Envenomations
Overview

- Venomous species
- Snakes
  - Crotalids
  - Elapids
- Spiders
- Scorpions
- Hymenoptera
  - Bees
  - Wasps and Hornets
  - Fire Ants
- Bufo Toad
http://brilliantmaps.com/venomous-animals/
Venomous species per state

http://brilliantmaps.com/venomous-animals/
Venomous Snakes

Approximately 150,000 – 300,000 domestic animals a year are bitten by venomous snakes in the US.

Every state except Maine, Alaska, and Hawaii is home to at least one species of venomous snake.
Venomous Snakes

Vipers

• Solenoglyphic - movable front fangs
• Long fangs
• Hemotoxic and myotoxic
• USA - Crotalids

Elapids

• Proteroglyphic - fixed front fangs
• Short fangs
• Neurotoxic +/- cardiotoxic
• USA - Coral snake
Venomous Snakes

Crotalids in the USA

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Crotalus adamanteus</em></td>
<td>Eastern diamondback rattlesnake</td>
<td>United States</td>
</tr>
<tr>
<td><em>Crotalus atrox</em></td>
<td>Western diamondback rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus cerastes</em></td>
<td>Mojave Desert sidewinder</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus horridus</em></td>
<td>Timber rattlesnake</td>
<td>United States</td>
</tr>
<tr>
<td><em>Crotalus lepidus</em></td>
<td>Rock rattlesnake</td>
<td>United States</td>
</tr>
<tr>
<td><em>Crotalus mitchelli</em></td>
<td>Speckled rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus molossus</em></td>
<td>Black-tailed rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus pricei</em></td>
<td>Twin-spotted rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus scutulatus</em></td>
<td>Mojave rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus tigris</em></td>
<td>Tiger rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus viridis</em></td>
<td>Western rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus viridis viridis</em></td>
<td>Prairie rattlesnake</td>
<td>United States</td>
</tr>
<tr>
<td><em>Crotalus viridis abyssus</em></td>
<td>Grand Canyon rattlesnake</td>
<td>United States</td>
</tr>
<tr>
<td><em>Crotalus viridis helleri</em></td>
<td>Southern Pacific rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Crotalus viridis lutosus</em></td>
<td>Great Basin rattlesnake</td>
<td>United States</td>
</tr>
<tr>
<td><em>Crotalus viridis oreganus</em></td>
<td>Northern Pacific rattlesnake</td>
<td>United States, Canada</td>
</tr>
<tr>
<td><em>Crotalus willardi</em></td>
<td>Ridge-nosed rattlesnake</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Agkistrodon contortrix</em></td>
<td>Southern copperhead</td>
<td>United States</td>
</tr>
<tr>
<td><em>Agkistrodon piscivorus</em></td>
<td>Eastern/western cottonmouth</td>
<td>United States</td>
</tr>
<tr>
<td><em>Sistrurus catenatus</em></td>
<td>Massasauga</td>
<td>United States, Mexico</td>
</tr>
<tr>
<td><em>Sistrurus miliarius</em></td>
<td>Pigmy</td>
<td>United States</td>
</tr>
</tbody>
</table>
Eastern Diamondback Rattlesnake

*Crotalus adamanteus*

Largest species of rattlesnake, potent venom

Inhabits dry sandy areas, palmettos, flatwoods, pinewoods, coastal dune habitats

Courtesy of Dr. Jesse Bullock
**Water Moccasin/Cottonmouth**

*Agkistrodon piscivorus*

North America's only venomous water snake

Found swimming in swamps, marshes, drainage ditches, and at the edges of ponds, lakes and streams
Copperhead

Agkistrodon contortrix

Tolerant of habitat alteration and remain common in suburban areas of many large cities

Rarely require antivenin, usually symptomatic treatment

http://modernsurvivalblog.com/survival-skills/the-4-deadly-poisonous-snakes-in-america/
Crotalid Envenomation

- 25% are dry bites

- The amount of venom released depends on:
  - Snake’s last meal – longer it’s been > venom
  - Size of the venom sacs – larger > venom
  - Ability to voluntarily compress the venom glands – adults have more control
# Snake Venom

<table>
<thead>
<tr>
<th>Component</th>
<th>Pit Viper</th>
<th>Coral Snake</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enzymes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proteinases</td>
<td>Heavy</td>
<td>Minimal</td>
<td>Tissue destruction, coagulation, anticoagulation</td>
</tr>
<tr>
<td>Hyaluronidase</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Hydrolysis of connective tissue stroma</td>
</tr>
<tr>
<td>Cholinesterase</td>
<td>Minimal</td>
<td>Heavy</td>
<td>Catalyzes hydrolysis of acetylcholine</td>
</tr>
<tr>
<td>Phospholipase A*</td>
<td>Heavy</td>
<td></td>
<td>Hemolysis may potentiate neurotoxins</td>
</tr>
<tr>
<td>Phosphomesterase</td>
<td>Minimal</td>
<td>Heavy</td>
<td>Unknown</td>
</tr>
<tr>
<td>Phosphodiesterase</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Hypotension</td>
</tr>
<tr>
<td><strong>Non-Enzymes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurotoxins</td>
<td>Minimal</td>
<td>Heavy</td>
<td>Flaccid paralysis</td>
</tr>
<tr>
<td>Cardiotoxins</td>
<td>Minimal</td>
<td>Heavy</td>
<td>Depolarizing</td>
</tr>
</tbody>
</table>
Ecchynocytosis
Clinical Signs

