Myths and misconceptions in small animal anesthesia

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The perianesthetic mortality rate for dogs and cats has been reported to range from 0.1% to 0.43%, but probably varies greatly from 1 veterinary practice to the next, with many veterinarians reporting a low incidence of anesthesia-related deaths in their practices. Nevertheless, even a rare anesthesia-related death has a marked impact on clients and the veterinary staff. Veterinary anesthesia has progressed to the point that survival is no longer the only criterion for good or successful anesthesia. Modern anesthetic techniques are designed to minimize risks, not only of obvious complications but also of hidden ones, and to maximize the odds of a favorable outcome. In discussing anesthetic drug protocols and monitoring techniques with small animal veterinarians, the authors have become aware of certain myths or misconceptions shared by many practitioners. In a medical community, beliefs often arise from a combination of clinical experience and the prevailing scientific evidence. As further research is conducted, many things that were once considered fact are disproved, yet reevaluation of beliefs does not always keep pace with the rate of scientific discovery. Thus, beliefs that were once evidence-based become outmoded and fall into the realm of myth or misconception.

The following comments are intended to refute some of the myths and clarify certain misconceptions surrounding the practice of small animal anesthesia, present current understanding of commonly misunderstood issues, and aid practitioners in providing higher quality care for their small animal patients.

Myth—Many breeds of dogs are sensitive to specific anesthetics.

Reality—Although certain breeds may be predisposed to problems that affect their responses to anesthesia (eg, cardiomyopathy in Doberman Pinschers and upper airway collapse in Bulldogs), very few breed-related sensitivities to anesthetic drugs have been identified. Greyhounds do have a well-documented tendency to have prolonged recoveries from thiobarbiturate anesthesia. And by extrapolation, many veterinarians avoid the use of thiopental in all sighthounds (eg, Whippets, Afghan Hounds, and Borzois), although sighthounds other than Greyhounds have not been studied in a controlled fashion and may not be similarly affected.

In addition, there are numerous anecdotal reports of Boxers fainting or collapsing when given acepromazine, possibly from excessive vagal response. Although poorly documented, this phenomenon seems to follow a geographic distribution, being more commonly reported in England, which may indicate a familial or genetic component. The authors have administered acepromazine at doses of 0.01 to 0.04 mg/kg (0.005 to 0.018 mg/lb), SC, to Boxers in Colorado without untoward effects, but recommend caution with dose and patient selection.

Finally, many veterinarians have a clinical impression that dogs of northern breeds, such as Alaskan Malamutes, Siberian Huskies, and Samoyeds, tend to respond to opioid administration by vocalizing or evidence dysphoric behavior. However, many northern-breed dogs respond appropriately to administration of opioids at lower dosages or to administration of opioids concurrently with a tranquilizer.

In summary, although many dog owners believe rumors that their particular breeds are sensitive to certain anesthetic drugs or that certain anesthetic drugs are contraindicated in their breeds, there is little evidence to support most of these rumors.

Myth—Preanesthetic medications should not be used because they delay recovery.

Reality—Premedications are very valuable in most cases. Tranquilizers, sedatives, and analgesics decrease anxiety and pain associated with hospitalization, restraint, injections, and other unpleasant procedures. They decrease the required doses of induction drugs and gas anesthetics, frequently resulting in less cardiovascular depression during induction and maintenance of anesthesia. While it is true that some premedications lead to prolonged sleepiness during recovery, most animals that have undergone painful procedures benefit from a quiet recovery period. After nonpainful procedures, the effects of some premedications (eg, opioids, benzodiazepines, and α2-adrenoceptor agonists) can be reversed or partially reversed, if necessary, to expedite recovery.

