Venomous Snakes

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Snakebite
A Neglected Tropical Disease
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A Neglected Tropical Disease (WHO)

• The World Health Organization has recently added **snakebite envenomation** to its list of Neglected Tropical Diseases

• Snakebite incidence: 5 million persons/year

• Snakebite mortality >125,000 annually

• Snakebite morbidity >400,000 persons left with permanent disability

• Lack of access to medical care and antivenoms in many parts of the underdeveloped world
World Health Organization
Symbol of the United States
Should it be the bald eagle, the turkey or the rattlesnake?

• **Benjamin Franklin** wanted to make the rattlesnake the symbol of the United States, rather than the Bald Eagle, which he thought to be “a bird of bad moral character.”

• In 1775, writing under an alias, Franklin recommended the rattlesnake represent the United States.

• Franklin wrote, “The rattlesnake is found in no other quarter of the world; lacking eyelids, she may therefore be esteemed an emblem of vigilance. She never begins an attack, nor, when once engaged, ever surrenders. She is therefore an emblem of magnanimity and true courage. Her weapons are decisive and fatal and her rattles total just thirteen, exactly the number of the Colonies.”
The Dramatic Works of Arthur Conan Doyle.

The Speckled Band
An Adventure of Sherlock Holmes

By Arthur Conan Doyle

Price One Shilling and Sixpence Net.

For no such amateur representation of this Play in Five Guineas, payable in advance to Samuel French, Limited, 26, Southampton Street, Strand, London.

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Sherlock Holmes: The Speckled Band

No swamp adder in India

Snakes don't drink milk!

Snakes can't hear whistles

Snakes can't climb ropes

The swamp adder's bite takes many, many minutes to kill
“I HATE SNAKES!”

-Indiana Jones in “Raiders of the Lost Ark”
“Ophidiophobia”

“I HATE SNAKES!”

Indiana Jones in “Raiders of the Lost Ark”
King Cobra, Tropical Asia

the world’s largest venomous snake
The Most Deadly Snakes in the World

• Australian brown snake (Pseudonaja)
• Tiger snake (Notechis scutatus)(Australia)
• Fierce Snake (or Inland Taipan)(Australia) (Oxyuranus microlepidotus)
  – Most potent venom of any snake
  – One drop of its venom can kill 200,000 mice
• Black mamba (Dendroaspis)
• Cobras (Naja sp.)
• Beaked sea snake (Enhydrina)
• Russell’s viper (Vipera russelli)
• African puff adders (Bitis sp.)
Australian Brown Snake
Venomous Snakes

*Elapidae* - Elapids

- Includes the highly venomous cobras, kraits, mambas, taipans, coral and sea snakes and all the venomous snakes in Australia
- Found mostly in tropical and subtropical regions—250 species in Australia, Asia, Africa, and tropical America
- Venom is a neurotoxin
Indian Cobra
with snake charmer
playing flute (snakes are deaf)
Western green mamba, Africa

Has a potent neurotoxin

Up to 10 ft long and can move at 20 mph

A Beautiful Snake!
Surfing in San Clemente

What does this have to do with venomous snakes?
Yellow-Bellied Seasnake
Distribution of Yellow-Bellied Sea Snake in U.S.
Venomous Snakes—U.S.A.

- **Crotalidae** (pit vipers)
  - *Crotalus*: rattlesnakes
  - *Agkistrodon*: copperheads, moccasins
  - *Sistrurus*: pygmy rattlesnake, massasauga

- **Elapidae**
  - *Micrurus fulvius fulvius* (Eastern coral snake)
  - *Micrurus euryxanthus* (Arizona or Sonoran coral snake)
Rattlesnake

Sonoran Coral Snake envenomating a nonvenomous snake
Elapidae
United States

- Eastern coral snake (*Micrurus fulvius*)
- Arizona coral snake (*Micruroides euryxanthus*)
- Very colorful with bands of red and black divided by white or yellow rings
- Head is black
- Several nonvenomous colubrid snakes mimic the color pattern of coral snakes
Sonoran Coral Snake

Distribution of *Micruroides euryxanthus*.
Eastern Coral Snake

Distribution of *Micrurus fulvius*.
ARIZONA CORAL SNAKE
(Micruroides euryxanthbus euryxanthbus)
Coral Snake: “red-to-yellow, kill-a-fellow” (red band next to yellow band)
Kingsnake: “red-to-black, nice-to-Jack” (nonvenomous)
Harmless Louisiana Milk Snake
Which one is the coral snake?

