Abstracts accepted for presentation at the Association of Veterinary Anaesthetists' meeting on May 19th and 20th, 2022, Nafplio, Greece

The following studies received ethical approval by institutional and/or national review committees, where appropriate

Abstracts

Oral presentations

Dog

Effects of oral tasipimidine premedication on quality of anaesthesia induction and anaesthetic requirements with and without methadone and dexmedetomidine in Beagle dogs

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The effects of tasipimidine, a new anxiolytic alpha-2A agonist, on quality of anaesthesia induction and anaesthetic requirements were studied.

Seven healthy Beagles underwent 4 treatments followed by isoflurane MAC immobility determination in random order (wash-out > 7 days) with the main investigator blind to treatment.

- P: Placebo p.o. 60 minutes before NaCl 0.9% IV followed by propofol IV.
- T-P: Tasipimidine 30 µg kg^{-1} p.o. 60 minutes before NaCl 0.9% i.v. followed by propofol IV.
- T-M-P: Tasipimidine 30 µg kg^{-1} p.o. 60 minutes before methadone 0.2 mg kg^{-1} i.v. followed by propofol IV.
- T-M-D-P: Tasipimidine 30 µg kg^{-1} 60 minutes before methadone 0.2 mg kg^{-1} and 1 µg kg^{-1} dexmedetomidine IV followed by propofol IV and dexmedetomidine at 1 µg kg^{-1} h^{-1}.

Sedation (0-19), catheter placement score (0-31), ease of catheter placement (0-4), time to intubation, intubation score (0-4), propofol dose, isoflurane MAC (electric stimulation) were analysed with repeated measures ANOVA and Kruskall-Wallis test (alpha = 5%).

	P		T-P		T-M-P		T-M-D-P	
	mean	SD	mean	SD	mean	SD	mean	SD
propofol dose (mg kg^{-1})	6.19	0.84^{a}	4.46	0.6^{b}	3.23	0.82^{c}	3.09	0.69^{c}
time to loss of consciousness (s)	117.7	17.4^{a}	84.3	15.6^{b}	67.8	21.1^{c}	64.3	31.9^{c}
time to intubation (s)	160.6	18.3^{a}	138.1	29.4^{a}	95	27.8^{b}	91.4	34.4^{b}
MAC (vol%)	1.26	0.12^{a}	1.02	0.09^{b}	0.83	0.13^{bc}	0.84	0.07^{c}

Tasipimidine induced mild sedation, differences in catheter placement conditions were not detected.

a,b different superscripts differ within row

An anxiolytic dose of oral tasipimidine may reduce anaesthetic dose requirements.

Effects of tasipimidine pre-medication on blood pressure and perfusion in Beagle dogs anaesthetized with isoflurane with and without methadone and dexmedetomidine

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Tasipimidine is a novel anxiolytic with high selectivity for alpha-2A adrenoceptors. The aim was to evaluate the effect of oral tasipimidine premedication on blood pressures and perfusion during general anaesthesia (GA) in dogs.

After instrumentation under sevoflurane and full recovery, 7 healthy Beagles received 4 treatments in random order, with at least 7 days wash-out, followed by individual isoflurane MAC for 120 minutes.

- P: Placebo PO 60 minutes before NaCl 0.9% IV followed by propofol IV.
- T-P: Tasipimidine 30 µg kg^{-1} PO 60 minutes before NaCl 0.9% IV followed by propofol IV.
- T-M-P: Tasipimidine 30 µg kg^{-1} PO 60 minutes before methadone 0.2 mg kg^{-1} IV followed by propofol IV.
- T-M-D-P: Tasipimidine 30 µg kg^{-1} PO 60 minutes before methadone 0.2 mg kg^{-1} and 1 µg kg^{-1} dexmedetomidine IV followed by propofol and dexmedetomidine at 1 µg kg^{-1} h^{-1} IV.

Blood pressures, CO (thermodilution), tissue oxygenation (stO_2, white light spectrophotometry) and tissue blood flow (TBF, laser Doppler) were measured at

predetermined time points. Data were analysed by repeated measures ANOVA and Dunnett´s t-test (alpha = 5%).
Tasipimidine alone induced a significant reduction in HR and CO by 20-30% in conjunction with a decrease in MAP (10-15%), TBF and stO_2. Haemodynamic variables were within commonly observed ranges during GA in all groups. In individual animals, MAP dropped below 60 mmHg with lowest values in group P.
Oral pre-medication with tasipimidine at 30 µg kg^{-1} induces a characteristic low dose alpha-2 agonist effect, which needs to be considered during GA.

Fast sequence intubation protocol in healthy dogs induced with propofol and rocuronium

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Difficult endotracheal intubation (EI) can be stressful, prolonged, and cause hypoxemia. Fast sequence intubation (FSI) might reduce stress and expedite EI.
Male intact Beagles (n = 6) received IV: acepromazine (0.03 mg kg^{-1}) and hydromorphone (0.1 mg kg^{-1}). In a masked block randomized cross-over design, following pre-oxygenation, induction was performed with propofol (2 mg kg^{-1}) IV over 5 seconds, followed by, placebo (0.9% NaCl; 0.06 mL kg^{-1}) or treatment (1% rocuronium; 0.6 mg kg^{-1}). Induction was 48 ± 10 minutes after premedication. Sugammadex (4 mg kg^{-1}) was administered IV after EI to dogs given rocuronium. Serum cortisol (SC), corrected blood glucose (cBG), PaO_2, $PaCO_2$, MAP, and HR were obtained at baseline and after EI (T1). Intubation time (IT), EI score, and spontaneous ventilation were recorded. Mixed-effect models and paired t-test were used for statistical analysis ($p < 0.05$).
Between groups, only treatment HR (90.1 ± 32.4) was higher than placebo (71.8 ± 15.8; p = 0.014). Baseline SC, cBG, PaO_2 were similar to T1. Baseline and T1 $PaCO_2$ (47.7 ± 6.2 and 58.8 ± 5.8 mmHg, p = 0.001), MAP (88.0 ± 9.9 and 81.2 ± 12.5 mmHg, p = 0.049) and HR (72 ± 16 and 78 ± 13 beats $minute^{-1}$, p = 0.014) had detected differences. The IT were similar

for placebo (54.3 ± 6.9 seconds) and treatment (57.8 ± 5.2 seconds). All EI scores were acceptable. Spontaneous ventilation was always present after EI.
While FSI is feasible without distressing dogs, rocuronium addition did not improve intubation conditions.

Evaluation of rocuronium-induced neuromuscular block on the patient state index in dogs anesthetized with propofol

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The patient state index (PSI) is an unitless number (0 to 100) derived from electroencephalography. Values of PSI between 25 and 50 indicates adequate anaesthesia level. The PSI calculation might be affected by neuromuscular block.
Six intact male Beagles, 12.3 ± 0.4 kg, received maropitant (1 mg kg^{-1}), acepromazine (0.03 mg kg^{-1}), and hydromorphone (0.1 mg kg^{-1}), all IV. Anaesthesia was induced with propofol IV at 2 mg kg^{-1} followed by an infusion of 13.2 mg kg^{-1} h^{-1}, adjusting the rate to maintain the PSI between 40 and 50 PSI. Electroencephalography electrodes in the forehead were used to measure PSI and the neuromuscular function was monitored with train-of-four ratios (TOFR). When the PSI readings were stable for 10 minutes during unchanged propofol infusion rate, TOFR and PSI values were recorded every 15 seconds for 12 minutes. Baseline data was collected in the initial 2 minutes, then rocuronium (0.6 mg kg^{-1}, IV) was administered. At 7 minutes, the dogs received sugammadex (4 mg kg^{-1}, IV) to reverse the neuromuscular block. Baseline PSI was 41 ± 6 and the overall average was 42 ± 5 after the administration of rocuronium and sugammadex (P = 0.497). The baseline TOFR was 0.97 ± 0.08 and complete block was confirmed with TOFR = 0 in all dogs. Sugammadex successfully reversed all dogs (TOFR = 0.97 ± 0.09 at 12 minutes).
No effect on PSI was observed for both rocuronium and sugammadex. The PSI can be used in propofol-anesthetized dogs with or without neuromuscular block.

An investigation into the detection of the pulse in conscious and anaesthetised dogs

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Pulse palpation is a simple technique requiring no equipment but there are no studies investigating how efficient veterinary professionals and students are at this skill and how reliable any findings are.
Prospective, observational, randomised study. A sample of 54 client-owned dogs scheduled for general anaesthesia was included. For each dog, three participants (senior anaesthetist, anaesthesia resident/nurse, veterinary student/animal care assistants) attempted pulse palpation at three locations (femoral, radial and dorsal pedal pulse) in conscious and anaesthetised dogs. Time-to-successful pulse palpation data was collected and modelled using a multivariate Cox regression survival analysis.
The overall success rate of pulse palpation was 77% (median time to pulse palpation = 10.91 seconds (IQR 19.09 seconds)). Success rate was lower in conscious than anaesthetised dogs. For both anaesthetised and conscious dogs there was a 77% lower likelihood of success at the radial compared to the femoral pulse (hazard ratio 0.23, 95% CI 0.38 – 0.69, $p < 0.001$). Veterinary students/animal care assistants had a 71% lower likelihood of success compared to senior anaesthetists (hazard ratio 0.29, 95% CI 0.22-0.39, $p < 0.001$). The median time to palpation was less than 10 secs for all experience groups at the femoral location in both anaesthetised and conscious dogs.
Palpation of the femoral location had the greatest likelihood of success and took the least amount of time. Monitoring the femoral pulse during induction of anaesthesia is suggested as a method for confirming spontaneous circulation. Pulse palpation improves with clinical experience.

Propofol-induced reduction in the patient state index in dogs

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The patient state index (PSI) is an encephalographic-based unitless algorithm from 0 to 100 that monitors the level of consciousness in people; however, it was not tested in dogs.
Six intact male Beagles were medicated, IV, with maropitant (1 mg kg^{-1}), acepromazine (0.03 mg kg^{-1}), and hydromorphone (0.1 mg kg^{-1}). Electrodes were placed to measure PSI continuously and baseline was recorded before the administration of propofol, IV. An initial

bolus of propofol (1.5 mg kg^{-1}, over 5 seconds) was followed 45 seconds later by a continuous rate infusion (CRI) of propofol (12 mg kg^{-1} h^{-1}). The PSI was recorded at 1-minute intervals for 5 minutes (T1 to T5) after the initial bolus. Anaesthesia onset time was determined from bolus to PSI ramp down. To decrease PSI below 50, additional doses of propofol (0.5 mg kg^{-1}) were administered with adjustments in the CRI (up to 16.7 mg kg^{-1} $hour^{-1}$). The plasma propofol concentration for each dog was estimated (CpE) at T5.
Onset time was 42.0 ± 22.0 seconds. The baseline PSI was 88.7 ± 2.5 and it was significantly lower at T2 to T5 (ranged from 47.3 ± 5.1 to 57.0 ± 15.8, one-way ANOVA for repeated measures, all $p < 0.022$) with adequate anaesthesia depth. Additional boluses and adjustments in the CRI of propofol were required in 4 of 6 dogs to decrease PSI less than 50. The CpE at T5 was 3.2 ± 0.5 µg mL^{-1}.
The PSI can track loss of consciousness during induction of anaesthesia in dogs.

The Effect of Remifentanil Infusion on Sevoflurane MAC_{NM} and Bispectral Index in Dogs

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The objectives of the study were to evaluate the effect of remifentanil infusion on the minimum alveolar concentration of sevoflurane preventing movement ($SEVOMAC_{NM}$) and Bispectral index (BIS) in dogs.
Ten adult beagles were anesthetized with sevoflurane in oxygen and baseline $SEVOMAC_{NM}$ was determined. Each dog received remifentanil infusion at 5, 10 and 20 μg^{-1} kg^{-1} $hour^{-1}$, in sequence, with 20 minutes washout between infusions. BIS monitoring was performed throughout the anaesthesia. Treatment $SEVOMAC_{NM}$ determination started 20 minutes after the start of each infusion. Venous blood samples were collected to determine remifentanil plasma concentrations, at baseline, treatment $SEVOMAC_{NM}$ determination timepoint, and 20 minutes after each infusion was stopped. A mixed-model analysis was used to determine the

effect of remifentanil infusion on response variables. The relationships between BIS and FE'SEVO, and between remifentanil plasma concentrations and the %decrease in $SEVOMAC_{NM}$ were evaluated. *p* value was set at <0.05.
The overall baseline $SEVOMAC_{NM}$ was 2.47 ± 0.11%. The percent decrease in baseline $SEVOMAC_{NM}$ was significantly different between remifentanil infusions at 5 and 10 μg^{-1} kg^{-1} $hour^{-1}$. The mean baseline BIS value was 69.48 ± 1.25 and was significantly lower than the BIS values recorded during remifentanil infusions. Mean baseline HR (107.7 ± 2) was greater than the HR during all remifentanil treatments. Conversely, for all remifentanil treatments, the MAP was greater than the values recorded at baseline (62.6 ± 1.2).
Remifentanil infusion at 5 and 10 μg^{-1} kg^{-1} $hour^{-1}$ reduced $SEVOMAC_{NM}$ in dogs.
Remifentanil infusion at any rate studied did not reduce BIS values.

Association between body mass and hypotension in dogs under general anaesthesia: a retrospective study of 1789 cases

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Conflicting evidence exists about whether body mass is negatively associated with risk of hypotension under general anaesthesia (GA) in dogs (Lizuka et al. 2013, Costa et al. 2015, Martin-Flores et al. 2019). This study examines whether previously reported associations between body mass and risk of hypotension persist in a larger, more diverse population. Records from all dogs undergoing GA at a single institution from December 2018 to June 2020 were reviewed retrospectively. Data on patient characteristics and GA were extracted. Hypotension was defined as ≥ 2 consecutive readings at an interval of ≥ 5 minutes where mean arterial pressure was < 60 mmHg. A multivariable general linear model was used to identify associations between recorded variables and hypotension.
From 1932 dogs anaesthetised during the study period, 1789 anaesthetics met the inclusion criteria. Increasing body mass (per 10 kg) was significantly associated with decreasing odds of hypotension (odds ratio 0.68, 95% confidence interval 0.60 - 0.77). Premedication with alpha-2 agonists and higher body temperature were also independently associated with reduced odds. Brachycephaly (odds ratio 1.72, 95% confidence interval 1.25 - 2.38), higher

American Society of Anesthesiologists physical status classification and having a surgical procedure (vs diagnostic) were associated with increased odds of hypotension.
Dogs of lower body mass and brachycephalic breeds may be at higher risk of hypotension under GA. These findings may also reflect the challenges of accurate blood pressure measurement in these patients. Particular attention should be given to monitoring blood pressure accurately in these groups.

