Basic Turtle Rehab

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What We Will Cover

- Primary Assessment and Triage
  - 20 minutes
- Clinical Techniques & Medication Selection
  - 30 Minutes
- Wound Management
  - 20 minutes
- Necropsies 101
  - 20 minutes

How Are Turtles Doing in The Wild?

- Humans are still a problem
  - Habitat Encroachment
  - Trauma
- Infectious Diseases
  - Mass population die offs in the wild + killing captive populations
  - Pathogens are temp adjusted for reptiles
  - Stable environment, no need for reptile-to-reptile contact

Primary Assessment & Triage

- History
- Visual Exam
- PE
- Isolate = Infectious Disease Suspects
- Develop Treatment Plan
  - Supportive care for Hypothermia, Dehydration, Infectious diseases, and Wound Stabilization

The Hard Part

- History Form/Intake Form
  - Species
  - Age Estimation
  - Location
  - Is this an abandoned pet?

The Visual PE

The following systems can be evaluated WITHOUT disturbing the animal.

- Eyes
- Ears
- Hydration status
- Proper jaw/beak occlusion
- Overall body condition score
- Obvious ambulation abnormalities, long bone fractures/luxations
- Respiratory Rate, CNS/Mentation, and . . .
- Skin

Handling Reminders

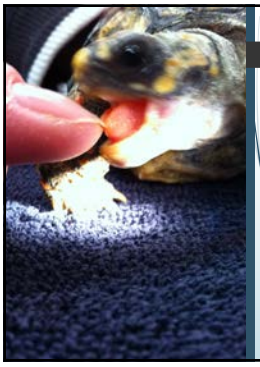
- Gently hold them by the shell in your palm
- Avoid making movements around head or face
- Mind the beak
  - Long necks
- Snappers: Bottom shell and tail

Snappers



Pointers Before you Start A Reptile PE

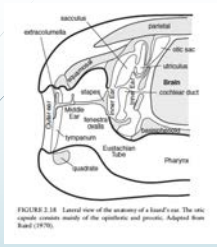
- Priority: Keep the animal comfortable and be safe
- You keep calm
- Let their anatomy guide you through the exam, its beautiful
- Mother Nature's most energy efficient designs



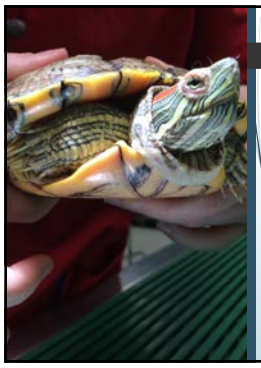
Oropharyngeal Exam

- Mucous membranes color and moistness
- Dentition (Jaw & Beak Exam)
- Glottis (Opening to Windpipe)
- Tongue Evaluation
- Roof of the mouth

EAR



Herpetology. Introductory Biology of Amphibians & Reptiles. 2nd. 2001



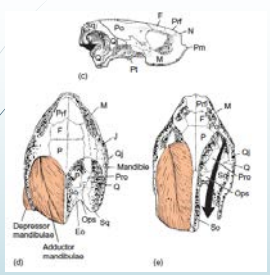
Eyes

- Eyes dull or appear sunken?
  - Estimate Dehydration
- Surface or internal eye trauma, punctures or damage?
- Cranial nerve overview:
  - Corneal+ palpebral (5,7), Globe retraction (5,6,7), Pupil position (3,4,6,8), Menace (2,7)
- Response to light?
  - Atropine cannot dilate their pupils

Body Condition & Hydration

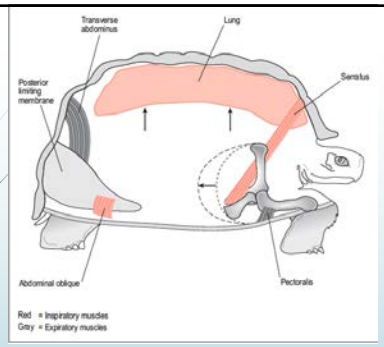
- Eyes → venous sinus → periorbital fat pads → head muscles
- Are the eyes sunken?
  - Dehydrated
- Are the head muscles collapsed as well?
  - Severely deydrated
  - Emaciated

Body Condition



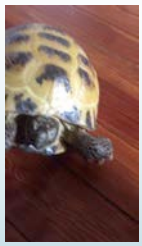
Respiratory System

- Large red blood cells
- Lungs and Saccular lung = 10 times the amount of air
- No diaphragm
- RR = 12-20 bpm is normal



O' Malley: *Clinical Anatomy and Physiology of Exotics Species* 2005

Getting a Respiratory Rate



Skin

- **Any breaches? Lacerations, Cuts? Characterize wounds**
- **If injured/diseased- how much of the skin is affected?**
- Are they shedding?
  - Characterize based on hydration status
- Any scars, vesicular dermatitis, lacerations, discoloration?

Shell: Skeleton + Skin

GI, Reproductive Tract & Urinary System

- Dependent on sex
- Dependent on feces/urine noted
- Eggs?
  - Intact
  - Fractured?
  - Color?
  - Texture?
- Urates/Urine
- Feces?
  - Odor?
  - Color?
  - Blood present

CLINICAL TECHNIQUES & MEDS

Brief Overview

- Antibiotics
- Analgesics
- Fluid Therapy
- Drug Administration Routes

First thing's first . . . .

Heat is a treatment

Thermoregulatory support GOVERNS the metabolism of fluid therapy, pain meds, antibiotics, and healing!

