Bites, Stings and Envenomations

Meredith Masters, MD

November 17th, 2014

c/o Michael Lohmeier, MD
Bites, Stings and Envenomations

- Objectives
  - Review “common” envenomations
  - Brief review of Biology
  - Principles of prevention, diagnosis and management
  - Envenomations
    - Arthropods
      - Insects (Hymenoptera)
      - Spiders (Arachnid)
      - Scorpions (Arachnid)
    - Reptiles
      - Pit Vipers (Crotalidae)
      - Coral Snakes (Elapidae)
    - Venomous Marine Life
Bites, Stings and Envenomations

- Phylum *Arthropoda*
  - Invertebrate, articulate legged animals
  - At least 1 billion species (95% of total)
  - Most successful life forms on Earth
  - 4 Subphyla
    - Trilobites (extinct)
    - Chilicerates (spiders, scorpions, ticks)
    - Uniramia (centipedes, millipedes, insects)
    - Crustacea (crabs, lobster, shrimp)
Bites, Stings and Envenomations

- Venomous Bites and Stings
  - 50% insect stings
  - 30% snake bites
  - 14% spider bite
  - 6% other
Hymenoptera
Bites, Stings and Envenomations

- **Class**: Insecta
- **Order**: Hymenoptera
  - Bees, wasps, ants
  - Account for more envenomation deaths than anything else
  - 10 million stings per year
  - 40-150 deaths per year
  - Death usually due to immunologically mediated mechanism
Bites, Stings and Envenomations

- Hymenoptera
  - Problems
    - Allergic Reaction
    - Anaphylaxis
    - Toxic venom effects (rare)
  - About 40-150 deaths per year
    - Honeybees 50%
    - Yellow jackets and wasps 50%
Hymenoptera

- 0.4% of the population is at risk for serious allergic reaction
- Most give history of progressively severe response
- Some deny any prior stings or only normal reactions
- 50% of patients who had an allergic reaction had NO previous warning symptoms!
Bites, Stings and Envenomations

- Hymenoptera
  - Local reaction (wheal/urticaria)
    - Sharp, burning pain
    - Pruritis (itching)
    - Edema
      - Extensive reactions may involve the entire extremity
      - Stings to tongue or throat may cause loss of airway
        - Still a life threat, even though not anaphylaxis!!
Bites, Stings and Envenomations

- Hymenoptera
  - Systemic reactions
    - Mild – diffuse itching, urticaria, swelling distant from site, flushing
    - Severe – laryngeal edema, severe bronchospasm, profound hypotension
  - Systemic reactions
    - Most deaths (75%) occur within 4 hours of the sting
Bites, Stings and Envenomations

- Hymenoptera
  - Treatment
    - Local Reaction
      - Remove retained stinger
        - Scrape or flick
      - Ice to Site
      - Oral antihistamines
      - Mild analgesics, NSAIDs, APAP, etc.
Bites, Stings and Envenomations

- Hymenoptera
  - Treatment of severe reactions and anaphylaxis
    - Airway management
    - Epinephrine 0.3mL of 1:1,000 SQ or IM
      - Every 15 minutes as needed
    - IVF
  - Antihistamines
Bites, Stings and Envenomations

- Medications for Anaphylaxis
  - Diphenhydramine (Benadryl)
    - 50mg PO/IM/IV every 4-6 Hours
  - Epinephrine (1:1,000)
    - 0.3mL of 1:1,000 solution every 15 minutes
    - AVOID IV
  - Cimetidine (Tagament)
    - 300-800 IV every 6 hours
  - Ranitadine (Zantac)
    - 50mg IV every 6 hours, or 150mg PO
  - Methylprednisolone
    - 125mg IV load, then 40mg PO every 6 Hours
  - Albuterol for bronchospasm
Bites, Stings and Envenomations

Grade 1 Allergic Reaction
- Enlarging local response at sting site
- Cold compresses
- Symptomatic medications

Grade 2 Allergic Reaction
- Generalized urticaria
- Diphenhydramine
- Epinephrine (if severe)
# Bites, Stings and Envenomations

