

# Proceedings

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# Lectures

# Monday, September 15th

# Pre-congress Day

9:00 - 9:45

# Pressure-Volume relationship in the respiratory system and its monitoring

#### Mathieu RAILLARD

Pressure—volume relationships should be used with purpose, and their loops or values critically questioned and interpreted with caution before being used to guide clinical decisions. This session covers the elastic behaviour of the lungs and chest wall and how their interaction generates the sigmoidal pressure—volume relationship. Static, quasi-static, and dynamic compliance, as well as compliance of the lung, chest wall, and entire respiratory system are discussed, focusing on their interpretation and measurement. Selected available measurement techniques are briefly reviewed with their advantages and limitations. Emphasis is placed on dynamic compliance of the respiratory system as one of the most clinically accessible variables.

9:45 - 10:15

### Pulmonary gas-exchange and Ventilation-perfusion mismatch

#### **Olivier LEVIONNOIS**

This session introduces the fundamentals of pulmonary gas exchange, explaining how oxygen and carbon dioxide move between air and blood. Attendees will learn the physiological basis of the ventilation-perfusion (V/Q) ratio, discover how mismatches arise, and understand their impact on oxygenation and  $CO_2$  removal. The lecture clarifies the roles of shunt and dead space, describes typical lung V/Q distribution in animals, and highlights key compensatory mechanisms.

# Ventilation modes and strategies in veterinary anaesthesia: a ventilatorcentric perspective

#### **Mathieu RAILLARD**

This session explores the foundations of mechanical ventilation in veterinary anaesthesia, beginning with the essential building blocks of a ventilatory cycle: control, trigger, limit, and cycling variables. It explains how these elements interact to define the phases of inspiration and expiration and govern animal—ventilator interaction. The most commonly available ventilation modes are described, including their theoretical basis and practical implementation on modern ventilators. Emphasis is placed on how different ventilators translate the same mode concept into specific technical behaviour, highlighting variations in trigger sensitivity, cycling criteria, and flow delivery. The session also examines the limitations inherent to anaesthesia ventilators compared with ICU systems, such as differences in bias flow, responsiveness, and mode sophistication, and how these factors can affect their performance.

11:15 - 12:00

# Comparative pathophysiology of the diseased lung and ventilation strategy

#### **Olivier LEVIONNOIS**

This lecture compares how various lung diseases disrupt gas exchange and V/Q matching in different veterinary species. It reviews methods to evaluate ventilation-perfusion mismatch. Participants will explore the basic pathophysiology behind conditions such as pneumonia, pulmonary edema, and obstructive disease, and learn principles of ventilation strategies tailored to underlying defects. The session emphasizes practical approaches for optimizing oxygenation and minimizing ventilator-induced lung injury.

12:00 - 13:00

### Liquid ventilation: concept and application

#### **Matthias KOHLHAUER**

Liquid ventilation represents an innovative experimental strategy in which the lungs are filled and ventilated with liquid perfluorocarbons that are able to dissolve a large amount of oxygen and carbon dioxide. Thanks to their unique physical properties, these liquids are able to deliver oxygen directly to the alveoli and to remove carbon dioxide, thereby sustaining normal gas exchanges for several hours. The use of such liquid as respiratory medium, instead of gas, presents several advantages: it eliminates the air-liquid interface within the alveoli, increases the recruitment of the lungs and improves the lung static compliance. Liquid ventilation has been developed for several decades in the setting of support of svere respiratory failure, ability to induce therapeutic hypothermia or improving intrapulmonary drug delivery. This innovation is currently under investigation for the human applications but could also reprent an interesting strategy in veterinary medicine.

# Alveolar recruitment strategy in the operating theatre

#### **Mathieu RAILLARD**

This session examines alveolar recruitment manoeuvres (ARMs) in the operating theatre, beginning with human practice. It covers how and when to perform ARMs and the rationale for recruitment. Techniques such as sustained inflation and stepwise approaches are discussed, including step durations and individualised PEEP selection. Indications and contraindications are also addressed. Evidence in dogs and horses is then reviewed. The session summarises the reported benefits and limitations in both species, including improvements in oxygenation and compliance, the need for PEEP to maintain effects, and the physiological trade-offs such as cardiovascular compromise and the risk of hyperaeration at high pressures. Emphasis is placed on interpreting the literature to understand the balance between potential oxygenation gains and associated risks, and on identifying common considerations that apply across species.

14:40 - 15:00

### Use of selective lung ventilation

#### **Olivier LEVIONNOIS**

Focusing on advanced airway management, this session covers the indications, physiology, and techniques for selective and one-lung ventilation in veterinary thoracic surgery. Key learning points include understanding the physiological challenges of one-lung ventilation, the impact on gas exchange, management strategies for hypoxemia, and practical guidance on airway devices and monitoring.

#### 15:00-16:00

# Ultrasound for monitoring pulmonary ventilation?

#### **Belaid BOUHEMAD**

Lung ultrasound (LUS) has become a cornerstone of respiratory assessment in critically ill patients, offering an immediate, radiation-free, and dynamic imaging modality at the bedside. This session will present the technical rationale of LUS, emphasizing its utility not only for diagnosis but also for ongoing monitoring and ventilator management.

A key concept is that the echographic image or pattern is directly related to the degree of lung aeration: the normal air—tissue interface reflects ultrasound waves, rendering the lung parenchyma invisible. In contrast, pathological conditions such as pulmonary edema or consolidation modify tissue acoustic properties, allowing ultrasound to penetrate and generate specific artifacts (A-lines, B-lines, dynamic air bronchograms) that reflect varying levels of aeration loss.

The session will explore how to use LUS for diagnosing pneumothorax, pleural effusion, alveolar-interstitial syndromes, and pneumonia; for titrating PEEP; predicting weaning failure;

The lung ultrasound score (LUS score) will be introduced as a tool to semi-quantitatively assess and track changes in aeration. Attendees will gain practical knowledge on integrating ultrasound patterns into individualized care strategies, improving diagnostic precision.

#### **Learning Objectives**

- 1. **Explain the physiological and physical principles** that underpin lung ultrasound, including how ultrasound patterns are determined by the degree of lung aeration.
- Recognize and interpret key sonographic findings, including A-lines, B-lines, dynamic air bronchograms, subpleural consolidations, pleural effusions, and pneumothorax, in critically ill patients.
- 3. **Apply the lung ultrasound score (LUS score)** to assess and monitor changes in pulmonary aeration and evaluate response to therapeutic interventions.

#### 16:15 - 17:00

#### Mechanical ventilation in intensive care

#### **Tom GREENSMITH**

The core indications for invasive mechanical ventilation in veterinary ICUs include refractory hypoxemia despite appropriate non-invasive oxygen supplementation, severe and/or progressive hypercapnia and impending patient fatigue. In people, two other indications often forgotten by veterinarians (perhaps due to cost implications or the perception of hopeless outcomes) include cardiovascular instability refractory to treatment and the requirement for any reason of tight control of respiratory mechanics due to other comorbidities (such as head trauma). Targets for mechanical ventilation should include immediate normalisation of acutely life-threatening abnormalities. Some other abnormalities should not be rapidly normalised as this may be detrimental; for example, normalisation of profound compensatory respiratory alkalosis may lead to life-threatening acidaemia. Normal instrumentation for invasive mechanical ventilation should be tailored to the

underlying indication, but in the majority of cases includes central venous access (to facilitate venous blood samples and enable the multitude of infusions typically required), arterial catheterisation (for evaluation of pulmonary function and invasive blood pressure monitoring), urinary catheterisation (for both urine output monitoring as well as to reduce urinary scalding), ECG, pulse oximetry, capnography and continual temperature monitoring. Recording of variables should include the full

gamut of patient vital statistics as per general anaesthesia, as well as the current ventilator settings (as these may not always be the same as the patient's values, e.g. a patient breathing above their ventilator set respiratory rate). Although lifesaving, mechanical ventilation carries a multitude of potential complications, many of which are potentially fatal. There are many facets of

ventilator-induced (or associated) lung injury, and these include barotrauma, volutrauma, telectrauma, oxygen toxicity and biotrauma. The potential for deleterious effects on cardiovascular function, intracranial pressure, splanchnic organ function, hormone levels, oral/pharyngeal/tracheal mucosal trauma, severe keratopathies and systemic malnutrition are ever-present threats, and that's before we even consider ventilator-associated pneumonia! Anaesthetic agents used will vary slightly due to patient factors, however volatile inhalants are rarely used and infusions of multiple agents (such as opioids, ketamine, benzodiazepines and alpha 2 agonists) are typically used to minimise the dose of any single agent, as well as reduce the required

dose of the primary TIVA medication (commonly propofol or alfaxalone). Neuromuscular blocking agents (typically non-depolarising) may be used in certain situations; however, their effect on the ability to assess the response to a spontaneous breathing trial and the potential effect on the ability to wean the patient should be carefully considered before their use. The goal is to minimise physiologic alterations whilst maintaining the lightest plane of anaesthesia possible, at the same time as minimising asynchrony between the patient and the ventilator (which would otherwise be a potential source of severe cardiovascular dysfunction as well as markedly inhibiting appropriate oxygenation and alveolar ventilation). Despite this light plane, it is essential not to simply deepen the anaesthesia when a patient is asynchronous, as there may be other factors which can range from the benign (such as the need to defecate) to the potentially fatal (airway occlusion, pneumothorax etc.) which should be investigated.

Whilst being ventilated, patients need extremely rigorous nursing care to help minimise complications and recognise issues as promptly as possible. Nursing considerations include care of the artificial airway (and oropharynx if orotracheally intubated), assessment of pulmonary secretions, excellent ocular care to avoid exposure keratitis, physiotherapy to minimise musculoskeletal problems, frequent repositioning to reduce pressure sore formation, urinary and faecal management.

The circuit itself requires frequent monitoring to assess for fluid or secretion buildup, the need for circuit humidification and for any signs of contamination or damage, which would necessitate replacement. Daily veterinary considerations should include rigorous assessment of the major body systems, evaluation of any changes needed in anaesthetic management, review of ventilator settings and alarm set points, ocular and urinary assessment (for damage and infection respectively), thoracic and cardiac ultrasound (to monitor pulmonary changes and guide fluid and vasoactive agent use respectively) as well as the expectation each day that a spontaneous breathing trial should be performed unless contraindications exist. A wide array of ventilator modes now exist, many with manufacturer-specific names despite only subtle variations from other modes! It should be stressed that there is no one perfect mode of ventilation, and the absence of superiority of any one mode concerning patient outcome should highlight that all modes can be used safely in the right hands. Each mode has its pros and cons, and each has implications on the assessment and management of a patient. For example, the author prefers to use volume assist control in patients whose pulmonary compliance is expected to change rapidly (within hours) to enable a reasonably static tidal volume to be provided; however, the same level of safety could likely be afforded with pressure control if the alarm settings for tidal volume were set for a narrow range. While some modes have the potential to be used as a rescue therapy (such as airway pressure release ventilation), if the entire team (including the nursing staff) are unfamiliar with the management and specifics of such a mode, they are likely to result in a less safe environment for the patient. Some once popular modes (such as SIMV) have fallen out of favour, given consistent results documenting worse outcomes during weaning of mechanical ventilation in people. Due to the profound heterogeneity of patient populations, causative diseases and even the regional variations in pulmonary mechanics in a single patient, the ability to safely utilise the basic modes well is likely of greater benefit than reliance on promises of exceptional patient outcomes newer ventilator modes.

It is important to recognise that the vast majority of recommendations for the use of PEEP, pressure limits and tidal volumes have much of their evidence base either from older experimental models, or more recently from mechanical ventilation of humans with ARDS. Every human with ARDS is different, and the pulmonary mechanics are highly variable in the same person during the disease time course. The cause of ARDS (i.e. extra or intrapulmonary origin) also affects the mortality benefits of certain approaches, as does the patient's immunophenotype. We are likely to always be significantly behind our human medical counterparts, and we should remember that in many cases our patients are not afflicted with ARDS as it is currently diagnosed. The more homogenous the lung tissue, the safer any form of mechanical ventilation will be. Heterogeneity increases the risk of damage as it is impossible to ventilate a heterogenous lung in a manner which is safe for all alveoli.

Open lung management involves attempting to homogenise the lung as much as possible by recruiting as much lung as possible, as safely as possible. Closed lung management, by contrast, aims to ventilate the currently open areas of lung tissue, while minimising cyclic changes in unstable areas without attempts to recruit vast areas of lung. The baby lung concept (which was borne from adult ARDS) is the idea that even in a normal adult human, the functional area of lung tissue which could be ventilated may be akin to a paediatric patient (300-500g of functional lung tissue, akin to a 5-6 year old) and it may be impossible to recruit any further tissue (with any attempt to do so potentially causing severe injury to the currently functional lung tissue). The baby lung concept lies at the heart of small tidal volumes as a lung protective strategy, but it should be remembered that the normal anatomic dead space of cats and dogs is not the same as people. A recent small sample experimental study (Girotto et al. 2024) documented cats to have an airway dead space approximately half that of similarly sized dogs, and if some human guidelines were adhered to (4-6ml/kg), the set tidal volume may be smaller than the airway dead space resulting in profound alveolar hypoventilation. A full discussion of these concepts requires an entire conference by itself, but it should be evident that as we cannot know externally how much aerated lung tissue is present (without tests such as CT scans), nor can we know if it is possible to recruit lung tissue we cannot know which strategy is optimal in any one patient from day to day, let alone between patients. Recruitment manoeuvres make excellent sense in the context of atelectasia from hypoventilation, positional changes, or thoracotomy, but in ICU populations have consistently been documented to have no impact on outcome, only a transient effect on oxygenation indices, and the risk of pulmonary damage. They are not routinely performed for ICU populations given the risk/benefit relationship documented in human medicine so far. Alveoli filled with debris or fluid are less likely to be recruitable, and in many ICU patients their pulmonary consolidation is not due to atelectasia further bringing the use of these techniques into question. Positive end expiratory pressure (PEEP) is well known for its beneficial effects on functional residual capacity, improved compliance, reduced work of breathing, improved pulmonary vascular resistance, decreased shunt fraction and augmentation of left ventricular function. These benefits only exist when it is applied correctly and at an appropriate level. Excessive PEEP risks increasing anatomic and physiologic dead space, worsening venous return, increasing pulmonary vascular resistance and all the detrimental sequelae that would stem from such changes.

There is no optimal method to set PEEP despite a multitude of different techniques (the author is aware of 16 different techniques currently), but ARDSNet FiO 2 / PEEP guidelines applied directly to our patient population is almost certain to be dangerous. Due to the frequent need for airway disconnection and suctioning, the full benefits of even perfectly applied PEEP can never be realised without the ability to perform management techniques common in human medicine (such as continual closed system subglottal suction and bronchial vacuuming). While PEEP undoubtedly remains part of the multifaceted strategy to reduce ventilator-induced lung injury, extreme care should be taken when determining the 'appropriate' level which should be applied in patients with elevated intracranial pressure, bronchopleural fistulae, cardiovascular instability and obstructive airway disease. Weaning or liberation from mechanical ventilation is a subject in which there is almost no veterinary evidence. Many manufacturers create weaning algorithms for their ventilators with exciting names and even bolder claims of reduced clinician workload, faster extubation and better patient outcomes. None has been crowned victorious in the quest for the ideal weaning technique; thus, we should rely on common sense principles and evidence-based recommendations. Prolonged mechanical ventilation is common in people, and the more prolonged the period of ventilation the more difficult weaning may be due to patient fragility, immobility and weakened respiratory muscles. In animals, protracted ventilation is uncommon due to the financial constraints (the author's record is 10 days), meaning much of the difficulty faced by our human counterparts is

avoided. Several studies in people assessed commonly used weaning methods (such as the use of SIMV, T-pieces or spontaneous breathing trials) and SIMV has consistently been found to be a the worst method of weaning, which explains why in the most recent survey in people only 0-6% of ICU clinicians utilise SIMV (compared with over 90% in a similar survey in 1980s). Similarly, in trying to predict which patients are suitable to wean, to date over 460 different weaning predictors have been assessed, and none is a perfect predictor. Many patients who can be weaned cannot be predicted, and many who should wean fail attempts. It is for this reason that daily spontaneous breathing trials (SBT) are now recommended as the standard of care. The exact specifics of how to perform an SBT vary between study, institution and clinician. An SBT is a marked reduction in ventilatory support to the patient with a period of close observation – this can be as simple as disconnecting the artificial airway from the ventilator, or could involve applying small amounts of CPAP or pressure support. Even if not successful for extubation, the use of daily SBTs has been shown to have other patient benefits. We can't perform an SBT in the same manner as in people (in whom sedation holidays are recommended) as our patients would not remain compliant norintubated. For this reason the SBT should be planned into each day to ensure the maximum chance of benefit by weaning sedation for an appropriate period leading into the trial. SBTs in unstable patients or in those who are rapidly deteriorating are ontraindicated. Failure of an SBT has set criteria in people, which again may not all be as translatable to our patient population (given they will also likely be experiencing emergence from general anaesthesia), and therefore, common sense may need to be employed. One of the small pieces of evidence we do have in veterinary medicine is that most successfully weaned patients did not fulfil even the common-sense veterinary recommendations currently published for 'being appropriate' to undergo an SBT, further underlining this point.

Girotto et al. Dead space volumes in cats and dogs with small body mass ventilated with a fixed tidal volume. Veterinary Anaesthesia and Analgesia, 51(6);585 - 593

For a complete reference list used during the talk, as well as a list of useful resources please visit a Google Docs page housing the information at https://shorturl.at/OIpAa

#### **Learning outcomes**

- 1. Recognise complications associated with mechanical ventilation in the ICU
- 2. Understand the rationale behind approaches designed to mitigate ventilator- associated lung injury
- 3. Demonstrate a basic understanding of lung management strategies (open and closed lung approaches), as well as the baby lung concept
- 4. Understand the importance of spontaneous breathing trials and their use during weaning

# Tuesday, September 16th

9:30-10:30

# Zoobiquity: connecting human and animal welfare through anesthesiology and analgesia

#### **Baptiste BALANCA, Emmanuelle CANET-SOULAS**

In this session, we will examine the concept of Zoobiquity, the interconnectedness of human and animal health, through the lens of anesthesiology and pain management. We will begin by exploring the historical development of anesthesia education in both human and veterinary medicine, highlighting how each field has influenced and evolved the other. Through the study of translational research on cardiovascular and neurological diseases, we will explore how comparative models enhance our understanding of these conditions and the associated treatment approaches. Furthermore, we will discuss the evolution of perioperative care—pre-, intra-, and post-intervention—in both veterinary and human practice, emphasizing advances in patient safety, pain management, and personalized care. Attendees will learn about the value of a multidisciplinary, comparative approach to anesthesiology. They will discover innovative ways in which veterinary and human practices can inform each other. They will also appreciate the potential of translational research and animal well-being in addressing these differences.

#### **Learning objectives:**

- History of anesthesia education
- Anesthesia practices in translational research
- Future perspectives in anesthesia and peri-intervention care

# Conflict management and team building in the operating room

#### **Christelle FOURNEL, Marc LILOT**

This joint conference, featuring a human anesthesiologist-intensivist and a professional veterinary anesthetist, explores the complex human dynamics of conflict management and team cohesion in the operating room—a space where high stakes, strict time constraints, and life-or-death decisions are the norm.

The OR is a pressure cooker: the possible threat to patient life, the need for measured interprofessional risk-taking, and the urgency of decisions often heighten tensions. These stressors, combined with diverse personalities, hierarchical structures, and communication breakdowns, make the environment fertile ground for misunderstanding and conflict. Drawing on both medical and veterinary experiences, the speakers will present frameworks such as the DISC behavioral model and the Big Five personality traits to better understand individual responses under stress. They will provide tools for emotional regulation, assertive and intergenerational communication, and the management of difficult dyadic dynamics, as well as strategies for working with high-conflict personalities or toxic interpersonal patterns. Techniques for de-escalation, setting healthy boundaries, and preserving psychological safety will also be discussed.

Time pressure will be analyzed not only as a technical constraint but as a psychological amplifier of latent tensions. The importance of functional compromise, clear role definition, and structured debriefings will be highlighted as key pillars for sustainable team performance.

This conference ultimately offers a message of hope and shared purpose: that despite the intensity of the OR, collaboration, mutual respect, and ethical commitment can turn conflict into growth, and stress into cohesion—reclaiming a common sense of meaning in care.

#### Learning objectives:

- Gain a better self-understanding and one's inter-individual ecosystem
- Understand the meaning and importance of working together in a complementary way
- Identify individual objectives and prioritise common objectives
- Inspire constantly and appropriately trust and deep respect
- Prevent conflicts and dealing with it professionally (same goes for crisis)

### Anxiety in the perioperative period: which drugs for which behaviors?

#### Sarah HEATH, Mikhail DZIADZKO

The perioperative period can be challenging for human and non-human surgical patients. Expression of anxiety is prevalent and entirely natural but when the emotional challenge is excessive or poorly managed by the individual, it can alter the patient's experience and have potentially long-term consequences. Elevated anxiety can also create barriers between patients and caregivers, complicating care delivery and exposing professionals to emotional and operational challenges. This presentation will consider the perioperative challenge from both a human and veterinary perspective and discuss the similarities and differences across the species. It will discuss the challenges involved in assessing emotional health in surgical patients, acknowledging the limitations of available tools and the importance of skilled observation and interpretation, and the species-specific considerations in relation to factors that can influence it.

The role of medication for patients with signs of perioperative anxiety will be reviewed alongside potential limitations. The concept of One Green Health will be introduced, promoting a holistic and sustainable approach that values emotional, physical, and ecological health across species.

Finally, the importance of individualised, multidimensional strategies for emotional management will be emphasised. Practical approaches will be suggested, including environmental modifications, patient education, preconditioning, non-pharmacological interventions, and targeted pharmacological support where appropriate. A respectful, thoughtful approach to perioperative anxiety has the potential to improve patient outcomes, enrich professional practice, and support a more compassionate and sustainable model of care for all living beings.

#### **Learning outcomes:**

- Understand the potential for emotional responses to influence the patient's perioperative experience
- Appreciate the challenges in relation to measuring emotional impact on surgical patients
- Discuss the role of medication for anxious patients in the perioperative period
- Recognise the importance of individualised approaches to emotional management of perioperative patients

# Wednesday, September 17th

8:30-9:30

Sustainability in Anaesthesia: where do we stand?

#### **Ellie WEST, Florence LALLEMANT**

We have heard about the problems, and now we will hear some solutions. We will hear about sustainability work in veterinary clinics within the Mars Vet Health's global network of 3,000 clinics, demonstrating that sustainability practices and approaches can positively impact quality of care, resource savings and staff satisfaction. We will see some practical tools which can be taken away and used in clinics straight away. We will use real-life examples to learn how we can bring sustainability to life in our day-to-day practice. We will learn about some of the barriers to sustainable practices, and how they can be overcome. Most importantly of all, we will be introduced to some of the members of the community who are doing this work, so that we can remained connected to promote best practices for sustainability in France, and around the world. "

For several years, the French Society of Anesthesia and Resuscitation (SFAR) has become aware of its own environmental challenges: greenhouse gas emissions from halogenated gases, the use of fossil and mineral resources resulting from the significant consumption of single-use medical devices, significant production of healthcare waste, and significant medication waste. These numerous topics have given rise to practical eco-responsible care sheets and guidelines such as the one on clothing and the one on reducing the environmental impact of general anesthesia. Practices are therefore beginning to change and knowledge in this area is growing, with the ecological transition increasingly attracting the interest of caregivers. Notable developments are currently being noted, firstly with the authorization of the use of Desflurane constrained by European regulations relating to fluorinated gases from 2026. Furthermore, eco-responsibility in anesthesia goes beyond the care provided and also concerns the general environmental impact of hospitals. Thus, the SFAR warns about gas leaks from nitrous oxide administration networks and consequently calls for the closure of these networks, which provide significant GHG pollution. The eco-design of care continues to progress and is now focusing on prescriptions by favoring oral administration over intravenous administration, which emits much more GHGs and consumes devices. Finally, many other subjects remain to be investigated such as the evaluation and support for changes in practices, eco-responsible locoregional anesthesia and a better understanding of the potential ecotoxicity of our practices.

### **Learning objectives**

- 1. To be aware of what is being done for sustainability already in veterinary and human clinics
- 2. To know which practical tools can help with changing behaviours
- 3. To understand the main barriers in practice to transforming to sustainability

# 100% Green: Hypnosis

#### Anne Claire GAGNON, Philippe CUVILLON

Hypnosis is a physiological activity of the mind characterised by focused attention, absorption, dissociation, and plastic imagination. Over the last two decades, a growing number of studies on hypnosis have demonstrated its ability to modify the activity of the cortex. This activity is characterised by localised hypersignalling in the prefrontal, anterior cingulate cortex, amygdala, thalamus, insula, and somatosensory cortex

In surgery, hypnosis can be used on its own for minor surgical procedures and invasive manoeuvres and/or in selected patients or as an adjunct to anaesthesia (local, regional, and/or sedation). In this context, there is a green gain in terms of product and consumable savings. Administered by humans, it is free, has no proven adverse effects, and promises to help improve the cost/benefit ratio. However, several immersive techniques (virtual reality) can break this compromise, moving away from green and towards consumables.

#### **LEARNING OBJECTIVES:**

- 1: to gain a better understanding of the cortical connections that explain the physiological mechanisms of hypnosis
- 2: to define a clinical application strategy incorporating green anaesthesia
- 3: propose pathways integrating hypnosis and green economy and define the limits in surgery

Animal magnetism has been in 1766 the first name of technics that became hypnosis around 1830 in human medicine. Many tools and techniques were used for centuries to restrain animals during procedures, with one of the first described in chickens in 1636. Most of them are related to tonic immobility, a state of fear. They are unethical today, even if it works on chicken, rabbits, dogs, cats, and opossums. Dorsal immobility could be compared to human hypnosis, which is stress-free, but doesn't allow any surgery in this modified conscious state. Non-invasive procedure could be made easier under akinetic hypnosis for cats, cows. Acupressure, used in T Touch and Emotional Freedom Techniques, could be beneficial for all vet patients to decrease fear and stress before surgery, which could contribute to reducing the amount of anaesthetic drugs injected to vet patients.

#### **LEARNING OBJECTIVES:**

- 1. To know more about history of animal hypnosis
- 2. To understand the differences with medical hypnosis in human anaesthesia and how polyvagal theory applies to animals and humans
- 3. To use animal hypnosis, clipnosis and EFT as tools for a green pre-anaesthesia

# Loco-Regional Anaesthesia-Neuromodulation: Keep a Green Clear Consciousness

#### Jaime VISCASILLAS-Xavier CAPDEVILA

Surgical activity uses a lot of resources, and anaesthesia contributes in a disproportionate way to its carbon footprint. Volatile anaesthetics are exhaled without changes into the atmosphere and have very different environmental impacts: sevoflurane stays in the atmosphere 1–5 years, isoflurane 3–6, and desflurane 9–21 years; nitrous oxide stays more than one century. In hospitals, inhaled agents can be until 5% of the total emissions and 30–50% of the ones directly produced in perioperative care in high-income countries.

In human medicine, important steps already were taken. NHS Scotland removed desflurane in 2023 and NHS England did the same in 2024, and this was without evidence of worse patient outcomes. At the same time, clinicians are recommended to use low-flow techniques and total intravenous anaesthesia (TIVA) when it is possible. In veterinary medicine the situation is different. There is still a strong dependence on inhalants for maintenance; low-flow is not implemented everywhere, maybe because of equipment, monitoring limitations and also lack of knowledge; and nitrous oxide has been abandoned in most hospitals because the risk-benefit is poor and the environmental cost is very high.

Loco-regional anaesthesia (LRA) gives clinical and environmental opportunities. In human practice, LRA inside enhanced recovery protocols reduces the use of opioids and complications. However, the "green" benefit is not so simple: some life-cycle analyses show that spinal anaesthesia, low-flow inhalation and TIVA can have similar footprints if desflurane and  $N_2O$  are avoided and flows are kept minimal. So sustainability depends more in the group of practices (low fresh gas flow, not wasting oxygen, less disposables) than only in choosing RA instead of GA. Several studies also show that TIVA usually produces less  $CO_2$  equivalents than conventional inhalational anaesthesia when high flows are used.

In veterinary anaesthesia, the use of ultrasound-guided LRA is increasing very fast. Actually we can perform loco-regional techniques in the majority of the surgeries that are done in clinics and hospitals. In the last years a lot of literature has been published about these techniques although we still need to increase clinical evidence. Anyway, the evidence now shows better analgesia, smoother recoveries, and the possibility to reduce the volatile concentration or even to change to TIVA or sedation in some cases. Safety and efficacy are more and more supported, specially for fascial plane blocks and peripheral nerve blocks with ultrasound.

Neuromodulation increases the tools that avoid opioids and even opens the door to reduce the use of other drugs and the number of times that animals need to come to the hospital (with the reduction in pollution that is produced when the animal is not transported). The International Neuromodulation Society says it is the modification of nervous system activity by giving electrical or pharmacological agents in a targeted way. In human medicine, NICE guidelines recommend spinal cord stimulation (SCS) for neuropathic pain that does not respond to other treatment, with high-frequency stimulation as one of the best modalities. Peripheral nerve stimulation (PNS) is being used for persistent pain after arthroplasty, and radiofrequency ablation (RFA) of genicular nerves is more and more common in advanced knee osteoarthritis.

In veterinary medicine the evidence is still small but is promising. Pilot studies show that thermal RFA of the saphenous nerve and pulsed RF of the sciatic nerve can improve osteoarthritis pain in dogs that do not respond to usual therapy. Bigger controlled trials are necessary to know the safety, efficacy, cost-effectiveness, and also to understand the environmental cost of the devices.

Practical steps to keep a "green clear consciousness" are: not using desflurane and nitrous oxide; doing low-flow in a safe way (FiO<sub>2</sub> >0.45 and minimum  $^{\circ}$ 0.5 L/min O<sub>2</sub> to avoid hypoxic mixture); checking volatile consumption and teaching staff; using RA and TIVA when they are good for the patient; reducing plastics of one use and separating waste correctly; and in veterinary practice, training teams in ultrasound-guided RA and thinking well when to use new drugs like liposomal bupivacaine.

In conclusion, human and veterinary anaesthesia both have a climate responsibility, although starting from different situations. The roadmap is: (1) eliminate gases with high impact, (2) put RA as a standard of care for clinical and environmental reasons, and (3) study neuromodulation carefully with strong evidence and looking at the full life cycle of the devices. Good clinical practice and environmental protection can go together — this is the meaning of keeping a Green Clear Consciousness.

#### 12:00-13:00

# Learn to fly without volatile

#### **Enzo MINGHELLA-Valérie BILLARD**

#### Introduction

Total Intra-Venous Anaesthesia (TIVA) represents a safe and effective method for administration of general anaesthesia in both humans and companion animals. This presentation elucidates some of the principles of TIVA and its application in clinical practice, employing airplane flight analogy.

### **Pre-Flight Phase: Background**

Since the 1970s, TIVA took off due to the introduction of drugs with wide therapeutic windows, including propofol and specific opioids.

To avoid awareness and side effects associated with under- and over-dosing, pharmacokinetic (PK) and pharmacodynamic (PD) models (Marsh, Schnider and Eleveld for propofol in humans and Beths and Cattai for propofol in dogs and cats) have been developed and implemented into software to guide drug infusions: this marks the beginning of TCI (Target Controlled Infusion).

#### **Take-Off Phase: Safety and Induction**

Induction of anaesthesia defines the transition from an awake to an unconscious state combining immobility, reduced response to noxious stimuli and amnesia. As a smooth climb is ideal for a plane taking off, TCI allows the anaesthetist to gradually adjust doses to maintain cardiovascular stability and, when necessary, spontaneous ventilation. TCI can be provided using a pump (syringe driver) incorporating a software with selected PKs or using an external simulation software. Familiarity with the instrumentation (syringes, pumps, TIVA sets, etc.), and safety protocols contribute to the minimise human errors in TIVA.

#### Cruise Phase: Anaesthesia Maintenance

Dose requirements vary with interventional or surgical stimulations. Sudden 'turbulences' necessitate a methodical approach by adjusting drug concentrations.

Landing Phase: Recovery from TIVA

Although often well tolerated, TIVA may cause drug accumulation and delay recovery. Using lower target concentrations, employing a multimodal approach and considering species- and patients-specific factors can help to reduce the risk of an unpleasant landing.

#### Post-Landing Phase: TIVA indications, side effects and benefits

TIVA/TCI can be advantageous for many clinical scenarios. A few side effects, however, have been described. If used appropriately, it has the potential of reducing environmental pollution and prevent staff exposure to volatiles.

#### **Learning Objectives:**

1. Understand the underlying principles and safety considerations of TIVA and TCI in uman and veterinary anaesthesia.

# Thursday, September 18th

#### 14:00-15:00

# **Veterinary and Medical Research in Liverpool**

#### **Eddie CLUTTON, Jennifer HUNTER**

The influence of the University Department of Anaesthesia in Liverpool, UK which consisted of both veterinary and medical anaesthetists on the development of laboratory and clinical research across several animal species including man over 40 years will be detailed. In particular, the leadership of Professor RS Jones over many years in guiding academic lecturers from both professions in research studies on several neuromuscular blocking drugs and reversal agents will be revealed. The highest standards of neuromuscular transmission monitoring and the pharmacology of all related drugs were taught in detail. Other contributions included the multidisciplinary teaching of medical and veterinary under- and post-graduates on all aspects of anaesthesia. The extensive contributions of the academic department to veterinary and medical journal editorial work will also be discussed. The mutual and long-term benefits of such academic teamwork, both professional and personal, will be acknowledged.

### **Learning Objectives:**

- To demonstrate that both laboratory and clinical research by veterinary and medical anaesthetists working together is mutually beneficial;
- To promote the highest standards of neuromuscular monitoring across all animal species;
- To encourage understanding of the comparative pharmacology of neuromuscular blocking drugs and reversal agents across all animal species;
- To demonstrate the benefits of multidisciplinary teaching of undergraduates and postgraduates in both medicine and veterinary medicine;
- To demonstrate the benefits of veterinarian expertise in the editing of laboratory animal research in medical journals.

# **Anaesthesia and Analgesia in Wartime**

### Jérôme ARNAULD DES LIONS, Pierre PASQUIER

War brings with it many traumas and combat wounds, often causing severe suffering. Relieving and caring for the patient then become the priority of the clinician, whether doctor or veterinarian. These periods of intense suffering were an important driving force in learning how to relieve pain and avoid exacerbating it through therapeutic acts. The discovery and development of anesthesia and analgesia represented a real step forward in improving the safety and comfort of the injured, and the quality of care during surgery. Progress in these fields is closely linked to experimentation, and historical analysis shows a particularly strong link between man and animal in this field. It is rare to observe such rapid application of discoveries made in one species to another, in both directions, from the earliest times to the present day. Advances in science on the one hand, and the globalization of trade and war on the other, have favored the widespread use of new techniques, transforming anesthesia and analgesia into common therapeutic means for the benefit of all patients, including our faithful four-legged companions.

#### **Learning Objectives**

- Review the broad outlines of the evolution of anesthesia techniques and protocols.
- Highlight the strong links between the development of human and animal anesthesia.
- Understand the specific challenges of anesthesia and analgesia, drawn from past armed conflicts: limited resources, harsh environmental conditions, and the specific needs of warwounded animals and humans.
- Understand the management strategies for war trauma casualties: acute pain, hemodynamic stabilization, and postoperative care.

#### 16h30-17:30

# **Changes in Analgesia Practice over a Career**

#### Khursheed MAMA, Frederic AUBRUN

This shared presentation will provide an overview of changes in perioperative small animal and human medical analgesia practices over the course of a veterinary and medical career. The presentation will highlight the evolution of medications, techniques, and approaches over 30-plus years. The attendee will gain insight into how small changes can positively impact patients and learn when it may be warranted to go back to historical experiences in the management of patients. Similarities and differences between the human medical and veterinary approaches will also be highlighted.

#### **Learning Objectives:**

- -Understand the reasons for the evolution of analgesic practice
- -Assess whether these changes have been of benefit to patients
- -Decide which changes should be incorporated into their practice

# Is Laboratory Animal Anaesthesia Still Prehistory?

#### **Eddie CLUTTON, Christine BALL**

Before the advent of anaesthesia, much research was conducted on restrained, conscious animals. Vivisection was seen by many as a necessary way to advance scientific knowledge. By others, it was perceived as torture and therefore rejected as a means to gain knowledge.

The development of anaesthesia in the mid-nineteenth century required some experimentation on animals, but even once anaesthesia was established for human surgery, it was not universally administered to animals. As the nineteenth century progressed, scientific research accelerated, demanding greater access to experimental animals. At the same time, society was changing, becoming less tolerant of suffering generally.

Legislation eventually became inevitable. In 1876, Britain became the first country to pass an Act (The Cruelty to Animals Act) specifically protecting laboratory animals, and doing so by means of a licencing system. It was extremely controversial, being poorly enforced and driving much research out of Britain. Other countries were reluctant to follow suit, and while many researchers were treating animals humanely, it was only in the second half of the twentieth century that legislation became widespread. This paper will explore the early history of animal experimentation and the various attempts at legislation, before moving on to recent advances with the development of standards, training, and education to promote excellence in animal anaesthesia and research.

#### **Learning objectives**

- To define the role of animal experimentation in science and medicine before the development of anaesthesia
- To examine the effect of the discovery of anaesthesia on the treatment of experimental animals
- To investigate the legal challenges that developed in the nineteenth century as the rapid growth in scientific discovery led to more animal research just as society was demanding a more humane treatment of animals
- To define and explain the current state of animal experimentation and its regulation.
- To bring all of this information together to answer the question of whether the situation has improved for the research animal

# Friday, September 19th

#### 8:30-9:30

# Depth of Anaesthesia Monitoring: Where do we stand?

#### **Olivier LEVIONNOIS, David CHARIER**

Accurately assessing anaesthetic depth is essential for patient safety, yet traditional methods often rely on subjective clinical signs. This keynote will review both foundational concepts and the latest methodologies for monitoring anaesthetic depth, drawing on advances from both veterinary and human anaesthesia.

We will focus on electroencephalography (EEG) and its derived variables, exploring how real-time EEG monitoring enables precise titration of hypnotics, reduces the risk of intraoperative awareness, and supports optimal recovery. Practical guidance will be provided for interpreting EEG waveforms, processed indices, and real-time spectrograms, now available on most modern monitoring devices. Other methodologies will also be discussed to provide up-to-date knowledge.

Additionally, we will address the balance between nociception and antinociception, and how real-time monitoring can individualize opioid dosing, minimizing intraoperative hypotension and postoperative pain. The synergistic interaction between hypnotics and opioids in balanced anaesthesia will be highlighted, emphasizing the significant reduction in hypnotic requirements when even low concentrations of opioids are used.

Monitoring the depth of hypnosis is more complex with agents such as ketamine or dexmedetomidine, which are widely used today in human anaesthesia. Their use relies on mathematical modeling of plasma or brain concentrations. Spectral analysis of the EEG signal allows us to assess the effects of these drugs on cerebral electrical activity, reflecting their concentration at the site of action.

### **Learning Objectives:**

- Define depth of anaesthesia and contrast traditional monitoring methods with advanced approaches, including EEG.
- Analyze the principles, interpretation, and limitations of key monitoring methodologies in anaesthesia.
- Evaluate the clinical application of EEG and nociception monitoring for optimizing anaesthetic and opioid delivery.
- Apply practical strategies for individualized patient care based on real-time monitoring.

#### 9:30-10h30

# The contribution of music therapy to anesthesia and analgesia

Apostolos GALATOS, Gérard MICK

Music has been proposed as an anxiety and stress reduction method in companion animals. Lately, research has extended to its potential effect during the perioperative period. Physiological stress has been associated with the release of catecholamines, increasing anaesthetic risk in companion animals and further affecting wound healing and postoperative pain. Recent guidelines recommend the use of multimodal approaches in veterinary surgical cases, with growing interest in non-pharmacological therapies such as music, as an adjunct to conventional pharmacological approaches. Classical music or music specifically designed for dogs or cats has been reported to promote behavioral and physiological responses associated with reduced stress levels. The literature in companion animals regarding perioperative music implementation is limited; nevertheless, music-induced improvement in sedation levels, reduction in propofol requirements for intubation, intraoperative haemodynamic stability promotion, intraoperative anaesthetic and analgesic sparing effects and positive effects on postoperative pain and anxiety have been reported. However, the components of the music intervention should be standardized for a successful perioperative outcome in dogs and cats. Music type (genre, tempo, pitch, instrumentation), volume, method of music delivery, previous music experience, duration, timing and frequency of music application, seem to be important features of a music intervention. Considering that music treatment is a safe, low cost, low-risk, easy to deliver, noninvasive and potentially effective intervention, the current presentation will focus on the incorporation of music, as a non-pharmacological adjunct, into a multimodal approach in dogs and cats and furthermore aims to provide directional guidance for music implementation in a clinical setting.

#### **Learning objectives**

- Existing evidence regarding music's effect during the perioperative period in companion animals.
- Which are the basic components to be considered, when designing a perioperative music therapy intervention in dogs and cats.
- How to manage each component of the music intervention, in order to create an optimal music therapy protocol.
- What to anticipate when incorporating a music intervention into the perioperative period.

#### 11:00-12:00

# Al and ChatGpt in Anesthesiology

#### Sacha ROZENWAJG

Artificial intelligence has reached its peak of hype and is now taking root in the practice of anesthesiology. But where and how? After defining what AI is and its latest development, we will map real-world, high-impact AI applications – from perioperative decision support to predictive analytics, educational transformation, and its future scientific review.

We will focus on practical integration, medico-legal responsibility, and the fine line between assistance and automation: a pragmatic look at where we stand and where we must draw the line. All this with, of course, some provocative lines along the way.

#### **Learning Objectives:**

After this lecture, you will be able to:

- Understand the principles of machine learning, deep learning, and generative medicine
- Have insights into their current use in (human) anesthesiology
- Have a critique eye regarding the interaction between AI and human

# Lectures:

# **Nurses/GPs Program**

# Tuesday, September 16th

#### 9:30-10:30

# What for my patient? Protocols and cocktails

#### **Clara Conde Ruiz**

ASA 2 is like music to my ears, but are they all the same? Three patients to illustrate that it is not always possible to follow a straight route in anaesthesia... even during standard procedures! Three patients: Granny, whose knees are not what they used to be anymore... Junior, the baby puppy, is so cute and unstable! Demon, the uncooperative one (he loves vets, but not in the way you think...). A few protocols, tips, and cocktails to help clinicians and nurses solve the situation with honour.

#### **LEARNING OBJECTIVES:**

- Anaesthetic management of the geriatric patient
- Anaesthetic management of the paediatric patient
- Anaesthetic management of the aggressive patient

#### 11:00-13:00

# **Climate Workshop ECOVETO**

### Mannaïg de KERSAUSON, Emily FYFE

Join us for an engaging and collaborative workshop designed to spark collective reflection on the environmental impacts of veterinary practice—and what we can do to reduce them. The *EcoVeto Veterinary Clinic Fresk* is a dynamic, interactive session built around a facilitated card game that helps participants visually map out the cause-and-effect relationships behind the environmental footprint of veterinary activities.

Through teamwork and guided discussion, participants will collaboratively identify key impacts and explore the links between them.

In this workshop, you will:

- Use collective intelligence and work as a team, guided by a facilitator, to identify and connect cause-and-effect relationships between veterinary practice and its environmental impacts.
- Identify levers of action and explore practical, easy-to-implement solutions that can be integrated into everyday veterinary work.
- Co-create a tree-structured "fresk" illustrating the interconnected system—decorated by participants—which can then be displayed in your clinic or organisation.

This workshop is open to everyone—whether you're new to sustainability or already actively involved. Generalists, specialists, clinic leaders, and team members are all welcome.

Let's learn together and make a positive impact for animals, people, and the planet.

#### 14:00-15:30

# What could go wrong during anesthesia? Understanding hypoventilation and hypotension

#### **Perrine Benmansour**

In this session, you will learn how to troubleshoot and manage two common anaesthetic complications which happen under general anaesthesia in dogs and cats: hypoventilation and hypotension. You will gain the physiology and pharmacology knowledge needed to understand why hypoventilation and hypotension occur and how different treatment options can resolve these complications. We will explore how to decide which of the treatment options is most suitable to manage hypoventilation and hypotension.

After the session, you should feel more confident about clinical decision making relating to hypoventilation and hypotension in dogs and cats.

