Anesthesia Case of the Month

Sponsored by the American College of Veterinary Anesthesiologists. Comments and contributions should be directed to Dr. Jeff C. H. Ko, Department of Veterinary Clinical Sciences, College of Veterinary Medicine, Oklahoma State University, Stillwater, OK 74078; telephone: 405/744-8584; e-mail: kjeff@okstate.edu

History

A 5-year-old male green iguana (*Iguana iguana*) was evaluated at the Louisiana State University School of Veterinary Medicine for an elective orchidectomy because the iguana had developed aggressive behavior. In this species, aggressive behavior may be learned or the result of hormonal influences; therefore, the owner elected surgery in an attempt to modify this behavior. Physical examination revealed a 4.18-kg (9.2-lb) healthy adult iguana in good body condition with no apparent abnormalities. A presurgical blood sample was obtained from the ventral coccygeal vein. The Hct was 34%, and total plasma protein concentration was 6.0 g/dl, both within the reported reference range values.[1] On the basis of findings on physical examination and presurgical blood tests, the iguana was judged to be a suitable candidate for anesthesia and surgery.

Question

What is a suitable choice for anesthetic management of a green iguana for an orchidectomy?

Answer

When planning and managing the anesthesia of reptiles, the physiologic and behavioral characteristics of the species must be considered. Because green iguanas have the ability to hold their breath for several minutes, even hours, the use of gas anesthesia for induction can be a frustrating procedure.[1] Alternatively, injectable anesthetics can provide the muscle relaxation and sedation required to perform endotracheal intubation. In addition, premedication or induction with injectable anesthetics may decrease anxiety, provide analgesia, smooth recovery, and decrease anesthetic requirements. The effects of injectable anesthetics may be unpredictable in reptiles. This is most likely attributable to biologic variability, including age, sex, and even ambient temperature, all of which can affect the metabolism and effects of anesthetic agents. When establishing a dose of an injectable anesthetic for a reptile, starting with the lower end of the recommended dose and supplementing if necessary will reduce the risk of an overdose.

In this instance, we elected to induce anesthesia with a combination of tiletamine-zolazepam (5 mg/kg [2.27 mg/lb], IM) and butorphanol tartrate (0.75 mg/kg [0.34 mg/lb], IM); drugs were injected in a forelimb. These drugs are readily available to practitioners and are known to be effective anesthetics in reptiles.[1,2] Within 10 minutes of administration of these drugs, the iguana had a degree of muscle relaxation that would allow uncomplicated endotracheal intubation. Two drops of lidocaine (2%) were placed on the glottis to decrease laryngeal sensitivity during intubation (**Fig 1**). The glottis and larynx were easily identified, and a 3.0-mm (internal diameter) noncuffed endotracheal tube was placed. Following intubation, the iguana was connected to a nonrebreathing system. Anesthesia was maintained with isoflurane at a 3% vaporizer setting, with an oxygen flow rate of 145 ml/kg/min (65.9 ml/lb/min). Intermittent assisted ventilation was not provided initially, as spontaneous breathing was still present. A plane of anesthesia adequate for surgery was judged to be present when the palpebral reflex was decreased and tongue withdrawal and righting reflexes were absent.[1] However, following the initial skin incision, the iguana reacted with slight movement of a limb. Assisted ventilation was started at this point to facilitate the delivery of anesthetic. Ultimately, a surgical plane of anesthesia was reached within 25 minutes of endotracheal intubation. Continued assessment of the depth of anesthesia was performed by examining palpebral, tongue withdrawal, and toe pinch reflexes. During surgery the isoflurane concentration was maintained between 2 and 3.5%. Intermittent assisted ventilation was provided at a rate of 3 to 4 breaths/min, with a peak inspiratory pressure of 15 cm H_2O during ventilation. The iguana was placed on a circulating hot water pad to prevent hypothermia.

