Anaesthetic–related deaths: a selection of references from CAB Abstracts

1
Accession Number
20153059455
Author
Gjeltema, J.; Posner, L. P.; Stoskopf, M.
Title
The use of injectable alphaxalone as a single agent and in combination with ketamine, xylazine, and morphine in the Chilean rose tarantula, Grammostola rosea.
Source
Publisher
American Association of Zoo Veterinarians
Location of Publisher
Pomona
Country of Publication
USA
Abstract
This study evaluated the use of the injectable anesthetic, alphaxalone, as a single agent and in combination with ketamine, xylazine, and morphine in the Chilean rose tarantula, Grammostola rosea. Between two and four animals were evaluated for each anesthetic protocol, and two unanesthetized animals were evaluated for comparative purposes. Anesthetic duration, depth, and quality were assessed by scoring responses to tactile and trichobothria stimulation, muscle tone, purposeful movement, righting response, and heart rate throughout each anesthetic event. Alphaxalone administered into the dorsal opisthosoma in the location of the heart at 200 mg/kg produced moderate anesthetic effect with a median duration of 28 min (n=3; range 25-50). A combination of 200 mg/kg of alphaxalone and 20 mg/kg of ketamine induced a deep anesthetic state with a median duration of 70 min (n=4; range 37-207). The combination of 200 mg/kg of alphaxalone and 20 mg/kg of xylazine produced deep anesthesia with a median duration of 70 min (n=4; range 16-42). The combination of 200 mg/kg of alphaxalone and 20 mg/kg of xylazine produced deep anesthesia with a median duration of 27 min (n=4; range 16-42). The combination of 200 mg/kg of alphaxalone and 20 mg/kg of xylazine produced deep anesthesia with a median duration of 27 min (n=4; range 16-42). Morphine administered at 5 mg/kg 30 min prior to injection with 200 mg/kg alphaxalone had anesthetic durations of 9 and 30 min (n=2). Heartbeats could not be detected for periods of 7-27 min following anesthetic induction for the majority of animals receiving the alphaxalone/ketamine and alphaxalone/xylazine anesthetic combinations. No mortality was associated with any of the anesthetic protocols used; however, ambient temperature and ecdysis were identified as important factors that may alter response to anesthetics in these animals.
Publication Type
Journal article.

2
Accession Number
20153039541
Author
Hubbell, J. A. E.; Muir, W. W.
Oxygenation, oxygen delivery and anaesthesia in the horse.

Horses are the most difficult of the common companion animals to anaesthetise. Hypoxaemia or inadequate oxygen delivery to peripheral tissues during anaesthesia would seem a potential cause of increased mortality, but no direct link has been established. A number of methods of increasing oxygenation and oxygen delivery have been reported, with varying results and potential applicability. The purpose of this article is to review the literature with regard to oxygenation, oxygen delivery and methods to improve each and to make recommendations for clinical application.

An update on general anaesthesia in ruminants.

Most of the surgical procedures in ruminants are performed under the effect of local or regional anaesthesia only or in combination with sedation or tranquilization. In veterinary anaesthesia, inhalation anaesthetics are more popular because they provide predictable and rapid adjustment of anaesthetic depth. Intravenous anaesthesia always involves the delivery of a bolus dose or a fast loading infusion to achieve an adequate blood concentration of the anaesthetic drug. Maintenance of anaesthesia can be obtained by infusion of intermittent boluses (1BI), by continuous rate infusion (CRI) or by target controlled infusion (TCI). Inhalation anaesthesia is administered by using an anaesthetic machine. In large ruminants food should be withheld for 24-48 hr and water for at least 12 hr. Calves, sheep, goats, and camelids should be fasted for 12-18 hr prior to general anaesthesia and deprived of water for 8-12 hr. The alpha-2 adrenergic agonist drugs are most commonly used to induce sedation in ruminants. Thiopentone sodium is the most widely used intravenous induction agent. Ketamine is also commonly used in veterinary anaesthesia as induction agent. It provides mild cardiovascular stimulation and is safer than thiopental in sick animals. Propofol, a nonbarbiturate, nonsteroidal hypnotic agent, has been used to provide brief periods of anaesthesia. Economic considerations may limit the applicability of propofol in large ruminants. Bloat and regurgitation are two major complications of ruminant anaesthesia that are encountered due to physioanatomic peculiarities of ruminants. Food withdrawal is a main part of anaesthetic preparation in order to prevent regurgitation, bloat...
and associated respiratory disorders. Duration of food withdrawal is still a matter of research in different ruminant species. Postoperative myopathy-neuropathy can occur in large ruminants but is not a problem in calves, goat, sheep and camelids. Supportive therapy is a very important aspect of ruminant anaesthesia and can strongly influence the recovery and patient morbidity I mortality. Supportive therapy includes patient positioning, fluid administration, mechanical ventilation, cardiovascular support, good monitoring techniques, and oxygen administration to animals under intravenous anaesthesia.

**Publication Type**
Journal article.

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**<4>**
**Accession Number**
20143335284
**Author**
Ishida, T.; Onuma, M.; Ono, S.; Murakami, A.; Sano, T.
**Title**
Anesthesia-associated death in 160 rabbits.
**Source**
**Publisher**
Japanese Society of Veterinary Anesthesia & Surgery
**Location of Publisher**
Tokyo
**Country of Publication**
Japan
**Abstract**
The unexpected deaths of 160 rabbits undergoing anesthesia were examined retrospectively. All rabbits were assessed according to the American Society of Anesthesiologists (ASA) physical status classification system based on pre-anesthetic examination, laboratory tests and imaging findings. Abnormalities were evident on X-ray images in 4.7% (two out of 43) of the ASA class I cases. Of the ASA class II cases, 22.6% (12 out of 53) had abnormalities detected on laboratory testing, and 30.0% (15 out of 50) had abnormal imaging findings. The incidence of anesthesia-related death was 1.9%. None of the healthy rabbits undergoing ovariohysterectomy or castration died; however, anesthesia-related death occurred in three rabbits, one with uterine disease, one with a urinary calculus and one with gastrointestinal obstruction. One of these cases was classified as ASA class III and the remaining two as class IV. Two rabbits died 1 hour after premedication and the other died 18 hours after surgery due to a cardiac arrest. Our findings suggest that rabbits with ASA class III or IV physical health status are at higher risk of anesthesia-related death, so careful monitoring should be instituted for 24 hours after starting treatment.

**Publication Type**
Journal article.

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**<5>**
**Accession Number**
20143282101
**Author**
Lennox, A. M.
**Title**
Monitoring anaesthetics in exotics.
**Source**
The Veterinary Nurse; 2014. 5(6):306-311. 8 ref.
**Publisher**
Anaesthetic death rate is higher in exotic patients than in dogs and cats. Unfamiliarity with monitoring and inability to intubate are frequently cited reasons for higher death rate. Ability to hide signs of illness, and fewer healthy, elective anaesthetic procedures likely influence death rate as well. Direct vascular support can be challenging. For some patients, small size or unique anatomic features present unique challenges. Sophisticated monitoring equipment (e.g. capnographs, blood pressure monitors) designed for canine/feline use must often be adapted for exotic patients, and is more likely to fail when used in exotic patients. For this reason, the anaesthetist must develop a plan for addressing equipment failure, and have a backup monitoring device ready, if applicable. Anecdotally, it appears that changes in respiratory and cardiovascular parameters may occur more rapidly than in canine and feline patients. While careful patient preparation and monitoring are important for any anaesthetic patient, particular attention to detail may help improve anaesthetic survival rate in exotic species.

Objective: To characterize the physiologic and behavioral effects of a single induction dose and two maintenance doses of alfaxalone delivered by water immersion in the anesthesia of koi (Cyprinus carpio).

Study design: Prospective, within-subject complete crossover design. Animals: Six adult koi (Cyprinus carpio) with a median body weight of 344.5 g (range 292.0-405.0 g). Methods: Koi were immersed in water containing 10 mg L⁻¹ alfaxalone until immobile and then maintained with alfaxalone at either 1 or 2.5 mg L⁻¹ via a recirculating water system. Times for anesthetic induction and recovery periods were recorded. Physiologic and blood gas parameters were evaluated before, during and after the anesthetic trial. Response to noxious stimuli was also assessed. Results: Median anesthesia induction time for all fish was 5.4 minutes. Median recovery time was 11.8 and 26.4 minutes in the 1.0 and 2.5 mg L⁻¹ doses, respectively, which were significantly different (p=0.04). Cessation of opercular movement occurred in 0/6 and 4/6 fish exposed to 1.0 and 2.5 mg L⁻¹ dose respectively. No difference was observed in median heart rate over the duration of the anesthetic events. Response to noxious stimulation was 4/6 and 0/6 in the 1.0 and 2.5 mg L⁻¹ doses respectively. Oxygenation and ventilation did not change during the experiment, but there was a significant decrease in blood pH along with an increase in blood lactate concentration. Conclusion and clinical relevance: Administration of alfaxalone, via water immersion, as an induction and maintenance anesthesia agent provided rapid and reliable anesthesia of koi with no mortality. The maintenance dose of 2.5 mg L⁻¹
was sufficient to prevent response to noxious stimuli but was associated with a clinically relevant depression in opercular rate.

