Proceedings of the International Congress of the Italian Association of Companion Animal Veterinarians

June 8-10, 2012 - Rimini, Italy

Next SCIVAC Congress:

Mar. 8-10, 2013 – Pisa, Italy
SCIVAC International Congress
Canine Leishmaniasis and other Vector-Borne diseases.
Current State of Knowledge

Reprinted in the IVIS website with the permission of the Congress Organizers
http://www.ivis.org
INTRODUCTION

Anesthesia in reptiles is well described in terms of anecdotal use in clinical practice; however there are few scientific studies for use in this extremely diverse group of patients. Complicating a uniform approach to anesthesia is markedly variable resting metabolic rate among species, and the effects of environmental temperature on metabolism, among other factors. A 2005 survey of reptile veterinarians showed that the most commonly utilized agents for anesthesia, sedation and/or analgesia were isoflurane, ketamine, propofol and butorphanol. These veterinarians agree that anesthesia is challenging, and respiratory depression, difficulty in measuring anesthetic depth, prolonged recovery and hypothermia were listed as the most common complications.

A thorough discussion of reptilian physiology as it pertains to administration of anesthesia is beyond the scope of this paper. A number of points are helpful when considering anesthesia in reptiles:

1. Reptilian resting metabolic rate is lower than that of similarly sized mammals, and is markedly variable among reptilian species.
2. Reptile metabolism is highly dependent on environmental temperature. Therefore, environmental conditions influence anesthetic time of onset and recovery, and duration of effect.
3. Reptiles are considered “episodic breathers”, and breath holding complicates administration of inhalant induction agents.
4. Ventilation (respiratory rate and tidal volume) is reduced in an oxygen-rich environment.

PRE-ANESTHETIC FASTING

Timing of pre-anesthetic fasting is difficult in reptiles, as so many factors influence gastrointestinal transit time. In general, avoid feeding the reptile 1-2 days prior to surgery.

ROUTES OF ADMINISTRATION

Anesthetic and analgesic agents can be administered by routes commonly utilized in other species, including IM, IV or IO, and via the respiratory tract. Use of drugs designed for intravenous administration depends on the ability of the practitioner to competently perform venipuncture or secure vascular access. Even experienced reptile practitioners report IV access as challenging, and in many cases, stressful for the patient. Access sites for IV anesthetic administration depend on the anatomy of the species in question, and include the ventral coccygeal vein of snakes and lizards, jugular and coccygeal vein in tortoises, and abdominal vein of lizards. Intramuscular administration is common, and most practitioners avoid the use of the hindlimb musculature to avoid the first pass effect produced by the renal portal system. Although recent studies on portal circulation in selected reptile species downplay this feature, it is probably best to avoid administration of nephrotoxic drugs or those highly metabolized by the kidneys into the rear limb or epaxial musculature. Studies in humans and other mammals have shown that intravenous administration of drugs is nearly identical to intravenous administration. A study examining renal function in the green iguana showed similar uptake when radioactive substances were administered IV or IO.

Mask or chamber induction with inhalant agents is commonly described, but often requires extended induction periods due to breath holding.

PRE-MEDICATION

In traditional pet species, premedication is recommended to provide analgesia, ameliorate the stress of anesthetic induction, and to reduce the dosage and thus potential untoward effects of any single agent. These benefits can be
expected in reptiles as well, and premedication may allow quicker induction, and permit procedures such as catheterization and endotracheal intubation. Large, powerful or venomous species may require preanesthetic drug administration to facilitate safe handling and anesthetic induction. Unfortunately, clinical trials on the use of these drugs in various reptile species are lacking and reports suggests results are highly variable.

The most commonly reported preanesthetic agent used in reptiles is butorphanol. In other species, administration of butorphanol often results in reduction of isoflurane mean alveolar concentration (MAC). However, a single study in the green iguana showed that butorphanol had no such effect.4

Others report use of midazolam in combination with an opioid agent like butorphanol or buprenorphine. The author and others often find this combination will reduce patient struggling during manipulation and induction somewhat, but results are highly variable.

Acepromazine is not considered a useful drug for preanesthesia of reptiles.2 Other injectable agents can be used for preanesthesia in preparation for induction of anesthesia, and include ketamine, xylazine, medetomidine and combinations such as tiletamine and zolazepam.2 Higher doses of these drugs often result in prolonged recovery times.