Monitoring reptile patients during anesthesia can be accomplished by use of a number of devices avail-

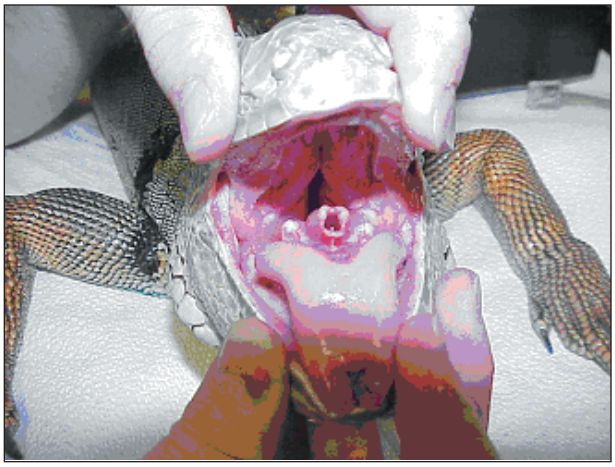

Figure 1—Photograph of the oral cavity of an iguana. Notice the glottis is readily apparent at the base of the tongue.

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able to veterinary practitioners. In this instance, a Doppler ultrasonic flow detector,[a] pulse oximeter,[b] and ECG[c] were used. The probe of the Doppler flow detector was placed in the left axillary region and secured to the body with gauze and tape to provide enough pressure for a clear audible signal (**Fig 2**). The probe position may need to be adjusted if the patient's position changes during surgery. The Doppler allows monitoring of the heart rate in a noninvasive manner. The heart rate fluctuated between 45 and 55 beats/min during the surgical procedure with an increase up to 68 beats/min in the immediate postoperative period. A reflectance anal probe was used with the pulse oximeter and placed inside the oral cavity of the iguana against the base of the tongue. **Oxygen saturation** (SpO_2) was maintained between 90 and 97% with assisted ventilation. In the immediate postoperative period, the SpO_2 decreased to 72% (**Fig 3**). This decrease was attributed to hypoventilation associated with a decrease in the frequency of assisted ventilation, and the SpO_2 returned to 94% with an increase in the rate of assisted ventilation. The change in SpO_2 associated with a decrease in minute ventilation rate demonstrated that pulse oximetry is a useful tool for monitoring reptiles. An ECG was also used. Leads were placed at the axillary region of both forelimbs and the inguinal region of a rear limb. Alligator clips were attached to hypodermic needles that had been inserted in the skin. The ECG display of the heart rate was not always consistent with the heart rate determined by the pulse oximeter. A more accurate heart rate was obtained by manually counting the rate on the ECG tracing. An ECG tracing from a reptile has the same wave components as in mammalian species, consisting of P, QRS, and T waves (**Fig 4**). However, an additional S-V wave may also be present. This wave may be present before the P wave and represents the depolarization of the posterior vena cava and sinus venosus.[1] Because of the slower heart rate and conduction pathway of the reptilian heart, the complexes are wider and have less amplitude, compared with mammalian tracings. The use of monitors is an important component of the anesthetic plan, because the information they provide is useful in determining anesthetic depth and physiologic status during surgery.

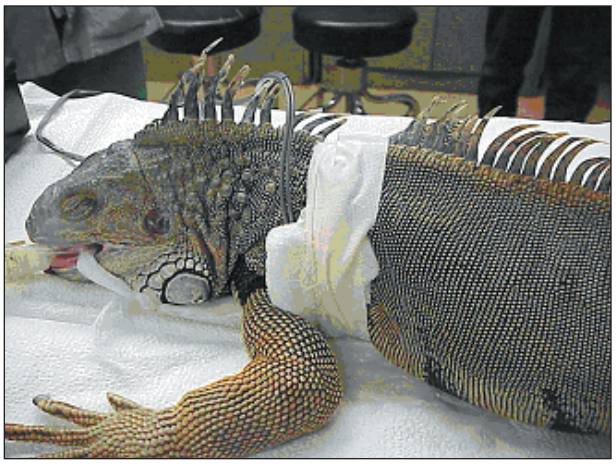

Figure 2—Photograph of a Doppler ultrasonic flow detector probe secured in the axillary region of the iguana. The probe can be placed in the left axillary region or, alternatively, over the sternum. Manipulation of the iguana during surgery may alter the positioning of the probe.