Common Herp Antibiotics

- **Ceftazidime**
- Metronidazole
- Trimethoprim sulfamethoxazole
- Enrofloxacin
- Chloramphenicol
- Cetiofur
- Azithromycin
- Florfenicol
- Ticarcillin
- Tulathromycin
- Danofloxacin

Antibiotics to Avoid

- Amikacin without good reason
- Baytril without cultures

"Review of bacterial and fungal culture and sensitivity results from reptilian samples submitted to a UK laboratory." *Veterinary Record 169.15 (2011): 390-390.*

Emerging Patterns of Resistance

	Ocular Isolates	Cutaneous	Respiratory	Oral	Abscess
Testudines	Coagulase-negative *Staphylococcus* (20%)	*Escherichia coli* (17%)	*Moraxella* (22.6%), *Escherichia coli* (12.9%)	*Escherichia coli*, *Moraxella*, non-fermenter species (12%)	*Escherichia coli* (17.4%)
Saurians	Coagulase-negative *Staphylococcus*, *Citrobacter*, *Pseudomonas aeruginosa* (33.3%)	*Proteus* sp, *Pseudomonas aeruginosa* (18.8%)	—	*Pseudomonas aeruginosa* (33.3%), *Proteus* (26.7%)	*Pseudomonas aeruginosa* (25%), *Salmonella* sp (16.7%)
Ophidians	—	*Pseudomonas aeruginosa* (16.7%)	*Pseudomonas aeruginosa* (15.4%)	*Pseudomonas* sp. (20%), *Stenotrophomonas maltophilia* (20%)	*Mixed Anaerobes* (17.4%)

Treating Pain

(ARAV 2013: Doug Mader):

"Its easier to prevent pain than to chase it."

- What are our options?
  - Opioids
  - NSAIDS
  - Local Anesthetics
  - ? Alpha 2's (Vet only)

Pain Medication: Opioids

- Receptor are exquisitely SPECIES SPECIFIC.
  - Tapentadol 5mg/kg PO q12h (T.Giorgi 2014 ARAV)
  - **Tramadol 5mg/kg PO q24h (Baker 2011), 10 mg/kg q48 (Norton)**
  - Morphine in turtles→ severe resp depression + anagelsia (Kladsky 2007)
  - Buprenorphine PK→ not clear (Murrow 2008)
  - Hydromorphone 0.5mg/kg in RES → analgesia, didn't measure res dep (Mans 2012)

Pain Medications: NSAIDs

- Less literature available
- **(THIS DRUG CLASS CAN HURT THE KIDNEYS, GUT, AND BLOOD CLOTTING)**
  - Ketoprofen 2mg/kg, t1/2 of >31 hrs (Tuttle 2006) !!!!
  - Meloxicam 0.2mg/kg q24h in green iguanas (Divers 2010)
  - Meloxicam in ball pythons? 0.3mg/kg -> no analgesia (Olsen 2008)
    - Wrong analyte (cortisol) measured for stress response (corticosterone) in reptiles !!!
    - So what does this mean?
- **So what do you do?**
  - Talk to your veterinarian

Analgesia: LOCALs

- Use locals during painful procedures, always!!!
  - Use Bird tox doses for reference
  - Max Lidocaine 2.2mg/kg, Bupivicaine 0.5mg/kg for local infiltration
  - Mader 2013 ARAV: 6mg/kg lidocaine max, 1mg/kg max bupivicaine

Estimating the Fluid Therapy Needs

- 5% Dehydrated
  - Dry oral cavity
- 8-10% Dehydrated
  - Sunken Eyes
  - Skin Folds
  - Depression
- Account for Ongoing Losses:
  - Breathing Heavy and Fast
  - Diarrhea
  - Blood Loss

Normal

Photos: Harriet Forrester

Fluid Therapy

- *Clinical Reference*: @ right temp → operate with plasma osmolalities similar to mammals, but can trend much higher
- How Much?
- 10-20 mls/kg SQ q24-48 hours
  - Distribute across different routes
  - Keep AQUATICS IN THE WATER
- How to calculate:
  - 0.450 kg turtle x 10mls = 4.5 mls

Fluid Therapy Delivery

- Cloacal & integumentary
- Humidity of ambient environment
  - Nebulization
- Oral
- SQ
- Coelomic

Fluid Therapy: Where?

- SQ versus IC
  - SQ:
    - THERE IS A SQ SPACE IN HERPS.
    - Dynamic Space during sheds (lymphatic cleavage zones).
  - Intra-coelomic:
    - Doesn't the animal need fluids in its vascular supply? Are you drowning it?
    - Does it have the plasma proteins to absorb your IC fluids?
    - Can be dangerous to do. You can easily puncture air sacs and bowel.

Humidity Therapy

- Nebulization: help maintain ambient humidity
- Drug Delivery:
  - Need small particle size (3-5um) to enter faveoli
    - Ultrasonic nebulizers are best
  - Agents
    - Saline
    - Mucolytics?
    - Antibiotics, Antifungal

Sites of Drug Delivery

- Oral (SAFE if animal has a functional GI)
  - in a treat or on the tongue, gavage, ETube
- Subcutaneous
- Inguinal fossa

Sites of Drug Delivery

- Intramuscular
  - Testudines: Cranial forelimb (lateral, biceps mm)

Sites of Drug Delivery

- Intravascular (for vets)
  - Testudine: jugulars, avoid subcarapacial sinus
- Cloacal: ESSENTIAL for fluid therapy

Suspected Infectious Diseases

Quarantine is Extremely Important

Mycoplasma	**Endemic in Gopher Tortoises**
Herpes	**Reported in Wild box turtles**
Ranavirus	**Causing Population Declines in the US**