#### **Learning objectives:**

- Understand how hypoventilation and hypotension are defined
- Understand what contributes to hypoventilation and hypotension during anaesthesia
- Understand how to troubleshoot and manage hypoventilation and hypotension during anaesthesia

# The Language of Pain: Learn to Hear What Isn't Said

#### **Latifa KHENISSI**

Understanding and promptly identifying perioperative pain is essential for ensuring optimal recovery and welfare in veterinary patients. This session, designed for veterinary nurses and first opinion practitioners, will focus on the practical and evidence-based identification of pain in dogs, cats, and horses, including during general anaesthesia, when behavioural cues are absent. Delegates will explore the latest guidelines and advances in pain assessment, learning to distinguish species-specific pain behaviours and physiological indicators. The session emphasises the use of validated pain assessment tools and the need for systematic, consistent monitoring to avoid under-recognition, which can lead to unnecessary suffering and delayed healing. Through interactive case discussions and practical examples, participants will gain confidence in recognising subtle and overt signs of pain, ensuring timely intervention and improved patient outcomes. This talk will equip attendees with the core skills and knowledge to make pain identification a cornerstone of their clinical practice, directly supporting patient welfare and recovery success.

#### **LEARNING POINTS**

- 1. Understand the challenges of pain identification in animals and why a systematic approach is vital.
- 2. Recognise species-specific pain behaviours and clinical signs in dogs, cats, and horses.
- 3. Interpret physiological indicators of pain, especially under general anaesthesia, and their limitations.
- 4. Apply validated, species-appropriate pain assessment tools for objective and repeatable evaluation.
- 5. Appreciate the critical impact of prompt and accurate pain recognition on recovery and animal welfare.

# Wednesday, September 17th

#### 8:30-10:30

# Everything you always wanted to know about anesthesia machines and circuits but were afraid to ask

#### **Anya STHYM**

Whether you're a veterinary nurse or a practicing clinician, you've likely worked with an anaesthesia machine hundreds of times — but how well do you really understand how it works? This is something we typically learn very well for the exam and then forget about most of it again. In this engaging and practical session, we'll take a deeper dive into the inner workings of veterinary anaesthesia machines, demystifying components like flowmeters, vaporizers, pressure gauges, oxygen flush systems, and scavenging setups.

#### We'll explore:

- How gas flows through the machine, and what happens when it doesn't
- Commonly used machines -pros and con's
- Common equipment errors and how to troubleshoot them
- Best practices for daily checks, maintenance, cleaning and safety

Designed to empower veterinary professionals, this talk will strip away the jargon and build confidence around using and understanding anaesthesia machines — once and for all. We will share practical experiences and questions.

# **Feline Stress Management**

### Tasha Mc NERNEY, Katherine ZATROCH

This lecture focuses on the unique challenges of managing stress and sedation in feline patients. We will delve into the behavioral and physiological aspects of feline stress, discuss effective stress-reduction techniques, and review the sedation options available.

Practical tips and case studies will be presented to help veterinary professionals improve the care and comfort of their feline patients.

### **Learning Objectives:**

- Understand the behavioral and physiological indicators of stress in feline patients.
- Review the sedation options available for feline patients and their appropriate uses.
- Develop comprehensive stress management plans to improve patient outcomes.

# Not just crosses and numbers...how to optimize my anesthetic monitoring

#### **Alexandre CHEBROUX**

Anaesthesia records are believed to have existed since 1895. Their general design has remained relatively unchanged since these early days. They display a combination of numerical data, graphs, and textual notes to allow the most accurate and complete documentation of all treatments and events occurring during the perioperative period. Over the years, they have become a pillar of patient safety but their scope of use has expanded considerably. They improve communication among the surgical and hospitalisation team, ensure compliance with legal, local, or international standards, and streamline administrative and statistical tasks. Recently the development of more affordable and portable technological solutions has allowed, mostly in the human anaesthesia field, the transition from paper-based anaesthetic record to electronic ones. Electronic records can be integrated in the anaesthesia workflow at different levels: from basic digital forms to fill in manually on a tablet, to fully integrated Anaesthesia Information Management Systems (AIMS) which interface with all hospital systems and patient information databases. To improve completeness and accuracy of data input, several systems now automatically capture physiological parameters and medication administration data directly from bedside devices, such as multiparameter monitors, anaesthesia machines, ventilators and infusion systems. In veterinary medicine, despite many scientific organisations encouraging the use of anaesthesia records (paper or electronic), adoption remains poor in general practice unless obligated by law. This presentation will detail good practice for anaesthesia record creation and implementation. Barriers existing in veterinary medicine that prevent a wider adoption of these tools will be identified and discussed.

In a second part, the author will provide an overview of the advantages of electronic records compared to the paper version, while also listing some of the limitations associated with their use. Many initial criticisms and shortcomings about these IT solutions have been studied or improved through randomised clinical trials and technological improvements. Moreover, some specific drawbacks of monitoring anaesthetised animals can be mitigated with a better use of equipment and acute clinical sense.

Finally, the increasing accessibility, automation capabilities, and adaptability of electronic systems present a promising opportunity to bridge the current gap in veterinary anaesthesia record adoption. By reducing the burden of manual data entry, improving the accuracy and consistency of documentation, and enabling better integration with other clinical systems, electronic records have the potential to make

anaesthesia monitoring more efficient and appealing to practitioners in everyday clinical settings.

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#### **Learning objectives:**

- Acknowledge the importance of monitoring and recording vital parameters and perioperative events during animal anaesthesia
- Identify barriers to use of anaesthesia records and reflect on your current practice for possible improvements
- Learn several tips to improve accuracy of instrumental monitoring
- Discover the possibilities offered by electronic records and new information technologies to improve efficiency and safety

# Perioperative pain: drugs and treatment modalities

#### **Perrine Benmansour**

In this session you will learn about multimodal analgesia options for the management of perioperative pain in dogs and cats. You will gain the physiology and pharmacology knowledge needed to understand how drugs and other treatment modalities can provide pain relief before, during and after anaesthesia. We will explore how to create and implement the most suitable perioperative analgesia plan. After the session, you should feel more confident about designing a tailored perioperative pain

#### **Learning objectives:**

management plan for dogs and cats.

- Learn about systemic drug options available to provide multimodal analgesia during the perioperative period
- Learn about locoregional anaesthesia options available to provide multimodal analgesia during the perioperative period
- Learn about non-pharmaceutical options available to provide pain relief during the perioperative period

# **Oral Presentations**

		Tuesday	
	Small Animals	Large animals	Other
Chair	Ludovic Pelligand	Polly Taylor	Ioannis Savvas
14H00-14H18	The sedative and cardiovascular effects of oral transmucosal acepromazine in dogs.  Madelyn Rollet	Prospective monitoring of post- anaesthetic morbidities in horses: Preliminary results from a CEPEF-4 satellite study. Janny de Grauw	Comparison of two volumes of bupivacaine-dye solution on ultrasound-guided sciatic and femoral injections in chickens. André Escobar
14H18-14H36	Investigating the efficacy of pregabalin, compared to gabapentin, at facilitating intravenous access and producing anxiolytic effects in cats.  Joe Simon	Prospective monitoring of post- anaesthetic morbidities in horses: Preliminary results from a CEPEF-4 satellite study. Janny de Grauw	Evaluation of low-dose medetomidine-vatinoxan and butorphanol combinations for sedation in canine radiographic procedures.  Francesca Zanusso
14H36-14H54	Pharmacokinetics and pharmacodynamics of an extended duration transdermal buprenorphine in dogs. Tokiko Kushiro-Banker	Standing sedation in horses and ponies: perioperative fatalities in a worldwide observational, prospective, multicentre cohort study.  Gozalo-Marcilla Miguel	Modulation of joint inflammation and synovial repair by dipyrone versus carprofen in a rat early monoarthritis model. Denise Fantoni Tabacchi
14H54-15H12	Evaluation of sedative and cardiovascular effects of medetomidine-vatinoxan and hydromorphone for premedication in dogs undergoing patent ductus arteriosus closure – Preliminary data.  Andrea Dutra	Dexmedetomidine post- conditioning improves cardiovascular function and maintains normal renal parameters in anesthetized, experimentally endotoxemic horses. Lee Sera	Evaluation of femoral nerve block in a multimodal approach during knee arthrotomy in rabbits. Cañón Pérez Ariel
15H12-15H30	Comparison of gabapentin and carprofen for the treatment of acute orthopedic surgical pain in dogs undergoing tibial plateau leveling osteotomy.  Audrey Wanstrath	Clinical predictors of recovery quality in equine anesthesia: A retrospective review of 240 cases. <b>Reza Seddighi</b>	Effect of bupivacaine 0.25% and 0.5% on the nociceptive, motor and proprioceptive response in a ultrasound-guided sciatic nerve model in rats.  Douglas Castro
15H30-16H00	Coffee break-Posters		

	Tuesday		
	Small Animals	Large animals	Other
Chair	T	6 17 11	5 1 11 11 1
Chair	Tristan Merlin	Gwenola Touzot Jourde	Delphine Holopherne
16H00-16H18	Anesthetic management and complications of transcatheter edge-to-edge repair for myxomatous mitral valve disease in dogs: 29 cases.  Bonnie Gatson	Comparison of the prevalence and location of trigger points in dressage and show-jumping horses. Camilla Schiesari	Dexmedetomidine versus clonidine as an adjuvant to lidocaine spinal anesthesia in ovine experimental model. Claudia Piemontese
16H18-16H36	Population pharmacokinetics of IV paracetamol: Do all dog breeds process the drug similarly? Ludovic Pelligand	Reliability of myotonometry in equine myofascial pain syndrome and effects of ischemic compression therapies.  Camilla Schiesari	AM404, an active metabolite of acetaminophen provides local anesthesia in rats via nociceptor specific sodium channel blockade. <b>Yishai Kushnir</b>
16H36-16H54	Effects of helium/oxygen mixtures on inspiratory resistance to gas flow during volume- controlled ventilation: an "in vitro" simulation for cats. Francisco Teixeira-Neto	Endoscopic evaluation of tracheal mucosal cuff site trauma following intubation with a 26.0 mm ID silicone endotracheal tube in adult horses – preliminary results. Jake Leech	Chloroprocaine-lidocaine pain- selective local anesthesia in rats is interval dependent. Yishai Kushnir
16H54-17H12	Lumbosacral foraminal injections in dogs: assessing an ultrasound- and fluoroscopy-guided technique in a cadaveric model. Roger Medina-Serra	Evaluation of acepromazine's impact on tissue oxygen saturation in horses sedated with detomidine using near-infrared spectroscopy.  Amanda James	Evaluation of the analgesic efficacy of local infiltration of levobupivacaine and bupivacaine, with or without tramadol, in a rabbit femoral fracture model. Yanmaz Latif Emrah
17H12-17H30	Interventional pain management in dogs with lumbosacral stenosis: preliminary retrospective long-term clinical outcomes of combined foraminal and epidural injections with or without pulsed radiofrequency.  Roger Medina-Serra	Total intravenous anaesthesia with remimazolam–ketamine–medeto midine in Thoroughbred horses. Yosuke Yamazaki	Evaluation of anesthetic effects of intramuscular administration of alfaxalone with ketamine or midazolam in Hy-Line W36 roosters. Josie N. Gamble

	Wednesday		
	Small Animals Large animals Other		Other
Chair	Sébastien Bauquier	Morgane Debuigne	Mandoline Chesnel
14H00-14H18	Addition of adrenaline to irrigation fluid in diagnostic and therapeutic arthroscopy in dogs: an anesthetic approach.  Ana Zapata	Cardiorespiratory and anesthetic effects of morphine or dexmedetomidine in sheep undergoing videolaparoscopic ovariectomy.  Ana Clara Barreto Pinheiro	Preliminary study of the use of butorphanol-midazolam or methadone-midazolam to sedate rabbits. Patricia Ruiz Lopez
14H18-14H36	Differences in distribution of ventilation between lateral and sternal recumbency in common Hippopotami measured by Electrical Impedance Tomography.  KN Kuek	Efficiency of isoflurane capture from anaesthetised experimental sheep. Flo Hillen	Sedative and analgesic effects of intramuscular methadone in rabbits undergoing ovariohysterectomy: preliminary results.  Mario Arenillas
14H36-14H54	Ultrasound-guided ischiorectal fossa block targeting the pudendal nerve in dogs: a cadaveric study. Jalise Zumstein	Ultrasound-guided transversus abdominis plane block in pigs undergoing laparoscopic ovariectomy: a preliminary clinical study. Chiara Cipollini	Pharmacokinetics of a high oral dose of a compounded tramadol hydrochloride suspension in domestic rabbits (Oryctolagus cuniculus).  Claire Vergneau-Grosset
14H54-15H12	Pharmacokinetics and postoperative analgesic efficacy of intravenous acetaminophen in dogs undergoing laparoscopic ovariohysterectomy.  Maria del Mar Granados	Five-minute exposure to EMLA cream reduces pain response to intravenous catheterisation in calves.  Dogukan Polat	Pharmacokinetics of a single dose of oral tramadol in brook trout (Salvelinus fontinalis). Claire Vergneau-Grosset
15H12-15H30	A retrospective study of propofol requirements for induction of anaesthesia in paediatric and geriatric dogs and cats.  Vasileios Zapridis	Single-site ventral distal paravertebral block results in successful paralumbar fossa anesthesia in steers. Madeline Butterfield	Effects of temperature on sedation induced by midazolam in bearded dragons (Pogona vitticeps).  Renata Pinho
15H30-16H00	Coffee break-Posters		

	Wednesday		
	Small Animals	Large animals	Other
Chair	Patrick Verwaerde	Latifa Khenissi	Caroline Didier
16H00-16H18	Mass balance, methaemoglobin and metabolite study of [14C]paracetamol after IV and oral administration in dogs. Ludovic Pelligand	Effect on mechanical nociceptive threshold of intravenous or intramuscular morphine in healthy donkeys. Ronan JJ Chapuis	Inducing hypoxaemia in experimental adult pigs by varying FiO2 with nitrogen.  Kate White
16H18-16H36	Efficacy, pharmacokinetics and safety of liposomal synthetic cannabidiol injected subcutaneously in dogs: A randomized, blinded, placebocontrolled, crossover clinical trial.	Effect of the rectus abdominal sheath block with 0.2% bupivacaine in anesthetized horses on anesthesia recovery.  Stéphanie Dantino	Concordance between rectal temperature and a core temperature measuring device with Zero Heat Flux technology in guinea pigs (Cavia porcellus) anesthetized with isoflurane: preliminary results.  José I Redondo
16H36-16H54	Treatment of abnormal pain or unpleasant sensation with constant rate infusion of ketamine in cats – a case study Tokiko Kushiro-Banker	Assessment of the pharmacokinetics and selected physiological and behavioral effects of three doses of orally administered tapentadol in horses.  Khursheed Mama	Morbidity and mortality related to anaesthesia for experimental myocardial infarction induction: lessons learnt from minipigs. Daniela Casoni
16H54-17H12	Evaluation of risk factors leading to poor anesthetic recovery after ocular surgery in academic small animal practice. Adrianna Sage	To determine the effect of the application of ice to the skin overlying the infraorbital canal on conscious equine patient compliance to infraorbital nerve block placement under standing sedation.  Shane Mart	Creation of digital and 3D printed models to teach the mechanisms of action and functions of benzodiazepines (BZD) in veterinary anesthesiology.  Yuri Karaccas Carvalho
17H12-17H30	Cardiovascular effects of intramuscular medetomidinevatinoxan with or without methadone in dogs anesthetised with sevoflurane.  Turunen Heta	Antinociceptive effects of the abdominis rectus sheath block with 0.2% bupivacaine in anesthetized horses.  Eutalio Pimenta	Simulator for training ultrasound- guided thoracic locoregional blocks in dogs. Yuri Karaccas Carvalho

	Thursday			
	Small Animals	Other		
	Géraldine Jourdan	Sabine Kastner	Delphine Le Chevalier	
9H30-9H48	Reliability and initial validation of SIESTA-II, A short form of SIESTA (SEAAV Integrated Evaluation Sedation Tool for Anaesthesia) for dogs. Fernando Martinez Taboada	Effect of early discontinuation of lidocaine infusion on accelerometry-based equine recovery from isoflurane general anesthesia: a randomized clinical trial.  Megan Sha	Comparison of medial and lateral ultrasound-guided approaches to RUMM (radial, ulnar, median, and musculocutaneous) nerve injections in rats. Douglas Castro	
9H48-10H06	A retrospective analysis of a single veterinary private practice canine population, treated with bedinvetmab (LibrelaTM).  Luca Zilberstein	Flow-control expiration (FLEX) for large animals achieved by a gate valve.  Joao Soares	Pharmacodynamics of subcutaneous hydromorphone administration in bearded dragons (Pogona vitticeps).  Colleen Elzinga	
10H06-10H24	Ultrasound-guided motor-sparing block of the distal tibia and peroneal nerves in dogs: anatomical study and preliminary clinical results. Patricia López Abradelo	Evaluating capture of isoflurane from anaesthetised horses. Kate White	Enhanced post-capture activity in urban red foxes (Vulpes vulpes) following alfaxalone-midazolam versus medetomidine-midazolam immobilisation: preliminary findings.  Patricia Romero	
10H24-10H42	Attitudes of veterinarians in the Republic of Ireland towards acute pain assessment and management in cats and dogs. Cipollini Chiara	Association between surgical duration, intraoperative hypothermia, and recovery quality in equine anaesthesia. Charlotte Sandersen	Sedative and antinociceptive effects of xylazine vs dexmedetomidine in New Zealand white rabbits. Daniela Casoni	
10H42-11H00	Effects of increased resistance to gas flow on the tidal volume delivered by pressure-controlled ventilation: an in vitro simulation for cats.  Francisco J. Teixieira-Neto	Can the Nose Outperform the Muscle? Pharmacokinetic Insights into the Use of Ketamine in Pigs. Isabela Peixoto Rabelo	The Effects of Canine ABCB1-1Δ Mutation on Common Pre- anesthetic Medication Combinations. Kristen Deom	
11H00-11H30	Coffee Break-Posters			

	Thursday			
	Small Animals	Large animals	Other	
	Géraldine Jourdan	Sabine Kastner	Delphine Le Chevalier	
11H30-11H48	Epidural catheter tip location and its potential adverse events in relation to cranial advancement in dog cadavers. Martinez Taboada Fernando	Pulsed radiofrequency treatment for the management of trigeminal- mediated headshaking syndrome in a horse. Martina Amari	Profile identification of brazilian anesthesists. <b>Maria Raquel Almeid</b> a	
11H48-12H06	Standardised anaesthetic protocol and complications during transcatheter occlusion of patent ductus arteriosus in dogs: A retrospective cohort study of 24 cases (2024).  Mayara Lima Travalini	Onset and duration of action of escalating doses of rocuronium in anesthetized healthy goats. Latchmi Baba	Development of a novel ensemble machine learning model for predicting post- anesthetic hypoxemia in mechanically ventilated dogs. Son Won-gyun	
12H06-12H24	Anesthetic mortality in canine patients in a veterinary teaching hospital in Spain: a retrospective study.  Patricia Cantero Campos	Reverse Trendelenburg attenuates hemodynamic depression during anesthesia in late-gestation mares. Carlos Valadao	Evaluation of laryngeal obstruction and edema using the endotracheal tube cuff leak test in dogs: clinical trials. Son Won-gyun	
12H24-12H42	Comparison of atracurium administered as a variable rate infusion or as intermittent boluses in dogs undergoing ophthalmic surgery.  Borja Sanchez Martinez Conrado	Use of adrenaline to facilitate surgical management of nephrosplenic entrapment in anaesthetized horses: A case series.  Maha Abunemeh	Owner's understanding of anaesthetic risks - Preliminary data. Beatriz Soares	
12H42-13H00	Comparison of pain in ovariectomy: laparoscopy vs midline celiotomy under an opioid free protocol (OFA) in dogs.  Mariela Goich	Intraoperative Complications In Anaesthetised Horses: A Comprehensive Prospective Study. <b>José I Redondo</b>	The impact of pharmacopuncture with lidocaine on perioperative analgesic requirements and systemic inflammatory response in dogs with pyometra.  Renata Cassu	

# Small animal Oral presentations Tuesday 16th

#### The sedative and cardiovascular effects of oral transmucosal acepromazine in dogs

<u>Madelyn Rollet</u><sup>1</sup>, Derek Flaherty<sup>1</sup>, Jennifer Bell<sup>1</sup>, Alicia Karas<sup>2</sup>, Adam Auckburally<sup>1</sup> <sup>1</sup>Southern Counties Veterinary Specialists, Forest Corner Farm, Ringwood, Hampshire, UK

Oral transmucosal (OTM) administration of injectable acepromazine is recommended for pre-admission sedation in fearful and aggressive dogs (Costa et al. 2019). The effects of OTM acepromazine have not yet been demonstrated. Our aim was to evaluate the sedative and cardiovascular effects of OTM injectable acepromazine

Single centre, prospective, randomised, blinded-controlled clinical trial. 28 client-owned healthy adult dogs undergoing elective surgical procedures were included. Patients were randomised into treatment group: OTM injectable acepromazine 2 mg ml<sup>-1</sup>, 0.05 mg kg<sup>-1</sup> or control group: equivalent OTM volume of water. Baseline HR, non-invasive blood pressure (NIBP) and sedation score (Hofmeister et al. 2010) were obtained prior to administration and repeated one hour later. Non-parametric data was analysed using Mann-Whitney and Wilcoxon Rank tests; parametric data was analysed using Student's t test.

OTM acepromazine significantly increased post-treatment sedation score compared to the control group (Table 1). Between groups, OTM acepromazine significantly decreased HR, SAP, MAP and DAP (Table 1).

OTM acepromazine significantly increases sedation score and decreases HR and NIBP. These findings support the administration of OTM acepromazine for pre-hospital sedation in dogs.

#### References

Costa RS., Karas AZ., Borns-Weil S. (2019) Chill protocol to manage aggressive & fearful dogs. Clin Brief 2:63-65.

Hofmeister EH., Chandler MJ., Read MR.(2010) Effects of acepromazine, hydromorphone, or an acepromazine-hydromorphone combination on the degree of sedation in clinically normal dogs. (Correction published in J Am Vet Med Assoc. 2011; 238[2]:182). J Am Vet Med Assoc. 237(10):1155-1159.

Table 1: Sedation Score and Cardiovascular Variables

Parameter	Group	Pre-treatment	P value	Post-treatment	P value
		Median (Range)		Median (Range)	
Sedation	ACP	0 (-3 – 3)	0.225	7 (-5 – 3)	<0.001
score	Control	-0.5 (-3 – 2)	]	0 (5 – 12)	1
		Pre-treatment		Post-treatment	
		Mean +/- SD		Mean +/- SD	
HR (bpm)	ACP	112.9 (+/- 22.1)	0.62	92.6 (+/- 22.5)	0.022
	Control	117.4 (+/- 26.0)	]	113.1 (+/- 22.2)	]
MAP (mmHg)	ACP	112.6 (+/- 19.0)	0.389	96.8 (+/- 16.5)	0.01
	Control	118.7 (+/- 18.2)	]	114.4 (+/- 17.1)	1
SAP (mmHg)	ACP	146.8 (+/- 21.5)	0.304	120.1 (+/- 17.4)	0.001
	Control	151.0 (+/- 20.7)	1	141.2 (+/- 16.6)	1
DAP (mmHg)	ACP	86.7 (+/- 17.5)	0.05	74.1 (+/- 13.1)	<0.001
	Control	99.0 (+/- 20.6)	1	93.9 (+/- 15.5)	1

<sup>&</sup>lt;sup>2</sup>Tufts Veterinary Emergency Treatment & Specialties, Cummings School of Veterinary Medicine, MA, USA

## Investigating the efficacy of pregabalin, compared to gabapentin, at facilitating intravenous access and producing anxiolytic effects in cats

<u>Joe Simon¹</u>, Sara Lawrence-Mills¹, Lucie Wilkins¹, Nicola Read¹, Gemma Taylor¹, Nadine Rogers¹, David Brodbelt², Rosanne Jepson¹, Ludovic Pelligand³

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<sup>3</sup>Royal Veterinary College, United Kingdom

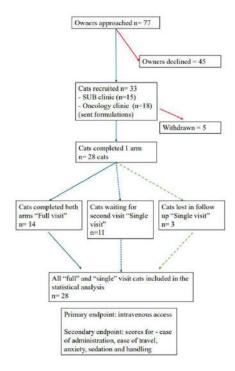
Anxiety in cats in clinical environments is a concern for veterinary professionals and clients (Taylor et al, 2022). Gabapentin is widely used, producing mild sedation and anxiolysis. Pregabalin (Bonqat) is a newly licensed liquid option, which may be easier to administer and can be dosed accurately.

In a prospective randomised blinded two period crossover study, cats that previously required gabapentin and needed two visits for veterinary intervention were recruited. Cats were randomised to start the study with gabapentin, based on their previously administered dose (50 or 100 mg), or pregabalin (5 mg kg<sup>-1</sup>) with minimum 7-day washout period between treatments. We hypothesised that pregabalin will facilitate intravascular access and provide comparable anxiolysis similarly to gabapentin. Primary endpoint: successful intravenous access. Secondary endpoints included: ease of administration and transport (owner); handling, sedation and anxiety scores (blinded assessors). A generalised linear mixed model was conducted to examine the effect of treatment on outcomes. The model used binomial distribution with a logit link and pairwise comparison to estimate the difference in probability. In the gabapentin period, the effect of dose (mg kg<sup>-1</sup>) was evaluated between the upper and lower quantiles.

Thirty-three cats were recruited; 28 were included in the analyses (Figure 1). Probability of successful vascular access was 73.7% and 69.3% for gabapentin and pregabalin, respectively (difference 4.3%, CI [-26.2 - 34.9%]). There was no difference in probability of secondary endpoint scores between treatments. Median dose of gabapentin was 19.6 mg kg<sup>-1</sup> (range 10.5 - 33.3 mg kg<sup>-1</sup>), with no difference on any outcomes based on dose given. Side effects included vomiting (pregabalin = 3), hypersalivation (gabapentin = 2; pregabalin = 1) and ataxia (gabapentin = 1).

At this stage, we could not detect a difference between pregabalin and gabapentin to facilitate intravenous catheterisation, or with anxiolysis.

Figure 1: CONSORT diagram outlining recruitment to analysis.



#### References

Taylor, S., St Denis, K., Collins et al. (2022) 2022 ISFM/AAFP Cat Friendly Veterinary Environment Guidelines, JSFM 24, 1133–1163

#### Pharmacokinetics and pharmacodynamics of an extended duration transdermal buprenorphine in dogs

<u>Tokiko Kushiro-Banker¹</u>, Charles Stone², Natacha Montalvo³, Jennifer McGann², Shirley Yeung², Patricia de Carvalho Ibrahim Obeid¹, Ashley Darr², Kristen Messenger⁴

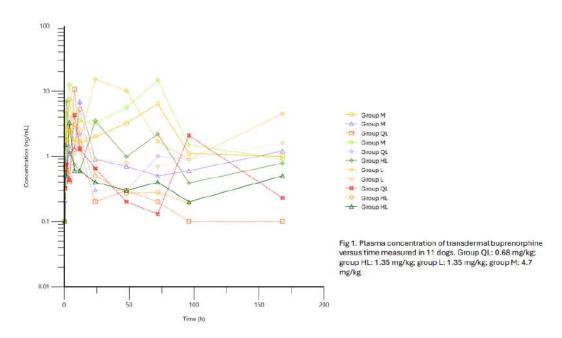
<sup>1</sup>Department of Specialty Medicine, College of Veterinary Medicine, Midwestern University, U.S.A

An extended-duration transdermal formulation of buprenorphine has recently become available in the United States for feline post-operative pain management. It reportedly provides analgesic effects for up to four days following a single topical application. The purpose of this study was to assess the pharmacokinetics and pharmacodynamics of this extended-duration transdermal buprenorphine in dogs.

Sixteen clinically healthy dogs were included in this study and were randomly assigned to one of four groups. Dogs in groups QL, HL, L, and M received transdermal buprenorphine at doses of 0.68 mg kg-1, 1.35 mg kg-1, 2.7 mg kg-1, and 4.7 mg kg-1, respectively. Blood samples were collected for pharmacokinetic analysis, and sedation scores, behavioral changes, rectal temperature, HR, and fr were assessed prior to application of buprenorphine and at 30 minutes, 1, 2, 4, 8, 12, 24, 48, 72, 96, and 168 hours following application. Plasma samples were analyzed using ultra-high-pressure liquid chromatography followed by detection with tandem mass spectrometry.

The median (range) for the maximum plasma buprenorphine concentrations (Cmax), the time to maximum concentration (tmax), and the area under the plasma concentration-time curve (AUC) were 8 (2-72) hours, 6.9 (2.2 - 15.2) ng mL<sup>-1</sup>, and 170.5 (68.7 - 761.8) h\*ng mL<sup>-1</sup>, respectively. The plasma concentrations were so variable that pharmacokinetic analysis could not be reliably performed in many of the dogs. Adverse effects observed included decreased appetite (35.7%), dysphoria (whining) (35.7%), hypersalivation (28.6%), diarrhea (21.4%), regurgitation (14.3%), and vomiting (7.1%). No signs of skin reaction at the application site were noted.

A single administration of transdermal buprenorphine produced highly variable pharmacokinetic profiles and was associated with some clinical adverse effects in healthy dogs without concurrent pain.



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## Evaluation of sedative and cardiovascular effects of medetomidine-vatinoxan and hydromorphone for premedication in dogs undergoing patent ductus arteriosus closure – Preliminary data

<u>Andrea Dutra</u><sup>1</sup>, Keila Ida<sup>1</sup>, Marica Engström<sup>2</sup>, Aleksi Tornio<sup>2</sup>, Ryota Watanabe<sup>1</sup>, Kara Moreno<sup>1</sup>, Courtney Baetge<sup>1</sup>, Sonya Gordon<sup>1</sup>, Mauricio Lepiz<sup>1</sup>

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While medetomidine-vatinoxan causes sedation with limited cardiovascular effects (Rolfe et al. 2012), its use for premedication in dogs with patent ductus arteriosus (PDA) has not been evaluated.

In this blinded randomized prospective clinical study, 23 dogs (2-72 months old; 1.1-22.2 kg) undergoing PDA closure were premedicated intramuscularly with hydromorphone (0.1 mg kg<sup>-1</sup>; H group) with or without medetomidine-vatinoxan (0.125 mg m<sup>2-1</sup>; HMV group). Behavioral (0-21 scale, 21 = extremely agitated), sedation (6-24 scale, 24 = not sedated), reaction to preparation (trichotomy and antisepsis) for IV catheterization (0-36 scale, 36 = extremely reactive), and IV catheterization scores (1-4 scale, 4 = extremely reactive), as well as HR, and blood pressure were obtained before and after premedication. Wilcoxon signed-rank test, Mann-Whitney U test, and t-tests were used (p < 0.05 considered significant).

Compared with the H group, the HMV group had lower scores (median [range]) for behavior (3 [2-12] vs 0 [0-5]; p < 0.001), sedation (20 [14-15] vs 15 [16-19]; p = 0.004), and preparation for IV catheterization (6 [2-16] vs 0 [0-5]; p < 0.001), as well as (mean  $\pm$  SD) SAP (134  $\pm$  22 vs 109  $\pm$  24 mmHg; p = 0.019), DAP (64  $\pm$  20 vs 45  $\pm$  11 mmHg; p = 0.027), and MAP (92  $\pm$  19 vs 63  $\pm$  13 mmHg; p = 0.002) after premedication. No significant HR differences were observed between groups (H, 112  $\pm$  30 beats minute<sup>-1</sup>; HMV, 113  $\pm$  42 beats minute<sup>-1</sup>). Despite initial blood pressure reduction after premedication in the HMV group, SAP remained within the normal range (Grubb et al. 2020), with no significant HR differences between groups

The addition of medetomidine-vatinoxan to hydromorphone enhanced sedation, facilitating pre-anesthetic preparation for IV catheterization in dogs with PDA.

#### References

Rolfe NG, Kerr CL, McDonell WN (2012) Cardiopulmonary and sedative effects of the peripheral  $\alpha$ 2-adrenoceptor antagonist MK 0467 administered intravenously or intramuscularly concurrently with medetomidine in dogs. Am J Vet Res 73:587–94.

Grubb T, Sager J, Gaynor JS et al. (2020) 2020 AAHA Anesthesia and monitoring guidelines for dogs and cats. J Am Anim Hosp Assoc 56:59–82.

<sup>&</sup>lt;sup>2</sup>Bioanalytical Laboratory, Institute of Biomedicine, University of Turku, Turku, Finland

# Comparison of gabapentin and carprofen for the treatment of acute orthopedic surgical pain in dogs undergoing tibial plateau leveling osteotomy

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<sup>1</sup>Department of Veterinary Clinical Sciences, The Ohio State University College of Veterinary Medicine, Columbus, OH, USA

Gabapentin is often prescribed for acute post-operative analgesia in dogs. The study objective was to determine if gabapentin alone or in combination with carprofen provides analgesia in the late post operative period after elective orthopedic surgery.

This was a prospective, randomized, double-blinded, placebo-controlled clinical trial with thirty-one dogs undergoing tibial plateau leveling osteotomy (TPLO) using a standardized anesthetic and immediate post-operative pain protocol. Patients randomly received: gabapentin 20 mg kg-1 every 8 hours plus placebo every 12 hours, gabapentin 20 mg kg-1 every 8 hours plus carprofen 2.2 mg kg-1 every 12 hours, or carprofen 2.2 mg kg-1 every 12 hours plus placebo every 8 hours starting the night prior to surgery and continuing for 2 weeks. Assessment included pain utilizing the Glasgow Composite Pain Scale and limb function with low-profile pressure measurement the day prior to surgery, and up to fourteen days after surgery. Data were analyzed using mixed effects ordinal logistic regression models.

Pain scores for all groups peaked at 24 hours after surgery [3 (1-6); median (range)] and returned to baseline by 2 days after surgery [1 (1-3)]. There was no significant difference in pain scores among groups at any time point, in the percent decrease of maximum force across time or among treatment groups, and there were no time-treatment interactions that influenced maximum force.

Gabapentin alone or in combination with carprofen did not result in improvement in pain scores or limb function compared to carprofen alone for dogs undergoing TPLO surgery.

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# Anesthetic management and complications of transcatheter edge-to-edge repair for myxomatous mitral valve disease in dogs: 29 cases

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Transcatheter edge-to-edge repair (TEER) is gaining popularity outside academic institutions as a treatment option for mitral valve disease. The aim of this study was to report on the management and complications of anesthesia in dogs undergoing this procedure.

Medical records of dogs diagnosed with myxomatous mitral valve disease undergoing anesthesia for TEER procedures at two institutions were reviewed. Twenty-nine cases were identified (22 males and 7 females). Median (range) age and bodyweight was 10 (3 to 15) years and 6.7 (3.5 to 14.7) kg, respectively. The most represented breed was the Chihuahua (n = 5, 17%). Mitral valve disease was classified as ACVIM Stage B2 (n = 11, 38%), C (n = 17, 59%), or D (n = 1, 3%). Intravenous preanesthetic medication with median dosages (range) included pantoprazole (n = 29, 1 mg kg-1), maropitant (n = 29, 1 mg kg-1), fentanyl (n=23, 3 (2.9-5.5) mg kg-1), methadone (n = 2, 0.2 mg kg-1) and morphine (n = 4, 0.1 mg kg-1). Induction agent combinations included alfaxalone (n = 1), alfaxalone-midazolam (n = 7), alfaxalone-lidocaine (n = 11), propofol-midazolam (n=1), etomidate-midazolam (n = 7), or etomidate-midazolam-lidocaine (n = 2). Anesthesia was maintained with isoflurane and with either fentanyl (n = 11), fentanyl-lidocaine (n = 9), fentanyl-midazolam (n = 3), or another full-mu agonist opioid infusion with lidocaine (n = 6).

Twenty-eight dogs received an intercostal nerve block with ropivacaine at a 1.2 (0.9-2.1) mg kg-1. Anesthetic and surgery times (mean  $\pm$  sd) were 213  $\pm$  40 minutes and 116  $\pm$  24 minutes, respectively. Cardiac arrhythmias were observed in all dogs. Other significant complications included hemorrhage (n = 6) and respiratory derangements (n = 11). Perioperative death occurred in one dog.

Due to the frequency of complications associated with TEER procedures, anesthetic management requires intense monitoring and preparation to immediately treat complications.

#### Population pharmacokinetics of IV paracetamol: Do all dog breeds process the drug similarly?

Pelligand Ludovic<sup>1</sup>, Serrano-Rodriguez Juan Manuel<sup>2</sup>, Granados Maria<sup>2</sup>, Juan Manuel Serrano Rodríguez<sup>3</sup>, Lucy Ann Davies<sup>1</sup>, María del Mar Granados Machuca<sup>4</sup>, Irene Sartini<sup>5</sup>, Mario Giorgi<sup>5</sup>, Hiroshi Yamazaki<sup>6</sup>, Maria Vertzoni<sup>7</sup>

<sup>1</sup>Royal Veterinary College, United Kingdom

The use of intravenous (IV) paracetamol in dogs is increasing, however, no licensed product exists. A drug development programme is needed to establish safe and effective dosages. This study aims to i) describe population pharmacokinetics (PK) of paracetamol in a large population of dogs and evaluate the effect of covariates ii) perform Monte-Carlo simulations to explore the adequacy of current dosage regimens to achieve putative plasma concentrations associated with analgesia.

Studies referencing IV paracetamol PK in dogs were selected, and raw plasma concentration-time data were obtained. Non-linear-mixed-effects model (Monolix) estimated PK parameters and explored covariate effects. *In silico* Monte-Carlo simulations evaluated the percentage of the inter-dose interval where plasma concentration exceeded target of  $1 \mu g \, mL^{-1}$  at steady state.

A total of 1095 plasma-concentration from 7 studies were modelled. Seventy-seven dogs (31 beagles, 21 greyhound, 6 labradors and 19 various-breeds) received doses from 0.2 to 20 mg kg<sup>-1</sup>. A two-compartment population PK model, with breed and anaesthesia as significant covariates, best described the data. The typical clearance of paracetamol was medium to fast (1.241 L<sup>-1</sup> kg<sup>-1</sup> h) in Beagles/various breeds. Clearance was 68.3% and 29.6% lower in Labradors (0.393 L<sup>-1</sup> kg<sup>-1</sup> h) and Greyhounds (0.874 L<sup>-1</sup> kg<sup>-1</sup> h), respectively compared to the reference population. Anaesthesia increased intercompartmental clearance from 0.146 to 0.232 L<sup>-1</sup> kg<sup>-1</sup> h. Steady-state volume of distribution was 1.51 L kg<sup>-1</sup>. Monte Carlo simulations predicted that with 20 mg kg<sup>-1</sup> every 8 hours, Labradors would maintain plasma-concentrations above the target for 89% of the dosing period compared to 49% for Greyhounds and 35% for Beagles/various-breeds.

IV paracetamol PK varied between dog breeds. The clearance of paracetamol is remarkably different in Labradors compared to other breeds, but this finding needs confirming with a larger population. Further research is needed to optimise dosage recommendations and understand the origin of breed-specific-differences.

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## Effects of helium/oxygen mixtures on inspiratory resistance to gas flow during volume-controlled ventilation: an "in vitro" simulation for cats

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Helium/oxygen mixtures (heliox) may decrease airway resistance (Raw) when compared to 100% FiO2 (FiO2(100%)) or oxygen/nitrogen mixtures. This study evaluated the effects of heliox, at different concentrations, on inspiratory resistance (Rinsp) using an in vitro model of volume-controlled ventilation in cats.

The ventilator, adjusted to deliver a VT of 40 mL (inspiratory time 1.5 seconds, 50% inspiratory pause, zero end-expiratory pressure), was connected to a test lung (compliance 8 mL cmH2O-1). The Rinsp was recorded as the endotracheal tube internal diameter ETtube(ID) was decreased from 4.5 (ETtube(4.5)) to 3.5 (ETtube(3.5)) and 2.5 mm (ETtube(3.5)) (n = 6 for each ETtube(ID)) with FiO2(100%), 50% FiO2 and 50% helium (Heliox(50%)), and 30% FiO2 and 70% helium (Heliox(70%). The same oxygen/nitrogen mixtures were used as controls. A two-way ANOVA followed by Tukey and Bonferroni tests analyzed data (p < 0.05).

Regardless of the heliox concentration, Rinsp significantly increased (p < 0.0001) by 9-10 times as the ETtube(ID) was decreased from 4.5 to 2.5 mm (p < 0.0001). Use of Heliox(50%) and Heliox(70%) significantly decreased Rinsp in comparison to FiO2(100%) regardless of the ETtube(ID) (p = 0.003 to < 0.0001). With the ETtube (2.5) Rinsp [cmH2O (L second-1)–1] was significantly decreased from  $63.9 \pm 2.6$  (FiO2(100%)) to  $49.7 \pm 1.6$  (Heliox(50%)) and to  $42.9 \pm 2.1$  (Heliox(70%)) (p < 0.0001 for all comparisons). With the ETtube(2.5), oxygen/nitrogen mixtures resulted in smaller decreases in Rinsp compared to Fi=-O2(100%) (FiO2 50%: 8.5% decrease; FiO2 30%: 9.1% decrease) than helium/oxygen mixtures (Heliox(50%): 22.3% decrease; Heliox(70%): 32.9% decrease) (p < 0.0001 for all comparisons).

Heliox minimized the increase in resistance to gas flow induced by progressive decreases in ETtube(ID). Its use may be beneficial in cats receiving mechanical ventilation with increased Raw.

## Lumbosacral foraminal injections in dogs: assessing an ultrasound- and fluoroscopy-guided technique in a cadaveric model

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Lumbosacral radiculopathy is the strongest predictor of lumbosacral pain in dogs (Medina-Serra et al. 2025). In human medicine, transforaminal epidural injections allow targeted perineural corticosteroid delivery and improve outcomes in patients with lumbar disc herniation and radicular pain (Kwak et al. 2023). This cadaveric study, approved by the Ethics Committee of Animal Experimentation (814/2022) and the Committee of Biosecurity in Experimentation (508 MEDINA) at the University of Murcia, evaluated injectate distribution using a novel ultrasound- and fluoroscopy-guided technique for lumbosacral foraminal injections in dogs.

Ten injections were performed bilaterally in five thawed adult canine cadavers using 0.1 mL kg<sup>-1</sup> of a Davidson-tissue-dye and iopromide solution. Needle placement at the cranial aspect of the L7 foramen was guided by ultrasound and confirmed fluoroscopically. Injectate distribution was assessed by fluoroscopy, computed tomography (CT), and anatomical cryosections.

Paravertebral contrast distribution at the foraminal region was observed in all injections (10/10). Epidural spread medial to the intervertebral foramen occurred in 8/10 injections. Anatomical dissections confirmed perineural epidural staining of the L7 spinal nerve in 9/10 injections. Subarachnoid spread was observed in 5/10 injections fluoroscopically and 6/10 by CT, most frequently in cadavers with foraminal stenosis. Intravascular uptake was detected in 1/10 injections by fluoroscopy and 2/10 on CT.

This technique consistently enabled accurate needle placement near the target nerve and achieved perineural and transforaminal epidural spread with minimal vascular uptake. The relatively frequent occurrence of subarachnoid migration reflects the injectate distribution pattern seen in this cadaveric model after initial needle placement. In clinical practice, this corresponds to the preliminary contrast study, allowing real-time assessment and cannula repositioning prior to therapeutic injection. These results support the potential clinical utility of this approach for targeted drug delivery in dogs with lumbosacral radiculopathy. Further research is required to elucidate its safety and efficacy in live animals.

#### References

Medina-Serra R, López-Abradelo P, Belda E et al. (2025) Multivariable analysis of the association between lumbar and lumbosacral MRI-diagnosed spinal pathologies and pain in dogs. Animals 15, 761.

Kwak SG, Choo YJ, Kwak S et al. (2023) Effectiveness of transforaminal, interlaminar, and caudal epidural injections in lumbosacral disc herniation: a systematic review and network meta-analysis. Pain Physician 26, 113–123.

### Interventional pain management in dogs with lumbosacral stenosis: preliminary retrospective longterm clinical outcomes of combined foraminal and epidural injections with or without pulsed radiofrequency

Roger Medina-Serra<sup>1</sup>, Francisco G Laredo<sup>2,3</sup>, Francesca de Strobel<sup>4</sup>, Sandra Sanchis-Mora<sup>5</sup>, Eliseo Belda<sup>3,4</sup>

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Lumbosacral stenosis is a recognised cause of pain in dogs, often involving disc herniation and foraminal narrowing with associated radiculopathy (Medina-Serra et al. 2025). In humans, transforaminal injections demonstrate superior outcomes to interlaminar approaches (Kwak et al. 2023) and are frequently combined with pulsed radiofrequency (PRF) at the dorsal root ganglion (DRG) to enhance pain relief (Park et al. 2024). However, their clinical utility in dogs with naturally occurring lumbosacral pain remains unreported.

