RADIOGRAPHIC TECHNIQUES AND POSITIONING OF EXOTIC COMPANION ANIMALS

Jody Nugent-Deal, RVT, VTS (Anesthesia) and (Clinical Practice – Exotic Companion Animal)

Veterinary Medical Teaching Hospital

University of California, Davis, CA

RADIOLOGY FOR EXOTIC SPECIES

Good radiographs are an important tool used as part of your diagnostic work-up. The diagnostic value of a radiograph is dependent on the quality of the technique and positioning of the patient. Digital radiology is quickly becoming the standard in most hospitals and will yield the best results. However, if digital radiology is not yet available in your hospital then high detail, rare earth cassettes with single emulsion film provides desired results. Mammography film will produce even better detail, but does require a higher kVp (kilovolt peak) and mA (milliamp). A technique can be extrapolated from your tabletop technique used on most of your feline patients. For extremely small patients, you can utilize a dental radiology unit. If you have the luxury of a digital radiology machine, then you can use similar techniques with a few adjustments. It is a good idea to consult with a radiologist to update your technique chart if needed.

REPTILES

Snakes

Two views are normally taken, which include a dorsoventral (D/V) or ventrodorsal (V/D) and a left or right lateral. Radiographs are taken in sections from head to tail and labeled with numbered lead markers to delineate each section. In most cases the snake will need to be heavily sedated or anesthetized to take good radiographs, unless the snake is really sick. A plastic snake tube can be used to obtain radiographs, but often diagnostic films are not produced unless the snake is unable to move within the tube and remains completely straight.
Chelonians

A complete radiographic series in the turtle or tortoise includes a dorsoventral (DV), horizontal lateral, and horizontal craniocaudal view. A horizontal beam is essential to obtain good radiographs. Since chelonians do not have a diaphragm, placing them in lateral recumbency causes shifting of the organs into the lung cavity which leads to poor radiographs. Most chelonians do not need to be sedated for radiographs. In most cases the patient will just sit there or it can be placed on a plastic dish with its feet hanging in the air. Radiolucent sponges can also be used to help position the patient.

The D/V view is used primarily to look at the gastrointestinal (GI) tract, shell, and to some extent, the limbs, head, and neck. The lateral view is used to primarily look at the lungs (although there is a great deal of summation) and the GI tract. Finally the craniocaudal view is used to observe both the left and right lung fields which are now separated from each other. Evidence of lung pathology (pneumonia) can often be observed with the craniocaudal view. It is important to note that proper technique is essential. Radiographic techniques that are too “light” can cause the lungs to look as though pneumonia is present when it is not. Conversely, radiographic techniques that are too “dark” can overexpose the lung tissue and cause the lungs to look normal even if pneumonia is present.

Extremity and head/neck radiographs can be very difficult to obtain due to the thickened shell. The limbs and head/neck should be extended away from the body. The x-ray beam should be centered over the area of interest and coned down as much as possible. As with dogs and cats, lateral and caudocranial or craniocaudal views should be taken of the limbs and a lateral and D/V or V/D views should be taken of the head and neck. Unless the patient is very ill, chemical restraint is often required to obtain these radiographs.

Lizards

Two views are normally taken which include a D/V and horizontal lateral. A horizontal beam is essential to obtain good radiographs. Since reptiles do not have a diaphragm, placing them in lateral recumbency causes shifting of the organs into the lung cavity which leads to poor radiographs. Most lizards do not need to be sedated for radiographs, but chemical restraint can be used if necessary. In most cases the patient will just sit there while the radiographs are being taken. Radiolucent sponges can be used to position the patient. You can also use vagal stimulation or the “vagal response” to calm the patient if needed. The vagal response in iguanas and other medium to large lizard species can be induced by gently applying digital pressure to both eyes for a few seconds to a few minutes. The patient will usually respond with a decrease in heart rate and blood pressure. The vagal response induces a short-term trance-like state allowing time to take radiographs and in some cases even draw blood.
GI Barium Series in Reptiles

