AVA

March 10–13, 2018

Grenada, West Indies

SPRING MEETING **2018**

Anaesthesia and analgesia—myths and misconceptions

Association Of Veterinary Anaesthetists

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KEYNOTE SPEAKERS

ADAM AUCKBURALLY BVSc CertVA DipECVAA PGCAP FHEA MRCVS
Southern Counties Veterinary Specialists, UK

Adam qualified from Liverpool University in 1998, and went on to spend 6 years in a busy mixed veterinary practice in rural Staffordshire, where he developed a keen interest in anaesthesia and critical care. He then completed a residency at Glasgow University and was awarded the RCVS Certificate in Veterinary Anaesthesia in 2006, and the European Diploma in Veterinary Anaesthesia & Analgesia in 2007. Until 2017 Adam was a Senior Clinician at the University of Glasgow's teaching hospitals. He now works at Southern Counties Veterinary Specialists in the UK and is a European and RCVS Recognised Specialist in Veterinary Anaesthesia & Analgesia.

STUART CLARK-PRICE DVM, MS, DACVIM, DACVAA, CVA
Associate Professor of Anesthesiology, Auburn University College of Veterinary Medicine

Dr. Clark-Price received his Doctor of Veterinary Medicine degree from Ross University School of Veterinary Medicine after completing his clinical rotations at Cornell University in 2000. He stayed on at Cornell and completed a Theriogenology Internship and then went to Kansas State University where he completed an Equine Internal Medicine Residency in 2003. He returned to Cornell University and completed an Anesthesiology Residency in 2005. Dr. Clark-Price achieved Diplomate status in the American College of Veterinary Internal Medicine in 2005 and Diplomate status in the American College of Veterinary Anesthesia and Analgesia in 2008. His research interests include thermoregulation during anesthesia, methods of assessing recovery of horses from anesthesia and anesthesia of various exotic animals including amphibians and reptiles.

REGINE HAGEN DVM, CertAVP(VDI), dipECVDI
Associate Professor Vet Diagnostic Imaging , SGU, Grenada

Diploma in Veterinary medicine from the University of Bern Switzerland in 1998, Doctor of Vet med from Univ of Bern 2002. RCVS Certificate of Veterinary Radiology in 2003, Diploma of the European College of Vet Diag Imaging in 2006.

Worked at Equine Hospital of University of Berne in 1998, Dissertation at AO Center Davos, Switzerland 1999 to 2000 on a new device for intramedullary reaming in sheep. Residency in Diagnostic Imaging

at the Royal Veterinary College in London UK 2000 to 2003. Lecturer Diagnostic Imaging at the Royal Dick School for Veterinary Studies, University of Edinburgh, Scotland 2003 to 2007. Lecturer and Senior Lecturer at the Vetsuisse Faculty of the University of Zurich 2008 to 2013. Associate Professor Vet Diagnostic Imaging , SGU, Grenada 2014 to 2015. University of Zurich 2015 and since 2016 SGU Grenada, WI.

HESTER MCALLISTER MVB, DVR dipECVDI

Lecturer in Veterinary Diagnostic Imaging at University College Dublin, Ireland and in St Georges University, Grenada, WI

Hester McAllister is a lecturer in Veterinary Diagnostic Imaging at University College Dublin and in St Georges University, Grenada, WI. She is co-author of the textbook Diagnostic Radiology of the Dog and Cat with J.K Kealy and J Graham. She was the first President of the European College of Veterinary Diagnostic Imaging in 1996 and is the current Vice-President of the International Veterinary Radiology Association. She is a past recipient of the EVDI Douglas and Williamson award. Her interests are radiology and ultrasonography of all species.

JEFFREY S. MOGIL PhD

E.P. Taylor Professor of Pain Studies
Canada Research Chair in the Genetics of Pain at McGill University
Director of the Alan Edwards Centre for the Study of Pain

Dr. Mogil has made seminal contributions to the field of pain genetics and is the author of many major reviews of the subject, including an edited book, The Genetics of Pain (IASP Press, 2004). He is also a recognized authority in the fields of sex differences in pain and analgesia, and pain testing methods in the laboratory mouse. Dr. Mogil is the author of over 200 journal articles and book chapters since 1992, and has given over 280 invited lectures in that same period. He is the recipient of numerous awards, including the Neal E. Miller New Investigator Award from the Academy of Behavioral Medicine Research, the John C. Liebeskind Early Career Scholar Award from the American Pain Society, the Patrick D. Wall Young Investigator Award from the International Association for the Study of Pain, the Early Career Award from the Canadian Pain Society, the SGV Award from the Swiss Laboratory Animal Science Association, and the Frederick W.L. Kerr Basic Science Research Award from the American Pain Society. He currently serves as a Councilor at IASP, and was the chair of the Scientific Program Committee of the 13th World Congress on Pain.

DANIEL PANG DMV, PhD, MSc, Dipl ACVAA & ECVAA
Associate Professor, Faculty of Veterinary Medicine, Université de Montréal

After obtaining my veterinary degree from the University of Bristol, Daniel spent a little under a year in small animal practice in England, followed by an internship at the University of Glasgow's School of Veterinary Medicine. He completed residency training and an MSc in veterinary anaesthesia at the Université de Montréal and was awarded Diplomate status of the European (ECVAA) and American (ACVAA) colleges of veterinary anaesthesia in 2006 and 2007, respectively. His PhD was on the molecular mechanisms of volatile anaesthetics, conducted in the Franks' laboratory at Imperial College London. Daniel joined the University of Calgary Faculty of Veterinary Medicine as an Assistant Professor in 2010 before returning to the Université de Montréal as an Associate Professor in 2016.

The focus of his research is pain assessment and welfare. These overlapping themes form the basis of his group's clinical and laboratory-based research, as we have sought to understand the applications and limitations of pain and sedation assessment scales in a range of species (dog, cat, rat). Through applying these scales, they have recently begun to develop the concept of enhanced recovery protocols, for optimising recovery from anaesthesia and surgery.

MARKUS WEISS Prof. Dr. med.
Head of the Department of Anaesthesia at the University Children's Hospital of Zurich

Markus Weiss is Head of the Department of Anaesthesia at the University Children's Hospital of Zurich since 2006. He was promoted to Professor of Paediatric Anaesthesiology at the University of Zurich in 2012. Markus travels regularly to Armenia to provide Continuous Education in Paediatric Anaesthesia. He published more than 200 papers in peer-reviewed journals, and he is founder and board-member of the SAFE-TOTS initiative (www.safetots.org). One of his favourite topic is the difficult airway in children.

PRACTITIONERS DAY

SATURDAY, MARCH 10
SGU True Blue Campus, David Brown Hall

START	FINISH	ITEM	SPEAKER
12:30pm	12:45pm	Registration	
12:45pm	1:00pm	Welcome Ceremony	Dr. G. Wybern
1:00pm	1:50pm	What do my anaesthetic monitors tell me?	Dr. D. Pang
2:00pm	2:50pm	Does publication equals proof?	Dr. D. Pang
2:50pm	3:30pm	Coffee break	
3:30pm	4:20pm	Common clinical case presentations and rational peri-anaesthetic management	Dr. D. Pang
4:30pm	5:20pm	The Highs and Lows of Health Assessment Scale Validation	Dr. D. Pang

1:00pm–1:50pm
What do my anaesthetic monitors tell me?

Daniel Pang D.M.V., Ph.D., M.Sc., Dipl. ACVAA & ECVAA
Associate Professor
Faculty of Veterinary Medicine
University of Montreal

This interactive session will cover the strengths and limitations of different physiologic monitors. Physiologic principles will be used to explain the basis and importance of information provided by each monitor, and their role in case management, including common artefacts and misconceptions. Monitors discussed will include: capnography, pulse oximetry, non-invasive blood pressure (Doppler ultrasound and oscillometric).

1. Capnography. Hypoventilation is a commonly encountered adverse effect during general anesthesia. Capnography is a relatively inexpensive, extremely useful, monitor of ventilation. It works on the basis that measured expired (end tidal) carbon dioxide reflects adequacy of ventilation. This is because carbon dioxide levels are inversely proportional to minute ventilation: as alveolar ventilation increases, carbon dioxide levels in the body are decreased (and vice versa). The physiologic basis for this relationship is the relatively constant rate of carbon dioxide production in most patients and ventilation as a primary route of elimination. Therefore, capnography provides distinct advantages the traditional method of monitoring ventilation; respiratory rate. Relying on respiratory rate alone does not provide information on the tidal volume, beyond a subjective assessment of thoracic excursions or reservoir bag volumes. As minute ventilation comprises both respiratory rate and tidal volume, monitoring respiratory rate alone provides limited information. While capnography does not measure tidal volume, the relatively constant relationship between carbon dioxide levels and minute ventilation provides an overview of ventilation, with a normal range for end tidal carbon dioxide of 35-45 mmHg. Most capnographs also measure respiratory rate. In addition to expired carbon dioxide, the waveform displayed by capnographs (carbon dioxide level over time) can be analysed subjectively to provide useful information about rebreathing, breathing system integrity, bronchoconstriction and muscle relaxation. The displayed waveform and accuracy of end-tidal carbon dioxide level can be affected by artefacts and type of breathing system.

2. Pulse oximetry. Pulse oximetry (SpO2) is often considered a "fail safe" monitor as it can identify the life threatening situation of hypoxemia (defined as a partial pressure of arterial oxygen [PaO2] < 60 mmHg). Pulse oximetry is an indirect monitor of PaO2, that works on the basis of the non-linear relationship between arterial saturation of hemoglobin with oxygen and PaO2, described by the oxyhemoglobin dissociation curve. Because this relationship is non-linear (sigmoidal), SpO2 values during general anaesthesia are affected by the concentration of oxygen typically provided

(> 97%) and resultant supra-physiologic levels of PaO2 (> 100 mmHg). As a result, pulse oximetry is less sensitive to changes in PaO2 when high concentrations of oxygen are inspired in patients with normal respiratory function. As pulse oximetry collects information from peripheral tissue beds, recent technology provides limited interpretation of peripheral perfusion, based on the quality of the pulse oximeter waveform, which reflects arterial blood flow. Several situations may affect the accuracy and reliability of pulse oximeters: skin pigmentation, tissue thickness, tissue perfusion, carbon monoxide inhalation.

3. Non-invasive blood pressure. Hypotension is a common adverse effect of inhalational anesthetic agents and carries the risk of reduced organ perfusion and dysfunction. Invasive blood pressure monitoring provides instantaneous and accurate information on arterial blood pressure; however, invasive monitoring requires technical expertise and expensive equipment and can be associated with complications (hemorrhage, hematoma, infection). As a result non-invasive blood pressure monitoring is more commonly used. Monitoring with a Doppler ultrasound uses the principles of ultrasound detection of blood flow, combined with a cuff and aneroid manometer to identify a single value of arterial blood pressure. In cats, this value approximates the mean arterial blood pressure, a useful measure of driving pressure. In dogs, the value is usually considered as approximating systolic arterial blood pressure. In contrast, oscillometric blood pressure monitoring relies on automated detection of pulsatile flow through a cuff that, when combined with proprietary algorithms, produces an estimate of systolic, mean and diastolic blood pressure. Oscillometric monitors can differ considerably in their accuracy and reliability. Selecting an oscillometric monitor will be discussed, based on existing guidelines for accuracy and interpretation of research data.

2:00pm–2:50pm
Does publication equal proof?

Daniel Pang D.M.V., Ph.D., M.Sc., Dipl. ACVAA & ECVAA
Associate Professor
Faculty of Veterinary Medicine
University of Montreal

The clinical veterinary literature is expanding at an ever increasing rate, with wide variability in the quality of published papers. Attendees will learn the basic principles of how to evaluate clinical research papers. Topics covered will include quality of evidence, bias in study design and reporting, statistical significance versus clinical relevance, and reporting standards. Examples from the literature will be used to illustrate key points.

1. Quality of evidence. Publication depends on a well-established yet highly variable evaluation process, based on peer review. As peer review depends on a largely subjective interpretation of quality, open to bias, it is no surprise that readers cannot rely on peer review as a guarantee of quality. Consideration of the source of information provides a starting point for evaluating the potential quality of evidence. In general, randomized controlled trials, meta analyses and systematic reviews rank above observational studies, case reports, editorials and textbooks. Beyond study type, the reporting of factors associated with bias and adherence to available reporting guidelines can be used as indicators of study quality.

2. Bias in study design and reporting. There is increasing evidence that absence of reporting certain sources of bias are associated with an overinflation of effect size, resulting in wasted financial and animal resources. These sources of bias, the "Landis 4", are randomization, blinding, data handling and sample size estimation. Surprisingly, these fundamentals of good study design are lacking in a high percentage of laboratory animal research papers, and recent evidence suggests a similar pattern in veterinary clinical research. Furthermore, neither journal impact factor nor research institute quality appear to predict the likelihood of these sources of bias.

3. Statistical significance versus clinical relevance. Positive findings are easier to publish than negative results. In turn, publications are required for career advancement and successful grant applications. These factors increase the pressure to find and emphasise significant results, with the declaration of "significance" based on statistical testing. However, to be of clinical value, statistical significance should be placed in the context of clinical relevance or importance. For example, small, yet "significant", changes in liver enzyme values are of limited interested if disease is associated with large changes. Furthermore, as statistical software becomes more accessible and simple to use, multiple inappropriate statistical tests can be applied until a significant result is achieved ("p hacking").

4. Reporting standards. Numerous studies have shown that key information is frequently unreported in research papers, making it impossible to reproduce studies. This deficiency has been associated with the waste of billions of research dollars in laboratory animal research. As a result, a large number of reporting guidelines (> 300) are now available, several of which (e.g. ARRIVE, CONSORT, REFLECT) have been adopted by veterinary journals. Unfortunately, adherence to reporting guidelines is poor, despite widespread agreement that they are useful and important. Therefore, the status quo remains, with little improvement in the potential to reproduce studies.

3:30pm–4:20pm
Common clinical case presentations and rational peri-anaesthetic management

Daniel Pang D.M.V., Ph.D., M.Sc., Dipl. ACVAA & ECVAA
Associate Professor
Faculty of Veterinary Medicine
University of Montreal

This session is a refresher and update on anaesthetic case management in companion animal species (dogs, cats, rabbits). A case-based presentation format will be used to guide attendees to rational peri-operative care and drug selection for common clinical scenarios, such as brachycephalic obstructive airway syndrome, feline hypertrophic cardiomyopathy, and mitral valve disease.