Mycoplasma

- Cause of chronic upper respiratory disease in tortoises
- Population declines of Gopher Tortoises in the 1970
- **Most well-researched pathogen in reptile medicine**
- Never cure animals, just treat to reduce clinical signs

Mycoplasma

- *M.agassizzi* in tortoises
- *M.testudinum* (less pathogenic)
- New strain
  - Now in Eastern Box turtles, Bogs, Spotted Turtles
  - Wild Snappers and Wood turtles in NY tested negative
- High morbidity
- Affects olfaction
- Severe affected tortoises moved long distances in short periods of time

Mycoplasma: Updates

- 58/83 (70%) of 83 bog turtles
- 3/3 of three eastern box turtles (100%)
- 2/11 (18%) spotted turtles.
- Wood turtles and snappers tested negative
- All Asymptomatic

Mycoplasma Clinical Signs

- Runny nose
- Trouble breathing

Mycoplasma : Clinical Signs

Signs of Chronic Tearing and Runny Nose

- Depigmentation Around eyes, nose

Mycoplasma Treatment

- Baytril: Not IM and not in the nares
  - pH of 11, can chemically burn muscle and tissue
- Clarithromycin
  - (ARAV 2014): 20mg/kg PO q48-72h did not suppress Mycoplasma
- Supportive care
  - Warm air nebulizations, fluid therapy, anti-inflammatories if stable

Mycoplasma Treatment

- 5mg/kg Tulathromycin IM q10d
- 6 mg/kg danofloxacin SQ q2d has been used to treat symptoms of Mycoplasma infections in tortoises *(Gibbons 2013)*

Mycoplasma Control

- Highly contagious
- Extremely environmentally stable
- Quarantine and strict biosecurity is recommended

- Disinfection
- Steam-treatment,
- Formalin (10%)
- Glutaraldehyde (2.65%)
- Possibly 5% to 10% ammonia

Herpes

Herpes: Who?

Terrapene Herpesvirus 1 (Kane 2016)

Eastern Box Turtles in Illinois & Tennessee

- Prevalence of THV1 was 31.3% with seasonal changes
  - July, prevalence was 52% and May as low as 13.3%
- Largely asymptomatic

New Strains And New Hosts?

- Spotted turtles *(Clemmys guttata)*
- Asymptomatic!

What Does Herpes it Look Like?

- Necrotic Plaques in mouth
- Conjunctivitis
- Nasal discharge
- Ocular discharge

Herpes Anti-Viral Updates

Treatments

Supportive Care

- Valacyclovir 2014
  - Doesn't stop herpes from killing cells in culture
  - Study in EBT: 40 mg/kg PO every 24 hours
- Gancyclovir 2014
- 25 and 50 µg/mL in vitro kills herpes

Ranavirus Quote

"The Ebola of Box turtles, except there's no need for direct contact"

- Matthew Allender

Ranavirus

Box turtle with ranavirus by: Scott Famsworth

What Does it Look Like

Survivorship and Clinical Course

- Rare for adult box turtles to live longer than 2 weeks with the virus
- Experimental model in juveniles, 100% mortality was noted 26 days at 22C, 30 days at 28C (Allender 2016)
- Median treatment in ranavirus in EBTs 49 days *(Sim ARAV 2012, 2015, 2016)*
- Release? Survivors and become re-infected and shed (Hausmann 2015)

Treatment

- Fluid therapy, warm water soaks, systemic and topical antibiotics, nutritional support, Vitamin A and D_3 supplementation, and potential anti-viral therapy (Gibbons 2013)
- Thermal support (30C) may help improve survival odds (Allender 2016)

Ranavirus Control

- Strict Quarantine
- FV3 is resistant to drying (Nazir 2012)
- Can last up to
  - 34 days in pond water at 22C
  - 102 days at 4C
  - 30-48 days in soil

Ranavirus Control

- One minute exposure (Bryan 2009)
  - Chlorhexidine (0.75%)
  - Sodium hypochlorite (3.0%)
  - Virkon S (1.0%)
- Potassium permanganate at 2 ppm or 5 ppm
  - Ineffective at inactivating the virus

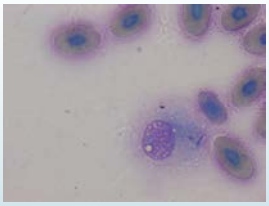
Ranavirus Take Home Points

- FV3 causes disease in arurans and testudines in North America
- Clinical Signs: Severe conjunctivitis, oral plaques, stomatitis, glossitis
- Treatment: Supportive
- Control: Quarantine and disinfection
- Release? Survivors and become re-infected and shed (Hausmann 2015)

All Three At Play

Mycoplasma, Herpes, Ranavirus

Bacteremia



Who Should I Report to?