Publication Type
Journal article.
Bille, C.; Auvigne, V.; Bomassi, E.; Durieux, P.; Libermann, S.; Rattez, E.

Title
An evidence-based medicine approach to small animal anaesthetic mortality in a referral practice: the influence of initiating three recommendations on subsequent anaesthetic deaths.

Source
Veterinary Anaesthesia and Analgesia; 2014. 41(3):249-258. 28 ref.

Publisher
Wiley-Blackwell

Location of Publisher
Oxford

Country of Publication
UK

Abstract
Objective: To evaluate anaesthetic death after implementation of recommendations and its risk factors in a small animal practice. Study design Observational cohort study. Animals All cats and dogs anaesthetized at the Centre Hospitalier Vétérinaire des Cordeliers during two periods, from April 15th, 2008 to April 15th, 2010 (period 1) and from June 15th, 2010 to August 24th, 2011 (period 2). Methods: Death occurring during or before full recovery from anaesthesia was recorded. At the end of period 1, a logistic regression model was generated to describe anaesthetic death and identify risk factors. Potential risk factors in our practice setting were identified, and three recommendations, relating to improving physical status and anaesthetic/analgesic regimen implemented for period 2. The relationship between anaesthetic death and recorded variables were analyzed, and where relevant, compared between periods. Results: Six thousand two hundred and thirty-one animals underwent general anaesthesia. The overall death rate during period 1 was 1.35% (48 in 3546, 95% CI [1.0-1.7%]) and during period 2 was 0.8% (21 in 2685, 95% CI [0.6-1.2%]). For sick animals (ASA status 3 and over), the overall death rate was 4.8% (45 of 944 95% CI [3.5-6.4%]) during period 1 and 2.2% (18 of 834 95% CI [1.3-3.5%]) during period 2; this represented a significant decrease in death rate in period 2 (p =0.002). In period 2, the main factors associated with an increased odds ratio of anaesthetic death were poor health status (ASA physical status classification) and old age. Species, gender, anaesthetic regimen, the nature and urgency of the procedure were not associated with risk. Conclusion and clinical relevance Following evidence based recommendations, the death rate related to anaesthesia was significantly decreased during period 2 compared to period 1. Application of evidence-based medicine may contribute to an effective approach to decrease death rates. Other factors, not monitored in this study, may also have had an impact.

Publication Type
Journal article.

<9>
Accession Number
20143128734

Author
Vigani, A.; Garcia-Pereira, F. L.

Title
Anesthesia and analgesia for standing equine surgery. (Special Issue: Standing surgery.)

Source

Publisher
Elsevier Inc.

Location of Publisher
New York

Country of Publication
USA

Abstract
Morbidity and mortality rate in equine anesthesia is still unacceptably high. Thus it is critical contemplating whether the benefit of general anesthesia for a specific patient and procedure outweighs the risks. Sedative protocols that would allow performing diagnostic and surgical procedures with the patient remaining standing would therefore be ideal. Infusion of short-acting agents allows to rapidly achieve a titratable steady state of sedation. Supplementing sedatives and tranquilizers with systemic analgesic or regional anesthetic techniques (i.e. epidurals) facilitates standing surgical procedures. Multimodal analgesia would also provide superior analgesia with potentially fewer side effects than a single agent approach.

Publication Type
Journal article.
The rabbit is a good experimental model for brachial plexus surgery. The risks of death during anesthesia were significantly greater in rabbits than cats or dogs. This article presents the protocol of injectable anesthesia for a short surgical procedure, safe for the rabbit patient and convenient for the surgeon.

Purpose of the study: To determine the incidence of fatalities in horses undergoing general anesthesia for examinations or surgical procedures from 2006 to 2011 at an Equine University Clinic (Munich), to differentiate between fatalities occurring in the time period from induction of anesthesia to recovery (anesthesia-related fatalities) and fatalities occurring after recovery but before discharge from the clinic (anesthesia-associated perioperative fatalities), and to identify risk factors for complications of general anesthesia. Material and Methods: Out of 2,440 anesthesia and medical records 1,989 anesthesia cases could be used for statistical evaluation. The evaluation covered the time period from induction of anesthesia to discharge from the clinic or until death. Based on documented clinical findings in the records, each horse patient was classified according to the American Society of Anesthesiology specialist (ASA-classification). 93.5% were healthy horses and 6.5% were high risk patients. The anesthesia record included 89.2% inhalation anesthesia, and 10.8% injectable anesthesia. 93.2% were elective surgeries. 6.8% were emergency procedures. Results: Ten of 1,989 anesthesia cases had a fatal outcome. Thus, the overall anesthesia related mortality rate was 0.5%. No horse died during maintenance of anesthesia (induction to placement in the recovery box). Four of the 1,989 (0.2%) horses died or had to be euthanatized during
recovery. One horse died because of cardiac arrest. Three other horses had to be euthanized due to prolonged recumbency in the recovery stall after colic surgery, myelomalacia and a fracture of the proximal humerus. Six of the 1,985 horses which had survived general anesthesia and recovery died in the postoperative period after recovery but before discharge, the anesthesia-associated perioperative mortality rate being 0.3%. Two of these 6 horses died from colitis x, one had a fatal pleuropneumonia, and another horse died from a large colon torsion. One mare became recumbent because of severe ataxia as a result of an activated severe facet joint arthrosis. The sixth patient had colic surgery and subsequently died of peracute circulatory collapse. By excluding the high risk patients, the overall mortality rate decreased to 0.3% (6/1,859). For horses with a poor general condition (ASA 2-5) the mortality rate was to 3% (4/130). In horses with colic and an ASA 4-5 risk, the mortality rate increased to 3.6% (2/55). A reduced general condition (p=0.004) and a long anesthesia time (p=0.002) lead to a high risk for perioperative mortality. Older horses were more frequently affected by harder recoveries (p<0.001). Horses with a reduced general condition suffered more frequently from intraoperative hypotension (p<0.001) and harder recoveries (p<0.001). In addition, there was a significant correlation between a reduced general condition and the development of nerve paralysis (p=0.009). Soft tissue surgeries also caused intraoperative hypotension (p<0.001). Surgeries on the head and neck led to the highest proportion of uncontrollable hemorrhage (p<0.001). Horses in dorsal recumbency significantly more often (p<0.001) developed a drop in blood pressure, as did horses with a long anesthesia time (p<0.001). A long duration of anesthesia effected also bradycardia (p<0.001) as well as nerve paralysis and more difficult recoveries (p<0.001). The application of acepromazin caused intraoperative hypotension (p=0.003) and hypoventilation (p<0.001).

Publication Type
Journal article.

<13>
Accession Number
20133385654
Author
Hartnack, S.; Bettschart-Wolfensberger, R.; Driessen, B.; Pang, D.; Wohlfender, F.
Title
Critical Incidence Reporting Systems - an option in equine anaesthesia? Results from a panel meeting.
Source
Veterinary Anaesthesia and Analgesia; 2013. 40(6):e3-e8. 34 ref.
Publisher
Wiley-Blackwell
Location of Publisher
Oxford
Country of Publication
UK
Abstract
Objective: To provide a brief introduction into Critical Incident Reporting Systems (CIRS) as used in human medicine, and to report the discussion from a recent panel meeting discussion with 23 equine anaesthetists in preparation for a new CEPEF-4 (Confidential Enquiry into Perioperative Equine Fatalities) study. Study Design: Moderated group discussions, and review of literature. Methods: The first group discussion focused on the definition of 'preventable critical incidents' and/or 'near misses' in the context of equine anaesthesia. The second group discussion focused on categorizing critical incidents according to an established framework for analysing risk and safety in clinical medicine. Results: While critical incidents do occur in equine anaesthesia, no critical incident reporting system including systematic collection and analysis of critical incidents is in place. Conclusions and clinical relevance: Critical incident reporting systems could be used to improve safety in equine anaesthesia - in addition to other study types such as mortality studies.
Publication Type
Journal article.