<table>
<thead>
<tr>
<th>Grade 3 Allergic Reaction</th>
<th>Grade 4 Allergic Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Dyspnea, wheezing, angioneurotic edema, nausea</td>
<td>- Dyspnea, dysphagia, hypotension, laryngeal edema</td>
</tr>
<tr>
<td>- Diphenhydramine</td>
<td>- Intubation</td>
</tr>
<tr>
<td>- Epinephrine</td>
<td>- Anti-hisamines</td>
</tr>
<tr>
<td>- Admit for observation</td>
<td>- Epinephrine</td>
</tr>
<tr>
<td>- If severe, treat as Grade 4</td>
<td>- Steroids</td>
</tr>
<tr>
<td></td>
<td>- ICU admission</td>
</tr>
</tbody>
</table>
Bites, Stings and Envenomations

- Hymenoptera
  - General Treatment
    - Prevent subsequent stings
      - Avoid exposures
      - No bright clothing
      - Avoid sweet fragrances
      - Avoid eating sweets outdoors
  - Self-Treatment
    - Medic Alert Tags
    - Anaphylaxis Kit
    - Hyposensitization Therapy
Spiders

MEANWHILE

IN AUSTRALIA
Bites, Stings and Envenomations

- Subphylum Chelicerada
- Class Arachnida
Bites, Stings and Envenomations

- **Spiders**
  - 50,000 species
  - 50 US species can bite humans
  - 15 US species will produce symptoms
  - 2 are particularly dangerous
    - Black Widow (Latrodectus mactans)
    - Brown Recluse (Loxosceles reclusa)
Bites, Stings and Envenomations

- Black Widow
  - Throughout the US
    - As far North as Oregon and New York
    - Common in the South and Southwest
  - Irregular webs in wood piles, under rocks, in trash dumps and outdoor structures
  - Occasionally in houses
  - Females rarely leave the web
    - Only females can bite humans
Bites, Stings and Envenomations

- Black Widow
  - Neurotoxic venom (alpha larotoxin)
  - Binds to nerve ending Calcium Channels
    - Triggers neurotransmitter release
    - Blocks neurotransmitter re-uptake
    - Inhibits normal nerve impulse transmission
    - Produces low serum Ca+2 levels
Bites, Stings and Envenomations

- Black Widow
  - Local Discomfort at bite site
    - Wound Care
    - Ice
    - Analgesia
    - Observe for progression
Bites, Stings and Envenomations

- Black Widow
  - Systemic Symptoms
    - Neuromuscular twitching, cramping
      - Calcium gluconate infusion
      - Diazepam 5-10mg IV
      - Methocarbamol 10mg
        - Robaxin, a skeletal muscle relaxant
  - Severe Pain
    - Opiates
  - Hypertension
    - Pain control/sedation
    - Nitroprusside (rarely)
Bites, Stings and Envenomations

- Black Widow
  - Symptoms peak in a few hours, then diminish
  - Usually symptomatic <24 hours
  - Can be symptomatic up to 4 days
  - 5% have delayed hypersensitivity 2-3 days after the bite
  - Mortality rate is unknown
  - Most recover completely
Bites, Stings and Envenomations

- Black Widow
  - Antivenin indicated for
    - Very young (<16)
    - Very old (>60)
    - Hypertensive reactions
    - Acute respiratory distress
  - Horse serum based antivenin
  - 1-2 vials
    - Potential for severe allergic reactions
      - Negative skin test and premedicate with antihistamines
      - Most symptoms resolve within a few hours after administration
        - Second vial is rarely required
Bites, Stings and Envenomations

- Brown Recluse (Loxosceles)
  - Southeast and South Central US
  - Related species in desert Southwest
  - Nocturnal, shy
  - Dark closets, basements
  - May live on floors, behind furniture in houses
  - Venom damages endothelial cells
Bites, Stings and Envenomations