PARC PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

http://www.parcplace.org/parcplace/resources/disease-task-team.html

Email:
Herp_disease_alert@parcplace.org

WOUND MANAGEMENT

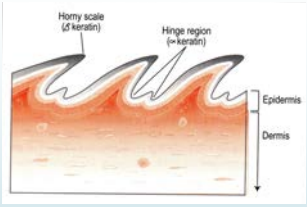
REPTILE SKIN FUNCTION

- The largest organ of the body
- Physical barriers
  - Immune System
  - Prevent Dehydration
  - Prevent Physical Injury
  - Vitamin D & Calcium Absorption

REPTILE SKIN FUNCTION

- Metabolic Thermometer
- Communication
  - Neurologic
  - Affective
  - Breeding

STRUCTURE OF NORMAL REPTILE SKIN

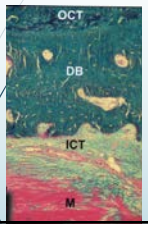


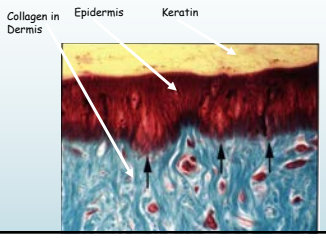
O'Malley: *Clinical Anatomy and Physiology of Exotics Species* 2005

STRUCTURE OF THE SHELL

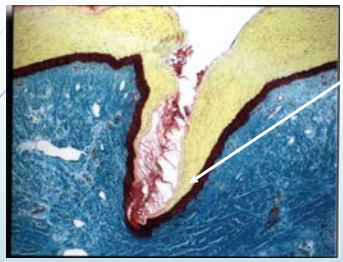
Jacobson: *Infectious Diseases & Pathology of Reptiles* 2008

OCT: Outer connective tissue
DB: Dermal Bone
ICT: Inner connective tissue
M: muscle





STRUCTURE OF THE SHELL



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The relationship of Dermal bone to Epidermal Scutes

Jacobson: *Infectious Diseases & Pathology of Reptiles* 2008

Quick Summary Wound Healing

- **1. Immediate Response**:
  - Hemostasis (clot formation
  - **a**nd a scab)→ Time: seconds
- **2. Inflammation**:
  - White blood cells move in, block infection and prepare for recons**t**ruction→ Time: 24-48 hrs
- **3. Proliferation:**
  - Epithelium migrates across **th**e wound): Day 3-10
- **4. Maturation:**
  - Wound contraction, repair, rebuilding the skin strength to normal) Days: 21- years (84 days in lizards)

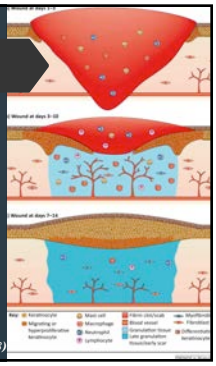


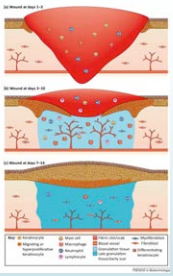
Image : Nature Reviews Molecular Cell Biology ***9, 628-638 (August 2008)***

HOW DOES THE SKIN HEAL?

- Immediate Response:
  - Hemostasis (clot formation and a scab)

Time

- Mammals: within seconds to minutes
- Lizards: variable time, if a clot forms
- Snakes: immediate clot



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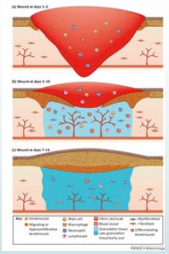
HOW DOES THE SKIN HEAL?

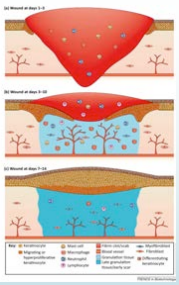
- Inflammation (white blood cells move in, block infection and prepare for reconstruction)



Time
- Mammals: 24-48 hours, Lasts 1-3 days
- Lizards: Variable, begins 6 hrs, lasts up to 30 hrs
- Snakes: 24 hrs, lasts up to 5-10 days

HOW DOES THE SKIN HEAL?

- Proliferation (epithelium migrates across the wound)



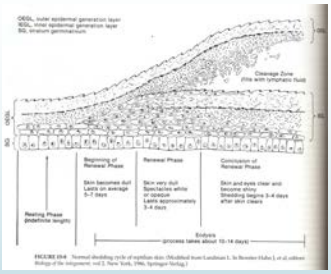
Time
- Mammals: 24 hrs to Day 4
- Lizards: 30-40hrs to Day 10
- Snakes: appears by Day 5-10

HOW DOES THE SKIN HEAL?

- Maturation (wound contraction, repair, rebuilding the skin strength to normal)

Time
- Mammals: Day 21 to 2 years
- Lizards: appears by Day 84
- Snakes: Day 21-42

SHEDDING & HEALING



A CLOSE LOOK AT THE SKIN

Shed Cycle: Resting Phase

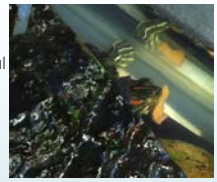
Jacobson: *Infectious Diseases & Pathology of Reptiles* 2008

Shed Cycle: Phase 4/5

WHAT AFFECTS HEALING?

- Environmental Temperature
  - Healing is temperature dependent
- Shedding Frequency
  - Age, season (thyroid levels), and HYDRATION status
  - Dehydration DELAYES wound healing

WHAT AFFECTS HEALING?



- Stress
  - ↑ Corticosterone levels (internal steroid), Pain
- Season
  - ↓ TSH, Photoperiod
  - ↓ Temperature
- Diet
  - Protein and Vitamin Intake

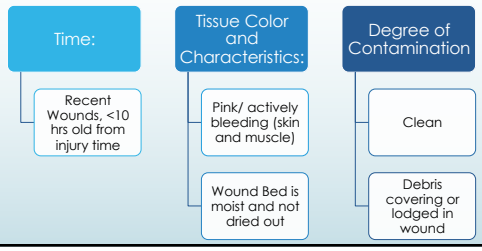
WHAT AFFECTS HEALING?

Existing Disease	• Liver Disease • Renal Disease • Endocrine Disease • Infectious Diseases
Topical Medications & Tissue Manipulation	• Ointments?