Myth—Small doses of α2-adrenoceptor agonists have minimal cardiovascular effects.
Reality—While the manufacturer of medetomidine, an α₂-adrenoceptor agonist, has recommended the use of doses ranging from 18 to 71 µg/kg (8.2 to 32.3 µg/lb), IV, much lower doses (1 to 10 µg/kg [0.45 to 4.5 µg/lb]), IV are sometimes useful to provide short-term sedation and analgesia. However, it has been reported that administration of medetomidine at a dose of 1 µg/kg, IV, in dogs caused cardiac output to decrease to < 40% of resting values and to remain nearly 50% below normal for at least an hour. In healthy young animals with good cardiovascular function, this decrease may be tolerated, but in older animals and animals with preexisting cardiac disease, such a decrease may have deleterious effects on tissue perfusion and oxygen delivery, including reduced perfusion of the myocardium itself. Interestingly, several surveys of small animal veterinary practices have suggested that use of the α₂-adrenoceptor agonist xylazine is associated with a higher incidence of periesthetic complications or death than use of any other anesthetic drug, possibly related to its detrimental cardiovascular effects. Although α₂-adrenoceptor agonists can induce excellent sedation and analgesia, caution is advised with regard to patient selection, even when very low doses are used.

Myth—The fewer drugs used to anesthetize an animal, the safer.

Reality—Actually, balanced anesthesia techniques that involve administration of multiple drugs often allow smaller doses of each drug to be used, resulting in fewer or less profound adverse effects than when a large dose of a single drug is used. For instance, the induction dose of propofol in dogs premedicated with acepromazine has a 50% lower induction dose need in dogs that have not been premedicated. Morphine administration can decrease the minimum alveolar concentration (MAC) of gas anesthetics by up to 63%. The use of balanced anesthetic techniques that involve lower doses of relatively depressant drugs, such as gas anesthetics, which produce profound dose-dependent hypotension, may benefit many patients.

Myth—It is dangerous to use more than 1 type of analgesic at a time in an animal.

Reality—Prevention and treatment of pain should involve a multimodal or balanced technique similar to the balanced techniques used for anesthesia. Drugs used to provide perioperative analgesia include opioids, α₂-adrenoceptor agonists, local anesthetics, non-steroidal anti-inflammatory drugs, and ketamine. The goal of using more than 1 drug is to provide better pain control while minimizing adverse effects. Single drug techniques can be used effectively to treat minor pain in dogs and cats. Acute pain induced by trauma or surgery generally responds better to combination drug therapy, rather than single drug treatment, in part because analgesics from different classes exert their effects in different parts of the neuroanatomic pathways giving rise to pain. Thus, combining 2 or more analgesic drugs during the perioperative period may provide additive or synergistic analgesic effects.

Myth—Opioids are dangerous because of their potential for adverse effects.

Reality—The adverse effects associated with opioids administered during the perioperative period in dogs and cats are rarely serious. The respiratory depressant effects of opioids in dogs and cats are much less profound than the effects in people, although some anesthetized animals given opioids along with other respiratory depressant induction drugs and gas anesthetics do benefit from mechanical ventilation. Hypoxemia may accompany respiratory depression if oxygen is not supplemented. Vomiting and defecation may occur when nonpainful animals are given an opioid, such as a preanesthetic dose of morphine, but usually this is a 1-time occurrence that does not seem to be a problem in the postoperative period or when opioids are given to an animal experiencing pain. Opioids can interfere with thermoregulation, but if necessary, body temperature can usually be maintained with appropriate heating or cooling devices. Behavioral changes, which can include agitation and dysphoria or excessive sedation, may occur in conscious animals treated with opioids; however, these effects can usually be managed by adjusting the opioid dosage, administering a tranquilizer concurrently, or administering a partial agonist. Some of the advantages of using opioids are excellent analgesia, minimal cardiovascular depressant effects, ability to decrease doses of other anesthetic drugs such as gas anesthetics, and ability to be reversed or antagonized.

Myth—Butorphanol is an effective and long-lasting analgesic.

Reality—A study of female dogs undergoing ovariohysterectomy found that administration of butorphanol at a dose of 0.5 mg/kg (0.23 mg/lb), IM, did not provide complete analgesia in all dogs at any time, and all dogs had signs of incisional pain by 30 to 90 minutes after receiving butorphanol. For visceral pain (colon balloon model), butorphanol at a dose of 0.4 mg/kg (0.18 mg/lb), SC, produced analgesia for < 60 minutes, even though a dose of 0.4 mg/kg was considered optimum, with a ceiling effect occurring at doses > 0.8 mg/kg (0.36 mg/lb). In another study, butorphanol did not significantly change the MAC of halothane in dogs. Taken together, these data suggest that butorphanol is useful only for fairly mild pain and if used for pain control in dogs, it should be administered every 1 to 2 hours. In cats undergoing onychectomy, butorphanol administration improved analgesia. However, the efficacy of butorphanol in cats varies widely, as does the duration of its effects, which have been reported to be from 80 to 360 minutes.

