Mortalità e Morbilità in anestesia


Perianesthetic Mortality in Domestic Animals: A Retrospective Study of Postmortem Lesions and Review of Autopsy Procedures.

DeLay J(1).

Autopsy of animals that die in the perianesthetic period allows identification of anesthetic and surgical complications as well as preexisting disease conditions that may have contributed to mortality. In most studies to date investigating perianesthetic mortality in animals, inclusion of autopsy data is very limited. This retrospective study evaluated autopsy findings in 221 cases of perianesthetic death submitted to a veterinary diagnostic laboratory from primary care and referral hospitals. Canine (n = 105; 48%) and feline (n = 90; 41%) cases predominated in the study, involving elective (71%) and emergency (19%) procedures. The clinical history provided to the pathologist was considered incomplete in 42 of 221 cases (19%), but this history was considered essential for evaluating the circumstances of perianesthetic death. Disease had been recognized clinically in 69 of 221 animals (31%). Death occurred in the premedication or sedation (n = 19; 9%), induction (n = 22; 11%), or maintenance (n = 73; 35%) phases or in the 24 hours postanesthesia (n = 93 animals; 45%). Lesions indicative of significant natural disease were present in 130 of 221 animals (59%), mainly involving the heart, upper respiratory tract, or lungs. Surgical or anesthesia-associated complications were identified in 10 of 221 cases (5%). No lesions were evident in 80 of 221 animals (36%), the majority of which were young, healthy, and undergoing elective surgical procedures.
resulting from cardiopulmonary resuscitation were identified in 75 of 221 animals (34%). Investigation of perianesthetic death cases should be done with knowledge of prior clinical findings and antemortem surgical and medical procedures; the autopsy should particularly focus on the cardiovascular and respiratory system, including techniques to identify pneumothorax and venous air embolism.


**Equine anaesthesia-associated mortality: where are we now?**

Dugdale AH(1), Taylor PM(2).

**OBJECTIVES:** To review the literature concerning mortality associated with general anaesthesia in horses and to assess whether there is evidence for a reduction in mortality over the 20 years since the Confidential Enquiry into Perioperative Equine Fatalities (CEPEF).

**DATABASES USED:** PubMed, Scopus, Google Scholar. Search terms used: horse; pony; equine; anaesthesia; anesthesia; recovery; morbidity, and mortality.

**CONCLUSIONS:** The most recent studies, in which isoflurane and sevoflurane have been more commonly used for anaesthesia maintenance, report fewer intraoperative cardiac arrests than older studies in which halothane was favoured. Catastrophic fractures, however, have become the greatest cause of recovery-associated mortality.


**Peri-anaesthetic complications in an equine referral hospital: Risk factors for post anaesthetic colic.**

Jago RC(1), Corletto F(1), Wright IM(1).

**REASONS FOR PERFORMING STUDY:** Peri-anaesthetic complications are relatively
common in equine patients and further investigations are warranted to identify manageable risk factors.

OBJECTIVES: To report morbidity and mortality rates and identify associated risk factors for horses undergoing general anaesthesia, within a predominantly racing Thoroughbred (TB) population.

STUDY DESIGN: Single centre retrospective observational study.

METHODS: Anaesthetic and case records of all horses ≥12 months old undergoing general anaesthesia at Newmarket Equine Hospital between August 2010 and April 2012 were analysed, excluding emergency abdominal/dystocia procedures or traumatology cases with cardiovascular compromise. Mortality and morbidity rates were calculated and described. Uni- and multivariable analyses were used to investigate the relationship between the principal complication, post anaesthetic colic (PAC) and risk factors.

RESULTS: A total of 1067 anaesthetic records of 1021 horses were included in the study; of these, 702 horses (65.8%) were TB, 169 (15.8%) developed a complication within 7 days of general anaesthesia and 10 (0.94%) died as a result. The most prevalent morbidity was PAC, 111 horses (10.5%) developed colic within 7 days of general anaesthesia. Thoroughbred horses (odds ratio [OR] 2.93, 95% confidence interval [CI] 1.73-4.96) and horses receiving sodium benzylpenicillin (NaBP) (OR 2.77, 95% CI 1.69-4.50) were at increased risk of PAC.

CONCLUSIONS: Thoroughbred racehorses were identified as at increased risk of PAC in this study and might benefit from more critical evaluation of post anaesthetic gastrointestinal function. An alternative to the administration of NaBP for prophylactic antimicrobial therapy needs to be further investigated if its role in PAC is confirmed by other studies.
Reversal of neuromuscular block in companion animals.