- Acute pain
- Marked swelling and edema
- Ecchymosis and bleeding at the bite site
- Cardiovascular compromise:
  - Vasodilation
  - Hypovolemia
  - Tachycardia
- Respiratory distress
- Nausea and vomiting
- Mental dullness
- Muscle tremors
Treatment

• First Aid:
  • Immobilization may delay absorption of venom
  • No other first aid techniques are recommended
• Fluid Therapy:
  • Avoid colloids
• Blood Products:
  • pRBC if anemic
  • FFP if coagulopathic, after antivenin
• Analgesics
• Local wound care
  • Antibiotics
  • Bandaging as needed
  • Hyperbaric oxygen therapy
Snake Antivenin

Antivenin is a “true” antidote
Antivenom is most effective when administered early on

Indications for antivenom
1. Rapid progression of swelling
2. Significant coagulopathy, defibrination, or thrombocytopenia
3. Neuromuscular toxicity
4. Shock
Antivenin

Mainstay of therapy for moderate to severe envenomation
• Limits progression and reverses coagulopathy
• Does not reverse necrotoxic effects

Triple control when time is tissue

https://www.crofab.com/
Antivenin

Antivenin Crotalidae Polyvalent (ACP)

• Derived from envenomated horses
• Whole IgG and horse serum albumin
• More antigenic
• 1-10 vials/dog depending on the severity

Antivenin Crotalidae Polyvalent (VenomVet)

• Derived from envenomated horses
• Fc portion cleaved leaving 2 Fab portions
• Less antigenic
• 3 year shelf life
Antivenin

Crotalinae Polyvalent Immune Fab$_1$ (Crofab)

- Uses fragments of antibodies
- Fc portion cleaved leaving 2 Fab portions
- Better volume of distribution
- Less antigenic and clinically as effective

https://www.crofab.com/
Antivenin

2 Foreign products effective against North American Pit Vipers, both require a special importer’s license

Antivipmyn

• Fab₂ antibody fragment polyvalent product of equine origin
• Cleared from body faster than IgG, but slower than Fab₁
• Mexico

Polyvet-ICP

• Polyspecific whole IgG of equine origin
• No albumin (< antigenic)
• Costa Rica
Reported mortality rates in dogs range from 1% to 30%, depending on the type of snake involved.

2 types of antivenin:

- Horse serum-derived, contains IgG that can neutralize the venom of all North, Central, and South American crotalids.
- Sheep-derived, contains Fab fragments of Ig, rather than the entire IgG molecule. The more immunogenic Fc portion of the antibody is eliminated during purification.
• 218 dogs – UF, NCSU, UMN
• 40% of the bites were identified (Pygmy rattlesnakes 22%, Cottonmouths 13%, Eastern diamondback rattlesnakes 5%)
• Median amount of vials administered 1 vial (1-10)
• Decision to administer antivenin was based on clinician’s decision and severity
• Administration of more vials was associated to poorer outcomes
• 113 envenomed dog by Prairie rattlesnake – Wheat Ridge Animal Hospital

• 2 groups: symptomatic treatment and antivenin treatment group

• Mortality rate 1.8%

• Both the cost and the duration of hospitalization were significantly greater in the group of dogs that received antivenom
Type III hypersensitivity reaction from injection of foreign protein or serum > immune complex formation, few days to 4 weeks after administration

Urticaria, arthralgias, myalgias, glomerulonephritis, vasculitis and neuritis

5y SF Boxer, Diamondback bite receiving 8 vials of antivenin

Day 3: pitting edema, fever, leukocytosis, hemolysis

Serum complement assay 60 U/mL (reference range 120–216 U/mL)

Strong correlation between amount of antivenin given and incidence of serum sickness in people
# Snake Severity Score

## Snakebite Severity Score

<table>
<thead>
<tr>
<th>System</th>
<th>Score</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Minimal: slight dyspnea</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Moderate: respiratory compromise, tachypnea, use of accessory muscles</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Severe: cyanosis, air hunger, extreme tachypnea, respiratory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>insufficiency or respiratory arrest from any cause</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Minimal: tachycardia, general weakness, benign</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dysrhythmia, hypertension</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Moderate: tachycardia, hypotension (tarsal pulse still palpable)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Severe: extreme tachycardia, hypotension (nonpalpable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tarsal pulse or systolic blood pressure &lt; 80 mmHg), malignant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dysrhythmia or cardiac arrest</td>
</tr>
<tr>
<td>Local Wound</td>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Minimal: pain, swelling, ecchymosis, erythema limited</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to bite site</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Moderate: pain, swelling, ecchymosis, erythema involves less</td>
</tr>
<tr>
<td></td>
<td></td>
<td>than half of extremity and may be spreading slowly</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Severe: pain, swelling, ecchymosis, erythema involves</td>
</tr>
<tr>
<td></td>
<td></td>
<td>most or all of one extremity and is spreading rapidly</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Very severe: pain, swelling, ecchymosis, erythema extends beyond</td>
</tr>
<tr>
<td></td>
<td></td>
<td>affected extremity or significant tissue necrosis</td>
</tr>
</tbody>
</table>