References

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Haemodynamic effects of pimobendan during general anesthesia in dogs

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The aim of this study was to evaluate the haemodynamic effects of pimobendan during general anaesthesia in dogs.
A prospective, randomized, triple-blinded, placebo-controlled, clinical study was conducted. Thirty-three dogs (median [range]: 9 [7-12] years, 11 [5-25] Kg; ASA I: 7 animals, ASA II: 26 dogs) were anaesthetised for different surgical procedures using dexmedetomidine (2-3 µg kg^{-1} IM) and methadone (0.2-0.3 mg kg^{-1} IM) as premedication, alfaxalone (0,5-1,5 mg kg^{-1} IV) as induction and isoflurane as maintenance agents. They were randomly allocated in two groups: eighteen dogs received pimobendan 0.15 mg kg^{-1} IV (PIMOBENDAN) and 15 saline solution 0.2 ml kg^{-1} IV (PLACEBO). Data were recorded before, 1 minute and 10 minutes after injection. Velocity integral time (VTi), aortic peak velocity (PVa) and aortic mean

acceleration (MAa) were measured using an oesophageal Doppler monitor (CardioQ-ODM). Heart rate, MAP, *f*r, temperature, SpO_2, $EtCO_2$ and EtISO were also registered. Data were analysed using a two-way ANOVA for trimmed means, M-estimators, medians, and a general linear model ($p < 0.05$).

After injection, VTi (13.0 cm [10.4, 22.3],) PVa (95.0 [83.0, 160] m sec^{-1}), and MAa (12.6 [9.40, 17.0] m sec^{-2}) were higher and EtISO lower (1.10 [1.00, 1.20] %) in PIMOBENDAN when compared to PLACEBO (VTi: 10.5 [6.50, 17.4] cm, PVa: 80.0 [62.0, 103] m sec^{-1}, MAa: 10.2 [7.00, 16.0] m sec^{2}. EtISO: 1.15 [0.900, 1.40] %. No differences were observed in the other variables.

Pimobendan increases VTi, PVa and MAa measured by oesophageal Doppler monitor during anaesthesia.

The pre-operative use of two different types of insulin in diabetic dogs undergoing phacoemulsification surgery: preliminary results

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The optimal protocol for glycaemic control of diabetic dogs does not exist and Caninsulin use prevails preoperatively. A blood glucose (BG) target range associated with perioperative complications has not yet been established. The aim of the study is to compare neutral insulin administered intramuscularly (Group NEU) and Caninsulin administered subcutaneously (Group CAN), for their ability to maintain perioperative BG within the range of 8.3 - 11.1 mmol/L in dogs undergoing phacoemulsification surgery.

So far, 20 dogs have been included in the study (9 female and 11 male). The morning before surgery dogs were randomly allocated to either group CAN (n = 10) or to group NEU (n = 10). The dose of insulin depended on morning BG levels. Continuous data are presented as median [range] and categorical data are presented as number of observations.

Dogs' age and weight were 105 [48 - 147] months and 9.75 [4.1 - 40.7] kg, respectively. In group NEU, the episodes within, above and below the BG target range were 13/61, 19/61 and 29/61 intraoperatively, and 10/62, 25/62 and 26/62 postoperatively. In group CAN, these episodes were 12/62, 34/62 and 16/62 intraoperatively, and 12/63, 25/63 and 26/63, postoperatively. No animal developed hypoglycaemia (BG < 3.3 mmol/L) perioperatively,

and 4/10 of dogs in group NEU and 2/10 in group CAN were hypotensive. Additional neutral insulin was administered to 3/10 of dogs. Glucose supplementation was administered to all dogs in group NEU and 8/10 of dogs in group CAN.
These are preliminary results, and no conclusions can be reached.

Effect of gabapentin on propofol and isoflurane anaesthesia and perioperative analgesia in dogs

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Gabapentin is an antiepileptic drug exhibiting analgesic properties especially in chronic pain conditions. However, its effect on the perioperative period needs to be investigated, as studies in dogs present conflicting data.
A randomized, blinded, cross-over experimental study was conducted on 11 Beagles undergoing bilateral ulnar osteotomy, with an 8-months interval in-between. Oral gabapentin 10 mg kg^{-1} (Gaba group) or placebo (Control group) were administered, 2 hours before premedication and every 8 hours thereafter. All dogs were premedicated with ACP 0.05 mg kg^{-1} and Morphine 0.1 mg kg^{-1} IM, while anaesthesia was induced with propofol and maintained with isoflurane. Propofol and isoflurane requirements, vital signs, sedation, and pain levels were evaluated throughout the perioperative period and for 48 hours postoperatively. The Sign test for paired samples, a non-parametric statistical method, was evaluated given that the same animals were studied in both groups (significance level of 0.05).
Median values and range for sedation scores in Gaba and Control groups, 2 hours after gabapentin administration and 30 minutes after premedication, were 2 (0 - 3) versus 1 (0 - 2) and 7 (2 - 10) versus 2 (2 - 5), respectively, while induction propofol doses (mg kg^{-1}) were 4.5 (3 - 5) in Gaba versus 5 (3.5 - 5.5) in Control, all differences being significant. No differences were observed concerning isoflurane requirements or postoperative pain scores. It seems that gabapentin contributes to better sedation levels and lower propofol consumption in dogs undergoing osteotomy but has no impact on acute postoperative pain.

References

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Epidural anaesthesia-analgesia in dogs undergoing cholecystectomy: a single centre retrospective study

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To assess the effects of epidural anaesthesia-analgesia (EAA) in dogs undergoing cholecystectomy.

Records of dogs undergoing cholecystectomy (2011 – 2019) were retrieved and allocated to group EAA or SA (systemic analgesia). Information (Table 1) was compared using Student t-test or Mann-Whitney U test, and Fisher's Exact test.

Of the 41 records included, 22 and 19 were allocated to groups EAA and SA, respectively. An epidural catheter (EC) was placed preoperatively in 8 dogs. In the remaining, EC was placed postoperatively but an epidural was performed preoperatively. The EC tip was between the 4th lumbar and the 10th thoracic vertebrae. Postoperatively, 3 dogs were excluded from group EAA: one (euthanasia) during the first 24 hours (F24h); two (euthanasia and EC dislodgment) during the second 24 hours (S24h).

When compared to SA, EAA reduced the perioperative analgesic requirements and promoted food intake in dogs undergoing cholecystectomy.

Table 1: (*p < 0.05)		**EAA**		**SA**	
		Yes	No	Yes	No
Preoperative	Levobupivacaine (%)	0.38 (0.19 – 0.48)			

Intraoperative	Opioid requirement (dogs)*	9	13	19	0
Postoperative	Levobupivacaine (%)	0.17 (0.125 – 0.25)			
F24h	Methadone (dogs)*	9	12	18	1
	Methadone administrations (n)*	0 (0 – 3)		5 (0 – 7)	
	Analgesic infusion (dogs)*	1	20	11	8
	Food intake (area under the curve)*	428 ± 249		241 ± 187	
S24h	Methadone (dogs)*	3	16	13	6
	Methadone administrations (n)*	0 (0 – 3)		3 (0 – 6)	
	Analgesic infusion (dogs)*	0	19	9	10
	Food intake (area under the curve)*	818 ± 300		499 ± 257	

Updates on the anatomy of the brachial plexus in dogs: contralateral comparison and body weight correlation in a cadaveric study

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In the present study, the anatomy of the brachial plexus in dogs was studied: the depth and diameter of each nerve were evaluated and compared with those of the contralateral limb. Eighteen canine cadavers were included and divided into three groups: small (SB); medium (MB) and large (LB) breed dogs. Following anatomical dissection, the suprascapular, the subscapular, the axillary, the radial, the ulnar, the median and the musculocutaneous nerves were identified. For each nerve, their origin from the spinal nerves, the diameters of the nerves and nerve roots, as well as the distance of the nerve roots from the skin were recorded. Differences between groups were compared with a single way ANOVA. All data were compared between the contralateral limbs with a paired sample t-test.

A total of thirty-six brachial plexuses were evaluated and all were seen to originate from the ventral rami of the C6, C7, C8 and T1 spinal nerves. The diameters of the nerves and nerve roots and the mean distance of the nerve roots from the skin presented larger values in LB

dogs, and they were positively correlated with body weight. No significant differences were recorded between contralateral limbs.
The contribution of the spinal nerves to the brachial plexus, the depth of the nerves and of their roots, as well as the nerve diameters were described. A deep anatomical knowledge might prove helpful for nerve location (Lemke and Creighton 2008), while reducing the incidence of complications (Campoy and Read 2013) during brachial plexus blocks.

References

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A novel ultrasound-guided cranial segments of cervical plexus block in dogs

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The aim of this anatomic study is to describe an ultrasound-guided technique for blocking the cranial roots of the intermediate cervical plexus block in dogs.
Nine canine thawed cadavers were used. Dissection of the cervical region was performed in one cadaver to recognize the relevant anatomy. Subsequently, an ultrasound-guided was carried out bilaterally inside the interfacial cervical plane below the superficial cervical muscles administering iodinated contrast at 0.3 ml kg^{-1}. The technique was repeated in seven more cadavers administering a 50:50 mixture of iodinated contrast: methylene blue at 0.15 ml kg^{-1} in each side, except in one cadaver (only iodinated contrast used). Computed tomography (CT) and dissection of both sides of the neck were carried out to evaluate the dye distribution. Results for distribution and nerve staining were presented in number (n/n).
The interfacial plane was recognized ultrasonographically in all the cadavers. All the injections resulted in a hydro-dissection of that plane. The C2, C3 and C4 ventral branches were stained in 12/12, 10/12 and 4/12 nerves, respectively. The fascia surrounding C2 and C3 ventral branches was stained in all the cases. CT images showed a cranial distribution up to C1 in 3/14 sides and a caudal distribution down to C6 in 1/14 sides. Contrast was observed inside the vertebral canal only administering 0.3 ml kg^{-1}.

This technique resulted in a predictable distribution and staining of C2 and C3 ventral branches. No spreading of contrast into vertebral canal was observed with low volume. Further studies will be necessary to demonstrate its clinical efficacy.

Comparison of intraperitoneal lidocaine and ropivacaine for postoperative analgesia in dogs undergoing major abdominal surgeries

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This study aimed to compare the postoperative analgesic efficacy of intraperitoneal lidocaine *versus* ropivacaine in dogs undergoing major abdominal surgeries.
Dogs were administered intramuscular dexmedetomidine and methadone. Anaesthesia was induced with propofol and maintained with isoflurane. At the end of surgery, dogs (n = 8/group) randomly received intraperitoneal lidocaine (4 mg kg^{-1}, diluted with 0.9% saline to 5 ml kg^{-1}, L group), ropivacaine (4 mg kg^{-1}, diluted to 5 ml kg^{-1}, R group) or 0.9% saline (5 ml kg^{-1}, C group). Pain was assessed preoperatively and at different time points up to 24 hours after extubation, using the Short Form of Glasgow Composite Pain Scale (SF-GCPS). Rescue methadone was administered if SF-GCPS $\geq$ 6/24 (Reid et al. 2007). Data were analysed using Kruskal-Wallis and Friedman tests.
In group C, postoperative SF-GCPS scores were significantly higher than in groups L and R, at 1 [4 (4 - 4), 2 (1 - 4), 1.5 (1 - 4)], 2 [4 (3 - 8), 2 (1 - 3), 1.5 (1 - 3)] and 4 [5 (2 - 8), 2 (1 - 4), 2.5 (2 - 3)] hours. Postoperative SF-GCPS significantly decreased in groups L and R when compared to preoperative scores. Treatment failure rate was 37,5% (3/8 dogs) at 9 hours in L group, 12.5% (1/8 dogs) at 12 hours in R group, and 100% (8/8 dogs) at 4 hours in C group. Intraperitoneal lidocaine and ropivacaine provides a reliable postoperative analgesia compared to control, but longer-lasting in group R.

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The pharmacokinetics of dexmedetomidine after perineural or single IV administration in anaesthetized dogs

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This study investigated the pharmacokinetics of dexmedetomidine (DEX) as an adjunctive drug to levobupivacaine for regional anaesthesia of oral cavity in dogs.

Thirty dogs undergoing dental procedures were assigned to three groups (n = 10) to receive levobupivacaine (all four dental blocks, Pascoe 2020) with DEX 0.5 µg kg^{-1} IO (infraorbital block), IA (inferior alveolar block) or IV. Placebo (IV group) or DEX (IO and IA group) was administered together with levobupivacaine perineurally at the last block, after which the DEX (IV group) or placebo (IO and IA group) was injected IV within 2 minutes. Blood samples were collected before and immediately after administration of the last oral block and 3, 4, 7, 12, 17, 32, 47, 62, 92, and 122 minutes thereafter. Quantification of DEX in plasma was performed using liquid chromatography coupled with tandem mass spectrometry. Pharmacokinetic parameters were calculated by analysis of plasma concentration–time curves using Graph Pad Prism

The results are shown in Table (mean ± SEM).

	C_{max} (ng mL^{-1})	T_{max} (minute)	Bioavailability	$t_{1/2}$ (minutes)	AUC (ng mL^{-1} minute)	V_D (L kg^{-1})	Cl (mL $minute^{-1}$ kg^{-1})
IV	5.23 ± 0.85			5.98 ± 0.46	42.11 ± 5.01	0.12 ± 0.02	14.17 ± 1.58
IO	0.47 ± 0.08	7.22 ± 1.28	0.48	63.44 ± 24.15*	20.08 ± 3.82*		
IA	0.76 ± 0.09	7.50 ± 1.63	0.56	23.78 ± 3.78*	23.78 ± 3.78*		

* Comparing to IV administration ($P < 0.01$, one-way ANOVA)

Infraorbital administration resulted in faster absorption, lower bioavailability and slower elimination compared with IA administration.

Reference

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Cat

Optimisation of cat neutering anaesthesia protocols for use in the community

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The aim of this study was to determine whether sedative combinations supplemented with isoflurane mask induction provided both appropriate anaesthesia for cat castrations and rapid recoveries suitable for ambulatory neutering services.

