates derived from the developed materials over a range of body mass (10-50 Kg) and plasma targets (1.0-5.0 μg ml^{-1}). During analysis the initial epoch was further divided into 0-2 and 2-15 minutes and deviation of simulated plasma concentration from plasma target calculated.

Simulated plasma concentration was significantly correlated with plasma target ($r = 0.996$, $p < 0.001$). The deviation from target during the 0-2 minute epoch was 0.37 ± 0.79 μg ml^{-1}, otherwise it was 0.04 μg ml^{-1} or less. Clinically significant relationships between deviation from target and plasma target or body mass were not demonstrated.

The manual system performed in a clinically appropriate way during simulations. Further evaluation, incorporating increases and decreases of plasma target, should be conducted before clinical use.

References

Beths T, Glen JB, Reid J et al. (2001) Evaluation and optimisation of a target-controlled infusion system for administering propofol to dogs as part of a total intravenous anaesthetic technique during dental surgery. Vet Rec 148, 198-203

Bruhn J, Bouillon TW, Ropcke H et al. (2002) A Manual Slide Rule for Target-Controlled Infusion of Propofol: Development and Evaluation. Anesth Analg 96, 142-147

Influence of Incisional Block with Bupivacaine Pre- or Post- Surgery on Opioid Consumption in Dogs Undergoing Hemilaminectomy

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Investigate the influence of bupivacaine infiltration before or after hemilaminectomy on peri-operative opioid consumption.

Thirty dogs, undergoing T13-L3 hemilaminectomy, were randomly assigned to receive bupivacaine 2mg/kg infiltration into the epaxial muscles before surgery (Group A), at wound closure (Group B) or no infiltration (Group C). Anaesthesia comprised dexmedetomidine 4 mcg/kg and methadone 0.3 mg/kg IV (premedication), alfaxalone IV (induction), and isoflurane in oxygen (maintenance). All dogs received meloxicam IV/PO. Response to surgery, defined as a change in physiological variables >20% above baseline, was treated with fentanyl 2.5 mcg/kg boluses, followed by a CRI at 5 mcg/kg/hr. The Glasgow Composite Pain Score (GCPS) was performed before premedication and at regular intervals until 24 hours postoperatively. Methadone 0.2 mg/kg analgesia was given IV if GCPS 5/20 or 6/24. Number of intraoperative, postoperative and total analgesic interventions was recorded. Analgesic interventions were analysed using Chi-Squared test, a Pocock approach (Schulz and Grimes, 2005) was used and statistical significance set as a p-value <0.029 with results presented as median (range).

Intra-operative analgesic interventions in Group A 0 (1), differed significantly from Group B 3 (2) and Group C 3 (3) (p = 0.019). For postoperative interventions, Group A 0 (0) and Group B 0 (0) differed significantly from Group C (1 (2) (p = 0.025), for total number of analgesic interventions Group A 0 (1), was significantly different to Group B 3 (2) and Group C 4 (5) (p = 0.014).
Bupivacaine reduced opioid consumption with pre-surgical infiltration having greatest benefit.

SCHULZ, K. F. & GRIMES, D. A. 2005. Multiplicity in randomised trials II: subgroup and interim analyses. *Lancet,* 365**,** 1657-61.

Perianesthetic mortality in English bulldogs: a retrospective analysis between 2010 and 2017

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Overall perianaesthetic mortality in dogs is 0.17 % (Brodbelt et al. 2008). The aim of this study was to determine the perianaesthetic mortality rate in English bulldogs at a veterinary teaching hospital.

Medical records from all English bulldogs, anaesthetised between January 2010 and September 2017, were collected. Data collected included: age, ASA status, weight, procedure types, anaesthetic duration, anaesthetic recovery location, and cause of death.

Data were collected from 345 anaesthetic episodes from 229 bulldogs. Nine bulldogs had anaesthetic-related deaths (3.93 %). Ages of survivors and non-survivors were 3 (0.25 – 14) (median (min – max)) and 3.7 (0.45 – 10.8) years, respectively. Anaesthetic duration in survived episodes was 2.5 (0.5 – 10) hours, and 3.5 (0.5 – 4.5) in non-survived episodes. ASA status of survivors and non-survivors was 2 (1 – 4) and 3 (2 – 4), respectively. Weights of survivors and non-survivors were 24.6 (4.1 – 57.9) and 24.8 (17.7 – 36.7) kg, respectively. Non-survivors were anaesthetised for brachycephalic airway reconstruction (n = 4), laparotomy (n = 3), ophthalmologic procedure (n = 2), cardiac procedure (n = 1), other respiratory procedure (n = 1), and/or urogenital procedure (n = 1). In the non-survivors, 7 recovered in ICU, one recovered in intermediate care unit, and one arrested intraoperatively. Five non-survivors required oxygen therapy immediately following extubation. The most common cause of death was respiratory dysfunction (89 %).

English bulldogs have a greater perianaesthetic mortality rate than what is reported for the general canine population. Most deaths occurred in the postoperative period secondary to respiratory complications.