## Gastrointestinal

<table>
<thead>
<tr>
<th>Score</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Minimal: abdominal pain, tenesmus</td>
</tr>
<tr>
<td>2</td>
<td>Moderate: vomiting, diarrhea</td>
</tr>
<tr>
<td>3</td>
<td>Severe: repetitive vomiting, diarrhea, or</td>
</tr>
<tr>
<td></td>
<td>hematemesis</td>
</tr>
</tbody>
</table>

## Hematological

<table>
<thead>
<tr>
<th>Score</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Minimal: coagulation parameters slightly abnormal, PT &lt; 20</td>
</tr>
<tr>
<td></td>
<td>sec, PTT &lt; 50 sec, platelets 100,000 to 150,000/mm³</td>
</tr>
<tr>
<td>2</td>
<td>Moderate: coagulation parameters abnormal, PT 20-50</td>
</tr>
<tr>
<td></td>
<td>sec, PTT 50-75 sec, platelets 50,000 to 100,000/mm³</td>
</tr>
<tr>
<td>3</td>
<td>Severe: coagulation parameters abnormal, PT 50-100</td>
</tr>
<tr>
<td></td>
<td>sec, PTT 75-100 sec, platelets 20,000 to 50,000/mm³</td>
</tr>
<tr>
<td>4</td>
<td>Very severe: coagulation parameters markedly</td>
</tr>
<tr>
<td></td>
<td>abnormal with bleeding present or the threat of</td>
</tr>
<tr>
<td></td>
<td>spontaneous bleeding, including PT unmeasurable,</td>
</tr>
<tr>
<td></td>
<td>PTT unmeasurable, platelets &lt; 20,000/mm³</td>
</tr>
</tbody>
</table>

## Central Nervous System

<table>
<thead>
<tr>
<th>Score</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
</tr>
<tr>
<td>1</td>
<td>Minimal: apprehension</td>
</tr>
<tr>
<td>2</td>
<td>Moderate: chills, weakness, faintness, ataxia</td>
</tr>
<tr>
<td>3</td>
<td>Severe: lethargy, seizures, coma</td>
</tr>
</tbody>
</table>

Overview and controversies in the medical management of pit viper envenomation in the dog

Antihistamines
• Only if type I Hypersensitivity occurs
• Incidence of hypersensitivity Crofab 14%, ACP 23-56% in humans, 7% in dogs

Glucocorticoids
• No proven benefits during envenomation
• Use in anaphylaxis and serum sickness may be useful

NSAIDS
• Impairs platelet aggregation – worsens coagulopathy

Antimicrobials
• Low incidence of infections from snake bites
Most common oral flora include gram (-) rods (Enterobacter, P. aeruginosa, Aerobacter, Proteus), Streptococcus, S. aureus, Clostridium and Bacteriodes

Venom itself may be bactericidal

102 envenomated dogs – private practice California

Only 1 patient developed an abscess, more likely due to compartment syndrome than the bite <1%

Antibiotics are only recommended if necrosis or abscess is present and based on culture
• 38 dogs – South Africa
• Cardiac arrhythmias have previously been reported in 9–25% of viper-envenomed dogs
• Dogs with systemic inflammation had significantly higher cTnI than dogs without systemic inflammation
• No difference in cTnI were observed between envenomed dogs without systemic inflammation and healthy control dogs
• Viper may have a cardiotoxic component to their venom or myocardial injury may be cytokine induced
Venom-induced consumptive coagulopathy:
  • Thrombocytopenia
  • Prolonged clotting times
  • Depletion of fibrinogen and clotting factors
  • Increased fibrin degradation product concentrations

38 dogs - UF

74% had abnormal TEGs (↓ G or ↑ Ly30), most common towards hypocoagulable

Decreased MA and G value on presentation was associated with mortality

TEG can be used as a monitoring tool to assess antivenin administration and need for additional vials
Coral Snake

50-110 cm long, requires chewing to inject

Most toxic snake in North America in terms of mg of dried weight

Elapid Family - Micrurus fulvius fulvius

Venom:
- Postsynaptic α-neurotoxin (block nicotinic ACH receptors of NMJ)
- Phospholipases - minimal effects
  - Hemolysin (inhibits platelet aggregation and plasmin)
  - Myotoxic (muscle swelling and weakness)
  - Cardiotoxic (↓ contractility)

Red on Yellow, kill a fellow
Red on Black, friend of Jack* Only in USA

Coral Snake Venom

Acetylcholine receptors

Acetylcholine

Endocytosis

Synaptic vesicles

Neuron

http://www.sareptiles.co.za/gallery/albums/userpics/17766/436473a-f1_2.jpg
Clinical Signs

