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Toxic Creatures: Bites and Stings

Osher Mini-Med School

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Objectives

Learn about creatures that can envenomate (bite and sting)

- Envenomation requires a toxin, not just the mechanical trauma from biting/stinging
- Snakes
  - Crotalinae (pit vipers)
  - Elapidae (cobras)
- Arthropods
  - Spiders
  - Scorpions

Objectives

For each:

- Discuss the clinical presentations
- Learn about potential treatment modalities
- Focus on species native to the U.S.
- This is a BIG topic
  - But we'll try to provide an overview

http://kids.nationalgeographic.com/animals/rattlesnake/#rattlesnake-tongue.jpg

Snakes

Epidemiology and Classification

- >8000 bites reported in the U.S. every year
  - Less than 10 deaths/year
- 99% of bites are from the family Viperadae, subfamily Crotalinae
  - AKA “crotalids”, “pit vipers”, “new world vipers”
- Venomous species are not endemic to Maine, Alaska, or Hawaii
  - But bites have been reported in every state except Hawaii

Epidemiology

- Majority of bites are in the summer months (April-September)
  - Peak in July (more people outside, increases exposure)
- 75% of bite victims are men, usually on an extremity
  - 10-15% children
- Over 50% of bites are when the victim is purposefully handling a known venomous snake

Crotalinae (Pit Vipers)

Do they live in pits?

- Name derives from a pit-like depression behind the nostril
  - Heat-sensing organ used to detect prey
- Native crotalids
  - Rattlesnakes (*Crotalus* and *Sistrurus*)
  - Cottonmouths, copperheads (*Agkistrodon)*

http://crispysnakes.tumblr.com/page/557

Crotalinae

Other ways to identify a pit viper?

- Triangular-shaped head
- Vertically elliptical pupils
- Front, paired, mobile fangs
  - Can retract like a hinge into the roof of the mouth
  - Rattlesnake fangs up to 3-4cm

http://duffygraham.deviantart.com/art/Diamond-Head-Rattlesnake-263651589

http://water-and-woods.com/2016/02/severed-rattlesnake-head-stays-alive-and-strikes-back/

Safety reminder

- If you're close enough to see the pupils
  - You're too close.

Crotalinae

What about the rattle?

- Not all rattlesnakes have rattles
  - Depends on the maturity of the snake
- Copperheads/cottonmouths don't have rattles
  - But may shake their tails like rattlesnakes

http://www.scpr.org/news/2016/05/12/60593/rattlesnakes-attack-2-women-in-san-bernardino-nati/

Cottonmouth, AKA Water Moccasins

Agkistrodon piscivorus

https://commons.wikimedia.org/wiki/File:Agkistrodon_piscivorus_6.jpg

http://www.virginiaherpetologicalsociety.com/reptiles/snakes/eastern-cottonmouth/eastern_cottonmouth.php

Copperhead

Agkistrodon contortrix

http://wunc.org/post/close-encounter-copperhead#stream/0

https://mikesart64.wordpress.com/tag/copperhead-snake/

Crotalid Bites

Of bites reported:

- ~ ½ from rattlesnakes, ½ from copperheads/cottonmouths
- Rattlesnake bites
  - Occur throughout the U.S., but more common in Southern/ Western states
- Copperhead/cottonmouth bites
  - More common in eastern/southeastern U.S.
- ~25% of bites are “dry”

U.S. Pit Vipers

Venom Toxicity

- Rattlesnakes > Cottonmouths > Copperheads

https://www.britannica.com/animal/rattlesnake
http://www.venombyte.com/venom/snakes/western_cottonmouth.asp
https://en.wikipedia.org/wiki/Agkistrodon_contortrix

