Snake Bites – When to be Rattled

Brook Eide MD, MS, FACEP

Disclosures

- I have no financial disclosures
- I do not represent CroFab or Anavip

This talk is not dedicated to the “Black Mamba”

Talk Objectives

- Be able to identify US snakes that have venomous bites
- Understand the mechanism of snake bites and effects of common venoms on the body
- Be able to tell a dry bite from a venomous bite
- Be able to know when and how to evaluate and treat snake bites in the field and in the ED
- Have an understanding of how antivenom works and what options are now available for it

Snakes and Medicine

- Snakes have been tied to medicine since the beginning of modern medicine
- Snakes have been associated with fear, treatment and symbolism

Medicine itself uses snakes symbolically

- The snake-entwined staff symbol is known as the “Rod of Asclepius.” It traces back to the Greek god of healing, Asclepius, who is mentioned by Homer in the *Iliad* (c. eighth century B.C.).
- The serpent-entwined rod wielded by the Greek god Asclepius, a deity associated with healing and medicine.
  - The serpent with its change of skin **symbolizes** rebirth and fertility.

“Snake in the grass”

An underhanded, stealthily treacherous individual. The metaphor was already used by the Roman poet Virgil in his *Eclogues* (37 b.c.).

Bible references snakes over 80 times

- “Cursed are you above all livestock and all wild animals! You will crawl on your belly and you will eat dust all the days of your life” (Genesis 3:14).

“Snake Oil”

- “Snake oil” comes from 19th-century Chinese railroad workers who used medicine made from the Chinese water snake. The stuff worked; rich in Omega-3 fatty acids, it effectively treated conditions such as arthritis and bursitis. Americans were amazed by its healing powers.
- The term took on a new meaning when phony patent medicines promised to cure every disease known to man. Made up of mostly alcohol, this snake oil convinced people they felt better.


SNAKES!


Rapid City
Journal

Man dies after rattlesnake bite at Spearfish golf course

- June 8, 2018

“ A 70-year-old man died Monday after suffering a rattlesnake bite at Elkhorn Ridge Golf Club near Spearfish.
Lawrence Walters, of Geneseo, Ill., was reportedly looking for a ball in tall grass when he was bitten. Lawrence County Coroner Marty Goetsch said the officially listed probable cause of death was cardiac arrhythmia secondary to the snake bite — in other words, a heart attack brought on by the reaction of Walters' body to the bite. Goetsch said Walters also had other medical problems.”

