

JUNE 2 - 4th, 2024

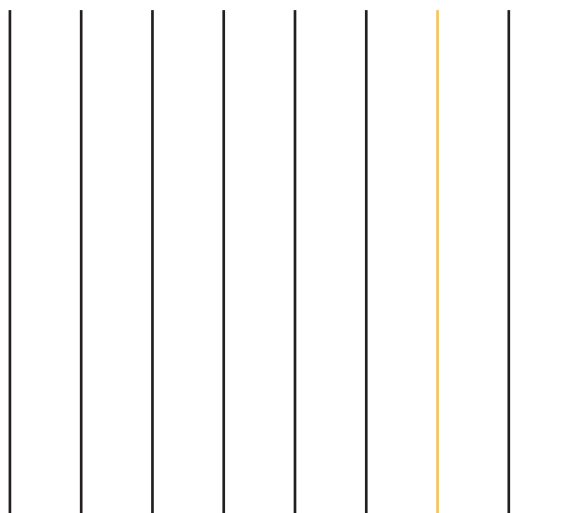


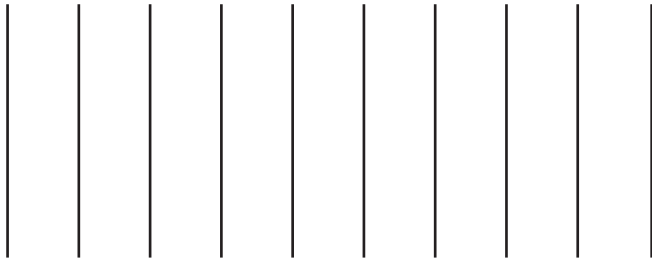
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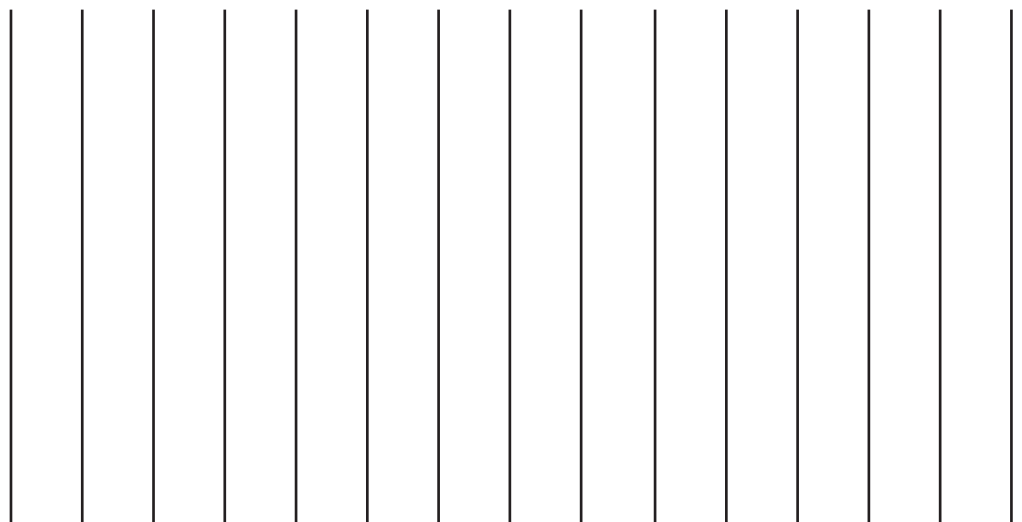
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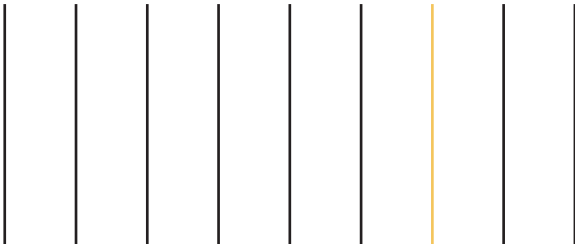
CONFERENCE EVALUATION



Thank you for joining us!

