

Reptile Anesthesia and Analgesia

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Outline

- Definitions
- Relevant anatomy
- Analgesia
- Anesthesia
- Protocols and examples
- Monitoring and support
- Recovery
- Keys to success

Definitions

- Tranquilization = the relief of anxiety and a state of relaxation while the patient is aware of its surroundings.
- Sedation = a state of central depression and drowsiness with the patient unaware of its surroundings.
- General anesthesia = induced unconsciousness characterized by controlled reversible depression of the central nervous system and analgesia. Patients under general anesthesia are not rousable and the reflex functions are attenuated. Surgical anesthesia is a deeper level that allows for painless surgery.



Definitions

- Analgesia = the freedom or absence of pain.
- Local analgesia = loss of sensation in a circumscribed area.
- Regional analgesia = loss of sensation or insensibility in a larger but limited body area.



Goals

- Balanced anesthesia
- Pre-emptive analgesia
- Facilitates handling and induction
- Reduce anesthetic requirements

Anatomy and Physiology

- Poikilothermic species
- Lack epiglottis
- Lungs differ in lizards, chelonians and snakes
- Lack functional diaphragm
- Three chamber heart (four in crocodilians)
- Renal-portal system



What about PAIN?

Signs of Pain

- Change in normal behavior
- Reluctance to move
- Abnormal ambulation
- Dull and closed eyes
- Anorexia
- Hunched posture
- Aggression in passive animal
- Passive behavior in normally aggressive animals
- Elevated and extended head
- Lameness
- Decreased tendency to coil (snakes)
- Aerophagia
- Color changes (darker or paler)



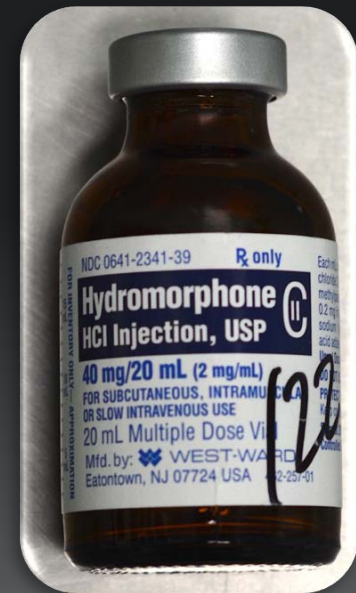


Analgesia- Morphine

- Pure mu agonist
 - Increased tolerance to thermal stimulus in red-eared sliders (RES), bearded dragons (BD), crocodiles and anole lizards, and electrical in iguanas and BD
 - Decreased duration of limb retraction in formalin test in Speke's hinged tortoise
 - Associated with severe (up to 80%) respiratory depression in RES
- Dosage: 1.5-5 mg/kg q24h

Analgesia- Hydromorphone

- Pure mu agonist
 - Increased tolerance to thermal stimulus in red-eared slider (RES)
- Dosage: 0.5 -1 mg/kg



Analgesia- Fentanyl

- Pure mu agonist
 - Increased tolerance to thermal stimulus in ball pythons and corn snakes
 - Plasma concentrations detectable in ball pythons and prehensile-tailed skinks with fentanyl patch
- Dosage 2.5-12.5 mcg/h q 24-72 h



Analgesia- Tramadol

- Weak mu agonist, inhibits reuptake of serotonin and norepinephrine
 - Increased tolerance to thermal stimulus in red-eared sliders (RES), and to electrical stimulus in bearded dragons
 - Plasma concentrations determined in sea turtles, bearded dragons
 - Respiratory depression in RES was less than with morphine
- Dosages in RES 5-10 mg/kg q 72 h PO

Analgesia- Meloxicam

- NSAID, cyclooxygenase (COX)-2 specific inhibitor
 - Increased the tolerance to electrical stimulus in bearded dragon at 0.4 mg/kg IM
 - Did not change physiologic parameters in ball pythons at 0.3 mg/kg, or hematological and biochemical parameters in iguanas at 0.2 mg/kg
 - Plasma concentrations determined in RES and iguanas
- Dosage 0.5 mg/kg q 24 h



Regional Analgesia/anesthesia

- Intrathecal spinal analgesia in red-eared sliders
 - Lidocaine – 1 hr.
 - Bupivacaine – 2 hr.
 - Morphine – 48 hr.
 - Preservative-free formulations
- *Mans, C. Clinical technique: intrathecal drug administration in turtles and tortoises. Journal Exotic Pet Medicine 23 (2014), pp. 67-70.*

Indications for Tranquilization

- Restraint of fractious animals
- Ultrasound
- Radiographs
- Transport
- Venipuncture
- Fine needle aspiration

Indications for Sedation

- Restraint of fractious animals
 - Ultrasound
 - Radiographs
 - Transport
 - Venipuncture
 - Fine needle aspiration
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- Minimally invasive procedures combined with local analgesia

Indications for Anesthesia

- Surgery
- Endoscopy
- Invasive procedures
 - Ultrasound-guided biopsy, etc..

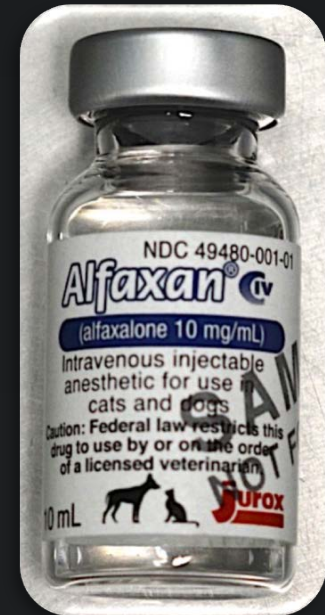


Injectable Agents

- Ketamine
- Dexmedetomidine
- Midazolam
- Propofol
- Alfaxalone

Alfaxalone

- Neuroactive steroid agent
- Rapid induction and recovery
- Intravenous (IV) and intramuscular (IM) routes
- Induction (5-10mg/kg), maintenance, constant rate infusion (CRI) and bolus
- Minimal cardiorespiratory depression*