Venomous Snakes

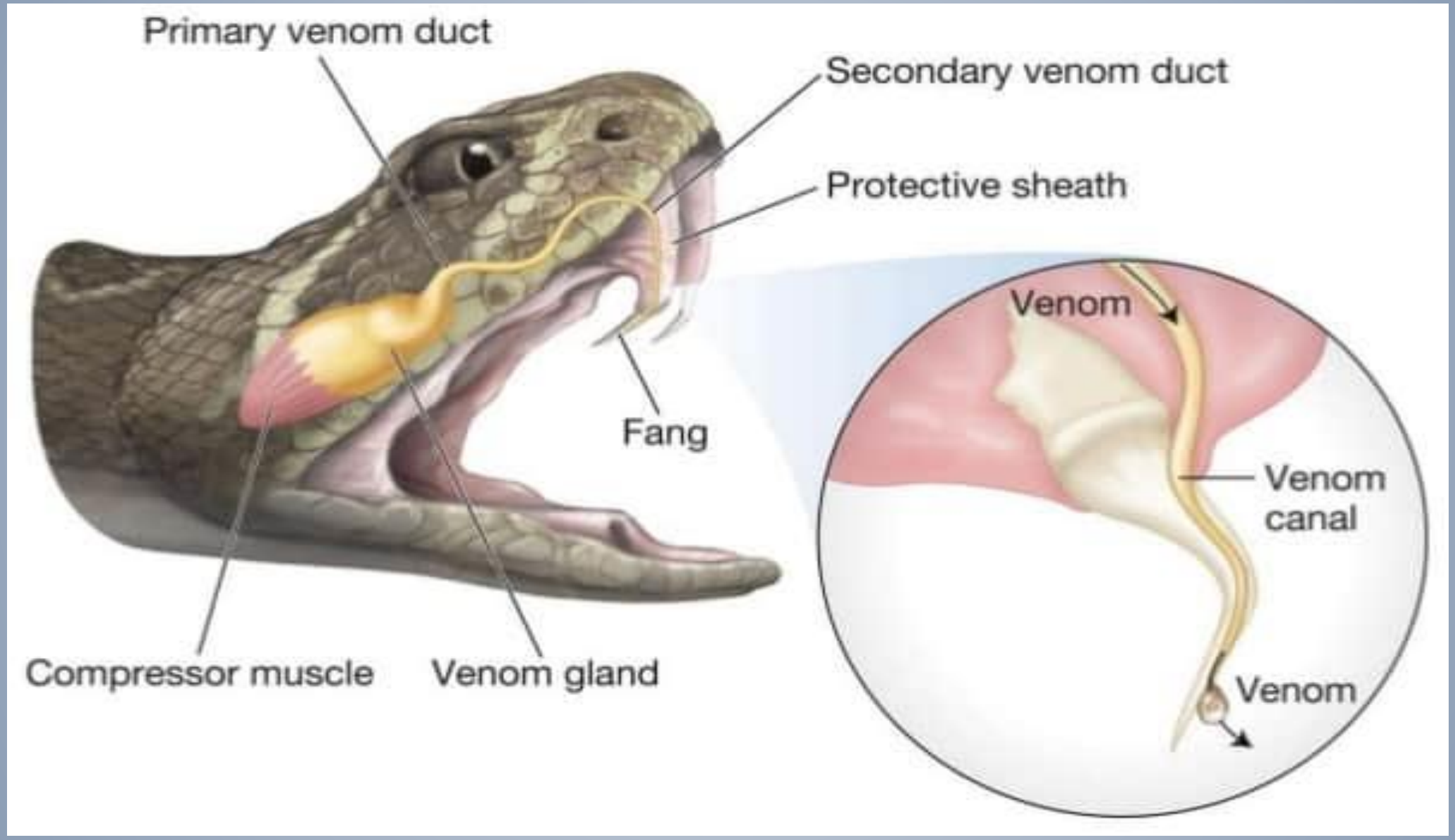
- Venomous snakes are species of the suborder Serpentes that are capable of producing venom, which they use for killing prey, for defense, and to assist with digestion of their prey
- The venom is typically delivered by injection using hollow or grooved fangs, although some venomous snakes lack well-developed fangs
- Venom is stored in the modified salivary glands of venomous snakes

Snake Venom Delivery and Injection System

- Most venomous snakes inject venom into their prey with their fangs
- Fangs are highly effective at delivering venom as they pierce tissue and allow venom to flow into the wound
- Some snakes are also able to spit or eject venom as a defense mechanism

Snake Venom Delivery and Injection System

- Venom injection systems contain four main components:
  - Venom glands
    - Specialized glands found in the head and serve as production and storage sites for venom
  - Muscles
    - Muscles in the head of the snake near venom glands help to squeeze venom from the glands
  - Ducts
    - Ducts provide a pathway for the transport of venom from the glands to the fangs
  - Fangs
    - These structures are modified teeth with canals that allow for venom injection


Primary venom duct
Secondary venom duct
Protective sheath
Fang
Compressor muscle
Venom gland
Venom
Venom canal
Venom

Snake Venom

- **Snake venoms** are composed of a complex collection of toxins, enzymes, and non-toxic substances, they have historically been classified into **three** main **types**
  - Cytotoxins
  - Neurotoxins
  - Hemotoxins
- The toxics substances work to destroy cells, disrupt nerve impulses, or both
  - This can lead to paralysis, internal bleeding, and death

Snake Venom

- The primary component of snake venom is protein. These toxic proteins are the cause of most of the harmful effects of snake venom.
- It also contains enzymes, which help to speed up chemical reactions that break chemical bonds between large molecules.
- These enzymes aid in the breakdown of carbohydrates, proteins, phospholipids, and nucleotides in prey.
- Toxic enzymes also function to lower blood pressure, destroy red blood cells, and inhibit muscle control.