Which one is the harmless milk snake?
Pit Vipers
Characteristics

• Heat-sensing pit located between each eye and nostril
• Elliptical pupils
• Fangs
• Triangular head
• Single row of subcaudal plates
Pit viper

Nonvenomous Snake

North American Snakes (excluding coral snakes)
Southern Copperhead, a pit viper, no rattle, not found in CA
Copperhead
More Pit Vipers

Trans-pecos Copperhead (Texas)

Eastern cottonmouth (water mocassin)
Florida Cottonmouth - a pit viper - no rattle
Cottonmouth
Rattlesnakes

- Found in all states except Alaska, Hawaii, Maine, Delaware, and District of Columbia
- Found up to 11,000 feet elevation in California; 9,000 feet elsewhere in USA
- Mature rattlesnakes eat only every 2-3 weeks
- Immune to rattlesnake venom
- Ovoviviparous: eggs hatch in mother’s body, so young are born alive
Rattlesnakes

- **Vision**: poor; close range only (a few feet); responsive to moving objects
- **Hearing**: rattlesnakes are deaf
- **Vibration**: excellent at detecting ground vibration
- **Smell**: excellent sense of smell
- **Pit**: detects heat at close range (<14 inches)(infrared thermal imaging?)
12. Diamondback rattlesnake skull showing fangs and replacement fangs.
Nathan W. Cohen
RATTLE

• Loosely articulated, interlocking series of horny rings at the end of the tail which produces a hissing sound when vibrated

• **Sounds *like frying bacon***

• A warning device intended to drive away creatures that might harm the snake

• New rattle segment forms each time the snake sheds its skin

• Poor correlation between number of rattles and snake’s age.
In general, a rattlesnake can strike out for half of its body length. For example, a six-foot rattler can strike to three feet away. However, a rattlesnake that is up on a ledge may be able to strike farther.
RATTLESNAKES
Southern California

• Southern Pacific rattlesnake
• Red Diamond rattlesnake
• Speckled rattlesnake
• Western Diamondback rattlesnake
• Sidewinder
• Mojave rattlesnake
SOUTHERN PACIFIC RATTLE SNAKE
(Crotalus viridis belleri)
Fig. 20 Southern Pacific rattlesnake (C. v. helleri) in resting coil
EM resident holding a rattlesnake that had bitten someone
Red Diamond Rattler
(San Diego County)
Eastern Diamondback
Western Diamondback
Aggressive, nasty disposition
Jackie Bibby, world recorder holder for rattlesnake bathtub sitting
Jackie Bibby a few years later with no leg and missing fingers
Snake Handling in Church, Harlan County, Kentucky
Reality TV
“Snake Salvation”
Preacher Jamie Coots

• “They shall take up serpents” (Mark 16:18)
• Feb 2014: bitten by rattlesnake during a service
• Refused to go to a hospital and died at home one hour later
Rattlesnake Bite Remedies

- Scarification, incision and suction
- Excision or amputation
- Cauterization: hot iron or coals, gunpowder
- Tourniquet
- Freezing, cold packs
- Cures derived from the snake
- Split-chicken treatment
Rattlesnake Bite Remedies

- Milk, onion, garlic, tobacco
- Turpentine, kerosene
- Alcohol
- Chemicals: potassium permanganate solution and caffeine tablets were part of snake bite kits (1900-1930)
- Opium, salt, ammonia
Prehospital Care
Rattlesnake Bites

• Note time of bite
• Avoid excessive activity
• Remove rings or constrictive items
• Immobilize the bitten part below heart level
• Mark level of swelling with a pen
• Transport as rapidly as possible to a medical facility equipped to handle snakebites
Prehospital Care
Rattlesnake Bite

• AVOID:
  – Tourniquets
  – Alcohol
  – Cryotherapy
  – Incision and suction

• Sawyer Venom Extractor?
SNAKE VENOMS

- **Hemolytic/cytotoxic venoms**
  - cause tissue destruction
  - low death rate, but limb loss is possible
  - North American pit vipers

- **Neurotoxic venoms**
  - direct action on brain and spinal cord
  - cause paralysis of voluntary muscles
  - higher death rate; victim dies of asphyxia
  - Elapids (Australian snakes, cobra, coral snake, etc.)
  - South American rattlesnakes
RATTLESNAKES

• North American rattlesnakes
  • mostly hemolytic/cytotoxic venoms
  • some have combinations of hemolytic and neurotoxic venom