Inhalational Agents-Isoflurane

- Minimal metabolism, eliminated by lungs
- Right-to-left cardiac shunting might result in mismatch gas concentration and poor anesthetic depth
- Dose dependent cardiovascular depression
- Minimum anesthetic concentration (MAC) 1.8-2.1% iguana, 1.37-1.71% monitors, 1.31-2.49 % rat snake
- Induction variable %, maintenance 2-3%

Inhalational Agents- Sevoflurane

- Faster induction and recovery than isoflurane in iguana, but similar recovery in monitors
- No significant cardiopulmonary differences with isoflurane in iguanas
- Less irritant to airways than isoflurane
- MAC 3.0-3.2% iguana, 2.05-2.97% monitors, 1.85-2.99% rat snakes
- Induction variable %, maintenance 3.5-4.5%

Premedication

- Combination of:
 - Ketamine
 - Dexmedetomidine
 - Midazolam
 - Propofol
 - Alfaxalone
 - Hydromorphone/morphine

Induction

- Propofol
- Alfaxalone

Maintenance

- Isoflurane or sevoflurane

Example 1

Tranquilization to sedation

- Sulcatta for exam and venipuncture
- Option A
 - Midazolam, ketamine +/- dexmed. IM or IV
- Option B
 - Alfaxalone IM

Example 2

- Esophagostomy tube
 - Midazolam IV or IM for sedation
 - Hydromorphone or morphine IM
 - Meloxicam
 - Local lidocaine block

Example 3

- Radiographs, gastroscopy +/- coelioscopy of Alligator snapping turtle
- Premed/induction
 - Hydromorphone 1mg/kg
 - Ketamine 2-5 mg/kg
 - Dexmedetomidine 0.025-0.05 mg/kg
 - Midazolam 0.5-1 mg/kg
 - IV injection
- Maintenance
 - Isoflurane

Example 4

- Radiographs, Gastrosocopy +/- coelioscopy of Alligator snapping turtle
- Premed/induction
 - Hydromorphone 0.5 - 1mg/kg
 - Propofol 10mg/kg or Alfaxalone 10-20 mg/kg
- Maintenance
 - Isoflurane

Example 5

- Green iguana coelomic surgery
- Premed/induction
 - Hydromorphone 1mg/kg
 - Ketamine 2-5 mg/kg
 - Dexmedetomidine 0.025-0.05 mg/kg
 - Midazolam 0.5-1 mg/kg
 - IV injection
- Maintenance
 - Isoflurane

Injection Sites



IV

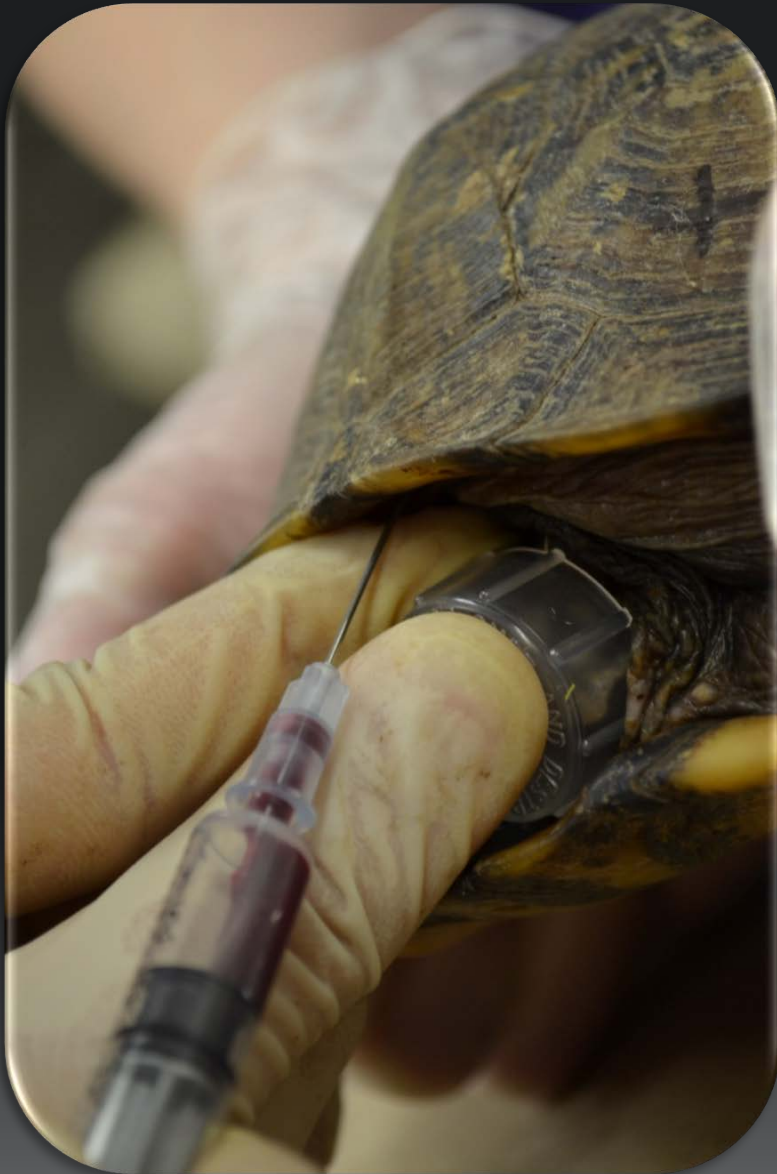
- Subcarapacial sinus
- Jugular
- Tail veins
- Brachial plexus
- Occipital sinus
- Ventral abdominal vein
- Palatine vein
- Etc..

