**Objectives**

- Explain wound care priorities in an austere or wilderness environment.
- Describe management considerations pertinent to animal bites and stings.

**Wilderness Wound Care Priorities**

1. 1) Identify wound type
2. 2) Achieve hemostasis
3. 3) Evaluate extent of injury
4. 4) Prevent infection
5. 5) Consider treatment options
6. 6) Consider the need for rapid evacuation
7. 7) **Principle**: In the wilderness, you do the best that you can with what you have!

**Wound Identification: Types of Wounds**

- Blisters
- Abrasions
- Lacerations
- Puncture wounds
- Amputations
- Open fractures
- Burns
- Animal & insect bites

**Achieve Hemostasis: Methods**

- Firm, direct pressure
- Layer dressings
- Elevation / pressure points
- Hemostatic dressing (kaolin-integrated gauze)
- Tourniquet: for life-threatening hemorrhage
- Shock management
- Hemostatic Dressings & Combat Tourniquets

**Evaluate Extent of Injury**

- Fully expose injured area and assess wound:
  - Location
  - Dimensions (width, length, depth)
  - Severity of contamination
  - Presence or absence of foreign body
  - Bone, tendon, joint & nerve involvement
  - Assess distal neurovascular & nerve function

**Prevent Infection**

- Typical contaminants:
- Skin flora: *S. aureus* (including methicillin-resistant species)
Soil: Clostridium & Pseudomonas species
Water: Vibrio, Aeromonas, Pseudomonas sp.
Oral flora from bites: Pasteurella, Eikenella & Streptococcus
Remove visible foreign material / contaminants
Irrigate wound: use cleanest water available; use water purification devices / tablets
Up-to-date on tetanus prophylaxis?

**Wound Care**

**Improvised Wound Irrigation**

- Consider Treatment Options: Leave wound open or close it?

**Factors**
- Time elapsed since injury
- Injury location
- Extent of contamination
- Injury severity & degree of underlying tissue involvement
- Injury mechanism / forces
- Immune competence of patient
- Proximity to definitive care

**Treatment: Wound Management Options**
- Judgment call – based on degree of contamination & potential for infection
- High risk wounds: Leave open
- Pack with saline or water-moistened gauze & dress; change packing 3X daily; oral antibiotics

**Wound closure:**
- Anesthesia available? Probably not...but, if so:
  - LET: topical lidocaine, epinephrine & tetracaine; massaged over wound for 20-30 min (associated with slight increase in wound infection rate)
  - 1% lidocaine for local infiltration (need supplies)
  - Ice

**Treatment: Wound Management Options**
- Methods to re-approximate edges: wound edges should touch but **not** be tightly pulled together
  - Tape: Wound closure strip or micropore tape / benzoin; duct tape with perforations made with a safety pin toward sticky side for wound drainage
  - Tie hair together using pieces of dental floss to knot & pull edges closed for scalp lacerations
  - Skin adhesives / glue (no topical antimicrobials if a cyanoacrylate product is used; will dissolve glue)
  - Staples – consider if available & wound will remain clean; never use on the face
  - Suture – not usually feasible unless in clinic setting

**Improvised Wound Closure Methods**
**Wound Dressing**
- Commercial non-adherent pads and / or dressing materials
- Cleanest available improvised materials (e.g., bandana, T-shirt)
- Wounds involving joints: consider splinting area to decrease risk of wound re-opening
- Topical antibiotics if no skin glue is applied: bacitracin best; neomycin OK, but more allergies
- Honey may act as a topical antimicrobial
- Change dressings at least once daily

**Antibiotics**
- Indications for **prophylaxis**:
  - Complex or mutilating wounds
  - Gross wound contamination / penetrating debris
  - Extensive ear & cartilage lacerations
  - Animal bites
  - Bone, joint or tendon penetration
  - Immunosuppressed patients or those with valvular heart disease

*Indications for **treatment**: Wounds with signs of infection

**Oral Antibiotics for Wounds**
- **Prophylaxis**: typically 3-5 day course
  - First generation cephalosporin
  - Amoxicillin-clavulanate
- For wounds from human & animal bites:
  - Metronidazole or Clindamycin, plus one of the following: (aerobic + anaerobic coverage)
    - Trimethoprim/sulfamethoxazole
    - Doxycycline (not for children)
    - Penicillin V potassium
    - Cefuroxime
    - Moxifloxacin