1. Brachycephalic obstructive airway syndrome. Brachycephalic obstructive airway syndrome is typically characterised by stenotic nares, everted laryngeal saccules, an elongated soft palate and a hypoplastic trachea. Affected breeds may present with minimal clinical signs of respiratory compromise, stridor or respiratory distress. Additionally, these breeds may be excitable, have increased vagal tone and an increased risk of gastric reflux. Successful perioperative care includes management of these factors and timely control of the airway. Sedation before induction of anesthesia provides anxiolysis, facilitating intravenous cannula placement, reduces the requirements of anesthetic drugs and can smooth recovery. However, muscle relaxation associated with sedation and contribute to respiratory obstruction, precipitating respiratory distress. Consequently, sedation should be tailored on an individual basis, depending on respiratory signs, temperament and reason for presentation. Different options for premedication, their various advantages and disadvantages, will be discussed. Tracheal intubation and extubation are the other critical phases during anesthetic management of these breeds. The rapid loss of muscle tone and hypoventilation associated with induction of anesthesia is associated with respiratory obstruction and hypoxemia, and intubation can be challenging as a result of their unique anatomy. During recovery, the challenge is to decide the optimal time to perform extubation, while preparing for the possibility of an obstructed airway. Tips and strategies to maximise successful and smooth management of these phases will be presented.

2. Feline hypertrophic cardiomyopathy. Feline hypertrophic cardiomyopathy results in an increase in myocardial mass with a subsequent decrease in ventricular filling capacity. In combination with a limited increase in myocardial perfusion, these cats have a considerable risk of sudden death perioperatively, as a result of a fatal arrhythmia. Avoiding tachycardia by controlling factors causing catecholamine release is key to limiting the risk of perioperative arrhythmias and mortality. These factors include stress, optimal oxygenation and ventilation, analgesia and appropriate management of blood pressure. A commonly encountered presentation of these cases is an aggressive, geriatric cat for

a dental procedure. Different options for case management, with a focus on sedation, heart rate and blood pressure management will be discussed.

3. Mitral valve disease. Mitral valve disease is the most common acquired cardiac disease in dogs, with a typical signalment of an older, small breed dog. In many cases, a presumptive diagnosis is made based on signalment and the presence of a cardiac murmur, without an option for a cardiology referral. The key to evaluation of anesthetic risk and successful case management in these dogs is interpreting clinical signs, ruling out pulmonary edema, a relevant history, and understanding pathophysiology. Dogs with significant cardiac disease, with a likely impact on anesthetic risk, have reduced heart rate variability (indicative of dependency on heart rate to maintain cardiac output and blood pressure) and reduced exercise tolerance. The presence of pulmonary edema is a contraindication for anesthesia. The goals of cardiovascular support during anesthesia are to support heart rate within a range close to the resting rate and avoid significant vasodilation or vasoconstriction. Vasodilation leading to hypotension increases the demands on a heart that has a limited ability to increase output as it attempts to maintain blood pressure. In contrast, vasoconstriction increases the fraction of left ventricular output that re-enters the left atrium and decreases cardiac output. Various options for anesthetic management using goal-directed therapy will be presented.

4:30pm–5:20pm
The Highs and Lows of Health Assessment Scale Validation

Daniel Pang D.M.V., Ph.D., M.Sc., Dipl. ACVAA & ECVAA
Associate Professor
Faculty of Veterinary Medicine
University of Montreal

Scales for assessing a wide variety of conditions, such as pain and sedation, are becoming widely available. To gain the maximum benefit from information provided by available scales, an understanding of scale development (and its limitations) is crucial. Key concepts of scale development and how they affect scale use and interpretation will be described, using pain and sedation scales in a variety of species (dogs, cats, rabbits, rats) as examples.

The ultimate goal of scale development studies is to validate a novel scale for clinical (or research) use. Unfortunately, scale validation is a complex process that is poorly understood by many scale users (researchers and practitioners). The key concepts of scale validation are reliability, validity and generalisability. Reliability (measurement error associated with a scale) can be assessed with internal consistency, inter- and intra-rater reliability. Internal consistency reflects the relationship between scale items (how closely they measure the same thing). Inter- and intra-rater reliability indicate the ability of a scale to generate similar results between different raters and the same rater at different times, respectively. Validity (the effectiveness of a scale to measure the subject of interest) has several forms, the most commonly evaluated are criterion, content and construct validity. Criterion validity compares a scale's performance against an existing, accepted standard. This can be challenging in animals when the subject of interest is difficult to measure with certainty (e.g. pain experience in animals) or an accepted standard does not exist. Content validity is often based on face validity, where expert opinion is used to determine if the scale contents make sense for the subject of interest (e.g. does respiratory rate reflect pain?). Construct validity applies hypothesis testing to assess scale performance during different experimental conditions (e.g. do pain scale scores increase as predicted following painful procedures?). Generalisability describes the ability of a scale to perform as predicted during validation studies in a range of different (heterogenous) settings. These may include animal population, type of subject (e.g. acute versus chronic pain) and personnel (e.g. experienced versus inexperienced veterinarians). Generalisability is difficult to predict without follow-up studies in heterogenous settings. Recently, validated feline pain scales have been shown to be sensitive to the use of ketamine (inflated pain scores in the absence of a painful procedure) and temperament (shy or aggressive cats artificially elevated pain scores). Such limitations do not reflect a failure of scale validation but should be suspected when scales are used in different settings.

For scales to be clinically useful they must be practical to use and help guide decision making. Valid, yet complex, scales that take many minutes to use or require specialised training are of limited practical value. Ideally, scale development should derive a relationship between scale scores and a suggested intervention (e.g. likely requirement for analgesia). This helps to guide decision making and support patient care. An understanding of scale validation allows practitioners to make informed decisions regarding scale use and interpretation.

PRECONFERENCE DAY

SUNDAY, MARCH 11

SGU True Blue Campus, David Brown Hall

START	FINISH	ITEM	SPEAKER
7:30am	8:30am	Registration	
9:00am	9:50am	Inadvertent perianesthetic hypothermia: in review	Dr. S. Clark-Price
10:00am	10:50am	Hypoxaemia in anaesthetised horses	Dr. A. Auckburally
10:50am	11:20am	Coffee	
11:20am	12:10pm	Complications during ventilator support	Dr. A. Auckburally
12:10pm	1:30pm	Lunch	
1:30pm	2:20pm	Fluid therapy for colic - can we cause harm?	Dr. A. Auckburally
2:30pm	3:20pm	Imaging of the thorax - significance for the anaesthetist	Drs. McAllister and Hagen
3:20pm	3:50pm	Coffee	
3:50pm	4:40pm	Imaging of the abdomen- significance for the anaesthetist	Drs. McAllister and Hagen
5:00pm	7:00pm	Registration at the Radisson	
6:00pm	8:00pm	Welcome reception at the Radisson	

9:00am–9:50am
Inadvertent Perianesthetic Hypothermia: A Review

Stuart Clark-Price, DVM, MS, DACVIM, DACVAA
Associate Professor of Anesthesia
Auburn University
College of Veterinary Medicine
Auburn, AL USA
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Inadvertent perianesthetic hypothermia (IPH) is one of the most common complications associated with general anesthesia in small animals. In fact, 70% of people and nearly 85% of dogs undergoing general anesthesia experience IPH. Hypothermia can have severe detrimental effects to a patient during the perianesthetic period and can include increased infection rates, delayed wound healing, decreased or inappropriate organ function, coagulopathy, pharmacokinetic alterations of administered medications, changes in inhalant anesthetic requirements, and delayed recovery. It has therefore been recommended that for any anesthetic event expected to last longer than 20 minutes, a heat loss minimization technique should be performed.

Core body temperature is the temperature of an organism at which it was meant to operate and tends to refer to the temperature of organs and deep structures of the body that are well insulated and is tightly regulated. Core temperature changes during anesthesia occur in a relatively predictable fashion in three phases. During phase one, usually occurring during the first hour, there is an initial rapid decline in core temperature, next, during phase two, over the following two hours, core temperature declines in a slower linear fashion, and finally, during phase three, core temperature stabilizes and remains relatively unchanged. The factors associated with the speed and magnitude of the heat loss that occurs during the three phases are based on many patient, drug, and environmental factors but the mechanisms of heat loss from the patient to patient remain the same.

Mechanisms of Heat Loss:

Convection: the loss of heat to cooler air surrounding the body
Conduction: the loss of heat to cooler objects in contact with the body
Radiation: the loss of heat to objects not in contact with the body
Evaporation: the loss of heat from evaporating moisture from the body

The body has many inherent mechanisms to defend a temperature set by the hypothalamus that can be utilized for both heat conservation/generation and heat dissipation. To increase or conserve body heat, physiologic mechanisms include changing vascular tone, piloerection, shivering and metabolic thermogenesis. Changes in vascular tone, sweating, panting and decreasing metabolic activity can be

utilized to decrease body temperature. All of these mechanisms are under some degree of autonomic nervous control and anesthetic drugs can interfere with the body's ability to adapt to a cooling environment. For example, not only do inhalant anesthetics decrease vascular tone and increase heat dissipation, hypothalamic responses to internal temperature decreases are blunted thus diminishing appropriate metabolic responses to hypothermia.

Techniques for minimizing IPH and in turn potentially decreasing side effects can be placed in to one of three categories, passive, active, and metabolic. Passive techniques that reduce the heat loss by countering convective and conductive heat loss include use of insular materials such as towels or other materials used to cover or wrap the patient. Active techniques apply heat to the surface of the patient in an attempt to reduce the heat gradient from the patient to the environment and slow the rate of heat loss. Some of the more common active techniques include forced warm air blankets, circulating warm water pads, and electric blankets. Metabolic techniques, although well described in human medicine, are still mostly in a research phase in veterinary medicine but have shown promise. This method provides a substrate to the patient that when utilized, induces the patient to produce more endogenous heat.

Inadvertent perianesthetic hypothermia is a common complication associated with general anesthesia of veterinary patient and can have clinically relevant adverse effects. By having an understanding of the mechanisms behind the development of IPH and methods for treatment and prevention, veterinary practitioners can improve the care and outcomes of their patients.

MCQs

In mammals, the tissue (organ) with the highest normal temperature is:

a. The heart
b. The brain
c. The liver
d. The lungs
e. The skin

The "thermostat" of the body is located in which of the following:

a. The pulmonary artery
b. The carotid body
c. The pons
d. The hypothalamus
e. The abdominal viscera

Cold temperature information is carried from the periphery to the spinal cord via which type of fibers?

a. A-delta fibers
b. C fibers
c. A-beta fibers
e. Cold specific fibers
f. A-alpha fibers

Heat loss from conduction is:

a. Loss of body heat to cooler air surrounding the body
b. loss of body heat to surfaces in contact with the body
c. Loss of body heat to structure not in contact with the body
d. loss of body heat from evaporation of moisture

Which of the following is not part of the lethal triad of trauma?

a. Coagulopathy
b. Metabolic acidosis
c. Hemorrhage
d. Hypothermia

In dogs, techniques that minimize inadvertent perianesthetic hypothermia should be employed for any anesthetic event longer than:

a. 5 minutes
b. 20 minutes
c. 60 minutes
d. 90 minutes
e. 120 minutes

Which of the following is not an active technique for reduction of perianesthetic hypothermia

a. Metallic fabric reflective blanket
b. Force warm air blanket
c. Warmed abdominal lavage
d. Circulating warm water pad
e. Resistive polymer electric blanket

10:00am–10:50am
Hypoxaemia in the Anaesthetised Horse

Adam Auckburally BVSc CertVA DipECVAA PGCAP FHEA MRCVS
Southern Counties Veterinary Specialists, UK

Horses commonly experience hypoxaemia during general anaesthesia. Anatomical arrangements and physiological adaptations make horses more susceptible to derangements in gas exchange. However, the long-term outcome of intraoperative hypoxaemia is largely unknown. Although hypoxaemia does not necessarily lead to oxygen deprivation in the tissues, the combined depressant effect of sedatives and anaesthetics on cardiac output and gas exchange can lead to reduced tissue oxygenation.
In conscious humans, hypoxaemia can cause symptoms that mimic mild brain injury (confusion, drowsiness and blurred vision). We might presume that horses may experience this when recovering from general anesthesia if they have suffered significant intraoperative hypoxaemia. Furthermore, because oxygenation is not monitored in recovery and oxygen supplementation is reduced or withdrawn, undetected hypoxaemia may also be present in the recovery room. Other consequences include increased myocardial lactate and subsequent effects on contractility, muscle injury and effects on wound healing and wound infection. However, the equine oxygen haemoglobin dissociation curve is left shifted (lower p50 value) compared with humans. Equine haemoglobin is therefore better at loading oxygen in the lung and our definition of hypoxaemia in terms of PaO2 may need to be different in horses. However, left shifting of the curve means that the haemoglobin is less efficient at offloading oxygen to the tissues.

Risk factors for the development of hypoxaemia have been identified (e.g. dorsal recumbency, emergency procedures), although the exact incidence in the general population of anaesthetised horses is not reported. Recumbent horses have dependent areas of lung compressed by abdominal viscera leading to a fall in functional residual capacity and large areas of atelectasis. This region of lung continues to be well perfused and a large intrapulmonary shunt develops. This is the major cause of hypoxaemia in anaesthetised horses. Additionally, breathing highly absorbable gases like oxygen, can also contribute to atelectasis and it is frequently necessary to administer 100% oxygen to horses. In conscious animals, hypoxic pulmonary vasoconstriction reduces the effects of poorly ventilated areas of lung on global oxygen content. Volatile anaesthetics depress this physiological mechanism in a dose dependent manner and therefore the anaesthetised horse is unable to compensate for atelectatic lung.

As we can assume that hypoxaemia is harmful, there have been attempts to develop methods to reduce the severity or to minimize hypoxaemia developing. These strategies have focused on recruiting atelectatic lung and keeping the lung ‘open’ with positive end expiratory pressure. Whilst this can be successful, there are often cardiovascular consequences, which may compromise either gas exchange further or affect oxygen delivery. Furthermore, the risk of injuring the lung using many

of these strategies is increased, particularly if the lung is already injured. Provision of continuous positive airway pressure as an adaptation to spontaneous ventilation has been shown to be effective in managing hypoxaemia. Other treatments manipulate pulmonary perfusion and divert blood away from atelectatic regions to well ventilated areas, and reduce intrapulmonary shunt. Pulsed inhaled nitric oxide administration has been extensively studied and significantly improves oxygenation. It is a potent pulmonary vasodilator and when administered to anaesthetised horses, reduces perfusion of atelectatic areas of lung and improves perfusion of ventilated regions.