Crotalids

Clinical Presentation

- Characterized by local swelling and tissue breakdown
- Can usually see 1-2 distinct puncture sites
- Effects can range from benign (dry bites) to life-threatening

http://misc.medscape.com/pi/iphone/medscapeapp/html/A771586-business.html

Local Effects

- Generally develop swelling (edema) and pain within minutes
  - May be delayed 8-10 hours
- Bruising (ecchymosis)
- Redness (erythema)
- Hemorrhagic blisters (blebs or bullae)

https://emerituscollege.asu.edu/sites/default/files/ecdw/EVoice6/snakes.html

http://www.nbcdfw.com/news/weird/Texas-Snake-Man-Bitten-By-Rattlesnake-140818923.html

Crotalids

Hematologic effects

- Approximately 1/3 to ½ of rattlesnake envenomations will develop coagulopathy (bleeding disorder)
- Decrease in platelet count (thrombocytopenia), decreased fibrinogen
  - Leads to bleeding and inability to clot normally

Crotalids

Systemic effects

- Less common than the local and hematologic effects
- May include:
  - Nausea, vomiting, “metallic” taste, generalized weakness, restlessness
- Some patients are allergic to the venom itself
  - Can present with anaphylaxis

https://www.thailandsnakes.com/thailand-epipen-epinephrine-auto-injector-availability/

Crotalids

Neurologic effects

- Not common with most rattlesnakes
- Mojave rattlesnake (*C. scutulatus)* is notorious
  - Muscle weakness, cranial nerve dysfunction
  - Respiratory paralysis

http://www.reptilefact.com/mojave-rattlesnake.html

Management

Pre-Hospital Care

- No first aid/field treatment has been proven beneficial
- Immobilize the affected limb
- Transport to hospital ASAP
- DON'T USE:
  - Tourniquets
  - Incision/suction
  - Venom extractors

https://www.rei.com/product/407144/sawyer-extractor-pump-kit

Management

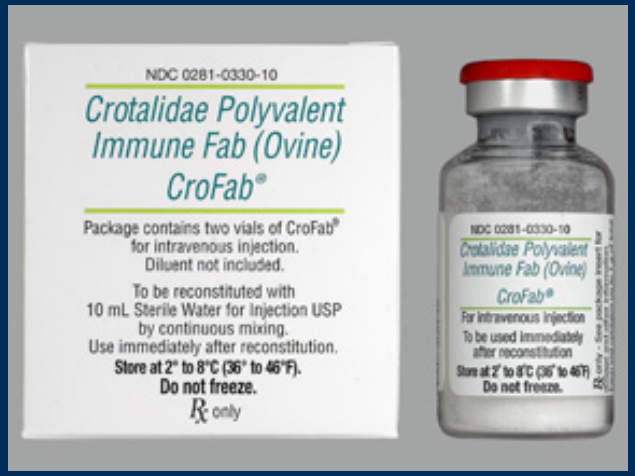
In-Hospital Care

- Supportive care
  - Focus on airway, breathing, and circulation
  - Endotracheal intubation if necessary
- Observation
  - Monitor suspected dry bites for 10-12 hours (delayed symptoms)
  - Mark the leading edge of swelling and monitor
  - Blood testing for coagulopathy

Management

Anti-Venom

- Crotalidae polyvalent immune Fab (CroFab)
- Ovine-derived antivenom developed from common North American pit vipers
  - Eastern and Western Diamondback, Mojave, and Cottonmouth



https://thehealthscience.com/topics/crofab-copperhead-antivenom-immune-fab-crotalidae-polyvalent-immune-fab-ovine-dosing

Management

Anti-Venom

- Indicated for progressive swelling, low platelets or coagulopathy, neurotoxicity, or any “significant” systemic symptoms
- Can halt progression of symptoms
  - Doesn’t prevent skin necrosis

http://www.chigiy.com/the_gardeners_anonymous_b/2010/05/rattlesnake-adventure-part-two.html

Elapidae (Elapids)