There is no conclusive data on the efficacy of analgesics in reptilian species. However, most agree the use of analgesia is a humane choice, especially when considering potentially painful procedures.2

**INDUCTION OF ANESTHESIA**

The most commonly reported induction agent in use in reptiles is propofol, as results tend to be reliable and predictable.1,2 However, use depends on the ability of the practitioner to achieve IV access, which can be difficult and stressful. Other injectable induction agents typically used include ketamine, tiletamine/zolazepam, and combinations using dexmedetomidine, again with variable results described from good to poor. Success and safety are often enhanced when these drugs are used in combination with preanesthetic agents, as described above.2

Simple mask or chamber induction with inhalant agents can be prolonged, as long as 13 minutes in Dumeril’s monitors.3 Alternatively, reptiles can be restrained and intubated while conscious, and then manually ventilated to achieve anesthesia. This technique is expected to produce stress, and should be utilized only when necessary.2

**ALFAXALONE IN REPTILES**

Recently, much attention has been focused on the use of alfaxalone (Alfaxan, Jurox, NSW, Australia), which is currently the author’s drug of choice for induction of reptile patients. Alfaxalone is an injectable anesthetic agent used for induction and maintenance of anesthesia in dogs and cats. The drug is available in Australia, and the UK, but not currently manufactured and distributed in the United States.

In dogs and cats, the drug can be used as a repeated bolus, or as a constant rate infusion (CRI) as part of total intravenous anesthesia (TIVA). As a CRI, the drug does not accumulate and recovery does not appear prolonged. This is supported by the observation that repeated bolus doses in reptiles do not appear to prolong recovery.

Alfaxan is frequently used in dogs and cats with premedications, including benzodiazepines and opioids. It is described for slow intravenous use, with a recommended rate of administration of about 60 seconds. Alfaxan is labeled for intravenous use only. However the drug causes no irritation or untoward effects if administered extravascularly. The manufacturer does not recommend combining Alfaxan with other drugs into the same syringe.

Alfaxan appears to have a wide margin of safety. In a study in dogs, patients were administered a 10 times overdose and survived, but required respiratory support. Cats survived a similarly at a 5 times overdose.

**Use of alfaxalone in reptiles in clinical practice**

The author and others have experience with the use of Alfaxan in reptiles in clinical practice. The motivation for use of Alfaxan are two fold: frustration with the array of drugs currently recommend for IM use in reptiles available in the United States, and technical difficulties associated with reliable intravenous administration.

Some reptile practitioners claim near 100% success rate with intravenous administration of anesthetics such as propofol in reptile patients. Skepticism aside, for those in practice with lesser talent, an effective, consistent intramuscular anesthetic agent with a reasonable recovery time is attractive.

The best uses for Alfaxan in reptiles appear to be the following: a) induction (with or without pre-anesthetics) followed by immediate intubation and maintenance with isoflurane; and b) sedation (with or without other agents) combined with local analgesia for brief, minor procedures. Even when combined with pre-medications, Alfaxan alone does not appear to achieve an acceptable surgical plane of anesthesia at currently explored dosages. Duration of action is variable but in general brief, often no more than 15 minutes. Full recovery is usually within one hour, but can be longer when combined with other agents, including inhalant agents, and especially in debilitated patients.

Dosages ranges based on the author’s experience are 5-25 mg/kg. Ill or debilitated patients require significantly less drug than fractious, more stable patients. Dosages required appear to be higher in chelonians and green iguanas, and lower in snakes and leopard geckos. The author always begins with the lower end of the dosage range (5-10 mg/kg), adding boluses as needed to effect.

The author has experienced only one fatality directly related to administration of Alfaxan, in a moderately debilitated green tree frog with a rectal prolapse. The author also was unable to inject enough Alfaxan (before running out) to achieve anything close to sedation in a 25-pound sulcatta tortoise.
MAINTENANCE OF ANESTHESIA

Inhalant agents (isoflurane, sevoflurane) are overwhelmingly preferred for maintenance of anesthesia, and intubation is practical in all but the smallest reptile species. The glottis is easily visualized, and the availability of medium to very small sized endotracheal tubes facilitates intubation.