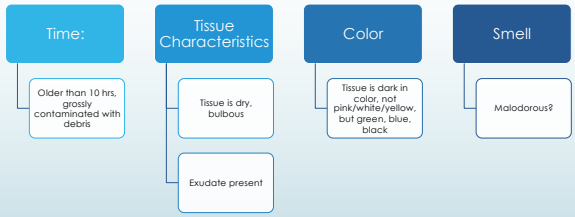
CLASSIFYING WOUNDS

- Fresh Wounds
- Chronic Infected Wounds
- Necrotic Wounds
- Large Wound Defects

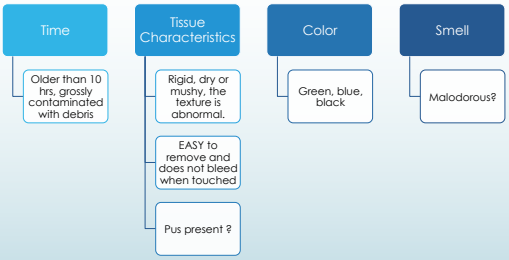
WHAT'S A FRESH WOUND?



WHAT'S A CHRONIC, INFECTED WOUND?



WHAT'S A NECROTIC WOUND?



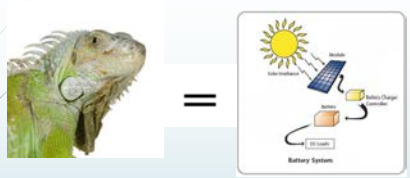
YOUR TREATMENT PLAN

1. Pain Management
2. Provide Environmental Heat
3. Decontaminate & Irrigate
4. Bandage
5. Correct Underlying Illness

PAIN MANAGEMENT

- Systemic Pain Medication
- Local Analgesics
  - Lidocaine (2.2mg/kg splash)
  - Bupivicaine (0.5-1.5mg/kg splash)
- Tissue Handling
  - Prevent wound drying
  - Stabilize tissue

WHY IS HEAT SO IMPORTANT?



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- Reptiles are Solar Batteries
- Metabolic energy demands: 1/10th that of mammals
- Metabolism, immune function, digestion, normal appetite, normal activity

IRRIGATION & DECONTAMINATION

- Saline
  - Gold standard for most situations
  - 30cc syringe with a 19G needle: jet blast to
  - microdebride!
- Iodide
  - Dilute to stimulate re-epithelialization but NOT be cytotoxic at 1:10 dilution

IRRIGATION & DECONTAMINATION

- Peroxide
  - Cytotoxic
- Chlorhexidine
  - BE CAREFUL
  - Concentration dependent cytotoxity
  - 0.05% chlorhexidine

PRIMARY LAYERS: DECONTAMINATE

- Gel -To-Dry, with Hydrogel:
- SIMPLE AND STILL EFFECTIVE
- PAINFUL
  - Sterile saline, hydrogel and gauze
  - For dry wounds
- For 2-5 days to remove leathery, necrotic flesh, severely infected tissue

PRIMARY LAYER: DECONTAMINATE

- Grossly Infected Wounds, Necrotic Wounds
- Hypertonic Saline
  - Osmotic action to remove necrotic tissue and bacteria.
  - First 24 hr bandage only
  - Risk wound drying
  - **LL has replaced with honey . . .**

PRIMARY LAYER: INHIBITING BACTERIA

- Prevent Infection
- Silver impregnated bandages/gels
- Classic:
- Silver Sulfadiazene Crème
  - Antifungal, viral, bacterial and
  - Anti-Pseudomonal
  - Does it help or hurt wound
  - healing in reptiles?

PRIMARY LAYER: INHIBITING BACTERIA

- **Manuka Honey** (methylglyoxal in this specific honey- flowers in New Zealand)
  - Hyperosmolar
  - Anti-inflammatory
  - Prevents bacterial resistance
  - Not painful
  - Antifungal, viral, bacterial
  - Anti-
    - Staph
    - MRSA
    - Pseudomonas

How Does Honey Work at What Stages of Healing?

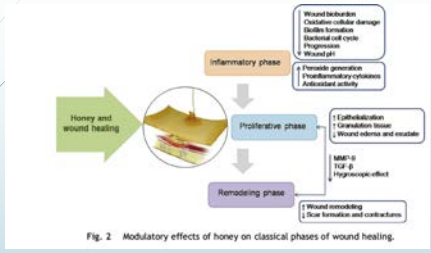


Fig. 2 Modulatory effects of honey on classical phases of wound healing.

Biological properties and therapeutic activities of honey in wound healing: A narrative review and meta-analysis. 2015. Journal of Tissue Viability. http://dx.doi.org/10.1016/j.jtv.2015.12.002

Manuka Honey Verdict

Manuka Honey rivals SSD/saline/hydrogel and sugar in action and best practice for . . .