Two sedative combinations, medetomidine 600 mcg m^{-2} and buprenorphine 180 mcg m^{-2} or medetomidine 500 mcg m^{-2} and methadone 5 mg m^{-2}, were given by intramuscular injection and their sedative effects were scored prior to mask induction using a simple descriptive scale adapted from Gurney et al (2000) consisting of 7 components with a total score of 18 possible. Meloxicam was given subcutaneously at 0.3 mg kg^{-1} prior to surgery. Endotracheal intubation and maintenance with isoflurane were used throughout orchidectomy in 89 cats. Atipamezole 5mg/ml was given intramuscularly at half of the original medetomidine volume following the completion of each surgery and recovery times were monitored to include sternal and entering portal times. Both combinations were compared for sedation quality and recovery times using the t-test.

The medetomidine and methadone combination provided higher sedation scores (13 ± 2.9), and shorter recovery times (4.9 ± 3.6 minutes), than the medetomidine and buprenorphine combination (12 ± 2.8) and (7.3 ± 3.6 minutes) respectively. Both combinations provided sufficient sedation to allow mask induction and endotracheal intubation prior to cat castration.

Medetomidine can be used in combination with methadone to provide rapid onset and reliable sedation in the cat. This permits mask induction, endotracheal intubation and rapid recovery following atipamezole administration.

Can cat carers reliably assess acute pain in cats using the Feline Grimace Scale? A large bilingual global survey (voted best abstract)

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This study aimed to investigate if cat carers could reliably assess acute pain using the Feline Grimace Scale (FGS) and if participants' demographics could affect scores.

An online survey in English and Spanish was advertised by the International Cat Care and other platforms (March to May 2021) using a convenience sample. Eligible participants were cat carers over 16 years-old and non-veterinary health professionals. Participants and a group of eight veterinarians scored 10 images of cats with different levels of pain. Data were analysed using linear models and intraclass correlation coefficient (ICC) ($p < 0.05$). Interpretation of ICC was: < 0.2 = poor; 0.21-0.4 = reasonable; 0.41 - 0.60 = moderate; 0.61 - 0.80 = good; 0.81 - 1.0 = very good (Altman 1991).

A total of 3039 responses were received with 1262 completed answers from 66 countries (86%, 11.1% and 2.9% identified as 'female', 'male' or 'other'). Scores for each action unit (AU) (ear position, orbital tightening, muzzle tension, whiskers change and head position) and their sum (FGS score) were not significantly different between carers and veterinarians, except for muzzle (carers: 0.9 ± 0.0; veterinarians: 0.7 ± 0.1, $p = 0.035$). The ICC single (carers) was 0.65, 0.69, 0.58, 0.37, 0.38, and 0.65 for AU ears, eyes, muzzle, whiskers, head, and sum of scores, respectively. Demographic data did not affect FGS scores.

The FGS scores had good reliability when used by cat carers regardless of demographic data showing potential applicability of the instrument to improve feline pain management and welfare worldwide.

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The effects of sedation with dexmedetomidine-butorphanol and anaesthesia with propofol-isoflurane on Feline Grimace Scale scores

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This study aimed to evaluate the effects of sedation and anaesthesia on the Feline Grimace Scale (FGS) scores in healthy cats.

Ten healthy adult cats (4.4 ± 0.7 kg) were included in a prospective, blinded, randomized, cross-over study with a 14-day wash-out. Saline (G1) or dexmedetomidine (5 μg kg^{-1})-butorphanol (0.2 mg kg^{-1}) IM (G2) was administered 15 minutes before anaesthetic induction with propofol and maintenance with isoflurane (30 minutes). Saline (G1) or atipamezole (50 μg kg^{-1}) (G2) was administered at the end of anaesthesia. Video-filming/image capturing was performed up to 24 hours after the anaesthesia. A total of 125 images were independently evaluated by four raters blinded to treatment using the FGS [ear/eye/muzzle/whiskers/head position; action units (AU)]. Inter-rater reliability and effects of sedation/anaesthesia were analysed with intraclass correlation coefficient [single measures (95% confidence interval)] and linear mixed model, respectively ($p < 0.05$).

Reliability was good for total scores [0.76 (0.69-0.82)], eye [0.79 (0.73-0.84)], muzzle [0.62 (0.54-0.70)] and head position [0.69 (0.61-0.76)], moderate for ears [0.60 (0.51-0.68)], and poor for whiskers [0.37 (0.22-0.51)]. Total and each AU scores were significantly higher in G2 than G1 after dexmedetomidine-butorphanol. In G1, total, eye, whiskers and head position scores were significantly higher than baseline at 0.5 hour post-anaesthesia. In G2, when compared with baseline, total and each AU scores were significantly higher after sedation whereas eye scores were significantly higher at 0.5 hour post-anaesthesia.

Sedation with dexmedetomidine-butorphanol and anaesthesia with propofol-isoflurane affect FGS scores on a short-term basis and may bias clinical pain assessment.

Construct validity, responsiveness, and reliability of the Feline Grimace Scale in kittens

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This study aimed to investigate construct validity, responsiveness, and reliability of the Feline Grimace Scale (FGS) in kittens.
Following ethics committee approval, thirty-six healthy kittens (aged 10 weeks to 6 months) were included in a prospective, randomized, blinded study. Video-recordings of kittens were performed before, and 1 and 2 hours after ovariohysterectomy using an opioid-free injectable aneasthetic protocol with or without multimodal analgesia, as well as before and 1 hour after administration of rescue analgesia (buprenorphine 0.02 mg kg^{-1} IM). Screenshots of facial images were collected from video-recordings for FGS scoring. Four observers unaware of time-points scored 111 randomized images independently and twice within a 5-week interval. Five action units (AU) were scored (ear position, orbital tightening, muzzle tension, whiskers position, and head position; 0-2 each). Construct validity, responsiveness, and inter- and intra-rater reliability were evaluated using linear models with Benjamini-Hochberg corrections, Wilcoxon signed rank test, and intra-class correlation coefficients (ICC), respectively ($p < 0.05$).
Total FGS scores were higher at 1 and 2 hours after ovariohysterectomy (2.96 ± 1.68 and 2.88 ± 1.69, respectively) than baseline (1.63 ± 1.73) ($p < 0.001$), and lower after the administration of rescue analgesia (before: 3.79 ± 1.94, after: 2.43 ± 1.79) ($p < 0.001$). Inter-rater ICC was 0.91 for FGS total scores and > 0.77 for all AU, except for whiskers (0.63). Intra-rater ICC was > 0.77 for FGS total scores.
The FGS is a valid and responsive acute pain scoring instrument with good to excellent reliability in kittens undergoing ovariohysterectomy.

Clinical assessment of a supraglottic airway device in cats

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This retrospective study aimed to assess the positioning of a supraglottic airway device designed for cats and determine potential factors which could anticipate its incorrect positioning.

The study was performed at the University CEU Cardenal-Herrera after obtaining ethical approval. Computed Tomography (CT) scans of cats anaesthetised for different clinical reasons were assessed. Normal capnographs were recorded in all cases during the CT scanning and no side effects were recorded. Veterinary students placed the devices under the supervision of an anaesthetist. The data recorded were the cat age, weight, gender, device shoulders position, bowl fitting around the larynx, oesophagus closure, device size used, and the relationship between the device size used and the recommended by the manufacturer in each case.

Data were analysed using "R" statistical software. Logistic regressions were used to identify the factors. Results were shown as numbers (n/n), median and range. A significant difference was defined when $p < 0.05$.

Fifty-five CT scans were assessed. Results were shown in Table 1. No significant differences were found among the recorded data and bowl fitting or oesophagus closure.

Our results show that an adequate capnography wave does not confirm the correct positioning of the supraglottic device.

Table 1.

Sex	Female: 28/55 Male: 27/55
Age	< 1-year-old: 1/55 1–12-year-old: 52/55 12-year-old: 2/55
Weight	3.25 (1.67-6) kg
Size	C2: 29/55 C3: 15/55 C4: 11/55
Recommended size	Correct: 42/55 Bigger: 5/55 Smaller: 8/55

Shoulders	Yes: 18/55 No: 37/55
Bowl fitting	Yes: 46/55 No: 9 /55
Oesophagus closure	Yes: 11/55 No: 43/55 Missing: 1/55

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Pharmacokinetics of bupivacaine following administration by an ultrasound-guided transversus abdominis plane block in cats undergoing ovariohysterectomy

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This study describes the pharmacokinetics of bupivacaine following administration via an ultrasound-guided transversus abdominis plane (TAP) block in cats undergoing ovariohysterectomy.

Twelve healthy adult cats (3.7 ± 0.7 kg) were included in a randomized, prospective, blinded clinical trial. Anaesthetic protocol included acepromazine-buprenorphine-propofol-isoflurane-meloxicam. Each cat received 1 mL kg^{-1} of bupivacaine 2% or 2.5% (2 mg kg^{-1} or 2.5 mg kg^{-1}; BUPI2 and BUPI2.5, respectively) via bilateral two-point TAP block before surgery (n = 6/group). Blood was collected using a dedicated catheter placed into a cephalic vein before (time 0) and at 5, 10, 15, 30, 60, 120, 240, 360, and 480 minutes after TAP injection. Plasma concentrations of bupivacaine were analysed using liquid chromatography-tandem mass spectrometry. Bupivacaine pharmacokinetics was described using a one-compartment model and non-compartmental analysis.

No signs of bupivacaine toxicosis were observed. Bupivacaine was detected up to 480 minutes (335 ± 76 in BUPI 2 and 485 ± 198 ng mL^{-1} in BUPI 2.5). For BUPI2 and BUPI 2.5, maximum bupivacaine plasma concentrations (Cmax) were 1166 ± 511 and 1810 ± 536 ng mL^{-1} at 33 ± 14 and 47 ± 22 min (Tmax), clearance was 5.3 ± 1.8 and 4.9 ± 1.4 mL min kg^{-1} and elimination half-life was 253 ± 55 and 217 ± 52 min, respectively.

A TAP block with two doses of bupivacaine produced concentrations below toxic levels (Chadwick 1985). A dose of 2.5 mg kg^{-1} is safe to be administered and further studies are warranted to investigate the analgesic efficacy of this technique in cats.

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Distribution of injectate spread using two approaches for an ultrasound-guided transversus abdominis plane block in cats: a cadaver and computed tomography study

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This study compared the distribution of a bupivacaine-iohexol-dye solution administered by one- versus two-point ultrasound-guided transversus abdominis plane (TAP) injection in cats. Eight cat cadavers were included in a randomized, prospective, blinded, anatomical and computed tomography study. On each side of each cadaver, volumes of 0.5 or 0.25 mL kg^{-1} per point of the solution were injected using either one (lateral; TAP-L) or two (subcostal and

lateral; TAP-SL) in-plane injection points, respectively. Computed tomography assessed contrast distribution and cranio-caudal spread into the TAP. Anatomical dissection evaluated dye distribution and number of thoracic (T) and lumbar (L) spinal nerves stained >1 cm circumferentially. Student's t and Mann-Whitney tests were used for statistical analysis ($p < 0.05$).

Eight TAP-L and eight TAP-SL injections were performed. The TAP-SL resulted in a wider spread of contrast (mm) compared with the TAP-L (87.0 ± 7.0 *versus* 71.4 ± 9.1; $p = 0.002$). The prevalence of nerve staining was higher using TAP-SL than TAP-L ($p = 0.001$). The ventral branches of T10, T11, T12, T13, L1 and L2 were stained in 2/8, 2/8, 5/8, 7/8, 4/8 and 1/8, and in 7/8, 7/8, 8/8, 8/8, 8/8 and 1/8 using TAP-L and TAP-SL approaches, respectively. Using computed tomography and dissection, minimal injectate was identified intraperitoneally or within the falciform ligament fat following both approaches TAP-L or TAP-SL.

Ultrasound-guided TAP-SL produced more consistent injectate spread around the thoracolumbar spinal nerves than TAP-L. Intraperitoneal injection is a possible risk. The efficacy of the TAP-SL block should be investigated in cats.

Ultrasound-guided suprainguinal femoral nerve block in cat cadavers: a descriptive study

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The aim of this study was to describe the ultrasound-guided technique for a suprainguinal approach to femoral nerve (FN) block in cat cadavers. A similar approach has been described in dogs.

Eight feline cadavers weighing 3.95 kg (range 3-5 kg) were used in our cadaveric study. Two cadavers (four limbs) were used to identify the anatomical features, and six cadavers (twelve limbs) were used to assess the spread of methylene blue dye after extra-epineural FN injection. The cadavers were placed in lateral recumbency, with the limb to be blocked uppermost, abducted, and extended caudally. A linear transducer was used for scanning and

placed perpendicular to the midline at the level of the inguinal nipple. After visualization of the FN, methylene blue was injected extra-epineurally using a hyperechoic needle and an in-plane approach. The cat was turned, and the technique was repeated on the contralateral side. A volume of 0.15 mL kg^{-1} of methylene blue was used for injection. After injections, the area was dissected bilaterally, and the success was evaluated. A positive FN staining was considered for a coverage of >2 cm in their entire circumference.

Twelve ultrasound-guided femoral nerve injections were performed. The femoral nerve was visualized as a circular structure with a honeycomb pattern center in the ventral portion of the iliopsoas muscle in all cases. All FNs (100% of cases) were stained over a distance of >2 cm in their entire circumference.

The ultrasound-guided suprainguinal approach may be suitable and reproducible for a successful femoral nerve blockade in cats.

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Retrobulbar block: an anatomical and computed tomography evaluation of two ultrasound-guided approaches in cat cadavers

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This study described two ultrasound-guided retrobulbar block techniques and compared their injectate spread using anatomical and computed tomography evaluation in cat cadavers.

Ten cadavers received two retrobulbar injections with 0.5 mL dye-iohexol-bupivacaine solution using either a rostral (RRB) or temporal (TRB) approach. For RRB, a microconvex transducer was positioned rostral to the globe and a spinal needle was introduced using an in-plane lateral-medial direction. For TRB, the transducer was placed perpendicularly to the temporal fossa and the needle introduced using an in-plane caudal-rostral direction.