ANALGESIA

As discussed above, very little is understood about effective analgesia in reptiles. The author combines an analgesic in pre-medication (usually butorphanol) with a lidocaine/bupivacaine incisional block at 1 mg/kg each combined and diluted with saline to desired volume. Toxic doses are unknown, but the author has found no complications with the use of these dosages.

MONITORING OF ANESTHESIA AND PATIENT SUPPORT

Most reptile patients do not spontaneously breath while under general anesthesia; therefore patients must be periodically mechanically ventilated (1-2 breaths per minute), or ventilated with a mechanical ventilator.

Retention of body heat is critical, and temperature should be monitored with a flexible constant read out temperature probe inserted into the oral cavity and into the esophagus. Body heat is maintained with active warming of the patient, and of administered fluids.

Vascular access can be difficult, but choices include IV catheter placement (often achieved with a cut down of the jugular vein), or IO placement in reptiles with limbs. Surgical fluid rate has not been established for reptiles, but is assumed to be lower than that of birds and mammals. The author used 1-2 ml/kg/hour.

The best cardiac monitor for reptiles is the ultrasonic Doppler, which is placed as close to the heart of the patient as possible, and taped into place.

Measurement of blood pressure is difficult in reptiles, and seldom used.

THE SURGICAL/ANESTHETIC EMERGENCY

Procedures for how to address anesthetic emergencies should be discussed and planned out well in advance of the actual emergency.

All emergency drugs should be on hand with dosages pre-calculated and pre-drawn, or with immediate access to a weight/dosage chart (Table 1).

Very little is reported on the use of emergency drugs in reptile patients. Anecdotally, most practitioners extrapolate from known mammal/avian drugs with variable success.

POST SURGICAL MONITORING AND CARE

Recoveries in reptile patients are usually long, and time from end of anesthesia to purposeful movement may be many hours.

Ventilation should continue with the use of an ambu bag, (not with pure oxygen, as respirations are inhibited in an oxygen rich environment) until the patient begins spontaneous movement.

Recovery will be prolonged if the patient is below optimum body temperature.

TABLE 1 - Injectable agents preferred by the author for anesthesia and analgesia of most common reptiles

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage (mg/kg)</th>
<th>Primary Usage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butorphanol</td>
<td>0.4-2.0 SQ, IM IV</td>
<td>Pre-anesthesia and analgesia</td>
<td>Efficacy uncertain in many species</td>
</tr>
<tr>
<td>Buprenorphine</td>
<td>0.02-0.2 mg/kg SQ</td>
<td>analgesia</td>
<td>Efficacy uncertain in many species</td>
</tr>
<tr>
<td>Morphine</td>
<td>0.05-4.0 mg/kg IM, IC, SQ</td>
<td>analgesia</td>
<td>Efficacy uncertain in many species</td>
</tr>
<tr>
<td>Midazolam</td>
<td>1-2 IM, IV in all species</td>
<td>Pre-anesthesia</td>
<td>Used in combination with butorphanol</td>
</tr>
<tr>
<td>Alfaxalone</td>
<td>5-25 mg/kg IM</td>
<td>Induction or sedation</td>
<td>Author’s drug of choice, combined with butorphanol</td>
</tr>
<tr>
<td>Ketamine</td>
<td>5-20 IM lizards 10-60 IM snakes 5-50 IM chelonians</td>
<td>Pre-anesthesia and anesthesia</td>
<td>Results extremely variable, use in combination with other pre-anesthetics to reduce required amount</td>
</tr>
<tr>
<td>Propofol</td>
<td>3-5 IV, IO</td>
<td>Induction of anesthesia</td>
<td>Induction agent of choice; requires intravenous or intraosseous administration</td>
</tr>
<tr>
<td>Isoflurane</td>
<td>Induce at 5%; maintain at lowest effective concentration</td>
<td>Induction and maintenance of anesthesia</td>
<td>Not recommended as sole agent due to high concentrations and time needed for induction; use in combination with pre-anesthetic and induction agents</td>
</tr>
</tbody>
</table>
REFERENCES


Address for correspondence:
Angela M. Lennox Avian and Exotic Animal Clinic
9330 Waldemar Road Indianapolis IN 46268, United States
www.exoticvetclinic.com