More work is required to definitively identify the impact of intraoperative hypoxaemia on mortality and morbidity in horses, and to further identify which treatment options lead to better overall outcomes.

MCQs

1. What is the p50 value of equine haemoglobin?

   a. 23.8 mmHg
   b. 26.6 mmHg
   c. 25.0 mmHg
   d. 28.8 mmHg

2. During which part of the respiratory cycle should pulsed inhaled nitric oxide be administered in order to treat hypoxaemia in anaesthetised horses?

   a. The entire breath
   b. Throughout inspiration
   c. The first part of inspiration
   d. The expiratory pause

3. What is the approximate intrapulmonary shunt in the conscious standing healthy horse?

   a. 3%
   b. 1%
   c. 0%
   d. 10%

11:20am–12:10pm
Complications of Mechanical Ventilation

Adam Auckburally BVSc CertVA DipECVAA PGCAP FHEA MRCVS
Southern Counties Veterinary Specialists, UK

Mechanical ventilation (MV) is used in a wide variety of circumstances. Animals undergoing procedures requiring general anaesthesia often need ventilator support to maintain satisfactory oxygen and carbon dioxide concentrations. In the critical care setting, MV is used to manage acute respiratory failure, removing the work of breathing whilst treatment of the underlying cause is instituted.

There is a plethora of literature describing lung injury in humans, and much of this work has been carried out in animal models, but relevant clinical veterinary information is limited and recommendations are often based upon human guidelines. There have been recent attempts to categorise acute respiratory distress syndrome (ARDS) in animals in a similar manner to humans. However, it is prudent to remember that some species, particularly large animals, have anatomical and physiologic peculiarities, which make extrapolation of information difficult at best. It is also important to note that technologies which are rapidly advancing in human medicine – e.g. critical care ventilators and advanced monitoring modalities – are not the norm in veterinary practice, and therefore diagnostic and therapeutic MV options are limited.

Cardiovascular Effects

The physiology of how MV affects the cardiovascular system is extremely complex. Filling pressure of the right atrium is decreased, venous return is reduced and a cardiac tamponade-like effect occurs. During inspiration, pulmonary vascular resistance (PVR) is affected due to compression or stretching of pulmonary vessels. This may be particularly problematic during recruitment manoeuvres (RM) whereby much larger tidal volumes are delivered for extended inspiratory times. These RM can dramatically, but temporarily, increase PVR and so increase right ventricular (RV) afterload. This causes RV volume to increase and can lead to acute RV failure in susceptible patients. Positive end expiratory pressure (PEEP) will worsen this situation as mean airway pressure will increase.

In healthy patients, the cardiovascular effects of appropriate MV are minimal or are compensated for and are usually not of clinical significance. However, compensatory mechanisms are blunted by general anaesthesia, spinal or extradural anaesthesia or sympathetic exhaustion.

Pulmonary Complications

Mechanical ventilation is an essential component in the management of anaesthetised and critically ill animals. However, MV can lead to morbidity and mortality even with careful management. Ventilator

associated lung injury (VALI) and ventilator induced lung injury (VILI) are terms which are used commonly within the literature although the definitions can be confusing. Terms currently used include barotrauma – relating to pressure related damage to structures e.g. pneumothorax and air embolism, which are immediately life threatening, and gas accumulation within the peritoneum, pericardium and mediastinum. Volutrauma is used to describe the effects of stretching of the alveolus and the subsequent damage that occurs. Volutrauma can lead to biotrauma (release of inflammatory mediators within the lung), and is inherently linked with ARDS. Ventilation of areas of the lung at low volumes can cause atelectrauma as a consequence of shear stress of the pulmonary epithelium and pulmonary capillary endothelium due to cyclical opening and snapping shut of alveoli. These problems can be appropriately managed in many patients by using a variety of 'lung protective strategies'.

Other complications, which are poorly described in the veterinary literature, include ventilator-induced diaphragmatic dysfunction and ventilator-associated pneumonia. The relevance of these disorders is unknown in veterinary patients. Further work coinciding with our improved understanding of pulmonary physiology and technological advances in equipment is paramount to improving ventilator safety.

MCQs

1. What is the effect on the pulmonary circulation as the lung is inflated towards total lung capacity?

    a. Increases pulmonary vascular resistance
    b. No effect
    c. Decreases pulmonary vascular resistance
    d. Precipitation of hypoxic pulmonary vasoconstriction

2. Mortality in human ARDS patients was significantly reduced when clinicians introduced which of the following changes to mechanical ventilation?

    a. Increased PEEP
    b. Strapped the chest
    c. Reduced the tidal volume
    d. Introduced an inspiratory pause

3. When considering potential ventilator associated lung injury, which airway pressure measurement is most significant?

    a. Peak inspiratory pressure
    b. End expiratory pressure
    c. Alveolar pressure
    d. Transpulmonary pressure

1:30pm–2:20pm
Fluid Therapy For Colic – Can We Cause Harm?

Adam Auckburally BVSc CertVA DipECVAA PGCAP FHEA MRCVS
Southern Counties Veterinary Specialists, UK

This session will primarily focus on intravenous fluid therapy (IVFT) for the management of plasma volume, electrolyte and acid base disturbances in surgical colic. However, recent evidence and experience suggests that enteral fluid therapy is often useful for some medically managed colic horses. However, this route of administration is not appropriate for those horses undergoing exploratory laparotomy.

In horses with acute colic, the release of endotoxin from the cell walls of Gram-negative bacteria, induce changes in the cardiovascular system and coagulation system that lead to shock. For the anaesthetist, the administration of IVFT to these animals can help to restore circulating volume, correct electrolyte and acid base derangements and increase the colloid osmotic pressure of the plasma. For cases of acute severe colic, the hypovolaemia that is present can be immediately life threatening and must be dealt with, usually prior to induction to general anaesthesia.

There is little robust clinical data available to help guide fluid therapy in horses with colic. Guidelines and recommendations available are based upon observational evidence, experimental research and extrapolation from other species, in particular from humans. Whilst this is of some value and assists in making rational and sensible decisions, there is a need for controlled clinical trials in this particular group of patients. However, assessment of the response to fluid therapy is of value in guiding the anaesthetist in the management of these very sick animals despite the fact that the ideal volume to administer is unknown.

The goal of fluid therapy in colic is to provide adequate volume to treat shock and support tissue perfusion, whilst minimizing the adverse effects that occur with fluid overload and electrolyte and acid base derangements following the administration of inappropriate fluids. Unfortunately, aggressive fluid resuscitation is often necessary and this makes the risk of complications greater. Complication rates are directly associated with the severity of disease, and since many horses requiring surgical correction of colic are extremely sick, the potential for harm is increased in these patients. Isotonic crystalloid solutions form the mainstay of therapy, but hypertonic saline is useful for rapid fluid resuscitation prior to induction to general anaesthesia. Colloids are also administered, although the volumes required can sometimes be cost prohibitive for clients. Recent evidence suggests that the use of colloids in septic patients should be avoided, or at least used judiciously with careful monitoring. Once again, this is based upon evidence from humans and data from horses with colic is lacking.

The administration of sodium bicarbonate to manage the lactic acidosis that invariably develops

in surgical colic is controversial and subject to individual clinical opinion. Current human guidance suggests that there is no place for sodium bicarbonate in management of a lactic acidosis due to the lack of demonstrable benefit and the potential for harm following its administration. However, sodium bicarbonate continues to be administered to horses with colic that are severely acidaemic. Whether or not this has an impact upon overall outcome is unknown.

MCQs

1. What are the current recommendations for sodium bicarbonate administration for lactic acidosis in humans?

   a. It should not be administered
   b. It should be administered when the arterial pH is < 7.1
   c. It should be administered if the patient is hypotensive
   d. It should be administered when the arterial pH is < 7.0

2. Colloids were removed from the EU marketplace in 2013 due to human patients experiencing which of the following complications?

   a. Anaphylaxis
   b. Acute kidney injury
   c. Hypervolaemia
   d. Coagulopathy

3. Which of the following fluids is not appropriate for fluid resuscitation of the acute surgical colic patient?

   a. 0.9% saline
   b. Normosol-R
   c. Hartmann's solution
   d. Plasmalyte 148

2:30pm–3:20pm
Thoracic Radiology (including the hyoid apparatus)

Hester McAllister, DVR DipECVDI, MVB MRCVS
Lecturer in Veterinary Diagnostic Imaging at University College Dublin, Ireland, and in St. Georges University, Grenada, WI

In order to assess thoracic radiographs it is important that they are taken in a standard manner. Evaluating the radiographic images for artefacts, incorrect positioning and phase of respiration are prerequisites before assessing the images for abnormalities. In addition knowledge of anatomical variations due to species, size and breed conformation is necessary. The pharyngeal region is usually examined by direct visualisation but abnormalities of the hyoid apparatus often require radiographic studies.

This presentation will deal with standard radiographic positioning of the thorax and the common artefacts that should be avoided. It will illustrate some examples of specific anaesthetic complications as well as some abnormalities of the hyoid apparatus, trachea, pleural cavity, pulmonary tissue and the ribs with interactive discussion of these conditions.

Hand-outs will be available on the day of the presentation.

References

1. Thrall: Textbook of Diagnostic Radiology. 7th edition, publisher Elsevier 2018

2. Kealy, McAllister and Graham: Diagnostic radiology of the dog and cat. 5th edition publisher Elsevier 2011

3. Holloway and McConnell: BSAVA Manual of Canine and Feline Radiography and Radiology. Publisher- BSAVA 2014

4. Schwarz and Johnson: BSAVA Manual of thoracic Imaging Publisher- BSAVA 2008

3:50pm–4:40pm
Imaging of the abdomen (mostly) - significance for the anaesthetist

Regine Hagen DVM, CertAVP(VDI), dipECVDI
Associate Professor Vet Diagnostic Imaging, SGU, Grenada

Interactive case discussions on cases with abdominal imaging (mostly radiographs). The focus of this session is on recognition of lesions that are of relevance with respect to anaesthesia.

Abdominal radiography generally includes a ventrodorsal and (right or left) lateral projection of the abdomen. Images are taken at the end of expiration. For VD projections, animals can be placed in a foam trough, hindlimbs in frog-leg position. For lateral projections patients are positioned with the forelimb extended, the sternum supported by a foam wedge to minimize rotation. For both projections the x-ray beam is centered caudal to the last rib in small dogs. In large breed dogs two projections are necessary in both VD and lateral position to include the entire abdomen and thus one is centered on the last rib and a second radiograph is taken with the x-ray beam centered on the mid-abdomen. Collimation should include the diaphragm (include to approximately 1 inch cranial to the xyphoid process) and the pelvic inlet (to the greater trochanter).

The radiographs serve as an overview of the abdominal organs, the boundaries of the abdomen and the visible musculoskeletal structures. Prior to looking for pathology, the radiographs should be assessed for quality; i.e. is the entire abdomen included, are positioning centering and the exposure adequate to assess the organs and the boundaries of the abdominal cavity.

When assessing abdominal radiographs, emphasis is placed on evaluating each organ's location/ position, number (if applicable), size/ dimension, shape, contour and radio-opacity. Based on this assessment most common pathologies are identified, as pathology generally presents as some degree of change to the features listed above. However, there are challenging cases sometimes requiring some out-of-the-box-thinking. Since the caudal lung fields are visible on abdominal radiographs they must be scrutinized also since lesions may be easily missed.

With regards to organomegaly, each organ's specific location and how enlargement of one organ effects adjacent structures must be considered because displacement of other organs often points to the organ of origin of a mass-lesion.

When assessing the dimensions of the GI tract, knowledge of the normal position and distribution of luminal gas of the stomach is crucial when diagnosing distension vs distension and volvulus. The small intestinal dimension and distribution of fluid/gas/other content may lead to diagnosing intestinal

obstruction and or displacement of (parts of) the GI tract into compartments that it normally does not occupy such as the thorax or the inguinal canal.

Loss of serosal detail (presence of fluid) smudges the contours of most organs and ultrasound may need to be added to allow for diagnosis and may aid sampling of fluid for analysis. Trauma to the urinary apparatus must be suspected in any patients that do not urinate spontaneously (and even in those who do) that have suffered (pelvic, RTA) trauma. Increased abdominal detail/ contrast may occur in cases with free abdominal gas, which is usually present in animals after laparotomy but rupture of either the GI tract or penetrating wounds to the abdominal wall or iatrogenic pneumoperitoneum must be considered. Changes in organ opacity may be due to presence of gas or mineralisations.

Assessment of the abdominal boundaries, including the diaphragm, ventral and lateral abdominal wall, lumbar spine and pelvic inlet must not be neglected.

Additional studies such as positive/ negative contrast studies can be added and must be added in some cases (e.g. suspected rupture of the urinary apparatus) to obtain a final diagnosis. Elective double contrast/ negative contrast studies of the bladder convey the potential risk of air embolism.

Ultrasound guided sampling techniques such as biopsies are generally performed under GA however most of these will be elective studies and do not necessarily pose an increased anaesthetic risk if the recommended precautions are taken (clotting profile prior to liver biopsies).

MAIN CONFERENCE

MONDAY, MARCH 12
Radisson Beach Resort Crown Ballroom

START	FINISH	ITEM	SPEAKER
7:30am	9:00am	Registration	
8:45am	9:00am	Opening Ceremony	Dr. Olson, *Dean of SVM, SGU* Dr. Childers, *Provost, SGU*
9:00am	9:50am	Sex Differences in Pain from Both Sides of the Syringe	Dr. J. Mogil
10:00am	10:50am	Pain in Mice and Man: Ironic Adventures in Translation	Dr. J. Mogil
10:50am	11:20am	Coffee and Exhibition	
11:20am	12:10pm	Nutrient induced thermogenesis in anesthetized dogs	Dr. S. Clark-Price
12:10pm	1:45pm	Lunch, Exhibition, and AVA General Meeting	
1:45pm	3:00pm	Abstract Session 1	
3:00pm	3:30pm	Coffee and Exhbition	
3:30pm	4:30pm	Abstract Session 2	
6:30pm		Gala Dinner at the Aquarium Restaurant	

CHAIRPERONS

Keynote Lectures: *Dr. Sabine Kästner*
Abstract Session 1: *Dr. Kathy Clark*
Abstract Session 2: *Dr. Kate White*

9:00am–9:50am

Sex Differences in Pain From Both Sides of the Syringe

Jeffrey S. Mogil
E.P. Taylor Professor of Pain Studies
CRC Chair in the Genetics of Pain (Tier I)
Director, Alan Edwards Centre for Research on Pain
McGill University
Montreal, QC

Pain researchers have now come to some consensus regarding the existence of small quantitative sex differences in the sensitivity to and tolerance of pain in humans. However, broad conclusions regarding the existence and direction of such sex differences are complicated by emerging evidence from laboratory animals that sex differences interact with genetic background; even the direction of sex differences may depend on genetic factors. In addition to these quantitative sex differences, evidence is rapidly emerging that the sexes may differ qualitatively in their neural mediation of pain and analgesia. That is, different neural circuits, transmitters, receptors and genes may be relevant to pain processing in males and females. I will present data from our laboratory demonstrating that the specific cellular and neurochemical mediation of chronic pain processing in the spinal cord in male and female mice are radically different. Sex differences in pain appear to be robust at every level of analysis. Data will be presented as well on sex differences in social modulation of pain, pain memory, chemosignaling and pain, and even the effect of pain on mortality.