Brodbelt DC, Blissitt KJ, Hammond RA, et al. (2008) The risk of death: the confidential enquiry into perioperative small animal fatalities. Vet Anaesth Analg 233, 1096-1104.

Preliminary results for the comparison of topical treatment of gastro-oesophageal regurgitation in dogs under general anaesthesia

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Gastro-oesophageal regurgitation (GOR) can lead to severe consequences such as oesophageal strictures. This study aimed to determine if oesophageal lavage significantly increases oesophageal pH during GOR management.

Dogs presenting with GOR under general anaesthesia were randomised into groups: lavage (G1) or no lavage (G2). All dogs underwent oesophageal suctioning until no further regurgitated material was retrieved. Dogs in G1 then had oesophageal lavage with tap water until the suctioned water was clear. All dogs had 4.2% sodium bicarbonate (0.6 ml kg^{-1}) instilled into the oesophagus. An oesophageal pH probe was placed to record pH immediately after: GOR (T1), suctioning (T2), lavage of the oesophagus (T3; G1 only) and sodium bicarbonate instillation (T4). Data were analysed with the Wilcoxon Rank-sum test and reported as median (range); $p < 0.05$ was considered significant.

Seventeen animals were recruited (G1: 8, G2: 9). pH was not significantly different at T1 [G1 3.18 (1.28 – 6.67), G2 2.95 (2.18 – 5.6); $p = 0.5$] or T4 [G1: 7.72 (6.2 – 8.9), G2: 7.8 (6.3 – 8.6); $p = 1.0$]. After lavage, pH increased by 1.2 (0.11 – 5.2) but overall change in pH following bicarbonate administration (T1 to T4) was not significantly different between groups [G1: 5.16 (2.11 – 6.21), G2: 4.12 (2.55 – 5.92); $p = 0.34$].

Both groups had similar and clinically important increases in oesophageal pH. Whilst oesophageal lavage increased pH this did not affect the final oesophageal pH when sodium bicarbonate was used. For this reason, oesophageal lavage may be an unnecessary treatment step.

Abstracts

22nd of March

Large animal stream

Time	Title
16.00	Pharmacokinetics and pharmacodynamics of hydromorphone hydrochloride in healthy horses
16.15	Clinical comparison of medetomidine and xylazine for isoflurane anaesthesia in horses
16.30	Evaluation of the Parasympathetic Tone Activity (PTA) monitor in horses undergoing xylazine-ketamine-isoflurane anaesthesia. Preliminary study.
16.45	Comparison of the cardiovascular effects of lidocaine or xylazine constant-rate infusion (CRI) in horses anaesthetized with isoflurane

Pharmacokinetics and pharmacodynamics of hydromorphone hydrochloride in healthy horses

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Opioids are a cornerstone of veterinary pain management, but have been minimally evaluated in horses. Study objectives were to determine physiologic and behavioral effects, and pharmacokinetics of hydromorphone in horses.

In a prospective crossover study, six healthy horses received hydromorphone 0.025 mg kg^{-1} IV (H0.025), hydromorphone 0.05 mg kg^{-1} IV (H0.05), or 0.9% saline, with a 7-day washout period. For each treatment, physiological, hematological, abdominal borborygmi score (ABS) and behavioral data were recorded over 5 hours. Fecal output was recorded over 24 hours. Data were analyzed using repeated measures ANOVA with significance at $p < 0.05$. Group H0.05 underwent blood sampling for quantification of hydromorphone and the metabolite, H3G, and pharmacokinetic modeling.

Hydromorphone administration resulted in increased heart rate (HR) and blood pressure, with values in H0.05 remaining higher than controls for 5 hours. Peak HR and mean arterial pressure for H0.05 were 59 ± 17 bpm and 169 ± 23 mmHg, respectively. Groups H0.025 and H0.05 had lower ABS than the saline group. Fecal output did not differ among treatments. No evidence of abdominal discomfort was observed. Recorded behaviors did not differ between groups. For hydromorphone, mean SD for volume of distribution at steady state, total systemic clearance, and AUC until the last measured concentration were 1.00 0.29 L kg^{-1}, 106 21 mL min^{-1} kg^{-1}, and 8.0 1.5 ng*h mL^{-1}, respectively.

Hydromorphone administered to healthy horses resulted in an increase in HR and BP with decreased abdominal borborygmi; however, fecal output was not affected

Clinical comparison of medetomidine and xylazine for isoflurane anaesthesia in horses

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This study compared the effects of two anaesthetic protocols (isoflurane + medetomidine versus xylazine) on cardiopulmonary parameters and recovery in horses.