IM

- Limbs
- Tail
- Epaxials

Injection Sites

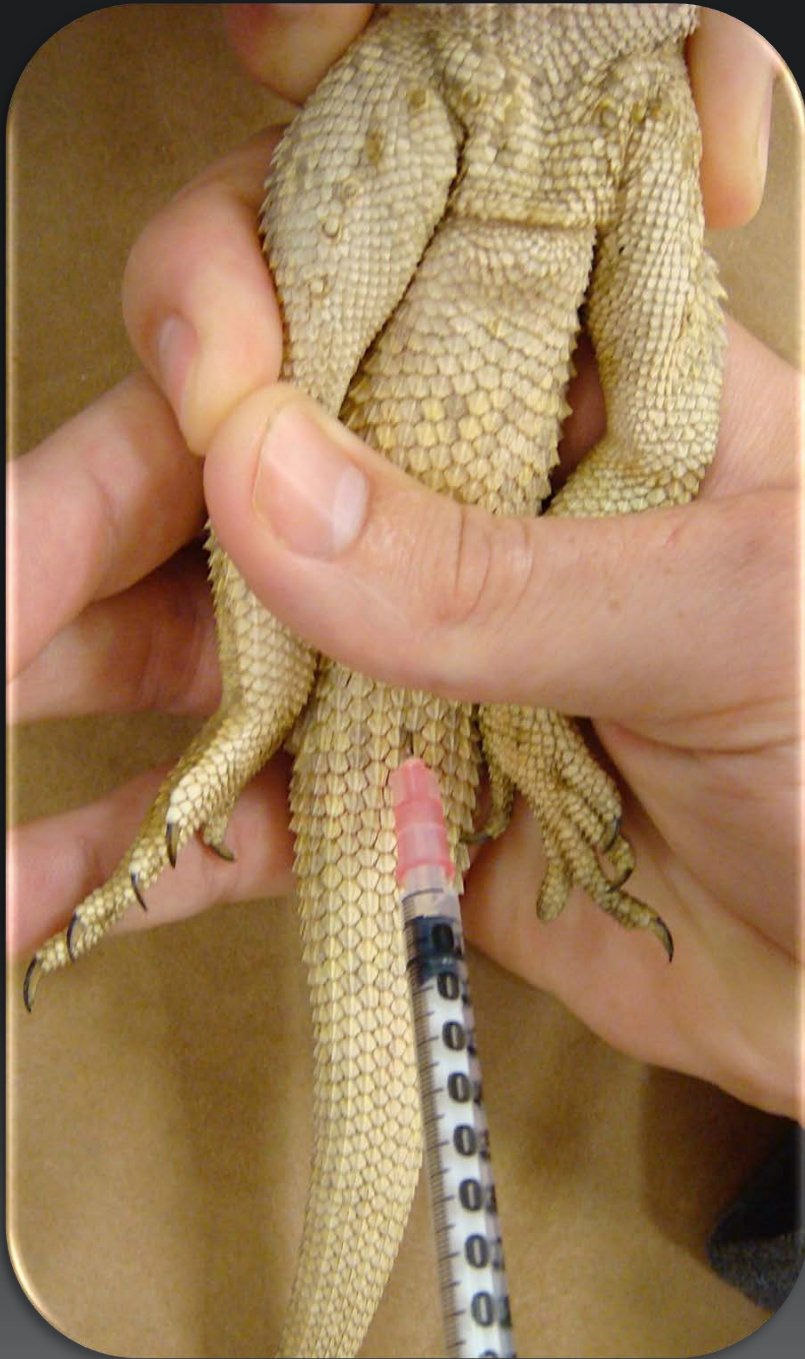




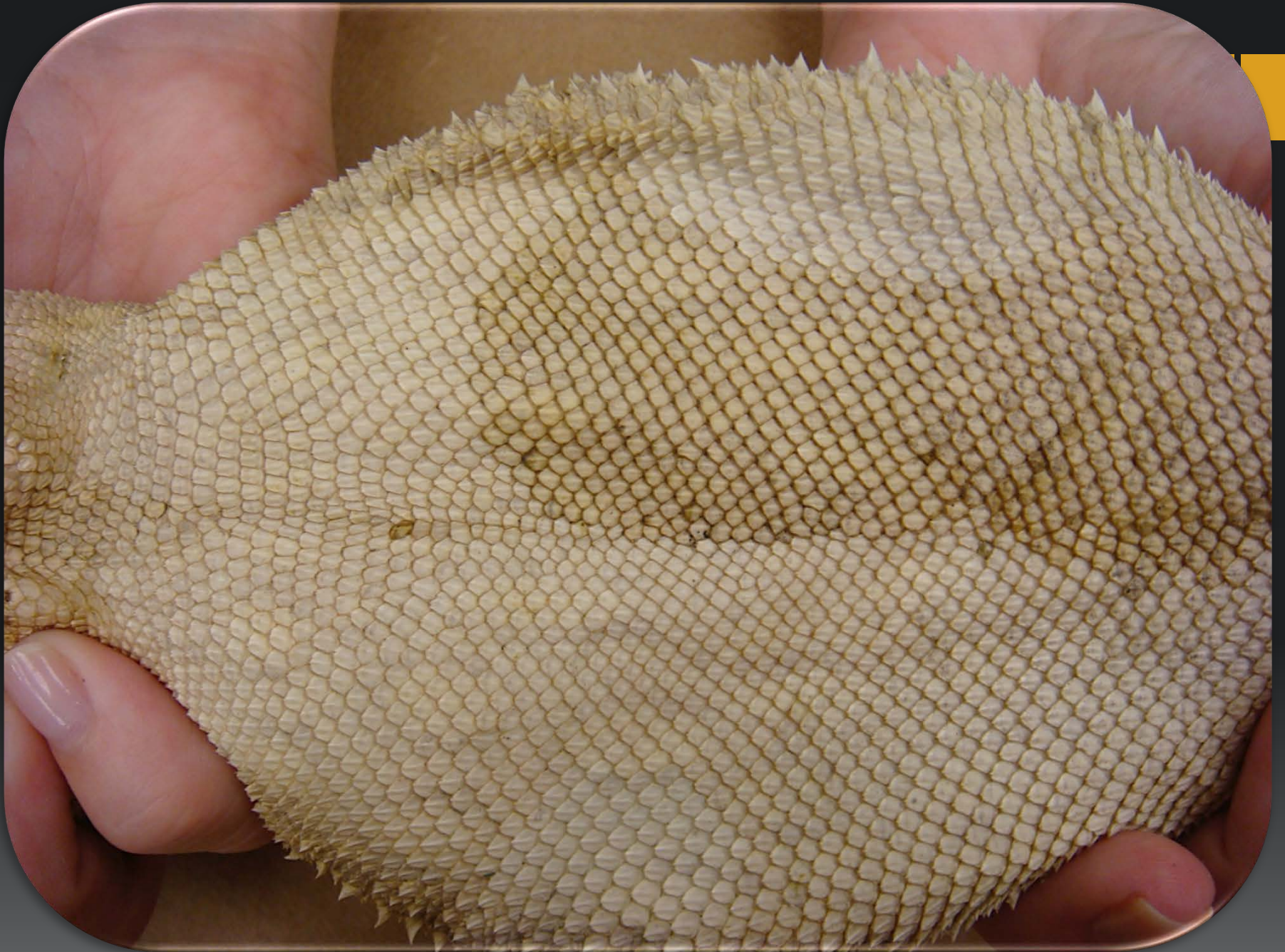


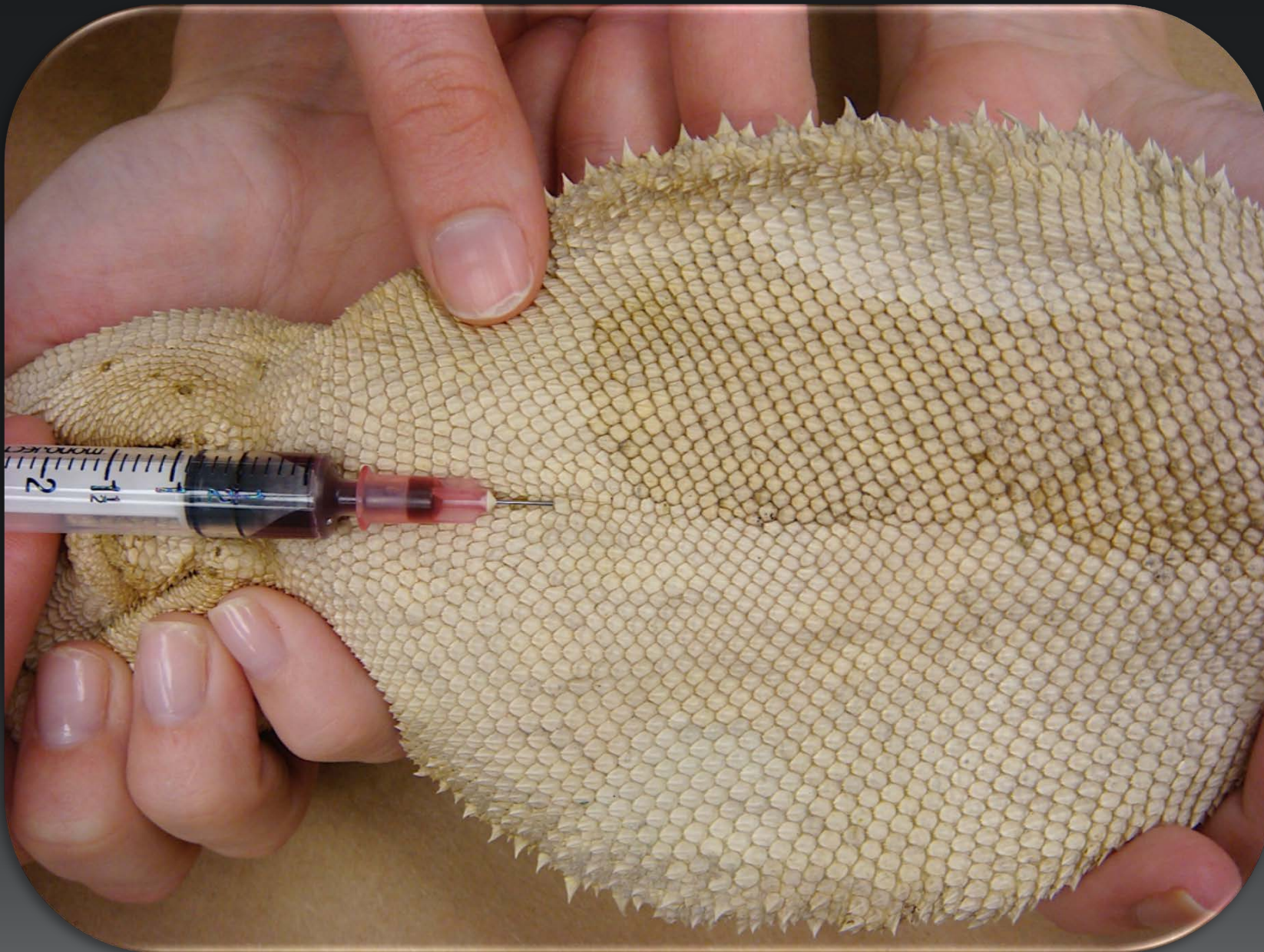




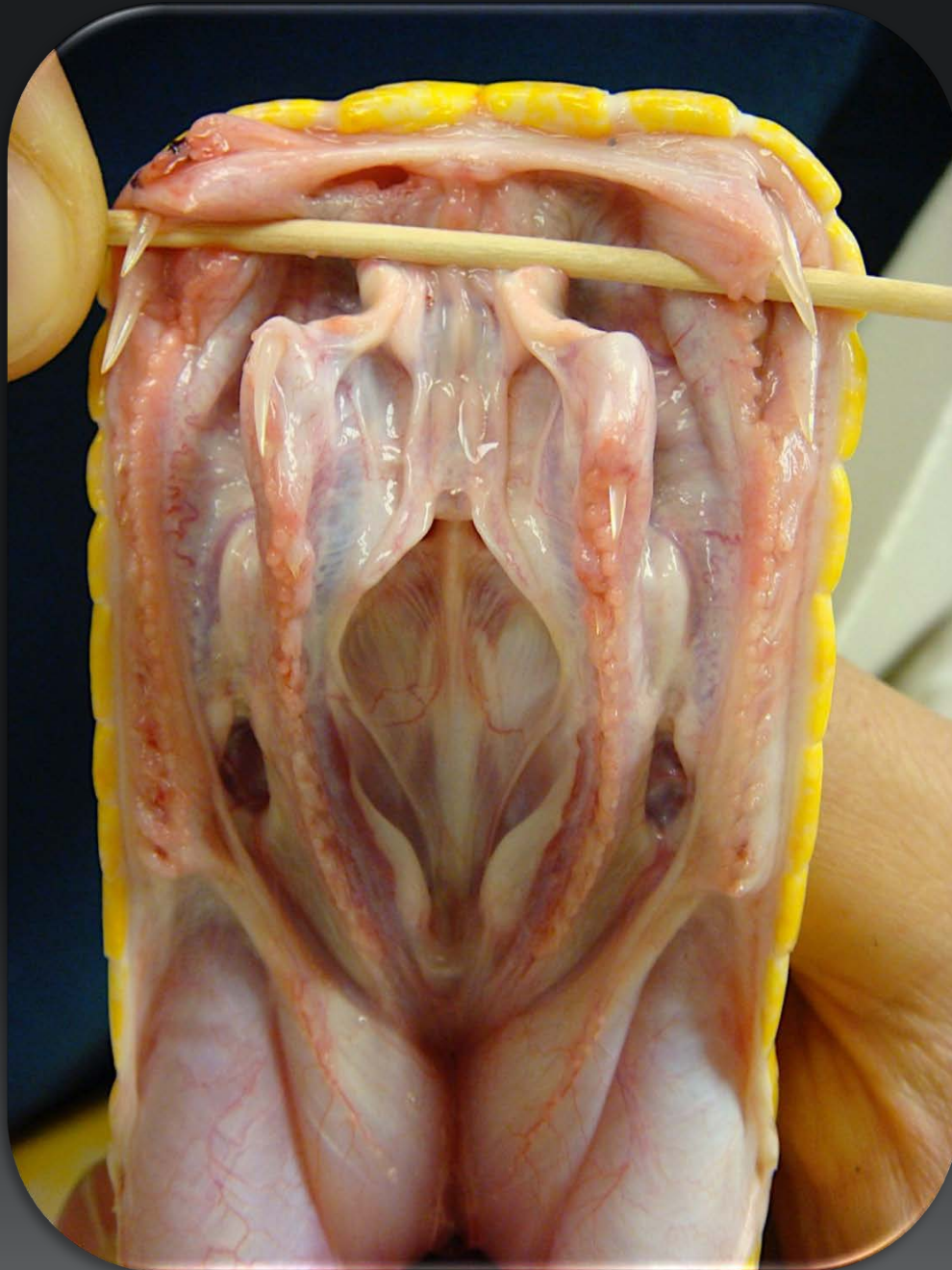