10:00–10:50am

Pain in Mice and Man: Ironic Adventures in Translation

Jeffrey S. Mogil
E.P. Taylor Professor of Pain Studies
CRC Chair in the Genetics of Pain (Tier I)
Director, Alan Edwards Centre for Research on Pain
McGill University
Montreal, QC

Recent decades have seen an explosion in our understanding of the molecular and cellular underpinnings of pain, but virtually none of this knowledge has resulted in new clinical therapies. The first part of the talk will explore the reasons for this lack of translation, including a mismatch between clinical characteristics and preclinical experimental design choices, species-specific gene expression, and emerging challenges in clinical trials. The second part of the talk will focus on recent studies in our laboratory concerning the modulation of pain by social factors. One would imagine these would be even harder to translate into humans, but in this domain translation between mice and undergraduates has been surprisingly successful. These observations collectively challenge assumptions commonly made about the biopsychosocial model, and have important philosophical implications for animal research.

11:20am–12:10pm
Nutrient Induced Thermogenesis in Anesthetized Dogs

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Inadvertent perianesthetic hypothermia (IPH) is one of the more common complications associated with general anesthesia in small animals. It has been reported that greater than 70% of people and 85% of dogs undergoing general anesthesia experience IPH. Patient complications associated with hypothermia include altered pharmacokinetic, organ dysfunction, increased infection rates and reduce wound healing, altered coagulation, delayed recovery, prolonged hospital stay, and increased cost of care. To reduce the magnitude of IPH and potentially decrease the incidence of adverse effects, techniques that minimize heat loss should be applied to canines for anesthesia expected to last longer than 20 minutes and consist of passive methods such as the use of insulator materials like towels or blankets and active methods of that provide supplemental heat to the patient such as water and forced air blankets. These methods have demonstrated variability in effectiveness and consistency thus frequently resulting in disappointing clinical results.

Nutrient induced thermogenesis (NIT) is the providing of substrate to induce or stimulate resting energy expenditure thus generating more body heat as a product. Protein or amino acids have the highest thermogenic capacity at 20 to 30% whereas fat has the lowest at 0 to 3% and carbohydrate fall in between at 5 to 10%. Starting in the early 1990s, Dr. Eva Selldén, a Swedish anesthesiologist, published a series of articles on the augmentation of body temperature utilizing intravenous infusions of amino acids. She was able to demonstrate that the thermic effect of amino acids minimized shivering, reduced post-operative hypothermia, shortened hospital stays, reduced blood loss from surgery, diminished "diabetes of surgery", had a mechanism of action that occurred in extra-splanchnic tissues, and can occur after intestinal administration of amino acids. These beneficial effects were noted when body temperature was increased only 0.3 to 0.8 C˚ compared to control groups. From there, research in this area has continued by many human research groups with a large concentration occurring in Japan resulting in a standardized dose of 240 kJ/hour of energy delivered during anesthesia.

Previous studies in animals is limited to a few publications in rats and dogs. In dogs, NIT has been shown to attenuate hypothermia, shorten the time to extubation after anesthesia and increase serum insulin and BUN. However, these studies were performed in research settings where the results

have limited translation to clinical settings. A study by Jin in 2012 looked at the safety of an infusion of amino acids at various rate and demonstrated a higher temperature at infusion rates of 12 or 24 kJ/kg/hour. However this study did not control for the effects of anesthetic drugs. A study in 2014 (Clark-Price et al.) that did controlled for the effect of anesthesia, demonstrated that a pre-anesthetic infusion of amino acids resulted in a difference of only 0.16 C° compared to a control group of dogs. However, that study administered a rate of only 8.5 kJ/kg/hour and administered the amino acids to awake animals. Based on work done by Dr. Selldén, it was determined that the thermic effect of amino acids may be blunted in awake patients. Anesthesia inhibits the thermosensitive neurons in the anterior hypothalamus that are responsible for thermoregulation. Thus, in awake humans and animals, whole body oxidative metabolism is regulated to prevent excessive heat production, however during anesthesia, heat production continues unabated. In recent study (Clark-Price 2018) performed in anesthetized dogs undergoing ovariohysterectomy, an amino acid infusion was administered during anesthesia in a controlled environment. Compared to a control group, the amino acid dogs had a higher body temperature after anesthesia, extubated sooner, and shivered less. Additionally, these dogs maintained a higher body temperature longer during anesthesia and warmed sooner during recovery.

The mechanism of action behind NIT is not completely understood but is believed to be related to insulin release and active phosphorylation of insulin-mTOR-dependent translation of factor 4E-BP1 and S6K1. This results in increased transcription of skeletal muscle protein synthesis with heat produced as a byproduct. A second postulated mechanism is through the activation of uncoupling proteins found on the inner surface of mitochondrial membrane proteins. Once activated, uncoupling proteins disrupt the proton gradient generated by NADH-powered proton pumps and lost energy unavailable for work dissipates as generated heat.

The use of NIT has shown great promise for use in dogs and potentially other veterinary species. Continued work is warranted to further define the use of amino acids and other substances for thermogenesis during anesthesia.

Abstract Session 1
Effects of blood pressure on oxygenation in mechanically ventilated anaesthetised horses administered pulsed inhaled nitric oxide

A Auckburally[1], T Grubb[2], M Wiklund[1], G Nyman[1].

[1]Department of Clinical Sciences, Faculty of Veterinary Medicine and Animal Science, Swedish University of Agricultural Sciences, Uppsala, Sweden; [2]Department of Anesthesia and Analgesia, Veterinary Clinical Sciences, Washington State University, Pullman, Washington, USA.

Anaesthetised horses commonly experience hypotension, hypoxaemia and hypoventilation. Treatments include dobutamine, pulsed inhaled nitric oxide (PiNO) (Nyman et al. 2012) and mechanical ventilation (MV) respectively.
We investigated the effects of blood pressure on the response to PiNO during MV.
12 horses were premedicated with IM acepromazine (0.03 mg kg-1), IV xylazine (1.1 mg kg-1) and butorphanol (0.025 mg kg-1). Anaesthesia was induced with IV ketamine (2.2 mg kg-1) and diazepam (0.05 mg kg-1) and maintained with isoflurane. Horses were ventilated and randomised to maintain MAP below (MV-L) or above (MV-N) 70 mmHg using a dobutamine infusion. Baseline physiological data were collected and following 15 and 30 minutes of PiNO. Data were analysed using Mann-Whitney, significance set at $p < 0.05$.
Parameters presented in the table were significantly higher in group MV-N than MV-L at all time points. During administration of PiNO, PaO2 was significantly higher than baseline only in MV-N.

Parameter	n	Group	Baseline	PiNO 15 minutes	PiNO 30 minutes
MAP	6	MV-L	53 ± 9	55 ± 8	56 ± 9
(mmHg)	6	MV-N	77 ± 11†	82 ± 4†	81 ± 3†
PaO2	6	MV-L	9.2 ± 7.4	10.1 ± 6.2	10.1 ± 5.4
(kPa)	6	MV-N	29.0 ± 19.4†	39.1 ± 20.2*†	40.2 ± 19.0*†

* significantly different from baseline
† significantly different from MV-L at corresponding time point

In mechanically ventilated anaesthetised horses, PiNO improves oxygenation only when blood pressure is supported with dobutamine. If hypotension is present then PiNO has little effect on arterial oxygenation.

References

Nyman G, Grubb TL, Heinonen E et al. (2012) Pulsed delivery of inhaled nitric oxide counteracts hypoxaemia during 2.5 hours of inhalation anaesthesia in dorsally recumbent horses. Vet Anaesth Analg 39, 480 – 487.

This research was funded by the Swedish-Norwegian Foundation for Equine Research

Abstract Session 1

Effects of pulsed inhaled nitric oxide (PINO) on arterial oxygenation during IPPV in horses undergoing elective arthroscopy or abdominal surgery under general anaesthesia

M Wiklund[1], K Kellgren[1], S Wulcan[1], T Grubb[2], G Nyman[1].

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Administration of PINO improves arterial oxygenation in spontaneously breathing anaesthetised horses both in research settings and in horses with colic undergoing abdominal surgery. The aim of this study was to evaluate the effects of PINO during anaesthesia in mechanically ventilated healthy and compromised horses.

Eighty horses were anaesthetised in dorsal recumbency, 50 underwent arthroscopy (A) and 30 abdominal surgery (C). Every second horse received PINO. Premedication and induction included standard doses of flunixine meglumine, acepromazine (group A), romifidine, butorphanol, diazepam and ketamine. Anaesthesia was maintained with isoflurane. Horses in group C received lidocaine CRI. Pulses of nitric oxide were delivered at the proximal end of the endotracheal tube during the first part of each inspiration. Blood was collected at the start (before PINO) and at the end of inhalation anaesthesia. Changes in PaO2 and F-shunt were analysed using paired t test, $p < 0.05$ was considered significant (*).

In horses receiving PINO, PaO2 increased from 18.6 ± 10.4 and 9.4 ± 7.2 to 26.7 ± 10.6* and 18.4 ± 10.4* kPa, and F-shunt decreased by 15 ± 11%* and 23 ± 16%* in the A and C group, respectively. In controls, PaO2 did not change, 17.9 ± 10.3 and 12.5 ± 14.5 to 16.7 ± 11.5 and 12.6 ± 12.4 kPa, and F-shunt increased by 11 ± 16%* and 5 ± 13% in the A and C group, respectively.

In conclusion, this study showed that PINO effectively improve arterial oxygenation and reduces shunt in mechanically ventilated anaesthetised horses.

The study was supported by grants from the Swedish-Norwegian Foundation for Equine Research

Abstract Session 1
Oxygen-induced hypoventilation following alfaxalone-dexmedetomidine-midazolam sedation in New Zealand white rabbits

FRB Rousseau-Blass, DSJP Pang.

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During sedation protocol development with alfaxalone in rabbits, hypopnea following oxygen administration was observed. The study aim was to investigate these observations.
Fourteen New Zealand white rabbits (3.1 - 4.9 kg, 1 year old) were sedated with intramuscular alfaxalone (4 mg kg-1), dexmedetomidine (0.1 mg kg-1) and midazolam (0.2 mg kg-1). Animals were block randomised to wait 5 (n = 7) or 10 (n = 7) minutes between injection and oxygen supplementation (face mask, 1 L min-1). Immediately before (PRE-5/10) and 2 minutes after oxygen administration (POST-5/10), respiratory rate (fR), PaO2 and PaCO2 (central auricular arterial sample) were recorded by a blinded investigator. Data were analysed with a Wilcoxon test and $p < 0.05$ considered significant.
Hypoxemia (PaO2 < 60 mmHg), that resolved with oxygen, was observed at PRE-10, but not PRE-5 (Table 1). Oxygen administration was associated with a significant decrease in fR ($p = 0.016$) and a significant increase in PaCO2 ($p = 0.016$) for both groups. Two rabbits were apneic for 2 and 2.5 minutes, respectively.
Early oxygen administration resolved sedation-associated hypoxemia, but blunted hypoxemic respiratory drive, causing hypoventilation and hypercapnia (Patterson et al. 2009).

	PRE-5	POST-5	PRE-10	POST-10
PaO2 (mmHg)	71 [61 – 81]	475 [134 – 500]	58 [36 – 80]	458 [251 – 496]
PaCO2 (mmHg)	37.6 [35.4 – 40.7]	61.2 [57.1 – 63.6]	41.7 [32.9 – 49.4]	62.3 [56.2 – 75.4]
fR (bpm)	44 [44 – 56]	8 [0 – 25]	36 [28 – 44]	12 [0 – 36]

Table 1. Data are median (range).

References

Paterson JM, Caulkett NA and Woodbury MR (2009) Physiologic effects of nasal oxygen or medical air administered prior to and during carfentanil – xylazine anesthesia in North American elk (Cervus canadensis manitobensis). J Zoo Wild Med 40, 39-50.

This research was funded by a Foundation J.-Louis Lévesque and NSERC Discovery Grant

Abstract Session 1

Influence of stepwise increase of intra-abdominal pressure on dynamic lung compliance and its relation to certain body dimensions in dogs

Inga-Catalina Cruz Benedetti[1], Tanja Peirits[1], Melissa Dorn[2], Claus Vogl[3], Christina Braun[1].

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Increased intra-abdominal pressure (IAP) during laparoscopy influences ventilation. The degree of change might be determined by body weight (BWT) and body dimensions (BD).
Body condition score (BCS), BWT, and BD (T1 = thoracic circumference behind shoulder, T2 = thoracic circumference over xiphoid, B = length of dorsum) were measured in 86 dogs prior to anaesthesia (IM acepromazine 0.01-0.02 mg kg-1, methadone 0.1-0.2 mg kg-1, IV propofol to effect) for elective laparoscopic surgery. Anaesthesia was maintained with isoflurane in oxygen using intermittent positive pressure ventilation (VT 12 ml kg-1; fR 14 breaths minute-1 adjusted to normocapnia). After each step of abdominal insufflation with CO2, IAP and dynamic compliance (Cdyn) were measured. For each dog, regression of IAP on Cdyn was performed; the slopes were target variables of multiple regressions with body dimensions (BWT, BCS, T1, T2 and B). Significance was set to $\alpha < 0.05$.
Due to recording errors, leakage or drug administration 31 dogs were excluded. For 55 dogs, baseline IAP was -7.6 to 7.4 cmH2O, and the slope for the influence of IAP on Cdyn was negative and linear. Among body dimensions, BWT had the largest influence on the slope of the Cdyn-IAP-curve (adjusted $R2 = 0.52$, $p < 0.0001$). Initial Cdyn (6 to 86 ml cmH2O-1) varied more than tenfold and depended strongly on BWT (adjusted $R2 = 0.58$, $p < 0.0001$).
Dynamic compliance varies strongly between dogs and depends on BWT. An increase in IAP negatively affects Cdyn more severely in small dogs than in large dogs.