• Muscle fasciculations, pharyngeal spasms, ptosis, salivation, drowsiness
• Hemolysis, hemoglobinuria
• Neurological signs: generalized muscle weakness, hyporeflexia, quadriplegia
• Cause of death: respiratory depression and paralysis

http://visual.ly/pets-summer-series-snakebites-family-pets
**Treatment**

- **Antivenin – Coralmyn ($760 per vial)**
  - Produced in Mexico
  - Special importer’s license needed
  - Polyclonal antivenom fragment produced from horses immunized to coral snakes
  - Use in confirmed and suspect cases
  - Only stops progression

- **Supportive Care**
  - Pressure immobilization until antivenin
  - Mechanical ventilation (up to 48hr)
  - Fluids
  - Nutrition
  - Risk of aspiration pneumonia
A retrospective evaluation of coral snake envenomation in dogs and cats: 20 cases (1996–2011)

Mayrim L. Pérez, DVM; Karlie Fox and Michael Schaer, DVM, DACVIM, DACVECC

- 16 dogs and 4 cats – UF
- Median time for onset of clinical signs 105 minutes (10 dogs witnessed bite)
- 10/14 received antivenin
  - Clinical signs improved in 24hr
  - Had shorter LOH
- 4/16 dogs required ventilation
- Hemolysis 60% dogs
- 71% survived to discharge

### Clinical Signs

<table>
<thead>
<tr>
<th>Dogs/Cats</th>
<th>Quiet mentation 50%/75%</th>
<th>Ataxia 19%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teraparesis 25%</td>
<td>Muscle fasciculations 12%</td>
</tr>
<tr>
<td></td>
<td>Ptyalism 25%</td>
<td>Decreased spinal reflexes 12%/25%</td>
</tr>
<tr>
<td></td>
<td>Tachypnea 25%</td>
<td>CP deficits 12%/75%</td>
</tr>
<tr>
<td></td>
<td>Shallow breathing 19%/25%</td>
<td>Slow PLR 6%/25%</td>
</tr>
<tr>
<td></td>
<td>Decreased to absent gag 19%</td>
<td>Hemorrhagic diarrhea 6%</td>
</tr>
</tbody>
</table>
Black Widow Spider

Females have an hour-glass pattern in red or orange on ventrum
Males are unable to penetrate skin due to small size of jaw

Venom is voluntarily injected by striated muscle
15% of human bites are dry

Cats are very sensitive to venom

*Latrodectus mactans*
*Latrodectus variolus*
*Latrodectus bishop*
*Latrodectus heperus*
*Latrodectus geometricus* – brown widow
*Latrodectus mactans*
Black Widow Venom

Venom has ↑ toxicity in spiders living in areas with higher temperatures

LD50: 0.42 mg/kg - *L. geometricus* (brown widow)
1.39 mg/kg - *L. mactans*

Syndrome in humans: 3-6 days

Onset of clinical signs occurs during the first 8 hr
Black Widow Venom

Neurotoxin - α-Latrotoxin:
• Stimulates end plate action potential, forming an open channel for monovalent cation exchange
• Depolarization > Ca-independent release of neurotransmitters (acetylcholine and norepinephrine) and inhibits their reuptake
• Later blocks neurotransmission, likely due to depletion of synaptic vesicle content at the NMJ
Clinical Signs

- Local tissue damage is uncommon, small puncture wounds may be visible
- Initial regional numbness > gives way to severe pain
- Tenderness in adjacent LN may precede hyperesthesia, progressive muscle pain and fasciculations > 10-20 hr later paralysis
- Cramping of thoracic, abdominal* and lumbar muscles is common
- Hypertension and tachycardia (pain)
- Respiratory distress > Cheyne-stoke respiratory pattern > death
- Cats are extremely susceptible and average survival time is 115hr (4.5 days)
- Elevated CK, leukocytosis, hyperglycemia, oliguria, albuminuria can be seen
Treatment

• Antivenin – Lyovac (*Latrodectus* antivenin)
  • Slow IV infusion
  • Allergic reactions and anaphylaxis can occur
  • Affordable, long-shelf life
• Ca gluconate for muscle cramping
  • No longer recommended
• Benzodiazepines – muscle relaxants
2-hour duration acute distress with pain and muscle stiffness involving the abdomen and pelvic limbs.

Clinical signs very similar to hypokalemic myopathy, however this usually does not progress to flaccid lower motor neuron paralysis as occurs with *Latrodectus* envenomation.
Antivenin was administered 26hr after hospitalization and clinical response was noted within 2 hr of administration, respiratory function improved and cat was in sternal recumbency

Antibiotics, steroids and aspirin were given as treatment (no longer recommended)

Hypokalemia was attributed to large catecholamine release and K shift
Brown Recluse Spider

Violin-shaped marking on the dorsum of the cephalothorax, neck of the violin pointing toward the abdomen

Nocturnal, active from spring through fall, found in and around human habitations

Necrotic arachnidism:

- *Loxosceles reclusa*
- *Loxosceles refuscent*
- *Loxosceles arizonica*
- *Loxosceles unicolor*
- *Loxosceles laeta*