Coral Snakes

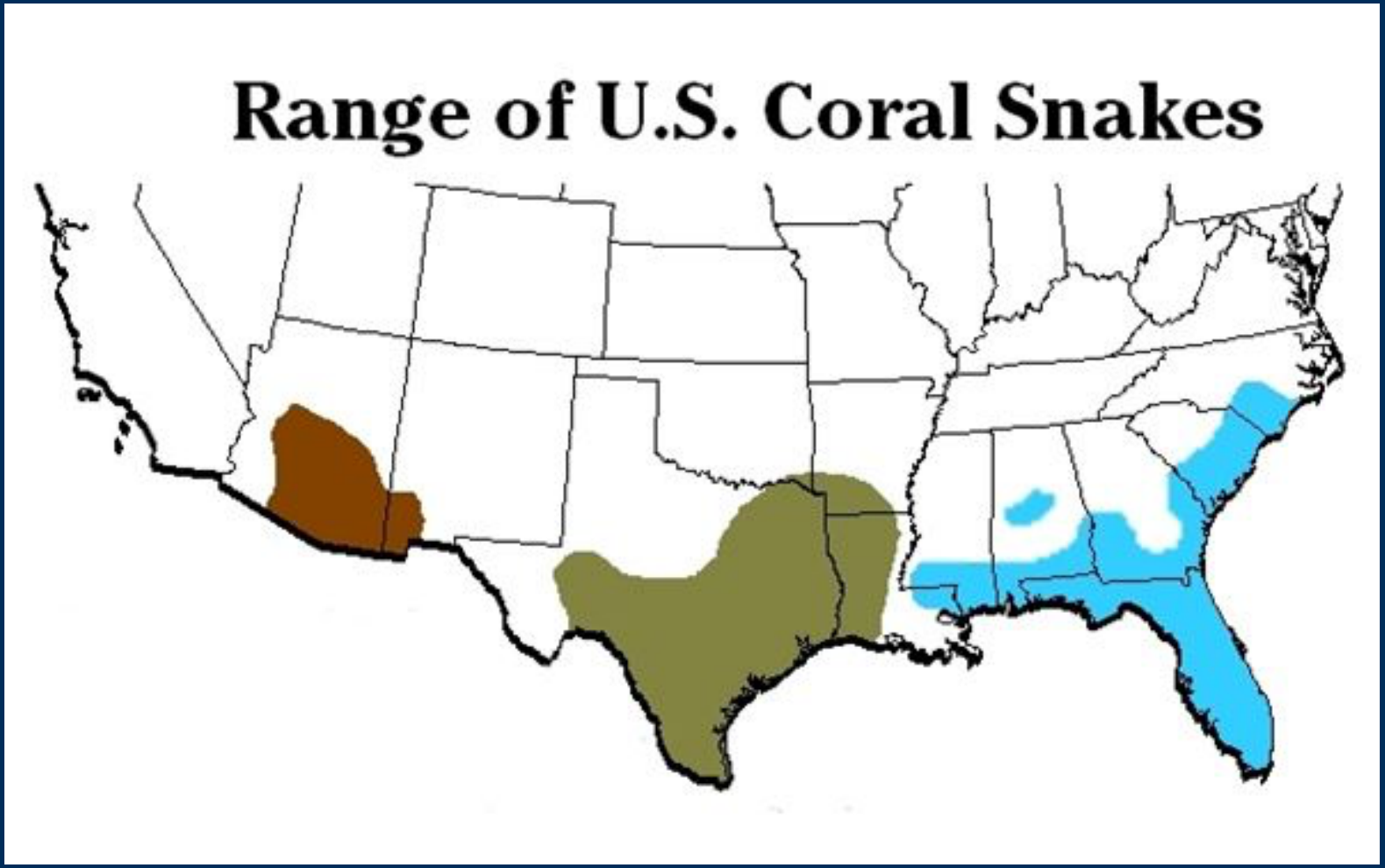
- Brightly colored
  - Red, yellow, and black bands
  - Often confused with the non-venomous King Snake

http://www.scwildlife.com/articles/julyaug2008/coralsnake.html

http://www.kingsnake.com/king/triangulum/elapsoides.html

"Red on yellow, kill a fellow. Red on black, venom lack"

-Someone



http://www.brighthub.com/environment/science-environmental/articles/55029.aspx

Elapidae (Elapids)