**Poisonous Snake Bite (US)**
- Native to all states except Maine, Alaska & Hawaii
- **Bite**: ~ 4,700 people / year
- Pit vipers are venomous at birth
- Snake bite-related deaths:
  - 2 to 5 deaths per year
  - More common in children & elderly
  - No antivenin, inadequate or late dose
  - Usually occur 18 - 32 hours after envenomation, but may occur earlier

**Snake Bite Risk Factors**
- Young, adult males
- Children < 10 years of age
- Persons under the influence of drugs or alcohol
- Use of snakes in religious rituals or “sport”

Crotalidae: Pit Vipers
- Rattlesnakes, Cottonmouths & Copperheads
- Heat sensitive pit between each eye & nostril; enables snake to locate warm-blooded prey
- Triangular head due to presence of venom glands; venom immobilizes & digests prey
- Two curved, canalized fangs--retract when mouth closed
- 3 pairs replacement fangs (fang replacement occurs throughout snake’s life)
- Snake regulates venom quantity based on size of prey; can inject from one or both fangs
- Amount of venom injected variable in defensive bites

Recognition of Envenomation Severity: No envenomation, Mild, Moderate, Severe

Manifestations Related to:
- Size of the snake (large snakes = more venom)
- Potency & amount of injected venom
- Depth of envenomation
- Location of the bite (vascular puncture or a bite to the face or neck can produce immediate crisis)
- Number of strikes (not all venom is injected with each bite; more bites = greater envenomation)
- Size & underlying health of victim

Advanced Interventions
- Tetanus prophylaxis / wound care; antibiotic prophylaxis not routinely indicated
- Contact Poison Control Center
- Consider antivenom (CroFab): Enhanced safety profile: no skin testing; best given within 6 hours
- Obtain EKG, CBC, coagulation profile
- Prophylactic fasciotomy not recommended; swelling from myonecrosis typically resolves with adequate antivenom dose
- Radiographic imaging to identify embedded teeth or fangs in bite wound
- Blood product transfusion not recommended; antivenom will usually reverse coagulopathy

CroFab--Crotalidae Polyvalent Immune Fab (Ovine)
- IV product introduced in 2001 to treat crotalid envenomation
- Specific antibody fragments of immunoglobulin G (IgG) bind & neutralize toxins
- Enhanced safety profile: No skin testing
- Administer within 6 hours if possible
- Contraindicated in known hypersensitivity to ovine (sheep) products, papain (papaya)
- Reverses coagulopathy & decreases edema
- Cautious use with known allergies to antivenom therapy, bromelain (a pineapple-derived enzyme), or mercury-containing products, renal / hepatic impairment & pregnancy.
- Dose: Reconstitute with 10 ml sterile water; add 4-6 vials to 250 ml NSS and infuse over 1-hour (slowly for first 10 minutes)
- Repeat 4-6 vials if needed then 2 vials q6h X 18 hours (same dose for adult & peds)
CroFab--Crotalidae Polyvalent Immune Fab (Ovine) ADR’s

- Serum sickness:
  Type III hypersensitivity reaction
  Develops within 3 to 21 days
  Skin rash appears first; progresses to fever, joint pain, malaise & pruritus
  Treated with oral steroids & diphenhydramine
  - Allergic reactions (usually mild to moderate):
    Pruritus & urticaria
  - Anaphylaxis rare, but more likely after prior CroFab treatment – sensitization can occur

Envenomation by a “Non-Venomous” Snake?

Wild Animal Bites: Know What Lives In Your Environment!

- Severity varies: depends upon animal & reason for attack; most do not attack unless provoked
- Most attacks occur far from definitive care (and involve a camera, alcohol or both!)
- Initial wound care similar to domestic animal bites
- Blunt trauma / crush injury common
- Antibiotic coverage is same as for domestic animals
- Wounds are tetanus-prone & generally left open
- Consider need for rabies prophylaxis

Wild Animal Bite Treatment Considerations

- Scene safety: Animal may still be in area
- Manage ABC’s: control massive hemorrhage
- Remove debris & foreign objects, including teeth
- Assess for fractures
- Evacuate for definitive care