Snake Venom

- An additional component of snake venom is polypeptide toxin.
- Polypeptides are chains of amino acids, consisting of 50 or fewer amino acids. Polypeptide toxins disrupt cell functions leading to cell death.
- Some toxic components of snake venom are found in all poisonous snake species, while other components are found only in specific species.

Cytotoxic venom

- Cytotoxic venom contains poisonous substances that destroy body cells.
- Cytotoxins lead to the death of most or all of the cells in a tissue or organ, a condition known as **necrosis**.
- Cytotoxins help to partially digest the prey before it is even eaten.
- Cytotoxins are usually specific to the type of cell they impact.
  - Cardiotoxins are cytotoxins that damage heart cells.
  - Myotoxins target and dissolve muscle cells.
  - Nephrotoxins destroy kidney cells.
  - Many venomous snake species have a combination of cytotoxins.
- Cytotoxins destroy cells by damaging the cell membrane and inducing cell lysis. They may also cause cells to undergo programmed cell death or apoptosis.
- Most of the observable tissue damage caused by cytotoxins occurs at the site of the bite.

Neurotoxic Venom

- Neurotoxic venom contains chemical substances that are poisonous to the nervous system.
- Neurotoxins work by disrupting chemical signals (neurotransmitters) sent between neurons. They may reduce neurotransmitter production or block neurotransmitter reception sites.
- Other snake neurotoxins work by blocking voltage-gated calcium channels and voltage-gated potassium channels.
- Neurotoxins cause muscle paralysis which may also result in respiratory difficulty and death.

Neurotoxic Venom

- Snakes of the family **Elapidae** typically produce neurotoxic venom.
- These snakes have small, erect fangs and include cobras, mambas, sea snakes, death adders, and coral snakes.
- Effects are uncontrollable muscle movement, convulsions, and breathing paralysis or diffuse paralysis.

Hemotoxic Venom

- Hemotoxic venom contains blood poisons that have cytotoxic effects and also disrupt normal blood coagulation processes.
- These substances work by causing red blood cells to burst open, by interfering with blood clotting factors, and by causing tissue death and organ damage.
- Destruction of red blood cells and the inability of blood to clot cause serious internal bleeding. The accumulation of dead red blood cells can also disrupt proper kidney function.
- While some hemotoxins inhibit blood clotting, others cause platelets and other blood cells to clump together. The resulting clots block blood circulation through blood vessels and can lead to heart failure.
- Snakes of the family **Viperidae**, including vipers and pit vipers, produce hemotoxins.

Major families of Venomous Snakes

- Viperids
  - Have hollow, foldable fangs. Vipers, rattlesnakes, copperheads, cottonmouths, adders, and bushmasters are in this family.
- Elapids
  - Have hollow fixed fangs. Cobras, kraits, mambas, sea snakes, coral snakes, and Australian copperheads are in this family.
- Colubridae
  - Have large fangs located in the rear of the jaw. This family contains many nonvenomous snakes, but also has a few very deadly snakes like boomslangs, tree snakes, vine snakes, and mangrove snakes.

Viperidae (Crotalidae) Family

- Vipers have an injection system that is very developed. Venom is continuously produced and stored in venom glands.
- Before vipers bite their prey, they erect their front fangs. After the bite, muscles around the glands force some of the venom through the ducts and into the closed fang canals.
- The amount of venom injected is regulated by the snake and depends on the size of the prey. Typically, vipers release their prey after the venom has been injected.
- The snake waits for the venom to take effect and immobilize the prey before it consumes the animal.
- Includes **pit vipers – rattlesnakes, cottonmouths, copperheads**

Rattle Snake

Copperhead

Cottonmouth / Water Moccasin

Water Moccasin vs Cottonmouth

- Why is the water moccasin also called a cottonmouth?