EMERGENCY STABILIZATION OF THE CRITICAL EXOTIC OR ZOO PATIENT

TRENTON SHRADER
DVM



EXOTICS

Kansas State University College of Veterinary Medicine

Emergency Intervention: Exotic Pets

Presented by Dr Trent Shrader, DVM

Kansas State University College of Veterinary Medicine

Overview: Peracute Stabilization

- | | |
|------------------------|--|
| 01 Introduction | 06 Oxygenation |
| 02 The ABC(D)'s | 07 Vascular Access & Fluid Support |
| 03 CPR | 08 Thermal Support |
| 04 Anesthesia | |
| 05 Monitoring | |

Introduction

Despite our best efforts, exotic pets commonly present to the attending veterinarian as urgent and emergent patients. A foundation of emergency management skills, accurate clinical interpretation, and interventional techniques will serve the clinician well.

In particular, consideration should be given to the potential risks to human health and safety, as well as unique patient anatomy and physiology.



Challenges of adding exotic and non-traditional pet ER care to your practice



- Specialized equipment
- Frequently, small patient size
- Appropriate staff training
- Training opportunities

Standardized Emergency Kits

6 Separate Kits

Depending on the types of exotic, or “non-traditional pets” your clinic sees, the content of your emergency kits will need to be flexible.

These are the six kits I keep readily available, based on the services we provide. Each contains specific equipment, quick dosing guides, and appropriately sized accessories to manage an emergency

Fish/Aquatics Kit

Mega-vertebrate Kit

Venomous Kit

Hoofstock Kit

Avian Kit

“General” Kit

The ABC's of Emergency Intervention

A

Airway

B

Breathing

C

Circulation

Airway Assessment

Oral Cavity

Ensure an unobstructed oral cavity

Evaluate for color, jaw tone, and salivary quality (1-2 seconds)

Nasal Passage

Ensure an unobstructed nasal aperture(s)

Evaluate for mucus quality, soft tissue or foreign material (1 seconds)

Palpation

For the respiratory elements that are not visually accessible

Evaluate pharynx, trachea, thoracic inlet for obstruction (2 seconds)

Chest Compliance

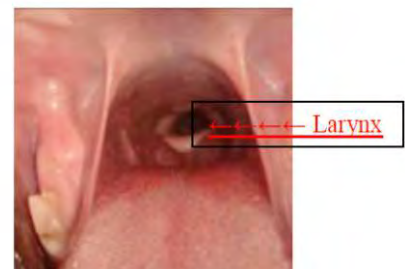
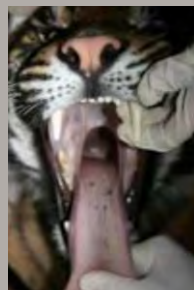
Very briefly, assess compliance to consider intrathoracic barriers to appropriate ventilation (1-2 seconds)

Airway Assessment

- Oral

Effective airway assessment requires an open oral exam with extension of the tongue and visualization of the arytenoid cartilages

- This may not be possible in some species (rabbits, guinea pigs) due to small oral aperture and pharyngeal anatomy



Barlow, Adam. (2012). Wild tiger capture and immobilisation. 10.13140/RG.2.1.4877.9363.

Airway Assessment

- Nasal

Not generally considered an essential component of an airway exam, many non-traditional species are obligate nasal breathers and nasal passage patency should be ensured

- I generally advise a brief (1-2 second) nasal exam even in mouth breathing animals as it may assist in your intervention technique (mouth to snout breathing may not be an option, for example)



Photo credit: Smithsonian's National Zoo and Conservation Biology Institute

Airway Assessment

- Palpation

A unique component of the zoological patient airway assessment. An inability to fully visualize the aboral airway due to size, anatomy, or physiology requires palpation of the larynx, trachea, or other respiratory features

- Reminder that tracheal/oral foreign bodies may be secondary - animals that are recumbent without airway control may inhale foreign material