Ultrasound-guided needle visualization was scored (good, poor, absent). Computed tomography and dissections were performed to determine injectate spread. Statistical analysis was performed using the Fisher's exact test ($p < 0.05$).
Needle visualization was "good" in 20% RRB and 50% TRB and never "absent". Injectate distribution was always within the retrobulbar compartment. Following RRB and TRB, injectate spread was exclusively periconal in 40% and 70% injections, intraconal in 50% and 0%, and in both compartments in 10% and 30%, respectively. The intraconal compartment was 100% stained in 60% RRB and 0% TRB ($p = 0.011$). The maximum circumferential spread in the periconal compartment was 75% and occurred in 40% RRB and 80% TRB. Computed tomography showed injectate spread into the orbital fissure and within the temporal muscle (40% and 50% RRB *versus* 70% and 30% TRB, respectively).
The RRB and TRB approaches resulted in different periconal and intraconal spread. Future studies should assess the clinical efficacy and optimal injectate volumes of these techniques for enucleation.

Does opioid-free anesthesia provide adequate analgesia within a multimodal protocol in cats undergoing ovariohysterectomy?

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This study aimed to compare the analgesic effects of an injectable protocol using multimodal analgesia with or without opioids in cats undergoing ovariohysterectomy (OVH).
Thirty-two healthy cats were enrolled in a prospective, blinded, randomized trial. Cats received a combination of ketamine (4 mg kg^{-1}), midazolam (0.25 mg kg^{-1}) and dexmedetomidine (40 μg kg^{-1}), and either buprenorphine (20 μg kg^{-1}) or saline (same volume as buprenorphine) IM [opioid (OPG) and opioid-free (OFG) groups, respectively]. Intraperitoneal bupivacaine 0.25% (2 mg kg^{-1}) and meloxicam (0.2 mg kg^{-1} SC) were administered before OVH. Atipamezole (400 μg kg^{-1} IM) was administered at the end of surgery. Pain and sedation were evaluated using the Feline Grimace Scale (FGS) and a

dynamic interactive visual analog scale, respectively, for up to 24 hours. Intravenous buprenorphine was administered if FGS scores ≥ 4/10. Statistical analysis included repeated measures linear mixed models, Fisher's exact test and Bonferroni adjustments when appropriate ($p < 0.05$).

Twenty-seven cats were included. The prevalence of rescue analgesia was lower in OPG (n = 0/13) than in OFG (n = 5/14) ($p = 0.04$). The FGS scores (least square means and 95% CI) were higher in OFG at 1h [2.0 (1.3-2.7)] and 2h [2.2 (1.5-2.9)] than baseline [0.7 (0.0-1.4)], but not in OPG. Sedation scores were not significantly different between groups.

Opioid-free injectable anesthesia was appropriate for some cats using a multimodal approach. However, single dose IM buprenorphine eliminated the need for rescue analgesia and assured adequate pain management after OVH in cats.

A comparison of an opioid-free injectable anesthesia protocol with or without multimodal analgesia in kittens undergoing ovariohysterectomy

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This study compared an opioid-free injectable anesthetic protocol with or without multimodal analgesia in kittens undergoing ovariohysterectomy.

In this prospective, randomized, and blinded clinical trial, twenty-nine healthy kittens (1.55 ± 0.46 kg and aged between 10 weeks and 6 months) were included. Anesthesia was performed with a single IM injection containing dexmedetomidine (40 μg kg^{-1}), ketamine (4 mg kg^{-1}) and midazolam (0.25 mg kg^{-1}). In the multimodal group (MMG), cats (n = 14) received SC meloxicam (0.1 mg kg^{-1}) and intraperitoneal bupivacaine 0.25% (2 mg kg^{-1}), whereas the same volume of saline was administered in the control group (CG, n = 15). Atipamezole (0.4 mg kg^{-1}) was given IM fifteen minutes after the end of ovariohysterectomy. Postoperative pain was assessed up to 24 hours using the UNESP-Botucatu multidimensional feline pain assessment scale – short form. Rescue analgesia (buprenorphine 0.02 mg kg^{-1} IM and also meloxicam 0.1 mg kg^{-1} in CG) was administered if pain scores were ≥ 4/12. Statistical

analyses were performed with linear models and post-hoc pairwise comparison with Benjamini Hochberg corrections ($p < 0.05$).
Pain scores were significantly higher in CG at 1 and 2 hours postoperatively (4.0 ± 2.6, 3.0 ± 2.5, respectively) than MMG (1.6 ± 1.0, 1.1 ± 1.0, respectively). The prevalence of rescue analgesia was higher in CG (n = 15/15) than MMG (n = 1/14) ($p < 0.001$).
This opioid-free protocol using multimodal analgesia produced adequate postoperative pain relief while almost eliminating the need for rescue analgesia in kittens undergoing ovariohysterectomy.

Equine

A step forward in the fourth Confidential Enquiry into Perioperative Equine Fatalities (CEPEF4): data collection over 14 months using an internet-based method

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The CEPEF2 is the largest study to evaluate equine anaesthetic risk (noncolic death rate 0.9%) (Johnson et al., 2002). Preliminary results from CEPEF4 (6.701 cases in six months), suggest a trend towards reduced mortality (Gozallo et al.,2021). This report updates the data, now from almost 20.000 cases.
Data were collected using an internet-based method, cleaned, and processed with the statistical software R.
Over 14 months, 19.796 general anaesthetics were collected from 77 centers. Of these cases, anaesthesia was maintained with partial intravenous anaesthesia (PIVA) in 10.982, inhalation only (INH) in 7.249 and total intravenous anaesthesia in 1.565. Mortality rates within seven days of general anaesthesia were: overall 0.9%, 0.6% in noncolics and 2.9% in colics.
Common anaesthesia practices include: i) sedation with drug combinations, primarily alpha-2-agonists/opioids ± acepromazine (71.2%); ii) induction with ketamine/benzodiazepines (86.6%); iii) isoflurane as the most common inhalant (87.2% of inhalant-based anaesthetics);

iv) PIVA (60.2%) is used more commonly than INH (39.8%) for inhalant-based protocols; and recovery v) light sedation with alpha-2-agonists (68.3%), vi) either with ropes (46.3%), free (44.0%) or manually-assisted (9.7%). Finally, vi) monitoring usually included electrocardiogram (90.9%), pulse-oximetry (87.7%), end-tidal carbon dioxide (84.3%) and invasive blood pressure (80.2%). Arterial blood gases were taken in 46.1% of horses, 72.5% if undergoing colic surgery.

This report confirms the previous preliminary results (2). Horses still die unexpectedly, but with a trend towards a lower frequency. Current anaesthetic practices have evolved from Johnston et al. (2002); in particular with increased use of opioid combination premedication, ketamine/benzodiazepine induction and PIVA maintenance, isoflurane-based.

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Mortality risks in horses undergoing standing sedation for surgery and advanced diagnostic imaging. Preliminary results of the fourth Confidential Enquiry into Perioperative Equine Fatalities (CEPEF4)

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Although general anaesthesia has the highest risk of complications, procedures carried out under sedation are not risk-free. Preliminary data showed 0.2% mortality after procedures in 1.955 standing sedated horses (Gozallo et al., 2021). We report updated data from over 5.000 cases.

Horses undergoing standing sedation for surgery or advanced imaging using continuous rate infusions (CRI) or at least one extra "top-up" were included. Data were collected and processed as for general anaesthetic cases in CEPEF4.
Over 14 months, data from 5.536 standing sedations in 57 centres were collected. Overall mortality for procedures under standing sedation was 0.2%. Eleven horses died within the seven-days period due to complications: colitis (3 horses), post-operative colic (3 horses) septic peritonitis (2 horses), re-fractures in the stable (2 horses) and surgical complications (1 horses). Premedication was usually based on combinations of alpha-2-agonists/opioids ± acepromazine (82.3%). Maintenance was either with "top-ups" (69.8%) or CRI (30.2%). For "top-ups", detomidine was the most common alpha-2-agonist (82.0%) and butorphanol the most common opioid (86.5%). For CRI, detomidine was the most common alpha-2-agonist (83.9%), and butorphanol (58.8%) or morphine (39.3%) the most common opioids. Monitoring was minimal, with only temperature, ECG and pulse-oximetry used in 5.7%, 3.3% and 1.1% of the patients, respectively.
Including more data supports the previous results, indicating that standing sedation in horses is not risk-free (Gozallo et al., 2021). The main limitation was that not every centre reported all their standing sedation cases.

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Automated classification of behaviour in horses, preliminary results

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Continuous and automated assessment of discomfort or pain in horses may be possible with the use of neuronal network tracking of their position, posture, activity, and special behaviours. The use of long short-term memory (LSTM), an artificial recurrent neural network architecture, was therefore tested in this study.
Ten horses were video-recorded for 4 hours and the behaviours resting, lying, moving, alert and feeding/foraging scored manually. Additionally, the same videos were analysed with an image processing software able to recognize nine key points (nose, ears, withers, tail, and

hoof). Firstly, the data obtained from the key point analysis of five horses were used to train the LSTM model to automatically predict resting/alert and feeding/foraging behaviours. Then, the data from the remaining horses were used to test the model. The accuracy of LSTM was obtained comparing manual versus automatic scoring and calculating the proportion of correct predictions (both true positives and true negatives) over the total number of cases examined.
The LSTM model showed a global accuracy of prediction of 95.65%. Accuracy of the prediction during training for resting/alert and feeding/foraging behaviours was 98.58% and 93.58%, respectively. However, less accuracy was observed during testing of the model.
The model showed acceptable accuracy to predict resting/alert and feeding/foraging behaviours during training. Although these preliminary results render LSTM as a promising tool for continuous and automated detection of pain and discomfort in horses, further studies with larger data are required to improve the accuracy of the prediction this model.

Validation of a commercially available automated video tracking system for horses

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Measurement of activity time budgets in horses is a promising method to determine animal welfare and discomfort. The use of cameras including artificial intelligence (AI) can be used to automatically assess activity and evaluate basic behaviours. However, validation of the method is required prior to clinical application.
Ten horses standing in a box were observed for 24 hours with a commercially available camera (ACARIS Horse Protector, *), with integrated AI. The camera analysed in real time the eating, resting, and lying behaviour of the horse and displayed the obtained data via an application in percentage per behaviour and per hour. Additionally, the videos were recorded. Likewise, these videos were manually scored for the same behaviours with a behaviour scoring software. Automatic and manually obtained data were compared using Bland-Altmann analysis.
The bias for eating, resting, and lying was -10.30%, 12.63% and 1.11% with a standard deviation of 23.42%, 23.60% and 10.03%. The correlation coefficient for eating, resting, and lying was 0.628, 0.615, and 0.808, respectively. The 95.0% lower confidence limit of mean

was -13.87% for eating, 9.03% for resting and -0.4% for lying. The 95.0% upper confidence limit of mean was -6.74% for eating, 16.23% for resting and 2.64% for lying.
The camera analysed the behaviour with an overall acceptable accuracy. Further improvement of the accuracy of the used AI camera is required to render the method suitable for automated analysis of welfare and discomfort in horses.

Influence of experimentally induced endotoxemia on microcirculatory variables in horses

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Endotoxemia can impair microcirculation by promoting vasoplegia and shunting of oxygenated blood (Ince 1999) leading to potential increase in mortality and morbidity in equids.
This was a prospective, randomized, controlled trial. Six healthy adult horses which were anaesthetized with isoflurane (ET_{Iso} ~1.6) and mechanically ventilated (normocapnia), received dobutamine CRI. Endotoxemia was induced with *E. coli* B55:O5 LPS 30 ng kg^{-1} over 30 minutes IV. Microcirculation variables of buccal, intestinal, and genital mucosa were obtained by sidestream-darkfield microscopy [(perfused deBacker density, proportion of perfused vessels (PPV), microvascular flow index (MFI), heterogeneity index {(HI); calculated}, laser-doppler flowmetry (blood flow, (LDF)], and white light spectrometry [tissue oxygenation (tSO_2)]. Measurements were obtained before and after endotoxin infusion at predetermined time points. Data were analyzed by one-way-ANOVA and Wilcoxon signed-rank test.
After endotoxin, buccal, intestinal, and genital tSO_2 and LDF did not change significantly. Sidestream-darkfield microscopy revealed no changes in perfused DeBacker density and PPV, whereas MFI and HI (Table) decreased after endotoxin infusion.

	Baseline		30-min		120-min	
	MFI	HI	MFI	MI	MFI	HI
Buccal	2.9 (1.8; 3)	0.1 (0.04; 0.16)	2.5 (0.7; 3)	0.17 (0; 2.3)	1.9 (0.7; 3)	0.6 (0.04; 2)
Intestinal	1.8 (0.7; 2.6)	1 (0.1; 2)	1.2 (0.2; 2)	0.8 (0.4;3.3)	0.9 (0.8; 2.4)	1.1 (0.6; 1.6)
Genital	2.8 (2.28; 3)	0.12 (0; 0.4)	2.4 (2; 2.8)	0.3 (0.1; 0.5)	1.5 (0.4; 2.1)*	1 (0.4;3.3)*
median (min; max), * p ≤ 0.05						

At the endotoxin dose used, short term experimental endotoxemia under isoflurane anaesthesia induced only minor alterations in microcirculation in horses.

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Effects of endotracheal intubation on respiratory pattern and distribution of ventilation in anaesthetised horses

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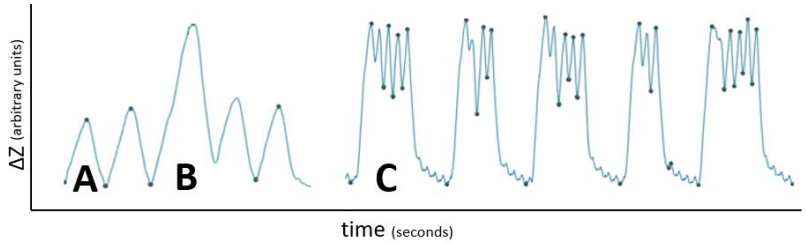
Equine respiratory physiology might be influenced by endotracheal intubation. This study aimed to compare breathing pattern (BrP) and ventilation distribution in anaesthetised horses spontaneously breathing room air via facemask (MASK) or endotracheal tube (ETT). Electrical impedance tomography (EIT) via a thoracic belt was used in six horses anaesthetised with TIVA (xylazine, ketamine, guaiphenesin). Horses positioned in right lateral recumbency were randomly assigned to breathe spontaneously via one of two treatments (either ETT or MASK) for the first 30 minutes, followed by the other treatment for additional 30 minutes. One-month later, during a second anaesthesia, treatment order was

inversed. EIT data were collected over 2 minutes every 15 minutes. The impedance change (ΔZ) curve was used to classify breaths as normal (linear inspiration and expiration), abnormal-sigh (>1.3 x ΔZ normal breath) and abnormal-*crown-like* (group of breaths with incomplete expiration in-between breaths) (Figure 1). Proportion of normal/abnormal breaths across treatments were compared using Cochran-Mantel-Haenszel analysis. Ventral-dorsal (CoVVD) and right-left centre of ventilation (CoVRL), inspiratory (t_i) and expiratory (t_e) times and I:E ratio were compared across treatments using a mixed linear model analysis. Breathing pattern was associated with treatment (p=0.012) with more abnormal breaths during ETT. CoVRL showed more dependent ventilation during MASK (p = 0.025). Inspiratory time was shorter for ETT (p = 0.045) with lower I:E ratio (p = 0.017). Endotracheal intubation alters BrP and shifts ventilation towards the non-dependent lung when compared to facemask in horses anaesthetised with TIVA.