Myth—Induction of anesthesia with gas anesthetics is safer than induction with injectable anesthetics.

Reality—Struggling and excitement during mask induction are not only unpleasant for the patient and dangerous for personnel, but may also lead to higher serum catecholamine concentrations, which can predispose to arrhythmias and anesthetic overdose. Induction times with gas anesthetics, even with newer, less-soluble anesthetics such as sevoflurane, are slower than induction times with injectable anesthetics. A
recent study of cats reported that mean ± SD times to intubation with sevoflurane and isoflurane induction were 7.2 ± 1.1 and 8.6 ± 1.2 minutes, respectively. By comparison, most IV induction techniques allow intubation within 1 or 2 minutes. During the relatively prolonged induction period necessary with gas anesthetics, there is no airway control, and hypoventilation can be severe, especially in patients with preexisting respiratory compromise such as a collapsing trachea or diaphragmatic hernia. In addition, the depth of anesthesia required for endotracheal intubation of a patient with a diaphragmatic hernia. In addition, the depth of anesthesia required for endotracheal intubation of a patient is usually about 30% greater than that required for surgical incision, which means that by the time most patients are intubated following mask induction, they will have already experienced considerable cardiovascular and respiratory depression. At least 1 private practice has found that hypotension (systolic arterial blood pressure < 90 mm Hg) occurred more frequently in dogs and cats in which anesthesia was induced with an inhaled anesthetic delivered by mask (37%), compared with those in which anesthesia was induced with injectable drugs (14%). In addition, the high oxygen flows and vaporizer settings required for gas induction are wasteful and result in substantial pollution that contributes to occupational health hazards.

Myth—Thiopental is a dangerous and outdated anesthetic induction drug.

Reality—Thiopental is a reliable and economical induction agent that still has a place in veterinary anesthesia. Thiopental is chemically stable and resists bacterial growth for up to 4 weeks. Anesthetic induction with thiopental is usually rapid, smooth, and excitement-free. In healthy dogs, thiopental may increase heart rate and decrease stroke volume, resulting in little change in blood pressure or cardiac output. Reducing the induction dose of thiopental by administering premedications reduces the cardiovascular effects. Ventricular dysrhythmias can occur with thiopental, but these too are less common when administration of premedications allows lower doses of thiopental to be used. Clinical impressions suggest that supplementing oxygen prior to and during induction also seems to reduce the incidence of dysrhythmias. A study of the use of thiopental in hypovolemic dogs concluded that thiopental had minimal deleterious effects, most cardiovascular variables improved, and neither hypotension nor respiratory depression occurred. Nonpremedicated dogs recovering from thiopental alone may be groggy and have difficulty standing, but tranquilizers or opioids generally help to smooth recovery, as does a period of gas anesthesia.

Myth—Acepromazine-ketamine is a good combination for surgical anesthesia in cats.