- Acute burns
- Shallow lacerations (vs hydrogel)
- Chronic infected ulcers
- Pain reduction at site of lesion

Biological properties and therapeutic activities of honey in wound healing: A narrative review and meta-analysis. 2015. Journal of Tissue Viability. http://dx.doi.org/10.1016/j.jtv.2015.12.002

PRIMARY LAYER: ENCOURAGING GRANULATION

- Wound Bed Support
- Macrophages secrete enzymes (MMP) which use *calcium* to degrade necrotic tissue
- Alginate "entraps" enzymes to stay at the site

PRIMARY LAYER: GRANULATION SUPPORT

- Day 5-10
- Healthy tissue in wound bed
- Semi-occlusive, helps maintain wound bed moisture
- Provides scaffold for contract for wounds with large defects

PRIMARY LAYERS: OCCLUSIVES

- Hydrogels
- Dry wounds + promote auto-lytic action
  - Not for heavily contaminated wounds
- Conform to the wound
- Bacterial barrier
- Moist environment
- Changed every 4 to 7 days

PRIMARY OCCLUSIVE FOR DRY WOUNDS

- Hydrogels
- Hydrocolloids
  - Wound Moisture
  - Promotes autolytic action in wound (WBCs clean up dead debris)
  - NOT for heavily contaminated wounds

PRIMARY LAYER FOR DRY WOUNDS

- Tegaderm
- Moist allow gas exchange but no fluid exchange
- Tegaderm can be used as a tertiary layer in some cases

SECOND AND TERTIARY LAYERS

- Second Layers
  - Protective
  - +/- Absorptive
  - Cast padding, dry gauze
- Tertiary Layers
  - Stabilize the bandage
  - VetWrap, Elastikon, Tegaderm
  - Avoid Duct tape and non-breathable dressings unless indicated
    - Healing is O2 dependent!

MAKING IT FIT!

- Pockets and Packing Wounds
  - Umbilical Tape
- Wounds with No curves
  - Simple interrupted or Tegaderm as a holding tertiary layer

CORRECTING EXISTING ILLNESS

- Dehydrated?
  - Mandatory cloacal soaking
- Poor Body Condition?
  - Assist Feed with the right stuff.
  - Start 1/3 of the normal amount then increase

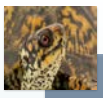
Shameless Plug

Come to the Nutrition Lecture!!

Diet breakdown: Chelonians

AQUATIC TURTLES

- Aquatic Veggies
- Feeder fish
- Pellets
- Insects
- Yellow-bellied Cooters: veggies only



BOX TURTLES

- Weeds, Garden Veggies
- Slugs/earthworms
- Berries
- Flowers

TORTOISES

- 100% plants only
- Weeds, fibrous roots
- REMEMBER= adapted to live in the Desert

COMPARATIVE WOUND HEALING TIMELINES

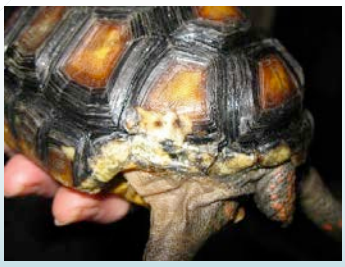
TRIAGING SHELL DAMAGE

STABILIZATION

10 DAYS LATER

30 DAYS LATER

120 DAYS LATER



Honey: Snake Wound

Day 0

Manuka Bandages

Manuka Honey

Week 1

Week 3

Zip Ties in Action!

Shell Stabilization: Harriet Forrest!

- Thank you for Developing this Technique!

Shell repair tools

- Instant glue
- Devcon 2-ton® waterproof epoxy
- Cable tie mounts
- Cable ties
- Cable tie gun

Slides : Harriet Forrester

Turtle Rescue of New Jersey

Shell Repair

- Clean fracture site
- Position tie mounts with superglue

Slides : Harriet Forrester

Turtle Rescue of New Jersey

Shell Repair

- Cover tie mounts with waterproof Devcon 2-Ton® epoxy
- Let dry for 24 hours

Slides : Harriet Forrester

Turtle Rescue of New Jersey

Shell repair

After the epoxy is dry, the first cable tie is inserted through the tie mounts

Slides : Harriet Forrester

Turtle Rescue of New Jersey

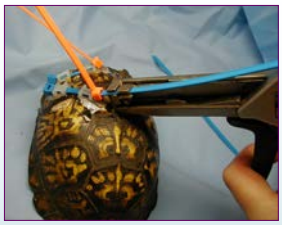
Shell repair

The second cable tie (red) is then slipped over the end of the first (blue)

Slides : Harriet Forrester

Turtle Rescue of New Jersey

Shell Repair



The end of the blue cable tie is placed in the cable tie gun. The trigger is slowly pressed to tighten the red cable tie against the tie mount.

Slides : Harriet Forrester

Turtle Rescue of New Jersey

Shell repair

After the cable tie is tightened, cut off the long ends.

Any number of mount pairs can be used, depending on the size and shape of the fracture.

Slides : Harriet Forrester

Turtle Rescue of New Jersey

Shell repair

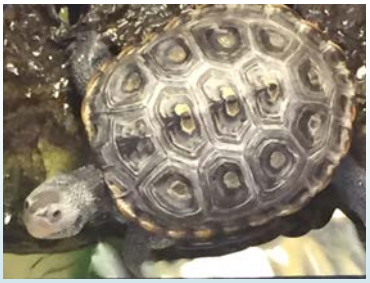
After the shell has healed, simply pop the mounts off with a flat edged tool.

Slides : Harriet Forrester

Turtle Rescue of New Jersey

Conclusion

- Recover as MUCH info from the Physical Exam to plan Triage
- Estimate hydration status, tissue damage
- Isolate infectious disease suspects
- Heat First
- Start systemic and local pain medications, antibiotics as needed
- Stabilization wounds . . .
- Reassess and support during recovery



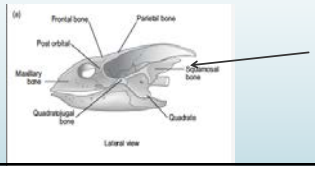
Turtle Necropsies

Why Do A Necropsy?