Figure 1. Impedance curve examples: A) normal. B) abnormal-sigh. C) abnormal-crown-like.



Effect of ketamine on xylazine based sedation in horses during standing ventriculocordectomy and laryngoplasty

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Beneficial effects of low dose ketamine have been studied in standing procedures (Muller et al. 2017). The aim of this prospective, randomized, clinical study was to determine the rate of xylazine constant infusion (CI) when ketamine CI was administered in standing healthy horses undergoing elective laser ventriculocordectomy and laryngoplasty.

Acepromazine (0.3 mg kg^{-1} IM), 30 minutes before sedation with xylazine (0.7 mg kg^{-1}; initial rate 0.5 mg kg^{-1} $hour^{-1}$), and morphine (0.1 mg kg^{-1}) IV were given. Ten minutes later ketamine bolus (0.25 mg kg^{-1} in 15 minutes + 0.5 mg kg^{-1} $hour^{-1}$; Group K) or saline (same volume; Group S) were administered. Every 10 minutes f_R, HR, SAP, MAP, DAP, ataxia,

sedation and surgical condition (0-3) were registered. The Ghent Sedation Algorithm was used to adjusted xylazine and if xylazine could not improve surgical conditions romifidine (4 μg kg^{-1}) was administered. A t-test or a Mann-Whitney U test (Range (25^{th}-75^{th})) were performed.

Thirty horses were included (13 S;17 K). Xylazine dose was significantly lower with ketamine (0.77 ± 0.31 vs 0.93 ± 0.42). No differences in romifidine bolus. Ataxia (p = 0.001), sedation (p = 0.001) and surgical conditions (p = 0.001) values were significantly different between S and K groups. Significant differences for f_R, HR, SAP, MAP and DAP existed between groups.

Ketamine CI reduced the xylazine dose and improved sedation quality.

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Comparison of iatrogenic trauma to the upper airway in horses during endotracheal intubation using 2 different sized endotracheal tubes

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In horses, there is a significant risk of iatrogenic trauma to the upper airway during endotracheal intubation. The objective of this *in-vivo* study is to compare trauma caused during endotracheal intubation using two different sized endotracheal tubes in horses undergoing general anaesthesia.

Twenty-seven Thoroughbred racehorses undergoing surgery in dorsal recumbency were included in this study. Endoscopic examination of the upper airway was performed pre/post-operatively. If lesions were present pre-operatively the horses were excluded from the study. Horses were randomly intubated with either a 26mm internal diameter endotracheal tube (ETT) (n = 14) or a 20mm internal diameter ETT (n = 13). Post-operative endoscopy was

performed following recovery and lesions in the larynx and trachea were noted along with intra-tracheal mucus plaques and graded on a scale from 0-3 (Heath et al 1989).
All horses in the 26mm ETT group had abnormal findings at endoscopy following recovery. These findings included grade 3 lesions (n = 7), grade 2 lesions (n = 4) and grade 1 lesions (n = 3). For horses intubated with the 20mm ETT included grade 2 lesions (n = 1), grade 1 lesions (n = 7) and no abnormalities were seen in 5 horses. A Chi Square and Fisher's exact tests were used to identify a significant difference between ETT size and whether the horse experienced mucosal trauma (P = 0.002), and the grade of intra-tracheal mucus plaques (P <0.001).
Results suggest that 20mm internal diameter ETT is less likely to cause severe trauma to the larynx and trachea compared to a 26mm internal diameter ETT in horses undergoing elective surgery.

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Clinical comparison between subcutaneous and intramuscular repeated injection of dexmedetomidine in anaesthetized horses: preliminary investigation

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Dexmedetomidine has been investigated in equine patients (Gozalo-Marcilla et al. 2018). Horses received acepromazine 0.03 mg kg^{-1} and detomidine 10 µg kg^{-1} IV. Anaesthesia was induced by IV diazepam 0,05 mg kg^{-1} and ketamine 2,5 mg kg^{-1} and maintained with a steady state isoflurane (1.3%) in 60% oxygen by mechanical ventilation. Seven horses each randomly received (blindly) dexmedetomidine (2 µg kg^{-1}) administered every hour subcutaneously (group SC) or intramuscularly (group IM). Ringer's lactate and dobutamine to maintain MAP > 70 mmHg were administered IV. Physiological parameters, arterial blood gases and recovery score (Young and Taylor 1993) were recorded. Data distribution was tested with Kolmogorov-Smirnoff test. Student's *t*, Mann-Whitney and ANOVA tests were applied ($p \leq 0.05$).
Arterial blood gas parameters were not statistically different between groups and within physiological ranges. No differences in anaesthesia (minutes) (IM 133 ± 19; SC 151 ± 11)

and extubating times (minutes) (IM 15 ± 11; SC 9 ± 3), time (minutes) to attain sternal (IM 41 ± 9; SC 44 ± 10) and standing position (IM 52 ± 7; SC 55 ± 7) together with recovery score (IM 1.4 ± 0.5; SC 1.4 ± 0.5) were detected. There was significant difference in urinary output (ml kg^{-1} $hour^{-1}$ IM 6.3 ± 2.7 SC 9.8 ± 2.2) and dobutamine (μg kg^{-1} $minute^{-1}$ IM 0.40 ± 0.15; SC 0.56 ± 0.10).

Dexmedetomidine administered either by IM or SC injection at indicated dosages, showed similar effects; further studies could elucidate whether this contributed to anaesthesia and recovery quality.

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The effect of morphine on mechanical nociceptive thresholds in donkeys

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To determine if morphine has an antinociceptive effect on mechanical nociceptive thresholds (MNT) in donkeys.

Eight clinically healthy standard donkeys were used. Following jugular catheter placement, animals acclimatised for 1 hour. Donkeys received 0.1 (LDM), 0.5 (HDM) mg kg^{-1} morphine or 0.9% saline (S) intravenously. Drugs were diluted to a final volume of 10 mL and injected over 60 seconds at time 0. Order of treatments was randomized with a washout period of ≥ 7 days. An MNT testing boot was placed on one thoracic limb with a sham boot on the contralateral limb. The first treatment limb was randomized and alternated subsequently. Baseline MNT measurements were made immediately before drug injection in triplicate and averaged. MNT were measured at 15, 30, 45, 60, 90, 120, 150, 180, 210, 240, 300 and 360 minutes after. Assessments were made by an observer blinded to treatment. Data were assessed for normality and analysed for differences between treatments and within a treatment with Friedman's test and Dunn's *post hoc* test, $p < 0.05$.

Overall median (range) baseline MNT was 8.9 (6.1-16.6 N) and did not differ between treatments. Following saline administration there was no change in MNT over time. Peak median MNTs were 16.2 N and 25 N at T60 with LDM and HDM, respectively. $p < 0.026$ for S *versus* HDM. Within HDM, MNTs increased from baseline between T45-T180 *(*$p < 0.001$ and 0.014 respectively).

In this group of donkeys, HDM had the greater antinociceptive mechanical effect compared with LDM or saline.

Comparison between the effects of two post-anaesthetic doses of medetomidine on characteristics of recovery from isoflurane anaesthesia in horses

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Recovery is the most dangerous phase of general anaesthesia in horses (Gozalo-Marcilla and Ringer 2021). Alpha$_2$-agonists enhance its quality but increasing the recovery time (Santos et al. 2003).

Prospective, blinded, randomized, clinical study to compare the effect on recovery of two doses of medetomidine. Horses were under a standard general anaesthesia protocol for arthroscopy. Medetomidine (0.5 or 1 µg kg^{-1}) IV was administered just after isoflurane was discontinued. Time of different recovery phases and number of attempts were recorded. Numerical scales NS1 (1: poor - 5: excellent) and NS2 (0: excellent - 4: poor) and a composite scale (CS) (1: excellent - 6: accident) were used for quality assessment. Mann-Whitney U-test was performed ($p < 0.05$). Median (range) is presented.

Twenty-two horses *per* group were included. Results for 0.5 and 1 µg kg^{-1} groups were respectively: lateral recumbency time: 35 (16 - 91), 43 (21 - 75) minutes; sternal recumbency time: 6 (0 - 51), 6 (0 - 37) minutes; total recovery time: 47 (22 - 98), 49 (32 - 80) minutes; number of attempts to sternal: 1 (1 - 3), 1 (0 - 3) and to standing: 2 (1 - 5), 1 (1 - 7); quality according NS1: 5 (2 - 5), 5 (3 - 5); NS2: 1 (0 - 3), 0 (0 - 2); and CS: 2 (1 - 4), 1(1 - 3). No significant differences between groups were found.

Medetomidine 0.5 µg kg^{-1} dose did not decrease the recovery time but maintained the recovery quality.

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Phenylbutazone, flunixin and meloxicam clinical efficacy for lameness and laminitis in horses

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This study aims to compare the effects of phenylbutazone (PBZ), flunixin (FLU) and meloxicam (MEL) in equine lameness and laminitis. If PBZ was clearly superior to FLU and MEL, then it could support its inclusion in the 'essential list' for horses.
During the crossover blinded study, ten horses and ponies presenting with laminitis (4) or lameness (6) received orally, randomly and alternatively (2 days washout) PBZ, FLU and MEL (4, 1.1, 0.6 mg kg^{-1}) once a day for 2 days. Lameness and laminitis scores (LS) were established from videos recorded morning and evening for 3 days (AAEP scale 0 to 5). Total scores, means and changes were compared among treatments (Friedmann rank-sum test, BiostaTGV).
From same initial LS (32; mean 3.56), day 1 and day 3 LS improvements are FLU (-3; 3.22), MEL (-4; 3.22), PBZ (-9; 2.56) $p < 0.008$ and FLU (-1; -0.17), MEL (-2; -0.22), PBZ (-12; -1.33) $p < 0.01$. Day 2 dose allows the best clinical changes, (-6; -5; -12) respectively and a residual effect (evening day 3) with PBZ only (-8; -0.89) $p = 0.27$.
Results suggest faster onset of action, longer action, and more persistent clinical benefits for PBZ in horse's lameness and laminitis pain management. PBZ appeared clinically superior to FLU and MEL in this study, which supports its potential inclusion in the essential list for horses and should inform clinical decision making to use better pain treatment without having horses to be signed out of the food chain.

Comparison of hydromorphone vs. butorphanol for pain management in equine patients undergoing elective arthroscopy

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Hydromorphone is a mu-opioid agonist with anti-nociceptive effects; however, it is unknown whether it provides superior analgesia compared to butorphanol in horses.
Forty healthy horses presenting for elective arthroscopy of any joint were enrolled. Horses randomly received equipotent doses of hydromorphone (0.04 mg kg^{-1}; TxH; n = 19) or butorphanol (0.02 mg kg^{-2}; TxB; n = 21) prior to surgery as part of a standardised anaesthetic protocol including flunixin meglumine. Horses were scored for pain by two masked observers using the Equine Utrecht University Scale for Facial Assessment of Pain (EQUUS-FAP) and a composite pain scale (CPS) at three timepoints: the day prior to surgery (baseline), two hours (P2), and four hours (P4) following anaesthetic recovery. Data were analysed with a mixed-effect model.
Mean ± SD EQUUS-FAP scores at baseline, P2, and P4 were 1.2 ± 0.2, 0.9 ± 0.2, and 1.1 ± 0.2, respectively, with no effect of treatment, timepoints or interaction (all $p > 0.116$). The overall CPS score at baseline was 2.9 ± 0.2. The CPS score increased at P2 (4.3 ± 0.5, $p < 0.001$) and P4 (4.2 ± 0.6, $p < 0.001$). Compared to baseline, CPS in TxH increased at P2 (4.7 ± 2.9, $p = 0.049$) and returned to baseline at P4 (3.8 ± 2.8, $p = 0.476$). The CPS score in TxB remained elevated at P2 (4.0 ± 2.9, $p = 0.009$) and P4 (4.6 ± 2.7, $p < 0.001$).
Hydromorphone, but not butorphanol, decreased CPS back to baseline four hours after recovery.

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Cattle

Quadratus lumborum block in calves – a cadaveric study

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Quadratus lumborum block (QLB) is a technique that provides analgesia for the abdominal region in dogs (Viscasillas et al. 2021). The aim of this abstract is to report a preliminary cadaveric investigation of QLB feasibility in calves.

Five cadavers of calves weighing 33 to 50 kg and euthanised for reasons unrelated to this study were used. In one calf, an anatomical dissection of the region of interest was performed. In the other 4 calves 0.4 ml kg^{-1} of a mixture of methylene blue and saline (n=1) or methylene blue, saline and iodine contrast (n=3) was injected dorso-laterally to the quadratus lumborum muscle, ventrally to the first lumbar transverse process, under ultrasound guidance. Computed tomography (CT) was performed to assess the solution spread in 3 calves and dissection was performed to assess nerve staining in one calf.

During dissection, dye was consistently observed on the ventral branches of the first and second lumbar nerves and slightly present around the thirteenth thoracic nerve. On CT, contrast was observed from the 13^{th} thoracic to the 4^{th} lumbar vertebrae, surrounding the hypaxial musculature inside the retroperitoneal space. In one calf, contrast was observed inside the vertebral canal at the level of the 13^{th} thoracic vertebra. Dye or contrast were not observed inside the abdominal cavity or organs.

The QLB, as performed in dogs and cats, appears to be feasible in calves. Further studies are needed to evaluate the clinical efficacy.