Abstract Session 1

Effects of hypothermia and hypothermia combined with hypocapnia on cerebral perfusion and oxygenation in piglets

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Hypocapnia and hypothermia are frequently associated with anaesthesia. Therefore, its effects on cerebral perfusion and oxygenation were investigated.

Twenty piglets (4 – 6 weeks) were randomly allocated to hypothermia (hypoT; n = 10) or hypothermia-hypocapnia (hypoT-HC; n = 10). Anaesthesia was induced and maintained using sevoflurane-midazolam (FiO2: 0.21 – 0.3). Lungs were artificially ventilated maintaining normocapnia. Intravenous fentanyl was administered for insertion of a femoral artery catheter, intracranial tissue oxygen (PtO2) and laser Doppler (tissue blood flow (BF)) probes. A near-infrared spectroscopy sensor was placed over the skull (rSO2).

After baseline (B) recordings, hypothermia (35.5 – 36.0 °C) was induced using a fan and hypocapnia (28 – 30 mmHg PaCO2) by hyperventilation. Once treatment goals were achived (Tr0), they were maintained for 30 minutes (Tr30). Data were analysed using mixed RM-ANOVA and Bonferroni tests ($p < 0.05$).

Tissue-BF decreased significantly from B to Tr0 independently of treatment. A significant increase in rSO2 (B: 49.5 ± 7.03; Tr0: 58.4 ± 5.89; Tr30: 60.3 ± 5.60 %) with a trend to increased PtO2 (B: 27.5 ± 7.79; Tr0: 29.7 ± 7.43; Tr30: 29.4 ± 7.43 mmHg) was detected during hypoT. With hypoT-HC no significant changes in rSO2 (B: 51.6 ± 6.31; Tr0: 54.6 ± 6.84; Tr30: 55.9 ± 6.40 %) but a decrease in PtO2 (B: 26.4 ± 8.67; Tr0: 23.2 ± 7.91; Tr30: 23.1 ± 7.78 mmHg) occurred.

Concluding, both treatments decreased cerebral-BF. However, oxygen extraction ratio as presented by rSO2 decreased during hypothermia alone. This was abolished by hypocapnia, resulting in decreased tissue oxygenation.

Abstract Session 2

Plasma concentrations and behavioral, physiologic and antinociceptive effects of sustained-release buprenorphine in dogs

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To evaluate potential usefulness of sustained-release buprenorphine (SRB) in dogs, plasma concentrations and selected behavioral, physiologic and antinociceptive effects were assessed. Six healthy adult beagles were administered two doses of SRB (0.06 mg kg-1 and 0.18 mg kg-1, subcutaneously) in a balanced crossover design, with a 2-week washout period. Blood samples were collected before drug administration and at predetermined intervals for 120 hours afterwards for subsequent buprenorphine concentration analysis by liquid chromatography - mass spectrometry (lower limit of quantification 0.010 ng ml-1). Behavioral and physiological parameters, and mechanical nociceptive threshold were assessed at fixed time points during the same period. Behavioral responses were analyzed using Wilcoxon's signed rank test; physiological and nociceptive responses were analyzed using repeated measures ANOVA. Post hoc comparisons were performed using Dunnett's test ($p \leq 0.05$).

Buprenorphine plasma concentrations were detectable up to 120 hours after drug administration with both doses, but averages decreased below 0.6 ng ml-1 (hypothesized therapeutic level; Ko et al. 2011) at 24 (0.53 ± 0.34 ng ml-1) and 60 (0.47 ± 0.19 ng ml-1) hours for the low and high doses, respectively. There were no significant differences in behavioral, physiological and nociceptive responses between doses, but a significantly higher mechanical threshold was observed from 1 (8.45 ± 1.62 lb/cm2) to 84 (8.11 ± 1.84 lb/cm2) hours after drug administration when compared to baseline (5.67 ± 1.30 lb/cm2). Both doses of SRB provided similar behavioral, physiological and antinociceptive effects. Antinociceptive effects were present after plasma concentrations decreased below previously postulated therapeutic levels.

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Abstract Session 2
Comparison of cardiovascular effects of fentanil, sufentanil or remifentanil infusion in propofol-anaesthetized dogs: preliminary data.

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Cardiovascular effects of opioid infusion in dogs are not widely investigated.
Nineteen healthy dogs undergoing laparoscopic ovariectomy were included in this prospective randomized blind study. After sedation with acepromazine (20 µg kg-1 IM), dogs were assigned to three groups: group F (fentanyl 6 µg kg-1 IV followed by 10 µg kg-1 hour-1), group S (sufentanil 0.75 µg kg-1 followed by 1.25 µg kg-1 hour-1) and group R (remifentanil 3 µg kg-1 followed by 5 µg kg-1 hour-1). Doses were considered equi-analgetic based on previous literature. Anaesthesia was maintained with propofol infusion. The HR, invasive blood pressure, arrhythmias incidence and hypotension (MAP < 60 mmHg) were compared.
Quantitative variables were analysed with pairwise correlation analysis descriptively, and qualitative variables with generalized linear models.
No significant differences were found for HR and arrhythmias incidence between groups. Blood pressure was similar between group S and the other two groups. After 90 minutes of infusion, group R and F differed significantly ($p < 0.05$) in SAP (119.9 ± 4.3 vs 105.2 ± 9.6 mmHg), but only marginally ($p = 0.05$) in MAP (75.7 ± 2.3 vs 66.8 ± 6.4 mmHg) and DAP (63.6 ± 3.5 vs 56 ± 5.1 mmHg). Hypotension was observed significantly more often in group F.
This preliminary data suggest that the three opioids in analysis offer the same hemodynamic stability during short infusion time. Fentanyl may be less indicated for patients prone to hypotension undergoing procedures longer than 90 minutes. More data are required to elucidate differences with group S.

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Abstract Session 2

Pharmacokinetics of fentanyl in dogs with low or normal heart rate anesthetized with isoflurane and hydromorphone.

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The pharmacokinetics of fentanyl were compared at low (LOW) or normal HR (NHR) in dogs anesthetized with isoflurane and hydromorphone.
Six male Beagles randomly received two treatments: LOW (HR: 50 to 80 beats minute-1) and NHR (HR: 110 to 130 beats minute-1). Dogs were maintained at a light plane of anesthesia with isoflurane and hydromorphone (0.1 mg kg−1 then 0.02 to 0.1 mg kg−1 hour−1) during the experiments. Cardiac index and HR were recorded. NHR was maintained with glycopyrrolate administered intramuscularly as needed. Fentanyl (20 µg kg−1) was intravenously infused over five minutes. Blood samples were collected at various times for 8 hours and analyzed for plasma fentanyl concentration. Pharmacokinetic parameter were estimated and compared between LOW and NHR using the paired Wilcoxon test. Differences were considered significant at $p < 0.05$.
A three-compartment model best fitted the data. Median (range) area under the curve (minutes ng mL-1), clearance (mL minute kg-1), and volume of distribution at steady state (mL kg-1) were respectively 607 (417 834), 33.2 (24.0 48.0), and 4064 (3453 6546) for LOW, and 326 (275 450), 61.3 (44.5 72.7), and 7195 (5077 8601) for NHR and were significantly different between the treatments..
The disposition of fentanyl in dogs anesthetized with isoflurane and hydromorphone was significantly affected by changes in HR and cardiac index. The dose of fentanyl may need to be increased or the interval decreased when bradycardia is treated in dogs anesthetized with isoflurane and hydromorphone.

Abstract Session 2
A comparison of opioid-based protocols for immobilization of captive Grevy's zebra (Equus Grevyi)

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Grevy's zebra (Equus grevyi) are an endangered species requiring immobilization. Comparative assessment of opioid-based techniques is warranted.
We retrospectively evaluated behavioral (e.g., time to work on animals) and physiological (e.g., HR) parameters from Grevy's zebra records. Single (3 ml) dart immobilizations between January 2007 and March 2017 at the San Diego Zoo Safari Park in zebra greater than one year of age were considered. Three protocols: etorphine and alpha-2 agonist (EA2; n = 11), etorphine, alpha-2 agonist and ketamine (EA2K; n = 16), and thiafentanil, alpha-2 agonist and ketamine (TA2K; n = 6) were compared. Each immobilization within a group was considered an independent event. Data were summarized as median and range and analyzed for overall differences ($p < 0.05$) between groups using the Kruskal-Wallis test.
Median overall time to work on animals was statistically different ($p = 0.029$; EA2 = 6.5 minutes, EA2K = 6.3 minutes, TA2K = 14.5 minutes). When the etorphine groups (median doses 19 and 20 µg kg-1) were combined and compared to the thiafentanil group (median dose 32 µg kg-1), median time to recumbency was also statistically significant ($p = 0.022$; EA2K + EA2 = 5.9 minutes; TA2K = 15 minutes). There were no significant differences between the groups for physiological parameters, anesthesia quality or recovery time.
While all protocols may be used for immobilization of Grevy's zebra, increased induction time was observed with the thiafentanil combination. The influence of increasing thiafentanil or alpha-2 agonist dosage in the dart warrants prospective evaluation.

MAIN CONFERENCE

TUESDAY, MARCH 13
Radisson Beach Resort Crown Ballroom

START	FINISH	ITEM	SPEAKER
9:00am	9:50am	Evaluating recovery of horses from anesthesia: moving beyond the subjective	Dr. S. Clark-Price
10:00am	10:50am	Safe anaesthesia in young children	Prof. Dr. M. Weiss
10:50am	11:20am	Coffee and Exhibition	
11:20am	12:10pm	Reducing fasting times in paediatric patients - quo vadis	Prof. Dr. M. Weiss
12:10pm	1:40pm	Lunch, Exhibition, and session on future cooperative research and multicenter studies	
1:45pm	3:00pm	Abstract session 3	
3:00pm	3:30pm	Coffee and Exhibition	
3:30pm	4:45pm	Abstract session 4	
4:45pm	5:00pm	Closing ceremony and presentation of Abstract Awards	

CHAIRPERONS

Keynote Lectures: *Dr. Regula Bettschart*
Abstract Session 3: *Dr. Simone Ringer*
Abstract Session 4: *Dr. Carl Bradbrook*

9:00am–9:50am

Evaluating Recovery of Horses from Anesthesia: Moving Beyond the Subjective

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The recovery period is likely the least controlled aspect of equine anesthesia, In fact, anesthetic mortality in horses ranges from 1 to 10% with up to 38% of these deaths related to injury during the recovery phase. Numerous studies investigating methods to improve the "quality" of the recovery of horses have been performed. Most of these utilize some form of subjective visual grading such as visual analog scales, numeric rating scales, simple descriptive scales, or composite grading scales. However, because they are subjective in nature, they are prone to systemic errors that may complicate the results and how to interpret them. Subjective equine scoring has been shown to have low sensitivity, low repeatability, high variability, be overly complex, and have institutional or gender bias. Additionally, with the use of many different methods being utilized, comparisons of studies performed at various institutions cannot be made with any certainty. In a study analyzing agreement of subjective scoring of equine recoveries, diplomates of the ACVAA had slight agreement and differed significantly suggesting that different clinical opinions may arise between individuals assessing a recovery. This has called for the need to reevaluate how equine recovery is assessed and the development of non-subjective methods.

Prior to developing assessment methods, the phases of recovery need be defined so that objective parameters can be developed. One description defines six phases to the recovery of horses from general anesthesia: 1) transition from anesthesia to recovery, 2) first movement, 3) movement to sternal recumbency, 4) first attempt to stand, 5) initial standing, and 6) standing and stable. Although not all horses will recover in the same way, learning what is "usual" recovery behavior for each phase is critical for the development of future interventions that may improve recovery quality.

Another factor that may play a role in the development of objective measures of recovery and the future for therapeutic intervention is have some knowledge of what practitioners consider to be important for an ideal recovery. One study indicated that for an ideal recovery, horses should recover in less than one hour, stand in one attempt and not fall after standing, not be ataxic after standing and not knuckle over at the fetlocks. It is unknown however, if any of these factors confer safety of recovery.

Accelerometry is a commonly used objective method to quantify movement in various fields of medicine. Accelerometry measures the change in acceleration of an object being measured and not the speed of the object. Accelerometry has been shown to be clinically applicable, has high repeatability and has been used to assess neuromuscular blockade, movement disorders after anesthesia, physical activity, and effect of analgesic medication, gait analysis, lameness and other variables. Recently, a system for using accelerometry to assess equine recovery was developed and described (Clark-Price 2017). This system was designed to utilize a 3-axis accelerometer and takes into account the number of attempts a horse may take prior to standing. By measuring the change in acceleration as opposed to the speed at which a horse is moving, more immediate and real-time changes can be assessed. A programmable 3-axis accelerometer takes measurements in three dimensions and can give a single number for an event base on a formula for the maximum change in velocity (VMAX): V_MAX= √(X^2+Y^2+Z^2). Once the VMAX of each attempt to stand and the successful attempt to stand is obtained, a horse's recovery score (RS) can be calculated as RS = 9.998 x G0.633 x (∑G)0.174 where G = VMAX of the successful attempt to stand and ∑G is the sum of the VMAX of any unsuccessful attempts to stand. Much work still need to be performed before this system can adopted as a standard for evaluation of recovery in horses but may lead researchers to an objective method that can be useful to evaluate individual studies as well as give a standard by which inter-institutional studies can be compared.

By utilizing objective measures and having a knowledge of what is "usual" for equine recovery, future studies can be designed that will have reliable results that can be applied to clinical situations with the goal of reducing complications associated with anesthesia of horses.