- To learn . . . .
- Anatomy
  - Species Specific Anatomy
  - Abnormal anatomy
- Diagnosis
  - Course of Disease
  - Confirm Cause of Illness
- Teach

Confirmation of Death

- High tolerance of Anoxia in Freshwater turtles
- Pith to confirm



Basic Necropsy Tools

- Knife
- Scissors
- Forceps
- Bonecutting instruments
- (rongeurs and shears)
- Cutting board
- Scalpel
- Camera
- Plastic Ruler

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Basic Necropsy Tools

- Slides
- Alcohol
- Culturettes
- Rubber Gloves
- Protective Gear
- Biohazard Bags
- Disinfectants: 10% bleach solution or chlorhexidine

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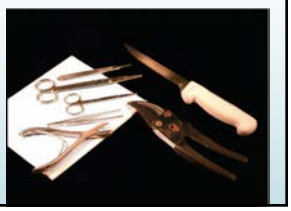

Getting Through the Bridge

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- Striker Saw
- Dremel Saw

Basic Collection Material

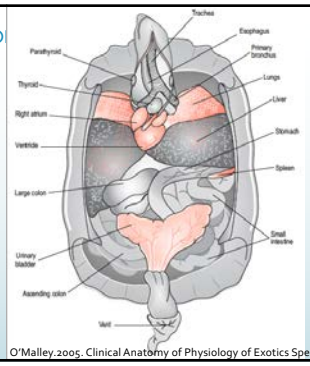
In preparation

- Refrigerate carcasses in dedicated fridge
- Perform "diagnostic" necropsy within 72 hrs of death
- Choose a dedicated space that can be disinfected (garage space, dedicated room- never near rooms frequently inhabited in the house)
- Disposal bags for biohazard material

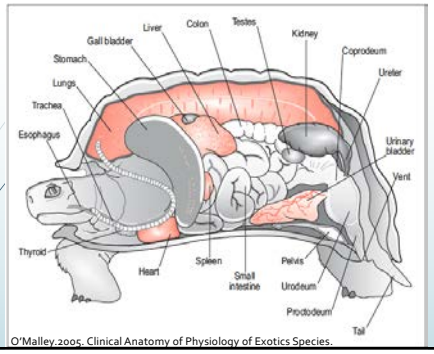
Visual Examination

- Write down:
  - Species
  - Weight
  - Body condition
  - Date of death
  - Estimated age
  - Carcass condition
- Shell Sheet: Measure and mark all shell lesions on your Chelonian shell topography form
- Take pictures of the carcass and obvious lesions

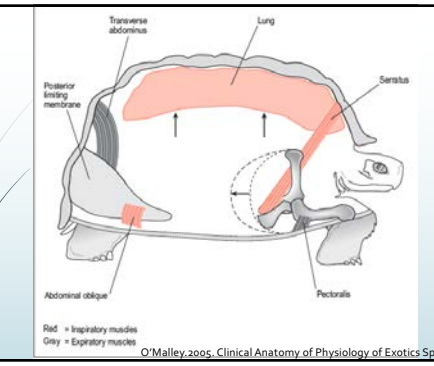
No



O'Malley.2005. Clinical Anatomy of Physiology of Exotics Species.



O'Malley.2005. Clinical Anatomy of Physiology of Exotics Species.



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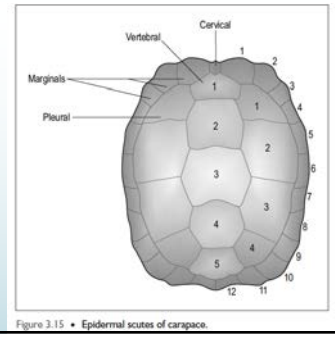


Figure 3.15 • Epidermal scutes of carapace.

O'Malley. 2005. Clinical Anatomy of Physiology of Exotics Species.

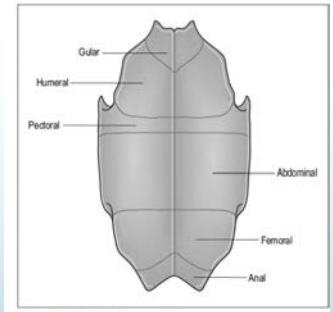


Figure 3.16 • Epidermal scutes of plastron.

D

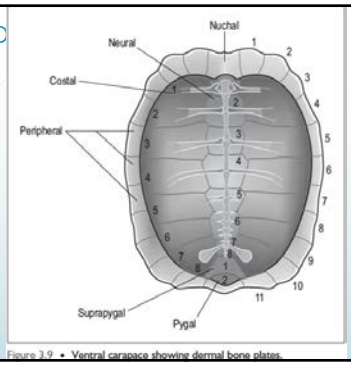


Figure 3.9 • Ventral carapace showing dermal bone plates.

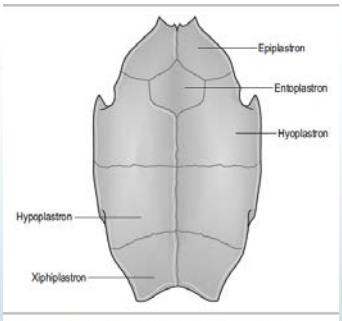


Figure 3.10 • Ventral plastron showing dermal bone plates.

The Approach

- Place Turtle on its back
- Saw: strike through the bridge on both sides to separate the plastron from the animal
- Knife- remove skin and muscle attachments of the plastron from arms and legs
- Remove plastron

Take a Picture!