Sixty horses undergoing elective surgery were randomly assigned to group medetomidine (M; n = 31) or xylazine (X; n = 29). After IM premedication with acepromazine horses were sedated with medetomidine 7 µg kg^{-1} or xylazine 1.1 mg kg^{-1} intravenously. Anaesthesia was induced with ketamine/diazepam and maintained with isoflurane in oxygen/air and medetomidine 3.5 µg kg^{-1} $hour^{-1}$ or xylazine 0.69 mg kg^{-1} $hour^{-1}$. Ringer's acetate and dobutamine were administered to maintain normotension. Controlled mechanical ventilation maintained end-tidal carbon dioxide pressures at 45 ± 5 mmHg (5.3 - 6.7 kPa). Heart rate, invasive arterial blood pressures, inspired and expired gas composition were recorded and arterial blood gases measured. Medetomidine 2 µg kg^{-1} or xylazine 0.3 mg kg^{-1} was administered before recovery. Recovery was timed and quality assessed with three different scoring systems. Data were analysed using two-way repeated-measures ANOVA, Mann-Whitney Rank Sum and t-test ($p \leq 0.05$).

No significant differences in mean ± SD were detected between groups regarding: anaesthesia duration (M: 145 ± 35, X: 148 ± 36 minutes), cardiovascular and respiratory variables and blood gases. With medetomidine $PaCO_2$ was higher at individual time points. Recovery was significantly longer with medetomidine (median (range): medetomidine: 64 (30 – 115), xylazine: 47.5 (24 – 92) minutes). Recovery scores did not differ between groups.

Medetomidine and xylazine at dose rates tested are comparable for isoflurane balanced anaesthesia for equine elective surgery.

Evaluation of the Parasympathetic Tone Activity (PTA) monitor in horses undergoing xylazine-ketamine-isoflurane anaesthesia. Preliminary study.

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To evaluate the association between changes in Parasympathetic Tone Activity (PTA) and haemodynamic parameteres (Gruenewald et al., 2013; Mansour et al., 2017) during noxious stimuli and drug administration in horses.

Observational, prospective study. Thirteen ASA I-II horses undergoing general anaesthesia for surgery. Horses received xylazine (1 mg kg^{-1}) IV. Anaesthesia was induced with ketamine (2.7 mg kg^{-1}) and diazepam (0.1 mg kg^{-1}) and it was maintained with isoflurane in oxygen. Depth of anaesthesia was assessed by palpebral reflex, nystagmus and muscle relaxation. Parameters (PTA, HR and MAP) were registered before and after the following events: 1-3-5 minutes after incision; 10 minutes after morphine administration (0.1 mg kg^{-1}); 3-5 minutes after ketamine administration (0.5 mg kg^{-1}); 5 minutes after dobutamine administration (0.5 μg kg^{-1} min^{-1}). Nociception was considered if HR increased ≥ 10%, MAP increased ≥ 20% or PTA decreased ≥ 20%. Data before and after each event were analysed using a Friedman and a Bonferroni tests. For the incision period Spearman correlation between PTA, HR and MAP was performed.

No significant changes were found during incision in PTA ($p = 0.272$), HR ($p = 0.113$) or MAP ($p = 0.268$), neither for other events. During incision, PTA and MAP showed a positive weak correlation (0.391). Ketamine and dobutamine events were registered in 10 and 21 occasions respectively. Six PTA decrement and three HR and three MAP increments were registered as nociceptive events.

During adequate depth of anaesthesia PTA showed a similar behaviour to haemodynamic parameters, remaining steady during the procedure.

1. Gruenewald M, Ilies C., Herz J et al. (2013) Influence of nociceptive stimulation on analgesia nociception index (ANI) during propofol-remifentanil anaesthesia. Br J Anaesth 110 (6), 1024–30.

2. Mansour C, Merlin T, Bonnet-Marin JM et al. (2017) Evaluation of the Parasympathetic Tone Activity (PTA) index to assess the analgesia/nociception balance in anaesthetised dogs. Res Vet Sci 115, 271–277.

Comparison of the cardiovascular effects of lidocaine or xylazine constant-rate infusion (CRI) in horses anaesthetized with isoflurane

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Lidocaine and xylazine are under investigation for preconditioning effects in intestinal ischemia-reperfusion syndrome.

Therefore we aimed to compare effects of lidocaine or xylazine CRI on haemodynamic variables during isoflurane anaesthesia.

As part of a terminal surgical study investigating pharmacological preconditioning, horses received either lidocaine 1.3 mg kg^{-1} or xylazine 1 mg kg^{-1} over 10 minutes as premedication. Anaesthesia was induced with guaifenesin to effect and ketamine 2.5 mg kg^{-1}, maintained with isoflurane and a CRI of lidocaine 0.05 mg kg^{-1} $minute^{-1}$ (group L; n = 5) or xylazine 1 mg kg^{-1} $hour^{-1}$ (group X; n = 5). Horses were mechanically ventilated. End-expiratory isoflurane concentration in both groups was kept at 1.2 - 1.3 vol%. Cardiac output (thermodilution), arterial and mixed-venous blood gases were determined at 60, 90, 170 and 200 minutes. Haemodynamic variables were calculated by standard equations indexed to bodyweight. Data were analysed using two-way-ANOVA and Bonferroni's t-test ($p < 0.05$).