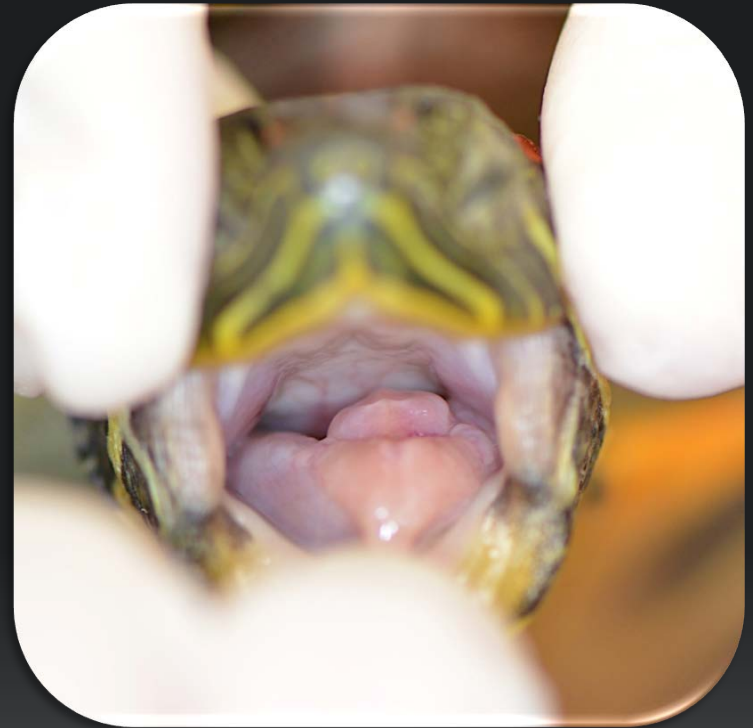






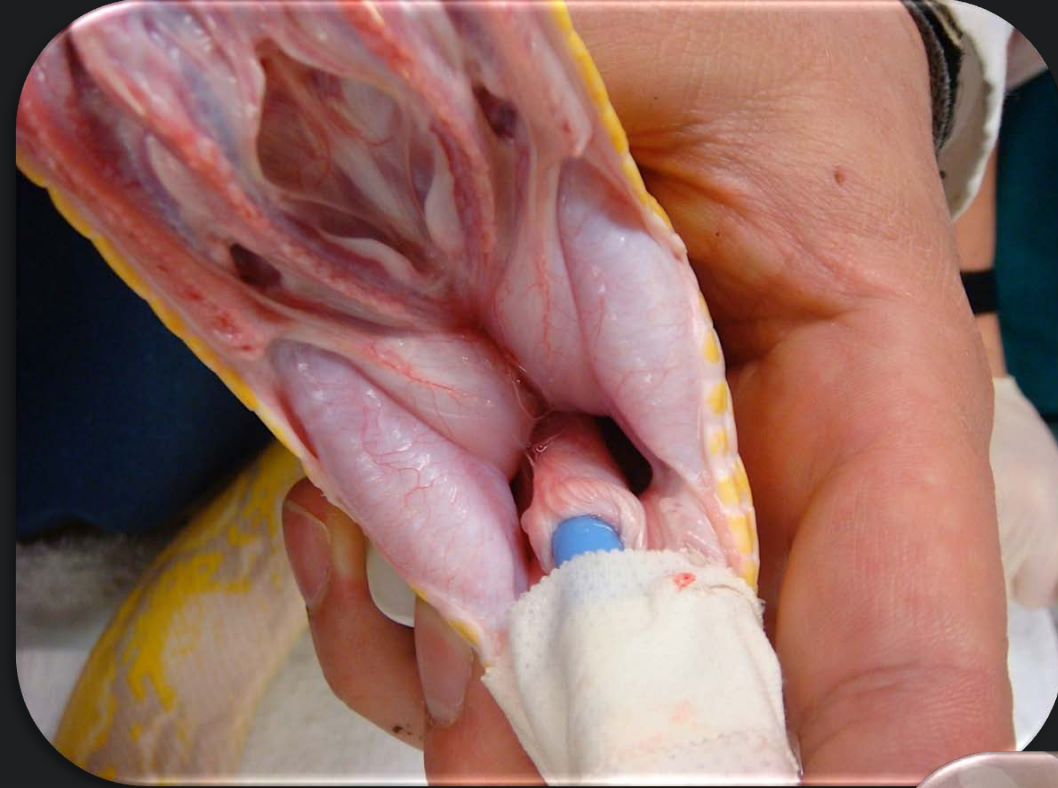


Intubation- Chelonians



Intubation- Snakes



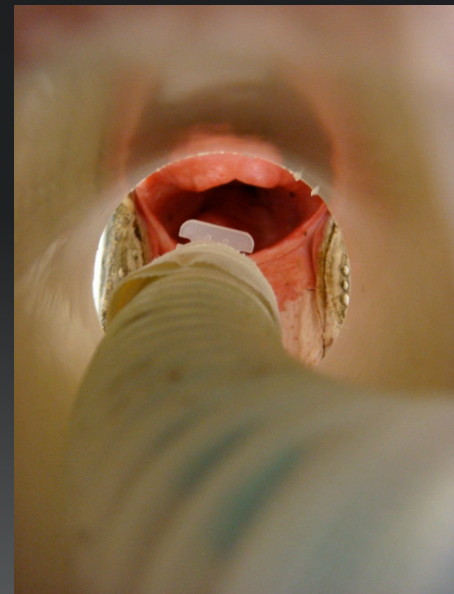
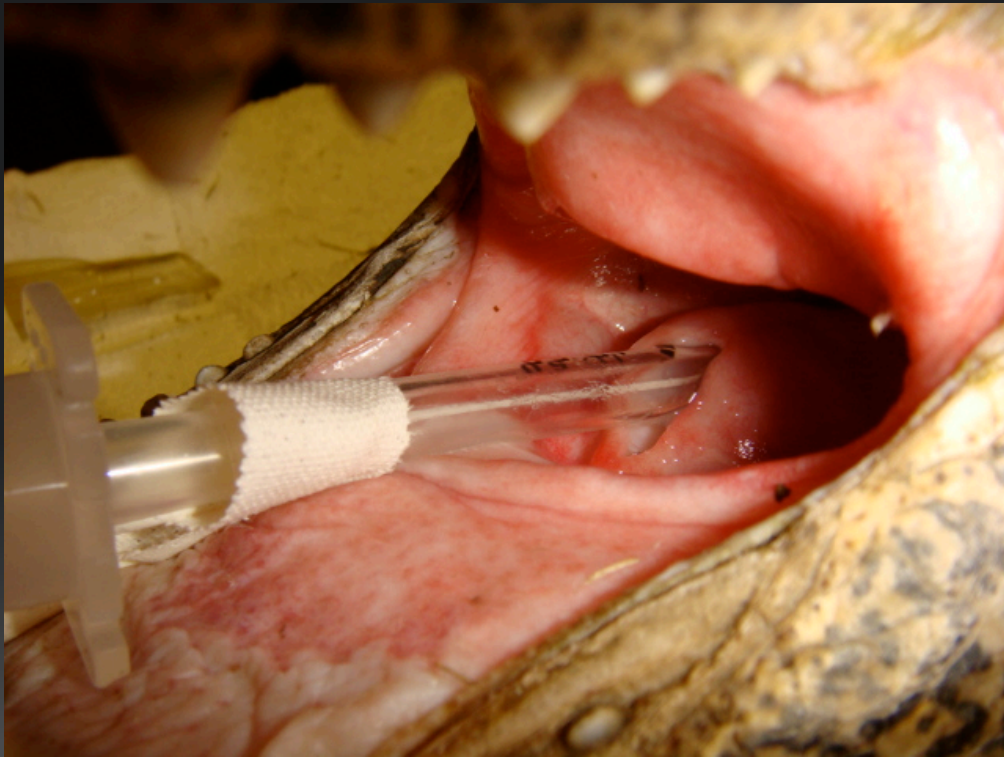


Intubation- Lizards





Intubation- Crocodilians



Patient Monitoring

- Corneal reflex is good indicator of depth and death
- Heart rate: Doppler, ECG, Ultrasound
- Respiratory rate: often need intermittent positive pressure ventilation (IPPV)
 - DO NOT EXCEED 15–20 mmHg
 - POP-OFF valve MUST REMAIN OPEN after breathing
 - 2–4 breaths/min
- **Temperature: KEY for successful anesthesia**
 - **Aim for 90 - 95°F (32-35°C) during anesthesia**