- Brown Recluse
  - Local Effects
    - Tissue Necrosis
    - Edema
    - Hemorrhage
    - Thrombosis
  - Systemic Effects
    - Due to hemolytic effects of toxins
    - Anemia, DIC, Renal Failure
    - More common in children
Bites, Stings and Envenomations

- Brown Recluse
  - Local signs and symptoms
    - No pain, or only mild stinging
    - Within 2 hours – local pain, blue-gray constrictive halo
    - Within 12-18 hours – bleb formation, growing ischemic zone
    - Within 5-7 days – aseptic necrosis, eschar formation, necrotic ulcer
      - Severe lesions can be up to 30cm in diameter
Bites, Stings and Envenomations

- Brown Recluse
  - Management of minor, local bites
    - Local cold application
    - Wound cleansing
    - Padded splint, bulky dressing
    - Tetanus update
  - No studies definitively show antibiotics helpful
    - Currently not recommended
  - Dapsone may help limit eschar size, but can cause methemoglobinemia
  - Surgical excision early not recommended as severity cannot be predicted early on
Bites, Stings and Envenomations

- Brown Recluse
  - Hospital Management (systemic loxoscelism)
  - Supportive and symptomatic care
  - Debride full thickness lesions with subsequent skin grafts
  - Dapsone may improve outcomes
  - Antivenin under development
  - Outcomes not improved by:
    - Steroids
    - Early excision
Bites, Stings and Envenomations

- **Tarantulas**
  - Large, wandering predatory spiders
  - About 30 US species
  - Relatively docile
  - Rarely bite
  - Bite produces local pain, edema, lymph node swelling
  - Flick irritating abdominal hairs if bothered (urticating bristles)
Bites, Stings and Envenomations

- Scorpions
  - 40 US Species
  - Only one potentially lethal (Centruroides exilicauda)
    - Primarily in Arizona
    - Occasionally in western New Mexico, southeast California, northern Mexico, far West Texas
    - No deaths since 1969
Bites, Stings and Envenomations

- Scorpion Bites
  - Neurotoxic venom
  - Acts on neuronal synapse and neuromuscular junction
  - Increased neuron sodium permeability
    - Neurotransmitter release at synapse
    - Increased acetylcholine release at neuromuscular junction
Bites, Stings and Envenomations

- Scorpion Bites
  - Local signs, symptoms
    - No local swelling or inflammation
    - Local pain with hyperesthesia
  - Treat symptomatically
    - Ice to area, mild analgesics, wound care
Bites, Stings and Envenomations

- Scorpion Bites
  - Systemic signs, symptoms
    - Extreme restlessness, agitation
    - Roving eye movements
    - Poor coordination, slurred speech, difficulty swallowing (bulbar findings)
    - Salivation, wheezing, stridor
    - Tachycardia, tachypnea, hypertension, vomiting
Bites, Stings and Envenomations

- Scorpion Bites
  - Treatment of Severe Envenomations
    - Antivenin
      - Wisconsin Poison Control 1-800-222-1222
      - Give IV Skin Test Precautions
        - 1-2 Vials
        - Goat Serum Antibody
  - Sedatives?
    - Caution, particularly with antivenin use
      - Avoid over-sedation
    - Phenobarbital
      - 5-10mg/kg
Snakes

TRAVEL

Snake on a Plane, in Real Life

By GERRY MULLANY  JANUARY 11, 2013 12:14 AM  1 Comment
Bites, Stings and Envenomations

- Phylum Chordata
- Subphylum Vertebrata
- Class Reptilia
Bites, Stings and Envenomations

- 45,000 bites per year in the US
- 8,000 bites from venomous snakes
  - 25% are dry strikes
  - 10 deaths per year

*Image: Man saying, "SNAKES... WHY DID IT HAVE TO BE SNakes?"*
Bites, Stings and Envenomations

- Coral Snake
- Timber
- Copperhead
- Eastern Diamondback
Bites, Stings and Envenomations

- Venomous Snakes
  - Types of US venomous snakes
    - Pit Vipers (Crotalidae)
      - Rattlesnakes
      - Copperheads
      - Water Moccasins (Cottonmouth)
    - Coral Snakes (Elapidae)
      - Cobra
      - Mamba
      - Kraits (not in the US)
Bites, Stings and Envenomations