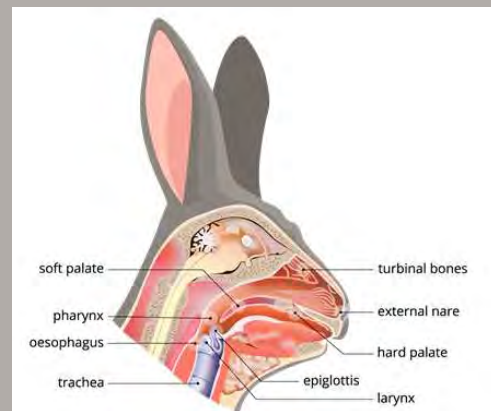


Photo credit: BioScience Media, 2017

Airway Assessment

- Chest Compliance

Another unique component of the zoological or non-traditional pet airway assessment. In some species, significant intrathoracic disease may be the cause of airway obstruction

- Initiation of chest compression in these patients can be associated with higher morbidity and mortality than we see in dogs and cats with unnecessary chest compressions, which are usually relatively benign (i.e. thymoma in rabbits)



Buckley, et al. (2011) Cardiopulmonary resuscitation hospitalized rabbits: 15 cases. 10.1053/j.jepm.2010.11.010

Breathing Assessment



Regular, unstimulated respirations are the norm in every species

Even animals associated with long periods of breath holding should be ventilating regularly during an emergency. Fish may be monitored via opercular movements. Some reptiles may have extreme pauses between breaths. Amphibians may respire through their skin and have minimal coelomic wall excursion.

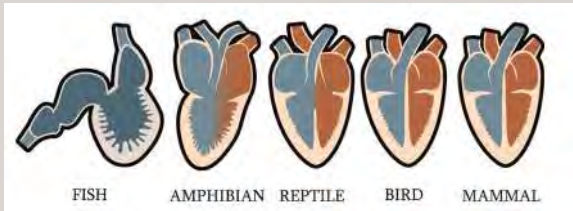
Somewhat controversial in primates

In human CPR, some experts advocate for the removal of rescue breaths from the protocol. In humans, primary cardiac arrest is more common than primary respiratory arrest, which may also be true for primates (capuchins, marmosets, and lemurs represent the most common pets). This is not believed to be the case in most mammals

Use supplemental tools when necessary

Glass slides in front of the nostrils may indicate airflow. Hands are more sensitive but being ungloved carries certain risks as well. Capnography with a nasal cannula or endotracheal tube is essential once obtained (to be discussed in detail in "monitoring")

Circulation Assessment



Establish pulses and perfusion (CRT)

Familiarize yourself with normal locations for strong superficial pulses in mammals (dorsal pedal, femoral, carotid) and birds (superficial ulnar, direct heart palpation).

Major vessel perfusion does not indicate microvascular perfusion!

Return of spontaneous circulation (ROSC) is the primary goal of all CPR

Circulation may be more challenging to define in a small subset of exotic patients (insects with circulating hemolymph, hibernating reptiles with exceptionally low peripheral vascular perfusion)

Heart contraction alone does not suffice

Auscultation of a beating heart is not sufficient evidence alone to establish the presence of vascular perfusion to the tissues

“D” is for Derivatives



Direct airway visualization may be impossible

Some of your emergency patients will have anatomically unique airways - Air sacs of birds, gills of fish, dermatologic respiration in amphibians. Spiracles of insects and arachnids. These deeper/less accessible organs may be impossible to visually evaluate but you can evaluate an analogous structure (pelvic respiratory skin in amphibians, air sac auscultation in birds, fanning the gills in a fish, lateral line visualization in tarantulas/roaches/etc)

Breathing

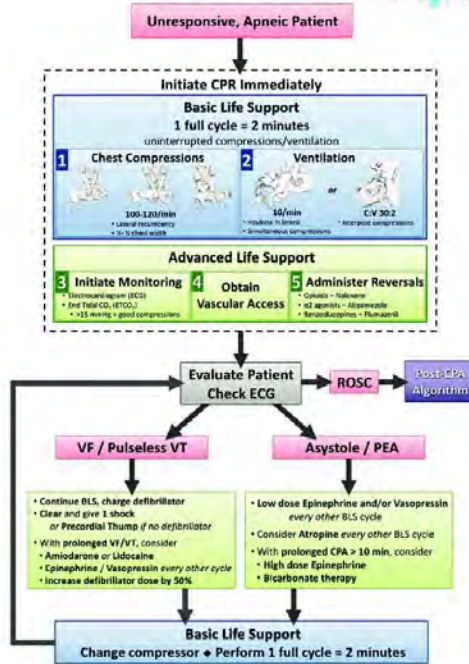
This may be particularly challenging in fish. Is opercular movement happening (opercular respiratory rate: ORR). Agonal breathing is not a functional respiration (and so should prompt CPR) but can be tough to distinguish in birds, reptiles, amphibians.