- All photos from Jacobson unless otherwise indicated

Oral Cavity

- Cut gular attachment near lower beak to expose oral cavity
  - Take samples
- Cut neck continuing down until you can remove the trachea and esophagus down to base of forelimbs

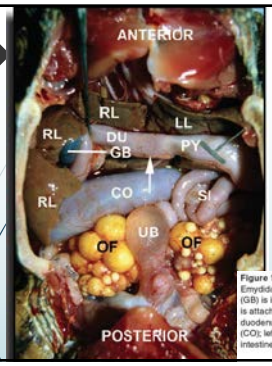
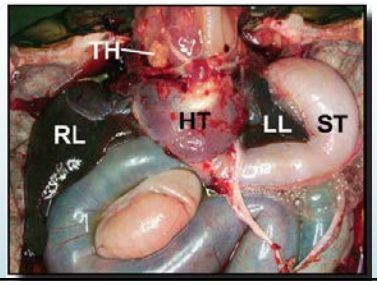


Figure 1.124. Red-eared slider, *Trachemys scripta elegans*. Emydidae. Ventral view of the coelomic cavity. The gallbladder (GB) is in the right lobe (RL) of the liver. The pancreas (arrow) is attached to the serosal surface of the pylorus (PY) and duodenum (DU). The following structures are also seen: colon (CO); left lobe of the liver (LL); ovarian follicles (OF); small intestine (SI); urinary bladder (UB).

Thymus Thyroids and Heart

- Examine and remove thymus, thyroids and heart before removing additional viscer
- Evaluate and remove liver lobes from stomach attachments
- Tie off the stomach and remove it in situ extending all the way down to the cloaca

Figure 1.267 Gopher tortoise, *Gopherus polyphemus*. Testudinidae. Ventral view of the anterior coelomic cavity. The heart (HT) is located between the left lobe (LL) and right lobe (RL) of the liver. Also seen are the stomach (ST) and thymus (TH).



Bladder, Kidneys, Adrenals

- BLADDER Is HUGE!!
- Can remove and examine, just ventral to the rectum
- Once GI and bladder are removed, gain access to the kidneys, gonads and adrenals
- Delicately remove lungs from trachea down
- Evaluate limb muscle, open joints and confirm normal appearance
- Remove head from occipital region
- Shell samples- use ronguers or Dremel to sample

Kidneys, Bladder, Adrenal Gland, Colon, Testes

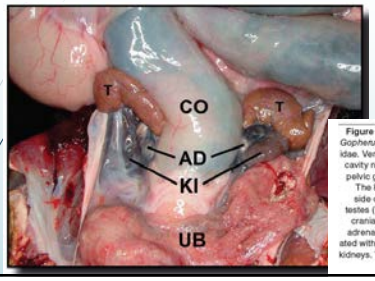


Figure 1.186 Gopher tortoise, *Gopherus polyphemus*. Testudinidae. Ventral view of the coelomic cavity near the pelvic canal. The pelvic girdle has been removed. The kidneys (KI) are on either side of the colon (CO) and the testes (T) are in contact with the cranial surface of kidneys. The adrenal glands (AD) are associated with the medial aspect of the kidneys. The urinary bladder (UB) is bilobed.

Uri

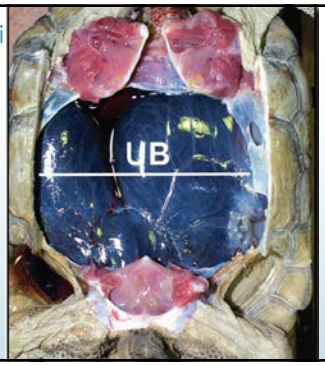


Figure 3.27 • Post mortem appearance of ovarian follicular stasis in a solitary kept Spur-thigh tortoise (*Testudo graeca*) that died from pneumonia. Note the huge muscles mass of the cranial and caudal trunk muscles.

Where Do I Send Samples?

- **State Diagnostic Lab / Academia**
- **Your Wildlife veterinarian (USDA)**
- **Specialty Services**
  - Zoo & Exotic Pathology : http://www.zooexotic.com/
  - Northwest Zoo Path: http://www.zoopath.com/

Costs for Samples

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Table 4.1 Fees for diagnostic and pathology services at regional diagnostic labs (some fees only for valid in-state submissions). These labs were chosen as examples; most states have a diagnostic lab to which samples may be submitted. Prices are listed in U.S. dollars.

	Illinois State Veterinary Diagnostic Lab[a]	University of Georgia College of Veterinary Medicine, Athens Lab[b]	Colorado State University Veterinary Diagnostic Laboratory[c]	Florida Animal Health Diagnostic Lab[d]
Necropsy plus histology	$90	$35	$60	$25
Surgical biopsy or individual tissue histologic evaluation	37	25	30	30
Bacterial culture	18	8	15	10
Toxicology (lead evaluation used as example test)	17	15	10	30
Parasitology	9	7	15	5

[a] Source: http://www.cvm.uiuc.edu/vdi/FEE_SCHEDULE_2003.html December 2004.
[b] Source: http://hospital.vet.uga.edu/dlab/fees.php May 2006.
[c] Source: http://www.dlab.colostate.edu/security2/test_price.cfm May 2006.
[d] Source: Personal communication, Florida Animal Health Diagnostic Lab, April 2006.

Saving Tissue

- Frozen
  - Partner with your veterinarian
- Formalin
- Consult a pathologist about next best steps

Let's Get Started!

Recommended Resources

- Jacobson. 2007. Infectious Diseases and Pathology of Reptiles
- O'Malley. 2005. Clinical Anatomy & Physiology of Exotic Species.
- Find a pathologist and make a friend ☺