Objective: To study current perianaesthetic mortality in dogs in Spain and to identify the main risk factors predisposing to perianaesthetic mortality in our country. Study design: A multicentre prospective cohort study. Animal population: Dogs anaesthetised for different surgical and diagnostic procedures at 39 Spanish veterinary clinics between February 2007 and March 2008. Methods: Data of patients, procedures and anaesthetic management were recorded. Anaesthetic death was defined as perioperative death within 24 hours of the procedure end. A multivariate study evaluated perinanaesthetic death using logistic binary regression models with the Wald technique. Results: 2012 animals were included in the analyses. Twenty-six dogs died. The global mortality rate was 1.29% (95% CI: 0.88-1.89%). ASA I-II was 0.33% (95 CI: 0.14-0.78%); ASA III-V was 4.06% (95% CI: 2.67-6.13%). Most deaths occurred during the post-operative period (20 dogs, 77%). The multivariate analysis revealed that high ASA grade was associated with an increased risk of mortality. The use of opioids plus NSAIDs during anaesthesia was related with a decrease of the risk. Conclusions: Perianaesthetic mortality in dogs in Spain was 1.29% (95% CI: 0.88-1.89%). ASA grade was the main prognostic factor of likelihood of death. The use of some analgesics (opioids and NSAIDs) in the perioperative period was associated with reduced odds of death and may be protective. Clinical relevance: Evaluation and stabilisation of patients before interventions may help lower risk of death during the anaesthesia. In addition to their use for welfare purposes, analgesics may be beneficial in reducing anaesthetic-related deaths.
UK
Abstract
Background: Capture, handling and chemical restraint are basic techniques often needed for research or management purposes. The aim of this study was testing a combination of tiletamine-zolazepam (TZ) (3 mg/kg) and medetomidine (M) (0.05 mg/kg) on Eurasian wild boar (Sus scrofa). A total of 77 free-ranging wild boar were captured by means of portable cages and corral traps and then anaesthetized with intramuscular darts using a blowpipe. The individual response to chemical immobilization was characterized using anaesthetic, clinical, and serum biochemical variables. After the procedure, 14 of these wild boar were monitored for 20 days using GPS-GSM collars. Results: Pre-release mortality during capture and handling (6.5%) was associated with severe trauma in corral traps. Capture specificity for wild boar was 96.3% and trapping effort was 16.5 days per captured wild boar. Mean induction period was 4.5 + or - 2.2 min, hypnosis period enabling effective handling was 61.6 + or - 25.4 min, and recovery period was 12.8 + or - 12.1 min. No heart or respiratory failure due to added stress occurred and post-release monitoring by GPS-devices revealed no mortality due to anaesthesia. According to the best statistical model obtained, the main factor driving anaesthetic efficacy and stress indicators is trap type. Conclusions: Both cage and corral traps are efficient methods to capture wild boar. Cage traps are safer, as demonstrated by mortality rates as well as anaesthetic, physiological, and serum biochemical responses. This anaesthetic protocol is useful for prolonged handling of wild boar and allows sampling and collecting data for ecological and epidemiological studies.

Publication Type
Journal article.

Accession Number
20133127506
Author
Senior, J. M.
Title
Morbidity, mortality, and risk of general anesthesia in horses. (Special Issue: Topics in equine anesthesia.)
Source
Publisher
Elsevier Inc.
Location of Publisher
New York
Country of Publication
USA
Abstract
General anesthesia in horses carries an increased risk of morbidity and mortality compared with other species. In recent years the number and complexity of epidemiologic studies in equine anesthesia has increased. The ability to interpret such studies and understand epidemiologic terminology is vital for veterinarians for them to make potential improvements to their anesthetic practice and to allow them to communicate effectively the findings of such studies to colleagues and owners. This article provides the equine clinician with a basic understanding of the methodologies that can be used in observational epidemiologic studies, and reviews the literature on equine anesthetic morbidity, mortality, and risk.

Publication Type
Journal article.

Accession Number
Continuous intravenous anaesthesia with sufentanil and midazolam in medetomidine premedicated New Zealand White rabbits.

Background: Anaesthesia in rabbits is associated with a high mortality rate, compared to that in cats and dogs. Total intravenous anaesthesia (TIVA) with drugs that provide cardiovascular stability and are rapidly metabolised could be of benefit for use in rabbits. The aim was to evaluate cardiorespiratory effects of TIVA with sufentanil-midazolam in eight New Zealand White rabbits. Subcutaneous premedication with medetomidine (0.1 mg/kg BW) was followed by IV administration of a mixture of 2.5 micro g/mL sufentanil and 0.45 mg/mL midazolam at a rate of 0.3 mL/ kg BW/ h for anaesthetic induction. Additionally, intravenous boluses of 0.1 mL of the mixture were administered every 20 s until the righting reflex was lost. Following endotracheal intubation, anaesthesia was maintained for 60 min with an infusion rate adjusted to suppress the pedal withdrawal reflex. Air and oxygen (1:2) were delivered at 3 L/min. Physiological variables were recorded before induction and at predefined time points during and after anaesthesia. Results: Righting and pedal withdrawal reflexes were lost within 3 and 5 min, respectively. Doses of sufentanil and midazolam were 0.48 micro g/kg BW and 0.09 mg/kg BW for induction, and 0.72 micro g/kg BW/h and 0.13 mg/kg BW/h for maintenance. Apnoea occurred in two rabbits. Induction of anaesthesia caused a significant increase in heart rate, cardiac output and arterial CO2 partial pressure and a decrease in mean arterial pressure, respiratory rate and pH. Mean time from stopping the infusion to endotracheal extubation was 5 min, and to return of the righting reflex 7 min. Anaesthesia was characterized by induction and recovery without excitation, with muscle relaxation, and absence of the pedal withdrawal reflex. Conclusions: TIVA with sufentanil-midazolam provided smooth induction and recovery of anaesthesia in rabbits but with marked hypotension and respiratory depression, requiring mechanical ventilation. Further evaluation is needed to establish if the protocol is useful for rabbits undergoing surgery.
Abstract
This study aims to report the incidence of deaths during anesthetic procedures in a period of four years (2007-2011). Were evaluated the records of 5,366 patients, among which 1,532 were of feline species and 3,834 were of canine species. The study showed that the incidence of deaths on the measured period was 0.96% of total procedures, being 0.55% for healthy patients and 1.32% for sick patients, proving that the ASA classification is important to establish the anesthetic risk in surgical procedures.

Publication Type
Journal article

<19>
Accession Number
20123180737
Author
Masters, N. J.; Burns, F. M.; Lewis, J. C. M.
Title
Peri-anaesthetic and anaesthetic-related mortality risks in great apes (Hominidae) in zoological collections in the UK and Ireland.
Source
Publisher
British and Irish Association of Zoos and Aquariums
Location of Publisher
London
Country of Publication
UK
Publication Type
Conference paper.

<20>
Accession Number
20123264440
Author
Title
Effects of a local anaesthetic and NSAID in castration of piglets, on the acute pain responses, growth and mortality.
Source
Animal; 2012. 6(9):1469-1475. 25 ref.
Publisher
Cambridge University Press
Location of Publisher
Cambridge
Country of Publication
UK
Abstract
The present study addresses the questions whether on-farm use of local anaesthesia with lidocaine leads to a reduction in pain responses during castration, and whether the non-steroidal anti-inflammatory drug meloxicam improves technical performance after castration of piglets. Five treatments were included in the
study: (1) castration without anaesthesia or analgesia (CAST), (2) castration after local anaesthesia with lidocaine (LIDO), (3) castration after administration of meloxicam (MELO), (4) castration after lidocaine and meloxicam (L+M) and (5) sham castration (SHAM). To reduce litter influences, each treatment was present in each of the 32 litters (n=32 per treatment). During castration, vocalizations were recorded continuously. Blood samples were collected 15 min before and 20 min after castration for determination of plasma levels of total cortisol, glucose, lactate and creatine kinase (CK). Mortality was registered and piglets were weighed several times to calculate growth. Several aspects of vocalizations during castration showed consistent and significantly different levels in CAST compared with LIDO, L+M and SHAM. CAST piglets squealed longer, louder and higher. Vocalizations of MELO piglets most resembled those of CAST. An increase in cortisol was seen in all treatments. However, in SHAM piglets this increase was significantly lower than in the other treatments. LIDO piglets showed a significantly smaller increase in plasma cortisol levels compared with CAST and MELO. L+M piglets differed significantly only from the SHAM group. Lactate levels differed significantly between LIDO and MELO, the level in LIDO being decreased after castration. In the other treatments an increase was measured. No treatment effects were found in plasma glucose and CK levels, nor in growth and mortality of the piglets. In conclusion, on the basis of vocalizations and plasma cortisol, local anaesthesia with lidocaine reduces pain responses in piglets during castration. A positive effect of meloxicam on technical performance was not found.

Publication Type
Journal article.
This study investigated associations between perioperative factors and probability of death and length of hospitalization of mares with dystocia that survived following general anesthesia. Demographics and perioperative characteristics from 65 mares were reviewed retrospectively and used in a risk factor analysis. Mortality rate was 21.5% during the first 24 h post-anesthesia. The mean standard deviation number of days of hospitalization of surviving mares was 6.3±5.4 d. Several factors were found in the univariable analysis to be significantly associated (P<0.1) with increased probability of penanesthetic death, including: low preoperative total protein, high temperature and severe dehydration on presentation, prolonged dystocia, intraoperative hypotension, and drugs used during recovery. Type of delivery and day of the week the surgery was performed were significantly associated with length of hospitalization in the multivariable mixed effects model. The study identified some risk factors that may allow clinicians to better estimate the probability of mortality and morbidity in these mares.

This article presents some tips in improving anaesthesia of dogs and cats in the practice. Focus is given on decreasing mortality due to anaesthesia, use of analgesic combinations, training, blood analysis, knowledge on anaesthetic complications, use of capnographs in monitoring patients, decreasing propofol dosage and side effects and premedication.
Recent work suggests anaesthetic deaths are more common in cats than dogs. Current estimates report that approximately 1 in 895 healthy cats die for an anaesthetic-related death, over twice that recently reported in dogs, with the early postoperative period being the highest risk period. Risk factors associated with death include patient health status, age and weight and procedure type and urgency. Endotracheal intubation and fluid therapy have also been associated with increased odds of anaesthetic death in cats and may reflect that these are higher risk procedures in cats compared to dogs. Pulse oximeter monitoring recently was reported to be associated with reduced risk of anaesthetic death. An awareness of these risk factors could help guide veterinary surgeons in their anaesthetic management of cats. In particular, greater attention to patient assessment and management prior to anaesthesia, as well as more careful fluid administration and monitoring during and after anaesthesia could help reduce perioperative complications in cats.