• South American rattlesnakes
  • mostly neurotoxic venoms
  • more dangerous, higher death rate than North American rattlesnakes
Rattlesnake Venom

• Lethal protein and peptide components
  • designed to immobilize prey rapidly
  • damages vascular endothelial cells; capillary leak
  • extravasation of fluid, colloid, and RBC’s
  • damages red blood cell membranes
  • causes edema, hypovolemia, hemoconcentration, pulmonary edema, hemolysis
Rattlesnake Venom

• Digestive enzymes
  • Phospholipase A2
  • Hyaluronidase
  • Amino acid esterase, other thrombin-like enzymes
  • Proteolytic enzymes

• Effects of digestive enzymes
  • local necrosis
  • hemolysis
  • disseminated intravascular coagulation
  • hemorrhage
Rattlesnake Envenomation

• Up to 25% of bites are “dry”
  • No venom injected

• Fang marks
  • Single or double puncture wound
Rattlesnake Envenomation

• **LOCAL**
  • Sudden, severe pain at bite site
  • Progressive swelling
  • Erythema, ecchymoses, bullae

• **SYSTEMIC**
  • Paresthesias of face, scalp, extremities
  • Muscle fasciculations
  • Metallic, minty or rubbery taste in mouth
  • Hemolytic anemia, DIC
Rattlesnake Envenomation

3 y.o. boy in Pediatric ICU
Rattlesnake Bite in Laguna Beach, CA
Rattlesnake Bite
Symptoms and Signs

• About 20% of rattlesnake bites are “dry” bites (no envenomation)

• Mojave rattler
  – Minimal local reaction
  – Neuromuscular blockade (neurotoxic venom)
Emergency Care
Rattlesnake Bite

• If signs of envenomation:
  – Start large bore intravenous line
  – Send CBC, platelets, PT, PTT, fibrinogen, fibrin split products, BUN, creatinine
  – Monitor progression of swelling:
    • Mark with a pen every 30 minutes
    • Measure limb circumference
  – Monitor development or progression of systemic symptoms
CroFab (Crotalidae Polyvalent Immune Fab)

• Antigen-binding fragment (Fab) of sheep origin
• More efficacious against some venoms, such as those containing neurotoxins
• Shorter serum half-life (12-24 hrs) than the equine IgG antivenom (61-194 hrs)
• Unlike the equine IgG antivenom, repeat maintenance doses are usually required to prevent recurrence of symptoms
• Adverse effects: rash, urticaria, pruritus common, but no anaphylaxis
• Dosage: 4-6 vials IV infused over 60 minutes. Repeat same dose q 1 hour x 2 if no improvement. Then repeat 2 vials q 6 hours for three more doses
• Emergency help telephone number: 877-377-3784
• Cost: $9,300 for 12 vials when it was first released, now higher
Crotalidae Envenomation

Additional Measures

• Intravenous fluids, pressor agents, blood components may be needed
• Compartment syndrome: very rare
  – Always document an elevated intracompartmental pressure prior to considering fasciotomy
• Antibiotics: not routinely indicated
• Tetanus immunization
• Avoid corticosteroids
• Do not perform debridement earlier than 3 days after the bite
Crotalidae Envenomation

• If fang marks are present, but no symptoms or signs of envenomation occur, observe patient for 8-12 hours
7. Mojave rattlesnake (*Crotalus scutulatus*), the rattlesnake with the most potent venom in the United States. Nathan W. Cohen
Mojave Rattlesnake
(Crotalus scutulatus)

• Venom contains a potent neurotoxin
• Minimal local signs with systemic neurologic symptoms
• Sudden respiratory paralysis and cranial nerve palsies
• Early use of antivenom indicated
Bites by Exotic (Imported, Non-Native) Snakes

- Cobra, mamba, fer-de-lance, etc.
- Up to 4-10% of venomous bites in U.S.
- Most victims are young adult males bitten in their residence
- All zoos maintain supplies of antivenom to all exotic snakes on their premises, but they usually do not release these antivenoms to the public.

- The physician should call the nearest regional poison center for advice on treatment for bites by exotic snakes. The American Association of Poison Control Centers lists the phone numbers of regional poison centers on their web site [http://www.aapcc.org/].
- The regional poison center is also an excellent source of advice for management of envenomations by native American snakes and spiders and other venomous creatures
For assistance in managing snakebites

• *Don’t look it up in a book!*

• Call a **poison center**, which are staffed with experts in snake envenomations (and other envenomations). The treating physician may be able to speak directly to a snakebite expert.