10:00am–10:50am
Safe anaesthesia in young children: what really matters

Markus Weiss, Prof. Dr. med.
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Annually, millions of neonates and infants worldwide are submitted to surgery and general anaesthesia. The safety of providing anaesthesia for these patients has recently been cast into doubt based on a large number of animal studies demonstrating that anaesthetic exposure during a vulnerable period of brain development cause neurodegeneration (neuro-apoptosis) and abnormal synaptic development with functional deficits in learning and behaviour later in life.[1] Recently, the US Food and Drug Administration (FDA) issued a warning related to the use of general anesthetics in children younger than 3 years of age.[2]

Perioperative complications are more common in neonates, infants and young children when compared with adults.[3] Similarly, it is well known that severe complications in paediatric anaesthesia have a 10 times increased mortality in children than in adults.[4] Anaesthesia-related complications are related to the child's age, comorbidities, (in)-competence of the anaesthesiologist and the anaesthesia team in charge.[5]

Children undergoing general anaesthesia regularly are at risk to endure fear, pain, hypotension, hypocapnia, hyperglycaemia/ hypoglycaemia, hypoxaemia and hypona- traemia with the latter due to inadequate perioperative fluid therapy.[6-9] Each of these single entities can ultimately affect organ maturation and neurocognitive development in addition to above mentioned serious perioperative cerebral damage, brain death and/or even death.[10]

Neurotoxicity of anaesthetics in young childhood as highlighted by the FDA is primarily a laboratory finding. Emerging robust clinical human data, however, do not support this laboratory evidence but reveal other factors that more importantly impact long-term neurocognition.[11-14] Newest clinical evidence related to neurotoxicity of anaesthetics in paediatric anaesthesia (GAS, PANDA, MANITOBA, Swedish Cohort Study) demonstrate, that the animal-laboratory based neurotoxicity of anaesthetics is not a clinical significant problem in paediatric anaesthesia.[14,15] Education of the mother, month of birth and gender were profound determinates of intellectual outcome but not anaesthesia.[6] Interestingly, there was a positive impact of anaesthesia on neurocognitive development in children older than 2 and 3 years or age respectively in two studies.[13,14] This is explained by the high proportion (50%) of ENT patients with obstructive sleep apnoea syndrome (OSAS) and chronic ear infections and related medication in this age group. OSAS is well known to result in neurocognitive retardation in children.[16]

In the meantime, the FDA recommendation to avoid anaesthesia in small children less than 3 years of age has been severely criticised by authorities as not evidence based and dangerous.[17] It delays

diagnostic procedures and surgery required in children and may be dangerous for the child's further well-being.[18] Similarly, the European Society of Anaesthesia (ESA) and the European Society for Paediatric Anaesthesia published a consensus statement, that the conduct and quality of anaesthesia is more important than the laboratory based neurotoxicity of anaesthetics in young children.[19]

Safe anaesthesia for every tot (www.safetots.org) is a non-profit initiative of leading paediatric anaesthesiologists promoting the safe conduct of anaesthesia in children.

Key points of safe conduct of anaesthesia in children are defined as the "Big 5 W":

the "How", "Where" "When", "What" and the "How" paediatric anaesthesia is performed.[20] Thereby, maintaining psychological and physiological homeostasis are the fundamentals a high quality paediatric anaesthesia (10N-Rule):

In conclusion, the discussion about neurotoxicity of anaesthetics in young children is distracting from the real safety issues in paediatric anaesthesia and does not really improve safety in children undergoing general anaesthesia. Anaesthesiologists rather than the anaesthetics are the threat to baby brains.14 Accordingly, research into the risks of anaesthesiologists-related neuromorbidity should be recognised as the principal target in neurodevelopmental research, rather than primarily focusing on anaesthetic agents to improve safety in paediatric anaesthesia.[20]

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11:20am–12:10pm
Reducing fasting times in paediatric anaesthesia – quo vadis?

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Pre-anaesthetic or pre-operative fasting is a universally applied principle in anaesthesia to minimise the risk of pulmonary aspiration of gastric content posed by the combination of regurgitation and loss of protective airway reflexes by anaesthetic agents. Guidelines published have cemented the principle that solids including semi-fluid food and milk-containing products should be avoided six hours, and clear fluids two hours before anaesthesia induction, respectively (6-4-2 regimen).[1-3] Infants are usually allowed ingestion of breast milk up to four hours before anaesthesia.

A recent multi-centre study of specialist paediatric centres revealed a very low incidence of aspiration of 2 and 2.2 per 10,000 cases for both elective and emergency cases respectively when using the 6-4-2-hour rule.[4] So far, pulmonary aspiration events in paediatric anaesthesia appear not to be associated with long-term morbidity or even mortality.

Recent research has contributed with new insights concerning pre-operative fasting in children. Children are often fasted for unnecessarily long intervals in spite of the implementation of current guidelines. High incidences of fasting for more than six or even 12 - 21 hours in various settings have been reported.[5,6] Prolonged fasting could have detrimental metabolic and behavioural effects in small children.

Small children have a higher metabolic rate and reduced glycogen stores compared with adults. A 28% incidence of hypoglycaemia in toddlers that were starving for at least 6 hours, as opposed to those who had a milk drink four hours before surgery have been reported earlier.[7] Furthermore, prolonged fasting is associated with ketoacidosis, especially in children less than 36 months of age, which can be avoided by optimized fasting times.[8,9]

New studies on gastric emptying in children using magnetic resonance imaging or gastric tube aspiration have shown that clear fluids in the pre-operative period are likely to pass through the gastric ventricle within less than an hour.[10-12] A 200 ml drink of water or lemonade will be reduced to 25 mL within 30 minutes of ingestion. For light solids, a four-hour period has been demonstrated to allow also sufficient gastric emptying.[13,14]

Very recent clinical reports indicate that reducing fasting intervals beyond the two-hour limit may be safe and result in a reduced risk of negative metabolic effects of fasting. Andersson and co-workers

found that omission of the two-hour fasting limit for clear fluids was not associated with an increased incidence of pulmonary aspiration in a retrospective audit of 10000 elective paediatric anaesthetics.[15] Another study group reports on an increase of children fasting less than four hours from 19% to 72% after the introduction of a standard operating procedure checking on fasting status on admission and allowing clear fluids up to one hour before anaesthesia.[16]

Based on newest evidence in pre-operative fasting in children the European Society for Paediatric Anaesthesia (ESPA) and the Association of Paediatric Anaesthetists of Great Britain and Ireland (APA) are going to adapt fasting guidelines for children by allowing clear fluids up to one hour before anaesthesia. Reducing fasting times for light solids requires more research in the future.

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Abstract Session 3

Pharmacokinetic/pharmacodynamic modelling of different intravenous combinations of detomidine and methadone in standing horses

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This blinded, randomised, cross-over study evaluated the pharmacokinetic (PK) and pharmacodynamic (PD) parameters and interactions between detomidine and methadone when given alone or combined in standing horses.

Eight horses received IV boli of saline (SAL), 5 µg kg-1 detomidine (DET), 0.2 mg kg-1 methadone alone (M), or combined with 2.5 (MLD), 5 (MMD) or 10 (MHD) µg kg-1 detomidine (washout period ≥ 1 week). Venous blood samples were obtained at predetermined times between 0 and 360 minutes after administration. Plasma detomidine and methadone were measured in a single assay with tandem Liquid Chromatography / Mass Spectrometry. Sequential PK/PD modelling compared rival models, with and without PK (effect of detomidine on the clearance of either drug) and PD interaction (Gozalo-Marcilla et al. 2017). Pharmacodynamic variables included mechanical (MT), electrical (ET) and thermal (TT) nociceptive thresholds, gastrointestinal motility (GIM), a sedation visual analogue scale (VAS), and head height above the ground (HHAG).

Two and three compartment models best described the PK of detomidine and methadone, respectively. Inclusion of concentration-dependent effect of detomidine on the clearance of both drugs improved the model. Modelling the PD interaction of methadone on the effect of detomidine revealed a synergistic effect for MT (α = 0.014), positive potentiation for ET (pot = 0.0064) and TT (pot = 0.136), an infra-additive effect for GIM (α = - 0.525) and VAS (α = - 0.853), and negative potentiation for HHAG (pot = - 0.098). Different PK/PD interactions were seen for each PD parameter and could be modelled in vivo.

References

Gozalo-Marcilla M, Luna SP, Crosignani N et al. (2017) Sedative and antinociceptive effects of different combinations of detomidine and methadone in standing horses. Vet Anaesth Analg 44, 1116-1127.

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Abstract Session 3

Sedative and antinociceptive effects of different detomidine constant rate infusions, with or without methadone in standing horses

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This blinded, randomised, cross-over study assessed sedation, antinociception and gastrointestinal motility (GIM) after detomidine loading and 2 hours constant rate infusions with or without methadone in standing horses.
Seven horses were administered IV saline (SAL), detomidine low (2.5 µg kg-1 + 6.25 µg kg-1 hour-1) (DL) and high (5 µg kg-1 + 12.5 µg kg-1 hour-1) (DH) alone or both combined with methadone (0.2 mg kg-1 + 0.05 mg kg-1 hour-1), (DLM) and (DHM), respectively. Head height above ground (HHAG), electrical (ET), thermal (TT) and mechanical (MT) nociceptive thresholds and GIM were evaluated at predetermined times between 5 and 240 minutes. Mixed effect model and Kruskal-Wallis ($p < 0.05$) were used for normal and non-normal data, respectively.
Sedation (<50% of basal HHAG) was only achieved for the duration of the infusion and for 15 minutes more in DH and DHM. Nociceptive thresholds were increased above baseline, to the greatest degree and for the longest duration with DHM (ET and TT for 135 minutes and ET for 150 minutes). After DH, TT was significantly higher than baseline from 30 to 120 minutes and MT from 15 to 135 minutes. After DLH, ET was increased at 90 minutes, TT at 30 minutes and MT for 120 minutes. Intestinal motility was reduced for up to 135 minutes after DL, 150 minutes after DLM and 210 minutes after DH and DHM. Treatment DHM produced sedation, with the most intense and steady antinociception, with reductions in GIM. Treatments DH and DLM provided comparable antinociception.

This work was supported by Fundação de Amparo à Pesquisa de São Paulo (FAPESP), Scholarship grant number (2014/00474-5 and 2017/01425-6).

Abstract Session 3

Pharmacokinetics and echocardiographic effects of dexmedetomidine after intranasal administration in healthy dogs

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Intranasal (IN) administration of anaesthetics is a novel strategy (Micieli et al., 2017). We studied the effects of IN dexmedetomidine on pharmacokinetics and echocardiographic variables in healthy dogs.
In a blinded randomized crossover design with one-week washout, six dogs received 0.02 mg kg-1 dexmedetomidine intranasally (DEX-IN) or intramuscularly (DEX-IM). Blood for DEX plasma concentrations was collected before (TB) and 2, 5, 10, 15, 30, 45, 60, 90 and 120 minutes after drug administration (T0). Physiological variables were recorded every 5 minutes until recovery. Sedation scores were noted. Echocardiography was performed at TB and T20.
Repeated data over time were analysed using a Scheirer-Ray-Hare test. Other data were compared using a Wilcoxon or Student t-test.
From T5 to T20, HR was significantly lower in DEX-IM than in DEX-IN (46 [43-59] versus 76 [72-83] beats minute-1). Time between lateral and sternal positions and time between T0 and sternal position were longer in DEX-IN than in DEX-IM (68 ± 08 min versus 45 ± 17 min and 89 ± 09 min versus 68 ± 15 min). Time from sternal to standing position was shorter in DEX-IN than in DEX-IM (29 ± 17 versus 64 ± 20 minutes).
Dexmedetomidine plasma concentrations were significantly lower in DEX-IN than in DEX-IM from 15 to 120 minutes after T0 (1.23 ± 0.48 versus 5.04 ± 1.05 ng mL-1). Echocardiographic parameters were not significantly different between groups.
At lower plasma concentrations, DEX-IN induces similar quality and a longer duration of sedation with similar cardiovascular effects than DEX-IM administration.

References

Micieli F, Santangelo B, Reynaud F et al. (2017) Sedative and cardiovascular effects of intranasal or intramuscular dexmedetomidine in healthy dogs. Veterinary Anaesthesia & Analgesia 44, 703–709.

Abstract Session 3

Evaluating the efficacy of atipamezole and flumazenil on recovery from sedation with alfaxalone – dexmedetomidine – midazolam in rabbits.

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Intramuscular ketamine-based sedation protocols provide profound sedation in rabbits but are associated with slow recoveries. The study aim was to develop a profound sedation protocol with short recoveries.

Twenty-four New Zealand white rabbits (3.0 - 4.5 kg, 10 months old) were sedated twice (T1, T2), 3 weeks apart, with intramuscular alfaxalone (4 mg kg-1) - dexmedetomidine (0.1 mg kg-1) - midazolam (0.2 mg kg-1) for an unrelated study requiring intraarticular injections. Oxygen was supplemented by face mask (1 L min-1) 10 minutes after injection and the following monitored by a blinded observer: respiratory (fR) and heart rates (HR), hemoglobin saturation with oxygen (SpO2), voluntary return to sternal recumbency (VSR). In a prospective, block randomised design: T1 (atipamezole [n = 12, 1 mg kg-1 IM] versus saline [n = 11, equal volume IM]). T2 (flumazenil [n = 12, 0.1 mg kg-1 SC] versus saline [n = 12, equal volume SC]); both groups received atipamezole (same dose). Data were analysed with a Mann-Whitney test and $p < 0.05$ considered significant.

VSR was significantly shorter ($p < 0.0001$) with atipamezole (74.5 [45-109] minutes) than saline (113 [87-137] minutes). The addition of flumazenil did not decrease VSR significantly (flumazenil, 109 [69 - 171] minutes; saline, 114.5 [76 – 157] minutes, $p = 0.50$). In 86 sedations, one adverse event (SpO2 < 30%) occurred, resolved with O2 administration.

This sedation protocol produced sedation suitable for intraarticular injections. Sedation duration could be shortened with atipamezole, but not flumazenil. The efficacy of flumazenil in rabbits requires further investigation.

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Abstract Session 3
ARRIVE has not ARRIVEd: support of the ARRIVE guidelines does not improve the reporting quality of papers in animal welfare, analgesia or anesthesia

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The ARRIVE guidelines were developed to improve animal research reporting. Hypothesis: articles published in ARRIVE supporting (SUPP) journals would show improved quality of reporting compared with non-supporting journals (nonSUPP).
Seven journals were selected (SUPP; n = 5, nonSUPP; n = 2). Relevant studies initially identified by manual search of tables of contents, followed by independent reading (2 authors). ARRIVE checklist items were categorized as fully, partially, or not reported. Guideline adherence was assessed pre-ARRIVE (2009) and post-ARRIVE (2015) in SUPP and nonSUPP journals using an unequal variance t test ($p < 0.05$ considered significant).
Included papers: 2009 (SUPP, n = 52; nonSUPP, n = 68) and 2015 (SUPP, n = 61; nonSUPP, n = 55). There were no significant differences between journals during 2009 or 2015 (Table 1). Small, statistically significant increases in reported items within journal types between 2009 and 2015 were observed, though magnitude of difference did not differ between journals ($p = 0.09$). No paper fully reported all checklist items. Items associated with bias were consistently poorly reported: sample size calculation (< 15%), allocation to experimental groups (< 30%).
Standards of reporting quality are low, reflecting a need for journals to do more than state support.

Table 1: Percentages of fully reported items before (2009) and after ARRIVE (2015) in supporting (SUPP) and non-supporting (nonSUPP) journals. Data are mean ± SD.