Coral Snakes

- Front, fixed fangs
- Fangs are comparatively small
  - Coral snakes tend to “latch” on or “chew”
  - Eastern coral snake (*Micrurus fulvius*) responsible for most morbidity/mortality
  - Texas coral snake (*Micruroides euryxanthus*) seems to be less dangerous

Elapids

Coral snake toxicity

- Only about 40% of bites cause envenomation
- Due to the small fangs, you may not see any puncture wounds
  - So the local effects are minimal

- Envenomation characterized by *neurotoxicity*
  - Paresthesias (tingling), slurred speech, double vision, muscle weakness
  - May lead to paralysis and death

Elapids

Management

- Pre-hospital care same as for crotalids
- In-hospital
  - Observe coral snake bite victims for 24 hours
  - Muscular weakness and respiratory paralysis may develop quickly
  - Supportive care
    - Intubation if necessary

http://www.backyardnature.net/yucatan/v_coral.htm

Management

Anti-Venom

- North American Coral Snake Antivenin (NACSA)
- Equine-derived from *Micrurus fulvius*
- Pfizer is the sole producer and they are no longer manufacturing it
- Some still available, but hard to obtain

- A new anti-venom is being studied in Florida
  - Not yet available

http://www.poisoncentertampa.org/poison-topics/coral-snake-antivenom/antivenom-faq/

http://www.bbc.com/earth/story/20150629-the-truth-about-tarantulas

Spiders

Epidemiology

- ~12,000-15,000 spider exposures reported to US Poison Centers annually
- Very few fatalities every reported

- But spider bites are difficult to confirm
  - Estimated that ~80% of reported “spider” bites are from something else
  - Mites, ticks, ants, bees, etc

http://www.spiders.us/image/latrodectus-mactans-6/

Black Widow Spider

Latrodectus mactans

http://zipcodezoo.com/index.php/Latrodectus_mactans

- Found in every state except Alaska
- *Mactans* means murderer in Latin
- Shiny, jet-black
- Female is large, 8-10mm
  - Male is smaller and fangs are too short to envenomate humans
- Rounded abdomen
- Red, “hourglass” marking on the belly

Black Widow Spider

Venom

- More potent on a volume-per-volume basis than pit vipers
- Venom contains many toxins
  - α-Latrotoxin is the most well described
- Causes a massive release of neurotransmitters
  - Epinephrine (adrenaline), norepinephrine
- Leads to a syndrome called, “Latrodectism”

Black Widow Spider

Clinical Presentation

- Local effects
  - Small puncture wound at bite site
  - Often associated with a “halo”
- Can progress to more severe, systemic symptoms

http://pulpbits.net/6-black-widow-spider-bite-stages/black-widow-spider-bite-stages/