Elapidae Family

- Elapids have a similar venom delivery and injection system as vipers.
- Unlike vipers, elapids do not have movable front fangs. Most elapids have short, small fangs that are fixed and remain erect.
- After biting their prey, elapids typically maintain their grip and chew to ensure optimal penetration of the venom.
- Coral Snakes

Coral Snakes

- Coral snakes have distinctive red, yellow, and black bands
- There are many mimickers of coral snakes, including the California king snake.
- The mnemonic “Red on Yellow, Kill a Fellow. Red on Black, Venom Lack (or Friend of Jack).”
- Coral snakes are not aggressive and live mostly underground. Thus, most of the bites occur while being handled.

Coral snakes

- Elapidae venom has various toxins which produce systemic neurotoxicity.
- Coral snake envenomation may present with serious systemic toxicity with little findings at the actual site of envenomation due to the venom's lack of cytotoxicity.
- The neurologic abnormalities may include weakness, numbness, fasciculations, tremor, diplopia, bulbar palsies with slurred speech, dysphagia, and respiratory paralysis (immediate cause of death). Ptosis is frequently the initial sign of toxicity.
- Onset of clinical effects following envenomation occurs between one and seven hours but may be delayed up to eighteen hours.

Colubridae Family

- Colubrids have a single open canal on each fang which serves as a passageway for venom.
- Venomous colubrids typically have fixed rear fangs and chew their prey while injecting venom.
- Colubrid venom tends to have less harmful effects on humans than the venom of elapids or vipers.

Types of Venomous Snakes in US

- Rattle Snakes
- Copper Heads
- Cottonmouths/Water Moccasins
- Coral Snakes

US Snake Bites

- Rattlesnakes account for 65% of bites
- Copperheads are responsible for 25%
- Water moccasins account for about 9%
- The final 1% is made up of coral snakes and exotic snakes

US Snake Bites

- Snakebites lead to approximately 9,000 emergency department (ED) visits annually
- Five people die each year in the US of snake bites
- Poison center data suggest a case-fatality rate among rattlesnake victims of approximately 1 death per 736 patients

Rattle Snakes

- Multiple species of Rattle Snake in US
- ***Crotalus viridis*** **-** Prairie Rattle Snake located from southern Canada to Mexico
- Other common names are western rattle snake or great plains rattlesnake
- Can be as large as 5 feet but most adults are 3.5 feet in length

Prairie or Western Rattlesnake range

Most susceptible to bites

- Children
- Intoxicated
- Snake handlers
- Male


host. store. share.
photobucket

Pre-hospital care of snake bites

- There are a lot of myths and misunderstandings of how to treat snake bites

Pre-hospital care of snake bites

*** Get away from the snake!!! ***

- Remove jewelry from affected limb
- Immobilize in neutral position
- Do not place tourniquet
- Ice does not help
- Avoid NSAIDS secondary to platelet dysfunction
- Avoid electrical current
- Do not incise wound or bite or attempt to extract venom

Snakebite911

- App made by CroFab manufactures
- Patient, first responder, and provider care information
- Helps find nearest hospital with antivenom

T-Mobile 3:05 PM 89%

Select an Option

I Have Been Bitten by a Snake

I am a First Responder

I am a Medical Professional in the ER

First aid | Hospitals | Education | About

Bite presentation

- Bites usually cause severe pain from the time of envenomation and swelling that can progress at various rates due to lymphatic spread.
- Hematologic abnormalities are common in Viperidae envenomation, including thrombocytopenia, elevated PT, and decreased fibrinogen.
- Systemic toxicity can result in oral paresthesia, metallic taste, fasciculations, tachycardia, hypotension, and anaphylaxis.