This retrospective cohort study evaluated long-term outcomes (capped at 24 months) following a single procedure involving ultrasound and fluoroscopy-guided foraminal and epidural corticosteroid and local anaesthetic injections, with (PRF; 9 dogs) or without PRF (No-PRF; 9 dogs) at the L7 DRG, in dogs with chronic lumbosacral pain. Outcome measures included ordinal clinical pain scores (single assessor) and Canine Brief Pain Inventory (CBPI) scores. Clinically relevant improvement was defined as a two-grade reduction in clinical pain score and a CBPI decrease of ≥1 point in pain severity and ≥2 points in pain interference. Data were analysed using Fisher's Exact Test, Wilcoxon signed-rank tests, Mann—Whitney U tests, and generalised linear mixed models in R.

Baseline outcomes did not differ significantly between groups. Pain severity and quality of life (QOL) improved significantly over time within both groups (p < 0.05). Dogs receiving PRF had significantly greater QOL improvement (p = 0.0247). Clinically relevant improvement was achieved in 9/9 of dogs in the PRF group and 5/9 in the No-PRF group. The median duration of clinically relevant improvement was longer in the PRF group [16.4 (2.2-24) months] than in the No-PRF group [8.9 (0 to 24) months], although this difference was not statistically significant.

These preliminary findings suggest that image-guided targeted injections, with or without adjunctive PRF, may provide long-term pain alleviation in dogs with lumbosacral stenosis.

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Medina-Serra R, López-Abradelo P, Belda E et al. (2025) Multivariable analysis of the association between lumbar and lumbosacral MRI-diagnosed spinal pathologies and pain in dogs. Animals 15, 761.

Kwak SG, Choo YJ, Kwak S et al. (2023) Effectiveness of transforaminal, interlaminar, and caudal epidural injections in lumbosacral disc herniation: a systematic review and network meta-analysis. Pain Physician 26, 113–123.

# Small animal Oral presentations Wednesday 17th

Addition of adrenaline to irrigation fluid in diagnostic and therapeutic arthroscopy in dogs: an anesthetic approach

<u>Ana Zapata<sup>1,2</sup></u>, Claudio Iván Serra<sup>1</sup>, José Ignacio Redondo<sup>3</sup>, Elena Ríos-Álvarez<sup>1</sup>, José Sansano-Maestre<sup>4</sup>, Rocio Fernández-Parra<sup>1</sup>

Systemic absorption of adrenaline has been reported in human arthroscopies (Abdelrahman et al., 2021). This study investigated whether similar absorption occurs in dogs, using cardiorespiratory variables and biochemical markers (McGuinness et al., 1997; Mansour et al., 2017).

A prospective, randomized clinical study was conducted on 41 joints in dogs undergoing diagnostic stifle (n = 20) or therapeutic elbow (n = 14), shoulder (n = 5), and stifle (n = 2) arthroscopies. All dogs received medetomidine (0.01 mg kg<sup>-1</sup>) and methadone (0.2 mg kg<sup>-1</sup>) IM, ketamine (1 mg kg<sup>-1</sup>) and propofol to effect IV, and maintained with isoflurane. Locoregional anaesthesia was performed. Ringer-Lactate (RL) was used as irrigation fluid during the first two minutes. Subsequently, each procedure type was divided into RL with adrenaline (0.33 mg L<sup>-1</sup>) or RL alone (control group). Cardiorespiratory variables (HR, SAP, MAP, DAP, fr) and parasympathetic tone activity (PTA; based on HR variability) were recorded at baseline (T0), after optic insertion (T2), and every 5 minutes (T5, T10, T15 and T20 for diagnostic; until T60 for therapeutic). Plasma concentrations of glucose, cortisol, and adrenaline were measured at T0, T20, and 20 minutes post-procedure (Tend20). Statistical analysis was performed using R (v4.4.2). Generalised linear models were applied to assess the effects of group, time, and their interaction. Significance was set at p < 0.05.

No significant differences between groups or over time were found in cardiorespiratory variables (p > 0,05), PTA (p = 0.80), or glucose (p = 0.78). Cortisol and adrenaline increased significantly at T20 in diagnostic procedures (1.15  $\pm$  0.79 vs. 4.95  $\pm$  2.48 nmolL $_{-}^{1}$  at T0 vs T20, p = 0.007; 33.87  $\pm$  20.35 vs. 94.06  $\pm$  143.50 pgmL $_{-}^{1}$ , p = 0.041), but without group differences.

Adrenaline at 0.33 mg L<sup>-1</sup> in arthroscopic irrigation fluid caused no significant systemic effects, suggesting minimal absorption.

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McGuinness OP, Shau V, Benson EM et al. (1997) Role of epinephrine and norepinephrine in the metabolic response to stress hormone infusion in the conscious dog. Am J Physiol Endocrinol Metab 273, E674–E681.

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

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#### KN Kuek Difference indistribution

#### 2024 Abstract winner

### Ultrasound-guided ischiorectal fossa block targeting the pudendal nerve in dogs: a cadaveric study

Jalise N. Zumstein<sup>1</sup>, Erin K. Keenihan<sup>1</sup>, Jessica D. Briley<sup>1</sup>

<sup>1</sup>Department of Molecular Biomedical Sciences, College of Veterinary Medicine, North Carolina State University, Raleigh, NC, USA

The objective of this prospective, randomized, anatomic study was to describe an ultrasound-guided (USG) regional anesthesia technique for perineural injection of the pudendal nerve (PdN) in dogs.

A total of seven thawed and 15 fresh canine cadavers were used. Anatomical dissection, sonography and computed tomography (CT) techniques were used. Seventeen cadavers (11 males and six females), with body mass of  $25.2 \pm 6.3$  kg (mean  $\pm$  standard deviation) were used: four for anatomical study and approach development and 13 administered bilateral USG transgluteal injections. Using a dorsomedial-to-ventrolateral needle trajectory, the ischiorectal fossa was targeted medial to the ischiatic spine. Each hemipelvis was randomized to be administered high (HV, 0.2 mL kg<sup>-1</sup>) or low (LV, 0.1 mL kg<sup>-1</sup>) volume injections of ropivacaine-dye solution. Following injection, cadavers were dissected. Successful PdN staining (>1 cm nerve length stained) and inadvertent staining of the sciatic nerve, or rectal, urethral or intravascular puncture was recorded. Volumes were compared using a mixed effects ordinal logistic regression model (p < 0.05 considered significant).

We excluded five cadavers owing to poor tissue preservation. The neurovascular bundle containing PdN and landmarks for ischiorectal fossa were defined using CT. Sonographically, landmarks were identified and dye solution injected into the fossa. Complete staining of the PdN was achieved in 69.2% (HV) and 58.3% (LV) of injections. There was no significant difference in nerve staining between groups (p = 0.864). There was no significant difference in sciatic nerve staining between HV (7.7%) and LV (8.3%) (p = 0.71). Rectal, urethral or intravascular puncture was not observed.

This is the first description of an USG ischiorectal fossa block using a transgluteal approach targeting the PdN in dogs. The described USG technique could provide anesthesia of the urethra and perineal region. Further studies are necessary to investigate this approach in live animals.

## Pharmacokinetics and postoperative analgesic efficacy of intravenous acetaminophen in dogs undergoing laparoscopic ovariohysterectomy

<u>María del Mar Granados Machuca</u><sup>1</sup>, Francisco Medina Bautista<sup>1</sup>, Juan Manuel Domínguez Pérez<sup>1</sup>, Setefilla Quirós Carmona<sup>1</sup>, Rocio Navarrete Calvo<sup>1</sup>, Carles Mengual Riera<sup>1</sup>, Juan Manuel Serrano Rodríguez<sup>1</sup>

Paracetamol is increasingly used as part of multimodal analgesia in dogs (Bello and Dye 2023), but its pharmacokinetics (PK) and analgesic efficacy after multiple doses remain underexplored. This study assessed its postoperative analgesic effects, PK, pharmacodynamics (PD), and safety in female dogs undergoing laparoscopic ovariohysterectomy.

A randomized, blinded trial compared IV paracetamol (10 and 20 mg kg $^{-1}$  every 8 hours) with buprenorphine (20 µg kg $^{-1}$  every 8 hours) for 24 hours. First administration was at the moment of extubation. Pain was assessed using the Glasgow Composite Measure Pain Scale – Short Form (CMPS-SF) up to 24 hours. Pharmacokinetics and PD were evaluated by nonlinear mixed-effects modelling to characterize drug disposition, define plasma concentration thresholds for analgesia, and model pain score evolution over time. The PK parameters were compared between breeds and doses (Mann–Whitney U test) and PD parameters were compared between treatment groups (Kruskal-Wallis test and the Mann–Whitney U test for a post hoc analysis). Hematological, hepatic and renal parameters were obtained before and 24 hours after treatment and were compared (Wilcoxon signed-rank test). Significance if p < 0.05.

Fifty-nine dogs were included. Paracetamol at both doses provided analgesia comparable to that of buprenorphine, with CMPS-SF scores maintained mainly between 0 and 2 (Fig. 1). Pharmacokinetic was described by a two-compartment model, with paracetamol maximum plasma concentration of 11.49 (2.16) and 19.78 (5.18)  $\mu$ g mL-1 and minimum of 0.11 (0.07) and 0.24 (0.21)  $\mu$ g mL-1 at 10 and 20 mg kg<sup>-1</sup> respectively. The PD model described the cumulative probability of low scores demonstrating a long-lasting analgesic effect. The drug was well tolerated and no adverse effects were observed.

Paracetamol at 10 and 20 mg kg-1 produces effective postoperative analgesia at the study conditions without side effects. Further studies are warranted to refine dosing strategies and assess broader clinical applications.

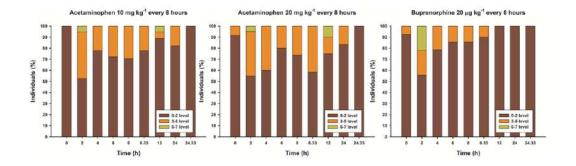


Figure 1.

Analgesic score levels by the CMPS-SF scale defined as percentage of individuals over the time grouped by three thresholds, from 0 to 2 in brown colour, from 3 to 5 in orange colour and from 6 to 7 in green colour.

#### References

Bello A, Dye C (2023) Current perceptions and use of paracetamol in dogs among veterinary surgeons working in the United Kingdom. Vet Med Sci 9, 1058. doi:10.1002/vms3.1058

<sup>&</sup>lt;sup>1</sup>Department of Animal Medicine and Surgery. Anaesthesia Unit. University of Córdoba, <sup>2</sup>Veterinary Pharmacology Area. Department of Nursing, Pharmacology and Physiotherapy.

# A retrospective study of propofol requirements for induction of anaesthesia in paediatric and geriatric dogs and cats.

<u>Vasileios Zapridis¹</u>, Glykeria Kirmanidou¹, Konstantinos Varkoulis¹, Iliana Tzortzi¹, Giorgos Kazakos¹, Ioannis Savvas¹, Tilemachos Anagnostou¹

<sup>1</sup>Aristotle University of Thessaloniki, School of Veterinary Science, Companion animal clinic

The aim of this study was to investigate the propofol requirements for induction of anaesthesia in paediatric, adult, and geriatric dogs and cats.

Retrospectively, 3,266 dogs and 606 cats induced with propofol were grouped according to premedication (presence or absence of an a2-agonist) and age (0 - 11 weeks, 11 weeks - 6 months, 6 months - geriatric and geriatric).

In the a2-agonist premedicated dogs, statistically significantly increased requirements of propofol were noted for neonatal (median 4.28, range 2.22 - 9.76 mg kg-1) and paediatric (3.8, 1 - 15.38 mg kg-1) dogs compared to the other groups [adult (2.1, 0.24 - 18.6 mg kg-1) and geriatric (1.61, 0.2 - 5.88 mg kg-1)] and a decrease in requirements in geriatric dogs when compared to the other groups. In a2-agonist premedicated cats, significant differences were observed between all groups [neonatal (median 10, 7 - 14 mg kg-1), paediatric (4.22, 1.76 - 15.63 mg kg-1), adult (2.22, 0.58 - 6.67 mg kg-1) and geriatric (1.87, 0.32 - 3 mg kg-1)]. In dogs premedicated without an a2-agonist, neonatal and paediatric dogs had significantly higher requirements for propofol (5.71, 2.88 - 16.67 and 5.12, 2.35 - 14, respectively) when compared to adult (2.92, 0.24 - 15.22) and geriatric (2, 0.38 - 9.38) dogs, with geriatric having decreased requirements when compared to all other groups. In cats premedicated without an a2-agonist, neonatal (9.71, 4 - 34) and paediatrics (8.47, 5 - 14.29) had significant differences both with adult (3.2, 1 - 8.33) and geriatric (1.95, 1 - 2.94) cats, with geriatric having significantly lower requirements than all other groups.

Neonatal and paediatric dogs and cats seem to require a higher dose of propofol for induction of anaesthesia when compared to adults and geriatrics, while geriatric patients seem to require a lower dose compared to other groups.

# Mass balance, methaemoglobin and metabolite study of [14C]paracetamol after IV and oral administration in dogs

<u>Ludovic Pelligand</u><sup>1</sup>, Elizabeth Mann<sup>2</sup>, Olivia Taylor<sup>2</sup>, Philip Bond<sup>2</sup>, Ray Cooke<sup>2</sup>, Scott Summerfield<sup>2</sup>, Barry Jones<sup>2</sup>, Tim Smith<sup>2</sup>, Ian D Wilson<sup>3</sup>

<sup>1</sup>Royal Veterinary College, United Kingdom, <sup>2</sup>Pharmaron UK Ltd, <sup>3</sup>Imperial College

The use of intravenous and oral paracetamol in dogs is increasing, however a drug development programme is needed to establish safety and efficacy. This study aims to determine the mass balance, routes and rates of excretion following a single oral administration of [14C]paracetamol to male Beagle dogs and compute pharmacokinetic parameters of total radioactivity in whole blood, blood cells and plasma.

Two adult male dogs were used in a two-period crossover study (Project license PP1414329). In the first period, IV paracetamol was administered at 10 mg kg<sup>-1</sup> with methaemoglobin (Siemens Rapid point 500) measured in whole blood, and samples of plasma and urine collected at intervals up to 48 hours. [14C] paracetamol at 10 mg kg (100 µCi kg<sup>-1</sup>) was orally administered in the second period, with total radioactivity in whole blood, blood cells and plasma evaluated and concentrations of paracetamol within plasma measured. Urine, faeces and cage washings were collected up to 168 hours post-dose for mass balance and metabolite analysis.

Total recovery of administered radioactivity over 168 hours was 85.4% and excretion mainly occurred during the first 48 hours. The majority of the radioactive dose was recovered from urine (73.0%), faeces (5.65%) and cage washes (6.7%). Small increases in methaemoglobin were observed within 1 hour post-dose (from 0.9 - 1% to 1.4 - 1.5%) and methaemoglobin returned to baseline at 6 hours. The mean Cmax for total radioactivity measured 10.3, 7.9 and 13.5  $\mu$ g equivalent g<sup>-1</sup> in whole blood, red blood cells and plasma respectively, between 0.5 and 1 hour post-dose. Average blood-to-plasma ratio was 72%. Concentrations of total radioactivity were still well above the limit of quantification at 48 hours post-dose.

The use of 14C radiolabel has allowed, for the first time, the routes of excretion and metabolic fate of paracetamol to be fully defined in the dog.

## Efficacy, pharmacokinetics and safety of liposomal synthetic cannabidiol injected subcutaneously in dogs: A randomized, blinded, placebo-controlled, crossover clinical trial

Yael Shilo-Benjamini<sup>1,2</sup>, Joshua Milgram<sup>2</sup>, Eran Lavy<sup>2</sup>, Maxim Quint<sup>2</sup>, Dinorah Barasch<sup>3</sup>, Ahuva Cern<sup>1</sup>, Yechezkel Barenholz<sup>1</sup>

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Study objectives were to determine the pharmacokinetics and effects of liposomal-synthetic-cannabidiol (L-sCBD) injection compared with placebo in dogs with radiographically confirmed naturally-occurring osteoarthritis.

Eight dogs (4 males, 4 females; 8.5 [4.5-12.5] years-old; 34.9 [22.7-42.7] kg) were injected SC twice with a 4-week interval; once with 7 mg kg-1 L-sCBD (50 mg mL-1) and once with empty liposomes (placebo; equivalent volume) in a randomized, blinded, crossover design. Each dog routine analgesics (e.g., NSAIDs) were continued. Blood was sampled for CBD and metabolites concentrations (baseline, 6-hours, 3-days, and weekly for 4-weeks), and for complete blood count and serum chemistry (baseline, 3-days, 1- and 4-weeks). Efficacy was assessed via activity monitoring collar and scorings by two veterinary specialists (both assessed all dogs) and by owners. Vital signs and local response were monitored. Aligned rank transform ANOVA and permutation tests were used for data analysis (p-value < 0.05).

Plasma concentrations of CBD were detected up to 4-weeks; median peak plasma concentration (Cmax) was 58.2 [range 35.1-141.0] ng mL-1, median time to Cmax was 3 [3-7] days and median half-life 6.1 [4.6-9.5] days. The metabolites 6-hydroxy-CBD, 7-hydroxy-CBD and 7-carboxy-CBD were detected at low concentrations. Pain and lameness scores and behavior were significantly improved after L-sCBD treatment versus placebo. At 3-days after L-sCBD treatment, neutrophils and alkaline-phosphatase increased significantly, while hematocrit and albumin decreased (all within reference range, except neutrophils in 2/8 dogs). Adverse effects included 2-days fever and a minor-moderate local swelling, which resolved spontaneously.

Subcutaneous L-sCBD provided long-term CBD plasma concentrations, improved analgesia and was tolerated by dogs. A larger clinical cohort is required to further assess L-sCBD benefits and safety.

# Treatment of abnormal pain or unpleasant sensation with constant rate infusion of ketamine in cats – a case study

<u>Tokiko Kushiro-Banker</u><sup>1</sup>, Shirley Yeung<sup>1</sup>, Jennifer McGann<sup>1</sup>, Aubrey Gould<sup>1</sup>, Benjamin Hulsey<sup>1</sup>, Jason Evans<sup>1</sup>

\*\*Indiwestern University College of Veterinary Medicine\*\*

Abnormal pain or unpleasant sensations can lead to symptoms such as self-mutilation and significantly impair the quality of life (QoL) for both the patient and caregiver. This study aimed to investigate the effects of the intravenous constant rate infusion (CRI) of ketamine on symptoms of abnormal pain or unpleasant sensation in cats.

Three cats diagnosed with dysesthesia based on history, neurological and orthopedic examinations, bloodwork, and urinalysis were enrolled. All cats exhibited distress focused on their tails and repeated self-mutilation. On the treatment day, a ketamine CRI was administered at 2 mcg kg-1 min-1 following a loading dose of 0.5 mg kg-1 IV. The CRI was maintained for 12 to 24 hours. Follow-up visits were scheduled at 2 weeks and at 1, 3, 6, and 12 months post-treatment. Owners completed a validated health-related QoL (HRQoL) questionnaire for cats before treatment and at 1, 2, 3, 4, and 6 weeks, as well as 2, 3, 4, 5, 6, 9, and 12 months after treatment. The HRQoL score (0-100) was subsequently calculated. If symptoms worsened within 4 weeks post-treatment, a second infusion was administered at 5 mcg kg-1 min-1 with the same loading dose.

Dysesthesia symptoms in two cats (Cat-1 and Cat-2) markedly improved after a ketamine CRI. Cat-1's symptoms resolved completely for nearly a year, with its HRQoL score improving within 2 weeks (from 75.2 to 92.7). Cat-2 required a second infusion. Its initial HRQoL score was already high and remained consistently high after treatments (97-100). Cat-3 showed mild improvement but was later excluded due to the owner's decision.

Ketamine CRI appears to be effective in alleviating dysesthesia symptoms in cats. Further research is needed to determine the optimal rate and duration of infusion, as well as the specific types of sensations ketamine CRI can effectively treat.

# Evaluation of risk factors leading to poor anesthetic recovery after ocular surgery in academic small animal practice

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<sup>1</sup>University of Wisconsin-Madison School of Veterinary Medicine

<sup>2</sup>University of Wisconsin-Madison School of Medicine and Public Health

This study examined possible risk factors associated with poor quality of recovery (QoR) in dogs and cats undergoing general anesthesia for ocular surgery in an academic teaching hospital.

In this retrospective cohort study, data from 305 records of dogs and cats that underwent general anesthesia for ocular surgery between September 2022 and May 2024 were examined for associations between QoR and other variables, including age, weight, sex, anesthetic risk, total anesthesia time, type of ocular surgical procedure, premedication, induction, and maintenance agents, intra-operative analgesics, pre-recovery sedation, and post-operative pain score (Glasgow Composite Measure Pain Scale – short form; maximal score 20) and temperature. Requirements for sedation and rescue analgesia during the recovery period were also evaluated. QoR was determined using a modified recovery scale and categorized as good or poor. Multivariate analysis of variance with adjustments for multiple comparisons was performed. Results are presented as mean ± standard deviation with statistical significance at p <0.05.

288 anesthetic records met inclusion criteria (249 dogs, 39 cats). 88/288 [30.6%; 77 dogs (30.9%), 11 cats (28.2%)] records indicated a poor QoR. Young cats were more likely to have a poor QoR (p = 0.005). No other variables were identified as risk factors for poor QoR. Most (88.6%; dogs 88.3%, cats 90.9%) patients categorized as poor QoR received sedation during the recovery period.

Poor anesthetic recovery in dogs and cats undergoing general anesthesia for ocular surgery is common. While young cats were more likely to have a poor QoR, no other specific risk factors were found in the population examined.

#### References

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Jones H, Robson K, Maddox T, et al. (2024) Incidence of an risk factors for poor recovery quality in dogs recovering from general anesthesia – a prospective case control study. Vet Anaesth Analg 51, 227-234.

## Cardiovascular effects of intramuscular medetomidine-vatinoxan with or without methadone in dogs anesthetised with sevoflurane

Heta Turunen<sup>1</sup>, Elisabeth Barker<sup>2</sup>, Sydney St.Clair<sup>32</sup>

<sup>1</sup>Vetcare Oy, <sup>2</sup>Dechra, <sup>3</sup>QTest Labs

Alpha2-agonists are often used as preanesthetics in combination with opioids. The objective of this study was to determine whether methadone would influence the cardiovascular effects of medetomidine-vatinoxan during sevoflurane anesthesia.

In this cross-over experimental study, six healthy Beagles pre-instrumented with digital radiotelemetry transmitter and aortic flow probes received medetomidine 0.25 mg m-2 and vatinoxan 5 mg m-2 (Zenalpha), with or without methadone 0.2 mg kg-1 (Zenalpha-methadone) intramuscularly. Anesthesia was induced with propofol approximately 20 minutes later (T0) and maintained with sevoflurane in total of 60 minutes (T60). Heart rate (HR), direct mean arterial pressure (IBP), cardiac (CI) and stroke volume indices (SVI) were recorded every 5 minutes. Each of the variables were analysed via a mixed linear model repeated measures analysis with  $p \le 0.05$  considered significant.

There were no statistically significant differences between the treatments in HR, IBP or CI during anesthesia. With Zenalphamethadone SVI was significantly higher from T30 to T60 in comparison to Zenalpha.

Combining methadone to medetomidine-vatinoxan did not cause clinically relevant cardiovascular changes during sevoflurane anesthesia in healthy dogs.

Table 1: Cardiovascular variables (mean ± SD) during sevoflurane anesthesia in dogs premedicated with medetomidine-vatinoxan (Zenalpha) with or without methadone

Treatment	Time (minutes)	HR (beats minute <sup>-1</sup> )	IBP (mmHg)	CI (L minute <sup>-1</sup> m <sup>-2</sup> )	SVI (mL m <sup>-2</sup> )
Zenalpha	10	93 ± 14	92 ± 7	$2.7 \pm 0.3$	30 ± 4
Zenalpha- methadone		90 ± 10	84 ± 15	2.6 ± 0.8	29 ± 7
Zenalpha	30	104 ± 7	67 ± 5	2.2 ± 0.3	22 ± 3
Zenalpha- methadone		100 ± 19	64 ± 3	2.5 ± 0.5	25 ± 5*
Zenalpha	50	99 ± 10	70 ± 6	1.9 ± 0.2	20 ± 4
Zenalpha- methadone		93 ± 11	67 ± 5	2.2 ± 0.4	24 ± 5*

<sup>\*</sup> Significant difference between treatments,  $p \le 0.05$ 

# Small animal Oral presentations Thursday 18th

Reliability and initial validation of SIESTA-II, A short form of SIESTA (SEAAV Integrated Evaluation Sedation Tool for Anaesthesia) for dogs.

Fernando Martinez Taboada<sup>1,3</sup>, Mireia García-Roselló<sup>2</sup>, José Ignacio Redondo<sup>2</sup>

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A standardised tool is essential for consistent canine sedation assessment in research and clinical settings. We evaluated inter- and intra-observer reliability, internal consistency and overall measurement precision of the SIESTA-II, a short form of the SIESTA scale.

Twenty-one Spanish-speaking veterinary anaesthetists assessed eleven parameters from the SIESTA scale, a subjective sedation rating (SUBJECTIVE) and a score using the proposed algorithm (ALGORITHM) on 25 videos viewed twice, 28 days apart. Weighted Cohen's  $\kappa$  and Fleiss'  $\kappa$  quantified inter-observer agreement; intra-observer  $\kappa$  was derived from paired viewings. A cumulative link mixed model estimated the intraclass correlation coefficient (ICC). Generalisability theory partitioned variance components. Cronbach's  $\alpha$  and the graded-response IRT model examined internal consistency. A random forest explored variable importance.

Inter-observer agreement, measured by Fleiss's  $\kappa$ , ranged from 0.64 to 0.83, closely mirroring pairwise mean weighted Cohen's  $\kappa^2$  values (0.20–0.84). The SUBJECTIVE and ALGORITHM scores yielded Fleiss's  $\kappa$  values of 0.61 and 0.63, and Cohen's  $\kappa$  values of 0.76 and 0.78, respectively. Intra-observer agreement (pairwise weighted Cohen's  $\kappa^2$ ) lay between 0.43 and 0.90, with Fleiss's  $\kappa$  for repeated ratings similarly high (0.66 for SUBJECTIVE, 0.66 for ALGORITHM). A cumulative link mixed model partitioned variance into case and evaluator components, yielding an adjusted intraclass correlation coefficient of 0.922, with case-level variance (82.8%) far exceeding evaluator variance (1.0%). D-studies showed 30 cases yielded a generalisability coefficient  $Gp_2$  of about 0.66, while four raters met  $Gp_2 \ge 0.95$ . Cronbach's  $\alpha$  (0.698) assessed internal consistency, and a graded-response IRT model confirmed unidimensionality, ordered thresholds, and acceptable discrimination. Random forest analysis revealed head position, posture change, and movement as the best predictors for subjective sedation ratings.

The SIESTA-II scale shows excellent inter- and intra-observer reliability, acceptable internal consistency, and strong generalisability, supporting its use for standardised canine sedation assessment in research and clinical practice.

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## A retrospective analysis of a single veterinary private practice canine population, treated with bedinvetmab (LibrelaTM)

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Bedinvetmab is a monoclonal antibody targeting nerve growth factor labeled in the European Union for the alleviation of pain associated with osteoarthritis (OA) in dogs. An initial retrospective case series was collected from a private French veterinary practice and characterizes dogs receiving this treatment. Bedinvetmab was used in a diverse patient population; preexisting comorbidities were common.

Dogs were treated between January 2021 and December 2024. Those with OA pain from  $\geq 1$  site and treated with  $\geq 1$  injections of bedinvetmab were included. Data were analyzed using descriptive statistics. Pain scores were assessed using a modified client-specific outcome measures (mCSOM; scale: 0–12). Cases from 206 dogs (mean 11, SD  $\pm 3$  years) were reviewed having received injections of bedinvetmab (median 3; range 1–34).

The hip (47%) and stifle (28%) joints were most affected, while getting up (38%) and lameness associated with walking (33%) were the most often defined mCSOM criteria. Breed, sex, age, or OA location did not impact initial mCSOM reductions. Initial mCSOM scores (before injection) did not differ significantly across analgesic treatments (63%; NSAID:  $9.7 \pm 1.7$ , Gabapentin:  $8.3 \pm 2.5$ , Both:  $9.5 \pm 1.9$ ) compared to no-treatment group (37%;  $9.6 \pm 1.4$ ). Preexisting comorbidities in descending order; Urinary, Neurologic, Cardiac, Dermatologic, Orthopedic, Cancer, Endocrine) were already present in 26% of dogs. New ones variably developed in 25% of dogs (in descending order; proprioceptive and motor disorder, , Gastric, Urinary, Dermatologic, Cardiac, Cancer) over the 3-year period. A subset of dogs (88/206) had initial mCSOM scores on Day 0, 10 and 30 and demonstrated a 48% decrease in mean mCSOM scoring (9.6; range 7.9-11.3 to 5; range 4-6) within 10 days which continued over the next 20 days.

This initial summary highlights the need for additional prospective review to further investigate these preliminary trends.

## Ultrasound-guided motor-sparing block of the distal tibia and peroneal nerves in dogs: anatomical study and preliminary clinical results

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A combined proximal sciatic and femoral nerve block is a recognised alternative to neuraxial anaesthesia in dogs undergoing pelvic limb surgery. However, these blocks are associated with delayed ambulation due to motor impairment (Campoy et al. 2012; Boscan & Wennogle 2016). This study aimed to describe the anatomy of the distal tibial and peroneal nerves in dogs and develop an ultrasound-guided block for distal pelvic limb surgery, sparing proximal tarsal muscular branches, intended to provide analgesia while preserving early motor function.

In the initial phase, approved by the Committee of Biosecurity in Experimentation (CBE) at the University of Murcia, two pelvic limbs from a dog cadaver were dissected to identify the course and sonographic appearance of the distal tibial and peroneal nerves at the distal third of the tibia. In a second cadaver, ultrasound-guided dye injections were performed in two pelvic limbs, followed by dissection to confirm nerve staining at the targeted sites.

For preliminary clinical evaluation, the technique was retrospectively assessed in four dogs undergoing distal pelvic limb surgery. Two dogs received ropivacaine 0.75 % and two received bupivacaine 0.5 % (0.2 mL Kg<sup>-1</sup>). Block efficacy was defined by the absence of intraoperative rescue analgesia, determined by heart rate and mean arterial pressure stability (measured five minutes before incision), and postoperative pain scores using the short-form Glasgow Composite Measure Pain Scale. Analgesia was effective in all cases, with a median pain score of 1/20 (range 0-3) until discharge. Early ambulation, defined as weight-bearing on all limbs, was observed in all patients at the first postoperative assessment (median 155 minutes post-block, range 90-220), supporting the motor-sparing effect.

These preliminary findings indicate that this ultrasound-guided distal nerve block may provide effective analgesia while preserving motor function in dogs undergoing distal pelvic limb surgery. Further studies are warranted to confirm these results.

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Boscan P, Wennogle S (2016) Evaluating femoral-sciatic nerve blocks, epidural analgesia, and no use of regional analgesia in dogs undergoing tibia-plateau-leveling-osteotomy. J Am Anim Hosp Assoc 52, 102–108.

Campoy L, Martin-Flores M, Ludders JW et al. (2012) Comparison of bupivacaine femoral and sciatic nerve block versus bupivacaine and morphine epidural for stifle surgery in dogs. Vet Anaesth Analg 39, 91–98.

## Attitudes of veterinarians in the Republic of Ireland towards acute pain assessment and management in cats and dogs

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Effective recognition and treatment of pain are essential for ensuring animal welfare. This study investigated the attitudes of veterinarians practising in the Republic of Ireland (ROI) towards their assessment and management of acute pain in cats and dogs.

An anonymous online survey, comprising five sections, was accessible to veterinarians. It requested demographic information, analgesic drug availability, use of pain assessment tools, pain scoring and treatment of pain associated with specific procedures in dogs and cats. Statistical inferences were interpreted using a 5% level of significance.

A total of 181 responses [140 female (77.3%), 39 male (21.5%)] were collected between January and December 2024. Female veterinarians were more likely to use pain scoring tools in both dogs (p = 0.029) and cats (p = 0.031), and to prescribe lidocaine in dogs (p = 0.007) compared to males. Postgraduate training was associated with an increased use of pain scoring tools in cats (p = 0.003) and a higher likelihood of prescribing ketamine in both species (p = 0.013). Veterinarians who graduated in the 2010s were more likely to use pain scoring tools in dogs compared to those who graduated in the previous decade (p = 0.016). Pain score tools were routinely used by 40.9% and 45.9% of practitioners in dogs and cats respectively. Practitioners employing pain scoring systems were also more inclined to prescribe opioids, use adjunctive analgesia, and implement loco-regional techniques in both species. Most respondents reported routinely administering NSAIDs and opioids. This drug combination was used in 90.1% and 82.9% of canine and feline ovariohysterectomies respectively.

This survey highlights increased use of multimodal analgesia and pain scoring tools among female veterinarians, recent graduates, and those with postgraduate training. NSAIDs and opioids are the most commonly prescribed combination for managing acute pain in small animals by veterinarians in the ROI.

Effect of increased resistance to gas flow....F Teixeir neto

## Epidural catheter tip location and its potential adverse events in relation to cranial advancement in dog cadavers

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Epidural catheter tip complications in humans and animals are rare but likely linked to insertion length and catheter type (Brichant et al. 2006). This study compared tip location using catheters with and without metallic guidewire, inserted to two different lengths in the epidural space of dog cadavers, assessed via computer tomography (CT).

Sixteen fresh greyhound cadavers were randomly allocated to receive epidural catheters with (W) or without (WO) guidewire. Each cadaver had two catheter placements at the lumbosacral intervertebral space, initially aiming towards the fifth lumbar vertebra (L5), then towards the third (L3). CT was used to evaluate the catheter tip's distance to the cranial aspect of the targeted vertebra (tip-target distance), presence of a loop, spinal canal exit, and quadrant location (dorsal–ventral, right–left). Wilcoxon signed-rank and Chi-square tests were used to compared continuous and binomial data respectively (p < 0.05)

No catheter exited the spinal canal, two catheters in the WO and one in W group looped (p = 0.544). Tip-target distance (WO group: 1.146 [-8.681 - 4.425] cm, W:-1.468 [-5.235 - 3.430] cm, p = 0.779) and tip-quadrant location were similar between groups (p = 0.414 and 0.476 for dorsal – ventral and right – left respectively). All looped catheters had ventral tip-quadrant locations. When W and WO were grouped and analysed per vertebra targeted, tip-target distance was also similar (L5: -1.275 [-8.620 - 1.540] cm, L3: -1.708 [-8.681 - 1.326] cm, p = 0.367). There was no difference in lateralisation (p = 1), but more catheter tips (7/16) ended in ventral quadrants when advanced to L3 than to L5 (2/16) (p = 0.049).

Most epidural catheters fell short of the target vertebra. None exited the spinal canal, but three looped. Advancing the catheter to L3 increased the likelihood of ventral positioning Further research is needed to determine the clinical implications.

#### Reference

Brichant JF, Bonhomme V & Hans P (2006) On knots in epidural catheters: a case report and a review of the literature. *Int J Obstet Anesth* 15(2), 159 – 162

## Standardised anaesthetic protocol and complications during transcatheter occlusion of patent ductus arteriosus in dogs: A retrospective cohort study of 24 cases (2024)

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Patent ductus arteriosus (PDA) is a congenital vascular anomaly resulting from the failure of closure of the ductus arteriosus. Its treatment options include surgical occlusion through thoracotomy and minimally invasive transcatheter occlusion. While transcatheter approaches are increasingly preferred, detailed anaesthetic reports using standardised protocols are scarce. To describe the anaesthetic management and intraoperative complications in 24 dogs undergoing transcatheter PDA occlusion, all managed with a single standardised anaesthetic protocol.

Medical records of dogs treated in 2024 were retrospectively reviewed. Anaesthetic monitoring included heart and respiratory rate, ECG, invasive blood pressure,  $SpO_2$ , and  $EtCO_2$ . Hypotension was considered when mean blood pressure values were below 60 mmHg, and hypertension was above 100 mmHg. Most dogs received methadone premedication (91,6%), followed by induction with etomidate, midazolam, lidocaine, and fentanyl (100%) and maintenance with isoflurane. Statistical analysis was performed using the Wilcoxon test to compare pre- and post-occlusion cardiovascular parameters. A significance level of  $\alpha \le 0.05$  was adopted to determine statistical differences.

Median surgical time was 110 minutes. Bradycardia occurred in 10 dogs (41,6%) treated successfully with one dose of atropine. Hypotension was observed in 19 cases (79.9%) and corrected with vasopressors. One case of hypertension was managed with sodium nitroprusside. Branham's sign occurred transiently in one patient. No significant change was observed in heart rate (p = 0.796) or systolic arterial pressure (p = 0.107), but mean and diastolic arterial pressures increased significantly post-occlusion (p = 0.028 and p = 0.015, respectively).

Transcatheter PDA occlusion in dogs, when conducted under a standardised anaesthetic protocol using cardiovascular stable agents such as etomidate, midazolam and fentanyl, resulted in mild and manageable hemodynamic changes. This approach reinforces the importance of protocol selection and the careful selection of drugs with minimal cardiovascular depression. Careful monitoring and individualised vasoactive planning are also essential.

### Anesthetic mortality in canine patients in a veterinary teaching hospital in Spain: a retrospective study.

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Despite the latest advances in anesthetic techniques, anesthesia can still lead to complications and death. The study of its associated risk factors is key to improving anesthetic safety, particularly when analyzed in a specific institution.

2,158 canine patients were included in a longitudinal retrospective cohort study. Anesthetic and medical records from patients anesthetized from January 2013 to December 2019 at the Veterinary Teaching Hospital of Alfonso X el Sabio University were evaluated. Records were studied from premedication to 48 hours post-extubation. Parameters recorded included demographic data, therapeutic/diagnostic procedure and its duration, anesthetic drugs administered and American Society of Anesthesiologist (ASA) classification of patients, among others. Anesthetic mortality was defined as spontaneous deaths occurred during the defined study period.

Anesthetic-related mortality rate was 0.4%. The highest proportion of anesthetic deaths (37.5%) occurred in Boxer dogs. 87.5% of procedures with anesthetic mortality were emergency interventions, exploratory laparotomy showing the highest incidence (table 1). Deaths occurred in patients classified as ASA III to ASA VE. 50% of deaths occurred 24 hours post-extubation (table 2). 75% of deceased dogs only received methadone during premedication.

The anesthetic mortality rate observed, and its associated risk factors, are consistent with current research. These initial data suggest that the incidence of anesthetic-related mortality in our institution is similar to that currently reported internationally and that introduction of extra safety features in the anesthetic management of patients with identified risk factors may be warranted.

Table 1. Type of procedure, duration and emergency status

Emergency procedure	n	Mean ± SD
Gastric dilatation-volvulus (GDV)	1	200 ± NA
Endoscopy	1	$25 \pm NA$
Exploratory laparotomy	3	$66 \pm 9$
Pyometra	1	$80 \pm NA$
Thoracotomy	1	132 ± NA
Non-emergency procedure	n	Mean ± SD
Enucleation	1	55 ± NA

SD: standard deviation; NA: not applicable

# Comparison of atracurium administered as a variable rate infusion or as intermittent boluses in dogs undergoing ophthalmic surgery

<u>Conrado Borja Sanchez Martinez</u>¹, Ignacio Redondo Garcia², Eva Rioja Garcia¹

This study retrospectively compared atracurium administered as a variable rate infusion (VRI) versus intermittent boluses (ITB), to assess total atracurium dose, neuromuscular function and recovery time in dogs undergoing ophthalmic surgery.

A retrospective analysis was performed on 48 anaesthetic records of dogs (24 per group based on a priori sample size calculation) meeting the inclusion criteria (body weight ≥5 kg; BCS 3-8/9; ocular procedures lasting over 60 minutes). Neuromuscular function was assessed with acceleromyographic train-of-four ratio (TOFr). Data recorded included body weight, total accumulated atracurium dose normalised to surgery time, time of TOFr between 0.2-0.7, time to recover 90% of baseline TOFr and requirement for neuromuscular blockade reversal. Continuous variables were compared using t-tests and categorical data were analysed using Fisher's exact test (p < 0.05).

A significant difference was found in the total accumulated normalised dose of atracurium between the VRI (mean  $4.22 \pm 1.23 \,\mu\text{g/kg/min}$ ) and ITB (mean  $5.5 \pm 2.13 \,\mu\text{g/kg/min}$ ) groups (p = 0.011). The median (IQR) time with a TOFr 0.2-0.7 was 20 (43) min in VRI versus 5 (5) min in ITB. Notably, the VRI group exhibited a significantly shorter 90% TOFr recovery time (mean  $13 \pm 6 \,\text{min}$ ) than the ITB group (mean  $42 \pm 14 \,\text{min}$ ; p < 0.0001). Although fewer dogs in the VRI group required reversal of neuromuscular blockade (only 2 versus 7 in ITB), this difference did not reach statistical significance (p = 0.14).

The infusion regimen of atracurium is associated with a lower total required dosage, less deep neuromuscular blockade and faster neuromuscular recovery compared with intermittent boluses. These findings suggest that a VRI approach offers a clinical advantage by avoiding deep levels of neuromuscular block and enhancing speed of neuromuscular recovery.

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## Comparison of pain in ovariectomy: laparoscopy vs midline celiotomy under an opioid-free protocol (OFA) in dogs

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Laparoscopic ovariectomy is associated with faster recovery, Lee et al (2013). However, conflicting data exist regarding intra- and postoperative pain. This study aimed to compare both techniques using an OFA protocol.

A prospective, randomized, blinded trial was conducted with 25 healthy female dogs assigned to ovariectomy via laparoscopy (LAP) or midline celiotomy (CEL). The OFA protocol included dexmedetomidine (5  $\mu$ g kg -1, IM), tramadol (3 mg kg -1, IM), propofol dose effect. Anesthesia was maintained with isoflurane. Intraoperative monitoring included HR, fr, blood pressure, ECG, Fe´CO<sub>2</sub>, SpO2, temperature, and end-tidal isoflurane (Dräger® monitor). Anesthetic depth was assessed clinically. Fentanyl (5  $\mu$ g kg -1 IV) was administered if any parameter increased by>% from baseline at T1 (basal), T2 (trocarization/incision), T3/ T4 (right/ left ovary dissection). Carprofen was administered postoperatively. Glasgow Composite Measure Pain Scale and Mechanical nociceptive testing (MNT, Von Frey, Ugo Basile®) were assessed 2, 4, 8, and 24 hours after extubation for evaluating postoperative pain, and hyperalgesia, respectively. Two-way ANOVA was used for MNT, and Fisher's exact test for intraoperative rescue. Significance was set at P < 0.05.

Intraoperative rescue analgesia was required in 6/12 (50%) dogs 3/13 (23%) in the LAP and in the CEL group, respectively (Figure 1). Although numerically different, this was not statistically significant. MNT decreased slightly at 8 hours in both groups (Figure 2), with no significant difference. All postoperative pain scores remained <6/24.

Laparoscopy and celiotomy resulted in comparable intraoperative and postoperative pain outcome under an OFA protocol. While the protocol provided effective postoperative analgesia, additional intraoperative analgesic support may be necessary, particularly during ovarian manipulation. Neither technique showed a clear advantage in terms of pain severity.

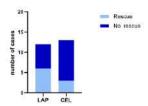


Figure 1: Frequency of intraoperative rescue/no rescue analgesia, 6/12 (LAP) and 3/13

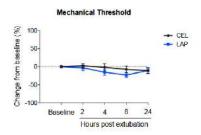


Figure 2: MNT (% change from baseline, mean  $\pm$ SEM)

# Large Animals Tuesday 16th

Prospective monitoring of post-anaesthetic morbidities in horses: Preliminary results from a CEPEF-4 satellite study

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Large-scale prospective studies investigating post-anaesthetic morbidity in horses are scarce. We sought to establish the prevalence and type of complications within 7 days after general anaesthesia. Eight centres prospectively reported morbidity up to one week for each patient undergoing general anaesthesia.