Black Widow Spider

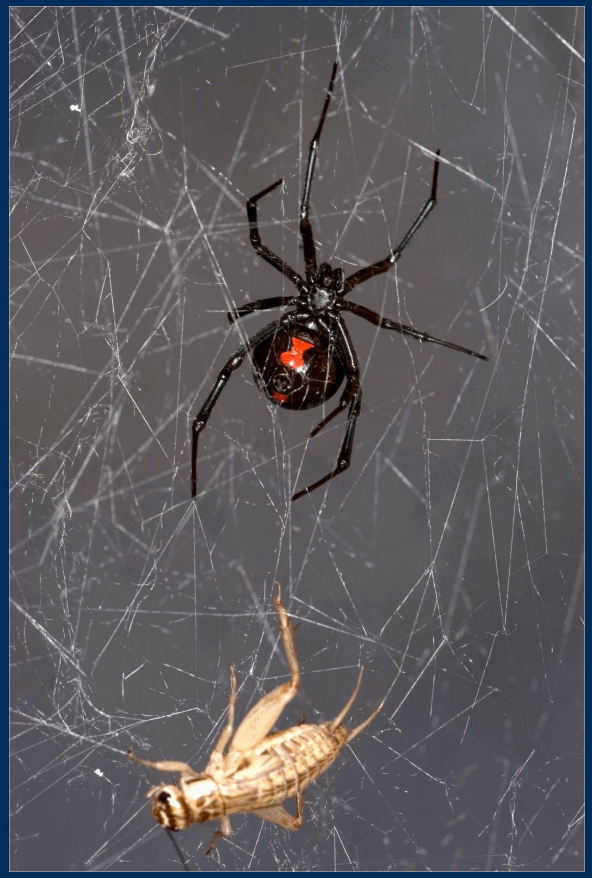
Clinical Presentation

- Myopathic Syndrome
  - Onset of muscle cramping and pain
  - 15 minutes to 1 hour after bite
  - Starts at bite site, then spreads
  - Classically causes severe abdominal and chest pain
  - May persist for several days

Black Widow Spider

Clinical Presentation

- Other systemic symptoms
  - Nausea, vomiting, sweating
  - High heart rate and blood pressure
  - "*Pavor mortis*" – fear of death
  - Rare cases:
    - Acute myocardial infarction (heart attack)
    - Priapism



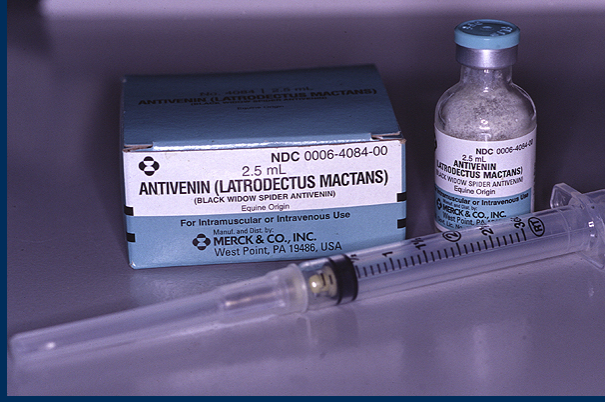
https://phys.org/news/2015-11-insect-dna-sequenced-black-widow.html

Black Widow Spider

Management

- Local wound care, if needed
- Pain management
  - Usually with IV medications
    - Opioids (pain relievers)
    - Benzodiazepines (muscle relaxants)

Black Widow Spider



http://www.ohmboy.com/blog/archive/2006_06_01_archive.html

Anti-Venom

- Currently available antivenom is equine-derived
- Rapidly effective and curative
- But…
  - High rates of allergic reactions
  - Anaphylaxis and serum sickness reported
  - Usually reserved for only severe, refractory cases
- A new, better tolerated antivenom is being studied
  - Not yet available

http://www.poisoncentertampa.org/poison-topics/venomous-critters/brown-recluse-spider/

Brown Recluse Spider, AKA Fiddleback

Loxosceles reclusa

- Named for brown, violin-shaped mark on it's cephalothorax
- Small, 6-20mm long
- Prominent in the Southeast/Southwest of U.S.
  - But found almost everywhere
- Very resilient, can survive up to 6 months without food/water
- Female more dangerous

https://en.wikipedia.org/wiki/Brown_recluse_spider

Brown Recluse Spider

Clinical Presentation

- Envenomation is termed "*loxoscelism*"
- Ranging from a small, red, "bite" site to systemic illness
- Bite can be initially painless
  - Develops into blister and bleeding 2-8 hours after bite
  - Necrosis of the central blister occurs 3-4 days later

http://healthool.com/brown-recluse-spider-bite/

Brown Recluse Spider

Clinical Presentation

- An eschar forms 5-7 days after bite
- Then falls off 1-2 weeks later
- Leaves an ulcer which may take months to heal

http://emedicine.medscape.com/article/772295-treatment

http://thesurvivaldoctor.com/2012/09/25/how-to-identify-a-spider-bite/

Brown Recluse Spider

Clinical Presentation

- Systemic Loxoscelism
  - Children are more susceptible
  - Occurs 1-3 days after bite
  - Fever, chills, vomiting, joint pain, muscle aches
  - Can cause muscle breakdown (rhabdomyolysis), kidney injury, and deaths have been reported

