Advancements in Evidence-Based Anesthesia of Exotic Animals

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KEYWORDS

• Alfaxalone • Anesthesia • Avian • Reptile • Small mammal

KEY POINTS

- The body of literature regarding anesthesia in companion exotic animal species continues to grow, emphasizing the importance of safe anesthesia and reliable anesthetic monitoring.
- Recent evidence-based advances in anesthetic pharmacology for exotic animal species have allowed for improved multimodal anesthetic management.
- Because very large interspecies variability can exist with regard to the pharmacokinetic and pharmacodynamic responses to anesthetic drugs, extrapolation of drugs and dosages from similar, yet taxonomically distinct species should be practiced with extreme caution.
- Anatomic nuances that make intubation, intravenous access, and monitoring challenging in a certain species are critical factors to understand before attempting to anesthetize a new species.
- Adaptation of anesthetic monitoring devices designed for humans and domestic animals to exotic animals is challenging, and further monitor validation is needed to make informed clinical decisions.

INTRODUCTION

As small exotic animals grow in popularity as companion pets, there is an increased urgency to improve the standard of veterinary care, including with the provision of safe, evidence-based protocols for anesthesia and sedation. Nonetheless, to date much of the current practice of exotic animal anesthesia relies on anecdotal drug dosing recommendations and extrapolation from unrelated species. Anesthesia and sedation of pet nondomestic species is often necessary for both invasive and noninvasive procedures. Even minimally invasive procedures, such as blood collection and

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radiographs, can be stressful for small prey species that are not domesticated or acclimated to human contact and restraint.

Extrapolation from domestic dogs and cats to exotics is complicated by differences in physiology, anatomy, and drug metabolism. Those differences affect the pharmacokinetic behavior of anesthetic drugs and can hinder the use of anesthetic monitors designed for domestic mammals or humans. Anatomic and physiologic nuances that make intubation, intravenous (IV) access and monitoring challenging in a certain species are critical factors to understand before attempting to anesthetize a new species.

It is the authors' hope that, with recent advancements in evidence-based practice, the standard of care for exotic pets will continue to improve based on scientifically sound best practices and rely less on anecdotal recommendations. Multiple books and chapters have been published about anesthesia in exotic pets, and this article focus on new scientific literature that has been published in the last 5 years. In many cases, the best evidence may come from studies of related wild or laboratory species; the authors discuss those studies if they clearly affect anesthetic practice in pet exotics. For ease of reading, the authors divide the article to highlight advances in anesthetic pharmacology and discoveries in anesthetic physiology and monitoring. To assist clinicians, **Table 1** summarizes anesthetic protocols for companion exotic animal species, according to currently available published evidence.

ADVANCES IN ANESTHETIC PHARMACOLOGY

Avian

Inhalant anesthetics remain a mainstay of avian anesthesia. The highly efficient respiratory system of birds allows for rapid induction and recovery from inhalants.[1] Volatile (inhalant) anesthetics are considered direct cardiovascular depressants and can cause hypotension due to dose-dependent decreases in myocardial contractility, stroke volume, and systemic vascular resistance.[2,3] Recent studies have examined the potency of certain volatile anesthetics in multiple avian species as well as the cardiopulmonary effects. Potency of inhalant anesthetics is often measured using the minimum alveolar (or anesthetic) concentration (MAC) required to prevent purposeful movement in response to a supramaximal noxious (painful) stimulus in 50% of subjects. Although MAC for individual inhalants is fairly consistent across species, documented variability in isoflurane MAC between avian taxa highlights the difficulty in extrapolating anesthetic drug dosing across multiple species. The mean $\pm$ SD isoflurane MAC in pigeons (*Columba livia*) is $1.8 \pm 0.4\%$,[4] whereas in thick-billed parrots it is reportedly much lower at 1.07% (95% confidence interval [CI] 0.97%–1.16%).[5] If an anesthetist treated the two species in these studies similarly, overdosing of parrots or underdosing of pigeons is possible. Directly comparing MAC studies may be misleading, depending on the type of stimulus used. Mean sevoflurane MAC in thick-billed parrots determined with toe-clamp stimulus was 2.35% (95% CI 2.13%–2.65%), similar to other avian species, whereas the same study found that the mean MAC with electrical stimulation was 4.24% (95% CI 3.61%–8.71%).[6] The MAC for volatile anesthetics can be lowered with the concurrent administration of additional analgesics or sedatives. In chickens, methadone (6 mg/kg intramuscular [IM]) was found to reduce the mean MAC of isoflurane by 30% (range 11%–46%). Butorphanol (4 mg/kg IM) was also evaluated for MAC reduction in guinea fowl but resulted in unacceptable cardiac arrhythmias.[7,8]

When comparing equipotent doses of isoflurane, sevoflurane, and desflurane in red-tailed hawks (*Buteo jamaicensis*), no significant differences were found in