A GI barium series can be performed in reptilian species. The barium is administered via a metal or red rubber feeding tube into the proximal esophagus. The mouth is gently opened using tape strips or a plastic spatula. GI transit time in reptiles is not well documented and can take several hours to days depending on the species. The barium series should consist of plain films (taken prior to barium administration), and films taken at 15 minutes, 30 minutes, and then every few hours post administration until done. Both a lateral and ventrodorsal whole body view should be taken for each time period. If the GI series is taking several hours, it is ok to continue the series the next day. You will need to play it by ear and make a guesstimate on how you will proceed. Often times only one or two radiographs will be taken per day until the barium series is complete.

EXOTIC SMALL MAMMALS

Sedation or general anesthesia is generally needed to take good diagnostic radiographs of exotic small mammals. Due to their size, whole-body radiographs are usually taken of the patient (although it is ideal to take separate thoracic and abdominal films). A complete radiographic series includes a V/D whole body radiograph and a left or right lateral whole body radiograph. Views of the limbs are taken in the same manner as dogs and cats. The patient is gently taped down to the x-ray table or directly onto the plate and positioned as necessary. The use of a sponge trough is helpful for positioning V/D views. Skull radiographs are often important, especially if dental disease is suspected. A complete skull series includes a lateral, V/D or D/V, left and right obliques, and a skyline view, also called rostrocaudal view. It is often helpful to use high detail mammography film or digital radiography to obtain the best images. The positioning techniques used for dogs and cats are used for exotic small mammals as well. Sand bags are generally not used due to the size and weight.

GI Barium Series in Small Mammals

A GI barium series can be performed in exotic small mammals, but it can be difficult to administer the oral barium. I find it easiest to attach the barium-filled syringe to a metal feeding tube used for birds and slowly administer the barium into the mouth. The metal feeding tube is not placed down the esophagus, but it is placed in the corner of the mouth and the barium is slowly administered. The metal feeding tube seems to work better than using just a plain syringe and there is often less mess. The GI transit time in hindgut fermenting animals such as rabbits, guinea pigs, and chinchillas can take several hours (sometimes over 24 hours) while carnivorous animals such as ferrets can have a transit time of about an hour or less. The barium series should consist of plain films (taken prior to barium administration), and films taken at 15 minutes, 30 minutes, and then hourly increments post administration until done. In cases where GI transit time is lengthy it is advised to take films every 2 to 4 hours. Both a lateral and V/D abdominal view should be taken for each time period.
**It is not required nor recommended that rabbits, chinchillas, and guinea pigs be fasted prior to performing a GI barium series.**

**BIRDS**

In general birds should be briefly anesthetized with either isoflurane or sevoflurane to obtain radiographs. Some people hand hold birds for radiographs, but this exposes the staff to unnecessary radiation, it is very stressful for the bird to be held down, and it increases the risk of fracturing a limb. Two views, the V/D and right or left lateral whole body radiographs, are commonly taken for a complete series. Whole body radiographs are commonly taken because the bird will fit on the plate and there is not a true delineation between the bird’s “thorax” and “abdomen” (no diaphragm in birds). If you need to take limb radiographs, the x-ray beam should be coned down to just radiograph the wing or leg. A lateral and anterior-posterior (cranial-caudal) (leg) or posterior-anterior (caudal-cranial) (wing) radiograph should be taken for completeness. Regardless of the view, the animal should be positioned in a symmetric, straight fashion. If the bird is rotated, the radiograph will be hard to read properly and may not be diagnostic. Either digital film or mammography film works well for radiographing most species of exotic animals. The technique will vary from clinic to clinic and will be based on the type of film, processing techniques and machine used. A quick “bird in a box” technique can be used for birds that are either very sick and cannot handle the stress of being restrained or anesthetized. The bird is placed in a cardboard box or paper bag in the D/V standing position. This technique is only helpful for checking the patient for an egg, large coelomic mass/fluid, or metal foreign body.

