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Comparison of tramadol and morphine for pre-medication of dogs undergoing general anesthesia for orthopedic surgery

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Tramadol is a centrally acting analgesic with opioid and monoaminergic actions. Its clinical effects have been well characterized in humans, where it has been in use for many years, but little is known for veterinary species. This study evaluated the sedative, emetic, thiopental-sparing and intraoperative respiratory and hemodynamic effects of tramadol in comparison to morphine for pre-medication of dogs undergoing orthopedic surgery under halothane anesthesia. Sixteen adult, healthy, mixed breed dogs (8.0 ± 2.6 kg) were studied. Eight dogs were pre-medicated with tramadol (1.0 mg kg^{-1} IM) and the other eight with morphine (1.0 mg kg^{-1} IM). After 20 minutes, anesthesia was induced with thiopental and subsequently maintained with halothane in oxygen using a Bain system, with spontaneous respiration. Degree of sedation and occurrence of emesis were evaluated after pre-anesthetic medication. Dose of thiopental necessary for tracheal intubation was compared between the two groups. Arterial blood gas analyzes were done before pre-medication and at 60 minutes of anesthesia. Heart rate and noninvasive arterial blood pressure were recorded before pre-medication and every 10 minutes during anesthesia. Observer was blinded of the treatment given for each dog. Tramadol produced no visible sedation and no vomiting, while morphine induced a moderate degree of sedation in all dogs and vomiting in 62% of them. Dogs pre-medicated with tramadol required significantly more thiopental (17 ± 3.8 mg kg^{-1}) for induction of anesthesia than those pre-medicated with morphine (12 ± 1.8 mg kg^{-1}). Pre-medication with morphine was associated with significantly higher $PaCO_2$ and lower pH at 60 minutes of anesthesia. The remaining respiratory parameters and the hemodynamic variables were similar between the two groups. In conclusion, dogs pre-medicated with tramadol at 1 mg kg^{-1} IM do not become visibly sedated and require a greater amount of thiopental for induction of anesthesia than pre-medication with morphine. As intraoperative respiratory function is better preserved with tramadol, it may be useful for pre-medication of respiratory compromised patients.

Desflurane vapor pressure depression

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Due to its high vapor pressure and low boiling point, desflurane requires a specially designed, electronically controlled, temperature and pressure compensated vaporizer to regulate agent delivery to the anesthetic circuit. However, if the vapor pressure and boiling point were decreased, desflurane could be used in any conventional variable bypass vaporizer. Raoult's Law states that the vapor pressure of a liquid is proportional to its molar fraction in a solution. Accordingly, propylene glycol was used as a solvent for desflurane, and the physical characteristics of this mixture were evaluated at various molar concentrations and temperatures. Desflurane boiling point increased and vapor pressure decreased as a nonlinear function of dilution, but these changes were less than predicted by Raoult's Law. Using a circle system with a breathing bag attached at the patient end and a mechanical ventilator to simulate respiration, an in-circuit, nonprecision vaporizer containing 40% desflurane and 60% propylene glycol achieved a 11.5 ± 1.0% (mean ± SD) circuit desflurane concentration with a 5.2 ± 0.4 (0 = off, 10 = maximum) vaporizer setting. This experiment was repeated with a dog

attached to the breathing circuit under spontaneous ventilation with a fresh gas flow of 0.5 L min^{-1}. Anesthesia was maintained for over two hours at a mean vaporizer setting of 6.2 ± 0.4, yielding mean inspired and end-tidal desflurane concentrations of 8.7 ± 0.5% and 7.9 ± 0.7%, respectively. Within 5 minutes after cessation of anesthesia, the dog was awake, extubated and standing. In clinical practice, propylene glycol may not prove an ideal solvent for desflurane due to its instability in solution and substantial positive deviation from Raoult's Law. However, rather than alter the vaporizer to suit physical properties of anesthetic agents, this study demonstrates that it may also be possible to alter anesthetic agents to suit physical properties of the vaporizer.

Pharmocokinetic and pharmacodynamic evaluation of intravenous morphine in dogs

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Morphine is considered the prototypical opiate analgesic. Despite the common use of morphine in dogs, ideal dosing strategies have not been formulated due to the difficulty in assessing its analgesic effects. The purpose of this study was to: 1) evaluate a noninvasive mechanical threshold device (von Frey device) to measure antinociceptive responses (pharmacodynamics) of opiates in dogs and 2) evaluate the pharmacokinetics (PK) and pharmacodynamics (PD) of intravenous (IV) morphine in dogs. Six healthy Beagle dogs were used. The von Frey threshold (vFT) response was evaluated hourly for 8 hours in each dog to examine the effect of repeated testing (controls). PK and PD (vFT) measurements were then made following a 1 mg kg^{-1} IV bolus of morphine sulfate. A two way blinded crossover consisted of an 8 hour IV constant rate infusion of saline or morphine with hourly PD measurements. The individual CRI was based on individual PK data and adjusted every 2 hours to attain targeted plasma concentrations of morphine of 10, 20, 30, and 40 ng mL^{-1}. Blood samples were taken hourly in all phases, except the controls. No significant ($p > 0.05$) intraindividual changes in vFT occurred in the controls over 8 hours. The morphine bolus produced increased vFT at 1, 2, 3, and 4 hours post injection ($p < 0.05$). The E_{MAX} and EC_{50} following the IV bolus were 213 ± 104% (increase from baseline) and 13.9 ± 5.8 ng mL^{-1}, respectively. The CRI produced increased vFT at plasma concentrations >30 ng mL^{-1}, when compared to saline controls ($p < 0.05$). Targeted plasma concentrations were inconsistent at higher infusion rates, suggesting the PK of morphine may change during CRI. The actual mean ± SD CRI plasma concentrations (ng ml^{-1}) were 10.8 ± 3.0, 22.7 ± 7.4, 32.4 ± 13.9, 35.7 ± 16.9. Morphine dosing protocols should be re-evaluated, as sufficient analgesia may not be obtained from published dosages. Intravenous boluses may be more predictable than CRI.

Evaluation of veterinarian and veterinary student knowledge and clinical use of pulse oximetry

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We hypothesized that veterinarians and veterinary students may lack key knowledge about pulse oximetry, which may result in this type of patient monitor not being used on appropriate patient populations or to its full capabilities. A questionnaire was developed to assess an individual's knowledge and understanding of pulse oximetry. Residents and specialists in anesthesiology and critical care at several academic institutions were surveyed first to assess the questionnaire for clarity and to serve as a control group. General veterinary practitioners (GPs) attending continuing education courses at the University of Georgia were surveyed over a 24-month period. Students entering their senior year anesthesiology rotation at the University of Georgia were also surveyed. Residents and specialists (69% correct responses) scored significantly higher than senior students (46%), who scored significantly higher than GPs (34%). Only 15% of GPs and 21% of senior students reported that they had received training in pulse oximetry in school. Those who had received training scored significantly higher than those who did not. Many GPs did not report using a pulse oximeter on their critical patients under anesthesia, a group that would be expected to benefit from its use. Veterinarians have a poor understanding about how pulse oximetry works, the information provided by pulse oximetry, and how to best apply it to their patients. Furthermore, the respondents did not use pulse oximeters in a