Working definitions were drawn up for 45 individual morbidities within 8 organ system categories. An online form was created, with case ID linking to the corresponding CEPEF4 mortality database entry. Preliminary datasets for 7 centres were reviewed and analyzed using descriptive and chi-square statistics.

Post-anaesthetic complications occurred in 599 of 3,412 cases, giving an overall prevalence of 17.6%. In total, 233 of 688 colic cases incurred morbidity (33.8%), compared to 366 of 2,724 non-colic cases (13.4%; p < 0.0001). A total of 905 complications were reported: 451 in colic cases and 454 in non-colic cases. More colic cases incurred two or more complications compared to non-colic cases (p < 0.0001). In non-colic cases, gastro-intestinal morbidity was most common (26.7% of all complications), followed by pyrexia (20.5%), surgical site (13.7%), cardiovascular (10.4%), and neuromuscular / musculoskeletal complications (9.9%). In colic cases, the top five consisted of gastro-intestinal (40.6%), surgical site (17.7%), pyrexia (16.0%), cardiovascular (10.2%), and respiratory complications (5.8%). Of all reported morbidities, 32.7% occurred in recovery or the first 24 post-anaesthetic hours. Structured interviews with ambassadors revealed challenges with case follow-up and reporting in some centres. Importantly, 5/7 mentioned a positive impact of study participation on hospital patient safety culture and inter-disciplinary collaboration.

Gastro-intestinal morbidities, pyrexia, and surgical site complications were the most frequent post-anaesthetic morbidities. Horses were more likely to develop complications after general anaesthesia for colic surgery. Prospective monitoring of morbidities requires rigorous definitions, and comprehensive detection and reporting is labour intensive. For CEPEF5, integration of morbidity and mortality reporting via the website would be preferable.

#### Acknowledgement

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## Standing sedation in horses and ponies: perioperative fatalities in a worldwide observational, prospective, multicentre cohort study

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Information regarding the mortality associated with standing procedures in horses is sparse. We report preliminary data from > 10,000 standing sedations.

Approved by the Ethical Committee of the Association of Veterinary Anaesthetists (2020-009), this confidential, observational, prospective, multicentre cohort study collected records of horses and ponies undergoing standing sedation (SS) for surgery or advanced imaging using continuous rate infusions (CRIs) or at least one additional "top-up". Procedures were classified as "NON-COLIC" or "COLIC". Outcome at seven days was recorded as i) "ALIVE", ii) "EUTHANASIA" or iii) "DEAD" (Johnston et al. 2002; Gozalo-Marcilla et al. 2025). Data were collected with a PDF questionnaire, which evolved into a webpage, (Domenech et al. 2024) and processed with the statistical software R.

Data were collected from 12,307 SS in 61 centres within 23 countries. Death rates were 0.2% overall (19/12,307), 0.1% for cases classified as NON-COLIC (16/12,237) and 4.3% for COLIC (3/70). For the NON-COLICs (16 deaths from 12,237 NON-COLICs), the causes of death were abdominal in nine (56.25%), (re-)fractures in four (25.0%), two were "found dead" (12.5%) and one (6.25%) for "other reasons". Premedication was usually based on combinations of alpha-2-agonists/opioids ± acepromazine (83.3%). Sedation was maintained using "top-ups" (78.6%), CRI (30.8%) or CRI + top-ups (9.4%). For "top-ups", detomidine was the most common alpha-2-agonist (77.8%) and butorphanol the most common opioid (88.4%). For CRI, detomidine was the most common alpha-2-agonist (88.3%), and butorphanol (53.8%) or morphine (45.1%) the most common opioids. Loco-regional anaesthesia was performed in 37.6% of the cases. Monitoring was minimal, with temperature, ECG and pulse-oximetry used in 5.8%, 3.8% and 0.9% of the patients, respectively.

Standing sedation in horses is not risk free. Even without the complications associated with GA which generally occur during recovery, horses still die unexpectedly within seven days of sedation alone.

## Dexmedetomidine post-conditioning improves cardiovascular function and maintains normal renal parameters in anesthetized, experimentally endotoxemic horses

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Dexmedetomidine infusions have shown benefits in anesthetized endotoxemic horses when administered concurrent to endotoxin but post-conditioning effects are unknown.

Ten systemically healthy horses donated for euthanasia for reasons other than acute gastrointestinal disease (e.g. advanced osteoarthritis) were instrumented for acquisition of cardiac index (CI) using saline thermodilution. All horses received IV Escherichia coli O55:B5 lipopolysaccharides (LPS) ( $0.1~\mu g~kg^{-1}$ ) while awake immediately prior to anesthesia. Horses randomly assigned to the control group (LPS; n = 5) received IV xylazine ( $1~mg~kg^{-1}$ ) and those assigned to treatment group (LPS-Dex; n = 5) received IV dexmedetomidine ( $0.005~mg~kg^{-1}$ ) prior to induction with IV ketamine ( $2.2~mg~kg^{-1}$ ) and midazolam ( $0.05~mg~kg^{-1}$ ) and maintenance with sevoflurane in oxygen and dexmedetomidine  $1.75~\mu g~kg^{-1}$  hr $^{-1}$  only in LPS-Dex (target FE'Sevo 3%~LPS, 1.8%~LPS-Dex). Cardiopulmonary, acid-base, and creatinine values were obtained every 30 minutes until euthanasia at 180 minutes. Data were compared between groups using mixed model analysis (p < 0.05).

Overall FE'Sevo was 36% lower in group LPS-Dex. Acid-base values were similar between groups. Mean  $\pm$  standard deviation mean arterial pressure was significantly higher in LPS-Dex at 30 minutes (84  $\pm$  18 mmHg LPS-Dex versus 52  $\pm$  7 LPS) and CI significantly higher in LPS-Dex at 30 and 60 minutes post-induction (57.9  $\pm$  15.6 mL minute<sup>-1</sup> kg<sup>-1</sup> LPS-Dex versus 43.1  $\pm$  9.4 LPS 30 minutes; 60.2  $\pm$  11.8 mL minute<sup>-1</sup> kg<sup>-1</sup> LPS-Dex versus 38.9  $\pm$  11.2 LPS 60 minutes). Creatinine was elevated and significantly higher in LPS from 60 minutes onward but remained normal in LPS-Dex throughout (201  $\pm$  38  $\mu$ mol L<sup>-1</sup> LPS versus 124  $\pm$  26 LPS-Dex 180 minutes).

Dexmedetomidine infusion with equipotent sevoflurane concentration provided early cardiac function benefit and maintains normal creatinine levels in anesthetized horses even when administered after the onset of endotoxemia.

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### Clinical predictors of recovery quality in equine anesthesia: A retrospective review of 240 cases

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Recovery from general anesthesia in equine patients carries a high risk of morbidity and mortality. Adverse recovery outcomes, including fractures, myopathies, and neuropathies, can compromise otherwise successful surgical procedures. The objective of this retrospective study was to identify peri-anesthetic factors associated with recovery quality in horses undergoing general anesthesia.

Medical records of 240 equine patients anesthetized at the University of Tennessee Equine Hospital were analyzed. Variables including age, weight, ASA physical status, pre-anesthetic behavior scores, anesthesia duration, opioid administration, and infusion of anesthetic/analgesics were evaluated. Recovery outcomes were assessed using a set of perianesthetic composite scores. Mixed model analysis was used, with individual animals as the random effect (p < 0.05). Data are presented as mean  $\pm$  SD.

The mean age and weight were  $9.0 \pm 7.0$  years and  $428 \pm 159$  kg, respectively, with a mean anesthesia duration of  $100 \pm 61$  minutes. The majority of cases were ASA I or II (39.4% and 36.4%), and 14% were classified as emergencies. Partial intravenous anesthesia (PIVA), incorporating continuous rate infusions (CRIs), was implemented in 49.4% of cases. Increased age, longer anesthesia time, higher ASA status, and elevated pre-anesthetic behavior scores were significantly associated with poorer recovery outcomes. Use of CRIs of ketamine combined with xylazine or lidocaine decreased recovery scores compared to inhalant-only protocols. Statistical linear models were developed to predict recovery quality based on individual patient characteristics.

Recovery quality is influenced by both patient- and protocol-specific factors. While PIVA combinations offer many benefits, use of ketamine with xylazine or lidocaine infusion in this study, was associated with a negative impact on the quality of recovery. These findings provide some key information to predict anesthetic risk factors for each individual animal and therefore the opportunity for developing individualized anesthetic protocols to enhance anesthetic safety in equine patients.

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#### Comparison of the prevalence and location of trigger points in dressage and show-jumping horses

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Myofascial trigger points (MTrPs) are localized, hypersensitive areas in muscles that can cause pain and reduced performance. Despite their clinical significance in humans, limited data are available in equine athletes. This study aimed to compare the prevalence and location of MTrPs in show jumping and dressage horses. A secondary objective was to evaluate the potential of thermography, pressure algometry, and facial expression scoring in characterizing MTrPs.

Fourteen horses (7 dressage, 7 show jumping) were examined. Muscle manual palpation was used to identify MTrPs, and involved the palpation of hypercontractile nodules, with a typical "twitch" response, defined as a transient visible or palpable contraction of the muscle fibers in response to pressure. Pressure algometry (Instrutherm® Dd-500) was applied perpendicularly to the skin at 1 kg cm<sup>-2</sup> s<sup>-1</sup> until the horse showed signs of discomfort. Thermography was used to compare the skin surface temperature of MTrPs with adjacent control areas (located at less than 10 cm from the MTrP). Additionally, facial expressions were recorded during palpation using the Horse Grimace Scale (HGS).

MTrPs were found in all horses. Both groups showed a high prevalence (> 60%) of MTrPs in the back. Dressage horses had a higher prevalence of MTrPs in the neck (17%) and a lower prevalence in the rump (17%) than show-jumping horses (3% and 30% respectively). Temperatures at MTrPs were significantly higher than at control points (p < 0.01). Median minimum, mean, and maximum temperatures at MTrPs were 34.2°C (29.5–37.6), 35.0°C (30.4–38.2), and 35.6°C (31.0–38.8), respectively, compared to 33.0°C (31.8–36.0), 33.8°C (32.6–36.3), and 34.8°C (33.6–36.6) at control sites. Facial expression scores were also higher during MTrPs palpation compared to control (16 [0–24] vs 6 [0–19], p = 0.004).

These findings open a perspective for better recognition of myofascial pain in horses.

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## Reliability of myotonometry in equine myofascial pain syndrome and effects of ischemic compression therapies

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This study aimed to evaluate the reliability of muscle stiffness measurements using the MyotonPro® device at myofascial trigger points (MTrPs) in horses, and to assess the effectiveness of two ischemic compression techniques—continuous and discontinuous—on these points.

A randomised, blinded, cross-sectional study was conducted on twelve horses aged 11.9 [6–19] years showing no signs of apparent pain. MTrPs were identified by manual palpation. Muscle stiffness was measured at control points and MTrPs using the MyotonPro® (Roch et al., 2020). Each horse received both continuous (90 seconds) and discontinuous (three times 30 seconds) ischemic compression, randomly assigned to two different MTrPs. Measurements were taken before and after each treatment to evaluate the effects on muscle mechanical properties. Linear mixed-effects models were used to analyse the variation in muscle stiffness, with horses and trigger point positions treated as random effects.

The methodology allowed for precise differentiation between treatment effects at different muscle sites. Muscle stiffness at MTrPs  $(489 \pm 30 \text{ N m}^{-1})$  was significantly higher than at control points  $(360 \pm 18 \text{ N m}^{-1})$ , with a mean difference of approximately  $128 \pm 23 \text{ N m}^{-1}$ . The caudal MTrPs showed greater stiffness compared to cranial ones  $(155 \pm 24 \text{ N m}^{-1} \text{ vs } 101 \pm 24 \text{ N m}^{-1})$ . Continuous compression did not significantly change stiffness. However, discontinuous compression unexpectedly increased muscle stiffness by approximately  $28 \pm 6 \text{ N m}^{-1}$ .

These findings support the MyotonPro® as a reliable tool for measuring muscle mechanical properties in horses. The differential response to ischemic compression techniques highlights the complexity of treating myofascial trigger points. Further studies combining myotonometry with imaging or oximetry are needed to understand the functional impact of these changes and to improve treatment approaches.

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### Endoscopic evaluation of tracheal mucosal cuff site trauma following intubation with a 26.0 mm ID silicone endotracheal tube in adult horses – preliminary results

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Previous studies have correlated endotracheal tube (ETT) diameter and intracuff pressure (Ferreira et al. 2021) and intubation duration with tracheal injury in horses (Parente et al. 2025). This study aims to further explore influences on tracheal injury in horses.

Thirteen horses were intubated using minimum occlusive volume (MOV) technique with silicone 26.0 mm ETTs and positioned in dorsal or lateral recumbency. Video endoscopy was performed before intubation and after extubation and tracheal mucosal injury was later visually scored using an ordinal scoring system adapted from Parente et al. (2025). Intracuff pressure was recorded every 20 minutes from cuff inflation until extubation. Recorded variables included bodyweight (kg), intracuff pressure (mmHg), intubation time (minutes) and tracheal injury scores. Shapiro – Wilk analysis was performed for data normality and Pearson's correlation was used between mucosal injury score and intubation time, intracuff pressure and bodyweight.

Intracuff pressures were  $160 \pm 22$  mmHg (range 136 - 210). Median change in tracheal injury score (post – pre) was 7 (IQR 2) and pre-intubation and post-extubation were 0 (IQR 0) and 7 (IQR 2) respectively. All horses (n = 13) demonstrated tracheal injury post extubation. Pearson's correlations between change in tracheal injury score and intubation time, intracuff pressure and bodyweight were (R = 0.563, p = 0.045), (R = - 0.097 p = 0.752) and (R = - 0.246 p = 0.417), respectively.

	n	Minimum	Maximum	Mean	Std. Deviation
Intracuff pressure (mmHg)	13	136	210	160	22
Intubation time (mins)	13	50	152	117	32
Bodyweight (kg)	13	440	669	561	62

Table 1: preliminary analysis results for the thirteen horses

Preliminary results indicate that intubation time may be positively associated with greater tracheal damage in horses intubated with high pressure low volume 26.0 mm ETTs. There was no correlation between tracheal injury score and bodyweight or intracuff pressure.

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### Evaluation of acepromazine's impact on tissue oxygen saturation in horses sedated with detomidine using near-infrared spectroscopy

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Near-infrared spectroscopy (NIRS) measures tissue oxygenation saturation (StO2). This study compared the effects of IV detomidine (D) and detomidine-acepromazine (DA) on StO2 in horses.

A group of eight healthy adult horses received IV detomidine ( $10 \mu g kg-1$ ) alone or combined with acepromazine ( $20 \mu g kg-1$ ) in a randomized crossover design with a one-week washout. The NIRS probe was placed on the sartorius muscle to measure StO2 before (0), and 5, 15, 30, 60, and 120 minutes after drugs administration. At the same time, sedation was scored using FaceSed. Mixed-effects linear models were used to evaluate treatment effects over time, with horse as random effect, time, treatment and their interaction as fixed effects.

Sedation scores were overall significantly higher in the DA group (Table 1). In both treatments, StO₂ significantly decreased over time with no differences between groups (Figure 1).

Acepromazine enhanced sedation but did not appear to improve StO<sub>2</sub> in horses.

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#### Total intravenous anaesthesia with remimazolam-ketamine-medetomidine in Thoroughbred horses

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Remimazolam is a new ultra-short-acting benzodiazepine that may replace midazolam in humans because of rapid recovery and safety. We compared total intravenous anaesthesia (TIVA) using remimazolam or midazolam in Thoroughbred horses.

Seven Thoroughbreds (4-6 years, 444-538 kg of body weight) were anesthetized with remimazolam–ketamine–medetomidine (RKM) or midazolam–ketamine–medetomidine (MKM) (blinded randomized cross-over design). Five minutes after premedication with IV medetomidine (5.0  $\mu$ g kg<sup>-1</sup>), anaesthesia was induced with IV remimazolam (0.05 mg kg<sup>-1</sup>) or IV midazolam (0.05 mg kg<sup>-1</sup>) followed by IV ketamine (2.0 mg kg<sup>-1</sup>). Anaesthesia was maintained for 60 minutes with constant-rate remimazolam (0.5 mg kg<sup>-1</sup> hour<sup>-1</sup>) or midazolam (0.1 mg kg<sup>-1</sup> hour<sup>-1</sup>) plus ketamine (3.0 mg kg<sup>-1</sup> hour<sup>-1</sup>) and medetomidine (5.0  $\mu$ g kg<sup>-1</sup> hour<sup>-1</sup>). HR, fr, arterial blood pressure and arterial blood gases were recorded every 5 minutes. Induction and recovery time were recorded. Induction and recovery qualities were scored on a scale of 1 (poor) to 5 (excellent). Statistical methods were the paired t-test for time and Wilcoxon signed-rank sum test for score.

There were no significant differences in induction time and score between RKM and MKM. No apnea was observed, and there were no significant differences in cardiopulmonary values between the two methods. Three horses showed awakening signs (nystagmus, slight limb movements, temporary increase in blood pressure) with both methods, but these signs disappeared soon and no additional anesthetics were required for maintenance. Recovery time (mean  $\pm$  SD) with RKM (20  $\pm$  10 minutes) was significantly shorter than with MKM (33  $\pm$  11 minutes), and recovery score (median, range) with RKM (4, 3–5) was significantly higher than with MKM (2, 2–4).

TIVA with RKM produced faster and better-quality recovery than MKM in Thoroughbreds.

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## Large Animals Wednesday 17<sup>th</sup>

### Cardiorespiratory and anesthetic effects of morphine or dexmedetomidine in sheep undergoing videolaparoscopic ovariectomy

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This study compared cardiorespiratory and anesthetic effects of dexmedetomidine and morphine in sheep anesthetized with propofol for videolaparoscopic ovariectomy.

Eleven adult Santa Inês ewes  $(53.3 \pm 7.9 \text{ kg})$  were randomly assigned to two groups: DEX group (n = 5) received  $5 \mu g kg^{-1}$  of dexmedetomidine IM, and MOR group (n = 6) received  $0.2 \text{ mg kg}^{-1}$  of morphine IM, ten minutes before surgical incision. Animals were premedicated with diazepam  $(0.25 \text{ mg kg}^{-1} \text{ IV})$ , followed by induction with propofol (IV to effect), and maintenance with propofol constant rate infusion, adjusted according to anesthetic depth. Sheep were ventilated with positive pressure  $(FiO_2 = 1)$ , VT set at  $8 - 10 \text{ mL kg}^{-1}$ , peak inspiratory pressure limited to  $20 \text{ cmH}_2O$ , and fr adjusted to maintain normocapnia. Recordings of HR, fr, SpO<sub>2</sub>, invasive MAP, SAP and DAP, arterial blood gases, and pH were carried out at baseline and predetermined time points. Sheep were positioned in  $45^{\circ}$  Trendelenburg with pneumoperitoneum. Data were analyzed using descriptive statistics, Shapiro-Wilk normality test, unpaired t-test, two-way mixed ANOVA, and Sidak's test  $(p \le 0.05)$ .

In DEX, HR was significantly lower at 60 (67  $\pm$  16 beats minute<sup>-1</sup>) and 75 minutes (52  $\pm$  2 beats minute<sup>-1</sup>) of anesthesia, compared to baseline and to MOR. There was a significant increase over time in PaO<sub>2</sub> within both groups, without differences between them. No significant differences were found between groups regarding SAP, MAP, DAP, fr, ETCO<sub>2</sub>, SpO<sub>2</sub>, and blood gas parameters. Propofol requirement (0.5  $\pm$  0.1 mg kg min<sup>-1</sup>) and standing times (49.9  $\pm$  16.6 minutes) were similar between groups. However, extubation time was significantly longer in DEX (14.2  $\pm$  2.8 minutes) than MOR (9.2  $\pm$  1.9 minutes). No adverse effects were registered.

Dexmedetomidine and morphine induced minimal cardiorespiratory changes in sheep. Morphine resulted in shorter extubation times.

#### Efficiency of isoflurane capture from anaesthetised experimental sheep

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The exact number of general anaesthetics performed on research animals in the United Kingdom is unknown but likely exceeds a million per annum (Home Office, 2014). Isoflurane is the most used volatile agent (Cicero et al. 2018) and a greenhouse gas contributing to climate change (Tennison et al. 2021). We evaluated the efficiency of a volatile agent capture device (VET-dock and VET-can, SageTech Veterinary, UK) in anaesthetised experimental sheep.

Sixteen sheep were recruited to fill a single VET-can to capacity. The filled device was returned to the manufacturer and contents extracted from the absorbent. Capture efficiency was determined by comparing the mass of isoflurane delivered with that desorbed. In vivo mass transfer (MT %) was calculated by weighing the VET-can and vaporiser before and after each anaesthetic. Spearman's correlation interrogated associations between MT and patient and anaesthetic variables.

In total, 537 g of liquid was extracted from the VET-can. This represented a 107% fill rate. The overall water captured was 45 g (8%). The weight of isoflurane extracted was 492 g. The weight of change due to isoflurane use from all vaporisers totalled 672.1 g. This resulted in an isoflurane capture efficiency of 56%. Univariate exploratory analysis was performed for 16 anaesthetics. The mean MT was  $67\% \pm 0.15$  (n = 16), increasing to  $75\% \pm 0.09$  (n = 10) when isoflurane was captured in the prep-room and theatre compared with  $46\% \pm 0.04$  (n = 4) where only theatre capture took place. There was a positive correlation between MT capture time as a percentage of total anaesthesia time (rs = 0.71, p = 0.003). Rapid recovery and extubation precluded continued capture of isoflurane at the end of the procedure.

Carbon savings of 3.08 kgCO2e 20 minutes<sup>-1</sup> of anaesthetic time were achieved. Future studies evaluating wash out kinetics and capture during recovery are indicated.

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### Ultrasound-guided transversus abdominis plane block in pigs undergoing laparoscopic ovariectomy: a preliminary clinical study

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The transversus abdominis plane (TAP) block desensitises abdominal wall and peritoneum. Porcine cadaver studies have described the technique, however clinical trials in pigs are lacking.

This study evaluated the isoflurane-sparing effect and the intra- and postoperative analgesic efficacy of an ultrasound-guided TAP block in pigs undergoing elective laparoscopic ovariectomy. Pigs were randomly allocated to TAP or control groups. Premedication consisted of azaperone, xylazine, butorphanol and ketamine administered IM. Anaesthesia was induced with ketamine ± thiopental IV. The block consisted of a three point per hemiabdomen technique, using lidocaine 1%, 0.1 mL kg-1 point (Michielsen et al. 2021). No sham injection was performed in the control group. Baseline HR and MAP were recorded prior to surgery at 1.0% end-tidal isoflurane (FE\_Iso) and at specified time points. A blinded investigator modified the anaesthetic requirements if HR and MAP exceeded 20% from baseline. At the end of anaesthesia, meloxicam was administered IV. Postoperative pain was assessed using the UNESP-Botucatu pig composite acute pain scale. Pigs scoring ≥ 6 received oral paracetamol as rescue analgesia. Data were analysed for differences between and within groups using a linear mixed model, p < 0.05.

A total of 29 pigs were recruited, 12 pigs in the TAP group and 14 in the control group; three pigs were excluded. Mean  $\pm$  standard deviation FE\_Iso area-under-the-curve for the duration of anaesthesia were  $7.12 \pm 0.89$  and  $7.19 \pm 1.04\%$  in the TAP and control groups respectively. There were no differences in HR and MAP between groups. Median pain scores (interquartile range) were 1 (1–4) in the TAP group and 1 (0–2) in controls. There were no significant differences in intraoperative or postoperative rescue analgesia requirements between groups.

Ultrasound-guided TAP block is a feasible technique in pigs. Pigs appeared comfortable throughout the perioperative period, regardless of group allocation.

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#### Five-minute exposure to EMLA cream reduces pain response to intravenous catheterisation in calves

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The Eutectic Mixture of Local Anaesthetics (EMLA) cream is a topical anaesthetic containing 2.5% lidocaine and 2.5% prilocaine. In humans, this eutectic formulation enhances the local absorption of active ingredients, thereby increasing its analgesic efficacy (Kopecky et al., 2001). EMLA cream is widely used in human medicine to desensitize the skin prior to venipuncture, reducing procedural discomfort (Rogers & Ostrow, 2004). The objective was to assess whether 2- and 5-minute exposure periods to EMLA cream could reduce pain-related behavioural responses during IV catheter placement in calves.

A total of 60 Holstein calves were enrolled in the study as part of a planned disbudding procedure. Calves were randomly assigned to four groups: EMLA or placebo cream with an exposure period of either 2 or 5 minutes (n = 15 per group). Following the allocated exposure time, an intravenous catheter was placed in the jugular vein, and behavioural responses were scored using a 0–3 scale. Data were analysed using Mann–Whitney U tests.

All calves completed the study without adverse effects, and no signs of secondary dermal toxicity were observed in any group. The reaction scores did not differ significantly between the EMLA 2 group and the Placebo 2 group (median [range]: 1 [0–3]; p = 0.57). However, a significant difference was observed between the EMLA 5 group (0 [0–2]) and the Placebo 5 group (1 [0–3]; p = 0.01).

This study demonstrates that a 5-minute exposure to EMLA cream effectively reduces behavioural reactions in calves during IV catheterisation. Based on these findings, a 5-minute exposure period may be recommended for use in veterinary practice to improve the welfare of calves undergoing intravenous procedures.

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Rogers TL, Ostrow CL (2004) The use of EMLA cream to decrease venipuncture pain in children. J Pediatr Nurs 19, 33-39.

#### Single-site ventral distal paravertebral block results in successful paralumbar fossa anesthesia in steers

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Traditional approaches to paravertebral anesthesia in cattle require multiple injections. We hypothesized that a single-injection ventral distal paravertebral block (VDPB) to the L1 transverse process would create paralumbar fossa anesthesia and complete staining of the targeted nerves versus injection at L2.

Seven healthy Holstein steers were used in this randomized, blinded, crossover study design. Each steer received a VDPB using 6 mg/kg of 2% lidocaine with methylene blue injected at L1 or L2 on either side. Onset and extent of anesthesia were assessed by response to 1 cm deep needle pricks along a typical paralumbar fossa incision site. Steers were euthanized as part of an unrelated study and dissected to characterize stain deposits of the T13, L1, and L2 spinal nerves. Fisher's exact test assessed the success of paralumbar fossa anesthesia and the total number of spinal nerves successfully stained using the two approaches.

For L1 injections, 6/7 (85%) were successfully anesthetized, and spinal nerves T13, L1, and L2 were successfully stained in 6/7 (85%), 7/7 (100%), and 7/7 (100%) of steers. For L2 injections, 6/7 (85%) were successfully anesthetized, and spinal nerves T13, L1, and L2 were successfully stained in 1/7 (14%), 6/7 (85%), and 6/7 (85%) of steers. Total block success was 78%. There was no significant difference in successful blockade between groups. T13 was significantly more likely to be stained with an L1 approach (p = 0.01).

Single-site VDPB injection at either location resulted in anesthesia of the paralumbar fossa.

### Effect on mechanical nociceptive threshold of intravenous or intramuscular morphine in healthy donkeys

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Intravenous morphine (0.5 mg kg $^{-1}$ ) increased the mechanical nociceptive threshold (MNT) in donkeys (Maney et al. 2023). The effects after administration by the IM route has not been investigated.

Six adult female donkeys were enrolled in a randomized, blinded, crossover, experimental study. Three separate treatments [IM and IV saline, IM saline and IV morphine (0.5 mg kg<sup>-1</sup>), IV saline and IM morphine (0.5 mg kg<sup>-1</sup>)] were administered. An algometer applied an increasing force (2 N/sec) on the dorsal metacarpus. The force was discontinued and recorded at the time of positive response (leg lift) or when 25.0 N was reached. An average baseline MNT was determined in triplicate before injections and at 15, 30, 45, 60, 90, 120, 150, 180, 210, 240, 300, 420, and 480 minutes post-injections. Gut sounds, HR, and fr were recorded. A mixed-effects model for repeated measures, followed by Tukey's test, were used to compare values within groups and among time points in each group. Significance level was set to 5% (Figure 1).

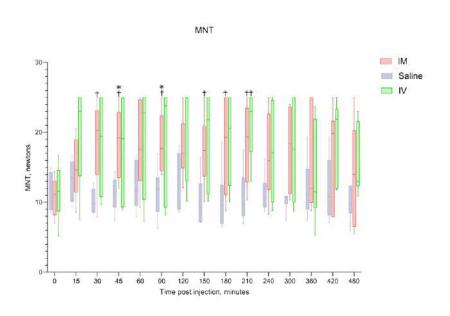
The median MNTs increased above baseline after administration of morphine and were statistically different at 45 and 90 minutes after IM administration. Compared to saline, statistical differences in MNTs occurred at 210 minutes after IV administration and at 30, 45, 90, 150, 180, and 210 minutes after IM administration. The threshold of 25.0 N was reached for 28/90 and 13/90 measurements after IV and IM administration respectively. After morphine administration, borborygmi temporarily ceased in all animals and returned in 5/6 animals by 480 minutes. No adverse events were noted.

Morphine administered IM provided antinociception for a longer period than administered IV. Higher MNTs were reached with IV administration.

Figure 1: Median (min and max) MNT difference in 6 jennies administered saline, morphine IM, or morphine IV. \*Different from treatment baseline. †Different from saline treatment.

#### Reference

Maney JK., Dzikiti BT, Escobar A et al. (2023) Morphine in donkeys: Antinociceptive effect and preliminary pharmacokinetics. Equine Vet J 55, 1086-1093.



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### Effect of the rectus abdominal sheath block with 0.2% bupivacaine in anesthetized horses on anesthesia recovery

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Following rectus abdominal sheath (RAS) block in dorsally recumbent anesthetized horses, dorsal spread of local anesthetic toward the femoral nerve is a concern for complications during recovery.

Six healthy horses were anesthetized twice using a standardized protocol. In a crossover design, 1 mL kg-1 of either 0.9% NaCl (ST) or 0.2% bupivacaine (BT) was injected bilaterally into the RAS using a 2-point ultrasound-guided technique. Horses remained anesthetized for one hour post-block before recovery. Duration of anesthesia and fraction of expired isoflurane (Fe'isoflurane) were recorded. Recovery variables included times for first movement, sternal recumbency, and standing, accelerometry-derived recovery score (RS), and number of standing attempts. Paired t-tests were used for parametric data (mean ± standard deviation), and Wilcoxon signed rank tests for non-parametric data (median [range]). Alpha was set at 5%.

Anesthesia conditions were similar between ST and BT with durations of  $98 \pm 5$  and  $93 \pm 5$  minutes and Fe'isoflurane of  $1.18 \pm 0.15$  and  $1.23 \pm 0.18\%$  (p > 0.181). Times to first movement, sternal recumbency, and standing were  $25 \pm 11$  and  $35 \pm 19$ ,  $51 \pm 21$  and  $57 \pm 25$ , and  $52 \pm 21$  and  $60 \pm 29$  minutes, for ST and BT respectively. RS and standing attempts were  $25.6 \pm 9.2$  and  $24.2 \pm 9.1$ , and 1 [1, 2] and 1 [1, 3], for ST and BT respectively. Recovery parameters were not significantly different (p>.366) between treatments.

The RAS block with bupivacaine did not affect recovery quality under the conditions studied.

### Assessment of the pharmacokinetics and selected physiological and behavioral effects of three doses of orally administered tapentadol in horses

Khursheed Mama<sup>1</sup>, Heather Knych<sup>2</sup>, Anabella Lynch<sup>2</sup> Daniel Mckemie<sup>2</sup>

<sup>1</sup>Colorado State University, <sup>2</sup>University of California Davis, Tapentadol is a chemically synthesized compound with a dual mechanism of action as a Mu receptor agonist and norepinephrine reuptake inhibitor. This dual action offers a potential advantage of efficacy with reduced side effects in horses where opioid dose and duration related gastrointestinal stasis and excitement may be observed.

Six adult, healthy, unfasted, thoroughbred horses received an escalating dose of tapentadol 1, 3, 5 mg kg<sup>-1</sup> orally in sweet feed with a 2-week washout period between doses. Blood was sampled from the jugular vein at fixed time points for 72 hours post administration (19 samples) for determination of tapentadol concentrations using liquid chromatography tandem mass spectrometry. Non-compartmental pharmacokinetic analysis was performed. Pre- and post-drug related behavior, locomotor activity, heart rate and gastrointestinal sounds were recorded. Nonparametric tests (Friedman and Wilcoxon signed rank) were used to assess pharmacokinetic data reported as median (range). Significance at P < 0.05. As shown in people, tapentadol was rapidly absorbed reaching maximum and dose dependent concentrations in less than one hour (Table 1).

At the highest dose, drug concentrations remained in the therapeutic range described for people for approximately 4 hours. There was some early variation in HR (to a peak of 60 bpm) with higher doses, and dose dependent changes in borborygmi during the first 6 hours post administration; no overt signs of colic were observed. Preliminary review of step counts did not reflect clinically relevant changes over the measurement period.

The ability to reach potentially effective plasma concentrations with oral administration and observation of limited side effects is encouraging for further study of tapentadol as an analgesic for horses.

Dose mg/kg	Cmax (ng mL <sup>-1</sup> )	Tmax (h)		
1	5.6 (3.3 - 21.7)	0.75 (0.5 - 1)		
3	17.8 (5.4 - 145)	0.625 (0.16-1)		
5	158 (20.5 - 626.2)	0.375 (0.25-0.75)		

### To determine the effect of the application of ice to the skin overlying the infraorbital canal on conscious equine patient compliance to infraorbital nerve block placement under standing sedation

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<sup>1</sup>University of California - Davis

Infraorbital nerve block placement in awake horses is difficult due to the noxious nature of this stimulus resulting in pronounced head movements. The authors hypothesize that patient compliance will improve by icing the area overlying the infraorbital canal prior to block placement.

Ten healthy adult horses weighing  $532 \pm 41$  kg were studied in a blinded, randomized, crossover trial. Each horse acted as its own control, receiving two treatments three weeks apart. For each treatment horses were sedated using detomidine. Sedation level was evaluated using a published simple descriptive scale1 to ensure clinically similar sedation between horses. Horses were assigned to receive five minutes of "ICE" (icing skin overlying the infraorbital canal) or five minutes of "NO ICE" (room temperature material placed on skin overlying the infraorbital canal) prior to block placement. A retrograde infraorbital nerve block was performed using 5 ml of mepivacaine. Block efficacy was tested using a muzzle needle prick. Each horse received the opposite treatment three weeks later. Nerve blocks were filmed and reviewed by two blinded investigators who scored patient compliance using a visual analogue scale, with 0 = Non-compliance and 10 = Total compliance. Reviewer scores were added for a total score out of 20 for each treatment. A paired t-test was performed to compare groups.

Mean  $\pm$  SD of "ICE" and "NO ICE" were 15.2  $\pm$  3.9 and 12.67  $\pm$  6.4 respectively. There was no statistically significant difference between groups. The block was unable to be performed in two horses with "NO ICE". Ten successful blocks were performed with "ICE".

Icing did not significantly improve patient compliance when performing an infraorbital block. The small number of horses included in this study, along with the fact that two horses did not tolerate the block at all without icing, potentially warrants conducting a larger study.

#### References

Taylor, P., Coumbe, K., Henson, F., Scott, D., Taylor, A., 2014. Evaluation of sedation for standing clinical procedures in horses using detomidine combined with buprenorphine. Vet. Anaesth. Analg. 41, 14–24. https://doi.org/10.1111/vaa.12055

### Antinociceptive effects of the abdominis rectus sheath block with 0.2% bupivacaine in anesthetized horses

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The rectus abdominis sheath (RAS) block, when performed on standing horses, provides antinociception (Ishikawa et al., 2023); however, its efficacy when performed in recumbent horses remains unclear.

Six adult horses were anesthetized twice using a standardized isoflurane-based protocol, receiving bilateral 2-point RAS injections (1 mL kg-1) of either 0.2% bupivacaine (BT) or 0.9% NaCl (ST) under ultrasound guidance in a randomized crossover design. Thereafter, the horses remained anesthetized for one hour. The HR, fr, ataxia score (AS, 0 to 4 scale), and mechanical nociceptive threshold (MNT) using a 1 mm diameter tip that protruded remotely (triplicate measurement midway the xyphoid and umbilicus were recorded at baseline and from 2 to 10 hours post-Baseline values were compared using paired t-tests and Wilcoxon tests. The post-block effects of treatment, time, and their interaction were analyzed with generalized linear mixed models ( $\alpha$  = 0.05).

Baseline HR, fr, and AS for ST and BT were  $35 \pm 6$  and  $31 \pm 3$  beats minute-1,  $19 \pm 2$  and  $17 \pm 3$  breaths minute-1, and 0 and 0, respectively. Similar HR, fr, and AS were observed during the post-block period. The baseline MNT was similar between ST (13.3  $\pm$  3.4 N) and BT (15.1  $\pm$  1.5 N). Post-block, the estimate MNT (95% confidence interval) was 13.7 (10.0, 18.8) and 22.2 (16.2, 25.0) N for ST and BT, respectively (p < 0.001) without an effect of time or the interaction of time with treatment.

The RAS block provided antinociception without adverse outcomes during the studied period.

#### Reference

Ishikawa Y, Sakai DM, SY Im J et al. (2023) Antinociceptive effects of bupivacaine injected within the internal abdominis rectus sheath in standing healthy horses. Vet Anaesth Analg 50, 294-301.

## Large Animals Thursday 18th

Effect of early discontinuation of lidocaine infusion on accelerometry-based equine recovery from isoflurane general anesthesia: a randomized clinical trial

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The impact of discontinuing lidocaine infusions 30 minutes before the conclusion of inhalant anesthesia on equine recovery has not previously been evaluated.

Forty healthy adult horses anesthetized for MRI received a standard anesthetic protocol. A lidocaine loading dose of 2 mg kg<sup>-1</sup>, followed by a continuous rate infusion of 3 mg kg<sup>-1</sup> hour<sup>-1</sup>, were administered. Horses were randomly assigned to either discontinue the infusions 30 minutes before the end of anesthesia (Group D, n = 20), or continue it until the end (Group C, n = 20). A 3-axis accelerometer was secured around the withers, where the maximum velocity per second (Vmax =  $\sqrt{(x^2+y^2+z^2)}$ ; x, y, and z equal axial accelerations for each axis (m s<sup>-2</sup>)) was associated with each standing attempt and used to calculate an objective recovery score (RS; excellent (11 to 30), good (31 to 50), fair (51 to 70), poor (71 to 90), or unacceptable ( $\ge$  91)).

Time to first movement, time to sternal recumbency, time to standing, and number of standing attempts were recorded. Data were analyzed using a student's t-test and a Wilcoxon test for parametric (mean  $\pm$  standard deviation) and non-parametric data (median (range)), respectively, with the significance set at 0.05.Times to first movement, sternal recumbency, and standing were 43 (21 - 69) minutes, 56 (29 - 90), 61 (29 - 111); and 33 (21 - 69), 45 (26 - 97), 50 (36 - 97), for groups C and D, respectively (p > 0.200). The number of stand attempts were 1 (1 - 5) for both groups (p = 0.823). RS were 22  $\pm$  7 and 25  $\pm$  8 for Groups C and D, respectively (p = 0.175).

There was no evidence that discontinuing lidocaine infusions 30 minutes before ending inhalational anesthesia, compared to continuing it until the end, enhanced recovery quality.

#### Flow-control expiration (FLEX) for large animals achieved by a gate valve

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Flow-controlled expiration (FLEX) improves pulmonary function in anesthetized horses, however, is only available in one commercial large animal anesthesia workstation. The aim of this study was to test whether a polyvinylchloride 2-inch gate valve could generate FLEX ventilation (FLEXV).

The valve was placed on the expiratory limb of a large animal breathing circuit. Its aperture was manually adjusted to achieve continuous flow throughout the entirety of the expiratory phase. Two polypropylene barrels simulating horse lungs were ventilated with an ascending-bellow ventilator using FLEXV or conventional ventilation. The barrels were also ventilated with the original FLEX. Respiratory mechanics variables including peak expiratory flow (PEF), mean airway pressure (Pmean), area under the scalar curves of airway pressure (AUCPaw) and volume (AUCVoI), and dissipated energy were recorded and compared between conventional, FLEXV and FLEX ventilation at identical settings of respiratory rate and tidal volume. Respiratory mechanics data were compared among conventional ventilation, FLEXV, and the original FLEX using descriptive statistics.

The manual adjustment of FLEXV could be performed by visual assessment of the ventilator below. Ventilation with FLEXV provided lower PEF and energy dissipated than in conventional ventilation (-1.9 vs -6.1 L second—1; 0.69 vs 1.69 J, respectively), with values similar to the FLEX (-2.3 L second—1 and 0.68 J). Ventilation with FLEXV was associated with AUCPaw, AUCVol and Pmean higher than in conventional ventilation (22258 vs 11656; 5109 vs 1922; and 9.9 vs 6.5 cmH2O, respectively). The AUCPaw of FLEXV was similar to FLEX (28043). The AUCVol of FLEXV was intermediate between conventional and FLEX (9736) and Pmean was lower in FLEX (6.8 cmH2O).

The addition of FLEXV to a large animal ascending below ventilator was able to generate flow and pressure patterns similar to the original FLEX, potentially offering an inexpensive and widely accessible alternative to the computer-controlled version.

#### **Evaluating capture of isoflurane from anaesthetised horses**

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Capturing volatile agents to prevent environmental contamination (and eventual repurposing) is beginning to be adopted in small animal practices in the UK. A single study recently identified an isoflurane capture efficiency of 65% in cats and dogs (White et al. 2025). The full environmental and economic cost of capture is unclear.

We evaluated the efficiency of capture and in vivo mass transfer (MT) in anaesthetised horses using isoflurane (VET-can, SageTech Veterinary, UK). Purposeful sampling at one UK equine hospital was used to recruit enough horses to fill two Vet-cans. The VET-can was positioned downstream of the anaesthetic breathing system (Bird Mark 7, JDMedical) before the active gas scavenging system. The primary outcome was capturing efficiency (isoflurane delivered: desorbed, %). *In vivo* MT was calculated by weighing the VET-can and vaporiser before and after each anaesthetic. The secondary outcomes were correlations between MT and patient characteristics and anaesthesia variables. Anaesthesia was induced with ketamine and midazolam following acepromazine, morphine and romifidine. Horses received isoflurane (ETISO 1.3-1.5%) in 100% oxygen. Horses' lungs were ventilated to normocapnia, and dobutamine infused to maintain MAP> 60mmHg. All horses received intraoperative romifidine (40mcg kg hour<sup>-1</sup>) and intravenous fluid therapy. Volatile hygiene measures were employed (leak checking, cuff inflation), and the breathing system was capped at the end of the procedure. Appropriate parametric or nonparametric statistical analyses were used.

Eighteen horses were recruited to the study, 6 horses filled can 1 (745 minutes: fill rate of 84%), efficiency of capture was 44% volatile and 17% water. Twelve horses filled can 2 (1418 minutes: fill rate of 109%), efficiency of capture was 35% volatile and 8% water. Median *in vivo* MT was 47% (19 - 60). Post disconnection capture from the anaesthestic circuit increased MT by 1.5-3.4%.

Future studies evaluating factors affecting equine capture are indicated.

#### References

White K, West E, Yarnell H, et al (2025). Efficiency of isoflurane capture from anaesthetised veterinary patients: a single-centre study of a volatile capture device. Br J Anaesth. 135, 276-278.

### Association between surgical duration, intraoperative hypothermia, and recovery quality in equine anaesthesia

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Peri-anaesthetic hypothermia is a well-recognised complication in small animal anaesthesia, associated with altered drug metabolism, delayed recovery, and increased morbidity. In equine anaesthesia, hypothermia remains an underreported issue.

This retrospective analysis included 1,020 equine general anaesthesia cases recorded at our teaching hospital. Rectal temperature was measured during the anaesthetic period and recovery. Data, extracted from the anaesthesia records, included patient demographics, clinical parameters, anaesthetic protocols, and intraoperative monitoring values. Hypothermia was defined as rectal temperature of <5°C for 15 minutes. Statistical analyses were performed to identify potential factors associated with the development of hypothermia, using Mann-Whitney U for continuous and Chi-Square tests for categorical data. Logistic regression was used to analyse the interactions.