Cardiovascular Support



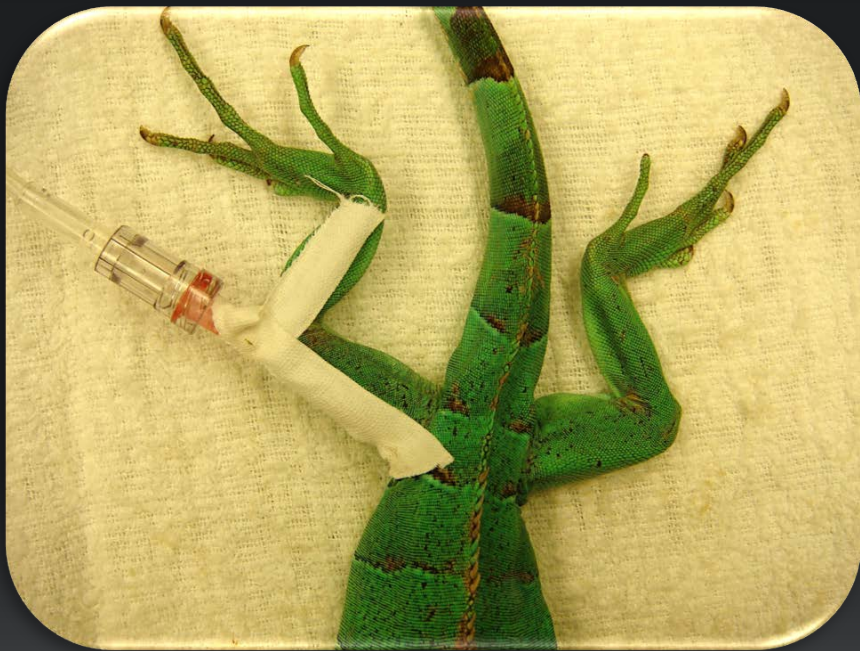
- Fluid therapy
 - Intravenous
 - Intraosseous
 - Subcutaneous
 - Intracoelomic

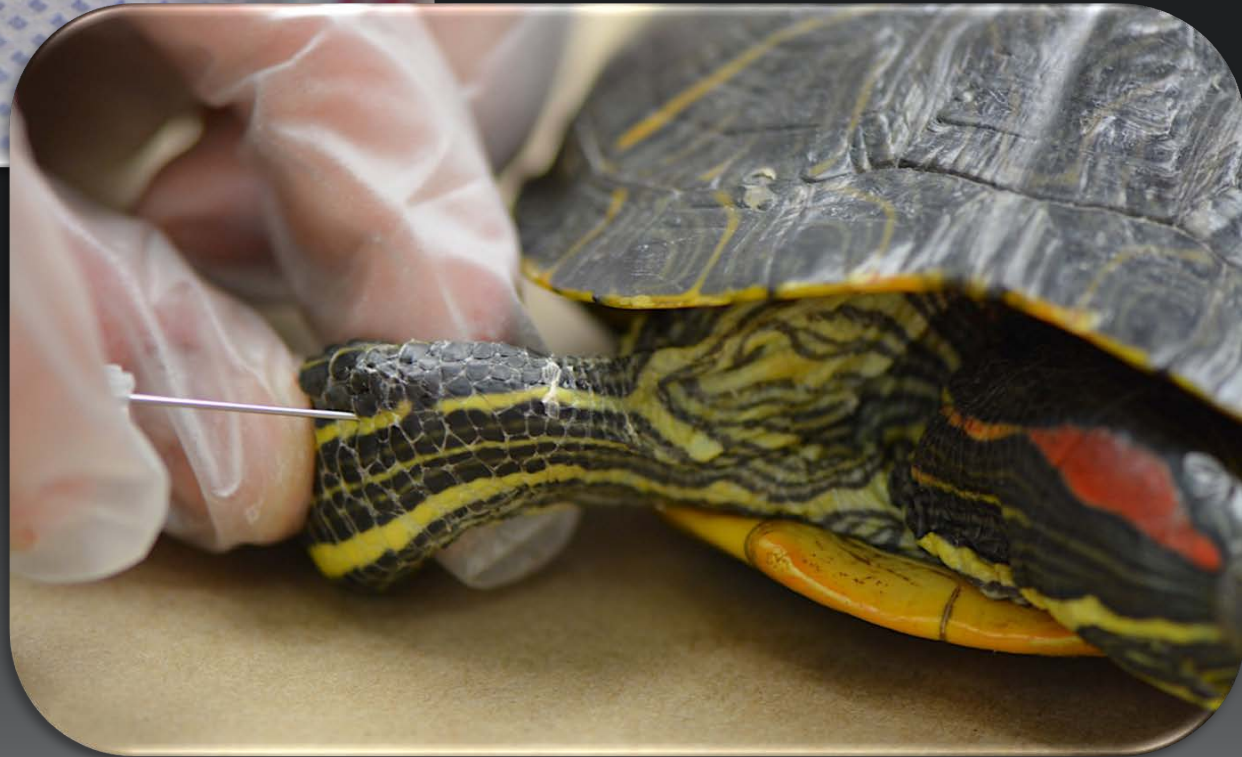
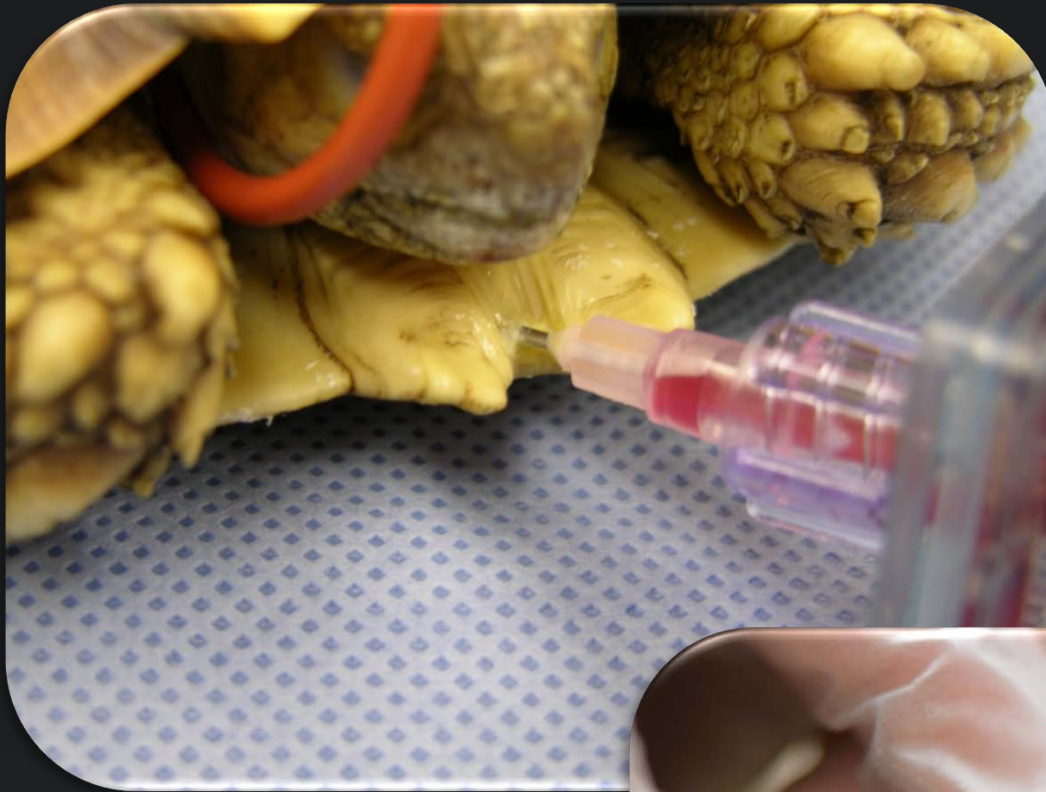
IO Access