Averaged over the four time points HR, MAP, cardiac index and oxygen extraction ratio were 35 ± 0 and 29 ± 2 beats $minute^{-1}$ ($p = 0.41$) , 62 ± 6 and 71 ± 6 mmHg ($p = 1.0$), 41.2 ± 3.2 and 30.8 ± 5.3 ml min^{-1} kg^{-1} ($p = 0.21$), 0.24 ± 0.02 and 0.36 ± 0.05 ($p = 0.49$) in group L and X, respectively.

In conclusion, both protocols obtain acceptable haemodynamic and oxygenation variables. Lidocaine seemed to maintain better cardiovascular function, which remained unproven due to the small sample size.

Posters

Thursday 21st of March

Agreement between invasive and oscillometric arterial blood pressure measurements using the LifeWindow multiparameter monitor and 2 different cuff sizes in anaesthetised adult horses

Evaluation of the pre-peritonel continuous wound infusion with ropivacaine for postoperative pain control following ovariohysterectomy in bitches

Evaluation of midazolam, lidocaine and fentanyl for co-induction of anaesthesia with propofol in sheep

An investigation into the use of mechanical nociceptive threshold (MNT) testing in dogs undergoing routine orthopaedic surgery.

Ultrasound-guided rectus sheath catheter placement in horses: a preliminary feasibility study

Friday 22nd of March

Comparison of continuous positive airway pressure and traditional oxygen therapy for treatment of postoperative hypoxemia in dogs

Analgesia by pharmacopuncture with flunixin meglumine into the acupoint GV1 (Ho Hai) in horses undergoing elective orchiectomy

Determination of the pharmacokinetics of medetomidine in Sprague-Dawley rats for refinement to the use of medetomidine and isoflurane in rodent functional MRI studies.

Plasma concentration and physiological responses to single and incremental combined doses of dexmedetomidine, tiletamine, zolazepam and butorphanol in growing pigs

Perception of small animal cardiopulmonary resuscitation in owners presenting to a small animal teaching clinic including a large first opinion service

Agreement between invasive and oscillometric arterial blood pressure measurements using the LifeWindow multiparameter monitor and 2 different cuff sizes in anaesthetised adult horses

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Arterial blood pressure monitoring using oscillometry is an attractive alternative to a direct (IBP) technique, but monitors vary in performance. The study aim was to compare oscillometric and IBP techniques. In a prospective, randomised clinical study, 43 adult horses undergoing general anaesthesia in dorsal recumbency for different procedures were recruited. Anaesthetic protocols varied according to clinician preference. IBP measurement was achieved after cannulation of the facial artery and connection to an appropriately positioned transducer connected to a LifeWindow monitor. Monitor accuracy was checked daily using a mercury manometer. For each horse, non-invasive blood pressure (NIBP) was measured with two cuff widths (corresponding to 25% or 40% of mid-cannon bone circumference), connected to the same monitor and six paired IBP/NIBP readings were recorded (minimum 3 minutes between readings). NIBP values were corrected to the level of the xyphoid process. A Bland-Altman repeated measures analysis was used to assess bias (NIBP-IBP) and limits of agreement (LOA).

The 40% cuff width (SAP: bias 7.9 mmHg, LOA -26.6 – 42.3. MAP: bias 4.9 mmHg, LOA -28.2 – 38.0. DAP: bias 4.2 mmHg, LOA -31.4 – 39.8) performed better than the 25% cuff width (SAP: bias 26.4 mmHg, LOA -21.0 – 73.8. MAP: bias 15.7 mmHg, LOA -23.8 – 55.2. DAP: bias 10.9 mmHg, LOA -33.2 – 54.9).

In the monitor studied, the 40% cuff width provided better agreement with IBP, however both cuff sizes failed to meet ACVIM Consensus Statement Guidelines for the Identification, Evaluation, and Management of Systemic Hypertension in Dogs and Cats.

Evaluation of the pre-peritonel continuous wound infusion with ropivacaine for postoperative pain control following ovariohysterectomy in bitches

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Lidocaine delivered via a wound catheter, offers effective analgesia after ovariohysterectomy in dogs (Morgaz et al., 2014). Ropivacaine has not been studied in dogs at all via wound catheter.

Twenty-two dogs were divided randomly into two groups: catheter group (CG), received ropivacaine for 24 hours (1 mg kg^{-1} + 0.8 mg kg^{-1} h^{-1}) delivered via wound catheter placed in the pre-peritoneal space and the epidural group (EpG), received ropivacaine (1.3 mg kg^{-1}) and morphine (0.1 mg kg^{-1}) epidurally after induction with propofol. At baseline and at 1, 2, 4, 6, 18, 21 and 24 hours after extubation, HR, f_R, rectal temperature and degree of sedation, were evaluated. Pain was assessed with a dynamic and interactive visual analog scale (DIVAS), Glasgow composite scale (CMPS-SF) and mechanical wound thresholds (MT) cranial, medial and caudal to the wound. In EpG, motor block and respond to digital clamp in hindlimbs were evaluated. When CMPS-SF ≥ 6, methadone (0,2 mg kg^{-1} IM) was administered. A Kruskal-Wallis test was carried out and when significant differences appeared, the Mann-Whitney U test was used.