Out of all cases, 110 horses (10.8%) experienced hypothermia. Cases with hypothermia had significantly longer mean surgery times (109 minutes) compared to non-hypothermia cases (75 minutes, p = 0.000031), worse recovery scores (median 2 vs. 1, p = 0.0012), longer recovery times (mean 61 vs. 46 minutes, p = 0.000064), and higher ASA score (3 vs. 2, p = 0.001). A significantly higher number of horses in the hypothermia group were anaesthetised for colic surgery (44.5% vs. 21.9%, p = 0.00003). Hypothermic horses were also more likely to suffer from hypotension, hypercapnia and hypoxaemia. When accounting for surgery duration, the independent effects of hypoxaemia and premedication with acepromazine on hypothermia were not significant, but hypotension and hypercapnia remained important risk factors. However, the retrospective nature of this study precluded us from determining the independent role of hypothermia on recovery length and quality.

These results show that surgery duration is the strongest continuous predictor of intraoperative hypothermia, and that hypothermia is related to recoveries of longer duration and poorer quality.

#### Can the Nose Outperform the Muscle? Pharmacokinetic Insights into the Use of Ketamine in Pigs

<u>Isabela Peixoto Rabelo</u><sup>1</sup>, Andréa Diniz<sup>2</sup>, Inácio Silva Viana<sup>3</sup>, Cinthya de Andrade Gujanwski<sup>3</sup>, Katielle Vieira Avelino<sup>4</sup>, Flavio Augusto Vicente Seixas<sup>4</sup>, Carlos Augusto Araújo Valadão<sup>3</sup>, Renata Gebara Sampaio Dória<sup>1</sup>

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Previous pharmacodynamic investigations in pigs, using data from the same randomized clinical trial, demonstrated that intranasal (IN) administration of a chemical restraint protocol produced faster onset and shorter duration of action compared to the intramuscular (IM) route, with comparable sedation quality (Rabelo et al., 2024). Building upon these findings, our objective was to evaluate ketamine pharmacokinetics following IN or IM administration of a drug combination for chemical restraint in pigs and assessed whether these parameters aligned with previous pharmacodynamic findings.

Twenty pigs were randomly assigned to receive IM or IN treatment (n = 10 each) with ketamine (7 mg kg $^{-1}$ ), azaperone (3 mg kg $^{-1}$ ), and midazolam (0.3 mg kg $^{-1}$ ). Mean body weight was 98.7  $\pm$  12.5 kg (IM) and 99.6  $\pm$  14.7 kg (IN). Pharmacokinetics were assessed by non-compartmental analysis (NCA) and population pharmacokinetics (PopPK) using PKAnalix $^{\circ}$  and Monolix $^{\circ}$ . Group comparisons used the t-test.

In NCA, the area under the curve from zero to infinity (AUC<sub>0</sub>-inf) and the apparent volume of distribution relative to bioavailability (Vd F<sup>-1</sup>) were lower in the IN group (AUC<sub>0</sub>-inf:  $91.6\pm35.5$  vs.  $121.8\pm23.9$  mg L<sup>-1</sup> h<sup>-1</sup>; Vd F<sup>-1</sup>:  $646.8\pm310.9$  vs.  $1045.4\pm484.3$  L). The relative bioavailability of the IN route was 75 %. PopPK supported a two-compartment model, with absorption constant =  $0.059\pm0.009$  h<sup>-1</sup>, clearance =  $7.7\pm0.75$  L h<sup>-1</sup>, central volume =  $53.5\pm13.7$  L, intercompartmental clearance =  $8.7\pm1.6$  L h<sup>-1</sup>, and peripheral volume =  $662.7\pm175.1$  L.

Despite lower systemic exposure, the IN route demonstrated pharmacokinetic properties compatible with effective drug delivery. When interpreted considering our previous pharmacodynamic findings, these results suggest that IN administration may benefit from alternative absorption pathways, such as nose-to-brain transport, reinforcing its potential as a viable alternative to IM administration in pigs.

#### References

Rabelo IP, Gujanwski CDA, Viana IS et al. (2024) Intranasal vs. Intramuscular administration of azaperone, midazolam and ketamine in pigs. Front Vet Sci 11, 1408103.

### Pulsed radiofrequency treatment for the management of trigeminal-mediated headshaking syndrome in a horse

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Trigeminal-mediated headshaking syndrome (TMHS) is a chronic neuropathic condition in horses, likely involving trigeminal nerve dysfunction (Roberts, 2019). Pulsed radiofrequency (PRF), a minimally invasive neuromodulatory technique, is used to treat human trigeminal neuralgia.

This case report describes the application of PRF to the infraorbital nerves in a 14-year-old Quarter Horse mare diagnosed with severe (grade 3) (Talbot et al., 2013) idiopathic TMHS. The horse achieved a baseline total score of 59% on the History, Rest and Exercise Score (HRE-S) (Kloock et al., 2024), with partial scores of 100% for History (H-S), 30% for Resting (R-S) and 47% for Exercise (E-S). Following owner's written consent, standing sedation (acepromazine 0.03 mg kg<sup>-1</sup>, xylazine 1 mg kg<sup>-1</sup>, butorphanol 0.02 mg kg<sup>-1</sup>) and retrograde maxillary nerve blocks (2.5 ml lidocaine 2% + 2.5 ml ropivacaine 1%) were administered. An 18 SWG, three-tined, 5-mm active tip, 100-mm radiofrequency needle was inserted into the infraorbital foramen under ultrasound guidance and advanced 9 cm into the infraorbital canal. Each infraorbital nerve received PRF at 42 °C and 50 Volt for 15 minutes.

Six weeks post-treatment, clinical signs improved to grade 2, with a 47% reduction in HRE-S (31%; H-S: 75%, R-S: 9%, E-S: 8%) and sustained relief for 12 months. Gradual symptom recurrence began at 13 months, prompting a second PRF at 16 months (grade 3; HRE-S: 58%, H-S: 100%; R-S: 24%; E-S: 50%), which led again to marked improvement to grade 1 at 6 weeks post-second-treatment, with a 59% reduction in HRE-S (24%; H-S: 63%, R-S: 0%, E-S: 10%), sustained until 6 months post-second-treatment. No adverse effects were observed.

Pulsed radiofrequency provided long-term pain relief, though complete symptom remission was not achieved. Further trials are needed; nonetheless, these results suggest PRF may be safe, effective neuromodulatory treatment for temporarily managing equine TMHS and improving quality of life.

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#### Onset and duration of action of escalating doses of rocuronium in anesthetized healthy goats

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Multimodal anesthesia is becoming more common across veterinary species, illustrated with an increased awareness of using neuromuscular blocking agents. Only atracurium dose has been reported in goats. This study aimed to determine the onset and duration of action of three doses of rocuronium in healthy anesthetized goats.

In a triple crossover design, nine female goats aged 21 to 71 months and weighing 36 to 87 kgs were anesthetized with propofol  $(6.00\pm0.52~\text{mg kg}^{-1})$  and isoflurane in 100% oxygen. Three doses of rocuronium 0.05 mg kg<sup>-1</sup> (RC05), 0.1 mg kg<sup>-1</sup> (RC1), and 0.2 mg kg<sup>-1</sup> (RC2) were randomly assigned and administered with a minimum one-week washout. Neuromuscular blockade was monitored using acceleromyographic train-of-four (TOF) every 15 seconds post-administration to determine the onset of paralysis (TOF = 0). Return of first twitch (TOF>) and duration of action (TOF = 100%) were determined by repeat TOF every 5 minutes. Data were analyzed using Wilcoxon tests. A p < 0.05 was used for significance and data are reported as median (range).

Paralysis (TOF = 0) occurred in 11% of RC05, 89% of RC1 and 100% of RC2. Data for RC05 was not further analyzed. Onset was 2 (1-4) minutes for RC1 and 2 (2-6) minutes for RC2 (p = 0.5). Return of first twitch was 35 (10 – 40) minutes for RC1 and 72.5 (50-210) minutes for RC2 (p = 0.0312). Duration of action was 105 (60-125) minutes for RC1 and 162.5 (125-260) minutes for RC2 (p = 0.0078). Variations in heart rate and arterial blood pressure within groups RC1 and RC2 were not observed.

At the doses tested, rocuronium at 0.2 mg kg<sup>-1</sup> resulted in effective neuromuscular blockade in all goats in this study.

#### Reverse Trendelenburg attenuates hemodynamic depression during anesthesia in late-gestation mares

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Pregnancy increases the risk of hemodynamic depression during inhalation anesthesia in mares. This study compared reverse Trendelenburg (RT) with standard dorsal recumbency in late-term pregnant mares (> 300 days) undergoing anesthesia.

Eighteen mares were allocated into three groups (n = 6): non-pregnant (CONTROL), pregnant (D), and pregnant with RT (DRT). They received IV xylazine (1 mg kg<sup>-1</sup>), followed by IV ketamine-midazolam (2.2 mg kg<sup>-1</sup>, 0.1 mg kg<sup>-1</sup>) and isoflurane (1.5 MAC) under controlled mechanical ventilation (PEEP 35–40 cmH20); fr 10 breaths min<sup>-1</sup>; I:E ratio 1:2; VT 10 mL kg<sup>-1</sup> min<sup>-1</sup>). HR (beats min<sup>-1</sup>), SpO<sub>2</sub> (%), MAP (mmHg), cardiac output (CO; L min<sup>-1</sup>), pulmonary artery pressure (PAP; mmHg), and central venous pressure (CVP; mmHg) were recorded. CO was obtained by Swan-Ganz thermodilution (Muir et al., 1976). Stroke volume (SV; mL beat<sup>-1</sup>) and systemic vascular resistance (SVR; dyn s cm<sup>-5</sup>) were calculated. Data were analyzed using ANOVA with Tukey's post hoc test for intergroup and Dunnett's test for baseline comparisons (p < 0.05).

From 30 minutes, HR increased in DRT (76  $\pm$  24), remaining higher than CONTROL (p <0.05). MAP increased over time in D, and at 60 minutes was highest in CONTROL (72  $\pm$  7), followed by D (60  $\pm$  6) and DRT [(50  $\pm$  10), p <0.05] CVP was lower in D ( $-1.5 \pm 4.2$ ) at 60 minutes compared to CONTROL (5.1  $\pm$  6.2) and DRT [(4.9  $\pm$  4.7), p <0.05]. CO increased in DRT from 10 minutes (34.1  $\pm$  10.1), surpassing CONTROL at 10 and 60 minutes (p <0.05). SV was higher in CONTROL at 30 (686.8  $\pm$  185.1) and 60 minutes [(551.3  $\pm$  141.4), p <0.05].

RT positioning was associated with cardiovascular adaptations – increased HR and CO, reduced SV, and lowing MAP. The CVP findings suggest that RT recumbency may partially alleviate pregnancy-related venous return impairment.

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### Use of adrenaline to facilitate surgical management of nephrosplenic entrapment in anaesthetized horses: A case series

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Surgical management of nephrosplenic entrapment (NSE) in horses is often complicated by splenic enlargement. The use of phenylephrine has been described in medical or surgical treatment of NSE (Abutarbush & Naylor 2005). However, its access for veterinarians is limited in some countries. Adrenaline is a potential alternative but is rarely described (Cherdchutham et al. 2021). This case series documents the use of adrenaline as a slow intravenous injection in 3 horses surgically treated for NSE.

All horses were presented with colic signs, unresponsive to medical treatment. Premedication included dexmedetomidine (3.5 - 5  $\mu$ g kg<sup>-1</sup> IV) and morphine (0.1 mg kg<sup>-1</sup> IV), followed by induction with either midazolam or diazepam (0.05 mg kg<sup>-1</sup> IV) and ketamine (2.2 mg kg<sup>-1</sup> IV). Anaesthesia was maintained with sevoflurane delivered in oxygen and air, and dexmedetomidine IV infusion (1  $\mu$ g kg<sup>-1</sup> hour<sup>-1</sup>).

Entrapment of the colon over the nephrosplenic ligament was observed with marked enlargement of the spleen, which restricted intestinal manipulation. Therefore, adrenaline was injected slowly over 3 - 5 minutes ( $10\mu g \ kg^{-1} \ IV$  in case (2),  $2.5 \ \mu g \ kg^{-1}$  in cases (1,3). This resulted in transient tachycardia and hypertension. Splenic contraction and size reduction were subjectively noted by the surgeon, allowing correction of the entrapment. Horses recovered uneventfully, cases (2,3) were discharged two weeks post-operatively, while case (1) was euthanized after a second laparotomy due to peritonitis and adhesions. Adrenaline was chosen due to the unavailability of phenylephrine. Being a potent vasoconstrictor, hypertension and reduced tissue perfusion were a matter of concern, in addition to tachyarrhythmias and sweating. However, the increase in HR and blood pressure was transient. Additionally, adrenaline is a legal drug for use in food producing animals.

In conclusion adrenaline was well tolerated in horses under general anaesthesia and facilitated surgical treatment of NSE.

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#### Intraoperative Complications In Anaesthetised Horses: A Comprehensive Prospective Study

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CEPEF4, the fourth phase of the Confidential Enquiry into Perioperative Equine Fatalities, represents the largest current investigation into perioperative fatality risk in horses.

This prospective multicentre cohort study collected data from 47,396 equine anaesthetic procedures, focusing on intraoperative monitoring practices, major complication rates, and emergency drug use. Complication rates were calculated for animals monitored with appropriate devices: arterial pressure for hypotension, pulse oximetry or blood gas analysis for hypoxaemia, capnography for hypercapnia, electrocardiography for arrhythmias, and thermometry for hypothermia. Awakening, bleeding, excitation, and difficult intubation were assessed across the entire cohort. Univariable logistic models evaluated complication risks by ASA grade (ASA I as reference; significance p < 0.05). Emergency administration of drugs, including atropine, adrenaline, ephedrine, dobutamine, phenylephrine, noradrenaline, colloids, hypertonic saline, and blood transfusions, was recorded. Blood pressure was monitored in 34,227 procedures, detecting hypotension in 12,402 cases (36.4%). Capnography identified hypercapnia in 1,699 out of 31,102 cases (5.5%). Oxygenation monitoring detected hypoxaemia in 1,648 out of 25,861 cases (6.4%). ECGmonitored horses experienced arrhythmias in 885 out of 42,118 procedures (2.1%). Hypothermia occurred in 579 out of 28,944 monitored cases (2.0%). Awakening complications affected 5,477 procedures (11.6%), whereas bleeding, excitation, and difficult intubation occurred rarely (< 1% each). Complication risks consistently increased with higher ASA grades.

Emergency drugs were administered during 4,613 anaesthetics (9.7%). Dobutamine comprised two-thirds of the interventions, with usage increasing progressively from 63% (ASA I) to 84% (ASA V). Colloids (3.5%) and hypertonic saline (3.8%) were the next most frequent interventions, primarily given to higher-risk horses. Other vasopressors and atropine were rarely used (< 3% each), and transfusions were infrequent (< 0.1%).

Despite widespread monitoring and cardiovascular support, intraoperative complications—especially hypotension—remain common, and their likelihood increases with ASA grade. These findings highlight the necessity for vigilant haemodynamic monitoring and prompt intervention in equine anaesthesia.

## Other Tuesday 16th

Comparison of two volumes of bupivacaine-dye solution on ultrasound-guided sciatic and femoral injections in chickens

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Ultrasound-guided local anesthesia of the sciatic and femoral nerves can be used for surgeries involving structures distal to the mid-femur. The aim of this study was to evaluate two injection volumes of bupivacaine-dye solution on nerve staining.

Eight female chicken cadavers weighting  $1.7 \pm 0.5$  kg were used. The ultrasound transducer was positioned on the lateral aspect of the thigh. Sciatic perineural injections were performed between the iliofibularis and the lateral aspect of the pubo-ischio-femoralis muscle. Femoral perineural injections were performed between the medial aspect of the pubo-ischio-femoralis muscle and the skin. The chickens' legs were randomly assigned to two groups based on the volume of bupivacaine-dye solution (Davidson Marking System; Bradley Products Inc.) diluted at a ratio of 0.1:10. The injectate was administered with the low volume group (LV) receiving 0.2 mL and the high volume group (HV) receiving 0.8 mL. Gross dissections were conducted to assess the distribution of nerve staining. Complete nerve staining was considered when extension of the dye on the nerve was > 1 cm. Coelomic cavity was examined for dye solution. Paired t-test was used to compare groups.

All sciatic nerves for both groups had complete nerve staining. Mean  $\pm$  SD for LV and HV stained was  $2.3\pm0.7$  and  $4.7\pm1.0$  cm, respectively (p = 0.0003). Two femoral nerves of each group had incomplete nerve staining. Mean  $\pm$  SD for LV and HV stained was  $1.3\pm0.7$  and  $2.1\pm1.4$  cm, respectively (p = 0.0855). Dye was detected in the coelomic musculature in one chicken and coelomic cavity in another chicken after femoral nerve injections.

Both LV and HV injections consistently stained the sciatic nerve. However, femoral nerve injections demonstrated inconsistent staining regardless of the injection volume used. Improvements to the technique for the femoral nerve approach are necessary.

### Evaluation of low-dose medetomidine-vatinoxan and butorphanol combinations for sedation in canine radiographic procedures.

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A new 1:20 medetomidine-vatinoxan formulation has recently entered the market, but the sedative and cardiovascular effects of low doses combined with butorphanol remain unclear. This study aimed to compare two low-dose regimens of the combination in dogs undergoing orthopaedic radiographic procedures.

Sixteen healthy dogs were randomly assigned to two equal groups and received IM butorphanol (0.15 mg kg $^{-1}$ ); in addition, group M-0.125 received IM medetomidine (0.125 mg m $^{-2}$ ) and vatinoxan (2.5 mg m $^{-2}$ ), while group M-0.25 received IM medetomidine (0.25 mg m $^{-2}$ ) and vatinoxan (5 mg m $^{-2}$ ). Sedation was assessed using a 21-point scale at 5-minute intervals, with scores > considered moderate sedation (Grint et al. 2009). At the same time points, HR, and MAP were recorded. If sedation was inadequate, propofol was titrated to effect for restraint, and dose recorded. Sedation time was measured from head-down onset until dogs spontaneously returned to sternal position post-procedure. Student's t-test analyzed differences between groups, and a linear mixed model was used to evaluate HR, and MAP over time. Statistical significance was set at p < 0.05.

Dogs weighed 2.5–45 kg. Fifteen minutes after sedation onset, the score was > 15 and remained at this level for additional 15 minutes, with no differences between groups (p = 0.967). Sedation lasted 57  $\pm$  11 minutes in group M-0.125 and 63  $\pm$  17 minutes in group M-0.25 (p = 0.462). No difference in propofol doses was detected (p = 0.550); six and seven dogs in groups M-0.125 and M-0.25 required propofol 15 minutes after sedatives administration. The HR significantly decreased over time (p < 0.001), although MAP remained above 65 mmHg in all dogs throughout the sedation period.

This study suggests that the doses of medetomidine and vatinoxan combining with butorphanol provides acceptable sedation and cardiovascular stability for orthopedic radiographs in dogs.

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### Modulation of joint inflammation and synovial repair by dipyrone versus carprofen in a rat early monoarthritis model

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Dipyrone has been classified as an anti-inflammatory for years, but no clear evidence exists beyond its action on cyclooxygenases.

We induced monoarthritis in male Wistar rats through by intra-articular mBSA/CFA injection. Rats were randomly assigned to a control group (healthy animals), two arthritis control groups (8-day and 13-day arthritis treated with tramadol 17.8 mg/kg SC), and 13-day arthritis treatment groups: low-dose dipyrone (177.8 mg/kg SC q8h), high-dose dipyrone (500 mg/kg SC q24h), or carprofen (10 mg/kg SC q24h). Arthritis was maintained for 8 or 13 days for assessment. We evaluated morphological changes (inflammation and synovial healing), cellular activity via [18F]FDG-PET/CT, PGE2 concentrations, lameness/inflammation/pain scores, and analgesic rescue. Additionally, we assessed the behavior and adverse effects on the stomach, liver, kidneys, and bone marrow. Data were analyzed using two-way ANOVA and Friedman test.

The morphological evaluation showed that treatment with dipyrone resulted, in a dose-dependent manner, in reduced inflammation and accelerated the synovial repair process through type I collagen fibers, while carprofen diminished the inflammatory infiltrate with less synovial repair than dipyrone. Dipyrone prevented the increase in type V collagen fibers, which are immunogenic and antigenic, unlike the other treatments. All treatments showed increased cellular activity assessed by [18F]FDG-PET/CT compared to the control; however, only dipyrone treatment decreased this activity on day 13  $(2,2\pm0.6;1.7\pm0.3)$  and  $(2.5\pm0.8;1.8\pm0.5)$ . PGE2 concentrations were elevated compared to control only in TR8 and TR  $(19.4\pm10.7;126.2\pm80.1;135.0\pm105.4)$ . No significant differences were observed among the groups regarding behavior, lameness/inflammation/pain scores, analgesic rescue, and adverse effects.

In conclusion, administering dipyrone at low or high doses may reduce inflammation, promote synovial repair, and prevent immunogenicity, highlighting its role in the modulation of joint inflammation in a rat model of early monoarthritis induced by mBSA/CFA.

#### Evaluation of femoral nerve block in a multimodal approach during knee arthrotomy in rabbits

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Retrospective study of anesthetic and follow-up records of 32 adult New Zealand rabbits from a biomedical research project approved by the ethics committee (CEA-OH-12188/2). The aim was to assess the efficacy of inguinal femoral nerve block (FNB) as part of a multimodal approach.

The anesthetic protocol included medetomidine, ketamine, midazolam, methadone and meloxicam subcutaneously, intravenous propofol, tracheal intubation, and maintenance with sevoflurane under mechanical ventilation. Spirometry, capnography, SpO2, temperature, and invasive blood pressure were monitored. A fentanyl patch was placed at the end. Two procedures were performed: creation of an osteochondral lesion in the medial condyle (SX1) or bioimplant placement (SX2) 14 days after SX1. The blocking technique with ropivacaine (ROPI) 0.2% or 0.4%, the intraoperative nociceptive response (LIR [low]-: 10 to <5%; MIR [moderate]:>% increase in HR and MAP), the need for intraoperative (IAR) and postoperative analgesic rescue, and voluntary food intake at 24-36 h were analyzed. Fisher's exact test compared data within ROPI and SX groups.

Fifty-seven procedures were performed (32 SX1 and 25 SX2), with FNB ultrasound-guided (US) and nerve-stimulated (NS) in all cases; in 2 cases, no response was obtained to NS. ROPI 0.2% was used in 41 cases and 0.4% in 16 cases, with volumes of 0.1-0.2 ml kg<sup>-1</sup> based on observed distribution on US. No significant differences were found within the ROPI or SX groups. Seven LIR events were recorded in 6 procedures (one with no NS response during the block). One MIR event was observed. Four IAR were administered in 3 cases. In the 4-hours postoperative period, 7% of cases required postoperative analgesic rescue. Voluntary food intake was 88% at 24 hours, reaching 100% at 36 hours.

The multimodal approach, including FNB with either concentration of ropivacaine, appears valuable and feasible for medial knee arthrotomy and medial condyle injury in rabbits.

### Effect of bupivacaine 0.25% and 0.5% on the nociceptive, motor and proprioceptive response in an ultrasound-guided sciatic nerve model in rats

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Ultrasound-guided sciatic nerve injection has been described in rat cadavers; however, the pharmacological properties of local anesthetics concentration remain underexplored and poorly understood. The objective of this study was to evaluate nociceptive, motor and proprioceptive responses following ultrasound-guided perineural sciatic injections of different concentrations of bupivacaine.

In a randomized, blinded, crossover study, eight Wistar rats underwent isoflurane anesthesia and received ultrasound-guided sciatic nerve injections of 0.1 mL of 0.25% (B25) or 0.5% bupivacaine (B50), with one-week between treatments. Mechanical sensitivity [Electronic Von Frey, (grams +/-)], motor function [tactile placing; gait response (1–3 score)] and proprioceptive functions [grip test (+/-); paw positioning: (clubbed/normal)] were evaluated at baseline (time 0), 10, 20, 30, 40, 60, 90, 120, 180, 240, 300 and 360 minutes post isoflurane recovery. Data were analyzed using mixed models with significance set at p < 0.05.

Sciatic nerve blockade was observed within 20 minutes post isoflurane recovery with treatment, time and interaction on nociceptive function being significant from 20 to 240 minutes (p < 0.05). Group B25 sensory function peaked at 111.2 grams [95% CI: 100.8–121.5 (-)] at 60 minutes and returned to baseline 55.5 grams [95% CI: 45.2-65.9 (+)] by 240 minutes. Motor and proprioceptive functions were reduced at 20 minutes [median score: 1 (IQR: 1)] and returned to baseline by 240 minutes. Group B50, sensory function peaked at 133.7 grams [95% CI: 123.3–144.1 (-)] at 90 minutes and returned to baseline 52.0 grams [95% CI: 41.6-62.4 (+)] in 300 minutes. Motor and proprioceptive functions were reduced at 10 minutes [1 (IQR: 0.25)] and returned to baseline by 300 minutes.

In conclusion, B25 and B50 achieved complete clinical sciatic nerve blockade in all rats. Duration and efficacy of bupivacaine on nociception, motor and proprioceptive functions appeared to be concentration dependent.

### Dexmedetomidine versus clonidine as an adjuvant to lidocaine spinal anesthesia in ovine experimental model

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Sheep are routinely used as orthopedic models for their anatomical and physiological similarities to human joints. Spinal anesthesia is a technique that provides adequate analgesia for these procedures (Edmondson 2016). Clonidine is a widely used adjuvant in human spinal anesthesia; dexmedetomidine is a new and more selective alpha-2 agonist than clonidine (Sarma et al. 2015). This study compared the duration and analgesic effect of these two drugs as an adjuvant in spinal anesthesia.

The study involved 39 sheep undergoing experimental pelvic limb cartilage damage surgery. Animals were sedated with diazepam (0.4 mg kg<sup>-1</sup>) and buprenorphine (10  $\mu$ g kg<sup>-1</sup>) intravenously. Propofol was given as needed (0.5 mg kg<sup>-1</sup>) and oxygen support was continuous. Animals were placed with the treated limb in dependent position for the lumbosacral spinal block. Sheep were divided into three groups of 13 animals, receiving lidocaine 2% (Lgroup), lidocaine 2%+clonidine 2  $\mu$ g Kg<sup>-1</sup> (CLgroup) or lidocaine 2%+dexmedetomidine 1  $\mu$ g mL<sup>-1</sup> (LDgroup) for spinal block at a dose of 1 mL every 10 kg. After surgery, the times (minute) of recovery of sensibility (RoS) and standing (ToS) from the spinal block were recorded. The degree of ataxia (ATA) was also measured every 10 minutes using a numerical scale (1=absent, 2=mild, 3=severe).

Results are shown in the Table.

Dexmedetomidine is more effective than clonidine in prolonging lidocaine spinal anesthesia. Its effects include both motor and sensory aspects, representing an important refinement of the technique.

	Lgroup	CLgroup	LDgroup	p LvsCL	p LvsLD	p CLvsLD
RoS (minute)	146 ± 21.8	207 ± 27.1	198 ± 60.4	<.001	<.008	
ToS (minute)	127 ± 25.2	220 ± 35.7	316 ± 80.3	<.001	<.001	<.001
ATA20 (score)	2 (2-1)	3 (3-2)	2 (2-2)	<.001		0.002
ATA30 (score)	1 (2-1)	2 (3-2)	2 (2-2)	<.001	0.004	
ATA40 (score)	1 (1-1)	1 (2-1)	2 (2-2)		<.001	<.001

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### AM404, an active metabolite of acetaminophen provides local anesthesia in rats via nociceptor specific sodium channel blockade.

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Despite its wide use, the mechanism of action of acetaminophen remains unknown. AM404, an active metabolite of acetaminophen, may provide analgesia peripherally via inhibition of nociceptor specific voltage gated sodium channels (NaV).

AM404 10mM or vehicle (DMSO, tween-20 & saline) were administered intraplantar in naïve male and female Sprague Dawley rats or following complete freund's adjuvant (CFA), formalin or capsazepine injections. Mechanical (MWT) and thermal withdrawal thresholds (TWT) were examined at baseline and from 15 to 120 minutes post administration and normalized to the contralateral limb and baseline. A current clamp was used to examine the effect of AM404 on the excitability of trigeminal ganglion nociceptive neurons. A voltage clamp was used to measure sodium currents in ND7-23 cells expressing NaV1.7 and HEK293 cells expressing NaV1.8. Two-way ANOVA with corrections for multiple comparisons were performed to compare treatments between groups. Significance was set at p < 0.05.

AM404 inhibited action potential firing in nociceptive neurons, ex vivo. In in vitro expression systems, AM404 blocked sodium currents with an IC50 of  $41 \pm 24$ nM for NaV1.7, and  $65 \pm 36$ nM for NaV1.8. In vivo, in naïve animals mean ( $\pm$  standard deviation) MWT was higher following AM404 at 30 and 60 minutes ( $1.29 \pm 0.27$ ,  $1.42 \pm 0.83$  respectively) compared to vehicle ( $0.93 \pm 0.34$ ,  $0.97 \pm 0.21$ ) and TWT at 60 minutes ( $1.33 \pm 0.39$  vs  $1.04 \pm 0.21$ ). Following formalin administration MWT was higher with AM404 compared to vehicle at 60 minutes ( $0.94 \pm 0.66$  vs  $0.55 \pm 0.41$ ). MWT was higher 60 minutes after AM404 when administered two days following CFA ( $0.37 \pm 0.12$  vs  $0.13 \pm 0.05$ ).

This study demonstrates that AM404 provides local analgesia via nociceptive specific NaV. This elucidates a peripheral mechanism of acetaminophen analgesia and may be a future tool for pain specific loco-regional anesthesia.

### Evaluation of the analgesic efficacy of local infiltration of levobupivacaine and bupivacaine, with or without tramadol, in a rabbit femoral fracture model

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Local infiltration with levobupivacaine and bupivacaine is underutilized in orthopedic pain management, and few studies have evaluated their efficacy (Perets et al., 2018; Korat et al., 2017). This study aimed to assess the effects of surgical wound infiltration with levobupivacaine or bupivacaine, with or without systemic tramadol, on vital signs and pain scores in a rabbit femoral fracture model. The study protocol was approved by the Animal Experiments Ethics Committee of Atatürk University, Erzurum, Turkey (decision no: 2023/02).

Forty-eight male New Zealand White rabbits underwent femoral shaft osteotomy and intramedullary pin fixation. Animals were randomly assigned to six groups (n = 8): Group C received 0.25 mL of 0.9% saline locally; Group T received saline plus intramuscular tramadol (5 mg/kg) every 8 h for 3 days; Group B received 0.25 mL of 0.5% bupivacaine locally; Group BT received bupivacaine plus tramadol; Group L received 0.25 mL of 0.5% levobupivacaine locally; Group LT received levobupivacaine plus tramadol. Pain was assessed using the Rabbit Grimace Scale, HR, fR, PR, SpO<sub>2</sub>, RT, MAP, blood glucose, and cortisol at baseline and at 2, 4, 6, 12, 24, 48, and 72 hours postoperatively. All animals were closely monitored, and rescue analgesia was administered if pain scores exceeded predefined thresholds. Parametric data were analyzed using repeated measures ANOVA with Bonferroni correction ( $\alpha$  = 0.05), and pain scores using Kruskal-Wallis and Dunn's tests.

HR remained stable in all groups except for a significant decrease in LT. MAP declined over time, without intergroup differences. Cortisol levels were lowest in LT at 8 hours. Pain scores in LT and BT were significantly lower than in other groups (p < 0.05).

In conclusion, local infiltration of levobupivacaine or bupivacaine, particularly when combined with tramadol, provided effective and safe postoperative analgesia in rabbits undergoing orthopedic surgery.

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### Evaluation of anesthetic effects of intramuscular administration of alfaxalone with ketamine or midazolam in Hy-Line W36 roosters.

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This study assessed intramuscular (IM) injectable anesthetic protocols for maintaining a surgical plane of anesthesia in roosters.

Sixty healthy roosters were randomly assigned to one of four treatment groups (n = 15/group). Treatment MA1 (midazolam 1 mg kg<sup>-1</sup> and alfaxalone 20 mg kg<sup>-1</sup> IM) and KA1 (ketamine 10 mg kg<sup>-1</sup> and alfaxalone 20 mg kg<sup>-1</sup> IM) were assessed first, and increasing dosages were implemented in treatments MA2 (midazolam 1 mg kg<sup>-1</sup> and alfaxalone 22 mg kg<sup>-1</sup> IM) and KA2 (ketamine 15 mg kg<sup>-1</sup> and alfaxalone 20 mg kg<sup>-1</sup> IM). All roosters were premedicated with butorphanol 2 mg kg<sup>-1</sup> IM. Cecectomy surgeries were performed once a surgical plane of anesthesia was achieved. Data were analyzed using an analysis of covariance (SAS 9.4) and with significance at  $P \le 0.05$  and separated using Fisher's LSD; surgeon served as covariant.

Anesthesia duration differed significantly among MA1 and MA2 (P < 0.0001). MA2 had the longest duration (41.67 min), followed by MA1 (28.78 min). Both MA1 and MA2 differed significantly from KA1 (9.35 min) and KA2 (14.98 min). No significance occurred between KA1 and KA2, despite dosage increase. All of the MA2 roosters reached a surgical plane of anesthesia, while only 11 of 15 roosters in MA1 reached surgical depth. KA1 and KA2 protocols were insufficient, with 3 roosters combined reaching surgical depth; most required immediate isoflurane supplementation.

These results support the butorphanol-midazolam-alfaxalone combination as a viable injectable protocol for chickens. In contrast, butorphanol-ketamine-alfaxalone is inadequate for achieving a surgical plane of anesthesia.

### Other

# Wednesday 17th

#### Preliminary study of the use of butorphanol-midazolam or methadone-midazolam to sedate rabbits

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Rabbits often require sedation for procedures that may involve painful interventions.

This preliminary, prospective, randomised, and blinded study aimed to compare the sedative and physiological effects of IM methadone–midazolam versus butorphanol–midazolam in rabbits. Eleven New Zealand White rabbits (3 males, 8 females; median weight 2.08 [1.49–2.37] kg; age 3.5 [3–4] months) were included. Animals received either butorphanol (0.5 mg kg<sup>-1</sup>) or methadone (1 mg kg<sup>-1</sup>) combined with midazolam (1 mg kg<sup>-1</sup>) IM. Baseline HR, SAP, DAP, MAP, and SpO<sub>2</sub> and at 10- and 20-minute postadministration, were recorded. A rabbit sedation scale (Raulic et al., 2021) was applied at the same time points. Anaesthesia was induced 30 minutes later with IV alfaxalone, titrated to effect. Data were assessed for normality using the Shapiro–Wilk test. A two-way repeated measures ANOVA evaluated the effects of treatment and time. Mauchly's test assessed sphericity, with Huynh–Feldt correction applied when violated. The Wilcoxon test was used to compare alfaxalone doses. Data are presented as median (P25–P75); significance was set at p < 0.05.

No significant differences were observed between groups in HR,  $SpO_2$ , sedation score, or alfaxalone requirements. The methadone–midazolam group showed higher fR at 10 and 20 minutes (p = 0.040), and higher SAP (p = 0.045) at 20 minutes. Within-group analysis showed increases from baseline in fR (p = 0.001), SAP (p = 0.008), DAP (p = 0.005), and MAP (p = 0.005–0.026) at various time points. In conclusion, methadone–midazolam provides sedation comparable to butorphanol–midazolam in rabbits, with similar alfaxalone requirements for anaesthetic induction. However, methadone may be associated with increased blood pressure.

Further studies with larger sample sizes are needed to confirm these findings.

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#### Acknowledgement

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### Sedative and analgesic effects of intramuscular methadone in rabbits undergoing ovariohysterectomy: preliminary results

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Effective pain management in rabbits remains a clinical challenge due to limited species-specific data (Benato et al. 2019). This randomized, controlled, blinded clinical trial aimed to evaluate the sedative and analgesic effects of IM methadone in female rabbits undergoing elective ovariohysterectomy.

Thirteen healthy, mixed-breed rabbits (mean weight:  $3.2 \pm 1.1$  kg; age:  $31 \pm 13$  months) were randomly assigned to receive IM dexmedetomidine ( $20~\mu g~kg^{-1}$ ) and midazolam ( $1~mg~kg^{-1}$ ), combined with either NaCl 0.9% (0.02 mL kg<sup>-1</sup>; control), low-dose methadone ( $1~mg~kg^{-1}$ ), or high-dose methadone ( $2~mg~kg^{-1}$ ) as premedication. Sedation was assessed 10 minutes post-administration (Raulic et al. 2021). Anaesthesia was induced and maintained with isoflurane in oxygen, and all rabbits were mechanically ventilated. Intraoperative nociception was continuously estimated via HR, fr, and invasive arterial blood pressure. Capnography was also monitored. Fentanyl ( $5~\mu g~kg^{-1}$  IV) was administered as rescue analgesia if any parameter increased >20% from baseline or if ventilatory asynchrony occurred. At the end of surgery, all animals received IV meloxicam ( $0.3~mg~kg^{-1}$ ), atipamezole ( $0.2~mg~kg^{-1}$ ), flumazenil ( $0.1~mg~kg^{-1}$ ), famotidine ( $1~mg~kg^{-1}$ ), and metoclopramide ( $2~mg~kg^{-1}$ ). Postoperative pain was assessed hourly for 8 hours following extubation (T1–T8) using the Bristol Rabbit Pain Scale (BRPS) and Rabbit Grimace Scale (RbtGS). Buprenorphine was administered as postoperative rescue analgesia based on predefined pain thresholds and clinical criteria. Pain scores were compared between groups and against baseline (T0) using ANOVA and repeated measures ANOVA (p < 0.05).

Sedation scores, isoflurane requirements (mean end-tidal concentrations), and rescue analgesia were similar between groups. The BRPS scores differed significantly between treatments (p = 0.012) and timepoints (p = 0.006), with lower scores in methadone groups at T2 (p = 0.004) and in the high-dose group at T4 (p = 0.018), compared to control group. RbtGS varied over time (p < 0.001), but not between groups (Table 1).

Methadone, particularly at 2 mg kg<sup>-1</sup>, enhanced postoperative analgesia and reduced pain scores, supporting its role in multimodal analgesia protocols for rabbits.

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### Pharmacokinetics of a high oral dose of a compounded tramadol hydrochloride suspension in domestic rabbits (*Oryctolagus cuniculus*)

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Tramadol is a weak opioid mu-agonist, a serotonin-reuptake inhibitor and N-methyl-D-aspartate receptor antagonist. The analgesic effect of tramadol in rabbits has been documented through a model of reduction of the MAC of isoflurane (Egger et al. 2009). Despite the low bioavailability of an oral dose of 11 mg kg-1 (Souza et al. 2008), empirical use is common in domestic rabbits.

The present pilot study was conducted in two rabbits to evaluate the sedative effects of an oral dose of 30 mg kg-1 based on a validated sedation scale (Raulic et al. 2021). The same oral dose was then administered to six healthy male rabbits and plasma concentrations of tramadol and its metabolites, O-desmethyltramadol (M1) and N-desmethyltramadol (M2), were determined by high performance liquid chromatography at 10, 20, 30, 45, 60, 90 minutes and 2, 3, 4, 6, and 10 hours. Pharmacokinetic parameters were calculated using a commercial software (PK Solver 2.0). Duration of analgesic effect was based on the minimal efficient plasma concentration determined in a previous pharmacodynamic study in rabbits using a model of isoflurane MAC reduction (Egger et al. 2009).

Average time to tramadol maximum plasmatic concentration (Cmax) was 40 minutes (91 ng ml-1 ± 38), terminal half-life (T1/2) was 4.0 hours ± 2.4 and mean area under the curve (AUC) from the first dose to infinity were 192 ng h ml-1. The M1 metabolite reached concentrations compatible with analgesic effect after 10 minutes and up to 3 hours after administration in some individuals, while tramadol did not reach analgesic concentrations based on the previous pharmacodynamic study (Egger et al. 2009). Mild sedation was detected in four rabbits at the 20 minutes to 6 hours timepoints. No adverse effects were noted in any of the rabbits.

Given the short duration of action, clinical use may be limited.

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#### Pharmacokinetics of a single dose of oral tramadol in brook trout (Salvelinus fontinalis)

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Fish antinociception has gained interest in research but effective analgesia has only been documented for injectable drugs, such as morphine (Romano et al. 2024) or robenacoxib (Raulic et al. 2021). The aim of this study was to determine pharmacokinetic parameters after oral administration of a single dose of tramadol HCl and to evaluate clinically detectable adverse effects in fish.

Six healthy adult book trout (*Salvelinus fontinalis*) kept in water at 11°C, 5 males and 1 female (weight range: 1025-1333 grams), were gavage fed with 5 mg kg-1 of a tramadol compounded suspension (Summit Pharmacy, Aurora, ON, Canada) (24-Rech-2294). Tramadol was administered via a 10-Fr red rubber tube in the stomach along with yellow-colored solution. The cranial part of the body was maintained elevated for 30 seconds to prevent regurgitation. Blood samples of 0.3 mL were obtained by venipuncture from the ventral coccygeal vein at 1, 2, 4, 6, 24, 32 and 46 hours after drug administration. Sedation was evaluated at each timepoint using a semi-quantitative score. Plasma concentration of tramadol and its two main metabolites M1 (Odesmethyltramadol) and M2 (N-desmethyltramadol) were measured by high-performance-liquid-chromatography.

High interindividual variability was noted. Tramadol mean elimination half-life was 19 hours. Time to peak drug concentration (Tmax) of tramadol was reached in around 24h and Tmax of M1 in around 2 hours. Only M1 reached concentrations compatible with analgesia in mammals, above 32 ng mL-1 (Egger et al. 2009) in 5 out of 6 individuals. Sedation was noted in all fish at 24 hours. No adverse effects were detected and the fish were alive 6 months after the study.

Further studies should evaluate the pharmacodynamics of tramadol in fish. If analgesic effect is demonstrated, tramadol could be administered through medicated diets in ornamental fish.

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### Effects of temperature on sedation induced by midazolam in bearded dragons (Pogona vitticeps)

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Midazolam is commonly used in reptiles (Arnett-Chinn et al., 2016) and maintaining an optimal body temperature is recommended during sedation in these species (Kischinovsky et al., 2013). The study aimed to evaluate the effects of different temperatures on sedation in bearded dragons.

In a randomized, crossover study, eight laboratory bearded dragons (13–14 months old) were given midazolam (1 mg kg $^{-1}$ ) subcutaneously cranial to a forelimb under normothermia (28–32 °C, MN) and hypothermia (18–21 °C, MH), with a washout period of 14–16 days. The experimental room was maintained at 19 ± 1°C. For MH, experiments began only when animals reached 18–21 °C. A heat lamp prevented temperatures from dropping below 18 °C for MH and maintained optimal conditions for MN. Animals were video-recorded at baseline (T0) and from 10 to 180 minutes postinjection (T10–T180). Recordings were scored by the same blinded observer (MR) using a validated sedation scale (0–12) (Pinho et al., 2024). For MH, a heat pad was provided after the T90 to simulate anesthesia recovery active warming. Sedation scores were compared within (Friedman and Dunn's) and between treatments (Wilcoxon paired test). Data are presented as median (range). *P* value was significant when < 0.05. Incidence of loss of righting reflex (LORR) was analyzed descriptively.

Peak of sedation occurred at T120 for MN [5 (2–6)] and at T60 for MH [6 (2–8)]. Sedation scores were significantly higher than T0 at T30–T180 for MN (p < 0.047), and from T20–T120 (p < 0.033) and at T180 (p = 0.010) for MH. No significant differences were found between treatments at any time point (p > 0.08). LORR was observed only in MH (n = 6).

Subcutaneous midazolam produced similar levels of sedation in bearded dragons at both temperatures. Sedation peaked earlier and LORR occurred only in hypothermia.

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### Inducing hypoxaemia in experimental adult pigs by varying FiO<sub>2</sub> with nitrogen.

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Veterinary anaesthetists can be usefully involved in animal experiments to i) ensure animal welfare ('refinement') and ii) manipulate physiological variables to achieve scientific objectives. ('reduction' i.e. reduce the animal numbers required) (Russell & Burch 1959). Insufficient methodological detail in scientific reports precludes experimental reproducibility (Kilkenny et al. 2009) so sharing successful methodology is another reductionary measure.