Reality—A combination of acepromazine and ketamine has commonly been used as a general anesthetic in cats undergoing routine procedures such as ovariohysterectomy, castration, and orchectomy. Acepromazine is a tranquilizer and provides no analgesia, whereas ketamine is generally thought to provide good superficial analgesia and little to no analgesia for deep or visceral pain. Administration of acepromazine (0.11 mg/kg [0.05 mg/lb], IM) and atropine (0.045 to 0.067 mg/kg [0.02 to 0.03 mg/lb], IM) 15 minutes prior to administration of ketamine (22 mg/kg [10 mg/lb], IM) has been used in cats to provide anesthesia for surgical procedures. Another combination cited includes acepromazine (0.2 mg/kg [0.09 mg/lb], IM), butorphanol (0.4 mg/kg, IM), and ketamine (25 mg/kg [11.4 mg/lb], IM) for elective procedures such as ovarioectomy. Thus, the doses of ketamine used to provide analgesia and general anesthesia are relatively high. Lower doses of ketamine, which are frequently used to induce anesthesia in dogs and cats, are unlikely to provide anesthesia sufficient for surgical procedures. Higher doses of ketamine increase the risk of adverse cardiovascular effects, such as tachycardia, hypertension, and the associated increase in myocardial oxygen demand, and are more likely to be associated with prolonged and rough recoveries. Acepromazine and ketamine administered without supplemental oxygen increases the risk of anesthesia-related hypoxemia. Ketamine-induced CNS and cardiovascular stimulation may be particularly detrimental in the presence of hypoxemia. Although both acepromazine and ketamine are useful anesthetic drugs in cats, inducing and maintaining anesthesia with this combination places cats at undue risk for inadequate analgesia and clinically important adverse effects.

Myth—Ketamine is a safe drug in patients with failing cardiac function.

Reality—Ketamine is considered to be a relatively safe induction drug, with a therapeutic index (ie, the ratio of median lethal dose to median effective dose) of 8.5 to 16, depending on species, compared with thiopental's therapeutic index of 4.6 to 7. In addition, in a survey of small animal veterinarians in Colorado, ketamine was the most popular induction drug. When used in healthy patients without other medications, ketamine generally increases heart rate and blood pressure as a result of a generalized increase in sympathetic tone. However, in isolated heart preparations, the direct effect of ketamine on the myocardium is depression. In patients with clinically important cardiac disease, patients in shock that have sympathetic neurotransmitter depletion, and patients in which ketamine is used concurrently with other drugs such as benzodiazepines, the sympathomimetic, cardiovascular effects of ketamine are not apparent and cardiac depression may ensue. Therefore, although ketamine is an excellent induction drug in many situations and may have additional benefits in regard to pain relief, caution is advised with its use in patients with heart failure.

Myth—Propofol is the safest injectable anesthetic induction drug.

Reality—The therapeutic index of propofol is similar to that of thiopental, and both are probably slightly less safe, in this regard, than ketamine. An increased incidence of postoperative infections has been associated with use of propofol, possibly as a
result of suppression of reticuloendothelial function by the diluent.\textsuperscript{9} Cardiorespiratory effects of propofol are similar to those of thiopental, although propofol is less likely to increase heart rate or induce arrhythmias.\textsuperscript{30} Because the blood-brain equilibrium time for propofol is about 3 minutes, compared with 1 minute for most other induction drugs, it may be easier to overdose animals with propofol than with other faster-acting induction drugs. In dogs, propofol can induce substantial vasodilation,\textsuperscript{31} and at the Colorado State University Veterinary Teaching Hospital, hypotension is such a common sequela to propofol induction that a bolus of fluids (5 to 10 mL/kg [2.3 to 4.5 mL/lb]) is administered IV to almost all patients before propofol is given. Cyanosis is also reported with propofol induction unless oxygen is supplemented before, during, and after induction.\textsuperscript{32} Propofol's biggest advantage is the rapid, smooth recovery associated with its use, and this is certainly a reason to prefer propofol for short outpatient procedures in appropriately selected patients.

**Myth**—Sevoflurane is superior to isoflurane, and you are out of date if you are not using sevoflurane.

**Reality**—While everyone is entitled to his or her personal preferences, there is no compelling reason to switch from isoflurane to sevoflurane. Sevoflurane and isoflurane induce similar dose-related cardiovascular and respiratory depression,\textsuperscript{40} and neither drug sensitizes the heart to catecholamine-induced arrhythmias. Although the lower solubility of sevoflurane should result in faster induction and recovery times, a recent study\textsuperscript{33} in cats demonstrated that induction was only slightly faster when sevoflurane was used (mean, 7.2 min), compared with isoflurane (mean, 8.6 min), and recovery time was not significantly different between the 2 drugs. In addition, isoflurane does not produce toxic by-products. Although clinical use of sevoflurane has not been associated with increased renal toxicoses, sevoflurane breakdown can produce fluoride ions and small amounts of compound A, which have the potential to be toxic to the kidneys.\textsuperscript{41} Therefore, low oxygen flow rates (<1 to 2 L/min) are not recommended when using sevoflurane. Currently, sevoflurane is considerably (approx 5 times) more expensive than isoflurane.