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Pig

Comparison of invasive and modified oscillometric arterial blood pressure measurements in anaesthetised pigs undergoing magnetic resonance imaging

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Non-invasive blood pressure (NIBP) monitoring in magnetic resonance imaging (MRI) is challenging due to lack of MRI safe equipment.
Twelve Landrace pigs were anaesthetised with sevoflurane twice (n = 24), at 5 (9.0 ± 1.3 kg) and 12 weeks of age (35 ± 3.5 kg), for MRI. Oscillometric (petMAP graphic II, using a seven-meter prolongation outside the Faraday shield) and invasive blood pressure (IBP) measurements were compared. The metatarsal artery was catheterized, and the NIBP cuff placed on the contralateral metatarsus. Values of SAP, DAP and MAP were recorded every 5 minutes for 1 hour and analysed by comparison of variances and covariances, Bland-Altman and 4-quadrant graphs.
A total of 617 paired measurements were recorded. Assuming no correlation between methods' technical errors, estimated errors of the biological variance of IBP MAP and DAP were less than 5%, but 60% and 113% for NIBP, respectively. For SAP, estimates were 60% for NIBP and 65% for IBP. The bias for NIBP SAP, DAP and MAP was 2.75, 3.47 and 1.75 mmHg with a standard deviation of 14.3, 10.0 and 8.73 mmHg and a correlation coefficient of 0.57, 0.73 and 0.78, respectively. Adequate tracking of invasive blood pressure was shown over longer intervals.
Modified oscillometric measurements adequately reflected IBP in anaesthetised pigs undergoing MRI and met most of the ACVIM criteria for SAP, DAP and MAP except for the correlation criterion. While an absolute quantification of modified NIBP measurements might be misleading, relative temporal quantification was shown to be acceptable.

Rabbit

Pharmacokinetics and behavioral effects of a single oral dose of trazodone in rabbits

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This prospective randomized cross-over study evaluated the pharmacokinetics of a single oral dose of trazodone and its effects on activity and behaviour in six and eight healthy juvenile female New Zealand rabbits, respectively.

Trazodone plasma concentrations were determined by High Performance Liquid Chromatography-Mass Spectrometry in six rabbits immediately before and up to 24 hours following drug administration. Eight rabbits were equipped with accelerometers (activity) and video recorded. Three treatments were administered orally: trazodone (TRAZ; 20 mg kg^{-1}), placebo (PLAC), or no-treatment (CONTR); 3-day wash-out. Partial ethograms included exploring/grooming/vigilance/hiding. Analyses were performed over 10 hours with mixed linear models ($p < 0.05$).

Maximum plasma concentration was 6,592.6 ± 586.5 ng mL^{-1} 15 to 30 minutes after treatment. Mean half-life was 3.24 ± 0.36 hours. Area under the curve from zero to infinity was 25,412.5 ± 5,420.9 ng mL^{-1} $hour^{-1}$. Activity was greater in TRAZ and PLAC at 0-2 hours after treatment than CONTR. In TRAZ activity was reduced from 2-10 hours compared to 0-2 hours. Rabbits receiving TRAZ explored more than PLAC and CONTR at 0-2 hours; exploring was reduced in TRAZ from 2-10 hours compared to 0-2 hours. Grooming was more frequent from 0-2 hours in PLAC compared to TRAZ and CONTR and was reduced in PLAC from 2 hours onward. Compared to PLAC and CONTR, TRAZ hid less and CONTR were more vigilant than TRAZ and PLAC.

Rabbits receiving trazodone demonstrated reduced hiding and vigilance behaviours. Further studies are warranted to evaluate its clinical application.

Miscellaneous

A systematic review on the measurement properties of pain scoring instruments in farm animals

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This systematic review aimed to investigate evidence on measurement properties of pain scoring instruments in farm animals.

A registered report protocol was published with the methodology (Tomacheuski et al. 2021). Studies reporting the development and validation of acute and chronic pain scoring instruments based on behavioural and/or facial expressions of farm animals (bovine, ovine, caprine, camel, swine and poultry) were included. Data extraction and assessment were performed individually by two investigators using the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) guidelines (Prinsen et al. 2018). Nine categories were assessed: general design requirements and scale development, content validity and comprehensibility, internal consistency, reliability, measurement error, criterion and construct validity, responsiveness, and cross-cultural validity. Overall strength of evidence (high, moderate, low, or very low) of each instrument was scored based on methodological quality, number of studies and studies' findings.

Twenty instruments for three species (bovine, ovine and swine) were included. Three behavior-based instruments scored overall high evidence: UCAPS (Unesp-Botucatu Unidimensional Composite Pain Scale for assessing postoperative pain in cattle), USAPS (Unesp-Botucatu Sheep Acute Composite Pain Scale) and UPAPS (Unesp-Botucatu Pig Composite Acute Pain Scale). Four instruments scored overall moderate evidence: MPSS (Multidimensional Pain Scoring System for bovine), SPFES (Sheep Pain Facial Expression Scale), LGS (Lamb Grimace Scale) and PGS-B (Piglet Grimace Scale-B). Most instruments scored overall low or very low strength of evidence.

Pain scoring instruments showed considerable variability regarding their measurement properties. Instruments with reported validation are urgently required for pain assessment of goat, camel and avian species.

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Environment

Economic and environmental impact of reducing fresh gas flow rates in one veterinary hospital

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In alignment with the Climate Change Agreement, it is essential the veterinary industry assesses its carbon footprint. The economic and environmental impact of a policy to implement the use of Low Fresh Gas Flow (LFGF) during sedation and general anaesthesia (GA) has been evaluated in a small animal hospital.

Prospective stratified study organised into 3 phases over 5 consecutive weeks:

Phase One - Observational Phase of 2 weeks duration.

Phase Two - Training Phase of 1 week duration. All staff were trained in the new policy regarding LFGF (rebreathing circuit = oxygen flow of 10 ml kg^{-1} min^{-1}, non-rebreathing circuit = fresh gas flow of 100 ml kg^{-1} min^{-1}).

Phase Three – Implementation Phase: lasting 2 weeks. The new policy was used for all patients undergoing sedation or general anaesthesia.

In all phases all patients admitted for sedation or GA were included.

The volume of isoflurane and sevoflurane used was estimated using a daily inventory during phase 1 and 3. A weekly inventory of oxygen, air, and nitrous oxide cylinders used was taken. The economic and environmental impact between phase 1 and 3 was calculated.

Deviations from the LFGF policy, and the reason for the deviation, were recorded.

Complications related to LFGF were also recorded.

Despite a violation of the policy was recorded in 52% of anaesthetics or sedations, a saving of 23 tonnes $CO2_e$ and cost reduction of £9000 per annum could be achieved. The use of LFGF anaesthesia produces a substantial economic and environmental saving and should be used where possible.

Carbon footprint of a canine tibial plateau levelling osteotomy (TPLO)- preliminary results

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The carbon footprint of veterinary procedures is unpublished despite increasing environmental awareness. This prospective study calculated the carbon footprint of a canine cruciate surgery at a veterinary hospital.

Ethical approval and informed consent were obtained. Five dogs presenting for tibial plateau levelling osteotomy (TPLO) to a UK referral centre with board-level anaesthetists were recruited. The following data were collected and presented as median (range): duration of anaesthesia, weight of sevoflurane used per procedure, consumables used (weight, material) from kennel to the end of the surgery, travel data for client and four staff, hospital energy use, and waste disposal. Carbon dioxide equivalents (CO_2e, kg) were calculated using available conversion factors (Campbell & Pierce, 2015; Circular Ecology 2019; NHS 2011). Pearson's correlation coefficient (PCC) was used to assess the relationship between carbon emissions and duration of anaesthesia, and distance travelled to the clinic. Results are presented as median (range).

The carbon emissions per TPLO surgery were 73.5 (51 - 100.8) kgCO_2e. Anaesthetic duration was 150 (135 - 195) minutes. The largest emissions contributors were volatile anaesthetic agent 26.5% (9.6 - 39.4%); other pharmaceuticals 26.4% (12 - 34.2%) and transport 22.9% (19.6 - 26.8%) Total carbon emissions correlated closely with anaesthesia duration (PCC 0.96) and miles travelled (PCC 0.90).

Reducing the carbon emissions of a procedure should focus on efforts to reduce the volatile anaesthetic agent, pharmaceutical and transport emissions. Further research is needed to confirm achievable reductions from various strategies. Further clinical comparisons using isoflurane as an alternative to sevoflurane should be performed.

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Posters

Understanding the Feline Grimace Scale: a study of dimensionality, the importance of each action unit and factors affecting assessment

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This study aimed to investigate the dimensionality, importance of each action unit (AU), and factors affecting pain assessment using the Feline Grimace Scale (FGS).
One-hundred images of cat faces were scored using the FGS by five veterinarians and five veterinary students. Cats were classified as painful or pain-free whether cut-off for rescue analgesia was reached during real-time assessment. Scale dimensionality was studied using principal component analysis and calculating the loading value for each AU. Item-total correlation (Spearman rank correlation) investigated correlations between each AU and total FGS scores. Linear mixed models assessed responsiveness for each AU and factors influencing scores (age and sex of raters, pain condition and group). Multiple correspondence analysis (MCA) investigated the relationship between AU scores ($p < 0.05$).
Each AU presented high loading values (0.86, 0.83, 0.87, 0.83 and 0.84 for ear position, orbital tightening, muzzle tension, whiskers, and head position, respectively). High item-total correlation was observed among AUs, and AUs and FGS scores. Each AU and FGS total scores were significantly different between pain-free (0.16 ± 0.02) and painful (0.71 ± 0.03) cats. Muzzle had the lowest sensitivity (0.63) and whiskers had the lowest specificity (0.65). Male (0.39 ± 0.02) and female (0.48 ± 0.02) raters scored images significantly different.

The FGS is a unidimensional scale. Each AU has similar weight and high correlation. Responsiveness was confirmed for each AU. Total scores may be affected by rater sex and pain condition. Muzzle and whiskers are less discriminative than other AUs.

Assessment of an ultrasound-guided rectus sheath block: preliminary results of an anatomic study in foal cadavers

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Ultrasound-guided rectus sheath block has been described in several species (Ferguson et al., 1996; Ferreira et al., 2021; St James et al., 2020). It provides analgesia for midline abdominal wall from xiphoid process to pubic symphysis. The aim of this study was to describe the technique in foals and evaluate the distribution of the dye.

Ten fresh cadavers weighing 37 ± 5 kg were included. Four ultrasound-guided injections (two per hemiabdomen) were performed, two cranial and two caudal to the umbilicus. The injectate consisted of a 20:80 mixture of iodinated contrast: blue-tissue-dye at 0.25 ml kg^{-1} per point. The ultrasound probe was placed transversally on the linea alba and moved laterally until the edge of rectus abdominis muscle was identified. The needle was advanced in-plane, from lateral to medial, until its tip was located below this muscle. Dissection was performed to evaluate the injectate distribution. Intramuscular and intra-abdominal distribution were also recorded.

Results are summarized in Table 1, as frequency (n/n) and percentage (%) of nerves stained. Small amounts of dye were found inside the abdomen in 4/10 cadavers.

The described technique is easy to perform. The block could provide analgesia for umbilical surgery. Further studies are needed to evaluate effectiveness in live foals.

Table 1

NERVE	Frequence (stained/identified)	Percentage stained

TH13	3/20	15%
TH14	8/20	40%
TH15	16/20	80%
TH16	19/20	95%
TH17	18/20	90%
TH18	17/20	85%
L1	12/20	60%

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Responsiveness of the UNESP-Botucatu Cattle Pain Scale in *Bos taurus* and *Bos indicus*

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This study aimed to assess the responsiveness of the Unesp-Botucatu Cattle Pain Scale (UCAPS) in *Bos taurus* (Angus) and *Bos indicus* (Nelore) undergoing orchiectomy.

Ten Nelore and nine Angus bulls were submitted to scrotal thermic stress (until 40ºC) for 135 minutes, followed by orchiectomy. Sedation was administered with xylazine (0.05 mg kg^{-1}) IV. Anaesthesia was induced with ketamine (2.5 mg kg^{-1}) and diazepam (0.05 mg kg^{-1}) IV and maintained with isoflurane. Flunixin (1.1 mg kg^{-1}) IM and epidural xylazine (0.05 mg kg^{-}

[1]) were administered before the surgery. Animals were filmed for 3 minutes 48 hours before surgery and before fasting (M0); before sedation (M1), 2 to 4 hours after they achieved sternal recumbence (M2 - before analgesia), 1 hour after morphine (0.1 mg kg^{-1} IM) (M3) and 24 hours after surgery (M4), when animals received flunixin 1.1 mg kg^{-1} IM. Two blinded observers scored the UCAPS (0 – 10) in 95 randomised videos, twice, one-month apart. Statistics was performed by the generalized linear mixed model ($p < 0.05$).
The medians (range) of UCAPS scores were M0 2 (0 - 9), M1 3 (0 - 9), M2 7 (0 - 10), M3 5 (0 - 10), and M4 5 (0 - 10). The median scores of the UCAPS were greater at M2 and M3 than M0 and M1.
The UCAPS was responsive to moderate and severe pain but not to rescue analgesia in *Bos taurus* and *Bos indicus* and may be used clinically for assessing pain in both species.

Ultrasound-guided saphenous nerve block in rabbits (*Oryctolagus cuniculus*): cadaveric study comparing two dye volumes

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The saphenous nerve (SN) is the terminal sensory branch of the femoral nerve (FN). Preservation of hindlimb motor function makes the SN-block advantageous over the FN-block (Portela et al 2018). We aimed to develop an US-guided SN-block technique in rabbits that would adequately stain (≥ 1 cm) (Briley et al 2021) the SN without affecting the FN. Spread obtained using two different dye volumes was compared.
In ten hindlimbs from five cadavers (mean ± standard deviation 1.62 ± 0.1 kg), after randomization, the SN block was performed on the right or left hindlimb with 0.05 mL kg^{-1} or 0.1 mL kg^{-1} of tissue dye in lidocaine (1:50).
Dissections allowed nerve staining measurements (Figure-1; Table-1). The nerve length staining was significantly different between groups ($p = 0.0476$; Fisher exact test).
Regardless of the volume used, the US-guided SN technique adequately stained the SN but not the motor branch of the FN. Clinical studies are needed to assess if this technique provides analgesia without affecting FN motor function in rabbits.

Figure.1: US-guided SN block (A); sono-anatomy (B); dissection (C); SN staining obtained using two dye volumes (D). Femoral artery (FA); femoral vein (FV); pectineus-muscle (P).

Table.1: Comparing nerve stain using two dye volumes.