Circulation

Establishing macrovascular circulation may be challenging in itself. Microvascular circulation is probably impossible to rapidly evaluate in a clinically applicable way for most non-traditional species

CPR Algorithm

RECOVER



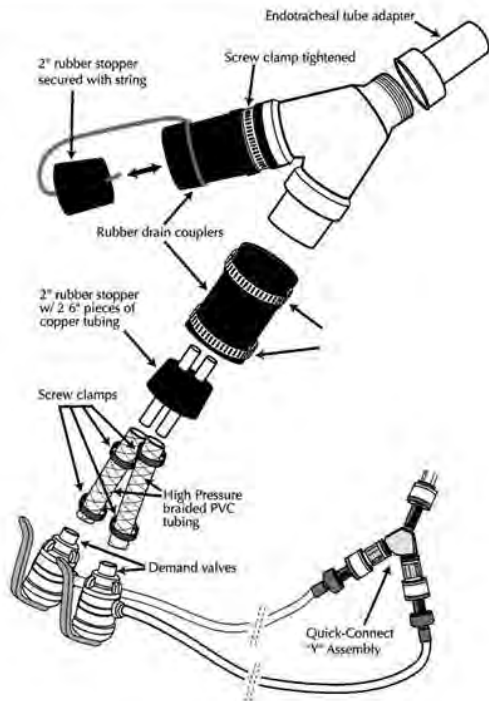
Administer CPR

For mammals, follow the standardized protocol for CPR administration as described in the Basic and Advanced Life Support courses through the RECOVER Initiative

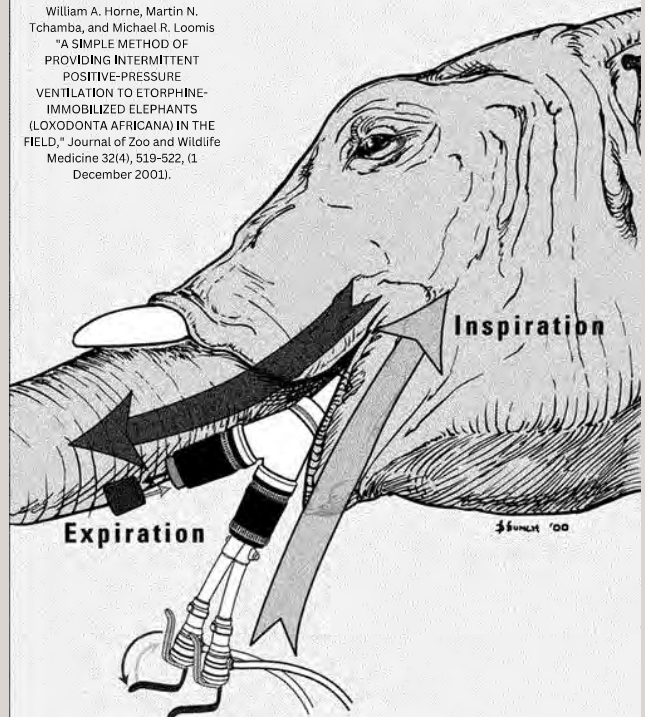
But first, a few unique situations:

Avian Compressions





William A. Horne, Martin N. Tchamba, and Michael R. Loomis
 "A SIMPLE METHOD OF PROVIDING INTERMITTENT POSITIVE-PRESSURE VENTILATION TO ETORPHINE-IMMOBILIZED ELEPHANTS (LOXODONTA AFRICANA) IN THE FIELD," *Journal of Zoo and Wildlife Medicine* 32(4), 519-522, (1 December 2001).