**Myth**—Intravenous administration of fluids is warranted only during long surgical procedures.

**Reality**—Fluids are administered IV to compensate for insensible fluid losses that occur during anesthesia and surgery. Fluid loss is generally attributed to drying of exposed tissues and evaporation from the respiratory tract, especially with the administration of oxygen. Longer surgical procedures have a greater potential than shorter procedures for clinically significant fluid losses to occur. Nevertheless, IV administration of fluids is also beneficial in patients anesthetized for short procedures. As discussed elsewhere in this text, dogs and cats anesthetized for short, routine procedures are at risk of hypotension. The withholding of food prior to anesthesia, coupled with the reluctance of some dogs and cats to drink water while at a veterinary clinic, may lead to dehydration prior to anesthesia. Even mild degrees of dehydration, which tend to be difficult to recognize clinically, increase the likelihood of hypotension during anesthesia. Intravenous administration of fluids is 1 of the cornerstones of preventing and treating hypotension during anesthesia.

Intravenous administration of fluids may decrease recovery time by helping to maintain hepatic and renal blood flow, thereby hastening the elimination of anesthetic drugs. A return to normal function after anesthesia may be slowed by dehydration, which may actually become worse during recovery if the animal is still not drinking. Overall, IV administration of fluids prevents and corrects dehydration and hypotension and facilitates the elimination of anesthetic drugs, all of which are as important with a short procedure as with a long one. Finally, placing an IV catheter provides venous access for administration of emergency drugs in the event of an untoward episode during anesthesia and surgery.

**Myth**—Electrocardiographic activity indicates a beating heart.

**Reality**—While ECG monitoring is useful in detecting changes in heart rate or rhythm, it should be recognized that the ECG indicates electrical activity only, not mechanical activity (pumping) by the heart muscle. It is possible to have relatively normal ECG activity concurrently with severe hypotension or even cardiac arrest, as evidenced by continuation of ECG activity for several minutes following administration of an overdose of pentobarbital for euthanasia. Therefore, the ECG alone should not be relied on to indicate the circulatory status of an anesthetized patient.

**Myth**—Respiratory depression or apnea during anesthesia is a crisis.

**Reality**—Apnea is rarely a crisis unless the animal cannot be intubated. Most anesthetized, intubated animals breathing 100% oxygen can remain adequately oxygenated with only 1 or 2 breaths/min.\textsuperscript{42} Pulse oximetry can help determine whether oxygenation is adequate, and capnography or measurement of arterial blood gas partial pressures, if available, can confirm severe respiratory depression. If excessive respiratory depression or apnea occurs, efforts should be made to identify and correct the cause (eg, excessive anesthetic depth, recent administration of a respiratory depressant drug, and iatrogenic hyperventilation). In the meantime, providing 1 to 2 breaths/min of 100% oxygen will sustain adequate oxygenation in most patients, although hypercapnia may persist or worsen. Animals that cannot be expected to breathe spontaneously (eg, animals with a diaphragmatic hernia or undergoing an open chest procedure) and animals in which hypercapnia would be particularly detrimental (eg, animals with a brain tumor or head trauma) should be manually or mechanically ventilated at a rate of 8 to 15 breaths/min to help maintain normal oxygen and carbon dioxide partial pressures.

**Myth**—Pulse oximeters measure the adequacy of ventilation during inhalant anesthesia.

**Reality**—During inhalant anesthesia, oxygen is almost always used as the carrier gas and often comprises > 90% of the total inspired gases. As stated pre-
viously, at this concentration of oxygen, even complete apnea will not result in hypoxemia in dogs and cats with normal lung function for upwards of 30 minutes (although this time is less in horses). Therefore, pulse oximetry cannot be expected to detect hypoventilation in oxygen-breathing patients. In patients breathing room air (21% oxygen), however, desaturation generally accompanies hypoventilation and pulse oximetry may be useful in indicating hypoventilation-induced hypoxemia in these patients.44

Myth—A strong palpable pulse indicates good blood pressure and perfusion.