**GI Barium Series in Birds**

A GI barium series can be easily performed in avian species. The barium is administered via a metal or red rubber feeding tube into the crop. The beak is gently opened using tape strips. GI transit time in most common pet birds can take about 30 minutes to about 6 hours (depending on species). The barium series should consist of plain films (taken prior to barium administration), and films taken at 15 minutes, 30 minutes, 45 minutes, and then hourly increments post administration until done. Both a lateral and V/D whole body view should be taken for each time period. Most birds should be sedated for this procedure.

**ULTRASONOGRAPHY IN EXOTIC SPECIES**

Ultrasonography can be a useful diagnostic tool in most species, but in birds, the airsacs and keel bone get in the way of getting a good look at many of the organs. Ultrasonography can also be utilized in reptiles and exotic small mammals. The same techniques used with dogs and cats are used with these species as well. Chelonians can be difficult due to the carapace and plastron. The ultrasound probe can be placed in the inguinal area after pulling the hind limb away from the body. You must be careful
because chelonians are very strong and can easily destroy an ultrasound probe by pulling their leg back into the body wall. Lizards with thick scales can often be difficult to ultrasound due to poor image quality.

**COMPUTED TOMOGRAPHY SCANS IN EXOTIC ANIMALS**

Computed tomography (CT) machines are becoming more easily accessible and are often common in large referral hospitals and academic institutions. Performing CT examinations in the exotic pet has become an important diagnostic tool. The scans are done in a similar manner as for dogs and cats. Most patients will need to be anesthetized during the CT scan to prevent moving and general motion artifact. Chelonians are the exception. Most turtles and tortoises can simply be placed on a radiolucent bowl and taped down. As long as the animal’s legs cannot touch the ground, they will stay in place long enough for a complete CT scan. Common CT scans include skull (dental disease in exotic small mammals), thorax, abdomen, and pelvis. Most scans can be completed in 15 to 30 minutes or less!

**MAGNETIC RESONANCE IMAGING SCANS IN EXOTIC ANIMALS**

Magnetic resonance imaging (MRI) machines are common in academic institutions and are now becoming available in some large referral centers. MRI is not as commonly performed in exotic animals as CT scans, but there is an occasional need for MRI scans in these unique patients. Disadvantages of MRI include prolonged scan times, difficulty monitoring anesthesia, difficulty keeping patients warm, and poor image quality due to the size of the patient and area being scanned.

**COMMON DRUGS USED FOR CHEMICAL RESTRAINT**

Sedation and/or anesthesia may be required for exotic patients requiring diagnostic imaging. The species, ASA status, and procedure being performed should be taken into consideration prior to giving any drugs. General anesthesia is similar to that performed in dogs and cats. Patients should be intubated when possible, even for short procedures. Establishing a patent airway is important. Intravenous catheterization should be considered for prolonged procedures and monitoring equipment should be placed as well. At the minimum, HR, RR, MM color, CRT, and pulse quality, and blood pressure should be monitored.

Common anesthetic drugs used in reptiles include but are not limited to: midazolam, butorphanol, morphine, dexmedetomidine, tiletamine-zolazepam (Telazol), ketamine, propofol, and isoflurane.

Common anesthetic drugs used in exotic small mammal patients include, but are not limited to, midazolam, butorphanol, buprenorphine, full mu opioids, acepromazine,
ketamine, dexmedetomidine, propofol (in ferrets only) and isoflurane/sevoflurane. Propofol is generally not suggested for use in exotic small mammals that may be difficult to intubate as a common side effect is apnea.

Common anesthetic drugs used in avian patients include, but are not limited to, midazolam, butorphanol, full mu opioids (controversial and more research is needed), and isoflurane/sevoflurane.

- It is important to consult an exotic animal formulary prior to administering drugs.
- Midazolam is the benzodiazepine drug of choice for exotic animals because it is often given intramuscularly or subcutaneously. Due to the solubility of midazolam, it is safe and effective to give intramuscularly (IM), subcutaneously (SC), or intravenously (IV). Diazepam has unreliable systemic uptake when given via any route other than (IV). Due to this, diazepam is generally not used much in exotic animal medicine.