	2009	2015	P value
SUPP	55.3% ± 11.5%	60.5 ± 11.2%	0.02
Non-SUPP	51.8% ± 9.0%	60.2 ± 10.0%	< 0.001
P value	0.071	0.89	NA

References

Kilkenny C, Browne WJ, Cuthill IC et al. (2010) Improving Bioscience Research Reporting: The ARRIVE Guidelines for Reporting Animal Research. PLoS Biol 8(6): e1000412.
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Abstract Session 4
Facial expressions of pain in cats: development of the Feline Grimace Scale

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The aim of this study was to develop the Feline Grimace Scale (FGS) to evaluate acute pain in cats. Thirty-one client-owned painful cats [scores ≥ 4/16: composite measure pain scale (Calvo et al. 2014)] and twenty non-painful control cats were included in a prospective, observational, case-control study. Cats were video-recorded undisturbed in their cages. The assessment of facial expressions was performed using screenshots from video files. Two observers independently compared images of controls and painful cats to identify differences in facial expressions. Angles were measured between the medial border of the ear and the crown (medial angle) and between the lateral border of the ear and an imaginary line connecting both marginal cutaneous pouches (lateral angle). Horizontal and vertical distances were measured between ear tips, ear bases, eyes and muzzle. Bonferroni-corrected independent t-tests were used to compare distance ratios and angles between groups ($p < 0.05$).
Ear position, orbital tightening, muzzle tension, whiskers position and lowering of the head (action units) were different between groups. Angles were: medial (126.5 ± 4.7°; 140.4 ± 6.5°), lateral (78.9 ± 3.1°; 68.5 ± 5.9°), and distance ratios were: ear tips/bases (2.85 ± 0.3; 2.34 ± 0.3), eyes height/width (0.79 ± 0.1; 0.50 ± 0.2), muzzle height/width (0.70 ± 0.1; 0.50 ± 0.1) in control versus painful, respectively ($p < 0.0005$, all comparisons).
Specific action units were identified between painful and control cats. Reliability and responsiveness testing are required; the FGS could be an adjunct for feline acute pain assessment.

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Calvo G, Holden E, Reid J et al. (2014) Development of a behaviour-based intervention level for assessing acute pain in cats. J Small Anim Pract 55, 622–629.

This study was funded by the Fonds en santé des animaux de compagnie, Faculté de médecine vétérinaire, UdeM. Dr Evangelista is a recipient of the International Veterinary Academy of Pain Management (IVAPM) fellowship.

Abstract Session 4
Shaving does not affect QST measurements - mechanical sensory threshold, mechanical and thermal nociceptive thresholds - on the equine face

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Hairy skin is supposed to act as insulation, therefore clipping or shaving of the evaluated areas is a common practice while performing quantitative sensory tests (QST), especially thermal stimulation in horses (Love et al. 2011).
Thirty-four warmblood horses (15 mares, 5 stallions and 14 geldings) between the age of 1 and 23 years (mean: 10.5 years) were included in the study to evaluate the effect of shaving on mechanical sensory threshold (MST), mechanical and thermal nociceptive thresholds (MNT and TNT, respectively). Six (MST) and five (MNT and TNT) areas of the left side of the face with clear anatomical landmarks were evaluated. Ten horses had 2 (MNT) or 3 (MST and TNT) of these areas shaved due to participating in another study. Linear Mixed model was used to evaluate the effect of shaving on the QST thresholds. We have found that shaving had no significant effect on any of the QST thresholds (MST: $p=0.055$; MNT: $p=0.078$; TNT: $p=0.087$).
Removal of the hair to perform QST measurements on the face of horses is found to be redundant. Our findings can promote the use of QST methods in horses as it does not seem to require the alteration of cosmetic appearance of the patients.

References

Love EJ, Murrell J & Whay HR (2011) Thermal and mechanical nociceptive threshold testing in horses: A review. Veterinary Anaesthesia and Analgesia 38 (1), 3-14.

Abstract Session 4
Greater auricular and auriculo-temporal nerve blocks in the rabbit: an anatomical study.

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In rabbits, total or partial ear canal ablation with lateral bulla osteotomy are commonly performed; however, there is no established protocol for regional nerve blockade. This study evaluated the feasibility of carrying out greater auricular (GA) and auriculo-temporal (AT) nerve blocks in rabbits. Anatomical evaluation of nine rabbit cadavers informed about nerve location, block technique, and volume of methylene blue (MB) required. For the GA, the needle was inserted caudal to the atlas until the tip contacted its transverse process; MB (0.1 mL kg-1) was injected with needle retraction. For the AT, using the 'No Tilt' approach, MB (0.075 mL kg-1) was injected perpendicular to the skin in the space between the mandible and bullae; for the 'Tilt' approach, the needle was instead inserted at 45°—to be parallel to the mandibular ramus—and it was advanced slightly before MB injection. Using these protocols, the extent and distribution of MB staining was determined for 14 cadavers. Success was calculated from a modified grade of staining scale (Portela et al. 2017).
Results show that these protocols are feasible for blockade of GA and AT nerves in rabbit cadavers; further studies are needed to assess clinical effectiveness. Preliminary data suggests the 'Tilt' approach would be more successful for the AT block; however, blockade of the mandibular nerve may be of concern.

Table 1. Results of nerve staining

	GA (n = 14)	AT	
		Tilt (n = 8)	No tilt (n = 6)
Success rate	88.8%	80%	54%
Mandibular nerve staining	-	37.5%	8%

References

Portela DA, Campoy L, Otero PE et al. (2017) Ultrasound-guided thoracic paravertebral injection in dogs: a cadaveric study. Veterinary Anaesthesia & Analgesia 44, 636-645.

Abstract Session 4

Refinement of an indwelling catheter for consecutive blood sampling enables stress-free postoperative handling for research pigs

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Postoperative blood sampling through a catheter causes minimal stress for research pigs in comparison with restrain for venipuncture. Although heparin is used, clotting is a problem in pigs and heparin can interfere with the study design.
An indwelling catheter (BD Careflow™ 3Fr, 20G, 200mm) was coated with 2-methacryloyloxyethyl phosphorylcholine-based polymer (MPC) (Ishihara et al.1999), to investigate if clotting could be avoided. Fourteen pigs (25-30 kg) included in a transplantation study, were acclimatized for 14 days before the study. Anaesthesia was induced intramuscularly with tiletamine-zolazepam (Zoletil® vet. 500 mg mL-1) 5 mg kg-1 and medetomidine (Domitor® vet. 1 mg mL-1) 0.05 mg kg-1.The catheter was inserted into the auricular vein of both ears (n=27 successfully placed) and advanced into the external jugular vein with the Seldinger technique. Blood sampling followed by flushing with saline was performed once a day for four days. All pigs were euthanized at the end of the transplantation study and necropsy was performed.
None of the pigs showed signs of discomfort from the catheter. Sampling and flushing were successful during 4 days in 25 out of 27 catheters (93%). Two catheters were damaged. On necropsy, no pathological signs of inflammation was seen in the region of insertion and no pathological findings were observed in the auricular, maxillary or external jugular veins in any animal.
The use of MPC coated catheters eliminate clotting and facilitate blood sampling without restrain of the pigs. The percutaneous introduction technique offers access to the external jugular vein in pigs without surgery.

References

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Abstract Session 4
A survey of conduct of anaesthetic monitoring in small animal practice of the United Kingdom

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Monitoring is a key aspect of anaesthetic safety but little is known about current practices. A survey was used to assess various aspects of small animal anaesthetic monitoring.
Veterinary surgeons, nurses and student nurses working in the United Kingdom were invited to participate in an anonymous, internet-based survey including free text, multiple choice questions and Likert scales. No questions were mandatory. Data were analysed with descriptive statistics and presented as percentage respondents answering each question.
1,266 people consented to participate. The majority of respondents were in general practice (72.7%). 58.6% were registered veterinary nurses. 49.2% report their practice had one or more multi-parameter monitors, whilst 92.4% had two or more anaesthetic machines.
For routine procedures, respondents monitored; HR (98.6%), *f*R (98.1%), mucous membrane colour (96.0%), eye position (95.1%), capillary refill time (91.4%), palpebral reflex (89.7%), jaw tone (89.2%), pulse oximetry (84.1%), non-invasive blood pressure (61.5%), body temperature (60.9%), and capnography (46.2%).
58% felt at least moderately comfortable using and interpreting their available monitoring. However 32.3% felt uncomfortable interpreting pulse waveforms, 30.9% ECG, 30.0% PET'CO2 and 33.3% capnography waveforms. 60.9% had additional roles to fulfill whilst monitoring anaesthesia.
83.4% felt they would benefit from further training in monitoring. 35.7% felt patients were being adequately monitored at their practice. 99.4% agreed monitoring is important to patient outcome. The most significant factor limiting an improvement in monitoring was finance (29.3%).

This study provides data on the conduct of anaesthetic monitoring in small animal practice and highlight areas were additional training may be required.

Poster 1
Comparison between admixture of ketamine-propofol or tiletaline-zolazepam-propofol: cardiorespiratory parameters, induction and recovery quality in healthy beagles

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Recently ketamine (not Tiletamine) has become a restricted drug in France. In this study we compared two induction 1:1 propofol admixtures with ketamine or tiletamine-zolazepam (Ketofol and Zolefol, respectively).
Twelve healthy beagles were included in this randomized, cross-over study. The induction was set up at 0.5 ml kg-1 minute-1. Volume infused, intubation quality, intubation, extubation, sternal and walking time were recorded. Electrocardiography, HR, SpO2, fR, PE'CO2, expired VT (ml) and invasive arterial pressures (instrumented 60 minutes before the procedures) were noted every 5 minutes. Recovery was assessed with a modified multimodal scale (Biermann et al. 2012). An arterial blood gas sample was taken before and after the induction in order to evaluate the alveolar ventilation and dead space (at room air). Data were processed with a Wilcoxon matched pairs rank test and significance set at $p \leq 0.05$.
Induction volume (median (ranges)) was significantly lower for zolefol 1.3 (1.0-2.4) mL kg-1 over ketofol 2.1 (1.31-2.5) mL kg-1 ($p = 0.009$). No differences were observed in any cardiorespiratory parameters. A post-induction drop in SpO2 and PaO2 was observed in all dogs. Time to intubation was shorter for zolefol over ketofol ($p = 0.009$). Extubation and recovery of sternal position were no significantly different. Walking time was longer for zolefol 26.4 (16.5-38) over ketofol 19.5 (13.8-27.5) minutes ($p = 0.01$). Recovery quality was better for Zolefol group ($p = 0.02$).
Tiletamine-zolazepam can substitute ketamine in admixture with propofol for the induction of anaesthesia. However both protocols should receive supplementary oxygen

References

Biermann K, Hungerbühler S, Mischke R et al. (2012) Sedative, cardiovascular, haematologic and biochemical effects of four different drug combinations administered intramuscularly in cats. Vet Anaesth Analg. 39, 137-150.

Poster 2

Sedative and physiological effects of intramuscular alfaxalone and hydromorphone prior to anesthesia with isoflurane in seven guinea pigs (Cavia porcellus)

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The aim of this study was to evaluate the efficacy and some physiological effects of alfaxalone and hydromorphone as premedication in guinea pigs undergoing surgical removal of a vascular access button.

Seven healthy adult guinea pigs (1.02 ± 0.08 kg) were sedated with hydromorphone (0.3 mg kg-1) and alfaxalone (3 mg kg-1) intramuscularly (IM). Ten minutes after premedication, anesthesia was induced and maintained with isoflurane in oxygen delivered via a face mask. At the end of the procedure meloxicam (0.5 mg kg-1) was administered subcutaneously. Heart rate, respiratory rate, SpO2 and end-tidal isoflurane concentrations were recorded at 2 minute intervals. Quality of sedation (profound to no sedation), anesthesia induction (smooth to very poor) and recovery (good to poor) were assessed and time to return of locomotion was recorded. Temporal changes were analyzed using one-way ANOVA for repeated measures followed by Dunnett's test when appropriate ($p < 0.05$).

Alfaxalone and hydromorphone produced moderate sedation. Five guinea pigs demonstrated a negative righting reflex when placed in dorsal recumbency and were minimally responsive to stimulation. Anesthesia induction was fair with minimal to moderate excitement. Recovery was smooth. Total anesthesia time and time to return of locomotion were 29 ± 6 and 15 ± 4 minutes, respectively. All monitored physiological variables remained within normal ranges for the species. Respiratory rate decreased significantly compared to baseline.

Alfaxalone (3 mg kg-1) and hydromorphone (0.3 mg kg-1) (IM) is a suitable premedication protocol for healthy guinea pigs undergoing minor invasive procedures.

This research was funded by CALAM/CALAS

Poster 3
Identification of mucopurulent secretion from lower airways in healthy dogs undergoing anesthesia in Grenada - A pilot study

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Mucopurulent and frequently blood-tinged secretions have been observed on the endotracheal tube (ETT) at extubation in 1.7 % of clinically healthy dogs undergoing elective gonadectomy at St. George's University (Kalchofner Guerrero et al. 2017). The aim of this study was to identify the secretion and to test for sensitivity to different antibiotics.
Endotracheal tubes of clinically healthy dogs (ASA I and II) undergoing elective gonadectomy in 2017 were inspected on extubation. A sample was taken in the case of obvious mucopurulent secretion on the ETT. In total, 34 samples were collected and cultured on blood, phenylethyl alcohol, and MacConkey agars. Isolated bacterial colonies were analyzed by antimicrobial susceptibility using the Kirby-Bauer disk diffusion method on Mueller Hinton agar. Antibiotics used for sensitivity include ampicillin, amoxicillin-clavulanic acid, cephalexin, cefpodoxime, chloramphenicol, ceftriaxone, clindamycin, ciprofloxacin, ceftazidime, enrofloxacin, gentamicin, imipenem, cefotaxime, novobiocin, oxytetracycline, and ampicillin/sulbactam. Gram staining and oxidase tests were also performed. Descriptive statistical analysis was performed.
Of the 34 samples, 20 showed no significant growth for bacteria (58.8%). Nine samples indicated Pasteurella (26.5%), four samples Klebsiella (11.8%), and one sample Staphylococcus (2.9%). The samples showing significant growth were submitted for sensitivity testing. All 14 samples were susceptible to at least one antimicrobial drug, with enrofloxacin showing complete susceptibility and ampicillin showing the most resistance.
The finding of Klebsiella and Pasteurella identifies subclinical respiratory disease in clinically healthy canines in Grenada; this finding is probably related to the tropical climate. Further studies in other tropical areas may be indicated.