Peterson, 2016
Brown Recluse Venom

Sphingomyelinase D:
• 1ary dermonecrotic factor
• Binds to cell mb, chemotaxis
• Prolongs aPTT, depletes factors VIII, IX, XI, and XII

Venom volume:
• Sex of spider (females >)
• Size of spider (larger >)
• Abnormally high or low temperatures (< volume)

Venom effects:
• Induces rapid coagulation and occlusion of small capillaries > tissue necrosis
• Hemolysis
• Platelet aggregation
• Frees body lipids act as emboli and inflammatory mediators

<table>
<thead>
<tr>
<th>Venom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyaluronidase</td>
</tr>
<tr>
<td>Esterase</td>
</tr>
<tr>
<td>Alkaline phosphatase</td>
</tr>
<tr>
<td>Lipase</td>
</tr>
<tr>
<td>5-ribonucleotide phosphorylase</td>
</tr>
<tr>
<td>Sphingomyelinase D</td>
</tr>
</tbody>
</table>
Clinical Signs

- Mild stinging up to 8 hr
- Subsequent pruritus and soreness (vasoconstriction and local ischemia)
- Edema with target, or “bull’s eye,” mark (erythematous area, dark necrotic center)
- Hemorrhagic bulla within 24-72 h with eschar (sloughs in 2-5 weeks > ulcer)
- Fever, vomiting, arthralgias, leukocytosis, hemolytic anemia, hemoglobinuria
- Systemic involvement is rare (AKI, DIC, death)
Brown recluse spider (*Loxosceles reclusa*)
envenomation in small animals

Lonny B. Pace, DVM and Richard S. Vetter, MS

Clinical categories:
1- No clinical signs or local irritation 95% cases
2- Necrotic arachnidism, gangrenous arachnidism or cutaneous loxoscelism 4% cases
3- Viscerocutaneous loxoscelism <1% cases

Proposed treatments:
- Steroids
- Dapsone
- Antihistamines
- Colchicine
- Surgical excision
- Vasodilators
- Hyperbaric oxygen
- Antibiotics
- Anticoagulants
- Shock therapy
- Topical nitroglycerine
- High dose Vit C
- Meat tenderizer

A Chilean study rated susceptibility based on weight/dose relationships in several different animals to *L. laeta* venom. Rabbits, mice, guinea pigs, and dogs were rated as high susceptibility; hamsters, pigeons, chickens, and toads had moderate susceptibility; frogs were low; and rats and fish exhibited no response to the venom. Dogs (n = 2)
Dapsone:
- Antimycobacterial used in leprosy and pemphigus
- Inhibits influx of neutrophils
- Side effects similar to loxoscelism
- Only to be given within the 1st hours of the bite
- Not recommended

Antivenin:
- Only available in Brazil
- Successful if given within 1 hour of envenomation
- Antigen binding fragments attenuate the lesion if given within 4 hr

Tetracyclines:
- Decreases MMPs activated by venom
TREATMENT

• No antidote in USA
  • One antivenom in Brazil

• Mild local envenomation usually will respond to topical cool compresses

• Supportive care
  • Wound management
  • Pain management
  • Broad spectrum antibiotic therapy if needed
IDENTIFYING COMMON UNIFIED STATES HOUSE SPIDERS

LEGEND

- **HARMLESS**: Non-toxic bite.
- **SERIOUS**: Venomous. Non-fatal bite. (Potentially lethal. Seek immediate medical attention.)
- **DANGEROUS**: Toxic bite. Potentially lethal. Seek immediate medical attention.
- **SPECIES IS COMMON**: Lightly populated
- **NONE**: None

**BROWN RECLUSE**
Brown recluse spiders are light to dark brown, with a characteristic dark brown violin marking on their back.

**FOUND IN**
Prefers woodpiles, rubble piles, under stones, in hollow stumps, sheds and garages. Indoors it can be found in undisturbed, cluttered areas in basements and crawl spaces.

**YELLOW SAC SPIDER**
Yellow sac spiders are small to medium-sized spiders (0.5 to 2.5 inches long) and are usually yellowish or light-colored.

**FOUND IN**
Yellow sac spiders could be found in places like Garden sheds, Garages, House foundations, Behind picture frames, Window sills and Backyards.

**DOMESTIC HOUSE SPIDER**
Commonly known as the barn funnel weaver in North America. These spiders are often yellowish-brown in color with an elongated abdomen.

**FOUND IN**
Common in buildings or other man-made structures; any cellar, barn, or dark corner is fair game for this spider. It can be found outdoors in other sheltered spots, such as in wood piles and under rocks, etc.

**BLACK WIDOW**
Black widows are black and shiny, with a telltale red hourglass shape on their back.

**FOUND IN**
Prefers woodpiles, rubble piles, under stones, in hollow stumps, sheds and garages. Indoors it can be found in undisturbed, cluttered areas in basements and crawl spaces.

**JUMPING SPIDER**
Jumping spiders are compact in shape with short legs. They are usually black in color with pale markings.

**FOUND IN**
They are active during the day and are often found on windows, ceilings, walls, and other areas exposed to sunlight.
IDENTIFYING COMMON
UNITED STATES
HOUSE SPIDERS

LEGEND

 саха

HARMLESS
Non-toxic bite.