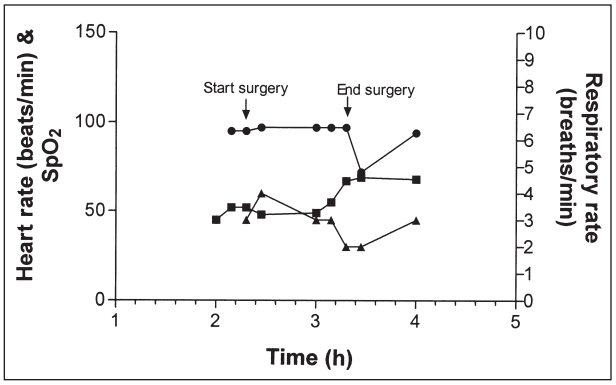

Figure 3—Graph representing the heart rate (squares), respiratory rate (triangles), and oxygen saturation (SpO_2; circles) during the peri-anesthetic period. Notice the decrease in SpO_2 after a decrease in respiratory rate.

In addition to monitoring physiologic function during anesthesia, venous access is also recommended. In this iguana, catheterization of the ventral abdominal vein was not feasible because a celiotomy was required for the orchidectomy. A second option was to place a jugular catheter; however, this requires a cut-down to reach the vessel. Instead, we elected to catheterize the ventral coccygeal vein. A 22-gauge 1-in catheter[d] was placed on the proximal one-third ventral aspect of the tail (**Fig 5**), using the same technique as for drawing blood from this vessel.[1] The catheter was flushed with a small volume of saline (0.9% NaCl) solution to prevent clotting after insertion. If catheterization is not possible, this vessel can also be accessed by use of a butterfly catheter. Intraosseous catheterization of the tibia has been described[1]; however, this is a much more invasive technique that is reserved for use in hypotensive reptiles in critical condition or those requiring long-term drug administration.

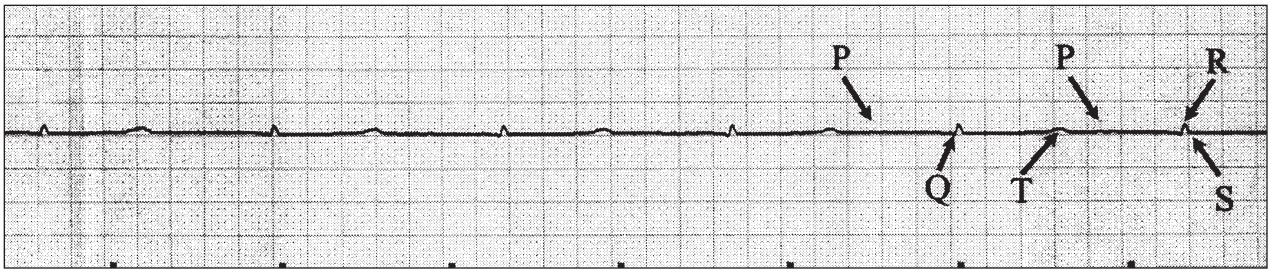

Figure 4—An ECG tracing from the iguana during surgery. Notice the wide complexes with low amplitude. The ECG tracing provided an accurate method for obtaining the heart rate. An S-V wave was not recorded on this tracing.

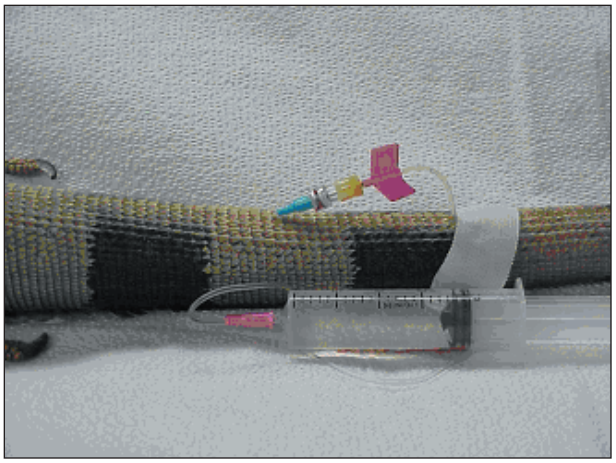

Figure 5—Photograph of a 22-gauge 1-in catheter placed in the ventral coccygeal vein. The catheter was secured in place with surgical glue and porous tape.