References

Kalchofner Guerrero KS., Rodriquez AI, Hegamin-Younger C et al. (2017) Anaesthetic complications in 596 dogs undergoing elective gonadectomy as part of a third-year veterinary surgical training program. Proceedings AVA Spring Meeting Manchester UK, p67.

Poster 4

A pilot examination of association between body condition score, body mass and needle length for successful epidural placement in dogs.

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Depth to epidural space has been assessed in women undergoing labour epidural (Seligman et al., 2017). The aim was to examine the association between needle length, body mass (BM) and body condition score (BCS) in dogs.
Clinical cases (dogs, n = 43) positioned in sternal recumbency underwent epidural injection of morphine 0.1mg kg-1 & bupivacaine 0.5% 1mg kg-1 at the L7 S1 interspace with a 22-gauge spinal needle. Epidural placement was confirmed with a hanging drop or lack of resistance test using saline. Following injection and prior to removal of the needle a single operator pinched the needle at the level of the skin. Once removed the distance from the level of the skin to the tip of the needle was measured with a standard ruler. Parameters recorded included needle length, BM, BCS, age, gender and breed. Epidural anaesthesia was deemed successful if no response to nociception was detected during surgery (HR, fR or MAP increasing 20% of baseline). Correlation and linear regression analysis were conducted using Minitab vs. 17.3 software. Linear regression models were constructed to predict the needle length (mm) using BCS and BM (kg) as independent predictors.
Needle length was significantly moderately correlated with BCS ($r = 0.325$, $p = 0.033$) and significantly but highly correlated with BM ($r = 0.686$, $p < 0.001$). BCS and BM were not significantly correlated ($r = 0.033$, $p = 0.834$).
Statistically and clinically significant association exists between body condition score, body mass, and length of epidural needle.

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Poster 5
Differential effects of alfaxalone and isoflurane on diffuse noxious inhibitory controls of hind limb nociceptive withdrawal reflexes in the rat

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A possible reduction in descending inhibition in chronic pain models can be studied electrophysiologically by measuring the effect of diffuse noxious inhibitory controls (DNIC) on spinal excitability, however outcomes may be affected by anaesthesia. This study compared the effect of isoflurane and alfaxalone on DNIC of spinal nociceptive withdrawal reflexes (NWR).
Twenty-eight male Sprague Dawley rats (384 ± 46g) had cannulae implanted in trachea, left carotid artery and jugular vein during isoflurane anaesthesia and local anaesthetic infiltration; half were decerebrated to the pre-collicular level (Dobson & Harris 2012). Subsequently animals received alfaxalone (1.67 mg kg-1 minute-1 for 2.5 minutes then 0.75 mg kg-1 minute-1 or isoflurane. After 60 minutes EMG responses were evoked in ankle flexor tibialis anterior (TA) and knee flexor biceps femoris (BF), or ankle extensor medial gastrocnemius (MG) by alternate electrical (8 shocks, 2ms duration, 1 Hz) stimulation of ipsilateral toes or heel respectively every 2 minutes. Inhibition of NWR evoked by 100µl 5mg/ml capsaicin into the contralateral forelimb was compared between groups. In decerebrated animals, capsaicin significantly inhibited toes-BF and toes-TA in the isoflurane, but not alfaxalone, group (tested using Friedman's ANOVA) to a median (IQR) of 39% (30–42%) and 38% (32-40%) of pre-capsaicin controls respectively. In intact animals, capsaicin significantly inhibited heel-MG reflexes to 66% (58-68%) of controls under alfaxalone but it was not possible to elicit reflexes or DNIC using isoflurane without subjecting animals to potentially aversive stimuli. Therefore alfaxalone but not isoflurane facilitates electrophysiological recordings of NWR in intact rats.

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Poster 6
Can we measure safety culture in veterinary anaesthesia?

A Redpath[1], C Oxtoby[2], K White[1].

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Safety culture is embedded in organisational culture and can be a predictive indicator of safety outcomes (Dov 2008; Ginsburg 2014).
The aim of this pilot study was to study safety culture in an equine hospital, to establish barriers to the introduction of a safety intervention (anaesthesia checklist) and identify possible suggestions for implementation.
A validated veterinary safety culture questionnaire (Oxtoby et al. 2017) was distributed to 13 staff in the surgical suite of a busy equine hospital. The questionnaire focused on four main domains that can be used to assess safety culture: production pressures, staff perception of management, communication and technical skills. All participants responded using a 1 to 5 Likert scale and free text responses. Subsequently an anaesthesia checklist intervention was adopted for 60 elective anaesthetics. Anonymised scores for each of the four domains were compared for each individual and between groups of staff using Mann-Whitney U test. Free text was also recorded.
Significant differences between vets and nurses were evident in communication and leadership domains ($p = 0.003$ and $p = 0.04$ respectively) with nursing staff being more negative about these aspects of safety culture. Areas contributing to potential errors included communication, handover, questioning hierarchy, and the role of audit. Acceptance and adoption of a safety intervention was poor. Changes were made to standard operating procedures following the study.
The questionnaire was a good tool to identify sources of error, and target interventions and these results will inform design of a larger multicentre study.

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Poster 7
Comparison of two doses of buprenorphine for peri-operative analgesia in female cats undergoing anaesthesia for neutering

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Efficacy of SC buprenorphine (0.02 mg kg-1) in cats is variable (Giordano et al. 2009). The study aim was to compare post-operative analgesia afforded by SC buprenorphine (0.3 mg ml-1) at higher doses in female cats undergoing ovariohysterectomy.
Eighty-three cats (ASA I), median age 12 months (range 1.2 - 84) weighing 2.5kg (± 0.8) were recruited and randomly allocated to receive 0.12 mg kg-1 buprenorphine (B12) or 0.24 mg kg-1 buprenorphine (B24) SC followed 30 minutes later by 0.04 mg kg-1 medetomidine IM. Anaesthesia was induced with alfaxalone IV to effect and maintained with isoflurane in oxygen. All cats received meloxicam before surgery. Temperament score, quality of sedation, induction of anaesthesia, dose of alfaxalone and recovery were scored using simple descriptive scales. Atipamazole was administered following surgery. Physiological variables during anaesthesia were recorded. Cats were assessed postoperatively by the same blinded observer at 2, 4 and 24 hours using the Colorado Feline acute pain scale. Data were compared using Students paired t-test or Mann-Whitney U tests as appropriate.
No significant differences were identified between groups. Mydriasis persisting for at least 24 hours was evident in 75 cats (90%). One dose of rescue analgesia (methadone 0.5 mg kg-1) was required in 3 cats (7%) in B12 and 4 cats (10%) in B24. No differences in analgesia were detected between groups with these protocols. The provision of prolonged analgesia enables dosing frequency reduction but is no substitute for regular pain scoring. Analgesic regimes must be tailored to the individual patient.

References

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Poster 8

Mechanical nociceptive threshold (MNT) testing in rats: effects of probe tip configuration and cage floor characteristics for electronic von Frey (EvF) compared to traditional filaments (Fil)

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An EvF requires fewer replicate stimuli than traditional Fil to assess mechanical allodynia. The present study evaluated effects of probe and flooring characteristics on MNT measured using a rat-specific EvF (RatMet, Topcat Metrology Ltd) and Fil (Stoelting).

Twelve adult male (Wistar or Sprague Dawley) rats (420 ± 27g) were randomly assigned for testing (both hind paws) with 4 different probes (9L: 0.9 mm diameter, long; 9S: 0.9 mm diameter, short; 5L: 0.5 mm diameter, long; 5F 0.5 mm diameter, flexible) plus Fil on three floors (mesh, wide spaced bars or narrow spaced bars). Triplicate EvF readings were taken for each paw and the up-down method used for Fil. Within and between group comparisons were made with 1-way repeated measures and 2-way ANOVA, respectively. Significance was $p < 0.05$.

There were no significant differences in MNT with different floor surfaces, but the mesh was technically easier for application of EvF probes and the rats appeared more comfortable. MNT were 67 ± 12g (mean ± SD), 66 ± 7g, 49 ± 7g, 55 ± 8g and 13 ± 4g for 9L, 9S, 5L, 5F and Fil respectively, hence probe length did not influence MNT but MNT using 0.9 mm diameter probes were significantly higher ($p = 0.004$) than with 0.5 mm. All EvF MNT were significantly higher ($p<0.0001$) than with Fil.

Consistent with previous RatMet data (Pang & Shuster, 2015) probe tip diameter influences MNT but probe flexibility and length are less influential.

References

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Poster 9
A retrospective evaluation of anaesthetic morbidity and mortality in a captive Gibbon collection

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Anaesthesia associated morbidity and mortality of the lesser apes (Symphalangus (Siamang), Nomascus (Crested Gibbons species), Hoolock (Western Hoolock Gibbon) and Hylobates (allopatric species) is unpublished.
The aim of this study was to evaluate anaesthesia morbidity and mortality in a large captive gibbon collection holding all four genera.
Records from 111 anaesthetic procedures and 13 post-mortems were retrospectively reviewed to assess the anaesthetic-related mortality rate, and contributing factors over a seven-year period (2011-2017). Method and quality of induction, maintenance and recovery characteristics plus physiological parameters, including HR, PR, fr, SpO2, FE'CO2, rectal temperature and blood pressure via oscillometry were recorded. Data were compared using Student's t-test or Mann-Whitney U tests as appropriate. For detailed analysis over time variables were analysed by two-way repeated measures ANOVA.
The population consisted of both sexes of 6 species of gibbon aged 15.5 years (1.4 - 51.6) weighing 8.9 kg (2.5 - 15.7) anaesthetised for routine and emergency procedures. Anaesthesia was induced with medetomidine (0.05 mg kg-1) and ketamine (5 mg kg-1) and maintained with isoflurane in 92% of cases. Hand injection (n = 91) resulted in a significantly superior quality of induction of anaesthesia compared to darting (n = 19), top up boluses were significantly more likely in darted animals. One animal died during anaesthesia (0.9%) and 11 were euthanised.
Medetomidine-ketamine-isoflurane anaesthesia in gibbons is associated with similar morbidity and mortality (0.9%) as other domestic species (Brodbelt et al. 2008) and the great apes (Masters et al. 2007). Hand injection offers advantages over darting.

References

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Poster 10
Prevalence of hyperkalemia during general anesthesia in Greyhounds

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We observed bradyarrhythmias in Greyhounds undergoing general anesthesia in the absence of relevant history or clinical signs of disease. Corresponding blood sampling revealed marked hyperkalemia, and directed intervention with successful outcomes.
In an effort to characterize the prevalence and time course of anesthesia-induced hyperkalemia to facilitate clinical management in Greyhounds, blood was sampled and analyzed for potassium prior to, and at a minimum of 30 minute intervals, beginning one hour after induction of general anesthesia, and continuing into the post-anesthetic period if hyperkalemia was present. Physiological parameters, the need and type of intervention, and outcome were also recorded. These data were retrospectively summarized for Greyhounds seen between 2013 and 2017.
Hyperkalemia (> 5.6 mEq L-1) was measured in 36 of 95 anesthetic events. Twenty-nine hyperkalemic episodes occurred at 2 hours or more following anesthesia induction; 7 occurred at 1.5 hours or sooner. Most dogs received hydromorphone, acepromazine, and atropine premedication, midazolam and propofol for induction, and isoflurane maintenance with mechanical ventilation. Hyperkalemia occurred in the absence of respiratory or metabolic derangements. No animals were hyperthermic. Interventional treatments included intravenous fluid therapy, discontinuation of anesthesia or treatment with insulin and dextrose. All animals recovered and were discharged from the hospital.
Hyperkalemia in Greyhounds undergoing general anesthesia occurs with high prevalence; duration of anesthesia appears to be a risk factor. Awareness, monitoring and early interventions with accepted treatment protocols can be lifesaving. Future studies should be directed at identifying the cause.

Poster 11

A retrospective study on the prevalence and covariates associated with oculocardiac reflex in dogs undergoing enucleation.

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The oculocardiac reflex (OCR) is a potential anesthetic complication (Alia et al. (2014), Joffe & Gay (1966)). The aim of this study was to report the prevalence and covariates associated with OCR in dogs undergoing enucleation.
Medical records (n =145) of dogs undergoing enucleation between January 2010 and June 2015 at the Matthew J. Ryan Veterinary Hospital of the University of Pennsylvania (PennVet) and the Faculty of Veterinary Medicine of Université de Montréal were reviewed retrospectively. Demographic data (age, breed and body weight) and whether patients received anticholinergic drugs or retrobulbar blocks (RBB) prior to surgery were recorded. The OCR was defined as sudden intraoperative bradycardia without concurrent administration of opioids or agonists of alpha2 adrenoreceptors. Continuous and binomial logistic regression analysis was performed to evaluate the association between OCR and continuous (age) or binomial variables (brachycephalic vs dolicocephalic, RBB and anticholinergic administration), respectively. Significance was set at $p = 0.05$.
Prevalence of OCR in 145 dogs undergoing enucleation was 4.8%. Preoperative administration of RBB was associated with lower prevalence of OCR (odds ratio : 0.117; CI : 0.116, 0.119; $p = 0.017$). Neither age ($p = 0.558$) nor the brachycephalic conformation ($n = 126$, $p = 0.097$) was associated with the occurrence of OCR. Preoperative administration of anticholinergics did not reduce the prevalence of OCR (odds ratio: 1.525; CI: 1.504, 1.547; $p = 0.72$).
RBB may contribute to decreased risk of OCR in dogs undergoing enucleation whereas preoperative anticholinergics, age and the brachycephalic conformation may not.

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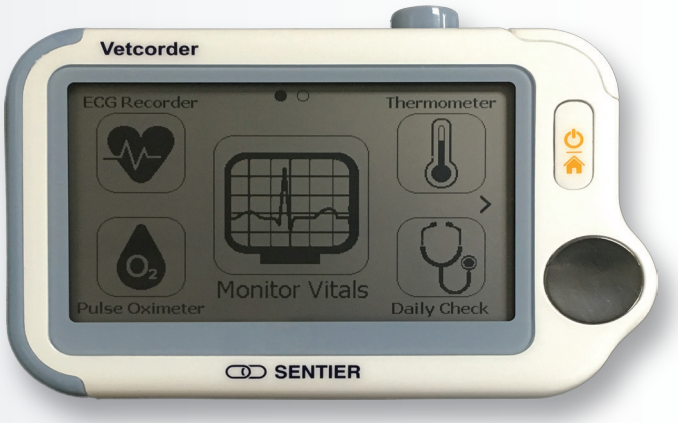

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