CPR: A brief review

Start compressions as soon as arrest identified

Compressions in a healthy animal are relatively benign

Already delayed in most exotic pets

Compress the chest approx. 33-55% diameter

A rate of 100-120 bpm is appropriate for all mammals, regardless of normal heartrate. 150-170 in birds.

Intubation should occur concurrently with compressions

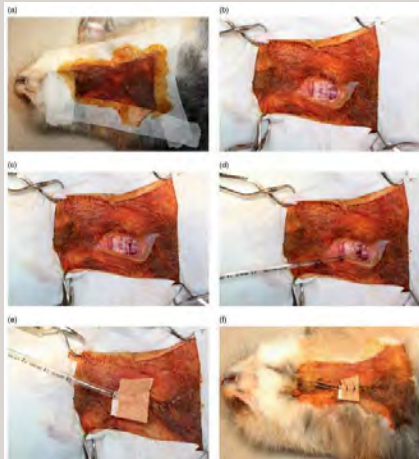
Don't stop compressions to intubate, continue while in lateral

One cycle of CPR is 2 minutes

Swap compressor to prevent fatigue

Administer epinephrine/ glycopyrrolate/ atropine every other cycle

CPR Pearls



Atropine works in rabbits:

Due to atropine esterase activity, the dose is increased and the duration of activity is reduced, but it remains a vital and effective resuscitation drug

Tight fitting face masks work:

In a review of 15 rabbits, successful ROSC was achieved in over half of patients. Due to the challenge of intubating urgently, tight fitting face mask ventilation is advised in small herbivores

ROSC won't happen in a hypothermic patient:

We probably under-prioritize the urgency that thermal support should be provided to exotic patients presenting in an emergency setting. Forced air or circulating water blankets are preferred

In CPR, it's better to be close than slow:

You may not remember doses precisely or calculate volumes with exact precision but it's better to administer a slightly low or high dose during the critical seconds of an arrest

Don't let perfection be the enemy of good

Facemask ventilation or nasal intubation can be effective

In some species, emergency intubation is challenging and time consuming. Tight facemask ventilation has been shown to be very effective in rabbits for emergency resuscitation

Backup options to vascular access

Vascular access is challenging in debilitated and shock-affected animals, making some challenging species borderline impossible. Consider administration of Epi/Atropine via endotracheal tube if IV isn't available. But don't forget about oral veins! (sublingual esp.)

You aren't awarded beauty points

If your best vascular access is an intraosseous catheter, scrub and place it. Draping and sterile gloving is best but those are precious seconds. Air sac cannulation in a bird delivers oxygen just as effectively as an endotracheal tube. Duct tape is a strong and effective muzzle to secure an oral cavity around a bite block (a PVC pipe, for example)

Anesthesia of the Emergency Exotic Patient

Fundamentals and Essentials

Standardized protocols are rarely the right solution

Many clinics will have “sick cat” or “sick dog” anesthesia protocols that are mistakenly perceived as “emergency event” protocols.

Usually this means:

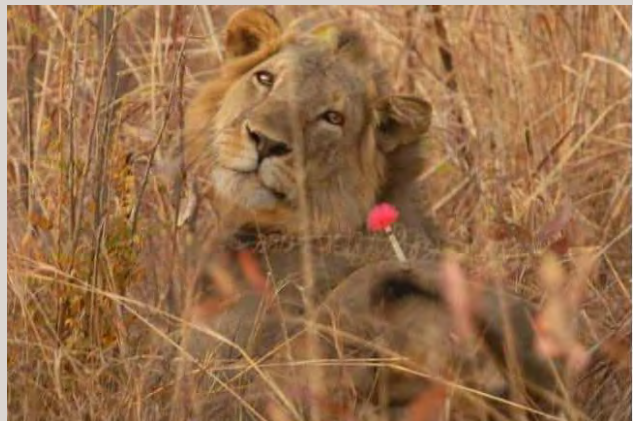
- Very low doses that are inadequate to sustain a sedation
- Sedation doses are designed for either
 - Fractious animals that are in extreme pain or
 - Patients too reactive to place a catheter

Think quickly, but still THINK. 30 seconds to consider comorbidities can save a life

Very ill birds and small mammals often benefit from sedation and/or anesthesia to prevent the compounding effects of stress on their disease.