Reality—While a palpable pulse does at least confirm that the heart is beating and creating some degree of circulation, a strong pulse indicates only that there is a large difference between systolic and diastolic blood pressures, not necessarily an optimal mean blood pressure or good perfusion of tissues.45 For example, a puppy with a patent ductus arteriosus may have exceptionally strong pulses, yet have low mean blood pressure and relatively poor tissue perfusion. Many anesthetized animals with palpably normal pulses are actually hypotensive, as indicated by mean arterial blood pressure < 70 mm Hg.

Myth—I would know if my anesthetized patients had low blood pressure.

Reality—As indicated previously, the only way to accurately assess blood pressure is to measure it. Many animals that are hypotensive during anesthesia appear clinically normal, with normal heart and respiratory rates, pink mucous membranes, and physical signs (eye position and reflexes and jaw tone) indicating appropriate anesthetic depth. When asked to name the biggest problem encountered when anesthetizing dogs and cats, only 1 of more than 20 small animal veterinarians interviewed cited hypotension; it is unlikely to be purely coincidental that the same veterinarian was also the only one in the group who routinely measured blood pressure in her anesthetized patients.46 Many dogs and cats that are hypotensive appear to recover from anesthesia without any overt problems. However, vital organs such as the kidneys, which require a minimum blood pressure to maintain adequate perfusion, can be damaged by hypotension. Because 75% of nephrons must be nonfunctional before BUN and creatinine concentrations increase or clinical signs appear, it is likely that substantial perianesthetic kidney damage might go unnoticed. At least 1 expert on renal disease has suggested that measurement of arterial blood pressure during anesthesia would help reduce the likelihood of renal ischemia.47

Myth—Low blood pressure during anesthesia only happens to old or sick animals.

Reality—At the Colorado State University Veterinary Teaching Hospital, blood pressure is routinely measured in all anesthetized animals. A recent survey of 1 year's anesthesia records indicated that 32% of all anesthetized dogs were hypotensive (systolic arterial pressure < 90 mm Hg or mean arterial pressure < 60 mm Hg) at some point during anesthesia. It might be speculated that the patients anesthetized in academic veterinary hospitals tend to be sicker and therefore more susceptible to anesthetic-induced hypotension than those anesthetized in private practices for routine elective surgeries. However, a separate review of Veterinary Teaching Hospital patients undergoing only elective ovariohysterectomy indicated that 28% of these presumably healthy and young dogs were hypotensive. Given that all of these patients were administered fluids IV at a standard rate of 5 to 10 mL/kg/h during anesthesia, it is likely that the incidence of hypotension might have been even higher if fluids had not been given. In most cases, hypotension was corrected by decreasing the anesthetic vaporizer setting or administering additional fluids IV, but in 12% of anesthetized dogs, inotropes such as dobutamine or ephedrine had to be administered to increase blood pressure to an acceptable value. A separate survey of blood pressure measurements in a private small animal veterinary clinic indicated that hypotension occurred in 22% of anesthetized dogs and 33% of anesthetized cats for an overall incidence of 27%.48 In that clinic, blood pressure increased when the vaporizer setting was decreased (6% of anesthetized animals) or when additional fluids were administered IV (8% of anesthetized animals), but 13% of all anesthetized animals were hypotensive and did not receive any treatment.

Myth—Dentistry is a minor procedure that requires no special patient preparation or monitoring during anesthesia.

Reality—Many patients that undergo dental procedures are old and have other problems such as mitral regurgitation or hepatic or renal disease. Consequently, anesthesia of these patients is likely to entail greater risk than anesthesia of younger, healthier patients, and the anesthetic protocol should be planned only after careful consideration of physical examination and laboratory findings. Appropriate IV administration of fluids and monitoring of blood pressure, oxygenation, and heart rate and rhythm are especially important in older or compromised patients.

Myth—Bradycardia is a sign that the vaporizer setting should be decreased.

Reality—Although tachycardia during surgical stimulation may indicate an insufficient plane of anesthesia, deep planes of gas anesthesia as a general rule do not cause bradycardia. Increasing the depth of anesthesia with some anesthetics, such as sevoflurane, may actually cause the heart rate to increase.49 Bradycardia during anesthesia is more often associated with the use of opioids and α2-adrenoceptor agonists or with interventions that increase vagal tone (usually responsive to anticholinergics) or hypothermia (often unresponsive to anticholinergics).

Myth—Movement during anesthesia indicates conscious awareness by the patient.

Reality—One of the important benefits of general anesthesia is its ability to render a patient immobile.
Immobility is helpful in many procedures and vital in a few. The MAC of an inhalant anesthetic, the primary indicator of its anesthetic potency, is defined as the MAC required to prevent movement in response to a noxious stimulus in 50% of the patients studied. In general, muscle activity is reduced in a linear fashion as anesthetic depth is increased. For these reasons, immobility is generally regarded as an important marker of anesthetic depth. However, when cerebral function is studied, the onset of movement is not closely associated with the onset of consciousness. In fact, a fair amount of movement can occur long before awareness is reported in people. Therefore, movement that does not interfere with the procedures being performed may not be detrimental to the patient. An understanding of this fact may prevent an overreaction to movements during anesthesia and prevent anesthetizing patients beyond what is necessary, leading to cardiovascular and respiratory depression, which may be far more detrimental.

Myth—Animals that take a long time to wake up were probably at too high a vaporizer setting.

Reality—Currently used anesthetics, such as isoflurane and sevoflurane, are relatively quickly eliminated through the respiratory system once the vaporizer is turned off, and extubation should be achieved within 10 minutes. For animals on a circle system, periodically emptying the rebreathing bag and refilling it with pure oxygen will help prevent rebreathing of the anesthetic. Even after deep levels of anesthesia, the blood and brain concentrations of gas anesthetics should decrease sufficiently within 15 minutes that the animal will wake up. If it does not, other potential causes of prolonged anesthesia, such as hypothermia and administration of sedative drugs such as opioids, should be considered. It is important to realize that a fast recovery is not necessarily a good recovery; animals that have undergone pain-inducing procedures are likely to benefit from both the analgesia and slower, quieter recovery afforded by administration of opioids.

Myth—Administering oxygen at the end of surgery delays recovery.

Reality—The administration of oxygen has minimal to no effect on recovery time but may have benefits in preventing hypoxemia. Discontinuation of oxygen administration before extubation resulted in hypoxemia (pulse oximeter values < 90%) within 3 minutes in 5% of healthy dogs (American Society of Anesthesiologists status 1 or 2) recovering from anesthesia. If a circle system is used, periodically emptying the breathing bag and refilling it with oxygen will help remove exhaled anesthetic from the system. Assuming a scavenging system is in use, keeping the animal connected to the anesthesia breathing circuit during recovery has the added benefit of reducing pollution in the recovery area.

Myth—I would know if my patients were in pain after surgery.

Reality—Recognizing pain in the postoperative period is often difficult in dogs and cats. Some painful dogs and cats will display behaviors that will be correctly interpreted as pain. Unfortunately, many other animals will not demonstrate behaviors that will convince the veterinary staff that they are actually in pain. In fact, residual anesthetic drugs and tranquilizers such as acepromazine often prevent or mask the demonstration of behaviors suggestive of pain. Adding to the difficulty of recognizing pain is the fact that no foolproof method exists to measure and quantify pain in animals.

Diagnosing pain in animals often requires time and knowledge of the normal behavior of the species and individual. It is certainly understandable that a busy veterinary staff with no training in the evaluation of pain would frequently overlook painful patients. Since the correct diagnosis of pain in dogs and cats is often difficult, a working assumption that all surgical procedures inflict pain in animals will provide better quality of care than the assumption that the staff will be able to readily recognize those animals in need of analgesics. Proactively using analgesics to minimize postoperative pain is consistent with the fundamental principles of providing good medical care to each of our patients.

References

13. Dyson DH, Doherty T, Anderson GI, et al. Reversal of oxy-