Risk of anaesthetic mortality in dogs and cats: an observational cohort study of 3546 cases.

Risk factors associated with death include patient health status, age and weight and procedure type and urgency. Endotracheal intubation and fluid therapy have also been associated with increased odds of anaesthetic death in cats and may reflect that these are higher risk procedures in cats compared to dogs. Pulse oximeter monitoring recently was reported to be associated with reduced risk of anaesthetic death. An awareness of these risk factors could help guide veterinary surgeons in their anaesthetic management of cats. In particular, greater attention to patient assessment and management prior to anaesthesia, as well as more careful fluid administration and monitoring during and after anaesthesia could help reduce perioperative complications in cats.
Objective: To evaluate the anaesthetic death risk for dogs and cats in a French private practice. Study design: Observational cohort study. Animal population: All small animals anesthetized at the Centre Hospitalier Vétérinaire des Cordeliers between April 15th, 2008 and April 15th, 2010. Methods: General anaesthesia was defined as a drug-induced unconsciousness characterised by a controlled and reversible depression of the central nervous system and analgesia, sufficient to allow endotracheal intubation. Patient outcome (alive or dead) was assessed at the end of anaesthesia defined as the meeting point of the return of consciousness, rectal temperature >36 degrees C and ability to maintain sternal recumbency. Death occurring during anaesthesia was recorded. Relationship between anaesthetic death and ASA status, species, age, nature of the procedure, anaesthetic protocol and occurrence of epidural administration of a combination of morphine and bupivacaine were analysed. Results: During the study period 3546 animals underwent general anaesthesia. The overall death rate in the present study was 1.35% (48 in 3546, 95% CI 0.96-1.75). The death rate of healthy animals (ASA 1 and 2) was 0.12% (3 in 2602 95% CI 0.02-0.34). For sick animals (ASA status 3 and over), the overall death rate was 4.77% (45 in 944 95% CI 3.36-6.18). The death rates in the ASA 3, 4 and 5 categories were 2.90%, 7.58% and 17.33%, respectively. The main factor associated with increased odds of anaesthetic death in ASA categories 3 and over was poor health status (ASA physical status classification). The nature of the procedure the patient underwent and epidural administration of a combination of morphine and bupivacaine were not correlated with the occurrence of death during anaesthesia. Neither species nor age effects were detected. Conclusion and clinical relevance: Specific factors were associated with increased odds of anaesthetic death, especially poor health status. Efforts must be directed towards thorough preoperative patient evaluation and improvement of clinical conditions if possible. Identification of risk factors before anaesthesia should lead to increased surveillance by trained staff. This could result in better outcomes.

Publication Type
Journal article.

Accession Number
20113307251

Author
Vries, M. de

Title
Anaesthesia and liver disease: understanding blood results.

Source
Veterinary Times; 2011. 41(38):16...20. 4 ref.

Publisher
Veterinary Business Development Ltd

Location of Publisher
Peterborough

Country of Publication
UK

Abstract
To minimise morbidity and mortality associated with general anaesthesia, and to identify higher risk patients, routine pre-anaesthetic haematology and biochemistry blood tests are often performed. Especially in elderly patients and in patients with, for example, endocrinologic diseases it is not uncommon to find raised liver enzymes. When are these elevations reason for concern? Raised enzymes are not necessarily indicative of liver function impairment. Liver function may be better evaluated by measuring albumin, total proteins, bile acids, bilirubin and ammonia concentrations. Blood results should always be interpreted in conjunction with a thoroughly taken history and clinical examination.

Publication Type
Journal article.
Use of supplemental intravenous anaesthesia/analgesia in horses.

Abstract
General anaesthesia in horses is associated with a significant risk of both morbidity and mortality. One major factor contributing to this is the marked cardiopulmonary depression that occurs in this species in association with the use of volatile anaesthetic agents. Attempts to minimise the required volatile concentration for the maintenance of unconsciousness by administering additional injectable agents may have beneficial effects on the outcome for the animal. This article describes the characteristics of the agents commonly used for supplemental intravenous anaesthesia/analgesia (SIVA), and highlights the key points that must be taken into consideration when undertaking the concurrent administration of these drugs.

Feline anesthetic deaths in veterinary practice. (Special Issue: Emerging issues in feline medicine.)

Abstract
Anesthetic complications appear relatively rare, though recent work suggests they are more common in cats than dogs. Current estimates indicate that approximately 0.11% (1 in 895 anesthetics) of healthy cats die of an anesthetic-related death, which is more than twice as frequent as has been recently reported in dogs (0.05% or 1 in 1849). Most of these deaths occurred in the postoperative period. A number of risk factors have been associated with death, including patient health status, age, weight, and procedure type and urgency. Endotracheal intubation and fluid therapy have been reported to be associated with increased odds of anesthetic death in cats and may reflect higher risk techniques in cats compared with dogs. Monitoring patient pulse and the use of a pulse oximeter were also recently reported to be associated with reduced risk of anesthetic death. These data can help veterinarians care for their patient under anesthesia and address greater attention to patient assessment and management before anesthesia, as well as more...
careful fluid administration and patient monitoring during and after anesthesia, which could reduce perioperative complications in cats.

Publication Type
Journal article.

<29>
Accession Number
20113056142
Author
Pawar, H. B.; Sanaye, S. V.; Sreepada, R. A.; Harish, V.; Suryavanshi, U.; Tanu; Ansari, Z. A.
Title
Comparative efficacy of four anaesthetic agents in the yellow seahorse, Hippocampus kuda (Bleeker, 1852).
Source
Publisher
Elsevier Ltd
Location of Publisher
Oxford
Country of Publication
UK
Abstract
In modern aquaculture, anaesthetics play an important role in reducing handling stress and mortality. In this investigation, the efficacy of four anaesthetic agents (MS-222, benzocaine, clove oil and 2-phenoxyethanol) was compared in captive-bred yellow seahorse, Hippocampus kuda (Bleeker, 1852). The lowest effective concentrations based on the efficacy criteria of complete anaesthetic induction within 180 s and recovery within 300 s were determined to be 125 mg L-1 (induction 115+or-16 s and recovery time 246+or-36 s) for MS-222, 175 mg L-1 (induction 175+or-19 and recovery time 354+or-55 s) for benzocaine, 50 mg L-1 (induction 115+or-28 and recovery time 385+or-37 s) for clove oil, 1000 micro l L-1 (induction 176+or-22 and recovery time 271+or-37 s) for 2-phenoxyethanol. Induction and recovery times for adult H. kuda anaesthetised with anaesthetic agents were dose-dependent (P<0.05). The onset of individual phases of anaesthesia and recovery times depended significantly on the concentration of the anaesthetic used (P<0.05). An inverse exponential relationship was observed between concentrations of anaesthetic and induction time, whereas exponential relationships were observed between concentrations and recovery times for all anaesthetic agents evaluated. Amongst all tested anaesthetics, MS-222 and clove oil were proven to be most effective and the latter appears to meet many of the criteria of an ideal fish anaesthetic. The study has potential significance with regards to seahorse husbandry in terms of stress, survival and production efficiency.
Publication Type
Journal article.

<30>
Accession Number
20113055438
Author
Touzot-Jourde, G.; Levionnois, O. L.
Title
Principal complications associated with inhalation anaesthesia: recognition, prevention and treatment. (Theme: Anesthesie: protocoles et gestion des risques.) [French]
Source
Volatile anesthesia in horses carries a high risk of complications that affect primarily the cardiorespiratory system. If left untreated, intraoperative mortality is a possible event and they may result in further complications during the recovery period. The most commonly encountered complications are explained as well as how to identify, prevent and treat them.

Publication Type
Journal article.
Intravenous anaesthesia in horses under field conditions. (Special Issue: Helse og velferd hos hest) [Norwegian]
Source
Norsk Veterinaertidsskrift; 2010. 122(7):527-533. 31 ref.
Publisher
Den Norske Veterinaerforening
Location of Publisher
Oslo
Country of Publication
Norway
Abstract
There is a higher mortality related to general anaesthesia in horses than in many other species. In the setting of an equine clinic, anaesthesia is usually maintained with an inhalational agent. In some instances, it may be necessary to anaesthetise horses under field conditions, and it is described how this can be done in a proper way. Suitable drug combinations, monitoring and handling of the horse are described. Complications to anaesthesia are described and anaesthesia of foals is briefly discussed.
Publication Type
Journal article.

Accession Number
20103258447
Author
Onuma, M.; Ono, S.; Ishida, T.; Shibuya, H.; Sato, T.
Title
Mortality rate related to anesthesia-associated complications in 111 ferrets.
Source
Publisher
Japanese Society of Veterinary Anesthesia & Surgery
Location of Publisher
Tokyo
Country of Publication
Japan
Abstract
Among 111 ferrets, we classified and investigated them that had died of anesthesia-associated complications according to the American Society of Anesthesiologists Physical Status (ASA-PS). The mortality rate on anesthesia-associated complications of ferrets within 24 hours was 2.7% (ASA III: 2 ferrets, ASA IV: 1 ferret), and these ferrets were more than 4-year-old. In these ferrets, the main cause of death was cardiac arrest before/after surgery. Therefore, an age of 4 years or older and ASA grade of III or higher may significantly increase the risk of anesthesia-related death.
Publication Type
Journal article.