Initial ED Snake Bite Evaluation

- Tetanus
- Clean wound
- Mark any borders if inflammation present
- Supportive care and pain management
- Determine type of snake and if envenomation occurred

Initial ED Evaluation

- Palpation of the envenomated area and marking the leading edge of swelling and tenderness every 15 to 30 minutes is a useful way to determine whether local tissue effects have stabilized or are progressing.
- Opioids are preferred over non-steroidal anti-inflammatory drugs (NSAIDs) because of the theoretical risk of bleeding associated with NSAID use in patients who may develop coagulopathy or thrombocytopenia due to envenomation.
- Standard recommendations for tetanus booster immunization.
- Antibiotics are not recommended.

Who to treat

- Signs of moderate to severe signs of envenomation
  - Marked swelling
  - Systemic findings of envenomation
  - Abnormal coagulation testing and/or bleeding
- Dry bite vs envenomation

Dry Bite

- Defined as bites that do not result in local tissue damage, hematological abnormalities, or regional lymph node pain.
- 20 to 25% of bites are dry bites
- The true incidence may be much higher since they may not be seen in the emergency department and thus are not reported to the poison control center.
- Even if seems dry – treat bites to face or neck
- Normal labs 8 to 12 hours after bite confirm dry bite.
- Patients with apparent non-envenomation be observed in a health care facility for at least 8 hours, with repeat platelet count, prothrombin time, fibrinogen, and hemoglobin measurement prior to discharge.

Clinical Effects Produced by Envenomation

- *Local tissue effects*
  - Include soft tissue necrosis and chemically mediated inflammation. Clinically, these effects are evident as pain, redness, swelling, tenderness, and myonecrosis that begin adjacent to the bite site and spread with movement of the venom through the lymphatic system.
  - More than 90% of envenomated pit viper victims develop local tissue effects.
- *Hematologic venom effects*
  - Include fibrinogen degradation and platelet aggregation and destruction.
  - On a laboratory basis, these manifest as decreased fibrinogen levels, elevated prothrombin time, and thrombocytopenia. Detection of fibrin split products may be an early sign of a hematologic venom effect and is a sensitive predictor of subsequent coagulopathy. In prospective studies, the presence of fibrin split products within the first 12 hours of treatment predicted subsequent hypofibrinogenemia with 87% sensitivity and 69% specificity.
- *Systemic venom effects*
  - Include hypotension from direct cardiovascular toxicity, third-spacing and vasodilatation, nausea and vomiting, angioedema, and neurotoxicity.
  - Many pit viper envenomations can cause patients to experience a metallic taste and localized neuromuscular effects (fasciculation and myokymia).

What is the only state with no venomous snakes?

Rattle Snake Bite

- Labs
  - CBC (platelets)
  - PT, PTT, INR
  - Fibrinogen
  - Electrolytes, creatinine
  - D-dimer
  - (CK)
- Repeat in four to eight hours

Snake Bite Labs

- Fibrinogen is a more sensitive measure of venom-induced defibrination than prothrombin time, and should be followed, if obtainable.
- Although one-time measurement of fibrin split products in the first 12 hours post-bite is useful for early detection of incipient hematologic venom effects, no proven role in therapy has been established for serial fibrin split product measurements, and an elevated FSP alone is not an indication for antivenom treatment.

Indications for Antivenom

- Treatment with antivenom is indicated for any patient with progressive local tissue effects, hematologic venom effects, and systemic signs attributable to venom.
- Experts recommend withholding antivenom from patients with limb envenomations who have localized pain and swelling as the only manifestation of envenomation, provided that these local tissue effects are not progressing.
- For extremity envenomations, some experts use a threshold of swelling that has crossed a major joint [wrist, elbow, ankle, or knee] and is progressing for this purpose, while other experts treat minor hand envenomations more aggressively. Unfortunately, it is not known whether early administration of antivenom in a patient with apparently minor envenomation improves long-term limb functional outcomes.
- Any degree of true neurotoxicity, including localized fasciculations or myokymia, is an indication for antivenom administration. Some patients may present with symptoms attributable to anxiety; in the absence of signs of progressive envenomation, these patients can be reassured and observed.

Antivenom for everyone?