Emergency Hazardous Animal Anesthesia

1. In some states and clinics, you may be asked to attend an emergency for a potentially dangerous animal
2. You will probably need to dart. Practice darting seriously and frequently, prior to accepting a call to do home visits for hazardous species
3. Multimodal anesthesia is still the preference. Mitigating the maximum dose of any one drug is desirable, unless you can't fit the entire volume in your remote drug delivery device.



General Considerations for Emergency Hazardous Animal Anesthesia cont.

1. Ketamine - Butorphanol - Midazolam - Dexmedetomidine is usually well tolerated and allows for rapid induction while generally preserving cardiac output and spontaneous respirations in critically ill predators
 - a. Again, standard protocols are generally poor plans: for example, if you have an elderly cat with known renal dysfunction, there's no need to add poor anesthetic plan and event to the other health crisis it is experiencing
2. In some large hoof stock, you may need super potent opioids
 - a. These require special licensing as they can be potentially fatal to humans
3. Prepare for the anesthesia to go poorly
 - a. Prepare your staff and equipment for hypotension, respiratory depression, cardiac arrest, hyper/hypothermia, etc



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Emergency Non-Traditional Pet Anesthesia Cont.

Other non-traditional pets may require immobilization to allow safe access. Having a pole syringe, darting equipment, or other remote capture equipment is VERY useful. Some circumstances you may need them include:

- Extremely high stress individuals prone to capture myopathy with restraint
- Severely injured animals liable to cause further/life threatening injury to themselves
- Animals that may need to be transported substantial distances for appropriate medical intervention
- Animals that have escaped their farms/fenced areas or that have wandered into hazardous areas

Monitoring

Pulse Oximetry

Lingual is most reliable for the majority of animals

Consider the vulva, prepuce, ear, toe pad, propatagium, or other site if necessary

Non-invasive Blood Pressure, +/- IBP

NIBP is dramatically faster to acquire - forelimb, tail, pelvic limb, and tongue are all acceptable

IBP may be added once underway

Capnography

Essential tool in every intubated patient.

Can be fitted to the back of a tight fitting face mask in non-intubated patients but accuracy is questionable - trends

Electrocardiography

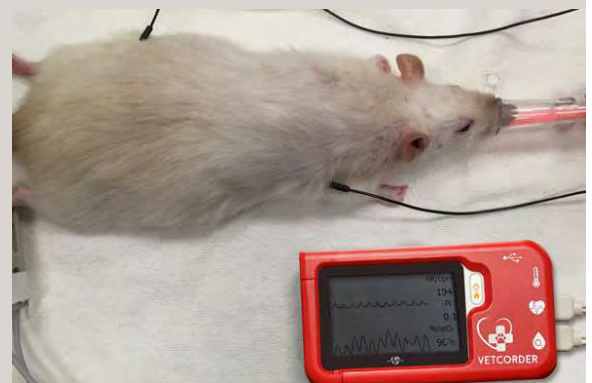
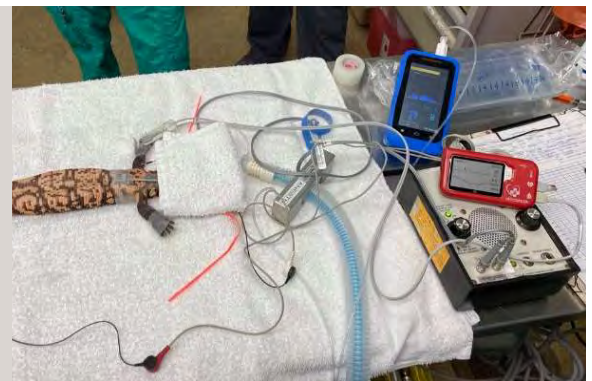
Heart rate, rhythm, and waveform will be a first indicator of many biochemical abnormalities as well

Place these four monitoring tools should be placed early and monitored continuously while the animal is still critical

There are published normals for dozens of species for normal monitor placement and expected values under anesthesia or awake



Figure 1. Electrode position for *Amazona ochrocephala* parrot. Red and yellow cables in superior members in the dorsal fold of the wing, black and green cable on inferior members on the knee joint.