Accession Number
20103181735
Author
Robertson, S. A.
Title
How safe is anesthesia for cats?
Source
Publisher
The North American Veterinary Conference
Location of Publisher
Gainesville
Country of Publication
USA
Publication Type
Conference paper.

Accession Number
20103181734
Author
Posner, L. P.
Title
Complications during anesthesia: evaluation and treatment.
Source
Publisher
The North American Veterinary Conference
Location of Publisher
Gainesville
Country of Publication
USA
Publication Type
Conference paper.

Accession Number
20103145789
Author
Overholser, B. R.; Zheng, X. M.; Pell, C.; Blickman, A.
Title
Sudden death in the presence of overt beta-adrenergic receptor activation in guinea pigs immediately following isoflurane anesthesia.
Source
Veterinary Anaesthesia and Analgesia; 2010. 37(3):273-279. 31 ref.
Publisher
Blackwell Publishing Ltd
Location of Publisher
Oxford
Country of Publication
UK
Abstract
Observations: A case series of sudden death is reported in five consecutive guinea pigs following anesthesia with inhalational isoflurane during beta-adrenergic receptor stimulation with isoproterenol. Sustained-release isoproterenol pellets or mini-osmotic pumps were implanted subcutaneously in male Dunkin-Hartley guinea pigs as part of a research study to assess the interplay of adrenergic receptor activation and the development of atrial arrhythmias. The continuous exposure to isoproterenol resulted in a similar presentation and eventual sudden death in all guinea pigs exposed to inhalational isoflurane between 15 to 40 minutes after discontinuation of anesthesia. Death occurred in guinea pigs in this case series despite the fact that doses of isoproterenol used were more than 10-fold lower than previously reported in guinea pigs in the absence of isoflurane anesthesia. The cause of death was suspected to be due to an interaction of isoproterenol with isoflurane anesthesia, as placebo implantation or anesthesia alone did not result in cardiac arrest. Of four subsequent guinea pigs anesthetized with the combination of xylazine and ketamine (X/K), three survived isoproterenol implantation for the full 21-day study period while one died perioperatively. Conclusions: There was an increased rate of post-anesthetic mortality associated with isoproterenol pellet implantation in guinea pigs anesthetized with isoflurane compared to X/K. This may be due to the detrimental effects of the combination of isoflurane during overt beta-adrenergic receptor activation or cardioprotective effects of X/K anesthesia during beta-adrenergic receptor hyperactivity.

Publication Type
Journal article
Conference paper.

Accession Number
20103012454

Author
Correa, A. L.; Oleskovicz, N.; Moraes, A. N. de

Title

Source
Ciencia Rural; 2009. 39(9):2519-2526. 27 ref.

Publisher
Centro de Ciencias Rurais, Universidade Federal de Santa Maria

Location of Publisher
Santa Maria

Country of Publication
Brazil

Abstract
The aim of this study is to report the incidence of surgical anaesthetic deaths in an 11-year period (1996 to 2006) when no complementary or laboratory exams were done prior to the anaesthetic procedure. A retrospective study was carried out, evaluating the anaesthetic records used during the procedures at the Veterinary Clinical Hospital/Santa Catarina State University in Brazil. A total of 7012 anaesthetic procedures were evaluated, from which 5500 (78.4%) were general anaesthesia performed in dogs and 1512 (21.6%) in cats. The deaths included in this study occurred during the trans-anaesthetic or at immediate postoperative period. The American Society of Anesthesiologists (ASA) classification, patients' age, sex or the surgical procedure accomplished were not taken in consideration. All the animals were submitted to the anaesthetic-surgical procedures only after pre-anaesthetic clinical evaluation, with no previous complementary data, and they were monitored during the trans-anaesthetic period based on clinical anaesthesia. In this period, 63 deaths were observed, 49 in dogs (77.8%) and 14 in cats (22.2%). The mortality rate observed in dogs was 0.89% and 0.92% in cats. In conclusion, the higher mortality rate in dogs was associated with the anaesthetic protocol with atropine, xylazine, thiopental and halothane (20.4%), but no protocol related to this rate in cats was identified. The drugs associated with larger mortality rate were diazepam, etomidate and isoflurane for dogs and cats, when analysed individually.

Publication Type
Journal article.
Anaesthetic complications have been studied intermittently in small animal practice. Current estimates suggest that approximately 0.1-0.2% of healthy and 0.5-2% of sick dogs and cats die of an anaesthetic-related death. This is substantially greater than the risk of mortality reported in human anaesthesia. Recent work has identified the post-operative period as the highest risk period and has documented a number of risk factors for mortality. Knowledge of factors associated with anaesthetic-related death and high risk peri-operative periods could aid patient management and reduce complications.

Publication Type
Journal article.

General anesthesia of horses entails considerable risk of morbidity and mortality. A large-scale, multicenter study reported that the death rate from non-colic-related anesthetics was 0.9%, while the perianesthetic mortality rate at a single, busy equine surgical practice was somewhat more favorable, at 0.12%. While any perianesthetic death is devastating, mortality figures alone do not reflect the overall morbidity of equine anesthesia in terms of nonterminal events or injuries related to recovery. In some circumstances, recognition of perianesthetic complications may allow appropriate intervention to prevent the complication from worsening or progressing to mortality. This article describes some of the complications that may occur during and after general anesthesia of horses, and suggests ways to prevent or mitigate them.

Publication Type
Journal article.
Clinical technique: use of capnography in small mammal anesthesia. (Topics in medicine and surgery: techniques and procedures.)

Objective: To estimate the risks of anaesthetic and sedation-related mortality in companion animals in the UK. (The Confidential Enquiry into Perioperative Small Animal Fatalities, CEPSAF). Study design: A prospective cohort study with nested case-control study. Animal population: All small animals anaesthetized and sedated at participating centres between June 2002 and June 2004. Methods: Patient outcomes at 48 hours (alive, dead and killed) were recorded. Anaesthetic and sedation-related death was defined as death...
where surgical or pre-existing medical causes did not solely cause death. Species-specific risks of anaesthetic-related death and 95% confidence intervals (95% CI) were calculated. Risks were also estimated in the sub-sets of dogs, cats and rabbits that were either healthy or sick (ASA 1-2 and 3-5, respectively). Results: One hundred and seventeen veterinary practices participated in the study and 98,036 dogs, 79,178 cats and 8,209 rabbits were anaesthetized and sedated. Overall risks of anaesthetic and sedation-related death in dogs were 0.17% (1 in 601, 95% CI 0.14-0.19%), in cats 0.24% (1 in 419, 95% CI 0.20-0.27%) and in rabbits 1.39% (1 in 72, 95% CI 1.14-1.64%) within 48 hours of the procedure. In healthy dogs, cats and rabbits, the risks were estimated to be 0.05% (1 in 1,849, 95% CI 0.04-0.07%), 0.11%, (1 in 895, 95% CI 0.09-0.14%) and 0.73% (1 in 137, 95% CI 0.54-0.93%), respectively. In sick dogs, cats and rabbits, the risks were 1.33%, (1 in 75, 95% CI 1.07-1.60%), 1.40% (1 in 71, 95% CI 1.12-1.68%) and 7.37% (1 in 14, 95% CI 5.20-9.54%), respectively. Postoperative deaths accounted for 47% of deaths in dogs, 61% in cats and 64% in rabbits. Most other small animal species had higher mortality risks. Conclusions and clinical relevance: Small animal anaesthesia appears to be increasingly safe. Greater patient care in the postoperative period could reduce fatalities.

Publication Type
Journal article.

Accession Number
20073262639

Author
Masters, N. J.; Burns, F. M.; Lewis, J. C. M.

Title
Peri-anaesthetic and anaesthetic-related mortality risks in great apes (Hominidae) in zoological collections in the UK and Ireland.

Source

Publisher
Blackwell Publishing

Location of Publisher
Oxford

Country of Publication
UK

Abstract
Objective: To estimate the risk of death and identify the major risk factors for peri-anaesthetic mortality in great apes (Hominidae) that underwent anaesthesia in zoological collections in the UK and Ireland between 1 January 1990 and 30 June 2005. Study design: confidential, retrospective cohort study. Animal population: The study population comprised all great apes from 16 zoological collections in the UK and Ireland that were anaesthetised during that period. Methods: All available anaesthetic records were collected. Outcome at 7 days post-anaesthesia was recorded as alive, dead or euthanased. The risk of peri-anaesthetic mortality was calculated. Multivariable analysis of potential risk factors was performed. Results: A total of 1,182 anaesthetic records were collected and analysed. Sixteen peri-anaesthetic deaths occurred, resulting in a peri-anaesthetic mortality risk of 1.35%. Twenty percent of deaths (3/15) occurred during maintenance and 80% (12/15) occurred post-anaesthetic but within 7 days. A subjective assessment suggests at least five anaesthetic-related deaths occurred; in other words an anaesthetic-related mortality risk of 0.42% (5/1,182) or above. In the multivariable analysis, health status and age were significantly associated with peri-anaesthetic mortality. Animals assessed as 'sick' pre-anaesthetic were associated with a 26-fold (95% CI 5.55-122.32) increased risk of death compared with animals with a good health status. Animals aged over 30 years were associated with a 30-fold (95% CI 3.44-261.85) increased risk of death, compared with adults aged between 10 and 30 years. Conclusions and clinical relevance: This study has shown that great ape anaesthesia appears to carry a high risk of mortality. Sick and aged patients are at an increased risk of death and particular care should be exercised during their anaesthesia. Standardisation and completeness of anaesthetic records across zoological collections would assist greatly in further studies.
Publication Type
Journal article.