Jones RS(1), Auer U(2), Mosing M(3).

OBJECTIVE: To review the evidence regarding the reversal of neuromuscular block (NMB) in companion animals with emphasis on the development and use of newer agents.

DATABASE USED: Data sources include scientific reviews and original research publications in both human and veterinary literature using Pubmed and Scopus as search data bases. Unpublished and locally published data on reversal of NMB are presented.

CONCLUSIONS: Residual NMB has been shown to increase morbidity and mortality in humans and needs to be avoided. It can be detected only by adequate neuromuscular monitoring. The proper use of reversal agents avoids residual NMB and recurarization should not occur. Anticholinesterase inhibitors, such as edrophonium and neostigmine have been used to reverse NMB when the need for this has been established. Reversal is influenced by several factors and a number of undesirable side-effects of these drugs have been reported. Sugammadex, a γ-cyclodextrin, which was designed specifically to encapsulate rocuronium, is more rapid in its actions, has fewer side effects and can reverse profound NMB induced by aminosteroidal muscle relaxants.

Retrospective study of the perioperative management and complications of ureteral obstruction in 37 cats.

Garcia de Carellan Mateo A(1), Brodbelt D(1), Kulendra N(1), Alibhai H(1).
OBJECTIVES: To describe perioperative management and complications, risk factors and mortality rates in cats anaesthetized for treatment of ureteral obstruction.

STUDY DESIGN: Retrospective, clinical, cohort study.

ANIMALS: Thirty-seven client-owned cats anaesthetized for ureteral surgery.

METHODS: Records with sufficient data for cats treated between March 2010 and March 2013 were examined for breed, age, gender, history, concurrent diseases, pre- and post-anaesthetic biochemical and haematological parameters, American Society of Anesthesiologists classification, anaesthetic protocol, surgical technique, surgeon, perioperative complications and mortality within 48 hours after extubation. Associations between risk factors and outcome variables were evaluated using univariable analysis. Odds ratios and 95% confidence intervals were calculated for significant parameters. Sensitivity and specificity using receiving operator characteristic curve analysis were calculated for creatinine, potassium level and standard base excess (SBE) to denote survival or non-survival.

RESULTS: Preoperatively, all cats were azotaemic: mean±SD urea was 31.6 ± 26.9 mmol L(-1) and median (range) creatinine was 562 μmol L(-1) (95 μmol L(-1) to off scale). Thirteen cats were hyperkalaemic (K+ 6.5 mmol L(-1)). Anaesthesia-related complications included bradycardia (n=8, 21.6%), hypotension (n=15, 40.5%) and hypothermia (n=32, 86.5%). Seven cats (18.9%) died postoperatively. Non-survivors were significantly (p=0.011) older (9.8±1.9 years) than survivors (6.4±3.1 years) and had higher potassium concentrations (p=0.040). Risk factors associated with mortality were ASA classes IV and V (p=0.022), emergency procedures (p=0.045) and bicarbonate administration (p=0.002). Non-survivors had higher creatinine concentrations (p=0.021) and lower SBE (p=0.030).
CONCLUSION AND CLINICAL RELEVANCE: Intraoperative anaesthetic complications were common; increased age, poor health status, preoperative bicarbonate administration, hyperkalaemia and increased creatinine were associated with increased risk for death and can be used to predict risk for complications.


Anesthesia and analgesia for standing equine surgery.
Vigani A(1), Garcia-Pereira FL(2).

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.


Perianesthetic morbidity and mortality in dogs undergoing cervical and thoracolumbar spinal surgery.
Posner LP(1), Mariani CL, Swanson C, Asakawa M, Campbell N, King AS.

OBJECTIVE: To evaluate and compare perioperative morbidity and mortality in dogs undergoing cervical and thoracolumbar spinal surgery.

STUDY DESIGN: Prospective case series.
ANIMALS: 157 dogs undergoing cervical or thoracolumbar spinal surgery.

METHODS: Data were collected sequentially on canine cases presented from the Neurology Section of the North Carolina State University Veterinary Teaching Hospital for anesthesia and surgery for cervical spinal cord disease. Simultaneously, data were collected on all thoracolumbar spinal surgery cases during the same time period. Data included signalment, drugs administered, surgical approach, disease process, cardiac arrhythmias during anesthesia, and outcome.