We describe a method for inducing hypoxaemia in adult pigs by varying  $FiO_2$ . Preanaesthetic medication in 3 Landrace X pigs was azaperone 4 mg kg-1, ketamine 5 mg kg<sup>-1</sup> and dexmedetomidine 20 mg kg<sup>-1</sup> IM. Anaesthesia was induced with alfaxalone 0.15-0.41mg kg<sup>-1</sup> IV. The trachea was intubated with an experimental endotracheal tube with a pulse oximeter incorporated in the cuff. Anaesthesia was maintained with isoflurane in  $O_2$  (fresh gas flow was 4 litres min<sup>-1</sup>) alfaxalone 3mg kg hr<sup>-1</sup> and dexmedetomidine 2mg kg hr<sup>-1</sup>. Pigs' lungs were ventilated to normocapnia. A metered flow of  $N_2$  was introduced between the ventilator's supply gas inlet and circle system. Hypoxaemia was achieved by altering the  $O_2:N_2$  flow ratio. The vaporiser setting was simultaneously altered to maintain  $E'_{ISO}$  at 1.2%. Arterial blood gas analyses were performed during desaturation epochs to validate the endotracheal tube's pulse oximetry technology.

Reducing  $FiO_2$  to 0.12-0.16% was readily achieved and reduced  $PaO_2$ . Recovery was rapid when the  $O_2:N_2$  flow ratio was increased: the lowest recorded  $PaO_2$  in one animal, 33.3 mm Hg increased to 425 mmHg within 5 minutes.

Modifying equipment to allow  $N_2$  inflow and varying the  $O_2$ :  $N_2$  ratio is a simple and inexpensive method for controlling  $FiO_2$  in hypoxaemic pig models. These details will assist others involved in experiments requiring variable  $FiO_2$ .

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### Concordance between rectal temperature and a core temperature measuring device with Zero Heat Flux technology in guinea pigs (Cavia porcellus) anesthetized with isoflurane: preliminary results

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Hypothermia is frequently observed during anesthesia in small mammals. Zero heat flux (ZHF) technology is considered a noninvasive, accurate, precise method to assess core temperature in humans and presented concordance with measurements in the pulmonary artery in pigs (Guschlbauer et al. 2016). This study aimed to determine the agreement between rectal temperature and ZHF thermometry in anesthetized guinea pigs (Cavia porcellus).

A total of 14 adult female Hartley guinea pigs weighing 897 ± 154 g (mean ± SD) were used. Anesthesia was induced and maintained via a face mask connected to a non-rebreathing circuit using 5% and 2% isoflurane in 100% oxygen, respectively. After hair clipping, the ZHF monitor sensor (SpotOn®, Bair Hugger®, 3M, USA) was placed in the midline, at the level of the sternum, and the temperature probe of a multiparametric monitor (Contec® CMS8000, China) was inserted into the rectus approximately 6 cm (TR). Temperature was recorded by both methods every 2 minutes over 24 minutes. The agreement between the paired measurements was studied using the Bland-Altman method corrected for repeated measures, and the 95% confidence intervals (95% CI) of the limits of agreement (LoA) were calculated with a bootstrap non-parametric method based on percentiles (Olofsen et al. 2015).

The bias (median of the differences) between both methods was  $-0.5^{\circ}$ C, with the upper LoA (ULoA) at  $-0.3^{\circ}$ C (95% CI = -0.3, -0.2) and the lower LoA (LLoA) at  $-1.0^{\circ}$ C (95% CI = -1.1, -1.0) (Fig.1). Differences between two thermometric techniques are considered clinically acceptable when the bias is within  $\pm 0.2/0.3^{\circ}$ C and LoA are within  $\pm 0.5^{\circ}$ C/ $0.6^{\circ}$ C from the bias (Olasinde et al. 2020).

Therefore, the results obtained are close to what could be considered clinically acceptable, highlighting the narrow 95% CI of the LoA.

### Morbidity and mortality related to anaesthesia for experimental myocardial infarction induction: lessons learnt from minipigs

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Spontaneously occurring myocardial infarction is a life-threatening condition in humans. We aim at reporting morbidity and mortality related to anaesthesia for experimentally induced closed-chest myocardial infarction in minipigs.

Thirty-six Göttingen minipigs underwent left coronary catheterization via femoral access, followed by ballon inflation and occlusion of the left anterior descending artery (ischemia: 90 minutes) and deflation (reperfusion: 120 minutes). Minipigs were sedated with ketamine 10 mg kg<sup>-1</sup>, dexmedetomidine 15 µg kg<sup>-1</sup> and morphine 0.2 mg kg<sup>-1</sup> IM. Anaesthesia was induced with propofol 1-3 mg kg<sup>-1</sup> and ketamine 1 mg kg<sup>-1</sup> IV and maintained with sevoflurane (max 1 MAC: 2.2% Et) and lidocaine (30 µg kg<sup>-1</sup> minute<sup>-1</sup>). Dexmedetomidine 1-5 µg kg<sup>-1</sup> hour<sup>-1</sup> was added unless bradycardia was present. Amiodarone 5 mg kg<sup>-1</sup> was administered before coronary occlusion. At recovery, minipigs received IV meloxicam 0.4 mg kg<sup>-1</sup>, furosemide 2.5 mg kg<sup>-1</sup> and nitro-glycerine 0.2 mg over 30 minutes. We recorded intraoperative mortality, 72 hours mortality, and the incidence of cardiopulmonary resuscitation (CPR), electrical rhythm conversions, intraoperative nociception, post-operative pain, intra and post-operative arrhythmias.

An intra-operative mortality of 11.1% was recorded (4/36 minipigs). Seven animals (19.4%) developed ventricular fibrillation during coronary occlusion, anticipated in six cases by marked S-T segment changes, and underwent CPR and electrical external defibrillation (43% success). No minipigs surviving the procedure died within the next 72 hours. Two animals needed intra-operative cardioversion. Intraoperative nociception was recorded during the reperfusion phase in six animals (16.6%), and post-operative pain in four, which had previously shown intra-operative nociception. Intra-operative arrhythmias were recorded in 31 animals and needed treatment in 16 (51.6%). Seven minipigs were diagnosed with post-operative arrhythmias at rest, being sinus bradycardia the most represented (4/7), which resolved within 24 hours.

Myocardial infarction induction brings about high risk of intraoperative fatal arrhythmia. Non-fatal arrhythmias have a good post-operative prognosis.

### Creation of digital and 3D printed models to teach the mechanisms of action and functions of benzodiazepines (BZD) in veterinary anesthesiology

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Benzodiazepines (BZD) are commonly administered as preanesthetic medications in veterinary practice. Understanding the mechanisms of action and function of these compounds in patient animals is thus of utmost importance when training in veterinary medicine. This subject is typically taught through expository lectures using flat diagrams. However, the use of three-dimensional models could increase students' learning levels and reduce the degree of abstraction related to BZDs.

Therefore, the present study aimed to create and evaluate 3D models representing benzodiazepine drugs and their binding sites. We hypothesized that 3D models of benzodiazepines (BZDs3D) (figure 1) could be used effectively as teaching tools, making it possible to learn about the mechanisms of action and their functions during the training of veterinary medicine students. Fifty-two students from a veterinary medicine course took part in the study and were divided equally into two groups: the 3D group (G3D), students who used BZDs3D, and Control Group (CG), students who used flat schemes for learning. A pre-test, post-test, and satisfaction questionnaire (each comprising ten questions) were used to assess the performance of the students in both groups.

Between the pre- and post-tests, the G3D group showed greater improvements in their scores than the CG, suggesting that BZDs3D was effective at promoting student learning (figure 2 and 3). The satisfaction evaluation revealed good acceptance of the methodology employed.

The use of 3D printed models can contribute to learning pharmacology and anesthesiology.

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### Simulator for training ultrasound-guided thoracic locoregional blocks in dogs

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Performing ultrasound-guided thoracic blocks (UGTB) requires anatomical knowledge and ultrasound interpretation. The objective was to develop a simulator for UGTB training (US-GTB).

The study was conducted at the Fluminense Federal University/Brazil, without the use of live animals or cadavers. The simulator was based on canine thoracic anatomy and ultrasound. The layers representing the skin and muscles were produced with silicone and the rib cage by a 3D printer. The images were generated with ultrasound with a 5-10 MHz linear probe and with the use of a 21Gx100mm peripheral block needle. The simulator was tested by 05 anesthesiologists with experience in ultrasound-guided locoregional blocks. The anesthesiologists captured the images, without knowing which anatomical structures were reproduced. They described the anatomical structures and related the body region that the simulator represented during palpation and evaluation of the US-GTB. Subsequently, they used a needle to mimic the performance of the blocks.

Palpation allowed the delimitation of the thoracic cage and the identification of the ribs and intercostal spaces. The images allowed the identification of muscles, parietal pleura and ribs. The simulated musculature had echogenicity and depth compatible with the thoracic wall of an adult dog. The acoustic shadows of the ribs were visualized for cavity delimitation. The simulation of the intercostal block was performed by positioning the needle on the caudal edge of the ribs. The serratus block occurred after a needle passed through different muscle layers of the US-GTB, mimicking the deposition of the anesthetic between the muscles. The simulator represented the canine thoracic wall, allowing manipulation, ultrasound visualization and the performance of locoregional blocks, such as the serratus plane and intercostals by all anesthetists.

The US-GTB seems to be a tool for training anatomical identification and for performing UGTB.

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### Other

## Thursday 18th

Comparison of medial and lateral ultrasound-guided approaches to RUMM (radial, ulnar, median, and musculocutaneous) nerve injections in rats

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The objective of this study was to evaluate nerve length staining after a medial or lateral RUMM ultrasound-guided approach in rat cadavers. The hypothesis tested was that the medial approach would result in greater length of staining.

Ten Wistar rat cadavers were used. Each rat received a medial or lateral RUMM injection in both thoracic limbs. For the lateral approach, a 19–5 MHz linear ultrasound probe was positioned over the triceps region at the proximal third of the brachium, perpendicular to the longitudinal axis of the humerus. For the medial approach, the same probe was positioned at the proximal third of the humerus over the superficial pectoral and biceps brachii muscles. A 25-gauge echogenic needle was inserted in-plane from a caudal-to-cranial direction, targeting the neurovascular sheath and the musculocutaneous nerve located outside the fascia. A 0.1 mL bupivacaine-dye solution was injected, equally divided between the neurovascular sheath and the musculocutaneous nerve. Gross dissection was performed, and the length of nerve staining was measured. A two-tailed t-test was used to compare staining of the radial, ulnar, and median (RUM) nerves and a Mann-Whitney test was used to compare staining of the musculocutaneous nerve with significance of p < 0.05.

Length of RUM staining was greater for the medial approach ( $10.4 \pm 1.0 \text{ mm}$ ) compared to the lateral approach ( $6.7 \pm 0.5 \text{ mm}$ ) (p < 0.001). There was no difference between the two approaches for the musculocutaneous nerve, medial, 5 mm (IQR: 4.7–6 mm); lateral, 5.5 mm (IQR: 5–6 mm)] (p = 0.72). One musculocutaneous nerve did not stain in the lateral approach.

In conclusion, the medial approach achieved a longer RUM but not musculocutaneous nerve staining compared to the lateral approach.

### Pharmacodynamics of subcutaneous hydromorphone administration in bearded dragons (Pogona vitticeps)

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Thermal threshold (TT) testing has been validated and used for testing opioid efficacy in bearded dragons (Pogona vitticeps) (Sladky et al. 2008, Couture et al. 2017, Hawkins et al. 2019). This randomized, blinded, crossover study investigated TT changes after subcutaneous hydromorphone administration in this species.

A sample of six healthy adult bearded dragons was enrolled after obtaining informed owner consent. The TT testing was conducted using a ramped stimulus ( $2^{\circ}$ C/second) applied to the inner thigh until a response (leg kick, escape, attention to device) was observed or a maximum cut-off temperature ( $60^{\circ}$ C) was reached. Cold thermal latency (CTL) was tested by applying a  $0^{\circ}$ C probe until a behavioral response was elicited or the cut-off time (60 seconds) was reached. A minimum 20-minute interval between tests reduced habituation and skin irritation. Hydromorphone (0.5 mg kg-1) or an equal volume of saline was randomly administered subcutaneously axillary off midline. The TT and CTL were determined at 0, 2, 4, 8, 12, and 24 hours after injection by a single evaluator. The procedure was repeated four weeks later with the alternative treatment. Data were analyzed using mixed-effect models on ranks. Repeatability and test-retest reliability were measured using the coefficient of variation (CV) and Spearman's rho. Significance was set at p < 0.05.

Hydromorphone significantly increased TT compared to placebo at all time points ( $p \le 0.002$ ) with good repeatability (CV 28.53%). The highest median (interquartile range) TT of 60 (60, 60) °C was recorded two and four hours after injection. Animals recorded overall longer CTL after hydromorphone administration than saline (p < 0.001), regardless of time (p = 0.26). TT and CTL showed low test-retest reliability (Spearman rho = 0.21 and 0.38, respectively). No skin damage was observed.

Hydromorphone can provide analgesia in bearded dragons for 24 hours.

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### Enhanced post-capture activity in urban red foxes (Vulpes vulpes) following alfaxalone-midazolam versus medetomidine-midazolam immobilisation: preliminary findings.

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Medetomidine-midazolam (MM) is a recommended combination for immobilising wild foxes (Shilo et al., 2010). However, even when a2-adrenoceptor agonist-induced sedation is reversed with an antagonist, rebound sedation can occur (Ranheim 1999; Vainio & Vähä-Vahe 1990), leading to prolonged and potentially unsafe recovery in wildlife.

This prospective, blinded, randomised clinical trial compared MM with an alfaxalone-midazolam (AM) combination. Our hypothesis was that AM would result in higher post-capture activity levels within the first 24 hours. Fifteen urban red foxes (Vulpes vulpes) were captured: seven received MM (medetomidine 0.07 mg kg<sup>-1</sup> + midazolam 0.8 mg kg<sup>-1</sup> intramuscularly, IM) and eight received AM (alfaxalone 3 mg kg<sup>-1</sup> + midazolam 0.8 mg kg<sup>-1</sup> IM). Each fox was fitted with a GPS collar equipped with Very High Frequency (VHF) and accelerometery units. Sedation was reversed with atipamezole (0.35 mg kg<sup>-1</sup> IM) for MM and flumazenil (0.01 mg kg-1 IM) for AM.

Activity during the 24-hour post-immobilisation period was evaluated using Vectorial Dynamic Body Acceleration (VeDBA) as a proxy for energy expenditure. Five datasets from 4 foxes (AM n = 3; MM n = 2; one fox acting as its own control) are included in these results. Preliminary accelerometery data shows higher activity levels in AM-treated foxes compared to those receiving MM. Early results, analysed via linear regression, show significantly higher VeDBA values in the AM group (Figure 1) after the initial release-related activity burst (p < 0.001). Further segmented regression analysis is underway.

These preliminary findings suggest that the AM protocol may result in higher post-reversal activity levels in foxes during the 24-hour following immobilisation.

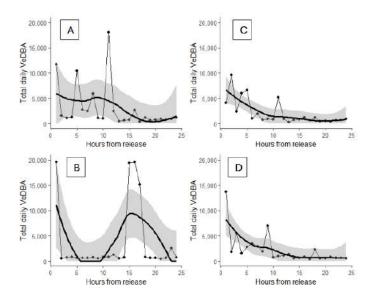


Figure 1. Daily activity levels (VeDBA) of four red foxes following reversal of immobilisation using two sedation protocols: AM (A, B) and MM (C, D).

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### Sedative and antinociceptive effects of xylazine vs dexmedetomidine in New Zealand white rabbits

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Xylazine has been used in cardiac electrophysiology studies in rabbits (Odening et al. 2008). We aimed at comparing sedative and antinociceptive effects of xylazine and dexmedetomidine.

Forty-seven New Zealand White rabbits, admitted for intra-aortic, trans-coronary gene therapy via carotid cannulation and short-term aortic arch occlusion, were randomly assigned to receive either Xylazine 4 mg kg-1 (group X) or Dexmedetomidine 100  $\mu$ g kg-1 (group D), combined with S-Ketamine 15 mg kg-1 and Buprenorphine 0.02 mg kg-1 SC. Fifteen minutes later, sedation was scored. After general anaesthesia induction, airways were secured with an endotracheal tube or, in case of failure, a laryngeal mask. Anaesthesia was maintained with S-Ketamine and either Xylazine (2.25 mg kg-1 hour-1) or Dexmedetomidine (10  $\mu$ g kg-1 hour-1). If MAP or fR increased at least 20% from baseline during surgery, rescue analgesia was administered. Sedation (0 = no sedation to 11 = deep sedation) and intubation (0 = excellent to 14 = very difficult) scores were compared between groups using Mann-Whitney test. The likelihood of administering further sedation (score < 7), rescue analgesia, and of failed tracheal intubation was assessed with relative risk (rR) followed by Fischer exact test. P  $\leq$  0.05 was deemed significant.

The likelihood of administering further sedation was higher in group X than D (rR = 3.136, p = 0.013). The likelihood of failed tracheal intubation (rR = 0, p = 0.237) and rescue analgesia (rR = 2.976, p = 0.22) was not significantly different. Sedation was deeper in group D (median 9, IQR 8 - 10) than in group X (median 7, IQR 4 - 9, p = 0.048). Intubation score in group D (median 5, IQR 2.25 – 7.75) and in group X (median 4.5, IQR 1.75 - 9) were not different (p = 0.704).

Dexmedetomidine provided deeper sedation without better antinociception than xylazine.

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### The Effects of Canine ABCB1-1Δ Mutation on Common Pre-anesthetic Medication Combinations

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The ABCB1-1 $\Delta$  mutation impairs P-glycoprotein (p-gp) function, altering drug distribution and increasing risk of adverse effects. Butorphanol, maropitant, and acepromazine are p-gp substrates, but limited clinical data on use in affected dogs exist (Mealey et al. 2023). We hypothesized administering multiple p-gp substrate medications would produce more pronounced sedation and alteration in cardiovascular parameters (non-invasive blood pressure (BP), HR) in affected dogs.

Twenty-three client-owned dogs were grouped by ABCB1-1 $\Delta$  genotype: 11 Normal/Normal (N/N) and 12 Mutant/Normal (M/N). All dogs underwent two treatments in a blinded, prospective, crossover design: maropitant 1 mg kg<sup>-1</sup> IV followed one hour later by either butorphanol 0.2 mg kg<sup>-1</sup> and acepromazine 0.02 mg kg<sup>-1</sup> or butorphanol 0.4 mg kg<sup>-1</sup> and acepromazine 0.04 mg kg<sup>-1</sup> IV, with a five-day minimum washout. Sedation score (SS), BP, HR, fr, and temperature (T) were obtained at baseline, one hour after maropitant alone, and for six hours after butorphanol and acepromazine (sedative) administration. Data were analyzed using linear mixed-effects models and Type III ANOVA (p = 0.05).

Mean SS changed significantly over time (p < 0.001) after but not before sedative administration, with higher sedative dose (p < 0.05), but not genotype (p = 0.9), increasing SS significantly. Significant differences occurred in HR, fr, MAP, and DAP between baseline and all times after sedative administration (p = 0.005, p < 0.001, p < 0.001, p < 0.001, respectively), with no significant effect of genotype or dose. SAP changed significantly over time after sedative administration (p < 0.001) and was affected significantly by dose (p < 0.05) but not genotype (p = 0.12).

Maropitant (1 mg kg $^{-1}$  IV) alone did not cause significant sedation in M/N or N/N dogs compared to baseline. Heterozygous ABCB1- $^{-1}\Delta$  genotype did not significantly impact SS, HR, fr, BP, or T in dogs administered either combination of acepromazine and butorphanol.

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### Profile identification of brazilian anesthesists

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This is the first survey conducted on the anesthetic practices of brazilian veterinarians.

An online questionnaire (CEP/UFRPE No. 4.670.086) was applied to licensed veterinarians, consisting of 34 questions about perianesthetic management in dogs and cats, considering three biases: gender, region of practice (Southeast, Center-West, North, South, and Northeast), and level of professional development (residency and/or specialization; master's and/or PhD; no further training). Descriptive statistics were applied to each question, followed by Chi-square or Fisher's exact test (p < 0.05) to assess associations between qualitative variables.

The response rate was 80% (418 out of 473 professionals completed all questions). There was a statistically significant difference among professionals from different regions regarding the use of equipment such as basic monitors and capnographs, with lower usage in the North (OR = 0.29; 95% CI: 0.11 - 0.76) compared to the Southeast. In pre anesthetic medication, acepromazine was one of the most used drugs (358/418; 85.6%). However, tramadol (OR = 5.47; 95% CI: 2.91 - 10.28) was more frequently used in the Northeast, while dexmedetomidine was more commonly used in the South (OR = 2.03; 95% CI: 1.16 - 3.56). Propofol for anesthetic maintenance was more frequently used in the South compared to other regions (OR = 1.80; 95% CI: 1.09 - 2.98). Women were more likely to use monitoring equipment and assess clinical parameters such as palpebral reflex ( $\chi 2 = 10.73$ , p = 0.001) during anesthesia than men. Academic training (master's/PhD) was associated with the use of safer equipment such as infusion pumps (OR = 14.04; 95% CI: 5.04 - 39.10), and the use of reversal agents like atipamezole (OR = 17.73; 95% CI: 3.82 - 82.30).

The survey reflected the actual practices of these professionals and their total or partial adherence to the latest veterinary anesthesia guidelines, particularly among women in the Southeast region with academic training.

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### Development of a novel ensemble machine learning model for predicting post-anesthetic hypoxemia in mechanically ventilated dogs

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Post-anesthetic hypoxemia remains a critical complication associated with mortality in dogs (Duffee et al. 2023). Artificial intelligence (AI) could be used for early risk detection and safer anesthesia. This study aimed to develop a novel ensemble machine learning (ML) model to predict post-anesthetic hypoxemia and identify key predictors.

This retrospective, single-cohort study included dogs presented between January–June 2022 at Seoul National University Veterinary Medical Teaching Hospital with written owner consent. Dogs undergoing inhalational anesthesia with invasive blood pressure monitoring were included; duplicate or incomplete cases were excluded. Twenty-four features from pre-anesthetic examinations, intra-anesthetic monitoring and recovery were used as input. Mild hypoxemia ( $PaO_2 < 80 \text{ mmHg}$ , Ortlieb et al. 2025) measured during recovery via the arterial catheter was the outcome. The Synthetic Minority Over-sampling Technique was selectively applied to generate synthetic cases, and address class imbalance (hypoxemic versus non-hypoxemic), using class probability thresholds. A combination strategy for ensemble learning based on boosting algorithms, optimized for categorical data, was used. ML analyses used Python with PyTorch and scikit-learn libraries. Feature significance was assessed using t-tests and chisquared tests, with p < 0.05 considered significant.

The dataset included 149 dogs fulfilling inclusion criteria and 211 generated cases. A validation set (16 dogs per class) was drawn from the original data; hypoxemia occurred in 10.7%. The final model achieved 88.4% accuracy and an area under the receiver operating characteristic curve of 0.890. Brachycephalic breed, pulmonary compliance, left lateral recumbency, tidal volume and peak airway pressure were key predictors (ranked by importance), all showing significant group differences (p = 0.00001-0.00625).

Despite the small sample size and retrospective design, the proposed ML model showed strong discriminative ability, suggesting clinical applicability for early identification of dogs at risk of post-anesthetic hypoxemia. Identified features could facilitate early detection and prevention of anesthesia-related respiratory complications.

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### Evaluation of laryngeal obstruction and edema using the endotracheal tube cuff leak test in dogs: clinical trials

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This study evaluated whether the cuff leak test (CLT), which compares expiratory tidal volumes with and without endotracheal cuff inflation under positive-pressure ventilation can identify dogs at risk of upper airway obstruction.

Client-owned dogs undergoing non-respiratory computed tomography under general anesthesia were prospectively enrolled with informed owner consent. To reduce anatomical variation and obtain standardized data, endotracheal tube (ETT) sizes of 5.0-6.0 mm were selected. Pre-anesthetic thoracic radiographs were used to estimate optimal ETT size, which was validated on CT by assessing tracheal-to-tube diameter compatibility at the cuff level. All dogs were managed under a standardized anesthetic protocol, including constant rate infusions of remifentanil ( $10 \mu g/kg/h$ ), midazolam (0.02 mg/kg/h), and ketamine (0.3 mg/kg/h), followed by induction with propofol (6 mg/kg), maintenance with sevoflurane, and invasive arterial pressure monitoring via the dorsal pedal artery. The cuff leak test (CLT) was performed immediately after discontinuation of inhalant anesthesia, with expiratory tidal volumes measured six times using the flow sensor of the ventilator. The average values under cuff-inflated ( $V_1$ ) and cuff-deflated ( $V_2$ ) conditions were used to calculate the cuff leak percentage (CLP) as ( $V_1 - V_2$ )/ $V_1 \times 100$ . Arterial blood gas analysis was performed 10 minutes post-extubation in room air (FiO<sub>2</sub> 0.21). Dogs with PaO<sub>2</sub> <80 mmHg were assigned to the obstructiongroup.

Differences in CLP between groups were analyzed using the Mann–Whitney U test. In dogs (n = 10, 5 per group), body weights ranged from 2.9 to 9.8 kg, Median CLP was significantly lower in the obstruction group (0.09%, range: 0.03-0.22%) compared to the control group (53.2%, range: 16.2-56.7%), and this difference was statistically significant (p = 0.036).

These findings suggest that the CLT may be a clinically useful tool for identifying dogs at risk of post-extubation laryngeal obstruction.

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### Owner's understanding of anaesthetic risks - Preliminary data

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Pre-operative education has been shown to reduce parental anxiety and improve satisfaction in human pediatrics (Morrison et al. 2019). Better understanding owner's perceptions of anesthetic risks may enhance communication, patient safety, and client satisfaction.

This study used an online, voluntary anonymous survey presented to dog and cat owners admitted for elective procedures requiring general anesthetic (GA) at a small animal secondary and tertiary referral hospital. Descriptive, Chi-square, Mann-Whitney U, and McNemar's statistical tests were used to assess owner demographics, anesthetic risk awareness and discussion preferences.

Seventy-five responses were received representing owners of 56 dogs (74.7%) and 19 cats (25.3%), with a mean pet age of  $6.53 \pm 3.74$  years. Death was the most frequently mentioned GA risk (65.3%), followed by respiratory complications (34.7%), gastrointestinal and drug related complications (24%). 9 (12%) owners were not aware of any GA related risks. BOAS-related complications were mentioned by 13 out of 17 brachycephalic breed owners. Previous pet GA experience was associated with increased awareness of death as a GA risk (p = 0.033). Owners that had personally had a GA before were significantly more familiar with several risks including difficult intubation (p = 0.001), respiratory depression (p = 0.003) hypothermia (p = 0.024) and hypoxia (p = 0.009). The risk of death was approximately 13 times more likely to affect owners' decision for consent compared to hypothermia (OR = 0.077, McNemar's p = 0.034). Death was also the anesthetic risk most owners wished to discuss with the veterinarian (61.3%), while hypotension, excitement on recovery and gastroesophageal reflux were the least frequently selected for discussion (14.7%). 16 owners (21.3%) indicated that they did not wish to discuss any anesthetic risks.

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#### References

Morrison, C., Munk, R., Lo, J.S., Przybylko, T., Hughes, R. and Cyna, A., 2019. Parental understanding of their child's risk of anaesthesia. British Journal of Anaesthesia, 123, pp.E5–E6.

### The impact of pharmacopuncture with lidocaine on perioperative analgesic requirements and systemic inflammatory response in dogs with pyometra

Renata Cassu<sup>1</sup>, Isabela Nicácio<sup>1</sup>, Stelio Luna<sup>1</sup>, Luiza Peruchi<sup>1</sup>, Nicácio Gabriel<sup>1</sup>, Gustavo Zanelli<sup>1</sup>

<sup>1</sup>Department of Otorhinolaryngology, University Hospital Regensburg, Franz-Josef-Strauss-Allee 11, D-93053 Regensburg, Germany

analgesia and interleukin levels in dogs with pyometra undergoing ovariohysterectomy.

This study compared the effects of lidocaine pharmacopuncture and intravenous constant rate infusion (CRI) on perioperative

Following methadone (0.3 mg kg<sup>-1</sup> IM) administration, anesthesia was induced with propofol intravenously dosed to effect and maintained with isoflurane. After intubation, 27 dogs were randomly assigned (n = 9 per group) to receive lidocaine (1 mg kg<sup>-1</sup>) at the Stomach 36 and Spleen 6 acupoints (LAP-G), lidocaine CRI (2 mg kg<sup>-1</sup>; 50  $\mu$ g kg<sup>-1</sup> min<sup>-1</sup>; LIV-G), or saline CRI (2 mL kg<sup>-1</sup>; 2 mL kg<sup>-1</sup> min<sup>-1</sup>; SAL-G). Intraoperatively, cardiopulmonary variables and FE´ISO were monitored. Fentanyl (2.5  $\mu$ g kg<sup>-1</sup>) was given to control cardiovascular responses to surgical stimulation. Pain and sedation scores were assessed prepagatively and up to 24 hours post-

min<sup>-1</sup>; SAL-G). Intraoperatively, cardiopulmonary variables and FE'ISO were monitored. Fentanyl (2.5  $\mu$ g kg<sup>-1</sup>) was given to control cardiovascular responses to surgical stimulation. Pain and sedation scores were assessed preoperatively and up to 24 hours post-extubation. Methadone (0.3 mg kg<sup>-1</sup> IM) was given as rescue analgesia. If pain persisted, metamizole (25 mg kg<sup>-1</sup> IM) was administered. Interleukins (IL-6 and IL-10) were measured before and 24 hours after surgery. Data were analyzed using Fisher's exact, Wilcoxon, Kruskal-Wallis, and Friedman tests (p < 0.05).

Cardiopulmonary variables, FE'ISO, interleukin levels, pain, and sedation scores did not differ among groups. Analgesic intervention was required in 11% in LAP-G (fentanyl and methadone, n = 1), 56% in LIV-G (fentanyl and methadone, n = 3), and 67% in SAL-G (fentanyl, n = 3; fentanyl and methadone, n = 1; methadone, n = 2), with significant differences only between LAP-G and SAL-G (p = 0.04). Compared to baseline, IL-6 significantly decreased postoperatively in LAP-G (Figure 1).

Lidocaine pharmacopuncture provided similar effects to CRI lidocaine, while reduced analgesic requirements compared to saline CRI and attenuated IL-6 from preoperative levels.

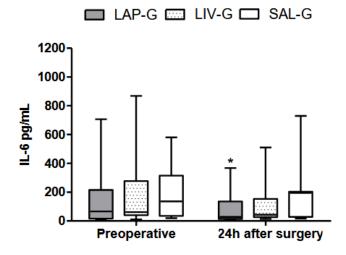


Figure 1. Serum IL-6 concentrations in dogs with pyometra undergoing ovariohysterectomy

### **Funding**

Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP – Grant number: 2018/13116-0)

<sup>\*</sup>Significantly different from baseline values (Wilcoxon test, p = 0.031)

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# Posters Small Animals

4714

Owner's understanding of anaesthetic risks - Preliminary data

### Beatriz Soares<sup>1</sup>, Carolina Jimenez<sup>1</sup>

<sup>1</sup>Clinical science and services, The Royal Veterinary College, Hatfield, United Kingdom

Pre-operative education has been shown to reduce parental anxiety and improve satisfaction in human pediatrics (Morrison et al. 2019). Better understanding owner's perceptions of anesthetic risks may enhance communication, patient safety, and client satisfaction.

This study used an online, voluntary anonymous survey presented to dog and cat owners admitted for elective procedures requiring general anesthetic (GA) at a small animal secondary and tertiary referral hospital. Descriptive, Chi-square, Mann-Whitney U, and McNemar's statistical tests were used to assess owner demographics, anesthetic risk awareness and discussion preferences.

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### References

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Ultrasound-guided pulsed radiofrequency of the canine hip joint capsule: a preliminary study

**Federica Alessandra Brioschi**<sup>1</sup>, Martina Amari<sup>1</sup>, Giuliano Ravasio<sup>1</sup>, Alessandra Bobbio<sup>1</sup>, Francesco Ferrari<sup>1</sup>

1Department of Veterinary Medicine and Animal Sciences, Università degli Studi di Milano, Lodi, Italy

This study aimed to evaluate the efficacy of a novel ultrasound-guided pulsed radiofrequency (PRF) technique targeting the canine hip joint capsule for the management of chronic osteoarthritic pain.

A total of four client-owned dogs with unilateral or bilateral hip osteoarthritis were enrolled. Dogs were anaesthetised and positioned in lateral recumbency. The lateral aspect of the hip capsule was virtually divided into five sectors. Ultrasound-guided PRF was applied to each sector, at 42°C for 10 minutes per site. To determine treatment efficacy and duration, Pain Severity Score (PSS), Pain Interference Score (PIS), and Quality of Life (QoL) were assessed by owners using the Canine Brief Pain Inventory (Brown et al. 2008) before treatment initiation (T0) and at one (T1), two (T2), four (T3) and twelve (T4) weeks post-treatment. Additionally, pain was evaluated by a non-blinded veterinary surgeon at monthly intervals, using a visual analogue scale (VAS). Data were analysed using the Shapiro-Wilk test and Student's t-test.

Baseline PSS  $(4.1 \pm 0.5)$  was significantly higher than values recorded at T1 $(1.8 \pm 0.9)$ , T2  $(2.3 \pm 1)$ , T3  $(1.6 \pm 0.7)$  and T4  $(1.9 \pm 1.7)$ . Baseline PIS  $(3.6 \pm 0.6)$  was significantly higher than at T1 $(1.3 \pm 0.7)$ , T2  $(1.5 \pm 1.1)$  and T3  $(1.4 \pm 1.1)$ . Compared with the baseline, the QoL improved at T4 in all but one dog. Basal VAS  $(6.7 \pm 1.9)$  was significantly higher than at T3  $(3 \pm 1.4)$ . Ultrasound-guided PRF of the hip joint capsule was associated with a reduction of chronic pain due to osteoarthritis and with an improvement in QoL.

These preliminary results suggest a potential role for PRF of the hip joint capsule in managing chronic pain in dogs, although larger studies are warranted to confirm efficacy and define optimal treatment intervals and potential side effects.

### References

Brown DC, Boston RC, Coyne JC, et al. (2008) Ability of the canine brief pain inventory to detect response to treatment in dogs with osteoarthritis. J Am Vet Med Assoc 233, 1278e1283.

Comparison of Tiletamine-Zolazepam-Propofol admixture with propofol alone for induction of anesthesia in healthy adult dogs: a pilot study

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Tiletamine-Zolazepam is commonly used for canine anesthesia induction. However, its application as co-induction agent remains sparsely documented [Fernandez-Parra et al. (2018), Hampton et al. (2019)]. This pilot study compared the induction characteristics of a 1:1 tiletamine-zolazepam-propofol (TZP) admixture (9 mg mL<sup>-1</sup>) versus propofol alone (10 mg mL<sup>-1</sup>).

Ten healthy adult dogs followed a randomized crossover design with a 14-day washout. Following IM premedication with acepromazine (0.05 mL kg<sup>-1</sup>), both treatments were administered IV via syringe driver (0.4 mL kg<sup>-1</sup> min<sup>-1</sup>). Duration of sequences, total amount of drug, physiological parameters and quality of endotracheal intubation, anaesthesia and awakening were recorded.

A marked reduction in propofol dose was observed in the TZP group  $(4.1\pm1.0~\text{mg kg}^{-1})$  compared to the propofol group  $(7.5\pm1.0~\text{mg kg}^{-1})$ . The TZP group exhibited a superior intubation quality (Figure 1), coupled by a reduced induction time (TZP:  $2.17\pm1.67~\text{min}$ , Propofol:  $3.00\pm1.02~\text{min}$ ). HR, MAP and fr remained higher in the TZP group. Both groups showed comparable decreases in body temperature and similar anesthetic depth, with time to sternal recumbency longer in TZP group (TZP:  $40.57\pm20.53~\text{minutes}$ ); Propofol:  $33.10\pm12.53~\text{minutes}$ ). Recovery quality (scored 0-3) was deemed favorable in both groups (TZP:  $0.68\pm0.24$ ; Propofol:  $0.54\pm0.26$ ).

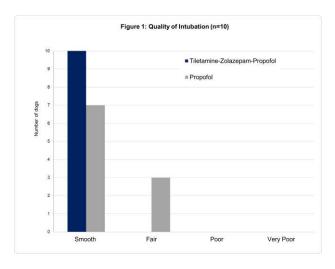
These findings suggest that the incorporation of tiletamine-zolazepam into a canine anaesthesia induction protocol may permit a reduction in the propofol dose, concurrent with enhanced intubation quality and attenuated cardiovascular depression compared to sole propofol administration. The clinical significance of these observations necessitates further investigation within a broader clinical context.

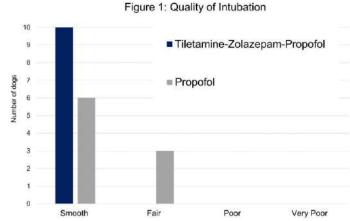
Figure 1: Quality of intubation Acknowledgements: The study was funded by Virbac.

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Fernandez-Parra R, Evangelista F, Hennet J et al. (2018) Comparison between admixture of ketamine-propofol or tiletamine-zolazepam-propofol: cardiorespiratory parameters, induction and recovery quality in healthy beagles, AVA Spring Meeting

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Evaluation of a Syndecan-1 ELISA for use in dog urine to investigate glycocalyx degradation following cardiopulmonary bypass in dogs.

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The endothelial glycocalyx, vital for health, is damaged by cardiopulmonary bypass (CPB) in children (Nussbaum et al., 2015). Urinary syndecan-1 is a marker of glycocalyx health (Ferrer et al., 2018).

Urinary syndecan-1 changes were investigated in client-owned dogs undergoing CPB for mitral valve repair (Oct 22-May 24). Following informed consent, samples were collected via urinary catheter (induction, T1, q2hr until recovery: T2, T3, T4), centrifuged, and supernatant frozen -80°C until analysis (Mar 25). Canine ELISA (MyBiosource) quantified urinary syndecan-1, assay range 100 ng mL<sup>-1</sup> – 1.56 ng mL<sup>-1</sup>. Urinary creatinine (µmol mL<sup>-1</sup>) was measured (Jaffe IDMS Traceable Method A) and syndecan-1/creatinine ratio calculated. Preliminary ELISA validation included dilutional parallelism, inter- and intra- assay variability (coefficient of variance, CV).

Twenty dogs were enrolled, yielding 77 samples (median 4/dog). Validation showed good intra-assay variability (n = 8; 3.06 ng mL<sup>-1</sup>, CV = 8.2%). Dilutional parallelism was poor (Table 1). Inter-assay highlighted one significant outlier (n = 8; 5.5 and 19.78 ng mL<sup>-1</sup>, CV = 77.6 and 74.9%). Clinical samples from the same dog were evaluated in duplicate on a single plate; 41 samples (53.2%) were below the limit of quantification (Table 2).

This ELISA demonstrates poor inter-assay variability, a matrix effect in the absence of prior extraction, and insufficient sensitivity to detect changes in urinary syndecan-1 following CPB in dogs.

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Nussbaum, C., Haberer, A., Tiefenthaller, A. et al 2015. Perturbation of the microvascular glycocalyx and perfusion in infants after cardiopulmonary bypass. J. Thorac. Cardiovasc. Surg. 150, 1474-1481.

Ferrer, N.M.B., Cavalcante, C.T. de M.B., Branco, K.M.C., et al 2018. Urinary Syndecan-1 and acute kidney injury after pediatric cardiac surgery. Clin. Chim. Acta 485, 205–209.

### **Tables**

Table 1

Dog	Sample	Dilution	Syndecan-1	Recovered
-	-	Factor	Concentration	(%)
			(ng/mL)	
1	1	0.5	5.94	100
	2	0.25	4.91	165.5
	3	0.125	3.87	260.9
2	1	0.5	21.00	100
	2	0.25	11.91	113.4
	3	0.125	8.22	156.5

Table 2

Sample	Time	Samples (n)	Quantifiable samples (n)	Median (IQR) Syndecan-1 (ng/mL)	Median Urinary Syndecan- 1/Creatinin e ratio	IQR Urinary Syndecan- 1/Creatinin e ratio
T1	Induction	20	0	-	-	-
T2	2hr	20	9	1.75 (1.52-2.78)	2.21	0.88-5.99
T3	4hr	20	15	2.31 (1.76-3.57)	3.70	2.58-5.47
T4	6hr	17	8	6.21 (3.31-10.65)	5.75	4.32-7.35

Comparison of bilateral cervical plexus block versus continuous rate infusion analgesia in dogs undergoing ventral slot surgery: a retrospective study

Teresa Mangas-Ballester<sup>1</sup>, Rocío Fernández-Parra<sup>2,3</sup>, Ariel Cañón-Pérez<sup>4</sup>, Jaime Viscasillas<sup>1</sup>

<sup>1</sup>Anaesthesia and Analgesia Service, AniCura Valencia Sur, 46460, Silla, Spain., <sup>2</sup>Department of Small Animal Medicine and Surgery, Faculty of Veterinary Medicine, Universidad Católica de Valencia San Vicente Martir, C/ de Guillem de Castro, 96, 46001, Valencia, Spain., <sup>3</sup>Veterinary Referral Hospital UCV, Universidad Católica de Valencia San Vicente Martir, Avenida de Pérez Galdós, 51, 46018Valencia, Spain, <sup>4</sup>Experimental Surgery Unit (ESU), Vall d'Hebron Institut de Recerca (VHIR), Vall d'Hebron, Hospital Universitari, Vall d'Hebron Barcelona Hospital Campus, Passeig Vall d'Hebron 119- 129, 08035 Barcelona, Spain

This retrospective study compared the analgesic efficacy of an ultrasound-guided bilateral cervical plexus block (BCPB) (Cañón-Pérez et al. 2024) versus the use of continuous rate infusion (CRI) in dogs undergoing ventral slot surgery. Objectives included assessing the need for intraoperative rescue analgesia (RA), the time from premedication to first RA (TP-RA) and the influence of lesion location—cranial or caudal to 5th cervical vertebrae—on RA.

The anaesthetic records of twenty-two dogs were included. The last anaesthetic records prior to the implementation of BCPB for these surgeries were selected for the CRI group. Eleven received BCPB with 0.25–0.33% bupivacaine (0.15–0.3 mL kg-1 site-1), and eleven received CRI of fentanyl, ketamine, lidocaine, or dexmedetomidine in various combinations. All dogs were premedicated with methadone; seventeen also received an  $\alpha$ 2-agonist. Anaesthesia was induced with propofol and ketamine and maintained with sevoflurane. RA was defined as intraoperative boluses of fentanyl and/or ketamine in response to nociceptive signs. Fisher's exact and Mann–Whitney U tests were used (p-value < 0.05 was considered significant).

No significant differences were found in weight, gender and premedication. RA was required in 7/11 (63.6%) dogs in the CRI group and 6/11 (54.5%) in the BCPB group, though the difference was not significant (p = 1). TP-RA was 200 (60-257 minutes) and 110 (76-140 minutes) for BPCB and CRI groups, respectively. The difference was not statistically significant (p-value = 0.055). Lesion location had a significant impact: 9/10 (90%) dogs with caudal lesions required RA versus 4/12 (33.3%) with cranial lesions (p-value = 0.001). When analyzed separately, this association remained significant in the CRI group (p-value = 0.003) but not in the BCPB group (p-value = 0.266).

The BCPB provides analgesia comparable to systemic CRI in these surgeries. Further studies are needed to define the potential advantages of the BCPB.

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Cañón Pérez A, Redondo García JI, Hernández Magaña EZ, et al (2024). A Novel Ultrasound-Guided Cervical Plexus Block: A Cadaveric Canine Study. Animals 14: 3094. https://doi.org/10.3390/ani14213094

Ultrasound- and CT-guided trigeminal neurolysis for palliative management of refractory oncologic pain in a dog

<u>Teresa Mangas-Ballester</u><sup>1</sup>, Paula Cortés-Barcelo<sup>1</sup>, Anna Meneses-García<sup>1</sup>, Carlos Gray-Jimena<sup>2</sup>, Iván Rodríguez-Armas 3, Jaime Viscasillas<sup>1</sup>,

<sup>1</sup>Anaesthesia and Analgesia Service, AniCura Valencia Sur, 46460, Silla, Spain., <sup>2</sup>Oncology Service, AniCura Valencia Sur, 46460, Silla, Spain, 3 Dignostic Imaging Service, AniCura Valencia Sur, 46460, Silla, Spain.

Oncologic pain is often difficult to manage, particularly in non-hospital settings. Although locoregional techniques are available, their duration of effect is frequently limited. Neurolytic procedures have been employed in both human and veterinary medicine to provide prolonged analgesia in cancer-related pain (Hjalmarsson et al., 2023; Koyyalagunta and Burton, 2010).