- Venomous Snakes
  - Pit Vipers
    - Heavy Bodies
    - Diamond Shaped Heads
    - Vertical, elliptical pupils
    - Heat sensing pits on the upper lip between the eye and nostril
    - Movable fangs
    - Venom primarily hemotoxic, necrotoxic
Bites, Stings and Envenomations

- Pit Vipers
  - Rattlesnakes
    - 13 Species
    - 7,000 bites per year
    - 9-10 fatalities
    - Most deaths are from Western Diamondback or Eastern Diamondback
Bites, Stings and Envenomations

- Pit Vipers
  - Copperhead (Agkistrodon contortrix)
    - Deaths are very rare
    - Minimal edema and pain
Bites, Stings and Envenomations

- Pit Vipers
  - Water Moccasin (Agkistrodon piscivorus leucostoma)
    - Causes an average of one death per year
    - Produce mild systemic symptoms
      - Potential for severe local tissue injury and necrosis
Bites, Stings and Envenomations

- Pit Vipers
  - Epidemiology
    - 25% are dry bites
    - 25-75% of venom is discharged in a bite
    - Replenishment in 3-4 weeks
    - Extremities are the most common bite site
    - Most common victims
      - Children
      - Intoxicated adults
      - Snake handlers and collectors
Bites, Stings and Envenomations

- Pit Vipers
  - Epidemiology
  - Risk Factors
    - The “6 T’s”
      - Testosterone
      - Tequila
      - Tattoo
      - Teeth (inverse relationship)
      - Trailer Park
      - T-shirt (Heavy Metal)
Bites, Stings and Envenomations

- Pit Viper
  - Envenomations
    - Pain, swelling at bite site
    - Progressive edema of bitten extremity
    - Bruising of bitten area
    - Formation of blood-filled vesicles
Bites, Stings and Envenomations

- Pit Vipers
  - Envenomations
    - Weakness, sweating, nausea, vomiting
    - Tachycardia
    - Hypotension, shock
    - Prolonged clotting times
    - Bleeding gums
    - Hematemesis, melena, hematuria
  - Grade of envenomation determines the need for antivenin
Bites, Stings and Envenomations

- Pit Vipers
  - Envenomation
  - Dry Bite
    - Local abrasion or bite mark without severe pain or swelling
    - Normal vital signs
    - Normal coagulation studies
    - Normal platelet count
Bites, Stings and Envenomations

- Pit Vipers
  - Envenomations
    - Mild envenomation
      - Local pain and swelling
      - Normal vital signs
      - Normal to mildly abnormal coagulation studies
      - Platelet count >100,000
Bites, Stings and Envenomations

- Pit Vipers
  - Envenomation
    - Moderate envenomation
      - Local pain and moderate swelling (>12” from bite site)
      - Normal vital signs
      - Abnormal coagulation studies (double pT and pTT)
      - Thrombocytopenia
        - Platelet Count <100,000
Bites, Stings and Envenomations

- Pit Vipers
  - Envenomation
    - Severe envenomation
      - Initial presentation consistent with shock
      - Altered mental status with or without normal vital signs and/or poor peripheral perfusion
      - Abnormal coagulation studies
        - pTT >50, INR >3, Fibrinogen <50
      - Thrombocytopenia
        - Platelets <20,000
Bites, Stings and Envenomations

- Pit Viper
  - Antivenom
    - Polyvalent ovine Fab ("Crofab")
      - Eastern Western Mojave rattlesnake and cottonmouth
      - OK for Copperhead as well
    - Sheep immunoglobulin Fab fragments
    - 4-6 vials initial dose
    - 4-6 vial follow up dose if no response in 1st hour
    - Clinical parameters and coags
Bites, Stings and Envenomations

- Elapidae
  - Coral Snake
    - Thin bodied
    - Small, rounded head
    - Brightly colored
    - Small fixed fangs
    - Injects venom by chewing
    - Venom primarily neurotoxic
Bites, Stings and Envenomations