RESULTS: Data were collected from 164 surgical events in 157 dogs. There were 52 cervical approaches; four dorsal and 48 ventral. All thoracolumbar surgeries were approached dorsolaterally. Four dogs 4/52 (7.6%) undergoing a cervical approach did not survive to discharge. Two dogs 2/8; 25%) underwent atlanto-axial (AA) stabilization and suffered cardiovascular arrest and two dogs 2/38; 5.2%) undergoing cervical ventral slot procedures were euthanized following anesthesia and surgery due to signs of aspiration pneumonia. All dogs undergoing thoracolumbar surgery survived until discharge (112/112). Mortality in dogs undergoing cervical spinal surgery was greater compared with dogs undergoing thoracolumbar spinal surgery (p = 0.009), however, in dogs undergoing decompressive disc surgery, intraoperative death rates were not different between dogs undergoing a cervical compared with thoracolumbar approaches (p = 0.32) nor was there a significant difference in overall mortality (p = 0.07).

CONCLUSION AND CLINICAL RELEVANCE: Overall, dogs undergoing cervical spinal surgery were less likely to survive until discharge compared with dogs undergoing thoracolumbar spinal surgery. Mortality in dogs undergoing cervical intervertebral disc decompression surgery was no different than for dogs
undergoing thoracolumbar intervertebral disc decompression surgery. However, dogs undergoing cervical intervertebral disc decompression surgery should be considered at risk for aspiration pneumonia.


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

Bille C(1), Auvigne V, Bomassi E, Durieux P, Libermann S, Rattez E.

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.


**Veterinary and human anaesthesia: an overview of some parallels and contrasts.**

Carter J(1), Story DA.

The history of human and veterinary anaesthesia is both intertwined and parallel. Physicians and anaesthetists often first experimented on animals and developments from human anaesthesia have been incorporated into veterinary medicine. Within veterinary medicine, anaesthesia is a specialty discipline as it is in human medicine. Veterinary anaesthetists undertake additional training and rigorous examinations for a diploma or fellowship. In contrast to human anaesthesia in Australia and New Zealand, veterinary anaesthesia is often performed by non-specialists and by veterinary nurses. Veterinary anaesthesia uses many of the same drugs for premedication, induction and maintenance of anaesthesia as human anaesthesia. However, there are species specific effects of some of the drugs
used that differ from the effects in humans. Furthermore, some agents, particularly alpha-2 adrenoreceptor agonists and ketamine, are used very widely in veterinary practice. Also in contrast to most human anaesthesia, in large animal and exotic animal practice the patients can present a physical danger to the anaesthetist. The most notable contrast between human and veterinary anaesthesia is in the reported perioperative complication and mortality rates, with a species dependent perianaesthetic mortality of up to 2% in dogs, cats and horses and greater than 2% in guinea pigs and birds, which is up to 100-fold higher than in human anaesthesia.


Peri-anaesthetic mortality in horses - the need for CEPEF-4.

Gent TC(1), Bettschart-Wolfensberger R.


Gil L(1), Redondo JI.

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.


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% Confidence interval (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.


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

Bille C(1), Auvigne V, Libermann S, Bomassi E, Durieux P, Rattez E.

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 °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.


Confidential enquiry into perioperative equine fatalities: CEPEF 4—a chance to gain new evidence about the risks of equine general anaesthesia.

Bettschart R, Johnston M.


Post-mortem findings in 54 cases of anesthetic associated death in cats from two spay-neuter programs in New York State.

Gerdin JA(1), Slater MR, Makolinski KV, Looney AL, Appel LD, Martin NM, McDonough SP.

Anesthetic-associated death (AAD) in cats is infrequent, but occurs far more frequently than in people. Post-mortem investigations of AAD in cats are uncommon, and results only sporadically published. Here we report the findings in 54 cases of AAD in cats. Significant gross and/or microscopic pre-existing disease, including pulmonary, cardiac, and systemic disease, was detected in 33% of cases. Pulmonary disease was most frequently diagnosed (24% of cases), and included cases of Aelurostrongylus abstrusus infection (9% of cases). Heart disease, including two cases of hypertrophic cardiomyopathy, was less frequent (11% of cases). Four percent died from surgical complications. No significant gross or microscopic disease was detected in 63% of cases. Additional studies are needed to determine if these findings are representative of AAD in cats in other geographic areas or with access to veterinary care. This study demonstrates that
Feline anesthetic deaths in veterinary practice.

Brodbelt D(1).

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.