<43>
Accession Number
20073114042
Author
Hallowell, G. D.; Potter, T. J.
Title
Anaesthesia in ruminants: sedation.
Source
Publisher
Veterinary Business Development Ltd
Location of Publisher
Peterborough
Country of Publication
UK
Publication Type
Journal Article.

<44>
Accession Number
20073106147
Author
Brodbelt, D. C.; Pfeiffer, D. U.; Young, L. E.; Wood, J. L. N.
Title
The risk of anaesthetic-related death in cats: results from the confidential inquiry into perioperative small animal fatalities (CEPSAF).
Source
Publisher
Society for Veterinary Epidemiology and Preventive Medicine
Location of Publisher
Roslin
Country of Publication
UK
Abstract
Recent figures describing the frequency or causes of anaesthetic-related death in cats have not been available. The aims of this study were to address these deficits. A nested case-control study was undertaken. All anaesthetics and sedations undertaken and related deaths (i.e. 'cases') within 48 hours were recorded. Details of patient, procedure, and anaesthetic management were recorded for all cases and controls. A multivariable mixed effects logistic regression model of factors associated with anaesthetic and sedation-related death was constructed. Between June 2002 and June 2004, 79,178 anaesthetics and sedations were recorded and the overall risk of anaesthetic and sedation-related death was 0.24% (95% CI 0.20-0.27%). Factors associated with anaesthetic-related death were health status, age, weight, procedural urgency and complexity, endotracheal intubation, fluid therapy, pulse monitoring and pulse oximetry. The risk of anaesthetic-related death in cats appears to have decreased since the last UK study. The results should aid patient management.
A multicentre prospective study was conducted to estimate the prevalence of and identify risk factors for reported morbidities in horses undergoing non-abdominal procedures at 4 equine hospitals in the UK. Data were collected prospectively on all horses admitted to each centre for non-abdominal procedures requiring anaesthesia between April 2004 and June 2005. Data from 861 anaesthetics were obtained. The overall prevalence of reported morbidities was 13.7%; the most common being postanaesthetic colic (5.2%). Postanaesthetic lameness due to myopathy, neuropathy or fractures was reported in 7 cases (0.8%). Two mortalities were directly related to anaesthesia (0.2%).

Objective: To determine the fatality rate of horses undergoing general anaesthesia at a private equine referral practice using a limited number of anaesthetic protocols. Methods: A retrospective analysis of
records (n=17,961) from all horses undergoing general anaesthesia for surgical procedures from 1997 to 2001 at Rood and Riddle Equine Hospital, Lexington, Kentucky, USA. Results were reported as percentage of the population, and as crude mortality rates for each procedure (deaths per 1000). Results: The prevalence of equine fatalities directly related to anaesthesia was 0.12% (n=21) and this rose to 0.24% (n=42) with the inclusion of horses killed or dying within 7 days post general anaesthesia. Causes of death directly related to anaesthesia were cardiac arrest (n=10), fracture in recovery stall (n=8), neuropathy and myopathy necessitating euthanasia (n=3). Crude mortality rates per procedure were <=7 deaths per 1000 cases, except arthrodesis/osteotomy cases were 66.7 deaths per 1000 cases. Conclusions: The anaesthetic fatality rate at this practice is lower than has been reported previously. Clinical relevance: Familiarity with an anaesthetic protocol in combination with reduced anaesthetic time, emergencies of shorter duration between diagnosis and surgery, and adequate preoperative examination appear to minimize the risks associated with general anaesthesia in horses.

Publication Type
Journal article.

Risk of capture-related mortality in large free-ranging mammals: experiences from Scandinavia.

Abstract
Chemical capture and anaesthesia of free-ranging mammals will always involve some risk of mortality even in healthy animals. Deaths may be directly or indirectly attributable to the anaesthetic event itself (e.g. drug overdose, drowning during induction and dart trauma) or may be caused by secondary effects from the capture (e.g. stress, myopathy, trauma or instrumentation with radio-transmitters). In long-term research projects on five major wildlife species in Scandinavia, the capture-related mortality rates (number of captures were: moose Alces alces 0.7% (N=2,816), brown bears Ursus arctos 0.9% (N=1,079), wolverines Gulo gulo 2.8% (N=461), Eurasian lynx Lynx lynx 3.9% (N=380), and gray wolves Canis lupus 3.4% (N=89). We suggest that wildlife professionals should strive for a zero mortality rate but adopt the standard that a mortality rate of >2% probably should not be accepted in any large mammalian species. This can be achieved by: (1) using an experienced professional capture team, (2) developing and following a capture protocol specific to each species, and (3) requiring that a mortality assessment be undertaken after any capture-related death. This assessment should re-evaluate the capture protocol, including how changes in anaesthetics and methodological approaches could have prevented the mortality.

Publication Type
Journal article.
20063127351
Author
Carareto, R.; Rocha, L. de S.; Guerrero, P. N. H.; Sousa, M. G.; Nunes, N.; Paula, D. P. de; Nishimori, C. T.
Title
Retrospective study of the mortality and morbidity associated with general inhalant anesthesia in dogs.
[Portuguese]
Source
Semina: Ciencias Agrarias (Londrina); 2005. 26(4):569-574. 13 ref.
Publisher
Universidade Estadual de Londrina
Location of Publisher
Londrina
Country of Publication
Brazil
Abstract
The records of 1153 dogs that underwent inhalant general anaesthesia at the Veterinary Teaching Hospital of Sao Paulo State University (UNESP, Campus of Jaboticabal, Sao Paulo, Brazil) from July 2000 until January 2003 were reviewed. We aimed at determining the mortality and morbidity rates, as well as their correlation with inhalation agents used for anaesthetic maintenance, and the American Society of Anesthesiologists (ASA) classification of the patients. The overall morbidity rate was 9.19%, whereas mortality rate was 1.13%. Although the data analysis showed the occurrence of complications and death in patients initially thought to be risk free and in patients where safe anesthetic agents were used, no statistical correlation was determined to exist between morbidity or mortality and either the ASA classification of the animals or the anaesthetic agent.
Publication Type
Journal article.

<49>
Accession Number
20063121213
Author
Mama, K.
Title
Individualizing anesthetic management - benefits to your patients and the practice: Part 2.
Source
Publisher
The North American Veterinary Conference
Location of Publisher
Gainesville
Country of Publication
USA
Publication Type
Book chapter
Conference paper.

<50>
Accession Number
20063080773
A new anaesthetic protocol for horses was evaluated in 300 clinical patients (296 horses and 4 donkeys). Particular attention was paid to cardiopulmonary function and recovery, as poor recoveries and bad cardiovascular function could represent the main causes for the high mortality rate associated with equine anaesthesia. 300 equidae of mixed breed, mean age of 8 years and mean weight of 486 kg were anaesthetized. Horses were premedicated with acepromazine intramuscularly (i.m.). Following sedation with medetomidine IV, anaesthesia was induced with ketamine and diazepam IV. Anaesthesia was maintained with isoflurane in oxygen and constant rate infusion of medetomidine. Horses were allowed to breathe spontaneously, unless apnoea necessitated artificial ventilation. The heart rate, respiratory rate, arterial blood pressure and composition of inhaled and exhaled gases were monitored continuously. Arterial blood gases were measured regularly. Incremental boli of ketamine or thiopentone were noted. Morphine and medetomidine were administered for recovery. Recovery time was recorded, and recovery quality was scored on a 1-5 scale (1=best, 5=worst). The mean duration of anaesthesia was 149 min. Hypotension or hypoxaemia occurred in a small number of horses. Both resolved when either additional fluids and sympathomimetics or a higher concentration of inspiratory oxygen were administered. 146 and 29 horses received supplemental ketamine and thiopentone, respectively. Recovery was scored excellent or good in 299 horses and poor in one horse. The mean duration of recovery was 50 min. Results suggested that the described anaesthetic protocol was suitable in maintaining anaesthesia in horses for various procedures of considerable duration. Cardiopulmonary function was well-maintained, and recoveries were of exceptionally good quality.

<51>

Accession Number
20063075416

Author

Title
Risk factors for anaesthetic-related death in referred dogs.

Source
Veterinary Record; 2006. 158(16):563-564. 23 ref.

Publisher
British Veterinary Association

Location of Publisher
London

Country of Publication
UK

Abstract
This study was conducted to identify the major risk factors associated with anaesthetic-related mortality and to estimate the mortality risk in a single UK canine referral practice population. A case-control study was
undertaken retrospectively from dogs anaesthetized at the Queen Mother Hospital for Animals (QMHA), Royal Veterinary College (RVC), from February 1999 to April 2002. Cases were defined as anaesthetic-related deaths occurring within 48 h of anaesthesia, in which anaesthesia could not be excluded from contributing to death. Potential risk factors assessed included patient health status, age, premedication with acepromazine, premedication with opioids, overall premedication, induction with thiopentone or propofol, maintenance of anaesthesia with halothane or isoflurane and duration of anaesthesia. During the 3-year period, 6026 dogs were anaesthetized, and 20 anaesthetic-related deaths were recorded. The anaesthesia-related death risk in the referral population for the year April 2001 to April 2002 was 0.58%. The duration of anaesthesia, opioid analgesia and patient age were insignificantly different between groups. Patients with a high risk status had a significantly higher odds of death compared to patients with low risk status. It was concluded that patient health status was an important indicator for risk of perioperative mortality, and the use of acepromazine was associated with reduced risk of death compared to other premedicants.

Publication Type
Journal article.

Accession Number
20063068346
Author
Proudman, C. J.; Dugdale, A. H. A.; Senior, J. M.; Edwards, G. B.; Smith, J. E.; Leuwer, M. L.; French, N. P.
Title
Pre-operative and anaesthesia-related risk factors for mortality in equine colic cases.
Source
Publisher
Elsevier
Location of Publisher
Amsterdam
Country of Publication
Netherlands
Abstract
Mortality rates for horses that have undergone emergency abdominal surgery are higher than for other procedures. Here, multivariable modelling of data from 774 surgical colic cases is used to identify pre-operative and anaesthesia-related variables associated with intra- and post-operative mortality. Intra-operative mortality was significantly (P<0.05), and positively associated with heart rate and packed cell volume (PCV) at admission, and negatively associated with the severity of pain. Post-operative mortality increased with increasing age and PCV at admission. Draught horses, Thoroughbreds and Thoroughbred-cross horses carried a significantly worse prognosis. We detected a small but significant variability in the risk of intra-operative death amongst referring veterinary surgeons. Different anaesthetic induction agents, inhalation maintenance agents and the use, or not, of intermittent positive pressure ventilation had no significant effect on risk of death. We conclude that cardiovascular compromise, level of pain, age, and breed are all associated with the risk of mortality in equine surgical colic cases.

Publication Type
Journal article.

Accession Number
20043216508
Author
Wilson, D. V.; Walshaw, R.

Title  
Postanesthetic esophageal dysfunction in 13 dogs.

Source  

Publisher  
American Animal Hospital Association

Location of Publisher  
Denver

Country of Publication  
USA

Abstract  
Thirteen dogs with postanesthetic esophageal dysfunction were identified; 10 of these animals had esophageal stricture. Regurgitation was noted in six dogs during the inciting anesthetic event. Clinical problems common to all dogs included vomiting/regurgitation and weight loss. Coughing was noted in six dogs, and aspiration pneumonia was present in four of these dogs. The associated mortality rate was 23%. The duration of symptoms ranged from 17 to 150 days, and the diagnosis was often delayed (up to 76 days from onset of clinical signs to diagnosis). Postanesthetic esophageal dysfunction was a debilitating and costly problem that developed in one dog despite current preventative treatment.

Mulcahy, D. M.; Tuomi, P.; Larsen, R. S.

Title  
Differential mortality of male spectacled eiders (Somateria fischeri) and king eiders (Somateria spectabilis) subsequent to anesthesia with propofol, bupivacaine, and ketoprofen.

Source  

Publisher  
Association of Avian Veterinarians

Location of Publisher  
Boca Raton

Country of Publication  
USA

Abstract  
Twenty free-ranging spectacled eiders (Somateria fischeri; 10 male, 10 female), 11 free-ranging king eiders (Somateria spectabilis; 6 male, 5 female), and 20 female common eiders (Somateria mollissima) were anesthetized with propofol, bupivacaine, and ketoprofen for the surgical implantation of satellite transmitters. Propofol was given to induce and maintain anesthesia (mean total dose, 26.2-45.6 mg/kg IV), bupivacaine (2-10 mg/kg SC) was infused into the incision site for local analgesia, and ketoprofen (2-5 mg/kg IM) was given at the time of surgery for postoperative analgesia. Four of 10 male spectacled eiders and 5 of 6 male king eiders died within 1-4 days after surgery. None of the female spectacled or common eiders and only 1 of the 5 female king eiders died during the same postoperative period. Histopathologic findings in 2 dead male king eiders were severe renal tubular necrosis, acute rhabdomyolysis, and mild visceral gout. Necropsy findings in 3 other dead male king eiders were consistent with visceral gout. We suspect that the perioperative use of ketoprofen caused lethal renal damage in the male eiders. Male eiders may be more susceptible to renal damage than females because of behavioral differences during their short stay on land in mating season. The combination of propofol, bupivacaine, and ketoprofen should not be used to
anesthetize free-ranging male eiders, and nonsteroidal anti-inflammatory drugs should not be used perioperatively in any bird that may be predisposed to renal insufficiency.

Publication Type
Journal article.

<55>
Accession Number
20043066871
Author
Cornick-Seahorn, J.
Title
Anaesthesia of the critically ill equine patient. (Critical care for all ages.)
Source
Publisher
W.B. Saunders
Location of Publisher
Philadelphia
Country of Publication
USA
Abstract
Mortality rates of healthy horses undergoing general anaesthesia for routine procedures have been reported to range from 0.6 to 1.8%, increasing to as high as 5% when systemically ill horses are included in the calculations. When general anaesthesia cannot be avoided in critically ill horses, the following measures should be addressed throughout the perianaesthetic period: preanaesthetic assessment and cardiopulmonary stabilization, perianaesthetic oxygen supplementation and ventilatory support, vigilant monitoring of the cardiopulmonary system, supportive therapy (i.e., inotropic agents, fluids) to promote adequate cardiac output, use of perioperative adjunct systemic or regional agents to reduce inhalant requirements, close observation and assistance during recovery, and postoperative analgesia.
Publication Type
Journal article.

<56>
Accession Number
20023141364
Author
Johnston, G. M.; Eastment, J. K.; Wood, J. L. N.; Taylor, P. M.
Title
The confidential enquiry into perioperative equine fatalities (CEPEF): mortality results of phases 1 and 2. (Equine Special Issue)
Source
Veterinary Anaesthesia and Analgesia; 2002. 29(4):159-170. 46 ref.
Publisher
Blackwell Science
Location of Publisher
Oxford
Country of Publication
UK
Abstract
Objectives: To document the equine perioperative mortality rate and to highlight any factor associated with an increased risk of death up to 7 days after anaesthesia. Study design: A prospective observational epidemiological multicentre study. Methods: Data were recorded from all equidae undergoing general anaesthesia in 62 UK clinics between February 1991 and March 1994. Power calculations indicated that 45 000 cases were required to detect the significance of important variables. Details of each horse, operation, anaesthetic agents and clinic personnel were recorded. Outcome at 7 days was recorded as: alive, put to sleep (PTS) or dead. Data were analysed by a standard multilevel logistic regression approach, considering the effects of clustering at the level of clinic. Results: Data were collected from 41 824 cases over 6 years. A total of 39 025 (93.3%) were alive on day 7 and 785 were dead giving an overall death rate of 1.9% (95% CI: 1.8-2.0) and 2014 (4.8%) were PTS. About 5846 horses undergoing emergency abdominal surgeries ('colics') were excluded from subsequent analyses. A total of 35 107 'noncolic' horses were alive at 7 days and 328 dead giving a death rate for noncolics of 0.9% (95% CI: 0.8-1.0). 543 (1.5%) noncolic horses classified PTS were excluded from further analyses. There were 109 (33%) deaths from cardiac arrest or postoperative cardiovascular collapse, with 107 (32%) from fractures and myopathies. Fracture repair, out of hours surgery and age below 1 month was associated with increased risk of dying whereas the use of acepromazine and intravenous anaesthetic agent maintenance of anaesthesia was associated with reduced risk. Conclusions: A number of potential contributors to the high risk of anaesthetic-related mortality have been identified. Further investigation of the underlying mechanism for their apparent harmful effects and development of alternative techniques is merited.

Publication Type
Journal article.

<57>
Accession Number
20023054287
Author
Kovac, M.; Scheidemann, W.; Schuttert, B.; Toth, J.; Stehle, C.
Title
Complications and risk factors during inhalation anaesthesia of horses. [German]
Source
Publisher
Schattauer GmbH
Location of Publisher
Stuttgart
Country of Publication
Germany
Abstract
In a retrospective study, complications encountered among 2339 horses that underwent surgery under general anaesthesia were analysed. 27 horses (1.15%) died, either during induction of anaesthesia, maintenance of anaesthesia or following complications in the postoperative phase. The majority of losses (n=25) occurred in colic patients. Two horses died after surgery for other reasons. Based on the patient classification according to the American Society of Anesthesiologists (ASA), it was shown that increasing severity of the underlying illness leads to a significant increase in perioperative fatalities. The most common cause of a perioperative fatality was postanaesthetic myopathy, which occurred with a frequency of 0.64%. Furthermore it was shown that duration of general anaesthesia has a large influence on the development of fatal complications.
Publication Type
Journal article.
Is isoflurane safer than halothane in equine anaesthesia? Results from a multicentre randomised controlled trial.