Electrocardiography in Birds

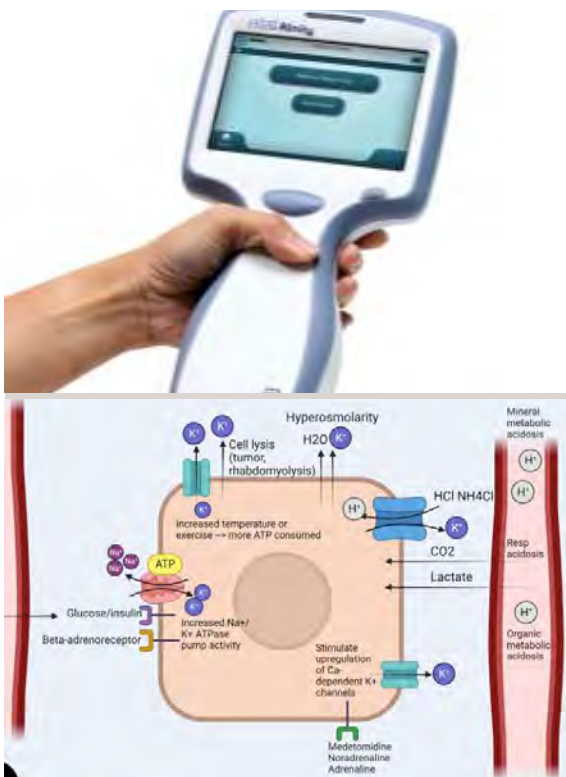


Echocardiography of small mammals readily translates from dogs and cats

- No significant differences between echocardiography and electrocardiography between breeds or sexes of rabbits

Avian ECG is best obtained as a 6-lead echo with paper speed of 100 mm/sec due to the rapid avian heart rate

- Heart rate, wave amplitude, intervals, and wave durations have all been published for a variety of avian species
- Cardiac disease is a common presenting complaint in psittacine birds and electrocardiography is an important triage diagnostic test in the acutely emergent avian patient



Continuous Blood Monitoring

Some species-specific anesthetic complications require supplemental monitoring:

- Medetomidine induced hyperkalemia (noted in big cats but seems to affect an unknown number of exotic species)
- Malignant hyperthermia in pot bellied pigs with isoflurane
- Passive regurgitation in guinea pigs
- Hyperthermia in chinchillas
- Regurgitation associated with narcotics in hoof stock
- Capture myopathy and subsequent pigmenturia with cardiac ischemia

Generally, most critical patients should have intra-procedural blood gas values collected every 90 minutes at a minimum

Oxygenation

Effective oxygenation in the emergent patient is a combination of oxygen delivery, oxygen absorption, delivery to tissue, and depletion of oxygen from the red blood cell into tissue cells

- Many, if not most, zoological animals presenting in an emergency will be experiencing some degree of hypoxia
 - Three primary interventions to reduce hypoxia
 - Increase inhaled oxygen concentration / PaO₂
 - Resolve underlying acid/base imbalances impairing oxygen absorption and delivery (especially from acidosis)
 - Increase minute volume and ventilatory rate
 - Preexisting misconceptions or knowledge gaps have prevented exotic vets from addressing hypoxia to the fullest extent of our abilities

Oxygenation



Misconceptions and Updates in Exotic Oxygenation

- Birds and many small mammals must be intubated with uncuffed endotracheal tubes - False
 - Due to their complete tracheal rings, use caution with cuffed tubes in birds. However, using a syringe with a pressure gauge, they can be safely intubated
 - Maintain pressure in the cuff balloon at approx. 12 mmHg
- Reptiles should be anesthetized on room air because 100% oxygen anesthesia will make them apneic - False to Misleading
 - In a study with bearded dragons, return to spontaneous respirations after anesthesia with 100% oxygen was no different than using room air. However, this is a single species and may not represent reptiles as a whole

Oxygenation Cont.