SERIOUS
Venomous. Non-fatal bite.

DANGEROUS

SPECIES IS COMMON

LIGHTLY POPULATED

NONE

HOB SPIDER
Large body of about 1/2-inch long. Their legs extend 1/2 to almost two inches. Color brown with yellow chevron-shaped markings on the abdomen.

FOUND IN
Outdoors in retaining walls, foundations, window wells, and stacks of firewood and brick. Indoors in basements, garages, or storage, under baseboard heaters or radiators, behind furniture in closets. Generally near the ground whether indoors or out.

SOUTHERN HOUSE SPIDER
Male are typically larger in size, lack the distinctive violin shape on their cephalothorax, and have unusually long slender pedes. The females are dark brown or black and more compact.

FOUND IN
They are partial to spaces within the masonry of buildings, especially dark recesses of window walls, shutters and overhangs. Occasionally found under tree bark but are frequently seen on houses, barns, bridges, and other man-made structures.

COMMON HOUSE SPIDER
Also known as American house spiders are generally dull brown in coloration, with patterns of differing shades often giving a vaguely spotted appearance (particularly noticeable on the legs).

FOUND IN
Common indoors, although they also have outdoor habitats. These spiders prefer humid locations and may be easily discovered in crawl spaces or basements.

CELLAR SPIDER
Cellar spiders are pale yellow to light brown in color with long, skinny legs and a small body.

FOUND IN
Cellar spiders well to human habitats and are commonly found in corners and dark spaces in and around buildings, especially in basements.

Scorpions

Small light brown scorpion common to the Sonaran Desert in southwest USA and northwestern Mexico

Nocturnal and prefers to ambush its prey, usually feeding on crickets, roaches, beetles, and other small insects

*Centruroides sculpturatus* – Arizona Bark Scorpion
Scorpion Venom

- Mucopolysaccharide
- Hyaluronidase
- Phospholipase
- Acetylcholinesterase
- serotonin
- Histamine protease inhibitors
- Histamine releasers
- Neurotoxins
# Scorpion sting classification

<table>
<thead>
<tr>
<th>Clinical Grade or Class</th>
<th>Clinical Effects</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Local effects only</td>
<td>Analgesia, local anesthesia</td>
</tr>
<tr>
<td>2</td>
<td>Autonomic excitation</td>
<td>Antivenom, prazosin</td>
</tr>
<tr>
<td></td>
<td>Agitation and anxiety</td>
<td>Oral benzodiazepines</td>
</tr>
<tr>
<td>3</td>
<td>Pulmonary edema</td>
<td>Admission to intensive care unit, noninvasive or mechanical ventilation, antivenom, vasodilators (e.g., prazosin), in some cases nitroglycerin††</td>
</tr>
<tr>
<td></td>
<td>Hypotension and cardiogenic shock</td>
<td>Antivenom, dobutamine infusion†</td>
</tr>
<tr>
<td></td>
<td>Severe neuromuscular excitation (associated with centruroides species)</td>
<td>Antivenom, benzodiazepine infusion†</td>
</tr>
<tr>
<td>4</td>
<td>Multiorgan failure, including coma, seizures, and end-organ damage caused by hypotension</td>
<td>Supportive care, mechanical ventilation, inotropes (e.g., dobutamine), benzodiazepine infusion</td>
</tr>
<tr>
<td>Treatment</td>
<td>Effect</td>
<td>Indications</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Analgesic agent (acetaminophen, ibuprofen)</td>
<td>Provides pain relief and antiinflammatory action; acetaminophen also has antipruritic effect.</td>
<td>Local pain</td>
</tr>
<tr>
<td>Local anesthetic agent</td>
<td>Provides relief from severe local pain</td>
<td>Severe pain that does not respond to analgesia</td>
</tr>
<tr>
<td>Antivenom</td>
<td>Binds toxins and prevents them from reaching target site; increases rate of toxin elimination.</td>
<td>Systemic envenomation</td>
</tr>
<tr>
<td>Prasoxin</td>
<td>Decreases peripheral vascular resistance without affecting cardiac output or heart rate or contributing to elevation of catecholamine levels</td>
<td>Indications of excess catecholamine, hypertension</td>
</tr>
<tr>
<td>Dobutamine (or other isotope)</td>
<td>Treats cardiogenic shock and decreases in cardiac output resulting from elevated catecholamine levels and myocardial injury</td>
<td>Hypotension due to cardiogenic shock</td>
</tr>
<tr>
<td>Nitroglycerin</td>
<td>Acts as vasodilator for treatment of pulmonary edema; decreases preload and afterload through arteriolar dilation and venodilation</td>
<td>Pulmonary edema</td>
</tr>
<tr>
<td>Benzodiazepine (e.g., midazolam, diazepam)</td>
<td>Acts as an anticonvulsant and may be effective for treatment of hypertension associated with sympathetic excitation; in cases of severe neuromuscular excitation, used for sedation and symptomatic relief (e.g., midazolam in patients with centruroides stings)</td>
<td>Neuromuscular incoordination, sympathetic agitation and seizures</td>
</tr>
<tr>
<td>Atropine</td>
<td>Acts as a muscarinic receptor blocker to ameliorate cholinergic effects of sting, including bradycardia, early hypotension, and excessive sweating or salivation; can potentiate sympathetic effects, including hypertension</td>
<td>Severe bradycardia associated with hypotension or cardiac decompensation</td>
</tr>
<tr>
<td>Other vasodilator (e.g., hydralazine, captopril, lidocaine, sodium nitroprusside, dionine)</td>
<td>Decreases peripheral vascular resistance and reduces hypertension, but evidence for use not strong and has potential adverse effects (e.g., sympathetic stimulation, reflex tachycardia)</td>
<td>Not recommended because of potential adverse effects</td>
</tr>
</tbody>
</table>
Hyperemic, pain, aggressiveness, tachypnea, tachycardia, and discrete erythema