A survey of the routine anaesthetic management of dogs and cats during sterilization by veterinarians in South Africa was conducted. Premedication, induction and most commonly used maintenance agents in dogs and cats were described. Information about monitoring of animals during the procedure and who is responsible for induction of anaesthesia and monitoring was obtained. Questionnaires were analysed with regard to demographic data, practice size, continuing education, the number of surgical procedures and sterilizations performed per week and an estimate of yearly mortality. Acetylpromazine is the most commonly used premedication in dogs and xylazine in cats. Thiopentone in dogs and alphaxalone/alphadolone in cats were the most commonly used induction agents. Alphaxalone/alphadolone in cats and halothane in dogs were the most commonly used maintenance agents. Records of anaesthesia were poorly kept and monitoring of animals was poorly performed. Respiratory rate was the most commonly monitored (90.7%), and in most cases the sole parameter that was monitored. On average 10.34±or-8.25 cats were operated per week, of which 5.45+or-5.60 were sterilized; 17.79+or-11.61 dogs were operated per week, of which 8.65+or-7.10 were sterilized. In total, 190 animals died under anaesthesia, a mortality rate of 1:1243. Just over 50% of practitioners had attended continuing education courses during their careers.
Accession Number
19992203558
Author
Gaynor, J. S.; Dunlop, C. I.; Wagner, A. E.; Wertz, E. M.; Golden, A. E.; Demme, W. C.
Title
Complications and mortality associated with anesthesia in dogs and cats.
Source
Publication Type
Journal article
Conference paper.

Accession Number
19982218764
Author
Moon, P. F.; Erb, H. N.; Ludders, J. W.; Gleed, R. D.; Pascoe, P. J.
Title
Perioperative management and mortality rates of dogs undergoing cesarean section in the United States and Canada.
Source
Abstract
The success of caesarean section was evaluated in 3908 puppies and 808 dams in the USA and Canada. Survival rates immediately, 2 h and 7 days after delivery were 92, 87 and 80%, respectively, for 3410 puppies delivered by caesarean section and 86, 83 and 75%, respectively, for 498 naturally born puppies. All puppies delivered by caesarean section were born alive in 614 of 807 (76%) litters. Maternal mortality rate was 1%. Of 776 surgeries, 453 (58%) were done on an emergency basis. The commonest breeds of dogs that underwent emergency surgery were Bulldog, Labrador Retriever, Boxer, Corgis and Chihuahua. The commonest breeds of dogs that underwent elective surgery were Bulldog, Labrador Retriever, Mastiff, Golden Retriever, and Yorkshire Terrier. The commonest methods of inducing and maintaining anaesthesia were administration of isoflurane for induction and maintenance (266 dogs, 34%) and administration of propofol for induction followed by administration of isoflurane for maintenance (237 dogs, 30%). It is concluded that mortality rates of dams and puppies undergoing caesarean section in the USA and Canada are low.
Publication Type
Journal article.

Accession Number
19982213440
Author
Dyson, D. H.; Maxie, M. G.; Schnurr, D.
Title
Morbidity and mortality associated with anesthetic management in small animal veterinary practice in Ontario.

Source

Abstract
During 1993, 66 small animal practices participated in a prospective study to evaluate the incidence and details of anaesthetic-related morbidity and mortality. Among 8087 dogs and 8702 cats undergoing anaesthesia, the incidences of complications were 2.1% and 1.3%, respectively. Death occurred in 0.11% and 0.1% of cases, respectively. Logistic regression models were developed and showed that a significant odds ratio (OR) of complications in dogs was associated with xylazine (OR, 91.5); heart rate monitoring (OR, 3.2); American Society of Anaesthesiologists (ASA) 3, 4, or 5 classification (OR, 2.5); isoflurane (OR, 2.4); butorphanol (OR, 0.35); technician presence (OR, 0.26); acepromazine (OR, 0.24); ketamine (OR, 0.21); and mask induction (OR, 0.2). Complications in cats were associated with ASA 3, 4, or 5 classification (OR, 5.3); diazepam (OR, 4.1); intubation (OR, 1.7); butorphanol (OR, 0.45); and ketamine (OR, 0.17). Cardiac arrest in dogs was associated with xylazine (OR, 43.6) and ASA 3, 4, or 5 classification (OR, 7.1). Cardiac arrest in cats was associated with ASA 3, 4, or 5 classification (OR, 21.6) and technician presence (OR, 0.19).

Publication Type
Journal article.

<63>
Accession Number
19982207494

Author
Mee, A. M.; Cripps, P. J.; Jones, R. S.

Title
A retrospective study of mortality associated with general anaesthesia in horses: emergency procedures.

Source
Veterinary Record; 1998. 142(12):307-309. 13 ref.

Abstract
A retrospective study evaluated 995 emergency equine general anaesthetics. The total mortality for emergency procedures was 31.4%. Horses anaesthetised for surgical colic had an increased risk of death or being killed, with a total mortality of 35.5% when compared to horses anaesthetised for non-colic related problems which had a total mortality of 15.3%. It is concluded that mortality is 4.25 times more likely for emergency procedures not associated with colic than for similar procedures carried out electively and emergency general anaesthesia for colic carries an increased risk of mortality of 9.86 times that of elective cases.

Publication Type
Journal article.

<64>
Accession Number
19982207050

Author
Mee, A. M.; Cripps, P. J.; Jones, R. S.

Title
A retrospective study of mortality associated with general anaesthesia in horses: elective procedures.

Source
Veterinary Record; 1998. 142(11):275-276. 7 ref.

Abstract
A retrospective analysis examined mortality associated with all procedures requiring general anaesthetic, performed at the Philip Leverhulme Large Animal Teaching Hospital, during February 1991 to December 1995. The study involved details relating to 2276 equine general anaesthetics and a variety of patient variables were examined. Within a group of 1279 animals undergoing anaesthesia for elective procedures, 46 (3.6%) died or were killed owing to a poor prognosis or financial implications. Mortality relating directly to the surgery or anaesthesia occurred in 8 of these cases. The surgical/anaesthetic death rate was 0.63%. Death which was apparently attributable directly to the anaesthesia occurred only once.

Publication Type
Journal article.

Accession Number 19962208647
Author
Title
The confidential enquiry into perioperative fatalities (CEPEF-1). Survival curves.
Source
Veterinary Surgery; 1996. 25(2):182.
Publication Type
Journal article
Conference paper.

Accession Number 19952211894
Author
Johnston, G. M.; Taylor, P. M.; Holmes, M. A.; Wood, J. L. N.
Title
Confidential enquiry of perioperative equine fatalities (CEPEF-1): preliminary results.
Source
Abstract
The preliminary results are given of a study involving 5922 horses (at 62 clinics) on which surgery was performed under general anaesthesia between February 1991 and March 1993. Overall death rate, for equine patients dying or being subjected to euthanasia within 7 days of a general anaesthetic because of perioperative complications was 102/5220 (0.9%) when all colic surgery and delivery of foals under general anaesthesia were excluded. The risk rates for various factors including type and time of operation, type and duration of anaesthesia and the age and preoperative condition of the patient, are listed.
Publication Type
Journal article.

Accession Number 19912215577
Author
Clarke, K. W.; Hall, L. W.
Title  
A survey of anaesthesia in small animal practice: AVA/BSAVA report.

Source  
Journal of the Association of Veterinary Anaesthetists of Great Britain and Ireland; 1990. 17:4-10. 10 ref.

Abstract  
Over 150 veterinary surgeons from 53 small animal practices [in the UK] collaborated in a prospective survey of anaesthetic accidents and emergencies by recording all anaesthetics administered and detailing the problems they encountered during 1984 to 1986. From these records it is estimated that 1 in 679 of the healthy dogs and cats died primarily as a result of anaesthesia; many of these deaths apparently occurred at a time when the animal was not under close observation. Anaesthetics involving the use of xylazine seemed to result in an exceptionally high mortality rate. Complications following endotracheal intubation appeared to be associated with several deaths in cats. The death rate in cats and dogs with pathological but not immediately life-threatening conditions was estimated to be 1 in 31. There was no evidence to suggest that some breeds (with the possible exception of the Pekingese) were more likely than others to die under anaesthesia.

Publication Type  
Journal article.

Accession Number  
19832225516

Author  
Tevik, A.

Title  
The role of anesthesia in surgical mortality in horses.

Source  
Nordisk Veterinaermedicin; 1983. 35(4):175-179. 4 ref.

Abstract  
The incidence of anaesthetic-surgical deaths at The Department of Surgery, The Norwegian College of Veterinary Medicine, Oslo for the period 1965-1981 was 1:37. Of 1216 patients operated upon in the recumbent position 33 did not survive. Of the 33 nonsurvivors 23 died within the first 24 hours after surgery. Anaesthesia was considered to be the direct cause of death on 10 occasions. Without mismanagement and with more intensive monitoring, 6 of the deaths could probably have been avoided. Of the 10 patients which died later than 24 hours after anaesthesia, 8 died from post-anaesthetic rhabdomyolysis.

Publication Type  
Journal article.