Concepts in Oxygen support for the emergency zoo patient

- Provide oxygen early and at high volume
 - Flow-by as early as possible, then intubate and ventilate
- In species that are challenging to support, utilize specialized equipment
 - Oxygen “leaf blower” to ventilate large hoof stock in the field (Zubinator)
 - Oxygen bubbler for fish, amphibians, aquatic environments
 - Chamber oxygen prior to handling for all high stress patients (small primates, small carnivores and herbivores, et)
- Using humidified oxygen, nasal cannulas are easy and can be used for field procedures, transport, especially hospitalization
 - Staple in place, most patients tolerate extremely well



Intravenous Access

Cephalic

Preferred site for most mammals, not readily available in non-mammalian species

Ventral Coccygeal

Preferred site in reptiles, but can be an alternative catheter site in large hoof stock or a site for IV injections off the needle

Basilic Vein

Preferred site in birds for IV catheter placement and allows for bandaging the wing in place to maintain.

Alternatively, may utilize the medial metatarsal

Intra-Osseous

Catheterization of the bone is best done in a sterile field with appropriate aseptic prep. However, for patients in decompensatory shock, it can be done in a exhibit/field setting

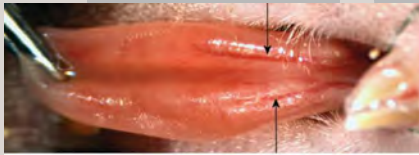
Always place some sort of venous access prior to any patient transport

Venous Access - Cont.

For urgent sampling or challenging patients, some alternative sites

Sublingual

I use this site commonly for urgent sampling in large species that have a thick fur coat. Significantly easier access compared to peripheral limbs



Medial Metatarsal

Commonly used sampling site in birds, can be easily obtained with minimal alcohol - Beneficial in hypothermic patients

Jugular vein

Preferred site for sample collection in almost every species, although can be a challenging stick in many small mammals and reptiles. Some birds (pigeons) have a venous plexus

Sub-carapacial

In chelonians, may represent an easier access site for the emergency trauma patient. Risk for ventral vertebral trauma and lymph contamination.



Fluid Therapy in the Peracute Emergency

Too large of a subject to even scratch the surface, but a few pearls from recent developments

Fluid resuscitation should be in small boluses

As a general rule, large shock boluses without time for assessment are not indicated due to the damage they may cause to the endothelial glycocalyx. This results in leakier vessels, hindering the response to treatment. 10 ml/kg then reevaluate briefly is a good rule

Use hypertonic saline over colloids

Rapidly administered colloids in the face of a septic patient or severely debilitated patient can commonly lead to movement of synthetic proteins into the interstitial fluid, counteracting the benefit of the increased oncotic pull.

Also, in large animals the necessary volume of crystalloids may be prohibitively slow to administer. Hypertonic saline will pull water from the interstitial space more quickly to return normal pressure

Stabilization of the acid/base balance is paramount

Appropriate response of the NO₂ receptors in the vascular endothelium relies on a pH of 7.3-7.5 in most species. Oxygen carrying capacity of hemoglobin is diminished at lower pH, as well as vasodilation due to smooth muscle response to the acidosis



Thermal Support

Always provide thermal support prior to transport. Hypothermia and/or hyperthermia are life threatening homeostasis deviations:

- Understand the appropriate core temperature for the species you are working with
 - Marsupials (kangaroos, wallabies, opossum) are somewhat common companions that have a lower core temp than other placental mammals
 - Many small mammals have significantly higher core temperature targets than dogs and cats
- Foil blankets are extremely effective
- Forced air warmers are also effective but will need a generator/electricity or portable unit



Summary

Control the situation

You can't treat an animal you can't touch. Anesthesia of the critical patient is concerning but necessary. Time is of the essence and it's best to be assertive in controlling the patient

Monitor Monitor Monitor

Appropriate intervention is dictated by testing, not guessing. Test and respond frequently and consistently until the patient is fully recovered and awake.

Stabilization isn't about style

It's great to have a plan but the reality is that outcomes are the only thing that matters. Use personal clothing as blankets, draw blood from odd places, make educated guesses with doses but you don't have time for a lit review. Always review your cases afterward to see if there are ways to bolster your preparedness.