



# Wound Management

Dr. Nancy Mettee, WIDECAST  
Director of Sea Turtle Medicine

# Sharp trauma

---

- Clean/sharp margins
- Typically from propellor, skeg, or propulsion system but also some bite wounds
- Stab = deeper than long
- Incision = longer than deep



# Blunt trauma

---

- Ragged wound margins
- Crushing/laceration (tear in dermis, often with bridging)
- Compression/cavitation
- Contusion = bruise, closed injury
- Abrasion, scrape caused by friction or stretching



# Constriction injury

---

- Slow crushing
- Circumferential loss of blood supply
- Tourniquet effect
- May result in traumatic amputation
- Typically affect mid shaft extremity
- Treatment varies on severity

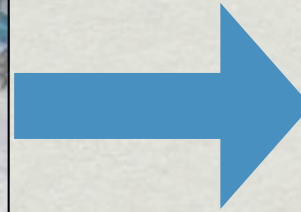


# Aging of injuries

## 3 STAGES OF HEALING



Acute/inflammatory phase



Proliferation phase



Maturation phase

*by convention,  
"acute" is  
within 24 hours  
of injury*

# Inflammatory phase

- Days
- Active bleeding
- Oozing serum
- Sharp edges
- No necrosis (dead tissue)
- No exudate (pus)
- No malodor



# Proliferation phase

- Weeks
- Well vascularized (red or pink) scar tissue
- Wound margins rounded
- Necrosis evident
- Infection (pus and malodor) evident, yellowish scab like material adherent to wound
- Tissue reorganization to epithelialize wound (cover over defect)



# Maturation phase

- Months
- Tissue remodeling to form dense scar
- Organized, smooth granulation tissue
- Low vascularity (pale or pigmented in final stages)
- No bleeding
- No exudate
- No infection/odor





# Individual factors affecting healing

---

- All sea turtle wounds are contaminated, culture and sensitivity is ideal
- Common culprits: E. Coli, Pseudomonas (often very resistant), Vibrio, Citrobacter, Aeromonas, and Salmonella
- Anorexia and hypoproteinemia (TS <1.5 mg/dl) will delay healing
- Necrotic tissue in the wound is food for infectious organisms!
- Dry dock results in impaired circulation
- Fungal infections are common in cold stunned and immune compromised individuals
- Appropriate diet, vitamin supplementation, stress



Wound management technique will depend on resources available

# Environmental factors affecting healing

---

- Holding temperatures of 75-85 degrees F (23-29 degrees C) will stimulate the immune system and improve metabolism
- Fresh water can damage exposed tissue
- Water quality : **“pre load”** bacteria present in incoming water, may be reduced or eliminated with filtration or by manufacture of sea water
- Water quality: **“load”** bacteria originating from patient exudate, decaying food material, or excrement, may be reduced by addition of chlorine to water (0.5-1 ppm chlorine), hygiene, and high flow rate of water
- Water quality: **“after load”** bacteria originating from other tanks/pipes as backwash, may be prevented with one way valves (require maintenance)
- Ultraviolet light?

# Open wound management



- Simplest
- Remove necrotic tissue (debride) weekly
- Clean source of high flow water
- Extended antibiotics
- Relatively slow healing, 6-12 month rehab time

# Bandaging out of the water



- Short term only due to dry dock issues
- Daily bandages changes
- Honey pack is a very effective and economical antimicrobial
- Wet to dry bandages
- SSD ointment, other topical antimicrobials
- Can do compression for hemostasis, grenades for drainage
- Increased healing time (4-6 months)

# Bandaging in the water



- Long term therapy, improved circulation + food intake
- Negative pressure wound therapy (NPWT), bandage change every q1-7 days
- Silverlon bandage, occlusive bandage with tegaderm changed q24-48 hrs
- Must have access to patient for bandage changes
- More tolerant of poor water quality as wound is sealed
- Dramatically increased healing time 2-3 months
- Can manage very high mortality wounds successfully

# Open pneumocoelom



Lung leaks can result in collapse without intervention  
Negative pressure needed to prevent lung scarring  
VAC therapy is ideal



# Open coelom



Drainage needed to prevent coelomitis/sepsis (ventral placement needed if no suction available)  
Barrier may be needed to maintain viscera in place if defect is present (implantable mesh, prosthetic)



# Head trauma

---

- If neurocranium fractured very high mortality
- Head trauma + neurologic signs (tremors, spastic movement, hyperesthesia) is grounds for euthanasia
- Encephalitis common but may take weeks to develop
- MRI or CT scan ideal
- DO NOT VAC!



# Fracture repair

---

- Only if fracture results in marked instability
- Bone to bone healing unlikely (will form fibrous union)
- Drilling holes in carapace is painful, a source for infection, and screws will loosen due to micromovement of shell and localized osteomyelitis
- Fiberglass or other occlusive NOT advised due to risk of infection without improved outcome



# Carapace and skull are **dermal bone**

---

- Growth occurs at suture lines--not end plates as with osteochondral bone
- Growth can be manipulated by distraction (pulling apart) and compression (pulling together) to reduce defects
- Implants or semipermanent fixtures will actually restrict growth and result in deformities (particularly an issue with juveniles and sub adults)
- Individuals should not be released with an implant in place due to risk of complications