At 6 hours, MT had a significantly higher values in CG (13.7 (10.1 - 16.7)) than in EpG (10.3 (2.2 - 14.8)). No other significant differences were found. Dogs in the EpG presented motor block for 1 - 4 hours. In EpG, one dog at 6 hours required rescue analgesia.

Ropivacaine delivered via a wound catheter is an alternative method to epidural anaesthesia after an ovariohysterectomy, without motor and sensitive block in hindlimbs.

Morgaz J, Muñoz-Rascón P, Serrano-Rodríguez JM et a. (2014) Effectiveness of pre-peritoneal continuous wound infusion with lidocaine for pain control following ovariohysterectomy in dogs. Vet J 202, 522-526.

Evaluation Of Midazolam, Lidocaine And Fentanyl For Co-Induction Of Anaesthesia With Propofol In Sheep

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Midazolam and fentanyl have been used as co-induction agents with propofol in dogs to reduce the propofol requirements during induction (Covey-Crump & Murison 2008; Minghella et al. 2016).

A prospective, randomized, blinded controlled study was performed in 60 sheep to evaluate the dose-sparing effect of midazolam (0.3 mg kg^{-1}, n = 15), lidocaine (1 mg kg^{-1}, n = 15) and fentanyl (3 μg kg^{-1}, n = 15) on propofol requirements and cardiopulmonary parameters.

Twenty minutes after premedication with detomidine (30 μg kg^{-1}) and morphine (0.2 mg kg^{-1}) IV, co-induction agent or saline (control group, n = 15) was injected over 60 seconds. Two minutes after, anaesthesia was induced with propofol to effect (1 mg kg^{-1} min^{-1}). Sheep were preoxygenated before and throughout the induction. Invasive arterial pressure, HR, *f*r, pH, $PaCO_2$ and PaO_2 were measured at baseline, 5 minutes after premedication and 2, 5 and 10 minutes after induction. Quality of sedation and induction were assessed. ANOVA and Bonferroni´s test was used for comparisons between groups and Dunnett´s test to compare baseline with each time point within group and propofol dose ($p < 0.05$).

Propofol requirement was significantly lower in midazolam and fentanyl groups (1.91 ± 0.84 and 2.59 ± 0.58 mg kg^{-1}, respectively) compared with saline group (3.35 ± 1.02). Cardiopulmonary variables changed over time but were not significantly different between groups. Quality of sedation and induction were similar in all groups.

Midazolam and fentanyl, but not lidocaine, decreased propofol requirement. Cardiopulmonary parameters were not different between the groups.

Covey-Crump GL, Murison PJ (2008) Fentanyl or midazolam for co-induction of anaesthesia with propofol in dogs. Vet Anaesth Analg. 35(6):463-72.

Minghella E, Auckburally A, Pawson P et al. (2016) Clinical effects of midazolam or lidocaine co-induction with a propofol target-controlled infusion (TCI) in dogs. Vet Anaesth Analg. 43(5):472-81.

An investigation into the use of mechanical nociceptive threshold (MNT) testing in dogs undergoing routine orthopaedic surgery.

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MNT testing is validated to evaluate nociceptive thresholds in dogs (Sanchis-Mora et al. 2017, Harris et al. 2018) and could improve assessment of pain state alongside Dynamic Interactive Visual Analog (DIVAS) and Short-Form Glasgow Composite (SFGCPS) pain scales. This prospective pilot study measured MNTs in 36 dogs by a blinded operator prior to surgery (T0), 4 (T4) and 24 hours (T24) after surgery. Data were analyzed using Student´s t test and Pearson correlation, considering $p < 0.05$ significant. Higher MNTs were measured at T4 in dogs that received an effective nerve block (PNB) (n = 25) compared to dogs that required rescue analgesia (fentanyl 1 µg kg^{-1}) (n = 11) in response to nociception during surgery (-0.56N ± 3.74 vs -3.82N ± 3.43, $p = 0.019$) suggesting a preventive analgesic effect. Higher MNTs were measured at T24 in dogs treated with paracetamol plus NSAID (PANSAID) (n = 15) in contrast with dogs receiving only NSAID (n = 21) (-2.20N ± 1.57 vs -5.60N ± 1.86, $p < 0.001$), while success rate of PNBs was 73% vs 67% respectively. Significantly fewer doses of postoperative analgesia (methadone 0.2 mg kg^{-1}) were administered in the PANSAID group within the 24-hour observational period (1.07 vs 1.90). MNTs, SFGCPS and DIVAS results were accordant over time but correlation was poor with this sample size. MNT testing could detect differences in analgesic provision following orthopaedic surgery. PANSAID with successful PNBs provided superior analgesia and informs protocol selection for subsequent studies.