A 5-year-old, 25 kg castrated male mixed-breed dog was diagnosed with an aggressive maxillary fibrosarcoma. Following a left hemimaxillectomy, enucleation, and chemotherapy, local tumour recurrence was identified six months later. The dog was presented with severe pain, including anorexia, vocalization, and behavioral changes. Systemic analgesia consisting of NSAIDs failed to improve the patient's condition. To enhance quality of life, trigeminal nerve neurolysis was performed under general anaesthesia. The sphenoid complex was identified via ultrasound using the technique described by Viscasillas et al. (2017). Computed tomography (CT) was used to confirm the appropriate distribution of the neurolytic agent and to exclude intracranial migration (Figure). Chemodenervation was performed using a 5:1:1 mixture of 98% alcohol, 0.5% bupivacaine, and iohexol, respectively. To minimize potential side effects, the mixture was administered in 1 ml aliquots,, each followed by CT evaluation of its distribution. A total volume of 3 ml was delivered.

The patient was discharged the same day. A Spanish-translated version of the Ohio State University Quality of Life Scale was completed by the owners, comparing the two weeks before (27 points) and after the procedure (101 points). Owner feedback indicated a marked improvement in the dog's well-being.

This case illustrates that ultrasound- and CT-guided trigeminal neurolysis can be a safe, effective palliative option for managing intractable oncologic pain in dogs. No immediate complications were observed. Targeted neurolytic techniques may represent a valuable strategy to improve quality of life in canine patients with refractory pain.

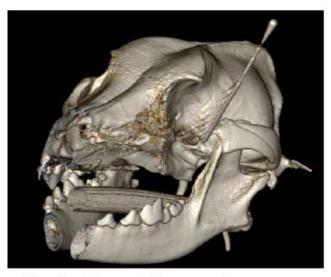


Figure: 3D reconstruction of the trigeminal neurolysis

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Minimum effective sedation dose of dexmedetomidine at GV20adj for radiographic examinations in cats.

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This study aimed to determine the minimum effective dose of dexmedetomidine, administered subcutaneously adjacent to the GV20 acupuncture point (SC-GV20adj), for feline radiographic examinations.

Eight adult cats (4 MC, 3 F, 1 FS;  $4.44 \pm 1$  kg) were enrolled in a prospective, randomized, blinded, crossover study. Each cat underwent three sedation episodes with SC dexmedetomidine at the GV20adj point (5, 10, 20  $\mu$ g kg<sup>-1</sup>; L, M, H groups). Sedation was scored using a modified 16-point Numerical Rating Scale. Sedation onset (SO) and level of sedation were assessed every 5 minutes, and suitability for three different radiographic views was determined. Radiographs began at 15 minutes, with monitoring extended to 30 minutes if sedation was insufficient. Sedation was reversed with atipamezole (100  $\mu$ g kg<sup>-1</sup> SC-GV20adj). Adverse events were recorded. Data were analyzed using two-way ANOVA and linear mixed models (p < 0.05).

Twenty-four sedation episodes (n = 8 cats, n = 3 each) were assessed. Adequate sedation to complete radiographic examinations occurred in 50% of cases (100%, 38%, 13% for H, M, L groups; p = 0.0021). Mean sedation onset were  $11 \pm 6$ ,  $15 \pm 9$ , and  $24 \pm 9$  minutes (H, M, L, respectively; H vs. L: p = 0.0020). NRS scores at onset were 12 (10–15), 12 (5–13), and 6 (4–13) (H, M, L, respectively; H vs. L: p = 0.0400). Vomiting occurred in 16 of 24 episodes. Previous studies using the SC-GV20adj route combined 10  $\mu g \ kg^{-1}$  with methadone (Solash et al. 2025) or butorphanol (Leclerc et al. 2023), may explain the low suitability (38%) with 10  $\mu g \ kg^{-1}$  of dexmedetomidine alone in our study. While 5  $\mu g \ kg^{-1}$  was insufficient, 20  $\mu g \ kg^{-1}$  provided reliable, profound sedation.

Thus, the minimum effective dose via SC-GV20adj for radiological examinations in cats was 20  $\mu g \ kg^{-1}$ .

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Fentanyl concentrations in plasma and colostrum of pregnant dogs following a single intravenous administration

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Premedication with opioids prior to caesarean section in dogs is desirable for analgesia, but pharmacokinetic data in pregnant bitches are limited (Navarro-Altuna et al., 2025). The study aims at exploring plasma and colostrum concentrations of the short-acting opioid fentanyl after IV administration.

Ethics committee approval was granted (Dnr 5.8.18 12021/2023). Animal owners provided written informed consent. Sixteen bitches undergoing caesarean section were premedicated with fentanyl 4  $\mu$ g kg<sup>-1</sup> IV over two minutes before induction with alfaxalone and maintenance with sevoflurane. Blood samples were collected immediately after fentanyl (T0) and after 2,5,10,15,20,25,30 and 35 minutes from a dedicated sampling catheter. Colostrum samples were collected once at the end of surgery (93  $\pm$  33 minutes after T0) from 14 bitches. Fentanyl concentrations were quantified using ultra-performance liquid chromatography coupled with tandem mass spectrometry (UPLC-MS/MS). Data were summarised using descriptive statistics (mean  $\pm$  SD).

The plasma concentration of fentanyl were  $6.2 \pm 3.6$  ng mL<sup>-1</sup> (T0),  $1.5 \pm 1.0$  ng mL<sup>-1</sup> (T2),  $1.1 \pm 0.3$  ng mL<sup>-1</sup> (T5),  $0.6 \pm 0.2$  ng mL<sup>-1</sup> (T10),  $0.4 \pm 0.2$  ng mL<sup>-1</sup> (T15),  $0.3 \pm 0.1$  ng mL<sup>-1</sup> (T20) and  $0.3 \pm 0.0$  ng mL<sup>-1</sup> (T25,T30 and T35). The concentration measured in colostrum was  $3.5 \pm 1.1$  ng mL<sup>-1</sup>.

The plasma concentration-time course of fentanyl indicates rapid distribution and elimination in anaesthetised pregnant bitches. At T5, plasma concentrations were equivalent to the lower range of the minimum effective plasma concentration for analgesia, while at T10, plasma concentrations were lower than the concentrations indicating provision of analgesia (0.95-2.00 ng mL<sup>-1</sup>) (Sano et al., 2006). The fentanyl concentration in colostrum might indicate accumulation or slower elimination compared to plasma. Considering potential oral or transmucosal absorption (Schmiedt et al., 2007), further studies are warranted to evaluate possible adverse effects on puppies.

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Effects of medetomidine or medetomidine-vatinoxan combined with fentanyl on propofol induction dose and mean arterial pressure in dogs anesthetized with isoflurane

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The aim of the study was to evaluate the selected cardiorespiratory variables and the propofol-sparing effect of medetomidine-fentanyl (MF) vs. medetomidine-vatinoxan-fentanyl (MVF) in isoflurane-anesthetized dogs.

A total of 80 dogs, ASA status I or II, aged 2-10 years, weighing 5-20 kg were included in this prospective blind randomized clinical study. For premedication, the dogs in the MF group (n = 40) received medetomidine 0.005 mg kg<sup>-1</sup>, the dogs in the MVF group (n = 40) received medetomidine (0.005 mg kg<sup>-1</sup>) and vatinoxan (0.1 mg kg<sup>-1</sup>). In dogs of both groups, fentanyl 0.01 mg kg<sup>-1</sup> intravenously followed by an infusion 0.01 mg kg<sup>-1</sup> hour<sup>-1</sup> was administered. Anesthesia was induced with propofol and maintained with isoflurane in oxygen-air. After induction (T0) and at ten minute intervals for 60 minutes (T10 – T60) HR, MAP, SpO2,  $f_R$ , Pe'CO<sub>2</sub>, esophageal temperature and dose of propofol for induction were recorded. The data were analyzed using Shapiro-Wilk and ANOVA tests (p < 0.05).

Dogs given MVF required a lower dose of propofol for induction  $(1.4\pm0.7 \text{ mg kg}_{-1})$  compared to MF group  $(1.8\pm0.7 \text{ mg kg}^{-1}, p=0.023)$ . At T0, HR was significantly higher in MVF group  $(80\pm21 \text{ beats minute}^{-1})$  compared to MF group  $(60\pm21 \text{ beats minute}^{-1}, p=0.025)$ . Dogs of MVF group had significantly lower MAP throughout the observation period with a higher incidence of hypotension (MAP < 60 mmHg; 52%) compared to MF group (7%, p < 0.001). At time T0 – T40 in MVF group, esophageal temperature was significantly lower. No other significant differences between groups were detected.

Premedication with medetomidine-vatinoxan-fentanyl provided a greater propofol-sparing effect compared to medetomidine-fentanyl. Combination of medetomidine-vatinoxan-fentanyl with isoflurane should be used with caution due to the high incidence of hypotension.

The study was supported by the Ministry of Education, Youth and Sports of the Czech Republic (Research Project IGA VETUNI No. 101/2025/FVL)

Incidence of bradycardia, hypotension, or bradycardia with hypotension in dogs undergoing fentanyl-propofol isoflurane or sufentanil-propofol-isoflurane anesthesia

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The aim of the study was to determine the incidence of bradycardia, hypotension, and bradycardia with hypotension in dogs undergoing general anesthesia provided by fentanyl-propofol-isoflurane or sufentanil-propofol-isoflurane.

A retrospective study was performed using anesthetic records from 130 dogs weighing 5 - 30 kg, aged 1 - 10 years undergoing general anesthesia. None of the dogs had bradycardia or hypotension before the anesthesia. For premedication, the dogs in the FEN-group (n = 65) received fentanyl 0.01 mg kg $^{-1}$  intravenously followed by an infusion 0.01 mg kg $^{-1}$  hour $^{-1}$  and the dogs in the SUF-group (n = 65) received sufentanil 0.001 mg kg $^{-1}$  intravenously followed by an infusion 0.001 mg kg $^{-1}$  hour $^{-1}$ . Anesthesia was induced with propofol and maintained with isoflurane in oxygen-air, dogs were mechanically ventilated. After induction and at 10 minute intervals for 60 minutes HR, MAP (oscillometric method), SpO $_2$ ,  $f_R$ , Pe'CO $_2$ , temperature, dose of propofol for induction and Felso were recorded. Bradycardia was defined as HR < 60 beats min $^{-1}$ , hypotension as MAP < 60 mmHg. The data were analyzed using Pearson's chi-square test, Shapiro-Wilk and ANOVA test (p < 0.05).

We did not detect a significant difference in the dose of propofol for induction or Felso for maintenance of anesthesia between the groups. In FEN-group 7 dogs (10.7%) developed bradycardia, 34 dogs (52.3%) hypotension, and 1 dog (1.5%) bradycardia with hypotension. In SUF-group 12 dogs (18.4%) developed bradycardia, 21 dogs (32.3%) hypotension, and 4 dogs (6.1%) bradycardia with hypotension. The incidence of bradycardia was not significantly different between groups. The incidence of hypotension was significantly higher in the FEN-group (p < 0.010) compared to the SUF-group.

Bradycardia occurs in dogs under general anesthesia using both fentanyl-propofol-isoflurane and sufentanil-propofol-isoflurane combinations. At the dosages used, the incidence of hypotension was higher in dogs receiving the combination of fentanyl-propofol-isoflurane, requiring caution.

Evaluation of firocoxib and pregabalin for the management of oncologic pain in dogs with oral neoplasms

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It is estimated that 43% of canine patients experience oncologic pain. Oral cavity tumors present unique anatomical and pathological characteristics with significant challenges for clinical management (Fan et al. 2014).

The objective of this study was to assess the efficacy of firocoxib and pregabalin in managing oncologic pain in canine patients with oral tumors, in a prospective, randomized, double-blinded, positively controlled trial. Patients (n = 20) were assigned to two groups: control group received firocoxib at 5 mg/kg once daily and a placebo capsule twice daily, while the treatment group received firocoxib at the same dose plus pregabalin at 4 mg/kg BID, for 21 days. Rescue analgesia with dipyrone (25 mg/kg) was permitted. Pain assessments were conducted on days 0, 7, 14, and 21. Caregivers used two validated scales: the Composite Oral and Maxillofacial Pain Scale (COPS-C/F) and the Canine Owner-Reported Quality of Life Questionnaire (CORQ) (Della Roca et al., 2019). The COPS-C/F also included a specific section for veterinary assessment. Blood samples were collected on days 0 and 21 for complete blood count and renal and hepatic function analysis.

Two dogs were euthanized before completing the study due to rapid disease progression. Statistical analysis using the Kruskal-Wallis test revealed no significant differences over time between groups for COPS-C/F caregiver assessments (control: p = 0.14; treatment: p = 0.11), COPS-C/F veterinary assessments (control: p = 0.29; treatment: p = 0.26), or CORQ scores (control: p = 0.15; treatment: p = 0.37). Treatment group exhibited a clinically relevant reduction of more than 30% in COPS-C/F pain scores (Farrar et al., 2001).

Although these findings were not statistically significant, a 30% decrease in pain scores suggests that the combination of firocoxib and pregabalin may be an option for managing cranial cancer pain in canine patients.

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### Perianesthetic analgesia management of brazilian anesthesists

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This is the first survey conducted on veterinarians perianesthetic analgesia practices in Brazil.

A questionnaire (CEP/UFRPE No. 4.670.086) containing 34 questions about analgesic and anesthetic management in dogs and cats was applied, with three biases considered: gender, region of practice (Southeast, Central-West, North, South, and Northeast), and length of professional experience (up to 5 years; between 6 and 10 years; up to 15 years; over 15 years of experience). Descriptive statistics were used for each question, followed by the Chi-square test or Fisher's exact test (p < 0.05) to verify associations between qualitative variables.

The response rate was 80% (418 out of 471 professionals completed all questions), and the participants were self-selected. There was a statistical difference among professionals from different regions regarding the use of meloxicam and dipyrone in the postoperative period, indicating higher usage in the Southeast and South compared to the North. Locoregional blocks (LRBs) use is more common among professionals who pursued academic enhancement, and the drugs mainly used for this purpose were lidocaine, bupivacaine, and morphine. Male specialists are more likely prone to use ultrasound. Regarding transanesthetic analgesia, CRIs with ketamine and dexmedetomidine are more frequently used by men. Postoperative pain assessments by more recently graduated professionals are based on clinical experience, and those without advanced training are more likely to neglect this assessment.

The study indicated that perianesthetic analgesia is satisfactory, as there is significant use of LRBs and equipment that enhances the procedure's effectiveness, along with CRI and postoperative medications.

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A randomised, blinded, prospective clinical trial comparing sedation scores in dogs following methadone and medetomidine administration at different sites: Intramuscular epaxial lumbar, intramuscular quadriceps, or subcutaneous Governing Vessel-20

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Subcutaneous injection is less painful than intramuscular injection (Gurney et al. 2009) but can have a less predictable effect and slower onset. However, subcutaneous injection of sedatives and analgesics at the Governing Vessel-20 (GV-20) may result in improved sedation and analgesia (Pons et al. 2017, Scallan et al. 2021).

Seventy-five dogs were premedicated with 5 mg m<sup>-2</sup> methadone and 500 µg m<sup>-2</sup> medetomidine. Route of administration was determined by random allocation: SC at GV20, IM quadriceps (IM-Q), or IM epaxial lumbar (IM-L) and sample size calculation indicated 25 dogs per group. Sedation was scored at 3-, 7- and 10-minutes post injection using a simple descriptive scale. The Kruskal-Wallis H test was used to determine any significant difference in sedation scores between groups. Post hoc pairwise comparison was carried out for significant results using a Dunn's test with Bonferroni correction.

Median sedation scores were 7 (2 – 15) for GV20 (n = 33), 8.5 (1 – 13) for IM-Q (n = 21) and 4 (0 - 13) for IM-L (n = 21) at 3 minutes; 13 (7 – 18) for GV-20, 15 (4 – 19) for IM-Q, and 11 (0 – 17) for IM-L at 7 minutes; and 16 (4 – 19) for GV-20, 16 (9 – 19) for IM-Q, and 13 (0 – 18) for IM-L at 10 minutes. Scores were different between IM-L and IM-Q (p = 0.009) at 3 minutes, IM-L and IM-Q (p = 0.008) and IM-L and GV-20 (p = 0.013) at 7 minutes, and GV-20 and IM-L (p = 0.028) at 10 minutes. Scores were similar between GV-20 and IM-Q. There was no difference in response to injection between groups (p = 0.207).

Sedation is more reliable following administration of methadone and medetomidine into the quadriceps compared with the lumbar muscles. Subcutaneous injection at GV-20 is a well-tolerated alternative to intramuscular sedation.

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### 4978

Volatile agent capture in dogs and cats following medetomidine-methadone-ketamine-isoflurane anaesthesia

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Isoflurane remains indispensable for the induction and maintenance of anaesthesia, however, its contribution towards climate change has been recognised (Romanello et al. 2023). Volatile capture is an emerging technology in human anaesthesia (Gandhi et al. 2024). One veterinary study identified an isoflurane capture efficiency of 65% using activated carbon (White et al. 2025).

During a prospective observational study, we evaluated the efficiency of a veterinary capture device for isoflurane (VET-can, SageTech Veterinary) in anaesthetised cats and dogs. Purposeful sampling at a charity practice was used to recruit enough animals undergoing general anaesthesia with isoflurane to fill one VET-can to capacity. The VET-can was positioned downstream of the anaesthetic breathing system (Circle system or Ayre's T piece with Jackson Rees modification) within the passive scavenging system. The vaporiser and VET-can were weighed pre- and post-anaesthesia to determine in vivo mass transfer (MT) of isoflurane and water. All animals were anaesthetised with medetomidine, methadone and ketamine and maintained with isoflurane in oxygen. Animals were continuously monitored with pulse oximetry, non-invasive blood pressure, capnography and agent end-tidal concentrations. At the end of the procedure, the vaporiser was turned off and the time recorded until FI'ISO and FE'ISO measured 0%. The primary outcome was capturing efficiency (isoflurane delivered: desorbed, %). The secondary outcomes were correlations (Spearman) between MT and patient characteristics and anaesthesia variables.

Thirty anaesthetics (21 cats, 9 dogs) over 1,705 minutes were required to fill the VET-can. There was an overall capture efficiency of 81% isoflurane and 4% water. The median MT including 4% water was 86% (57 - 101%). There were no significant relationships of MT with anaesthesia variables or patient characteristics.

The capture device prevented a mean release of 3.2 kgCO2e for each 20-minute anaesthetic period. The Vet-can technology is a promising carbon mitigation strategy and promises facilitation of isoflurane reuse.

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Comparison of peribulbar block with neosaxitoxin or bupivacaine on postoperative analgesia in dogs undergoing reconstructive keratoplasty: preliminary results

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Neosaxitoxin is a phycotoxin that has demonstrated long-lasting analgesic effects with minimal risk of systemic and local toxicity (Kohane et al. 2000, Cusick and Sayler 2013). The aim of this study was to compare the postoperative analgesic effects of a peribulbar block with neosaxitoxin or bupivacaine in dogs diagnosed with deep corneal ulcers undergoing reconstructive keratoplasty.

The anesthetic protocol included dexmedetomidine and methadone, propofol and isoflurane. Immediately after intubation, the dogs were randomly assigned to receive a peribulbar block with either neosaxitoxin (3.5  $\mu$ g diluted in 0.9% saline to a final volume of 0.2 mL kg-1; NeoSTX-G, n = 8) or 0.5% bupivacaine (0.2 mL kg-1; Bupi-G, n = 8). Subjective pain scores, corneal esthesiometry, and blepharospasm were assessed preoperatively and up to 24 hours post-extubation. Methadone (0.3 mg kg-1, IM) was administered as rescue analgesia if the pain scores totaled  $\geq$  9/21 or any categorical pain score was  $\geq$  3. The duration of analgesia (time between the peribulbar block and the first dose of rescue analgesia) was also recorded. Data were analyzed using unpaired t test, Fisher's exact test, the Mann-Whitney U test, and the Friedman test (p < 0.05).

Corneal esthesiometry, blepharospasm, and pain scores did not differ significantly between groups, except at 24 hours, when lower corneal sensitivity values were observed in the NeoSTX-G [1.5 (1-4.5 g mm-2)] compared to the Bupi-G [3 (2-4.5 g mm-2)] (p = 0.02). Rescue analgesia was required in 57% and 28.5% of the dogs in the Bupi-G and NeoSTX-G, respectively (p = 0.59). The duration of analgesia was longer in the NeoSTX-G compared to the Bupi-G ( $898 \pm 202 \text{ versus } 331 \pm 59 \text{ minutes}$ , p = 0.0028).

These preliminary findings suggest that peribulbar block with neosaxitoxin may be a viable option to prolonging analgesia following canine keratoplasty.

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Quadratus lumborum block in rabbits (Oryctolagus cuniculus): comparison after lidocaine, bupivacaine or lidocaine-bupivacaine administration.

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Ultrasound-guided quadratus lumborum block (QLB) is considered a safe procedure to generate abdominal analgesia, but information in rabbits is still scarce (Torres et al. 2023). The aim of this study was to determine the duration and caudal distribution of QLB, based on cutaneous dermatome mapping, comparing the administration of lidocaine, bupivacaine and lidocaine-bupivacaine combination.

A prospective, blinded randomized clinical study with a crossover design was conducted in 10 healthy rabbits, after owner consent, scheduled for general anesthesia for other purposes than this study. Each animal received three treatments with a washout time of one month among them. General anesthesia was performed with intravenous propofol and inhaled isoflurane in 100% oxygen. Animals were distributed into three groups: lidocaine 4 mg kg $^{-1}$  (LIDO), bupivacaine 4 mg kg $^{-1}$  (BUPI) and 2 mg kg $^{-1}$  lidocaine + 2 mg kg $^{-1}$  bupivacaine (LIDO-BUPI) using a final volume of 0.3 mL kg $^{-1}$  with Hartmann solution. The needle was introduced in-plane in ventro-dorsal approach under the thoracolumbar fascia of L1 transverse process. Dermatomes were determined by skin clamping technique. Data were evaluated with analysis of variance (p < 0.05).

No differences on block onset were observed among groups  $(10.3 \pm 2.1)$  minutes. Groups BUPI and LIDO-BUPI had higher time to maximum effect  $(114.7 \pm 44.1)$  and  $(108.0 \pm 31.9)$  respectively than LIDO  $(64.2 \pm 11.19)$  minutes. Block duration was shorter in LIDO  $(175 \pm 8.1)$  than BUPI  $(321.8 \pm 73.5)$  and LIDO-BUPI  $(373.0 \pm 57.6)$  minutes. The more frequent caudal distribution (21/30) was L1 - L5 in all treatments, although L1 - L6 was only observed in LIDO-BUPI (5/10) and BUPI (1/10). The L1 - L4 distribution was achieved only in LIDO (4/10). No signs of toxicity or ataxia were observed. The QLB, in all treatments, at the doses used, produced cutaneous abdominal desensitization in all rabbits.

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Torres L, Felisberto R, Economou, A et al. (2023) Ultrasound-Guided Dorsolateral Approach for Quadratus Lumborum Block in Rabbits (*Oryctolagus cuniculus*): A Prospective, Randomized, Blinded, Cadaveric Study Comparing Four Different Injectate Volumes. Animals, 13(16), 2559.

The effect of positive end-expiratory pressure (PEEP) on cardiorespiratory variables in healthy dogs undergoing elective ovariohysterectomy under two ventilation modes: preliminary results

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Positive end-expiratory pressure (PEEP) is often used to improve oxygenation during mechanical ventilation, yet its cardiovascular impact remains a concern.

Eighteen client-owned dogs undergoing elective ovariohysterectomy (dorsal recumbency) were prospectively enrolled in this study. All animals were premedicated with dexmedetomidine (120  $\mu$ g m<sup>-2</sup> IM) and tramadol (3 mg kg<sup>-1</sup> IM). Anaesthesia was induced with propofol to effect and maintained with isoflurane in 100% oxygen. The patients were randomly assigned to volume-controlled (group VCV, n=9) or pressure-controlled (group PCV, n=9) ventilation. A dorsal pedal artery and the pulmonary artery were catheterised. Cardiac output (CO), arterial oxygen content (CaO2) and delivery (DO2) were recorded at three timepoints corresponding to three PEEP levels (cmH2O): t20 (PEEP 0), t40 (PEEP 5), and t60 (PEEP 10), twenty, forty and sixty minutes after the initiation of mechanical ventilation, respectively. Data were analyzed using a general linear model for repeated measurements ( $\alpha$  < 0.05).

In group PCV, CO and DO2 decreased significantly from t40 to t60 while CaO2 increased significantly from t20 to t60. In VCV CaO2 decreased significantly in t40 and t60 compared to t20 (Table 1).

PEEP at 10 cmH20 in healthy dogs with PCV resulted in a reduction of CO and DO2, though oxygenation was improved.

		t20	t40	t60
СО	VCV	$1.78 \pm 0.44$	$1.84 \pm 0.36$	$1.80 \pm 0.43$
	PCV	$1.68 \pm 0.49$	$1.78 \pm 0.50^{a}$	$1.50 \pm 0.43^{a}$
CaO <sub>2</sub>	VCV	$17.61 \pm 2.52^{\text{b,c}}$	$16.70 \pm 1.80^{\mathbf{b}}$	$16.38 \pm 1.79^{\circ}$
	PCV	$16.59 \pm 2.01^{d}$	$17.10 \pm 2.22$	17.26 ± 1.91 <sup>d</sup>
$DO_2$	VCV	$30.93 \pm 5.98$	$30.73 \pm 6.19$	$29.14 \pm 8.08$
	PCV	$28.09 \pm 8.5$	$30.75 \pm 9.59^{e}$	$25.71 \pm 6.78^{e}$

Table 1. Mean  $\pm$  SD of CO (L/min), CaO2 (mL O<sub>2</sub>/dL), and DO2 (ml O2/min) in each group and timepoint. Same superscript indicates statistically significant difference in this pairwise comparison.

### 5048

Propofol requirements for induction of anesthesia in dogs with cervical or thoracolumbar myelopathy

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This retrospective study aimed to compare propofol requirements for induction of anesthesia in dogs diagnosed with either thoracolumbar or cervical focal myelopathy.

The anesthetic records of dogs with either cervical or thoracolumbar myelopathy anesthetized for diagnostic or surgical procedures from September 2021 to July 2024 were evaluated. Inclusion criteria were premedication with the same dose of dexmedetomidine (180  $\mu$ g m<sup>-2</sup>), and induction with propofol. The sedation scores and the total propofol dose required for intubation were extracted. Data were analysed with the Mann-Whitney test, the t-test, and the Pearson correlation test. A value of p < 0.05 was considered statistically significant.

Sixty anesthetic records were included in the study, 29 dogs with cervical and 31 with thoracolumbar myelopathy. Statistically significantly higher doses of propofol were required in the dogs with cervical (median 3.2 mg kg $^{-1}$ , range 1.5 - 7 mg kg $^{-1}$ ) than with thoracolumbar (1.9 mg kg $^{-1}$ , range 1 - 4 mg kg $^{-1}$ ) myelopathy (Mann-Whitney test, p < 0.0005). The sedation score in the dogs with cervical (mean 5.9, SD 1.9) also differed statistically significantly from the sedation score of the dogs with thoracolumbar (mean 7.4, SD 2.8) myelopathy (t-test, p = 0.02). Propofol dose and sedation score were significantly negatively correlated (Pearson's correlation coefficient - 0.333, p = 0.009).

Our findings suggest that propofol requirements are higher in dogs with cervical compared to those with thoracolumbar focal myelopathy. This should be considered when planning anesthetic protocols in order to optimize safety in these patients.

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Breed-specific anaesthetic mortality in dogs: Evidence from an analysis of 55,022 cases

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The objective of this study was to evaluate the breed's influence on anaesthetic mortality in dogs.

This multicentric cohort study evaluated 55,022 dogs undergoing anaesthesia, focusing on deaths directly linked to anaesthesia from premedication to 48 hours post-extubation. Dogs that were euthanised or died from medical or surgical complications were excluded. Data were analysed according to breed, Fédération Cynologique Internationale (FCI) groups and sections, MDR1 mutation status, and brachycephalic conformation, with mixed-breed dogs serving as a reference for statistical comparisons using a chi-square test (p < 0.05).

The overall anaesthetic mortality rate was 0.69%. In mixed-breed dogs, the mortality rate was 0.68% (deaths/number of cases: 109/16,107). Yorkshire Terriers (29/3,155; 0.9%, p = 0.174), Labrador Retrievers (14/2,727; 0.5%, p = 0.395), French Bulldogs (15/2,619; 0.6%, p = 0.632), Ibizan Hounds (20/2,372; 0.8%, p = 0.437), Poodles (12/1,840; 0.7%, p = 1.000), Golden Retrievers (10/1,477; 0.7%, p = 1.000), Dachshunds (4/1,188; 0.3%, p = 0.224), Maltese (4/1,162; 0.3%, p = 0.242), Boxers (5/1,138; 0.4%, p = 0.444), Beagles (6/1,121; 0.5%, p = 0.709) and English Cocker Spaniels (4/1,095; 0.4%, p = 0.298) showed no significant differences. In contrast, Chihuahuas (16/1,182; 1.4%, p = 0.013) and German Shepherd Dogs (17/1,163; 1.5%, p = 0.004) exhibited significantly higher mortality rates than mixed breeds. Analysis by FCI groups and sections revealed uniform survival rates, except for the Chihuahueno section. Comparisons by MDR1 mutation status (YES: 0.71% vs. NO: 0.70%; p = 1.000) showed no differences. However, brachycephalic breeds had increased mortality rates (YES: 0.82% vs. NO: 0.66%; p = 0.046).

Breed significantly influences anaesthetic mortality in dogs. Chihuahuas, German Shepherds, and brachycephalic dogs have a higher risk than mixed breeds. These findings support the development of breed-specific anaesthetic protocols and highlight the need for further research into the factors driving these differences.

Current attitudes towards the use of analgesics and painful interventions in small animals by Mexican veterinarians

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The aim of this study was to determine attitudes towards the use of analgesics and painful interventions in small animals by Mexican veterinarians, as no published information on this topic exists in Mexico.

A prospective online survey was distributed (April - December 2022) to associations of veterinary practitioners and organizers of veterinary meetings throughout Mexico. A survey link and QR code were provided. The survey consisted of four sections: 1) demographic data, 2) use of analgesics, 3) attitudes to painful interventions, and 4) continuing education. Descriptive statistics including frequency analysis and Chi-square test (p < 0.05) were used.

The survey was opened by 1,827 participants, of whom 280 completed it (15.32% response rate). 50% were women and 50% men. The most commonly used analgesics were nonsteroidal anti-inflammatory drugs (80.7%), steroids (71.6%), opioids (68.3%), local anesthetics (68%), ketamine (67%), and alpha-2 agonists (64%). Fewer than 5% used other analgesics, including gabapentinoids or cannabinoids. The most commonly used opioid was tramadol (68.3%), followed by buprenorphine (49.7%), and pure mu agonists (18%). For surgery-related pain, similar percentages used analgesics pre-operatively (81%) and post-operatively (83%). Veterinarians considered general abdominal surgeries to be painful interventions (40% to 65% participants) and orthopedic surgeries to be very painful (79% to 86%). In contrast, some (1.3% to 3.3%) considered orchiectomy not painful. All veterinarians considered continuing education important, though 27.4% reported difficulties accessing it. Regional workshops (99%) and lectures (87.5%) were the most important sources of knowledge. All participants treated pain, but few used pure mu opioids, even for very painful interventions. Lack of availability and fear of regulations were the most commonly reported barriers.

Continuing education programs are needed to train practitioners in the use of alternative drugs and analgesic techniques for treating painful interventions in Mexico, given the limited access to pure mu opioids.

Delayed motor recovery following propofol induction compared to alfaxalone in a cat with spinal disease

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Both alfaxalone and propofol act as allosteric modulators of the GABAA receptor, although their pharmacological profiles differ slightly (Warne et al. 2015). This case report describes suspicion of delayed recovery of motor function due to induction with propofol in a cat with spinal disease compared with alfaxalone.

The patient was a 10-year-old neutered male cat weighing 5.5 kg, presenting with an intramedullary spinal mass lesion (suspected sarcoma or glioma) at the T13–L1 level. Volumetric arc radiotherapy (VMAT) was performed under general anaesthesia across 15 daily treatments. At the beginning of the VMAT course, the cat's clinical symptoms included bilateral hindlimb paresis but remained ambulatory. Gabapentin (18 mg kg $^{-1}$ ) was orally administered 2-3 hours before induction, which consisted of either intravenous propofol or alfaxalone, and maintenance with isoflurane (End-tidal concentration between 0.5-1.1%). Propofol (7.05  $\pm$  0.35 mg kg $^{-1}$ ) was used in treatments 1, 3, 7, and 14; alfaxalone (3.40  $\pm$  0.76 mg kg $^{-1}$ ) was used in all others.

In treatments 1 and 3, where propofol was used for induction, the time to regain hindlimb standing was estimated at 120-240 minutes based on clinical impression, appearing delayed compared to alfaxalone. To explore this, gait was video-recorded at 30 and 60 minutes post-extubation in treatments 7 (propofol; 7.0 mg kg<sup>-1</sup>) and 8 (alfaxalone; 3.4 mg kg<sup>-1</sup>). In treatment 7, the patient could not stand at 60 minutes, whereas in treatment 8, standing was possible. Continued observations suggested slower motor recovery with propofol. In treatment 14 (propofol; 7.5 mg kg<sup>-1</sup>), the patient stood at 45 minutes, and no difference was noted compared to treatment 13 (alfaxalone; 3.0 mg kg<sup>-1</sup>).

This observation suggests that anaesthesia induction with alfaxalone may promote earlier motor function recovery in feline patients with spinal disease when compared with propofol.

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Retrograde placement of an intrathecal catheter using a lumbar L4-L5 approach in a kitten

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Epidural catheter placement is a well-established analgesic technique, more commonly performed in dogs than in cats (Hasen 2001). When cranial advancement is not feasible, a retrograde approach has been described in dogs (Raillard et al. 2016). Accidental subarachnoid catheter placement has been reported in dogs (Shippy et al. 2021).

A 4-month-old, 2.3 kg male European Shorthair cat was referred after a car accident. Bloodwork and abdominal ultrasonography were unremarkable. The patient presented severe dorsolumbar soft tissue defect and urethral laceration. Radiographs revealed bilateral femoral head and multiple pelvic fractures. Computed tomography was excluded by financial constraints. Hospitalization included methadone (0.2 mg kg<sup>-1</sup> IV) and meloxicam (0.05 mg kg<sup>-1</sup> SC). Surgical debridement and prepubic urethrostomy were planned. For perioperative and postoperative analgesia, under general anaesthesia, a 24G epidural catheter was placed at L4-L5, where the skin was intact. Under radiographic guidance, the patient was positioned in lateral recumbency, and a 20G Tuohy needle (bevel caudally) was inserted. Epidural access was confirmed via the hanging drop and loss-of-resistance techniques. A prefilled catheter with lohexol was advanced smoothly and additional 0.2mL contrast was injected. Radiographs revealed the catheter tip at L7 with contrast spreading to L2. Continuous dorsal and ventral contrast columns were consistent with subarachnoid placement. Epidural contrast contamination and air bubbles were likely due to loss-of-resistance technique (Figure).

Due to technical constraints, the catheter remained intrathecally. Analgesia was maintained with 0.25% bupivacaine (0.05 mL kg<sup>-1</sup>) every 4 hours. The Glasgow pain score improved from 8/20 to 3/20, allowing systemic analgesia reduction to buprenorphine (0.01 mg kg<sup>-1</sup>). The catheter remained in place for six days without complications.

Retrograde catheter placement is feasible in cats, offering an option when the conventional approach is impractical. However, there is a risk of subarachnoid placement in cats.

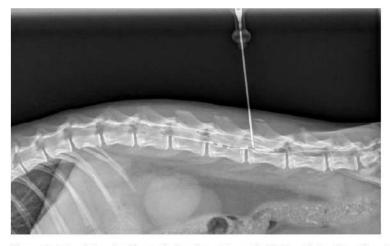


Figure 1: Laterolateral radiograph showing retrograde L4-L5 catheter insertion. Subarachnoid contrast columns, epidural contamination and air bubbles are visible.

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Incidence of emesis induced by low–dose intravenous administration of medetomidine in dogs: A retrospective study of 158 cases (2019-2024)

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Medetomidine induces emesis in dogs with a reported incidence of 8.8-33.3 %. However, prior studies predominantly used intramuscular doses of  $\geq 30 \, \mu g \, kg^{-1}$ . This study aimed to determine the incidence of emesis in dogs receiving a lower dose of intravenous medetomidine.

Anesthetic records of dogs received  $\leq 5~\mu g~kg^{-1}$  medetomidine intravenously before or after  $\leq 5~\mu g~kg^{-1}$  fentanyl before anesthesia induction from January 2019 to December 2024 were evaluated retrospectively. Data collected included demographics, dose of medetomidine and fentanyl, administration order, emesis, retching, sialorrhea, and lip licking within 5 minutes after administration. Cases with diagnosed or suspected gastrointestinal or emetic disorders were excluded.

A total of 158 cases met the inclusion criteria, of which 44 dogs were administered in the order fentanyl—medetomidine (FM), and 111 dogs were administered in the order medetomidine—fentanyl (MF). Dogs were [median (range)] 99 (5–219) months old, weighed 8.8 (1.4–80.2) kg, Body Condition Score 3 (3–9), and American Society of Anesthesiologists—Physical Status class 2 (1–3). Administered doses of medetomidine were 3.0 (0.5–5) and fentanyl 3.0 (2–5)  $\mu$ g kg<sup>-1</sup>. No statistical differences were found in these demographic parameters between the FM and MF groups. Incidence of emesis was 2 of 158 cases (1.3 %). Incidence of retching, sialorrhea, and lip licking was 1, 1, and 4 cases (0.63, 0.63, and 2.5 %), respectively. There were no statistical differences in these emetic signs between the FM and MF groups although both 2 cases of emesis were recorded only in the MF.

Results indicated that the incidence of emesis induced by  $\leq 5 \,\mu g \, kg^{-1}$  medetomidine intravenous administration was lower than that of previous reports investigated with the higher dose administration. In this study, fentanyl administration before medetomidine did not affect the incidence of emesis.

Impact of cephalic conformation on inhaled futicasone and salbutamol deposition in dogs: a computational study

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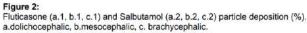
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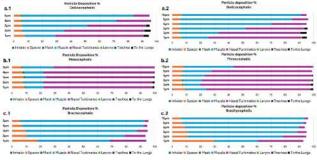
This *in-silico* descriptive study evaluates aerosol particle distribution and transport in dogs with different cephalic indexes, analysing the influence of airway morphology and particle size on drug delivery efficiency.

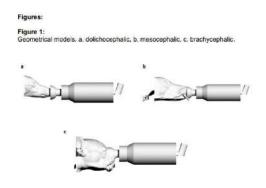
Computational fluid dynamics simulations were performed on geometric reconstructions of the upper airway and trachea from three healthy, client-owned dogs: a Whippet (dolichocephalic), a Malinois (mesocephalic), and a French Bulldog (brachycephalic). A 10 cm spacer with a spherical mask was adapted to each model (Figure 1). Analysis was conducted using Ansys CFX (Ansys Inc., Canonsburg, PA, USA) software, with a peak inspiratory flow of 1.125 L kg-1 min-1 (Rozanski et al. 1994) for the dolichocephalic and mesocephalic dogs, and 0.83 L kg-1 min-1 (Bernaerts et al. 2010) for the brachycephalic dog.

Simulations showed that particles primarily deposited in the device, muzzle, and nasal turbinates (Figure 2). Following a single inhalation, 0.84 [0.20-1.40] % and 1.17 [0-4.65] % of all particles reached the lungs in the dolichocephalic dog, 2.24 [0-4.45] % and 0.86 [0.05-1.85] % in the mesocephalic, for fluticasone and salbutamol respectly. In brachycephalic dogs, no particle reached the lungs, for either medication. The complex upper airway anatomy of brachycephalic dogs predisposes them to significant drug loss before reaching the bronchi.

These findings align with previous experimental studies in mesocephalic dogs, where 2.3±1.4% reached the lower respiratory tract of fluticasone (Chow et al. 2017), comparable to 1.97±1.4% of salbutamol in infants and children in radiolabeled studies. Optimizing inhalation protocols considering cephalic conformation is essential to improving drug delivery and therapeutic outcomes in canine respiratory emergencies and disease management.







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Evaluation of 2 mg kg<sup>-1</sup> Sugammadex for the Reversal of Moderate Rocuronium-induced Neuromuscular Blockade in Dogs

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Sugammadex reverses rocuronium-induced neuromuscular blockade (NMB) more rapidly than acetylcholinesterase inhibitors, yet its veterinary use remains limited. This study evaluated 2 mg kg<sup>-1</sup> sugammadex for reversing moderate rocuronium-induced NMB in dogs.

Twelve healthy adult client-owned dogs underwent the experiment preceding their elective surgery on the same day. Dogs were allocated to control (spontaneous recovery) or reversal (2 mg kg $^{-1}$  sugammadex) groups. Moderate NMB was defined as train-of-four (TOF) count = 1-3. Neuromuscular monitoring used acceleromyography in TOF mode, securing hindlimbs with a vacuum pillow, which allowed hock movement; 15 g preload applied if TOF ratio (TOFR) inconsistent. Recovery of NMB was defined as normalized TOFR  $\geq$  0.9. Following propofol induction without premedication and isoflurane maintenance ( $\geq$  60 min), rocuronium 0.6 mg kg $^{-1}$  IV was given. Sugammadex was administered at first twitch (T1) return, with monitoring for 60 minutes post-NMB recovery. Recovery time was defined as T1 reappearance to normalized TOFR  $\geq$  0.9; recurarization was defined as TOFR < 0.9 after initial recovery. HR, SpO2, blood pressure, body temperature, and blood gas variables were recorded. Data are presented as median (range). Statistical comparisons used Mann–Whitney U, Fisher's exact, or two-way repeated-measures ANOVA. P < 0.05 was considered significant.

Total experiment duration was 223 (169-319) minutes. Recovery time was significantly shorter in the reversal group at 1.3 (0.8-3.0) minutes, compared to 18.6 (12.3-35.5) minutes in the control group. Time from TOF count = 0 after rocuronium administration to T1 reappearance was 24 (15.0-40.3) minutes in controls and 22.6 (21.3-27.8) minutes in reversals, with no significant difference. No recurarization was detected. Physiological and blood gas values remained within normal limits for isoflurane-anesthetized dogs, without significant differences.

In conclusion, 2 mg kg<sup>-1</sup> sugammadex effectively and rapidly reversed moderate rocuronium-induced NMB in dogs, with no evidence of recurarization during the 60-minute observation period.

Evaluation of the safety, tolerance, effective dose, and immunogenicity of a vaccine for the treatment of chronic osteoarticular pain

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Xep01 is an innovative developmental immunotherapy based on the recombinant fusion immunogen rNGFSP, designed to elicit antibodies against endogenous Nerve Growth Factor (NGF) and Substance P (SP), two key mediators of pain and inflammation in canine osteoarthritis (OA). This study evaluated its safety, tolerability, effective dose, and immunogenicity in healthy dogs.

Thirty healthy, mixed-breed shelter dogs (mean age 3.2 ± 1.6 years; mean weight 21.8 ± 6.9 kg; 57% male) were randomly assigned into five groups: four vaccinated with escalating antigen doses (10, 50, 100 µg) and two adjuvant concentrations (1% and 0.5% Montanide™ Gel 01), and one control group receiving excipient. All animals received a priming dose followed by three subcutaneous booster vaccinations every two weeks. Ethical approval was granted (CEUA-UdelaR #1649). Safety monitoring included serial clinical exams and hematological, biochemical, and coagulation analyses through day 56. Immunogenicity was assessed by ELISA measuring IgG titers against rNGFSP, native NGF, and SP.

No moderate or severe systemic adverse effects were observed. Clinical parameters, body weight, and behavior remained stable. Mild, transient subcutaneous indurations (1–3 cm) occurred in 34% of vaccine events in the 100  $\mu$ g/1% group but resolved within 14 days. The 100  $\mu$ g/0.5% group showed no reactions> cm. All vaccinated groups seroconverted, with anti-rNGFSP IgG titers peaking at 1:24,000 in the 100  $\mu$ g/1% group. Cross-reactive IgG titers against NGF and SP reached 1:8000 and 1:1200, respectively, in the 100  $\mu$ g/0.5% group, with seroconversion rates of 85% (NGF) and 73% (SP).

These findings support the safety and immunogenic potential of Xep01, justifying further clinical development as a novel therapeutic class for OA pain.