Brown Recluse Spider

Treatment

- Lots of things have been tried with limited success
- Good wound care seems to be the best option
- Early surgical correction leads to worse outcomes
- Corrective surgery (cosmetic) can be performed several weeks after the wound stops progressing

http://www.medlibes.com/entry/brown-recluse

http://www.tarantulaheaven.com/mexican-red-knee-tarantula-brachypelma-smithi/

Tarantulas

- 54 species found in the desert Southwest
- Popular as pets
  - Female can live 15-20 years
- Defense:
  - Large fangs with a painful bite
  - “Urticating” hairs

https://pethelpful.com/exotic-pets/Tarantula-Bites

Tarantulas

Venom

- From the bite:
  - Relatively minor effects in humans
  - Can be lethal for small animals

- Urticating hairs:
  - Can be “shot” off the spider as a projectile
  - Recognized as foreign body and triggers an immune response

http://www.mikebasictarantula.com/Handling-OW-tarantulas.html

Tarantulas

Clinical Presentation

- Range from painless bites to severe pain lasting hours
- Often associated with fever (likely due to venom)
- Itching and redness

- Hairs cause intense inflammation
- Can puncture the eye
- Can cause respiratory distress if inhaled

Urticating Hairs

http://www.birdspiders.com/gallery/index.php/Tarantulas/Type-III-urticating-hairs-from-a-Theraphosa-apophysis-tarantula-embedded-in-the-sclera-of-a-human-eye

http://arachnoboards.com/threads/worst-urticating-hairs-in-tarantulas-ouch-which-ones-hurt-the-most.222664/page-2

Tarantulas

Treatment

- Supportive care
- Cool compresses, pain control
- Hairs on skin:
  - Adhesive/duct tape
  - Irrigate the area with saline or water
- Hairs in the eye:
  - Need to see an ophthalmologist for removal

https://en.wikipedia.org/wiki/Scorpion

Scorpions

Epidemiology

- Over 650 known species
- Envenomate by stinging, rather than biting
- End of the tail is called the "*telson*"
- Approximately 11,000-19,000 exposures per year in the U.S.
  - Mostly in the Southwest
  - Only one death reported (1995-2015)

http://www.arizona-leisure.com/the-desert-wild-stinging.html

Bark Scorpion

Centruroides exilicauda

- Venom contains four known neurotoxins
- Stings produce intense local pain, redness, burning
- Symptoms progress to maximum severity around 5 hours
  - May last 30 hours

https://www.pinterest.com/stillrollinalon/diane-fast/

Bark Scorpion

Clinical Presentation

- Systemic symptoms
  - High blood pressure, elevated heart rate, sweating
  - Vomiting, shortness of breath
  - Muscle twitching, gait imbalance, blurred vision
  - Most severe symptoms in children

Bark Scorpion

Clinical Presentation

- University of Arizona
- Dr. Leslie Boyer
- https://www.youtube.com/watch?v=DE60ig0CIZc

Bark Scorpion

https://en.wikipedia.org/wiki/Arizona_bark_scorpion#/media/File:Bbasgen-scorpion-front.jpg

Treatment

- Most envenomations aren't severe
  - Local wound care
  - Pain control
- Systemic symptoms
  - Intravenous benzodiazepines (midazolam, lorazepam, diazepam)

Bark Scorpion

Anti-venom

- Equine-derived
- Approved by the FDA in 2011
- Generally reserved for intractable pain
  - Or children with neurologic symptoms

http://boards.medscape.com/forums/?128@@.29f1be13!discloc=.2a0ce37b&cat=All

Summary

What have we learned?

- American pit vipers are dangerous
  - But luckily we have an effective antivenom
  - Don’t try to cut, suck, or drain the wound
  - Just get to a hospital!
- Coral snakes are less dangerous
  - But we don’t have easy access to antivenom
  - Red on yellow = bad

Summary

- Spiders are terrifying (personal opinion)
  - But you probably won't die
  - Treatment is largely supportive
- Scorpions can make you very sick
  - Children are much more susceptible
  - But we have an effective antivenom
- Hike at your own risk

Questions?