References

Harris, L. K., Whay, H. R., & Murrell, J. C. (2018). An investigation of mechanical nociceptive thresholds in dogs with hind limb joint pain compared to healthy control dogs. The Veterinary Journal, 234, 85–90.

Sanchis-Mora, S., Chang, Y., Abeyesinghe, S., Fisher, A., Volk, H. A., Pelligand, L. (2017). Development and initial validation of a sensory threshold examination protocol (STEP) for phenotyping canine pain syndromes. Veterinary Anaesthesia and Analgesia 2017, 44, 600-614.

Ultrasound-guided rectus sheath catheter placement in horses: a preliminary feasibility study

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Post-operative pain after midline celiotomy in horses is commonly treated with non-steroidal anti-inflammatory agents alone. In humans, reduced analgesic consumption post-operatively has been reported following rectus sheath block (Cho, 2018). This study was designed to investigate the feasibility of rectus sheath catheter placement in the equine abdominal wall.

Fresh Shetland pony cadavers (n = 7) were used. The ventral abdominal wall was clipped and visualized using a curved-array ultrasound probe (Philips Lumify C8-5) starting 5-10 cm from midline, midway between umbilicus and the xyphoid process of the sternum, looking for the area of maximum rectus muscle diameter. With the rectus sheath visualized, a 20G Tuhoy needle (Perifix, BBraun) was introduced and a 10 mL povidone-iodine solution test injection made. Successful 'lifting' of the rectus muscle off the fascia was recorded, and (if seen) followed by catheter introduction with a further 30 mL injection via the catheter port. Visual confirmation of catheter advancement in the intended fascial plane was recorded. This procedure was performed bilaterally (14 insertions). The abdominal wall was dissected to reveal injectate and catheter placement.

Of fourteen attempts, twelve (86%) were ruled successful based on ultrasound imaging and confirmed by dissection. One insertion (7%) was a partial failure (injectate in rectus muscle, catheter in fascial plane) and one (7%) a full failure (injectate and catheter in intraperitoneal fat); both of these represented the first attempt by that anaesthetist and were correctly identified as failures by ultrasound.

These results require further confirmation prior to application in live horses.

1. Cho S, Kim YJ, Jeong K, et al. (2018) Ultrasound-guided bilateral rectus sheath block reduces early postoperative pain after laparoscopic gynecologic surgery: a randomized study. J Anesth 32, 189-197.

Comparison of continuous positive airway pressure and traditional oxygen therapy for treatment of postoperative hypoxemia in dogs

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Postoperative hypoxemia (PH) may occur up to 10 % of healthy dogs (Firulete et al. 2017). The aim of this study was to compare face mask O_2 supplementation or 5 cmH_2O continuous positive airway pressure at room air ($CPAP_{air}$) administered with a helmet, to treat PH.

Pulse oximetry at room air was monitored every 15 minutes for one hour after extubation (EXT) in dogs recovering from general anesthesia. Dogs that showed hypoxemia at EXT (SpO2 < 95 %) were randomized to receive $CPAP_{air}$ or O_2. Of the 34 dogs included in the study, 21 were hypoxemic of which 10 were treated with $CPAP_{air}$ and 11 with O_2,, the remaining 12 dogs were normoxemic, and served as the control group. Data were analyzed with ANOVA test ($P < 0.05$)

Mean ± SD values of SpO_2 recorded at room air at the different times of the study

Groups	Extubation	T0	T 15	T 30	T 45	T 60
Control	96.4 ± 1.7* #	97.1 ± 1.6*#	96.5 ± 1.2*	96.9 ± 1.6*	97.4 ± 1.5	97.1 ± 1.5
$CPAP_{air}$	89.6 ± 5.7	90.5 ± 2.8	95.7 ± 0.8 *	96.7 ± 0.9 *	97.1 ± 0.8	97.1 ± 1.1
0_2	93.6 ± 3.9 #	91.9 ± 2.9	93.4 ± 1.9	93.1 ± 2.1	94.9 ± 0.8	95.1 ± 2.1

* $P < 0.05$ Vs 0_2 group; # $P < 0.05$ Vs $CPAP_{air}$ group

CPAP at room air is an effective treatment of PH in dogs ensuring a faster reestablishment of normoxemia, compared to face mask O_2.

References

Firulete C, Di Bella C, Skouropoulou D et al. (2017) Incidence and treatment of early transitory postoperative hypoxemia in dogs without cardiopulmonary pathologies: a pilot study. In: BSAVA Congress 2018, BSAVA (ed), Birmingham, UK. pp. 1.

ANALGESIA BY PHARMACOPUNCTURE WITH FLUNIXIN MEGLUMINE INTO THE ACUPOINT GV1 (*HO HAI*) IN HORSES UNDERGOING ELECTIVE ORCHIECTOMY

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The aim of the study was to evaluate the effect of a 1/10 dose of flunixin meglumine into the Governing Vessel 1 (GV1) acupoint in horses underwent elective orchiectomy.