Asymptomatic within 24h

Natural envenomation dose (0.4 mg/total dose SQ) – G2
  - local pain, hyperesthesia, sialorrhea, vomiting, diarrhea, sneeze and prostration

Experimental dose (0.25 mg/kg SQ) – G1
  - caused acute and reversible cardiac injury in few days
Hyperemic, pain, aggressiveness, tachypnea, tachycardia, and discrete erythema
Asymptomatic within 24h
Hymenoptera

3 medically important groups:
• Apoidea (bees 20,000 species)
• Vespoidea (wasps, hornets, and yellow jackets 15,000 species)
• Formicidae (ants 15,000 species)

Deliver venom by stinging

Most deaths are related to hypersensitivity reactions and anaphylaxis, although massive envenomation can lead to death regardless

Lethal dose: 20 stings/kg in most mammals
# Hymenoptera Venom

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Comparison of Hymenoptera Venom</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apids (bees)</strong></td>
<td><strong>Vespid (wasps, yellow jackets, hornets)</strong></td>
</tr>
<tr>
<td>Phospholipase A</td>
<td>Phospholipase A</td>
</tr>
<tr>
<td>Hyaluronidase</td>
<td>Hyaluronidase</td>
</tr>
<tr>
<td>Melittin</td>
<td>Melittin</td>
</tr>
<tr>
<td>Apamin</td>
<td>Apamin</td>
</tr>
<tr>
<td>Biogenic amines</td>
<td>Acid phosphatase</td>
</tr>
<tr>
<td></td>
<td>Acid phosphatase</td>
</tr>
<tr>
<td></td>
<td>Antigen 5</td>
</tr>
<tr>
<td></td>
<td>Mast cell degranulating peptide</td>
</tr>
<tr>
<td></td>
<td>Minimine</td>
</tr>
</tbody>
</table>

Fitzgerald et al, 2006
Bees

Honey bees can only sting once, barbed stinger stays in victim’s skin

Usually not aggressive, with exception of Africanized bees

Anaphylaxis is not dose-related and death can occur after a single sting

Venom:
• Phospholipidase A2 major allergen
• Mellitin causes pain > catecholamine release + phospholipidase A2 causes intravascular hemolysis
• Hyaluronidase disrupts collagen allowing venom to spread
• Apamin is neurotoxic
• Adolapin inhibits prostaglandin synthesis and is anti-inflammatory
• Mast cell degranulating protein
5 yo NM Beagle

100 bee stings > anaphylactic shock

48hr after presented in respiratory distress

Acute lung injury: acute onset, hypoxemia, bilateral infiltrates

Fluids, cefazolin, heparin and oxygen
Wasp and Hornets

More aggressive than bees, live in shrubs and trees
Carnivores, live on insects and sweets, feeding cue from flesh smell of sugars
Unbarbed stinger, can sting multiple times

Venom:
• Antigen 5 is the main allergen
• Phospholipidase A may produce coagulation abnormalities
5 y NM Golden Retriever and a 5y NM Labrador
Found collapsed with numerous yellow jackets on them

Labrador: Hemolysis, AKI, DIC, resp failure, euthanasia
• Necropsy: multiorgan hemorrhage, severe pulmonary edema, acute tubular necrosis

Golden: Coagulopathic, elevated liver enzymes, icteric, pulmonary edema
• Treatment: FFP, oxygen, furosemide, antibiotics, antiemetics
Fire Ants

Very aggressive, 3-4 mm, omnivorous
Latch on 1st with mandible, then stings with unbarbed stinger, rotate one step sideways and sting again, repeat this 6-7 times

Systemic toxic reaction: 50-100 simultaneous stings
Massive envenomation can occur leading to death in 24 hr, although most deaths are due to anaphylaxis
Fire Ants

Venom:
• 95% water-insoluble alkaloid (2,6 di-substituted piperidines) – cytotoxic, hemolytic, antibacterial and insecticidal – very painful, produces pustules
• Aqueous phase has 4 major allergens
• Hyaluronidase and phospholipase

Sterile pustules formed by 24 hr > pathognomonic
• Infiltrated with activated neutrophils and platelets with necrotic base

Treatment is symptomatic

Fitzgerald et al, 2006
Bufo Toad

Toads are known to be more active in periods of high rainfall, humidity and temperature.