Anesthetic recovery may be prolonged in reptiles. Once anesthetic gas administration is discontinued, assisted ventilation is provided to assist clearance of the gas. Following surgery, the animal is placed in a warm incubator, and assisted ventilation is continued. An ambu-bag may be used to assist ventilation, or a rebreathing bag may be attached to the breathing circuit. In many reptiles, respiration is controlled by both the oxygen partial pressure in inspired gas and temperature.[1] Therefore, continued oxygen supplementation may further delay the return to spontaneous breathing. In this case, the iguana was weaned off the anesthetic gas approximately 25 minutes prior to the end of surgery. The iguana opened its eyes 35 minutes after discontinuation of the anesthetic gas, and spontaneous breathing resumed 15 minutes later. Assisted ventilation, at 3 to 4 breaths/min, was provided with an ambu-bag following the completion of surgery and until the return of spontaneous breathing. In some cases, the return to spontaneous breathing is more prolonged. In these cases, the frequency of ventilation is reduced to increase the arterial partial pressure of carbon dioxide while continuing to monitor heart rate and other vital signs. Once the patient is breathing, the endotracheal tube may be removed. It should be stated that the recovery period can be much more prolonged than what may be expected for dogs or cats because of the physiologic characteristics of reptiles. Intracelomic fluids may be provided, depending on the length of surgery, estimated blood loss, and patient status, to maintain hydration. In this iguana, the recovery was smooth, and no complications were observed. The iguana was discharged to the owner the day after surgery.

Discussion

Exotic animal medicine is an evolving field in veterinary medicine. As diagnostic capabilities and treatment regimens continue to improve, practitioners are able to provide exotic animals the same quality of care offered to more conventional companion animal species. The intent of this report was to provide private practitioners with a practical anesthetic and monitoring protocol for surgical procedures in green iguanas. The green iguana is the most popular species of reptile now being kept as pets. Iguana owners are also seeking out more veterinary care for their pets, and iguana orchidectomy is 1 of the many medical services that are provided. With this in mind, it is only logical that we provide these patients with appropriate anesthetic management and pain control for surgical procedures. Reports[1,3] of the use of injectable and inhalant anesthetics in reptiles exist, but this area is still expanding. Pain control in exotic species is another subject of controversy, as some argue that reptiles are refractory to opioids, and their use may not be beneficial.[3] This controversy arises because the opioid receptors of reptiles are not completely understood. However, pain control is an integral part of patient management. Opioids will continue to fulfill this role until the clinical usefulness of other pharmaceuticals or techniques for pain control is investigated.

We chose to use a combination of tiletamine-zolazepam and butorphanol for sedation and induction of anesthesia in this iguana. Tiletamine-zolazepam is 2 to 3 times more potent than ketamine in providing anesthesia and good muscle relaxation while decreasing anxiety.[3] One reported adverse effect in reptiles is increased sensitivity to external stimulation[3]; however, this was not observed in our iguana. Butorphanol is an agonist-antagonist opioid that is also used as a sedative and analgesic in reptiles despite controversy about its effects. The use of tiletamine-zolazepam and butorphanol appears to be an alternative combination that is widely available and easily administered as an IM injection. There are a wide variety of doses available for these agents.[1,4] We chose a lower dose of tiletamine-zolazepam (5 mg/kg [2.27 mg/lb]) because of the larger size of the iguana and its calm nature in the examination room. The dose of butorphanol (0.75 mg/kg [0.34 mg/lb]) was in the midrange of reported doses.[4] The doses of these anesthetics should be adjusted according to the patient's age, size, health status, and temperament. One must also consider that the same dose of an anesthetic may have different effects in 2 apparently similar animals. In addition to injectable anesthetics, various inhalant anesthetics have been used in reptiles. Isoflurane is a widely available anesthetic gas used by many practitioners. This has proven to be a good inhalant anesthetic for reptiles, providing both smooth induction and recovery once the patient has been intubated. Other inhalant agents such as sevoflurane and halothane have also been used in reptiles.[5]

Once anesthetized, reptiles can be monitored with a Doppler ultrasonic flow detector, pulse oximeter, ECG, or a combination of any of these. These drugs and monitors are widely available and are used in many small animal and exotic animal practices. Therefore, most practitioners do not have to invest in new drugs or equipment to provide the same level of anesthetic management for exotic pets.

[a]Ultrasonic flow detector, model 811-B, Parks Medical Electronics Inc, Aloha, Ore.
[b]Surgivet V3402, SIMS BCI Inc, Waukesha, Wis.
[c]Datascope passport XG multifunction monitor, Datascope Corp, Paramus, NJ.
[d]Angiocath, Becton-Dickinson, Infusion Therapy Systems Inc, Sandy, Utah.

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