Breed Considerations in Anesthesia

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This lecture will cover common concerns with anesthetic management of certain dog breeds that may present to your clinic for procedures requiring general anesthesia. Management of brachycephalic breeds will be covered in detail. Other breeds that will be covered will include the northern breeds (e.g., Huskies, Malamutes), herding breeds, King Charles Cavaliers, Sighthounds, German Shepherds, and perhaps others as questions arise!

Learning objectives will include:

- How should brachycephalic dogs be managed in the peri-anesthetic period to optimize outcome?
- How should I be prepared if recovery of the brachycephalic dog does not go well?
- How can I optimize anesthetic management of these northern breeds?
- What is the MDR mutant gene in herding dogs and why should I care if I need to anesthetize them?
- Should I be at all concerned if a King Charles Cavalier requires general anesthesia?
- Are sighthound breeds any different than others?
- Anything to consider with German Shepherds?

There are few "true" breed sensitivities to general anesthesia. Breed idiosyncrasies to various anesthetic, sedative, and analgesic drugs should be considered when formulating an anesthetic plan, but these do not necessarily represent a breed sensitivity or reaction to specific drug or drugs.

Although many dog breed publications will report anesthetic sensitivity to certain drugs (e.g., ketamine, acepromazine) or to anesthesia in general, there are very few scientifically documented breed sensitivities to anesthesia. When owners or dog breeders present their animal and express concern about perceived anesthetic risk based on the animal's breed, it is important for the veterinarian to educate them to the general risks of anesthesia in all breeds/species and to reassure the client that the breed of the animal will be considered but that it is unlikely that there is a heightened risk based on the breed. Of course, there are some exceptions, and these will be covered here.

Brachycephalic Breeds:

Brachycephalic breeds (American bulldogs, French bulldogs, Boston terriers, Pekinese, etc.) have the classic 4 anatomic features that make anesthetic management challenging. These include

stenotic nares, elongated soft palate, everted laryngeal saccules, hypoplastic trachea. Because of these abnormalities, these dogs have an increased work of breathing due to increased upper airway resistance. They work hard all their lives to breathe! Heat makes it worse, as does stress. Sedation of these breeds is also risky because they will relax and hypoventilate, making them prone to hypoxia when breathing room air. These dogs are also prone to regurgitation and aspiration in the peri-anesthetic period, increasing their risk of hypoxia.

- Pre-operative management should include a limited fasting window, generally a light meal (wet food) approximately 4 hours prior to induction of anesthesia. This has been shown to reduce gastric acidity and to increase cardiac sphincter tone. Omeprazole should also be given 4 hours prior to induction of anesthesia (1 mg/kg PO) to assist in gastric acidity reduction. The inclusion of maropitant given SQ one hour prior to anesthetic induction (1 mg/kg) has been shown to reduce nausea and vomiting; alternatively, maropitant can be given after IV catheter placement to optimize PONV. That said, maropitant may contribute to low blood pressure under anesthesia so another option would be to administer it on recovery.
- Sedative choices should be considered carefully. While agitation and excessive restraint can increase the work of breathing of these patients, excessive sedation also renders them at risk for hypoxia. Older and more placid dogs may sedate well with midazolam combined with an opioid. Younger dogs will likely require an alpha-2 agonist such as dexmedetomidine combined with an opioid. Acepromazine should be used with caution at routine doses because of its long duration, lack of reversibility, and vasodilating effects, rendering upper airway resistance even higher. *Regardless of sedative choices, these patients need to be monitored closely whenever they are sedated.*
- Intubation can be challenging due to the long, floppy soft palate, large epiglottis, everted laryngeal saccules and smaller-than-expected trachea. Preoxygenation prior to intubation is warranted, since an increased F_iO_2 will improve P_aO_2, buying an extra window of time during intubation before the animal becomes hypoxemic. This should be done with a mask, not just holding the machine Y-piece near the animal's nares. If the dog struggles, don't force it as the oxygen consumption of struggling will negate any benefit of pre-oxygenation. Flow rates should be 5 L/min. Have lots of different size ETTs available, including some much smaller than you would predict based on the dog's weight. Use a laryngoscope and have a tongue depressor handy to push the soft palate dorsally. Check for circuit leaks immediately due to the risk for regurgitation!
- Anesthetic maintenance, once you have a secure airway, should be routine. These species, however, do have increased vagal tone so may require a dose of glycopyrrolate or atropine during anesthesia to treat a low heart rate (depending on blood pressure! If high due to an alpha-2 agonist sedative, DO NOT give an anti-cholinergic).
- Extubation should only be performed when the animal is able to actively and forcibly "spit out" the tube. Even after extubation, the dog should be monitored, especially if sedatives or opioid analgesics are on board.
- Management of recovery can be complicated. While these dogs need analgesia after a painful procedure, excessive sedation should be avoided. Ideally, NSAIDs plus local anesthesia should be used. Alternatively, agonist-antagonist opioids such as butorphanol