Twenty animals were given detomidine (0.02 mg kg^{-1}, IV), followed by ketamine (2.2 mg kg^{-1}, IV) and diazepam (0.1 mg kg^{-1}, IV), and intratesticular anesthesia (30 mL of lidocaine) for the surgery. As postoperative analgesia, the animals were given 1.1 mg kg^{-1} of intravenous flunixin meglumine (FIV) or 0.11mg kg^{-1} of flunixin meglumine into the GV1 acupoint (FGV). Pain assessment (Dalla Costa et al., 2014; Taffarel et al., 2015) was evaluated 12 hours before (baseline), and at 4, 6, 12, and 24 hours after the procedure; physiological parameters were measured at baseline and at 2, 4, 6, 8, 10, 12, 16, and 24 hours after the procedure.

The groups did not differ regarding pain assessment at any time. Heart rate was higher in the FIV group than in the FGV group at 2 hours (46 ± 5.2 vs. 37 ± 8.2 beats $minute^{-1}$). Gut sounds decreased at 2, 4, and 6 hours after surgery, in both groups. SAP was higher in the FGV group than in the FIV group at 8 hours (158 ± 18.1 vs. 134 ± 14.5 mmHg), 10 hours (157 ± 15.5 vs. 130 ± 11.5 mmHg), and 12 hours (151 ± 18.7 vs. 134 ± 15.8 mmHg).

Pharmacopuncture was equally effective as the conventional flunixin meglumine dose and route at pain control in horses underwent elective orchiectomy.

Dalla Costa E, Minero M, Lebelt D et al. (2014) Development of the Horse Grimace Scale (HGS) as a pain assessment tool in horses undergoing routine castration. PLoS One 9, e92281.

Taffarel MO, Luna SPL, Oliveira FA et al. (2015) Refinement and partial validation of the UNESP-Botucatu multidimensional composite pain scale for assessing postoperative pain in horses. BMC Vet Res 11, 1-12.

Determination of the pharmacokinetics of medetomidine in Sprague-Dawley rats for refinement to the use of medetomidine and isoflurane in rodent functional MRI studies.

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The combination of medetomidine and isoflurane is commonly used for anaesthesia of rodents undergoing functional magnetic resonance imaging (fMRI) because this combination of drugs appears to produce strong and reproducible resting-state and evoked blood oxygenation level dependent fMRI signals (Paasonen et al (2018)). The aim of this project was to 1) determine a target plasma concentration of medetomidine during low dose isoflurane anaesthesia of rats in an established protocol and 2) describe the pharmacokinetic profile of medetomidine administered subcutaneously in rats. Twenty-four male Sprague Dawley rats (333 ± 19 g) were randomly allocated to three equal groups: target plasma concentration identification (established protocol: isoflurane with medetomidine bolus 0.05 mg kg^{-1} SC then 0.15 mg kg^{-1} h^{-1} SC); SC = 0.05 mg kg^{-1} medetomidine SC; IV = 0.05 mg kg^{-1} medetomidine IV. The rats were anaesthetised with isoflurane and serial blood samples were collected prior to euthanasia up to 4 hours after the administration of medetomidine. Heart rate, expired CO_2, temperature and blood glucose concentrations were measured during anaesthesia. Serum samples were analysed using a liquid chromatography-tandem mass spectroscopy (LC-MS/MS) technique. Anaesthesia was uneventful in all rats aside from temporary apnoea after the administration of the bolus doses of medetomidine. The blood glucose concentration was >10 mmol L^{-1} during the study. The target plasma medetomidine concentration was 14.4 ± 3.0 ng/mL. Pharmacokinetic calculations will inform the ideal bolus and infusion regime for medetomidine with isoflurane for anaesthesia of rats for fMRI studies.

Paasonen J, Stenroos P, Salo RA, Kiviniemi V, Grohn O. (2018) Functional connectivity under six anesthesia protocols and the awake condition in rat brain. NeuroImage 172:9-20.

The project was approved by the Animal Ethics Committee of the University of Western Australia (RA/3/100/1599).

Physiological responses in relation to plasma concentration after one or two bolus doses of dexmedetomidine, tiletamine, zolazepam and butorphanol in growing pigs