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Two-point rectus sheath block technique results in more extensive dye spread in the abdominal wall than one-point technique in dog cadavers

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Some abdominal fascial plane blocks described in the literature have a more significant spread when a multiple-point technique is used. The goal of this study was to develop a two-point ultrasound-guided rectus sheath block (RSB2) and compare it to the currently described single-point technique (RSB) in dogs.

This prospective study used eight dog cadavers. Each dog received both techniques (RSB and RSB2) assigned randomly to right or left hemiabdomen. Equal volumes of methylene blue were used per hemiabdomen (RSB - 0.5 mL kg-1 and RSB2 0.25 mL kg-1 per injection site with a total of 0.5 mL kg-1). For RSB2, a cranial injection was performed by placing the transducer parallel with the costal arch. For the caudal injection, the transducer was placed in transverse orientation like RSB, but 2 cm caudal to umbilicus (as opposed to 1 cm cranial to the umbilicus - RSB). Dissections were performed to assess the extent of dye spread with each technique. Normality was assessed using the Shapiro-Wilk test, and data was confirmed to be nonparametric, so Mann-Whitney test was used.

More ventral branches of spinal nerves were stained in the RSB2 compared to RSB (6 [5 - 7] and 4.5 [4 - 6], respectively; p = 0.023). The greater dye distribution in the RSB2 was preferentially cranial to umbilicus. The incidence of specific thoracic (T) and lumbar (L) nerves staining following RSB and RSB2 techniques were respectively: T9 (12.5% and 25%), T10 (25% and 75%), T11 (50% and 100%), T12 (100% and 100%), T13 (100% and 100%), L1 (100% and 100%), L2 (87.5% and 75%) and L3 (0% and 25%).

The RSB2 resulted in more extensive abdominal dye spread, especially cranially; and overall, a greater number of nerves stained when compared to RSB using the same total volume of injectate.

Comparison of unilateral versus bilateral erector spinae plane block for intraoperative antinociceptive effect in dogs undergoing hemilaminectomy: a prospective randomized clinical trial

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The erector spinae plane block (ESPB) has recently gained interest for dogs undergoing hemilaminectomy (Portela et al. 2020, Bendinelli et al 2024). It appears that the cutaneous and spinal nerves cross or communicate across the midline (Capek S et al. 2015). This study compares the intraoperative efficacy of unilateral versus bilateral ESPB in controlling nociception in dogs undergoing thoracolumbar hemilaminectomy (ECAE 15/CESA/2024).

Healthy dogs were randomly assigned to receive either unilateral (group UNI, n = 18) or bilateral (group BIL, n = 18) ESPB. Dogs received methadone (0.1 mg kg-1) intramuscularly (IM), intravenous propofol to effect and isoflurane in oxygen. Dogs were mechanical ventilated to maintain end-tidal isoflurane concentration between 1.2% and 1.3% and end-tidal carbon dioxide partial pressure (PÉCO2) between 35 and 45 mmHg. Heart rate (HR), invasive arterial blood pressure (IABP), respiratory rate were monitored. Nociceptive event was defined as an increase in HR and/or APB of 20%. Intraoperative nociception was treated with fentanyl bolus (1  $\mu$ g kg-1) IV, if another nociception treatment was necessary fentanyl bolus followed by 3  $\mu$ g kg-1 h-1 constant rate infusion IV was administered. Anaesthesia time, intraoperative complication (bradycardia and/or hypotension), surgery time, incidence of nociceptive events and cumulative dose of fentanyl were recorded and compared between groups. A Student's t test was used to compare data between groups.

No differences were detected between groups regarding duration of surgery (p = 0.26), anaesthesia time (p = 0.93). There were no intraoperative complications in both groups. The intraoperative fentanyl requirement (p = 0.63) and total fentanyl consumption (p = 0.70) were not different between groups.

In dogs receiving methadone-propofol-isoflurane and unilateral or bilateral ESPB, no differences were observed regarding intraoperative requirements for rescue analgesia during hemilaminectomy. Unilateral ESPB might be a valuable option.

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Intraperitoneal nebulization of ropivacaine 1% for perioperative analgesia in dogs undergoing laparoscopic ovariectomy: a randomised clinical tria

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The instillation of intraperitoneal local anesthetics (IPLA) reduces pain and perioperative opioid consumption in both human and veterinary patients (Lambertini et al. 2018; Dai et al. 2022). Clinical trials in humans have demonstrated the advantages of nebulization techniques over traditional IPLA instillation (Ingelmo et al. 2010). This study evaluates the perioperative and postoperative efficacy of intraperitoneal nebulization of ropivacaine using the Aeroneb Pro® device for pain relief in dogs undergoing laparoscopic ovariectomy.

Thirty-two healthy dogs were randomly assigned to receive either 3 mg kg $^{-1}$  intraperitoneal ropivacaine 1% nebulization (group ROPI, n = 16) or no treatment (group CNTR, n = 16). Anesthesia was induced with fentanyl (5 µg kg $^{-1}$  intravenously IV), propofol IV to effect, and maintained with isoflurane in oxygen. Ropivacaine was nebulized via the laparoscopic port at the start of pneumoperitoneum. Intraoperative nociception was managed with additional fentanyl (1 µg kg $^{-1}$  IV), and the incidence of nociceptive events along with cumulative fentanyl dose were recorded. Postoperative pain was assessed using the short form of the Glasgow Composite Pain Scale (SF-GCPS), and rescue analgesia was administered with meloxicam (0.2 mg kg $^{-1}$  subcutaneously) and methadone (0.2 mg kg $^{-1}$  intramuscularly) as needed. Data were analyzed using Student's t-test or Mann-Whitney test.

No differences were found between groups in surgery duration (p = 0.16), pneumoperitoneum duration (p = 0.17), or intraoperative fentanyl use (p = 0.34). Pain scores were significantly higher in the CNTR group during the first 3 hours postoperatively (p < 0.001), and all dogs required rescue analgesia, instead only 6.3% of dogs in the ROPI group needed postoperative rescue treatment.

Intraperitoneal nebulization of ropivacaine provided effective postoperative analgesia in dogs undergoing laparoscopic ovariectomy, resulting in lower pain score and less rescue analgesia administration compared to the control group.

Dynamic changes in the arterial partial pressure of carbon dioxide—end-tidal carbon dioxide gradients and cardiopulmonary variables during canine laparoscopic surgery

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Laparoscopic surgery requires careful anesthesia due to capnoperitoneum (Srivastava et al., 2010). This study evaluated the difference between arterial partial pressure of carbon dioxide ( $PaCO_2$ ) and end-tidal carbon dioxide ( $ETCO_2$ ) before and after capnoperitoneum, assessing  $ETCO_2$ 's utility.

Eight healthy female mongrel dogs underwent laparoscopic-assisted ovariectomy, ovariohysterectomy, or gastropexy. Anesthesia was induced with intravenous propofol and maintained with isoflurane in oxygen (40 mL kg $^{-1}$  min $^{-1}$ ). Pressure-controlled ventilation maintained ETCO $_2$  between 35–50 mmHg. Dexmedetomidine (10 µg kg $^{-1}$ , intramuscular) was administered for analgesia. Fentanyl (0.5-1 µg kg $^{-1}$ , intravenous bolus or constant rate infusion) was given when heart rate or blood pressure exceeded baseline by 20%. Robenacoxib (2 mg kg $^{-1}$ , subcutaneous) was administered prior to recovery. Arterial blood samples from the dorsal pedal artery and corresponding mainstream ETCO $_2$  values were collected at five time points: baseline (T0), 15 minutes after dexmedetomidine (T0dex), 10 and 40 minutes after capnoperitoneum (T1, T2), and 10 minutes post-deflation (Tend). Cardiopulmonary variables were recorded every 5 minutes. Due to small sample size and non-parametric distribution, results are presented as medians with interquartile ranges. PaCO $_2$ , ETCO $_2$ , and their gradients were analyzed using the Wilcoxon signed-rank test. Agreement between PaCO $_2$  and ETCO $_2$  was assessed via Bland-Altman analysis with non-parametric limits of agreement.

The  $PaCO_2$ –ETCO<sub>2</sub> gradient significantly increased at T1, T2, and Tend compared to T0, rising from -0.5 (-4.75 - 3.75) mmHg to 3 (-1.75 - 5.75) mmHg, 4.5 (2.5 - 6) mmHg, and 4 (1.25 - 6) mmHg, respectively. The mean bias between  $PaCO_2$  and ETCO<sub>2</sub> increased over time, while the limits of agreement remained approximately consistent across time points.

Between T1 and T2, the increasing bias indicates that  $ETCO_2$  may underestimate  $PaCO_2$ . However, the discrepancy remained within acceptable limits, suggesting  $ETCO_2$  may be useful for trend monitoring during short-term laparoscopic procedures in healthy dogs. Further studies are required to determine its reliability as a direct substitute for  $PaCO_2$ .

Use of tranexamic acid in dogs undergoing corrective osteotomy surgery

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The use of an antifibrinolytic drug, such as tranexamic acid, can minimize blood loss during surgery, as it is an adjunct in bleeding control. This drug is widely used in human orthopedic surgery with a high degree of bleeding (more than 500 mL) which often requires blood transfusion. The aim of this study was to evaluate the effectiveness of tranexamic acid in dogs undergoing surgery with great potential of blood loss.

Twenty-one animals with ruptured cruciate ligament or patellar luxation, undergoing corrective osteotomy under general and local anesthesia, were divided in two groups. The first group received tranexamic acid as a bolus, at the time of induction, at a dose of  $10 \text{ mg kg}^{-1}$  followed by continuous infusion at the rate of  $1 \text{ mg kg}^{-1}$  hour  $^{-1}$  (GAT). The second group received saline solution 0.9% in a corresponding volume (GSS). Estimation of blood loss was made by weighing surgical drapes and gauzes when dry and then when soaked in blood. Serum lactate and fibrinogen, coagulation times (prolonged activated partial thromboplastin time - aPTT - and prothrombin time - PT), blood count and blood gas analysis were registered at three specific moments during the procedure: TB (baseline), T1 (1 hour after anesthesia induction) and T2 (immediately before the end of procedure). Statistical analysis was performed by ANOVA for repeated measurements, followed by Tukey and t-Student's test; values with p < 0.05 were considered significant.

There were no statistical difference between groups regarding any of the parameters, including blood loss measures (table 1). GAT presented a blood loss of  $8.35 \pm 5.03$  mL kg<sup>-1</sup> and GSS  $7.99 \pm 4.3$  mL kg<sup>-1</sup> (p = 0.77).

Therefore, tranexamic acid was not effective in reducing blood losses in dogs undergoing corrective osteotomies.

Table 1 – Blood loss values in total volume (mL), percentage of patient's weight (%) and relation to patient's weight (mL kg<sup>-1</sup>) from the groups studied during corrective osteotomies in dogs (n = 21) (mean ± SD)

Group	Group Volume (mL)		Relation (mL kg -1)
GAT	320,85 ± 184,22	0,89 ± 0,50	8,35 ± 5,03
GSS	309, 45 ± 182,10	0,83 ± 0,43	7,99 ± 4,3

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Anesthetic management and perioperative complications in dogs undergoing transvenous pacemaker implantation: A retrospective study

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Transvenous pacemaker implantation in dogs requires specialized anesthetic management due to underlying cardiac disease and perioperative instability. This study aimed to describe anesthetic protocols, complications, and outcomes associated with dog pacemaker implantation procedures.

A retrospective review was conducted on 18 anesthetic procedures in 16 dogs at the UFAPE Veterinary Hospital (2024–2025). Collected data included ASA classification, cardiac diagnosis of electrocardiogram, echocardiogram, and/or Holter, anesthetic protocols, intraoperative monitoring, and complications. Hypotension was defined as mean arterial pressure (MAP)  $\leq$ 60 mmHg, and hypertension as MAP> mmHg. Parametric data were analysed using paired t-tests, and non-parametric data with Mann-Whitney. Then, a comparison of intraoperative haemodynamic parameters was performed between dogs premedicated with butorphanol and those that received no premedication. The population included 16 dogs (50% male, 50% female), with a median age of 6 years (range 1–12) and a median weight of 8.9 kg (range 3.1–40). The third-degree atrioventricular block was the primary indication (75%). Premedication with butorphanol was used in 50% of cases, acepromazine in 5.5%, while 44.5% received no premedication.

Dogs receiving butorphanol showed a higher incidence of intraoperative normotension compared to those without premedication for SAP and MAP (p <0.05). Induction protocols included ketamine-midazolam (33.3%), ketamine-midazolam combined with etomidate or propofol (38.8%), propofol-based protocols (11.1%), and etomidate-based protocols (11.1%). Maintenance predominantly used ketamine-midazolam infusions combined with isoflurane after implanting the pacemaker (66.6%). Complications included hypotension (27.7%), hypertension (55.5%), electrode displacement (11.1%), and one cardiac arrest (5.5%) due to external pacemaker malfunction, successfully reanimated. All dogs survived the perioperative period.

Individualized anesthetic protocols provided adequate hemodynamic control and favourable outcomes. The use of butorphanol as premedication was associated with better haemodynamic stability intraoperatively due to the minor requirement of induction agents, while dogs without premedication.

Efficacy of tramadol for the management of acute postoperative pain in cats: a systematic review of clinical trials

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Tramadol is widely used in feline postoperative pain management; its clinical efficacy and optimal dosing remain unclear. This systematic review aimed to evaluate the effectiveness and safety of tramadol in feline surgical patients.

A structured search was performed between January 2025 and March 2025 in PubMed, Web of Science, CAB Abstracts and Google Scholar. Eligible studies included randomized controlled trials comparing tramadol to placebo or other analgesics, reporting postoperative pain outcomes using validated pain scales. The primary outcome was the number of animals requiring postoperative rescue analgesia. Secondary outcomes included the highest pain scores on validated scales and the incidence of adverse effects. Studies assessing chronic pain or using non-validated scales were excluded.

Seven clinical trials were included (Figure 1). Risk of bias was assessed using Cochrane's tool and was considered low across all studies. Brondani et al. (2009) and Schimites et al. (2023) included control groups and reported reduced pain scores with 2–4 mg kg<sup>-1</sup> of tramadol, alongside clear rescue protocols. Evangelista et al. (2014) found that 4 mg kg<sup>-1</sup> IM tramadol eliminated the need for rescue analgesia. Bauquier (2022) showed both oral and IM tramadol were effective. Goich et al. (2024) reported high intraoperative rescue needs at 3 mg kg<sup>-1</sup> but similar postoperative pain scores to morphine and methadone. Cagnardi et al. (2011) focused on pharmacokinetics and intraoperative response, with limited postoperative data. Steagall et al. (2008) assessed experimental rather clinical pain, limiting external validity. Ovariohysterectomy was the surgical model in most of the included studies and few adverse effects were reported.

This systematic review provides a comprehensive synthesis of current evidence on tramadol for acute postoperative pain in cats, highlighting its potential efficacy. Despite variability across studies, our findings offer a valuable foundation for future meta-analysis and clinical decision-making aimed at optimizing feline analgesia

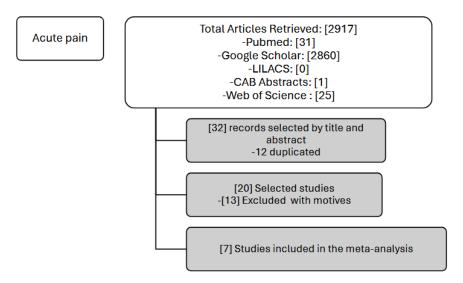


Figure 1: study flow diagram.

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Enflicoxib for postoperative pain and inflammation in orthopaedic surgery. A multicentre, randomised, non-inferiority, blind clinical trial.

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Enflicoxib has been recently approved in the EU to treat postoperative pain and inflammation. This study evaluated the safety and efficacy of a single dose of enflicoxib compared to daily firocoxib in dogs undergoing orthopaedic surgery.

A total of 216 dogs were randomly assigned to receive 8 mg kg<sup>-1</sup> enflicoxib (Daxocox®, Ecuphar/Animalcare) the day before surgery or 5 mg kg<sup>-1</sup> firocoxib (Previcox®, Boehringer Ingelheim) -2h, and daily for 7 days. All animals received intraoperative analgesia with dexmedetomidine and, optionally, fentanyl. Efficacy was measured using the Short-Form Glasgow Composite Pain Scale (SF-GCPS) at different time points (2, 5, 8, 24 hours, and 2, 3, 5, and 7 days) post-surgery. Inflammation was assessed using a Visual Analog Scale (VAS), and owners evaluated the response to treatment (ORTT) based on demeanour, analgesic effect, and mobility. The primary efficacy outcome was the SF-GCPS total scores area under the curve for the first 48 hours (SF-GCPS AUC2-48h), analysed with a non-inferiority t-test at 5% one-sided significance. Safety was evaluated by the incidence of adverse events and blood and urine analysis.

Enflicoxib demonstrated non-inferiority to firocoxib in SF-GCPS AUC2-48h [119.17  $\pm$  75.25 (95% CI 104.68, 133.66) vs 124.83  $\pm$  78.21 (95% CI 109.77, 139.89) with a difference of -5.66 (p = 0.002, 95% CI  $-\infty$ , 11.75)]. No significant differences were detected in the SF-GCPS total scores at each time point, ORTT, and safety observations. Inflammation scores were significantly lower for enflicoxib for the first 3 timepoints (p < 0,05).

In conclusion, a single dose of enflicoxib is a safe and effective alternative for managing postoperative pain and inflammation for up to seven days following orthopaedic surgery in dogs.

# Poster Large Animals

4694

Pharmacokinetics of remimazolam compared to midazolam after intravenous administration to horses

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Remimazolam (RMZ) is a new short half-life benzodiazepine used in humans. This study compared the pharmacokinetics and sedative effects of RMZ with midazolam (MDZ), a benzodiazepine commonly used in Thoroughbred horses.

Six Thoroughbred horses received a single IV dose of RMZ 0.05 mg kg<sup>-1</sup> or MDZ 0.05 mg kg<sup>-1</sup> over 60 seconds in a randomized crossover design. Blood samples were collected immediately after the end of dosing (0 minute) and at 5, 10, 20, 30, 45, 60, 90, 120, 180, 240 and 360 minutes after dosing, and plasma RMZ and MDZ concentrations were measured by LC-MS/MS. Concentrations were analyzed using a three-compartment model of a nonlinear mixed effect model. Wobble and stimulus responses were assessed every 5 minutes from the end of dosing and scored in 3 levels. Pharmacokinetic parameters were compared between RMZ and MDZ by using a paired t-test.

The mean pharmacokinetic parameters of RMZ and MDZ, respectively, were, for peak plasma concentration (Cmax),  $76.6 \pm 21.0$  ng mL<sup>-1</sup> and  $232.5 \pm 105.7$  ng mL<sup>-1</sup> in Cmax,  $0.84 \pm 0.13$  hour and  $3.94 \pm 0.15$  hour in terminal half-life,  $14.0 \pm 1.1$  L kg<sup>-1</sup> hour<sup>-1</sup> and  $0.45 \pm 0.02$  L kg<sup>-1</sup> hour<sup>-1</sup> in plasma clearance,  $2.0 \pm 0.3$  L kg<sup>-1</sup> and  $1.3 \pm 0.1$  L kg<sup>-1</sup> in steady-state volume of distribution, respectively. RMZ had a significantly shorter terminal half-life and higher plasma clearance than MDZ. Wobble and diminished stimulus response to RMZ and MDZ were observed immediately after administration until 5 minutes and 15 minutes later, and the response generally disappeared after 10 minutes and 20 minutes, respectively.

As in humans, the benzodiazepine RMZ was eliminated extremely rapidly in horses. Based on these pharmacokinetic parameters, the establishment of total intravenous anesthesia with RMZ for rapid and smooth recovery in horses is expected.

### 4764

Evaluation of Tissue Oxygen Saturation using Near-Infrared Spectroscopy in Horses Anesthetized with Two Fluid Administration Strategies

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This study aims to evaluate the effects of two different fluid administration strategies on peripheral tissue oxygenation (StO<sub>2</sub>) in isoflurane-anesthetized horses using near-infrared spectroscopy.

A group of 16 adult horses undergoing experimental celiotomy were anesthetized using intravenous xylazine (0.5–1 mg kg $^{-1}$ ), ketamine (2.5 mg kg $^{-1}$ ) and midazolam (0.1 mg kg $^{-1}$ ), and maintained with an expired isoflurane concentration of 1.1–1.3%. Lidocaine (1.3 mg kg $^{-1}$  bolus, followed by 50  $\mu$ g kg $^{-1}$  minute $^{-1}$ ) was administered. Dobutamine was infused to maintain mean arterial pressure (MAP) between 70–80 mmHg. Horses were randomly allocated to receive Hartmann's Solution at 2.5 mL kg $^{-1}$  hour $^{-1}$  (MNT) or 40 mL kg $^{-1}$  hour $^{-1}$  (OHD) for 120 minutes. The extensor carpi radialis muscle was used to monitor StO $_2$  through anesthesia. Measurements were recorded at baseline, 60 and 120 minutes after fluid initiation. Data were analyzed with mixed-effect linear regression, and correlations between StO $_2$  and physiological variables were assessed.

Baseline  $StO_2$  was higher in the MNT group [median (interquartile range; IQR) 91% (90–92%)] than the OHD group [87.5% (85–89.6%), p = 0.027]. Peripheral tissue oxygenation increased over time in both groups (p = 0.019), with no significant group-time interaction (p = 0.47). Mean arterial pressure was higher in the OHD group at 60 and 120 minutes (p = 0.009, p = 0.007), but central venous pressure was also higher at 120 minutes. Weak but significant correlations were observed between  $StO_2$  and MAP (rho = 0.36; p = 0.05) and serum lactate (rho = 0.36; p = 0.05). No significant associations were found with heart rate, cardiac output, dobutamine rate or central venous oxygen saturation, or venous partial pressure of oxygen.

StO₂ improved over time regardless of fluids rate and may reflect perfusion status during anesthesia, but further studies are warranted.

### Acknowledgment

Arden and Claudia Sims Colic Research

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Pharmacokinetics and tolerability of liposomal synthetic cannabidiol subcutaneous depot in six Holstein calves

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In horses, cannabidiol (CBD) was reported to provide analgesia, however, first-pass liver metabolism results in low oral bioavailability. Liposomal encapsulation of CBD facilitates slow-drug-release, providing long-term plasma concentrations with consistent effects. Analgesia of CBD was not reported in bovines.

Study goals were to provide preliminary pharmacokinetics and tolerability of a single SC injection of liposomal-synthetic-CBD (L-sCBD; 50 mg mL<sup>-1</sup>; 5 mg kg<sup>-1</sup>) in six Holstein calves (age 8-16 days; body weight 42.7-52.8 kg). Blood was sampled for CBD and metabolites plasma concentrations (baseline, 2, 6, 24, 48, 96-hours, and then weekly up to 6-weeks), complete blood count (baseline, 2-days, 1 and 4-weeks) and serum chemistry (baseline, 1 and 4-weeks). Physiologic parameters and adverse effects were monitored. Data overtime was compared with baseline using linear-regression mixed-effects (p-value < 0.05).

Plasma CBD concentrations were measurable for 3-6 weeks; median (range) peak plasma concentration (Cmax) was 44.1 (33.0-48.0) ng mL-1, time to Cmax was 1 (0.25-1) day, half-life was 5.3 (3.8-11.6) days and mean residence time (MRT) was 5.4 (4.0-8.7) days. The primary metabolite was 7-carboxy-CBD, which exceeded CBD exposure; the area under the concentration-time curve (AUC) ratio of 7-carboxy-CBD:CBD was 9.0 (4.2-16.1). A short-term significant increase in neutrophils was observed 2-days after injection. Several chemistry parameters changed from baseline but were clinically insignificant. The main adverse reaction was a local swelling, cytologically characterized as a sterile granulomatous inflammation, which spontaneously resolved within 2-weeks.

In conclusion, L-sCBD administered SC produced detectable CBD plasma concentrations for several weeks and was well tolerated by calves. Evaluation of L-sCBD as an additional long-term analgesic in calves undergoing routine painful agricultural management procedures (e.g., disbudding) is therefore of interest, as long as there is no concern for human exposure.

Sedative effects of continuous-rate infusion of medetomidine with vatinoxan in Thoroughbred horses

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Vatinoxan (VTX) is an  $\alpha$ 2 adrenoceptor antagonist that doesn't cross the blood–brain barrier, thus reducing the adverse effects of  $\alpha$ 2 agonists. The sedative and adverse effects of VTX with medetomidine (MED) were examined in Thoroughbred horses.

This was a blinded crossover study of three groups (gM: MED alone; gMA: MED + atipamezole (ATIP); gMV: MED + VTX) of six Thoroughbred horses. Continuous rate infusion (CRI) lasted 60 minutes after IV loading infusion, followed by a 60-minute observation. The following loading doses and CRI rates were used: for MED, 7.0  $\mu$ g kg-1 and 5.0  $\mu$ g kg-1 hour-1, respectively, in all three groups; for gMA, 140  $\mu$ g kg-1 and 100  $\mu$ g kg-1 hour-1 of ATIP were added; and for gMV, 140  $\mu$ g kg-1 and 100  $\mu$ g kg-1 hour-1 of VATX were added. Stimulus response score, ataxia score, head height, HR, fr, borborygmi score, and defecation frequency were recorded. Continuous and categorical variables were compared by using two-way ANOVA and Friedman's test, respectively.

Stimulus response score was significantly higher in gMA than gM, with no significant difference between gM and gMV. Ataxia score and head height showed similar trends. HR and fr were not significantly different among groups. Second-degree atrioventricular block was observed in 5 (gM), 6 (gMA), and 1 (gMV) horses. Borborygmi scores were significantly higher in gMV than gM, and defecation occurred only in gMV ( $2.3 \pm 1.1$  times). Therefore, ATIP had limited antiarrhythmic and gastroprokinetic effects, and it reduced the sedative effect of MED. In contrast, VTX effectively suppressed these reactions while maintaining the sedative effect.

CombiningVTX with MED should provide safe sedation in Thoroughbred horses by reducing the peripheral adverse effects of the  $\alpha 2$  agonist.

Sedative effects of detomidine alone and combined with ketamine compared to xylazine in calves undergoing cautery disbudding

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Detomidine, a potent  $\alpha_2$ -adrenoceptor agonist, is permitted for use in cattle under European legislation. However, its efficacy in calves for cautery disbudding remains poorly understood. This study compared the sedative effects of detomidine alone, detomidine with ketamine, and xylazine in calves undergoing cautery disbudding.

Thirty-nine calves  $(24 \pm 10 \text{ days old}, 71 \pm 16 \text{ kg})$  were equally and randomly assigned to receive IM detomidine 0.05 mg kg<sup>-1</sup> (D), detomidine 0.03 mg kg<sup>-1</sup> + ketamine 2 mg kg<sup>-1</sup> (DK), or xylazine 0.2 mg kg<sup>-1</sup> (X). Ten minutes later, all calves received SC bilateral cornual nerve blocks (4.5 mg kg<sup>-1</sup> procaine-epinephrine) and meloxicam (0.5 mg kg<sup>-1</sup>, SC). Cautery disbudding was performed 20 minutes post-sedation. Sedation depth was scored using a 19-point scale (Hokkanen et al. 2014), and reaction to disbudding on a 4-point scale (Adam et al. 2025). Latencies to recumbency, head lift and standing were recorded. Group comparisons used the Kruskal-Wallis test with Bonferroni correction (significance p < 0.05).

Recumbency times  $(2.2 \pm 1.01, 2.1 \pm 0.64 \text{ and } 2.2 \pm 1.1 \text{ min for DK, D, and X})$  did not differ significantly (p = 0.796). Head lift times were significantly shorter in DK than D  $(35.0 \pm 11.8 \text{ vs.} 54.6 \pm 21.0 \text{ min, p} = 0.035)$ . Standing times  $(63.2 \pm 30.3, 67.4 \pm 22.6, \text{ and } 77.9 \pm 33.4 \text{ minutes for DK, D, and X, respectively})$  did not differ significantly (p = 0.210). Disbudding reaction scores were comparable (p = 0.409). Sedation scores did not differ significantly except at 90 minutes, where D showed deeper sedation than DK (p = 0.043).

Detomidine, alone or with ketamine, provided effective sedation for cautery disbudding and may offer a suitable alternative to xylazine in calves.

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A pilot study evaluating capture of three volatile agents from anaesthetised horses

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The volatile agents are recognised as contributing to climate change with desflurane having the greatest impact (Haseler et al 2023). Capturing volatile agents is well-understood but full environmental and economic cost is unclear.

We evaluated the *in vivo* Mass Transfer of a capture device (VET-can, SageTech Veterinary, UK) in anaesthetised horses using isoflurane, sevoflurane and desflurane. Purposeful sampling at one UK equine hospital was used to recruit enough horses to fill two Vet-cans. The VET-can was positioned downstream of the anaesthetic breathing system (Bird Mark 7, JDMedical Phoenix USA) before the active gas scavenging system. *In vivo* mass transfer (MT %) was calculated by weighing the VET-can and vaporiser before and after each anaesthetic. Anaesthesia was induced with ketamine and midazolam following acepromazine, morphine and romifidine. Horses received isoflurane (n=12) or sevoflurane (n=5) or desflurane (n=1) for maintenance of anaesthesia. Horse's lungs were ventilated to normocapnia and horses received dobutamine to maintain MAP> 60mmHg. All horses received intraoperative romifidine (40 µg kg¹ hour¹) and intravenous fluid therapy. Volatile hygiene measures were employed (leak checking, cuff inflation), and the breathing system was capped and flushed at the end of the procedure and residual volatile % recorded. Appropriate parametric or nonparametric statistical analyses were used.

Eighteen horses were required to fill 2 cans. Vet-can capacity and the order of groups limited desflurane group size. There were no significant differences in patient characteristics, the dose of dobutamine, cardiopulmonary variables, MAC multiples, MAC hours or recovery quality. The median *in vivo* MT differed between groups (p = 0.035); 34% (22-54) for isoflurane, 48% (38-54) for sevoflurane and 80% (0) for desflurane.

Future studies evaluating wash out kinetics and capture during recovery are indicated, especially for isoflurane to maximise capture. The Vet-an offers exciting possibilities for sustainability advancements.

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Prospective comparison of recovery after desflurane and isoflurane anaesthesia incorporating a romifidine constant rate infusion in horses

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Serious injury during recovery from anaesthesia is a recognised complication. Coordinated rapid recoveries should reduce the risk. Desflurane's kinetics produce shorter recoveries than isoflurane (Midon et al 2024, Taylor et al 2023).

Isoflurane and desflurane anaesthesia, each incorporating a constant rate infusion (CRI) of romifidine, were compared. One hundred and one horses undergoing elective surgery were recruited prospectively. Anaesthesia was induced with ketamine and midazolam following acepromazine, morphine and romifidine. Horses were randomly assigned to receive isoflurane (I) or desflurane (D) for maintenance of anaesthesia. Horses' lungs were ventilated to normocapnia and haemodynamic support was provided (dobutamine to maintain MAP> 60mmHg). All horses received a romifidine CRI (40mcg kg hour<sup>-1</sup>) and 20 mcg kg<sup>-1</sup> in recovery. Recovery was unassisted and timed and video-recorded for offline evaluation (quality score 0-5 and number of standing attempts) by two "blinded" experienced clinicians. Appropriate parametric or nonparametric statistical analyses were used.

Group D horses were heavier (p = 0.0113), and there were more D male (p = 0.03) and dorsally positioned (p = 0.03). Averaged MAC multiples were lower in D than I (P < 0.0001). When averaged over the entire anaesthetic, MAC hours were similar between groups. Two D horses required additional thiopentone. There were no significant differences (Mann Whitney) in the dose of dobutamine, cardiopulmonary variables or recovery quality. There was substantial agreement between observers for I (kappa = 0.77) and D (kappa = 0.93) respectively. Recovery to standing was faster after D (35 [15-81]) than I (40 [23-92] minutes) (p < 0.0001). One D horse was euthanased due to spinal cord malacia.

Haemodynamic support and recovery quality were similar between groups. Desflurane horses stood up sooner; a shorter hazardous recovery "window" should allow less time for disaster however the environmental impact of desflurane must be considered concurrently.

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Interobserver agreement in the classification of anaesthetic deaths in horses: a tie-breaker approach

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The objective of this study was to assess inter-observer agreement in classifying fatalities during equine anaesthesia as either DEATH—an unexpected, unassisted death not attributable to any veterinary decision—or PTS, a planned euthanasia following a veterinary recommendation or the owner's request. In this retrospective, multicentre analysis, 2630 anaesthetised horses from the CEPEF4 database (Gozalo-Marcilla et al. 2025) were used.

Three independent evaluators (A, B, and C) assigned each case to DEATH or PTS. Inter-observer agreement was measured using Light's  $\kappa$ , Fleiss'  $\kappa$ , intraclass correlation coefficient (ICC), and pair-wise Cohen's  $\kappa$ . Records without unanimous agreement were defined as the "non-consensus subset" and reclassified by a fourth evaluator (D) to break ties.

Evaluators A, B, and C labelled 16.0%, 20.1%, and 33.3% of cases, respectively, as DEATH. A complete consensus was reached in 80.3% of the records. Overall agreement was substantial (Light's  $\kappa$  = 0.638; ICC = 0.618; Fleiss'  $\kappa$  = 0.618; all p < 0.001). Pairwise agreement was substantial between A and B ( $\kappa$  ≈ 0.81), moderate between A and C ( $\kappa$  ≈ 0.51) and B and C ( $\kappa$  ≈ 0.60). The nonconsensus subset comprised 519 records (19.7%). Within this subset, A, B, C, and D classified 6.9%, 26.6%, 91.9%, and 11.4% of cases, respectively, as DEATH. Agreement in this subset was poor (Light's  $\kappa$  = 0.090; p = 0.649). Compared with D, agreement remained substantial for A ( $\kappa$  = 0.53; 92.1%), moderate for B ( $\kappa$  = 0.22; 75.1%), and negligible for C ( $\kappa$  = -0.05; 13.3%). While agreement for classifying fatalities as DEATH (no veterinary decision) or PTS (veterinary decision involved) was substantial overall, it deteriorated in nearly one-fifth of cases.

This variability highlights the need for standardised, consensus-based criteria to improve consistency in reporting equine perianaesthetic mortality.

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The authors would like to thank the open-mindedness, hard work, honesty and diligence of the personnel of every collaborating centre who submitted the cases for CEPEF4. As sources of founding, we would like to thank the Association Veterinary Anaesthetists (AVA) to get this project started with the Kate Borer-Weir Memorial Fund. Also, to the AVA Trust for a second grant to pursue all the IT improvements moving towards the web system. Finally, to the Horse Trust (Horse Trust Project Reference G2023) which allowed us to refine our strategies of data handling, management and cleaning with the use of the website.

# Nerve stimulator-guided mandibular block in a pig undergoing dental extraction

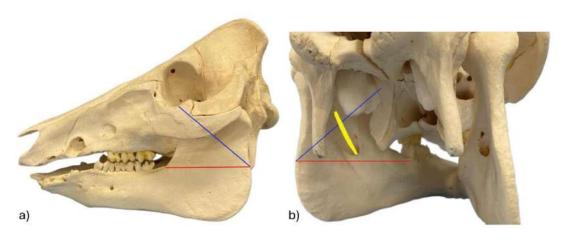
### **Ryota Watanabe**

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Provision of appropriate analgesia in farm animal species is limited due to the acceptance of painful conditions. Dental disease is inherently painful, and locoregional anesthesia is an effective strategy for perioperative pain management

A 9-year-old castrated male Vietnamese pot-bellied pig (pet pig) weighing 41 kg was referred for treatment of a chronic abscess involving left mandibular canine tooth. On admission, physical examination, hematology and serum biochemistry were unremarkable. The pig underwent dental extraction under general anesthesia (methadone-midazolam-azaperone-dexmedetomidine- propofol-isoflurane). A nerve stimulator-guided mandibular block was planned to provide analgesia and anesthetic stability. Anatomical landmarks were determined preoperatively (Figure 1), and a nerve-stimulator needle was inserted. The nerve stimulator was initially set to a current of 1.0 mA and a frequency of 2 Hz. Upon eliciting contraction of the masticatory muscle, the needle position was adjusted until muscle contraction was present at 0.6 mA but absent at 0.3 mA. At this point, bupivacaine 0.5% 3 mL was injected. The surgical procedure was started 15 minutes after the block. Throughout the procedure, vaporizer dial was maintained between 1.25~1.75% without nociceptive response to surgery. Acute hypotension (MAP dropped from 60~65 to 40~50 mmHg) due to hemorrhage from inferior alveolar artery (estimated 3.5 mL kg-1) was managed by temporal discontinuation of isoflurane, colloid bolus, ephedrine and continuous rate infusions of norepinephrine and ketamine. Recovery from anesthesia was uneventful without complications associated with the block.

Use of a nerve stimulator-guided mandibular nerve block during dental procedures in swine provides precise local anesthetic delivery, promotes anesthetic stability, and prevents intraoperative nociceptive responses



### Disclosure

The clinical case described in this abstract was managed during the author's prior affiliation at Université de Montréal, Canada.

Onset and duration of action of escalating doses of rocuronium in anesthetized healthy goats

Latchmi H.K Baba, Stuart Clark-Price, Hui-Chu Lin, Hedie Bustamente, Jenna Bayne

Multimodal anesthesia is becoming more common across veterinary species, illustrated with an increased awareness of using neuromuscular blocking agents. Only atracurium dose has been reported in goats. This study aimed to determine the onset and duration of action of three doses of rocuronium in healthy anesthetized goats.

In a triple crossover design, nine female goats aged 21 to 71 months and weighing 36 to 87 kgs were anesthetized with propofol  $(6.00 \pm 0.52 \text{ mg kg}^{-1})$  and isoflurane in 100% oxygen. Three doses of rocuronium 0.05 mg kg<sup>-1</sup> (RC05), 0.1 mg kg<sup>-1</sup> (RC1), and 0.2 mg kg<sup>-1</sup> (RC2) were randomly assigned and administered with a minimum one-week washout. Neuromuscular blockade was monitored using acceleromyographic train-of-four (TOF) every 15 seconds post-administration to determine the onset of paralysis (TOF = 0). Return of first twitch (TOF>) and duration of action (TOF = 100%) were determined by repeat TOF every 5 minutes. Data were analyzed using Wilcoxon tests. A p < 0.05 was used for significance and data are reported as median (range).

Paralysis (TOF = 0) occurred in 11% of RC05, 89% of RC1 and 100% of RC2. Data for RC05 was not further analyzed. Onset was 2 (1-4) minutes for RC1 and 2 (2-6) minutes for RC2 (p = 0.5). Return of first twitch was 35 (10 – 40) minutes for RC1 and 72.5 (50-210) minutes for RC2 (p = 0.0312). Duration of action was 105 (60-125) minutes for RC1 and 162.5 (125-260) minutes for RC2 (p = 0.0078). Variations in heart rate and arterial blood pressure within groups RC1 and RC2 were not observed.

At the doses tested, rocuronium at 0.2 mg kg<sup>-1</sup> resulted in effective neuromuscular blockade in all goats in this study.

Pharmacopuncture and intravenous low dose dexmedetomidine provide equivalent sedation in healthy horses

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Da Feng Men (DFM) is an acupoint used for relaxation in horses as a site analogous to the acupoint governing vessel 20 in dogs (Xie, 2007). This study evaluated the sedative effects of dexmedetomidine injected at acupoint DFM.

Ten horses received four treatments in a randomized, blinded, crossover design: (1) dexmedetomidine (DexmedDFM, 1  $\mu$ g kg<sup>-1</sup>) or (2) saline (SalDFM) administered at DFM (3) dexmedetomidine administered subcutaneously on the lateral neck (DexmedSC, 1  $\mu$ g kg<sup>-1</sup>), or (4) dexmedetomidine administered intravenously (DexmedIV, 1 $\mu$ g kg<sup>-1</sup>). FaceSed (Oliveira et al. 2021), EquiSed, (de Oliveira et al. 2021), head height above ground (HHAG), HR and fr were collected at baseline and 5, 15, 30, 45, 60 and 90 minutes after treatment. FaceSed, EquiSed and HHAG were compared with pairwise Wilcoxon signed rank test (Sidak's method). HR and fr were not included in the statistical analysis. Statistical significance was set at p < 0.05.

There were no statistical differences in sedation scores between groups at any timepoints. Maximal median (range) of FaceSed, EquiSed and minimal median HHAG are presented in Table 1. FaceSed was significantly higher at all time points in DexmedDFM and SalDFM, at T15, T30, T60 and T90 in Dexmed SC and at T5, T15, T30, T45, T60 in DexmedIV. EquiSed was significantly higher at T5 and T60 in DexmedDFM, T30 and T45 in SalDFM, T45, T60, T90 in DexmedSC and T5, T15, T30, T45, T60 in DexmedIV. Head height was significantly lowered at T60 in DexmedDFM and T5, T30, T45 and T60 in DexmedIV.

All treatments resulted in variable sedation. Dexmedetomidine administered subcutaneously at DFM provided sedation not significantly different from alternative treatment sites.

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Median [range](time)	DexmedDFM	SalDFM	DexmedSC	DexmedIV
Max FaceSed (/8)	3.8 [3;4] (T45)	3.0 [2;4] (T30)	3.8 [0.5;4] (T15)	3.5 [1.5;5] (T30)
Max EquiSed	7.8 [3.5;10.5] (T15)	9.5 [7;11] (T30)	9.5 [7;9.5] (6.5;11.5)	10.8 [9.5;11] (T15)
(/18)				
Min HHAG (cm)	102.5 [90;111.5] (T45)	107.3 [105;112] (T60)	106.3 [93;111] (T30)	102.5 [97.5;109.5] (T30)

Table 1. Timepoints of Maximal median of FaceSed, EquiSed and minimal median of HHAG per group.

Three-dimensional models for teaching the mechanisms of action of phenothiazines and butyrophenones in veterinary anesthesiology

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Phenothiazines (FNZ) and butyrophenones (BUT) are commonly used as sedatives in veterinary anesthesia. The greatest difficulties that students face when studying the mechanisms of action of these drugs involve spatial perception and the configuration of these molecules. Therefore, the study aimed to evaluate the use of three-dimensional (3D) models representing the mechanisms of action of FNZ and BUT as tools in the teaching and learning of veterinary anesthesiology.

Thirty-eight students participated in the study and were divided into two groups: the 3D group (3DG), composed of students who studied using 3D models, and the Control Group (CG), in which students studied using flat diagrams. Pre- and post-tests were administered to assess the level of knowledge of the students regarding the mechanism of action and functions of FNZ-BUT. The tests were worth 10 points. The questions applied were the same as those used previously to assess student learning, even in the absence of study. The pre- and post-test scores for GC and G3D were assessed by the normality test, followed by the paired Student's t-test. The unpaired Student's t-test was used to assess the mean gain between the groups. A reliability level of 5% was used.

Only the G3D group showed significant improvements between the pre- and post-tests regarding the mechanism of action (p = 0.010;  $1.79\pm0.92$  (pre-test) to  $2.58\pm1.07$  (post-test)) and function (p = 0.001;  $2.26\pm1.10$  (pre-test) to  $3.16\pm1.07$  (post-test)). The mean score gain was significant for G3D students ( $0.79\pm1.08$  points), with a significant difference in the mechanism of action (p = 0.043) compared to CG ( $0.11\pm0.99$  points).

These results indicate that the use of 3D models was more efficient than the use of flat diagrams in promoting learning about FNZ-BUT.

# Funding

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Figure 1. Medals after painting and vernieiting. (A) Cytoplasmic membrans. (B) Departing receptor linked to a BUT. (C) BUT. (D) FNZ. (E) Departing.

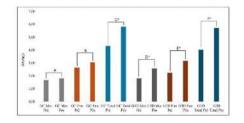


Figure 2. Mean scores for the pre- and post-tests, considering the mechanism of action (Meo) and function (Fun) to the CC and G30, p-values;  $A_c = 0.583; p = 0.73g; C; p = 0.01; D; p = 0.010; E; p = 0.001; E; p$ 

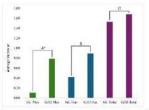


Figure 3. Average gain in apores between the pre-periphet testa in the CG and S3D p-values. At pri-0.048; b; p. p. 148; C; p. p. 0.833, CG (Control Group), 3D (3D Group), Fun (question ellisted to the function of FNZ-BUT), Mee (questions related to the mechanism of action of FNZ-BUT), Total (sit mechanism of action and function questions). "Showed statistical difference, FNZ, phenothiscines; BUT, butyophenores.