Rabies

Treatment: No effective treatment for symptomatic disease; nearly always fatal!
If animal is not available, victim must start post-exposure prophylaxis. Post-exposure Prophylaxis:
#1 – Immediate wound cleansing – BZK, soap & water!
#2 - Human Rabies Immune Globulin—RIG: injected into bite site & IM for passive immunity
#3 - Rabies vaccine 1 ml Deltoid IM for active immunity (Days 0, 3, 7, 14 -- new CDC 4-dose regime) -
-Immunosuppressed patients: 5th dose day 28

Spider Bites: Brown Recluse

- Medium size, light brown with fiddle-shaped mark on back (“fiddleback” or violin spider)
- Live in dark, secluded areas
- Venom has cytotoxic effects on tissue; bites cause ulcerative lesions

Spider Bites: Brown Recluse

- Bite may be painless, stinging to sharp & painful
- Intense aching & pruritus in minutes to hours
- Central bite site: bleb or vesicle surrounded by expanding erythema; later becomes dark & necrotic with eschar
- Systemic effects rare, but occur
Differential diagnosis: MRSA

Spider Bites: Brown Recluse

Interventions:
- Apply cold compress intermittently for first 4 days after bite
- Do NOT apply heat--will increase enzyme activity of venom & worsen wound!
- Rest & elevate affected area
- Supportive care: topical antiseptic & sterile dressing; antibiotics if infected
- No evidence that any pharmaceutical agent is effective to treat the envenomation itself
- May need debridement & skin grafting

Spider Bites: Black Widow
- Shiny black spider with red hourglass on abdomen
- Prefer cool, damp habitats like wood piles & under rocks
- Neurotoxic venom
- Initial bite may be painless with tiny papule or red mark; then intense pain develops out of proportion to bite size

S & S within 1 hour:
- Severe muscle cramping & spasms, nausea, vomiting, hypertension, abdominal pain & rigidity, diaphoresis, weakness, syncope, back pain
- Increased salivation, respiratory distress, slurred speech & paresthesias
- Seizures, pulmonary edema, uncontrollable hypertension & shock in severe reactions
- Effects self-limited; usually resolve in a few days

Interventions:
- Apply ice at once to slow action of neurotoxin
- ABC's
- Opiates for pain & benzodiazepines
- Antihypertensive agents may be indicated
- Tetanus prophylaxis
- 48 hours of monitoring; relapses can occur
- Contact Poison Control for advice:
  - Latrodectus antivenom for severe reactions; risk of anaphylaxis & serum sickness

Frostbite

Etiology: Skin exposure to below-freezing temperatures with ice crystal formation

Increased risk: Inadequate or wet clothing, fatigue, poor nutrition, smoking, alcohol & drug use, impaired circulation

Occurs most in extremities, with higher incidence in feet than hands

Frostbite
First Degree
- Pale, white & numb while frozen
- Edema & hyperemia after rewarming

Second Degree
• Area is pale, white & numb while frozen
• After rewarming, redness, edema & clear to white fluid-filled blisters

**Frostbite: Third Degree**
• Complete tissue freezing; pale, white & numb
• Pain, redness & edema with rewarming
• Blisters contain dark, hemorrhagic fluid; surrounding skin is red or blue & may not blanch

**Frostbite: Fourth Degree**
• Involves skin, muscles, tendons & bone
• Area is pale, white & numb while frozen
• “Chunk of wood” consistency
• Mottled skin with bluish discoloration forms deep, dry, black-crusted lesion; gangrene develops

**Frostbite Treatment**
• Splint to minimize motion, pad between fingers / toes & elevate
• Before thawing, give ibuprofen 400 mg q 12h (inhibits inflammatory cascade)
• Re-warm rapidly in 40 C water bath (104 – 108F hot tub temp)
• **Note:** Slow rewarming increases thromboxane & prostaglandin production; causes secondary damage
• Opiates for pain control!
• Tetanus prophylaxis

**Frostbite Treatment : DO NOT:**
• Use dry heat
• Thaw if part can refreeze
• Rub or massage area when frozen
• Rub frostbitten area with snow
• **Note:** If evacuation delay is expected, do not rewarm! Better to have victim walk out on frostbitten foot.

**Wilderness Emergency Preparedness**
• Tetanus prophylaxis up-to-date
• Consider medical supplies based upon type of austere / wilderness environment / excursion, trip duration & personal skills / training
• Medications: broad-spectrum antibiotics
• Communications: emergency contacts & travel insurance
• Emergency pain management Rx?
• Rabies prophylaxis?
• Know when to evacuate
Selected References:


