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Breed-Specific Anesthesia

Genetic differences and anatomic factors can contribute to variability and complications during anesthetic events.

Certain breed differences can lead to greater risks for airway obstruction, increased responsiveness to anesthetic drugs, and delayed recovery, all of which can result in increased anesthesia-related morbidity and mortality. Individual genetic variability can trigger unexpected and adverse responses to anesthetic drugs, which need to be identified by good recordkeeping and consistent patient monitoring. Although genetic differences are typically held responsible for prolonged recoveries and increased drug responsiveness, true genetic sensitivity has been demonstrated in only a handful of breeds, including the greyhound and the collie.

Because many canine breeds can suffer from cardiac disease, both acquired and congenital, it is important to know which patients are likely to be affected *before* the anesthetic protocol is planned. If cardiac disease is suspected, a full cardiac workup with a veterinary cardiologist is recommended.

CONTINUES

For breed-specific anesthesia at a glance, see the **Checklist** on page 20.

Safe and successful sedation and anesthesia can be performed in any breed of dog or cat with proper preoperative workup and appropriate patient monitoring.

BRACHYCEPHALIC BREEDS

Brachycephalic breeds have anatomic considerations that may affect anesthetic outcome. Most brachycephalic breeds suffer from brachycephalic airway syndrome (BAS), which is characterized by stenotic nares, elongated soft palate, everted laryngeal saccules, and hypoplastic trachea.

Affected dogs have narrower upper airways than do dogs with normal anatomic features.[1-3] Because in brachycephalic breeds additional airway contraction can occur with stress (ie, increased respiratory effort, turbulent flow), clinicians need to be prepared for possible upper airway obstruction. Furthermore, brachycephalic dogs must be monitored closely after premedication, throughout anesthesia and the postoperative period, and after extubation. An oxygen source and endotracheal tube should be readily available.

Many brachycephalic dogs respond well to acepromazine in conjunction with an opioid; however, the sedative dose should be half of that used for nonbrachycephalic dogs. Full mu-opioid agonists can be used but because they may cause excessive respiratory depression, a reversal agent should be available. Dexmedetomidine should be avoided because of the presence of high vagal tone in these breeds. Anticholinergics, such as glycopyrrolate, may be used to decrease airway secretions and counteract high vagal tone.

Preoxygenation is recommended before dogs with BAS are induced.[2-4] Propofol or a similar short-acting drug should be used for induction and intubation should be completed as rapidly as possible. Mask inductions should be avoided,[3,4] and smaller endotracheal tubes should be used.

Because brachycephalic breeds tend toward obesity, controlled or mechanical ventilation is often necessary. Most problems associated with mechanical ventilation occur during induction and recovery, so monitoring is particularly important.

Extubation should be postponed until the patient is bright, alert, swallowing—even chewing on the endotracheal tube.[4] If extubation is attempted while the patient is sedated and groggy from anesthesia, there is increased risk for upper airway obstruction. If upper airway obstruction occurs, the patient should be reintubated.

Brachycephalic cats should be handled with care from premedication to recovery and treated in a manner similar to dogs.

BAS = brachycephalic airway syndrome

SIGHTHOUNDS

Most breeds do not have true sensitivities to anesthetics, although sighthounds (particularly the greyhound) do have genetic factors that cause them to metabolize drugs differently. Therefore, before designing an anesthetic protocol, examination findings and blood work results need to be evaluated. Sighthounds have a higher packed cell volume and lower serum albumin concentration than do mixed breeds.[2,3] Sighthounds also should be evaluated for cardiac abnormalities (eg, dilated cardiomyopathy).

Because sighthounds are high-energy animals, they may experience high levels of hospitalization stress. Acepromazine is recommended for preventing stress in healthy sighthounds, but some individuals may be more sensitive to its sedative effects, so a lower dose (0.02–0.03 mg/kg) is advised.[4,5] In addition, sighthounds metabolize drugs more slowly as compared with the average dog. Thiobarbiturates should be avoided and other induction agents (eg, propofol, ketamine, etomidate) used instead.[1-3] Of note, propofol is metabolized more slowly in these dogs because of reduced hepatic enzymatic activity, which may result in slower recovery.[4,6,7]

Sighthounds have a low percentage of body fat (17%) compared with the average dog (35%),[6] which leaves them at risk for hypothermia during anesthetic procedures.[2,3,6] Therefore, it is important to use hot water blankets and forced-air warmers during the perioperative period.

Boxers of UK Lineage

On rare occasions, individual variability can result in a subpopulation within a breed that responds differently to anesthetics. An example can be seen in boxers from the UK. In this subpopulation, acepromazine often causes severe bradycardia, hypotension, and collapse, so a reduced dose of acepromazine (0.01–0.025 mg/kg) is recommended.[2,4]

Because there are no published reports describing similar effects in US-bred boxers, standard doses of acepromazine are typically routine in the US subpopulation.

HERDING BREEDS

The effect of certain anesthetic drugs on herding dogs (eg, collie, border collie, Australian shepherd, Shetland sheepdog) is somewhat controversial. However, these breeds have a high prevalence (eg, up to 75% in collies in the United States) for genetic mutation in the *ABCB1* (formerly *MDR1*) gene.[8,9] *ABCB1* encodes P-glycoprotein, an adenosine triphosphate–driven pump that is an integral component of the blood–brain barrier and provides protection from toxic drug accumulation in body fluids, such as cerebrospinal fluid (CSF).[10] In the collie and other herding breeds, this genetic mutation results in a defective pump that allows a select group of drugs to accumulate within the brain. Acepromazine and opioids, particularly butorphanol,[9] are members of this drug group, and their accumulation in CSF may cause marked sedation and respiratory depression. When using these agents in susceptible breeds, the dose should be decreased by 25% and patients closely monitored for side effects.[5,9]

CSF = cerebrospinal fluid, COX = cyclooxygenase

TOY BREEDS

Because of their size, toy breeds can present unique challenges. Obtaining an accurate weight and using the appropriate dose of anesthetic drug are essential. Monitoring during surgery likewise is important. In small patients, Doppler blood pressure measurement has been more accurate than oscillometric monitoring; in addition, it provides an auditory sound to monitor heart rate and rhythm.

Toy breeds have a greater body surface area–to–body mass ratio and higher metabolic rate, which can lead to lower body temperatures and hypoglycemia.[1] It is important to support normal body temperature during anesthesia, monitor blood glucose levels, and apply adequate supplementation as indicated.[3]

GIANT BREEDS

Giant breeds often respond profoundly to normal therapeutic doses of sedatives, such as acepromazine. In this patient population, it is important to either reduce the dose of acepromazine (0.01–0.025 mg/kg) or calculate the dose based on lean body mass or surface area and not the actual body weight.[2,3]

DOBERMAN PINSCHER

Genetic variation is also noted in Doberman pinschers. In addition to a predilection for developing dilated cardiomyopathy, these dogs can have von Willebrand disease, which impairs normal clotting. It is important to evaluate the coagulation status of these patients before surgery.

If von Willebrand disease is suspected, desmopressin (also known as DDAVP) given before surgery promotes von Willebrand factor secretion from endothelial storage sites.[3]

In this patient population, the use of NSAIDs is somewhat controversial and other analgesic options should be explored. If NSAIDs must be administered, preference should be given to cyclooxygenase (COX)-2–selective drugs.

CLOSING REMARKS

Although it is important to be aware of breed-related anesthetic differences, the primary consideration is the individual patient and tailoring the anesthetic protocol accordingly. With proper perioperative workup and appropriate patient monitoring, safe and successful sedation and anesthesia can be performed in any breed of dog or cat. Patient monitoring should begin with premedication and end only after the patient has been extubated and is normothermic, stable, and alert.

CONTINUES

See **Aids & Resources**, back page, for references & suggested reading.

CHECKLIST Anesthesia-Related Problems by Breed

Classification	Problem	Checklist of Actions
BRACHYCEPHALIC BREEDS (eg, bulldog, pug, Boston terrier, boxer, Cavalier King Charles spaniel, Pekingese)	Brachycephalic airway syndrome; increased respiratory effort; potential for upper airway obstruction	❑ Avoid excessive sedation ❑ Avoid α_2-agonists ❑ Administer acepromazine at half dose ❑ Preoxygenate ❑ Use short-acting induction agent ❑ Use appropriately sized endotracheal tubes ❑ Extubate after patient is sitting up, vigorously chewing, bright, alert
SIGHTHOUNDS (eg, greyhound, whippet, Italian greyhound, Afghan hound, Borzoi, Irish wolfhound, Saluki)	Delayed metabolism, increased responsiveness to acepromazine; possible delayed recovery from propofol; lower body fat percentage; hypothermia; high-stress hyperthermia	❑ Use low-dose acepromazine (0.02–0.03 mg/kg) ❑ Administer propofol slowly, only to effect ❑ Avoid thiopental & barbiturates ❑ Avoid patient contact with cold tables ❑ Use forced-air warmers, hot water blankets as needed ❑ Treat stress/pain-induced hyperthermia with anxiolytics, whole-body cooling, analgesics
HERDING BREEDS (eg, collie, Shetland sheepdog, Australian shepherd, border collie)	*ABCB1* mutation causes defect in P-glycoprotein pump, resulting in accumulation of certain drugs in CSF, followed by excessive sedation/respiratory depression	❑ Reduce butorphanol dose by 25% ❑ Reduce acepromazine dose by 25% ❑ Monitor carefully after sedation Note: Morphine not proven P-glycoprotein substrate, but dose may need to be reduced
TOY BREEDS (eg, shih tzu, Pomeranian, Chihuahua, Pekingese, Brussels griffon, toy fox terrier, Affenpinscher)	Hypothermia from large body surface area relative to body size; difficulty monitoring; hypoglycemia	❑ Use forced-air warmers, hot water blankets, warm IV fluids, warm fluid bags around breathing tubes as needed ❑ Avoid patient contact with cold tables ❑ Perform intraoperative Doppler imaging, along with routine monitoring (ECG, pulse oximetry, temperature) ❑ Monitor blood glucose concentration; supplement as needed
GIANT BREEDS (eg, Newfoundland, Great Pyrenees, Saint Bernard)	Profound response to sedatives	❑ Administer acepromazine or α_2-agonists at half dose ❑ Dose IM drugs based on lean body mass
DOBERMAN PINSCHER	Predilection for dilated cardiomyopathy, von Willebrand disease	❑ Evaluate coagulation status ❑ If von Willebrand disease suspected, administer desmopressin Note: NSAID use controversial (if necessary, give COX-2–selective drug)
BOXER of UK lineage only	Acepromazine-induced vagal response; marked hypotension, bradycardia; boxer cardiomyopathy	❑ Reduce acepromazine dose (0.01–0.025 mg/kg); avoid α_2-agonists ❑ Use anticholinergic drug with acepromazine unless heart disease present ❑ Give IV fluids, supportive care

CSF = cerebrospinal fluid, COX = cyclooxygenase