or partial agonists such as buprenorphine may be indicated depending on the procedure and how painful the dog appears. On the other hand, dogs that are agitated/stressed/struggling during recovery will worsen their airway resistance and may require oxygen supplementation and sedation. Options for sedation include very low intravenous doses of alpha-2 agonists. Oxygen supplementation can be via mask with an assistant, an oxygen cage, nasal prongs connected to an oxygen source, or naso-tracheal red-rubber feeding tubes connected to an oxygen source. One publication reports that nebulized epinephrine reduced post-operative upper airway obstruction in severely brachycephalic dogs.

Sighthound Breeds:

The one known and documented drug sensitivity based on breed is that of greyhounds having delayed recoveries after thiobarbiturates (thiopental). Of course, this drug is no longer available in the US. In the case of thiopental, delayed recovery was because greyhounds (and presumably other sighthound breeds) metabolize the drug via a different hepatic pathway and drug metabolism occurs much more slowly. That said, certain breed characteristics such as lean body type and temperament should be considered. For example, most injectable anesthetics (e.g., propofol, alfaxalone) redistribute out of the blood stream and brain into muscle and then into fat, allowing the circulating concentration of drug to diminish and the dog to recover. Since sighthounds have less total body fat, circulating concentrations of drug may linger. In addition, these breeds are generally high-strung and may require sedation for recovery.

Herding Breeds:

This would include Australian Shepherds and Mini Australian Shepherds (highest prevalence), Collies, Border Collies, and the Long-Haired Whippet). Dogs with the MDR1 gene, or at risk for that gene, should be considered carefully when choosing sedation. P-glycoprotein substrates include many anticancer drugs (anthracyclines, vinca alkaloids, epipodophyllotoxins), macrocyclic lactones (ivermectin, selamectin, milbemycin, and so forth), loperamide, acepromazine, butorphanol, ondansetron, and dozens of other drugs. Several studies have addressed P-gp's role in drug absorption, distribution, and excretion, and how these pharmacokinetic parameters affect safety and efficacy of P-gp substrate drugs in dogs. Butorphanol, or opioids in general, should be used at lower doses and owners and practitioners should expect a longer recovery.

Giant Breeds:

As a rule, giant breeds of dogs have a smaller body surface area to volume ratio, and, as such, require much lower doses of sedative/analgesic drugs on a mg/kg basis. It is always important to get an accurate weight and to estimate lean body weight from that. These breeds are usually tractable and do not require heavy sedation.

King Charles Cavaliers:

These cute little guys usually have a mitral murmur! If you auscultate a murmur, a full history is important to ensure there is no exercise intolerance. If the owner recognizes exercise intolerance

the case should be referred for further cardiac workup. If not, exercise caution with anesthesia, primarily with fluid rate of administration. Limit to 2-3 mL/kg/hour during anesthesia and keep your inhalant low with adjunctive analgesics and mu opioid premedications.

Northern Breeds:

These dogs (Huskies, Malamutes, Samoyed, Inuit) do not sedate well with opioids and benzodiazepines. They generally require an alpha-2 agonist for sedation. Opioids should be used for analgesia in consideration of the procedure planned. Regional analgesic techniques, when they are an option (e.g., intra-testicular block, line block for OHE, dental blocks), are a great alternative for pain management in these dogs. Upon recovery, these dogs tend to get very dysphoric and vocal with opioids, so concurrent sedation with alpha-2 agonists may be necessary. A low dose of propofol (e.g., 0.5-1 mg/kg) may be necessary to calm them while they "blow off" the inhalant.

German Shepherds:

Some of these dogs can be working police dogs that require oral sedation prior to entry to the veterinary clinic. Options include gabapentin at 10-20 mg/kg and trazadone at 5-10 mg/kg PO given 1-2 hours before arrival to the veterinary clinic. Besides that, these dogs are no different, other than they tend to have huge tracheas, so expect to use a larger ETT than you would predict based on body weight. They are also quite 2-dimensional with a deep and narrow thorax. When placed in dorsal recumbency as for an OHE they tend to not breathe well without assistance. They can also be a high-energy breed and may need sedation for recovery (see section above on Northern Breeds).