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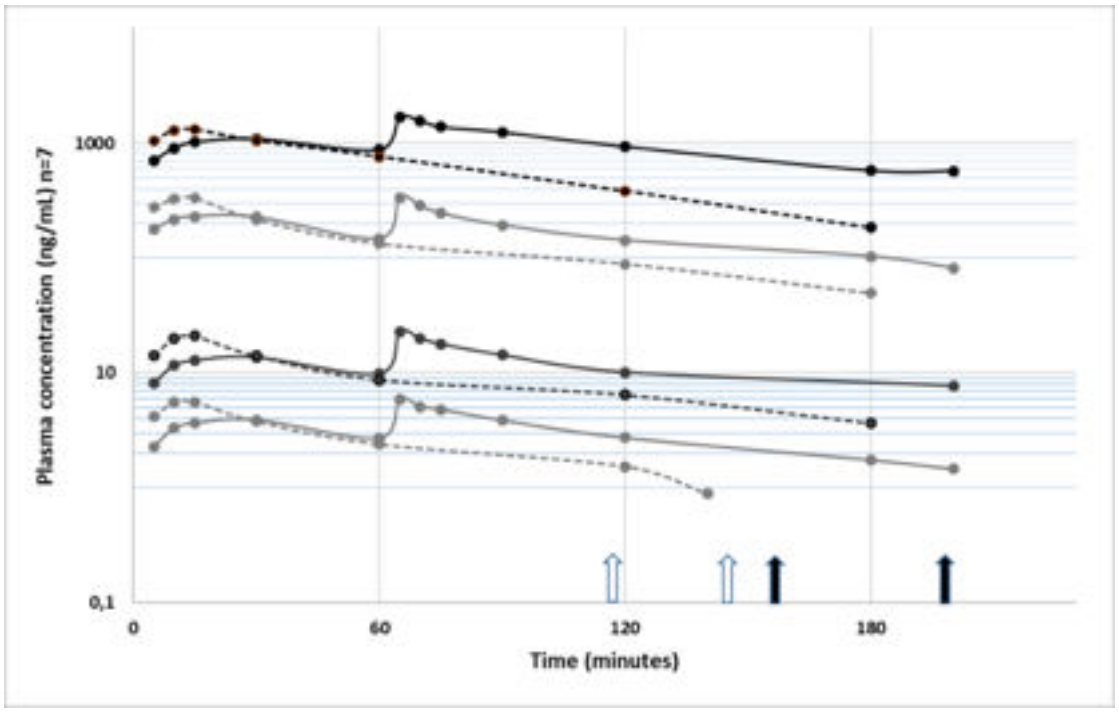
The pig is used as research animal. The aim was to evaluate physiological responses in relation to drug plasma concentrations after one or two bolus doses of anaesthetics.

Twelve pigs, 27–41 kg were randomised to one (1) or two bolus doses (2). In all pigs, anaesthesia were induced with dexmedetomidine 0.025 mg kg^{-1}, zolazepam/tiletamine 5 mg kg^{-1}, butorphanol 0.1 mg kg^{-1} intramuscularly. After 60 minutes group 2 was given dexmedetomidine 0.008 mg kg^{-1}, zolazepam/tiletamine 1.66 mg kg^{-1}, butorphanol 0.03 mg kg^{-1} intravenously. Blood samples were collected repeatedly from a MPC coated indwelling catheter, placed in the jugular vein (Ryden et al., 2018). Drug plasma concentrations were determined with mass spectrometry. Time to recumbency, first movements and standing position were recorded. Heart rate (HR), respiratory frequency (f_R), palpebral reflexes and response to noxious stimulus were monitored at set times points. Data was analysed by ANOVA, presented as mean ± SD, $p<0.05$ was considered significant.

Time to recumbency was 3.2 ± 0.8 minutes. HR and f_R did not change during anaesthesia. Palpebral reflex was absent in all pigs ten minutes after induction but the withdrawal reflex was present in some pigs after the initial injection.



Mean drug plasma concentration vs time points is shown as lin-log plot. Unfilled (single dose) and filled (two doses) arrows indicate time to first movement and standing, respectively.

The single intramuscular dose of the combination produced two hours of uneventful anaesthesia whereas the additional intravenous dosing prolonged the anaesthesia one hour.

RYDEN, A., MANELL, E., BIGLARNIA, A., HEDENQVIST, P., STRANDBERG, G., LEY, C., HANSSON, K., NYMAN, G. & JENSEN-WAERN, M. 2018. Systematic training enables stress free clinical examinations and samplings after kidney transplantation in pigs. In press.

Perception of small animal cardiopulmonary resuscitation in owners presenting to a small animal teaching clinic including a large first opinion service

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The purpose of this study was to gather information from veterinary clients to better understand and gauge the knowledge level and perception of small animal cardiopulmonary resuscitation (CPR) in an academic veterinary hospital.

An anonymous survey was developed and randomly distributed to a convenience sample of clients at a veterinary teaching hospital including a large first opinion service between October 2017 and March 2018. Of the 451 surveys distributed, 296 were used for the statistical analysis.

The majority of respondents (92%) knew the appropriate definition of CPR but only 11% knew how to perform CPR on a dog or cat. Most respondents (82%) wanted to discuss if their pet should or should not be resuscitated in the event of cardiac arrest. The mean estimate of rate of discharge provided by clients was 39.4% ± 25.6 and the majority of respondents (202 [68%]) got their estimate from an educated guess. The respondents who would choose CPR provided an estimated cost of US$257 ± 365 while the respondents who would not choose CPR provided an estimated cost of $491 ± 875 (p = 0.019). The respondents that watched television medical dramas estimated a higher rate of survival to discharge at 42% ± 25, while people who did not watch television medical dramas provided an estimated survival rate of 35% ± 26 (p = 0.034).

Inaccurate perceptions regarding cardiopulmonary resuscitation and survival rates exist amongst the general public. However, respondents are interested in becoming better informed.