(Conant 1958)

Eastern Coral Snake (venomous)

Scarlet King Snake (non-venomous)
Bites, Stings and Envenomations

- Elapidae
  - Coral Snake
    - Arizona coral snake
      - Not aggressive
      - No recorded human deaths
    - Eastern coral snake
      - Several bites reported annually
        - Mostly Florida, Texas
      - About one death every 5 years
Bites, Stings and Envenomations

- Elapidae
  - Coral Snake
    - Envenomation
      - Little or no pain
      - Little or no swelling
      - Paresthesias around bitten area
      - Muscular incoordination, weakness
      - Increased salivation
      - Difficulty swallowing, talking
      - Visual disturbance
      - Respiratory distress, respiratory failure
      - Shock, cardiovascular collapse
    - Most deaths occur from respiratory arrest within 36 hours
Bites, Stings and Envenomations

- Snakebite Management
  - Do NOT
    - Apply ice
    - Apply arterial tourniquet
    - “cut and suck”
    - Use electrical shock
    - Actively attempt to locate a venomous snake
    - Bring a live, venomous snake to the hospital
Venomous Marine Life

We're Gonna Need A Bigger Boat
Bites, Stings and Envenomations

- Marine Life
  - Phylum Cnidaria
Bites, Stings and Envenomations

- Venomous Marine Life
  - Jellyfish, Portuguese Man-Of-War, Fire Corals
  - Stinging cells (nemaotcysts) in tentacles
    - Function even when separated from the organism!
  - Venom is antigenic
Bites, Stings and Envenomations

- Venomous Marine Life
  - Jellyfish
    - Intense, burning pain
    - Red, hemorrhagic lesions
    - Nausea, vomiting, fevers, chills
    - Respiratory distress, wheezing, stridor
    - Hypotension, shock
    - Cardiovascular collapse
Bites, Stings and Envenomations

- Venomous Marine Life
  - Jellyfish
    - Remove tentacles
      - Use gloves and forceps
    - Can also use shaving cream, baking soda and “shave” the nematocysts
    - Vinegar can block discharge of nematocysts
      - Apply liberally
Bites, Stings and Envenomations

- Venomous Marine Life
  - Venomous Fish
    - Stingray
    - Scorpionfish, Lionfish, Stonefish
Venomous Marine Life

Stingrays
- 1,500 bites per year in the US
- Spine at the base of the tail with venom gland
  - Vasoconstrictive
- Pain, salivation, N/V, diarrhea, cramps
- Dyspnea, headache
- Typically step on an unsuspecting stingray
- Puncture wound to feet are the most common
Bites, Stings and Envenomations

- Venomous Marine Life
  - Stingray Management
    - Rinse the area and remove the spine
    - Soak in warm water, cleanse wound
    - Update tetanus
    - Antibiotics are usually not necessary
Bites, Stings and Envenomations

- Venomous Marine Life
  - Sea Urchins
    - Echinoderms
    - Toxin-coated spines that fracture
  - Symptoms
    - Pain, burning, discoloration of skin
    - Immerse injured area in hot water
    - Use acetic acid to dissolve embedded spines
    - Larger spines may require surgical excision
Venomous Marine Life

- General Principles for marine envenomations
  - Remove the pt. from the water
  - Assess and control ABC’s
  - Do not remove wet suit
  - Attempt to ID the offending organism
  - Transport to care as necessary
  - Irrigate the wound with NS
    - Vinegar as appropriate
  - Debride the wound if needed
    - Avoid suturing if possible
Summary

- Bites, Stings and Envenomations
- Management is generally conservative
  - Remove / Stop the offending agent
- Allergic reactions to bee stings
  - Treat with epi, antihistamines, steroids
- Snake bites
  - Can give CroFab for serious envenomations
- Marine Envenomations
  - Please don’t pee on anyone’s feet.
Questions?

Meredith Masters, MD
Michael Lohmeier, MD
November 17th, 2014