	Saphenous Nerve total length (cm)	Staining length (cm)	
		0.05 mL kg^{-1}	0.1 mL kg^{-1}
Rabbit-1	8.8	1.5	3
Rabbit-2	9	1.9	2.4
Rabbit-3	9.8	2.0	4.2
Rabbit-4	9	1.9	2.9
Rabbit-5	10	1	1.9
Mean ± standard deviation	9.32 ± 0.5	1.66 ± 0.4	2.88 ± 0.8

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Disposable airway pressure manometers for endotracheal tube cuff inflation

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The aim of this study was to assess the performance, accuracy, and repeatability of two models of disposable airway pressure manometers as cost-effective alternative for commercial cuff manometers for endotracheal tube (ETT) cuff inflation.
Eighteen units of each model were tested in a bench top model against a u-tube manometer. Each manometer was connected via three-way stopcocks to the inflation valve of a size 8.0 ETT with high-volume, low-pressure cuff placed in a model trachea. With each unit, three consecutive measurements were taken at pressures of 20, 25 and 30 cmH_2O. The cuff was inflated until target pressures were reached on the disposable manometer and true pressures were recorded from the u-manometer. Mean ± SD of recorded pressures and mean ± maximum deviation from target pressures were calculated for each model and target pressure. For model A, mean ± SD pressures were 19.6 ± 0.70, 23.6 ± 0.75 and 28.3 ± 0.79 cmH_2O, for model B 19.3 ± 0.61, 24.3 ± 0.88 and 29.2 ± 0.66 cmH_2O for target pressures of 20, 25 and 30 cmH_2O respectively. Mean [± maximum] deviation from target pressures for model A were -0.40 [-1.87], -1.40 [-2.87], -1.67 [-3.23] cmH_2O, for model B -0.70 [-1.7], -0.72 [-2.63], -0.78 [-2.07] cmH_2O for target pressures of 20, 25 and 30 cmH2O respectively.
Both models exceeded manufacturer's specifications and showed results comparable to commercial cuff manometers. In conclusion, both models represent cost-effective, accurate and reliable tools for ETT cuff inflation.

Experiences and attitudes of Slovenian pet owners regarding cannabinoid use in dogs and cats

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People rely on cannabis-based products to treat medical conditions including pain in animals. This study investigated Slovenian pet owners' experiences and attitudes regarding cannabinoid (CBD) use in dogs and cats.
An open online survey targeted Slovenian pet owners. Questions addressed demographic data and personal experiences with CBDs, information about the participant's animal (dog/cat, health status, CBDs administered (yes/no)), experiences with, attitudes toward or reasons for

not using CBDs in their pet, and postmodern health values (natural remedies, anti-science sentiment, holism, rejection of authority, individual responsibility, consumerism – valuing the possibility to choose from various therapeutic options). Descriptive statistics were conducted for demographics, personal experiences with CBDs, and experiences with CBDs in pets. Predictors of CBDs use were analysed using hierarchical multiple regression. Significance was set at $p \leq 0.05$.

From 408 questionnaires analysed, 85.8% of respondents were female, the mean age was 39.2 ± 11.6 years. Previous use of CBDs in animals was reported by 38.5% of respondents who reported mostly positive effects (Table 1).

Positive attitudes and previous personal experiences with CBDs were predictors of CBDs use in pets, but not demographics or postmodern health values. Owners' decision to use CBDs in pets was based on acquired information and personal experience.

Table 1. Reported effects of cannabinoids.

Positive	**%***
improved well-being	72.0
greater liveliness	35.7
improved mobility	34.4
other	29.9
improved appetite	28.0
no effect	8.3
Adverse	**%**
no effect	57.3
other	26.1
dizziness	10.8
excessive appetite/thirst	8.3
fatigue	6.4

*Multiple choice question: sum of % is greater than 100.

Methods used for endotracheal tube cuff inflation and pressure verification in veterinary medicine: A questionnaire on contemporary practice

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No consensus guidelines exist for endotracheal tube cuff (ETC) inflation in veterinary medicine (Ferreira et al. 2021, White et al. 2019). This study investigates methods used for ETC inflation and pressure verification.

An online survey link was distributed via ECVAA and ACVA e-mail lists and a closed Facebook community for Dutch veterinarians. The questionnaire comprised six demographic and twelve cuff-related questions per species (dogs, cats, farm animals and horses). Data were statistically analysed using SPSS software.

A total of 348 completed questionnaires were analysed. Cuff pressure was measured by 30% of respondents in cats, 32% in dogs, 8% in farm animals and 9% in horses. Anaesthesia diplomates were not more likely to measure cuff pressure than others, except in cats (OR 1.8; 95% CI 1.1-2.9). Although > 30 cm H_2O was more frequently selected in horses and farm animals, 20-30 cmH_2O was the most common answer for recommended cuff pressure range regardless of species. The preferred method to verify cuff seal was minimal occlusive volume in dogs, cats and farm animals, and evaluation of capnogram waveform in horses. Preference for a method was largely dictated by training, and diplomates were more likely to use ≥ 3 techniques to verify cuff seal than others (OR 2.1; 95% CI 1.3-3.3).

ETC pressure is not commonly measured in veterinary medicine. Many anaesthesia providers seem unaware of possible differences in ETC pressure per species. As teaching heavily influences ETC inflation technique, development of evidence-based guidelines could improve practice.

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Evaluation of external physical features for estimation of endotracheal tube diameter in dogs

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Endotracheal intubation, using the largest possible endotracheal tube (ETT), is essential for airway management in canine anaesthesia. Despite studies correlating tracheal diameter to inter-nare distance, weight or other external measures, evidence-based guidelines for ETT selection are lacking.
We prospectively recruited 36 dogs (2.2 - 75 kg), 10 brachycephalic and 26 non-brachycephalic, scheduled for head and neck computerized tomography (CT). Tracheal diameter at the level of the second cervical vertebra was measured on the CT scan. Weight, body condition score, and external measurements were recorded using a tape measure, including length of the humerus, and the minimal distance between nares, the eye and nare, eye and canine tooth, and both eyes. Correlations between external parameters and tracheal diameter were evaluated (Spearman or Pearson correlations). Parameters were compared between groups (t-test, Mann-Whitney U test and Fischer Z transformation).
Mean (± SD) tracheal diameter was smaller in brachycephalic dogs (13.50 ± 4.16 vs 17.61 ± 4.93) ($p < 0.05$). Weight had a significantly stronger correlation, and inter-nare distance a significantly weaker correlation, to tracheal diameter in non-brachycephalic ($r = 0.91$ and 0.47 respectively) vs. brachycephalic dogs ($r = 0.67$ and 0.88). Inter-nare distance was smaller than tracheal diameter in 36.1% of the cases. After excluding factors with multicollinearity four markers, weight, and inter-nare, inter-eye, and eye to nare distance, were found to predict tracheal diameter, describing 76% of tracheal diameter variation.
This study describes a novel method to predict tracheal diameter using external markers. Inter-nare distance alone is unreliable for ETT size estimation.

At recovery, does the nutritional status of dogs affect the decreasing rate of arterial oxygen measured with a multiwave pulse co-oximetry?

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Arterial oxygen content is impaired in obese sedated dogs with the risk of PaO_2 derangement during anaesthesia recovery. This study compares the oxygen decreasing rate in normal-fit (body condition score (BCS) 4 – 5/9) and overweight (> 5/9) dogs.

In 31 ASA I – II dogs, PaO_2 was estimated with the oxygen reserve index (ORI) using the same technology of pulse oximetry. Dogs mechanically ventilated with a $FiO_2 = 0.6$ to maintain normocapnia had an ORI of 1.0 (estimated $PaO_2 > 200$ mmHg). Once anaesthesia was finished, the breathing system was disconnected, and the time to have an ORI of 0.9, 0.0 (estimated $PaO_2 = 100$ mmHg) or the lowest value of SpO_2 were compared between overweight or normal-fit dogs. The BCS, time and their interaction were inserted as fixed effects in a linear mixed effect models and dogs as random effects.
In normal-fit dogs, a mean of 135 seconds elapsed before reaching an ORI of 0.9, compared to 108 seconds in the other group. Despite this difference, the model showed no statistical effects of BCS in oxygen decreasing rate ($p = 0.213$). In normal-fit compared to overweight dogs, the mean time to observe an ORI of 0.0 from the value of 0.9 was 45 and 39 seconds, respectively. The lowest value of SpO_2 was reached 39 and 46 seconds in animals with a BCS of 4 – 5 and > 5, respectively.
This study suggests that in healthy dogs, nutritional status doesn't affect the oxygen decreasing rate at recovery from anaesthesia.

Mechanical ventilation in two male common hippopotami (*Hippopotamus amphibius*) undergoing surgical castration

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Anaesthetized hippopotami may commonly develop respiratory depression and ventilation/perfusion mismatch when recumbent and anaesthetized (Miller et al., 2014).
Two healthy adult males (estimated bodyweight of 800 and 1800 kg) undergoing castration were darted intramuscularly with medetomidine (80 µg kg^{-1}) and ketamine (1 mg kg^{-1}). Animals were recumbent in 8 minutes and orotracheal intubation was achieved (26 and 28 mm endotracheal tube) at 28 and 37 minutes, respectively. Hippos were placed in dorsal recumbency, a 18G sublingual IV catheter was inserted, and anaesthesia was maintained with isoflurane (end-tidal concentration 0.8 ± 0.2 %) in oxygen. Non-invasive blood pressures, HR, *f*R, SpO_2, $Fe'CO_2$, venous blood gas and rectal temperature were recorded. Mechanical

ventilation was initiated with a V_T 8-10 ml kg^{-1}, peak inspiratory pressure 25-30 cmH_2O, positive end-expiratory pressure 5 cmH_2O, inspiratory time 2 seconds, expiratory time to maintain normocapnia (Mallard ventilator 2800C). Ringer's lactate solution and dobutamine was provided intravenously. Intratesticular blocks (lidocaine 2%, 400 mg) were performed. Intramuscular atipamezole (0.32 mg kg^{-1}) was administered for recovery.
Anaesthesia lasted 171 and 196 minutes, respectively. Mean HR was 47 ± 3 beats $minute^{-1}$, MAP was 85 ± 4 mmHg and rectal temperature 34.4 ± 0.2 °C; both animals had transient bradycardia resolved after atropine (0.005 mg kg^{-1} IV) administration. During mechanical ventilation, *f*r was 4 ± 0.3, SpO_2 98.3 ± 1.8 %, $Fe'CO_2$ 36.82 ± 4.06 mmHg. Recovery was uneventful (5 ± 1 minutes) after reversal.
Mechanical ventilation in medetomidine-ketamine-isoflurane anaesthetised hippos ensured adequate pulmonary ventilation supporting gas exchange despite dorsal recumbency.

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Incidence and treatment of postoperative hypoxemia in dogs undergoing general anaesthesia with variable FiO_2 and PEEP.

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This study evaluates the incidence of postoperative hypoxemia (PH) and compares O_2 supplementation, 5 cmH_2O continuous positive airway pressure (CPAP) or high flow nasal cannula (HFNC) for its treatment in dogs.
ASA 1 or 2 dogs were randomized for receiving spontaneous or mechanical ventilation with or without PEEP, FiO2 0.4 or > 0.8 during GA. Pulse-oximetry at room air was monitored every 15 minutes for one hour after extubation (EXT). Body condition score (BCS) was also recorded. Dogs that showed hypoxemia (SpO_2 < 95 %) at EXT were randomly treated with CPAP or O_2 or HFNC. Of the 600 dogs included in the study at EXT, 28% were hypoxemic of which 80 were treated with CPAP, 66 with O_2 and 23 with HFNC. T-test and odds ratios for occurrence of PH were used for analysis ($P < 0.05$).

SpO_2 was lower ($P < 0.05$) in the hypoxemic compared to normoxemic dogs at EXT (91.7 ± 3.2 % Vs 96.7 ± 1.6 %), 15 (91.8 ± 2.6 % Vs 97.2 ± 1.3 %) and 30 (94.1 ± 3.5 % Vs 97.2 ± 1.4 %) minutes after. Dorsal recumbency, no PEEP, BCS ≧ 4/5 and FiO2 > 0.8 were associated with PH (odds ratio: 1.92, 1.77, 5.80, and 3.79 respectively). Duration of hypoxemia was shorter with CPAP (17.8 ± 13.6 minutes) compared to HFNC (30.6 ± 21.9 minutes) and O_2 (41.6 ± 11.5 minutes).
Dorsal recumbency, obesity and high FiO_2 increase, while PEEP reduce the occurrence of PH in dogs.

Venous blood values in healthy captive Egyptian fruit bats (*Rousettus aegyptiacus*) during restraint *versus* under medetomidine-midazolam-fentanyl anesthesia, with or without oxygen supplementation

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The objectives of this study were to evaluate the effects of medetomidine-midazolam-fentanyl anesthesia and oxygen supplementation on venous blood gas, electrolytes, glucose, hematocrit, and lactate in Egyptian fruit bats (*Rousettus aegyptiacus*).
Twelve adult healthy bats (6 males, 6 females) were anesthetized with subcutaneous medetomidine-midazolam-fentanyl (0.17-0.17-0.017 mg kg^{-1}). Additional third of the initial anesthetics dose was administered at 25 and 40 minutes. Oxygen was supplemented from 40 minutes. Rectal temperature, HR and f_R were monitored for 60 minutes, then atipamezole (5 times the medetomidine dose) was administered subcutaneously. Blood samples were drawn from the wing vein before (baseline) and following the initial anesthetics injection at 15, 35, 50 and 75 minutes, and analyzed using iSTAT (CG8+ cartridge). Lactate was measured in 5 of the bats. Friedman test was used for data analysis. Significance was set at 0.05.
Temperature, HR and f_R decreased significantly over time. $PvCO_2$ increased significantly from baseline to 50 minutes (28.7 ± 3.1 to 41.9 ± 4.4 mmHg), pH decreased (7.39 ± 0.03 to 7.30 ± 0.03) and hematocrit decreased (50.7 ± 3.4 to 45.5 ± 3.5%). Oxygen supplementation resulted in a significant increase in PvO_2 (63 ± 8 to 21**1** ± 92 mmHg). Glucose decreased following atipamezole administration (263 ± 173 to 128 ± 115 mg dL^{-1}).

Medetomidine-midazolam-fentanyl anesthesia resulted in decreased ventilation and respiratory acidosis. Furthermore, the increase in PvO_2 following oxygen supplementation may suggest that wing venous blood provides capillary bed values in fruit bats**.**

Electrical impedance tomography (EIT) in chickens (*Gallus domesticus*): effect of four different recumbencies on cranial air sac ventilation

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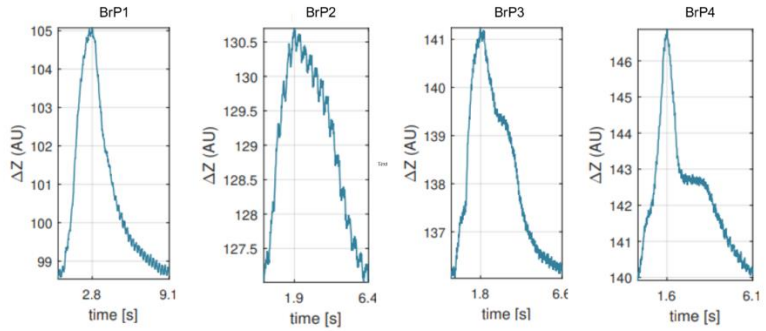
There are no published reports of electrical impedance tomography (EIT) in birds. This study aimed to evaluate this monitoring modality for ventilation in chickens in four recumbencies. Anaesthesia was mask-induced and maintained in ten endotracheally intubated, spontaneously breathing chickens with 2% isoflurane in oxygen. An electrode belt was placed caudal to the wings. Chickens were placed in dorsal, ventral, left lateral, right lateral recumbency in a randomised order. Data were collected over 2 minutes after 10 minutes of stabilisation for each recumbency. Four of the chickens underwent computed tomography for transverse image at the belt location afterwards. Linear mixed model and Fisher's exact test were used to compare impedance change (ΔZ) and breathing patterns (BrP) between recumbencies, respectively.
The ΔZ observed were synchronous to ventilation, therefore represents tidal impedance variation (TIV). Computed tomography confirmed that ventilation in the cranial air sacs were monitored. No difference was found for TIV between recumbencies. Four BrP were categorized based on the expiratory curve (EC): BrP1 and BrP2 with convex and concave EC, respectively; BrP3 and BrP4 with EC with inflection point above 50% and below 50% of ΔZ, respectively (Figure 1.). Recumbency had a significant association with BrP ($p < 0.001$). Dorsally recumbent chickens predominantly demonstrated BrP1 (50%) and BrP4 (40%). Ventrally recumbent chickens demonstrated BrP3 (30%) and BrP4 (40%). Laterally recumbent chickens primarily demonstrated BrP3 (79%).
EIT can monitor cranial air sac ventilation in anaesthetized chickens. Recumbency does not influence cranial air sac TIV but does influence BrP.

Figure 1. The four categorized BrP.



Influence of experimentally induced endotoxemia on macrocirculation and glycocalyx integrity in horses

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Endotoxemia with cardiovascular depression is a major cause of mortality and morbidity in equids (Parry et al., 1983) leading to potential destruction of the vascular glycocalyx. We hypothesize that endotoxemia impairs macrocirculation, leading to an increase in plasma glycocalyx shedding products.

In a prospective, randomized, controlled trial, endotoxemia was induced with *E. coli* B55:O5 LPS 30 ng kg^{-1} over 30 minutes IV in six healthy adult horses ventilated to normocapnia with isoflurane (ET_{Iso} ~1.6) in oxygen. Standard cardiovascular variables were recorded and calculated. Plasma heparan sulphate and syndecan-1 were analysed by Enzyme-linked Immunosorbent Assay and leucocytes and lactate were measured. Baseline measurements were performed before endotoxin and repeatedly after. Data were analysed by one-way-ANOVA and Wilcoxon signed-rank test $p \leq 0.05$.

After endotoxin (120 minutes), significant changes occurred in cardiac index (43 ± 9 vs. 80 ±17 ml kg^{-1} min^{-1}, p = 0.004), oxygen delivery index (431 ± 178 vs. 950 ± 166 ml min^{-1} kg^{-1}, p = 0.004), lactate (2 ± 1 vs. 4 ± 1, p = 0.002), and systemic vascular resistance index (239 ± 70 vs. 89 ± 19 dynes s^{-1} cm^{-5}, p = 0.009), in conjunction with a significant drop in leukocytes

(5 ± 1 vs. 2 ± 0 G l^{-1}, $p = 0.005$). Heparan sulphate (53 ± 11 vs 61 ± 10 µg ml^{-1}) and syndecan-1 (49 ± 14 vs 46 ± 9 µg ml^{-1}) did not change after endotoxin application.
Short term experimental endotoxemia under isoflurane induced hyperdynamic cardiovascular changes without significant glycocalyx shedding.

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The efficacy of bedinvetmab in a referred population of osteoarthritis cases - a preliminary clinical audit

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Nerve growth factor (NGF) is involved in osteoarthritis (OA) pain. Bedinvetmab is a novel, licensed, canine anti-NGF antibody. This preliminary audit assessed the efficacy of bedinvetmab administered to dogs with moderate/severe OA.
Dogs were assessed at their first pain clinic visit using Liverpool Osteoarthritis in Dogs (LOAD). Current medication was continued. Data collection commenced February 2021, bedinvetmab supply problems meant that no cases started treatment after July. Repeat LOAD was undertaken September/October 2021. Each dog received ≥ 3 doses of bedinvetmab, (0.5 - 1.0 mg kg^{-1} SC monthly).
Forty-five dogs started treatment, dogs with incomplete data were excluded. Thirty-seven had pre- and post-treatment LOAD scores available. Mean age was 10.21 ± 2.88 years. Initial medication was:

Medication:	**Number**	**%**
NSAID	32	86.5
Gabapentinoid	24	64.8
Memantine/Amantadine	7	18.9
Paracetamol	20	54.1

Mean pre-treatment LOAD score was 28.7 ± 5.84, post-treatment 22.0 ± 7.25. Treatment response was individually assessed (Lascelles et al. 2015):

Treatment effect:	**Number**	**%**
Good (LOAD > 30% reduction)	13	35
Fair (LOAD 1 - 30% reduction	20	54
Poor (no change/worse LOAD score)	4	11

Corral et al. (2021) undertook a placebo-controlled clinical study where 86% of cases were moderately to very severely affected with musculoskeletal disease, 25.7% were medicated. Canine Brief Pain inventory-based treatment success at day 28 (single dose) was 43.5%, and 17% in placebo recipients. Our owners were aware of treatment, a 'caregiver placebo' effect is likely (Conzemius & Evans, 2012). Bedinvetmab efficacy was demonstrated, but confirmation with blinded and placebo-controlled methodology is required.

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Evaluation of the HemoCue Hemoglobine device as POC method in horses

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Hemoglobine (Hb) is an important parameter of equine general health status, also used as diagnostic tool to detect anemia. HemoCue Hb 201+ System is a POC device validated as standard Hb measurement in humans that could be useful in routine equine practice.

To evaluate reliability, repeatability and clinical interest of the HemoCue Hb device (HC Hb) as a POC for equine medicine, samples from 28 examined healthy and sick horses were

analyzed with Vet ABC (once) and HC Hb (3 times). Student t test was used to compare means. Variances and their coefficients were calculated to check reliability and repeatability. Accuracy was determined using both Bland Altman and Pearson correlation tests ($p < 0.05$ significant).

Means were statistically comparable ($p = 1.56$) for the 109 tests: 14.59 ± 9 g^{-1} (Vet ABC); 14.70 ± 2.22 g^{-1} (HC Hb). Variances were 4.263 and 4.741, with VC 14.43 and 15.10 % respectively for Vet ABC and HC Hb. Accuracy was good (mean bias 0.107 g^{-1}) and limit of agreements (CI) between -0.626 and 0.841 g^{-1}. Good and highly significant correlation coefficient was calculated (0.986; $p < 0.0001$). HC Hb was easy to use everywhere in any conditions with dry chips and on battery. Tests were inexpensive.

HC Hb evaluation demonstrated a clinically acceptable accuracy of Hb measurement compared to Vet ABC in equine practice. HemoCue Hb 201+ System can be useful as a POC standard technique in equine practice to detect early anemia and optimize therapeutic decisions on site.

Effects of re-administration of a medetomidine-vatinoxan combination drug (Zenalpha) in dogs

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Zenalpha, a formulation combining medetomidine and vatinoxan, indicated to provide restraint, analgesia, and sedation in dogs, was studied to characterize the effects of its re-administration with intent to increase the intensity or length of sedation.

In this randomized, blinded, experimental cross-over study eight healthy instrumented Beagle dogs received a label dose of medetomidine (1 mg m^{-2}) and vatinoxan (20 mg m^{-2}) intramuscularly; 30 minutes later the same formulation was readministered with half of that dose. Control group (CG) received the label dose without re-administration. Cardiovascular safety was evaluated by continuous heart rate (HR) and mean arterial pressure (MAP) recordings, and sedation was assessed with a validated sedation scale (Wagner et al. 2017) at intervals, until 120 minutes after initial dosing. Differences between treatments were evaluated with a linear mixed model and Dunnett adjustment for multiple comparison ($p < 0.05$).

Significant differences in HR between groups were not detected except at 5 minutes after re-administration when HR was significantly lower when compared to CG (55 ± 12 versus 73 ± 7 beats minute^{-1} [mean ± SD]). Significantly lower MAP was observed from 40 minutes after re-administration (74 ± 10 mmHg versus 87 ± 8 mmHg) until the end of the observation period in comparison to CG, and transient hypotension (lowest MAP 56 mmHg) was detected in one dog. Sedation scores were significantly higher from 20 to 40 minutes following re-administration when compared to CG.

To conclude, re-administration of Zenalpha intensified sedation to some extent but was associated with decreases in MAP.

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Branchial plexus block in a deer (*Cervus elaphus)*: a case report

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Regional block techniques have not been evaluated extensively in wild animals (Auer et al., 2010). We describe a brachial plexus block in a deer (*Cervus elaphus*) for external osteosynthesis of the right radius.

An approximately 4-month-old, 15 kg deer was referred with an open fracture of the radius. Anaesthetic protocol included dexmedetomidine 15μg kg $^{-1}$, propofol 2 mg kg $^{-1}$ and isoflurane 1% in oxygen; meloxicam (0.1 mg kg^{-1}) was administered intravenously, for analgesia. An arterial catheter was inserted in the auricular artery. In addition, the skin area medial to the right scapulohumeral joint was aseptically prepared. A nerve stimulator was used to locate the nerves of the brachial plexus. Its negative electrode was attached to the proximal portion of a 22- gauge, 7.5 cm insulated needle. The current was gradually decreased to 0.5 mA, 0.1 msec and 2 Hz according to extension and flexion twitches of the limb. When approximately 5 cm of the needle was inserted, bupivacaine (1 mg kg^{-1}, total volume 3 ml) was used for brachial plexus block.

Throughout the surgery, which lasted 2 hours, the heart and respiratory rate were approximately 50 beats min^{-1} and 10 breaths min^{-1}, respectively. The recovery from anaesthesia was uneventful and no rescue analgesia was required. Two hours postoperatively the animal seemed like it could use its leg.

In our case, the brachial plexus block may have reduced anaesthetic requirements of the deer and possibly contributed to cardiovascular stability and analgesia.

References

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Postoperative acid-base and electrolyte changes in dogs after elective ovariohysterectomy. Preliminary results

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The aim of the study was to evaluate postoperative acid-base and electrolyte changes in healthy canine patients.

Medical records of dogs underwent elective ovariohysterectomy were reviewed. Cases should include at least four arterial blood samples (preoperatively, right after extubation, 6, and 24 hours postoperatively) and have the same anaesthetic protocol. Values of arterial blood pH, carbon dioxide tension, bicarbonate, sodium, potassium and glucose concentrations were recorded. A general linear model for repeated measures was used to evaluate any statistically significant effect of time on the variables.

Eleven dogs were included. They had been premedicated with dexmedetomidine (200 μg kg^{-1}) and methadone (0.2 mg kg^{-1}) IM. Anaesthesia had been induced with propofol and maintained with isoflurane in oxygen. Meloxicam (0.1 mg kg^{-1}IV) had been administered for analgesia. Immediately postoperatively, a statistically significant increase was noted in serum glucose concentration and cardon dioxide tension, and a decrease in pH, sodium and bicarbonate concentrations. Serum potassium was statistically non-significantly altered immediately postoperatively. Although all recorded variables return to pre-operative values 6 hours postoperatively, a statistically significant decrease in serum potassium concentration (3.84 ± 0.25 mmol L^{-1}), compared to preoperative (4.26± 0.32 mmol L^{-1}) ($p < 0.001$), after extubation (4.48 ± 0.55 mmol L^{-1}) ($p = 0.004$), and 24 h postoperatively (4.28± 0.32 mmol L^{-1}) ($p < 0.001$) concentrations, was found.

Serum potassium levels may decrease significantly 6 hours postoperatively in healthy dogs undergoing elective ovariohysterectomy, although clinically non-significantly. Further studies are required in order to evaluate the clinical significance of this finding.

Immunohistochemical localization of cannabinoid receptor type I in the feline synovial membrane with and without degenerative lesions

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This study aimed to evaluate cannabinoid receptor type I (CB1) expression in femoropatellar synovial membranes of adult cats with and without degenerative lesions.

Synovial tissues were collected post-mortem from twenty-seven joints. Samples were fixed, embedded in paraffin, and sectioned for histology and immunostained with anti-CB1 antibody (Ab23703 1%; antigen retrieval with EDTA buffer). Antibody specificity was tested on feline synovium samples employing western blot analysis. A board-certified pathologist graded the hematoxylin-eosin-stained sections according to patterns of osteoarthritis (OA)-associated synoviopathy including absence (0) or presence (1) of: synovial membrane proliferation, inflammatory infiltrate, villous hypertrophy, blood vessels proliferation and cartilage/bone detritus. The scores were summed to provide the final synovial sample grade (0-5). The localization of CB1 receptors within the synovium was assessed by immunohistochemistry.

Samples were represented as follow: grade (0) 18.5 %, (1) 48.1 %, (2) 29.7 %, (3) 0 %, (4) 0 % and (5) 3.7 %. Western blot analysis confirmed antibody specificity in the synovium (single band at the expected molecular weight). Positive cytoplasmic staining of CB1 was remarkable in the lining layer of the synovium and interstitial sublining layer areas of grade 5, but not grade 0 tissues. Grade 1 and 2 had milder positive staining than grade 5 tissues, mainly around blood vessels.

This study suggests that CB1 could be a relevant target for cannabinoid therapy and chronic pain management in osteoarthritic cats with high grading synovitis. Quantitative methods are warranted to evaluate the correlation between microscopic grading and synovial CB1 expression.