- Femur
- Tibia
- Carapace/plastron
- IO access can be used the same as IV but with slower volume of infusion

IO Catheter







Temperature Support

- Forced air warmer
- Heat blankets
- Heat lamps
- Warm fluids
- Rice/bean bags
- Etc..

Hypothermia

- Heat loss
 - Convection
 - Air exchange at body surface
 - Radiation
 - Heat loss to surfaces and environment
 - Conduction
 - Heat loss from contact (i.e. cold table)
 - Evaporation
 - Heat loss from lungs, skin, exposed tissues

Preventing Hypothermia



	Convection	Conduction	Evaporation	Radiation
Forced-air warmer	X	X		X
Heating pads		X		
Heat lamp				X
Rice/bean stockings				X
Water baths		X		X

Recovery



- Wean off gas before the end of procedure
- Maintain O₂ at low flow rate
- KEEP WARM!!!!!!!!!!!!!!!!!!!!!!
- Breathing stimulus
 - Reptiles: O₂

Key to Success



1. Keep patients warm
2. Keep patients hydrated
3. Balanced anesthesia and analgesia
4. Discontinue O2 before end of surgery

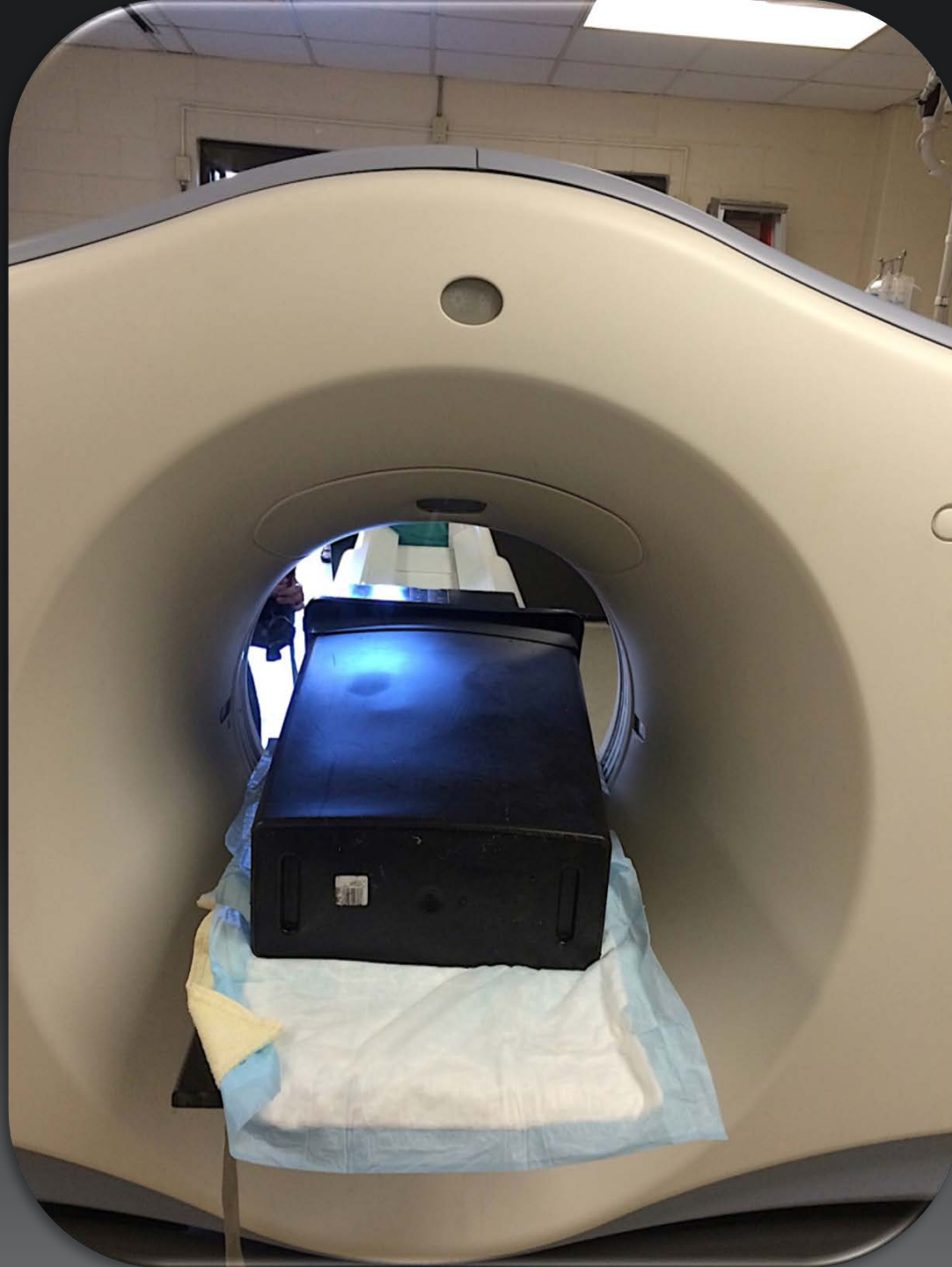


Not every patient needs drugs

RADS and CT









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Questions?