Cane or Marine toad *Bufo marinus* (Florida and Hawaii)

Colorado river toad *Bufo alvarius*
Bufo Toad Venom

Lethal dose: 0.1 g/dog (entire content of both parotids)
Absorbed across mucus membranes

Release secretions from parotid glands located on the dorsum of their head and neck

• Can also be squirted up to 2 mt
• Bufagenins and bufotoxins: cardioactive steroids, digitalis-like substances, inhibition of Na/K/ATPase $\uparrow$ intracellular Na in myocardial cells $\uparrow$ intracellular Ca $\uparrow$ predisposing to ventricular arrhythmia and possible fibrillation
• Bufotenine is a pressor substance (catecholamines, epinephrine, norepinephrine, dopamine) and hallucinogenic (serotonin, 5-HTP)
Bufo Toad

Treatment
• Wash mouth
• IV fluids
• Diazepam 0.5-2 mg/kg IV
• Propanolol 0.02-0.06 mg/kg slow IV – tachycardia
• Atropine – only if bradycardic (< 50beats/min), not necessary for ptyalism
• Hypertonic fluids if needed

Monitoring
• ECG
• Blood pressure
• Seizure watch
66 dogs with toad envenomation

Spring and summer most frequent envenomations

18% previous offenders (mean 3 exposures)

96% survival with treatment

---

**Clinical signs**

<table>
<thead>
<tr>
<th>Neurologic abnormalities 54%</th>
<th>Seizures 43% (9% status)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stupor 33%</td>
<td>Ataxia 33%</td>
</tr>
<tr>
<td>Nystagmus 31%</td>
<td>Extensor rigidity 8%</td>
</tr>
<tr>
<td>Hyperemic mm 51%</td>
<td></td>
</tr>
<tr>
<td>Ptyalism 42%</td>
<td></td>
</tr>
<tr>
<td>Recumbency or collapse 18%</td>
<td></td>
</tr>
<tr>
<td>Tachypnea 16%</td>
<td></td>
</tr>
<tr>
<td>Vomiting 12%</td>
<td></td>
</tr>
</tbody>
</table>
A retrospective report of 90 dogs with suspected cane toad (Bufo marinus) toxicity

MP REEVES

90 dogs
41% witnessed cases
59% suspected cases
76% small breed dogs (terriers mostly)
96% survival with treatment
Questions?
References


Envenomations

Mariana A. Pardo
Emergency and Critical Care
2016
Paralysis Tick

Larva: **SNOUT** is very long; **BODY** is pale grey to very dark blue-grey.

Nymph: **LEGS** are light orange-brown; **BODY** is pear-shaped to round and light grey to very dark blue-black.

Adult: **LEGS** form a v-shape line from the snout down the sides of the body; the first and last pair of legs are brown and the second and third pair are pale; **BODY** is pear-shaped to oval and yellow-grey to light grey with a dark band on the sides; **FACE** is oval but wider at the rear and brown; **SNOUT** is very long.

Tick activity scale

- LOW
- MEDIUM
- HIGH

= Life size
**Snake Severity Score**

**Pulmonary System**
- 0—Signs within normal limit
- 1—Minimal: slight dyspnea
- 2—Moderate: respiratory compromise, tachypnea, use of accessory muscles
- 3—Severe: cyanosis, air hunger, extreme tachypnea, respiratory insufficiency or respiratory arrest from any cause

**Cardiovascular System**
- 0—Signs within normal limits
- 1—Minimal: tachycardia, general weakness, benign dysrhythmia, hypertension
- 2—Moderate: tachycardia, hypotension (but tarsal pulse palpable)
- 3—Severe: extreme tachycardia, hypotension (non palpable tarsal pulse), malignant dysrhythmia or cardiac arrest

**Local Wound**
- 0—Signs within normal limits
- 1—Minimal: pain, swelling, ecchymosis, erythema limited to bite site
- 2—Moderate: pain, swelling, ecchymosis, erythema involves less than half of extremity and may be spreading slowly
- 3—Severe: pain, swelling, ecchymosis, erythema involves most or all of one extremity and is spreading rapidly
- 4—Very Severe: pain, swelling, ecchymosis, erythema extends beyond affected extremity, or significant tissue slough

**Gastrointestinal System**
- 0—Signs within normal limits
- 1—Minimal: abdominal pain, tenesmus
- 2—Moderate: vomiting, diarrhea
- 3—Severe: repetitive vomiting, diarrhea, or hematemesis

**Hematological System**
- 0—Signs within normal limits
- 1—Minimal: coags slightly abnormal, platelets 100,000 to 150,000
- 2—Moderate: coags abnormal, platelets 50,000 to 100,000
- 3—Severe: coags abnormal, platelets 20,000 to 50,000
- 4—Very Severe: coags markedly abnormal with bleeding present or PT unmeasurable, PTT unmeasurable, platelets < 20,000

**Central Nervous System**
- 0—Signs within normal limits
- 1—Minimal: apprehension
- 2—Moderate: chills, weakness, faintness, ataxia
- 3—Severe: lethargy, seizures, coma