- Pregnancy
  - Not contraindicated
- Children
  - Don’t lower the dose - Snakes inject the same quantity of venom into children and adults. Thus, the dosage of antivenom is **not** dependent upon age.
- Obesity
  - The dosage of antivenom is **not** dependent upon weight.
- Severity of reaction
  - Dosage varies with the **severity** of envenomation; specifically, higher doses of antivenom are needed for patients with hypotension or serious active bleeding.

Antivenoms

- Generally speaking, antivenoms act by complexing with and thus neutralizing venom antigens, preventing toxic effects as well as enhancing elimination.
- Administration of antivenom, in adequate doses, effectively halts the spread of local tissue effects, reduces hematologic venom effects, and reduces systemic effects resulting from crotaline envenomation.
- Given this mechanism, existing tissue damage is not reversed; rather, its progression is halted.

Antivenom Works

- Prior to the availability of antivenoms active against Crotalinae snakebites and the widespread availability of emergency departments and critical care units, snakebite mortality ranged from 5% to 36% in the United States.
- After the introduction of Antivenin Crotalidae Polyvalent (ACP) in the 1950s and the development of widespread availability of emergency and critical care medicine starting in the 1960s, deaths from snakebites dropped to less than 1%.

Antivenoms

- Antivenin (Crotalidae) polyvalent (ACP)
  - First Antivenom approved in 1954
  - Safety issues, hypersensitivity, and serum reactions
- Crotalidae polyvalent immune Fab (ovine), or simply FabAV (CroFab)
  - Approved in 2000
  - Improved safety, which was attributed to its animal source and purification methods
- Crotalidae immune F(ab')2 (equine), or simply F(ab')2 (Anavip)
  - Approved 2015 and available for use in 2019

Rattle Snake Bites

- Two FDA approved drugs
  - Crotalidae Polyvalent-immune Fab (ovine), brand name CroFab (FabAV)
    - Approved for rattlesnake, water moccasin (cottonmouth), and copperhead snakebites
  - Crotalidae Immune $F(ab')_2$ (equine), brand name Anavip (Fab2AV)
    - Anavip is only approved for rattlesnake bites

- Coral Snakes have their own antivenom

FabAV (CroFab)

- Consists of the purified Fab fragments of sheep immunoglobulin (IgG) raised against the venom of four snakes:
  - *Crotalus atrox* (western diamondback rattlesnake)
  - *Crotalus adamanteus* (eastern diamondback rattlesnake)
  - *Crotalus scutulatus* (Mojave rattlesnake)
  - *Agkistrodon piscivorus* (cottonmouth or water moccasin)
- FabAV is a polyvalent antivenom of four snake species native to North America.
- When infused, these Fab fragments bind venom in the intravascular space and are renally excreted.

FabAV (CroFab)

- Venom from each species is used to immunize four corresponding sheep flocks to produce ovine venom–specific immunoglobulins. Once the ovine samples are collected, they are purified and cleaved with papain to yield Fab fragments. At this stage, the monovalent antivenoms are mixed and packaged as a lyophilized powder.
- Reconstitute each vial with 20 to 25 mL of 0.9% sodium chloride solution, or until the vial is filled. Doing so will allow the antivenom to become reconstituted in approximately one minute.
  - After reconstitution, the given dose, in the number of vials, should be further diluted to a final volume of 250 mL of 0.9% sodium chloride injection to be administered over 1 hour with an initial rate of 25 to 50 mL/hr, increasing after 10 minutes to 250 mL/hr if the patient does not develop acute hypersensitivity.

FabAV (CroFab) Dosing

- The initial neutralizing dose of FabAV is 4 to 12 vials to achieve initial control.
  - Initial control is defined as the complete arrest of local injury, resolution of systemic signs, and coagulopathy returning to normal.
  - If initial control is not achieved, additional doses of 4 to 6 vials are recommended until initial control is achieved.
- Maintenance schedule of 2 vials every 6 hours for 3 doses is recommended (starting at 12 hours after initial control).
- Although it is recommended to initiate FabAV as soon as possible where indicated, no time limit for antivenom effectiveness has been identified, even beyond 24 hours – best started before 6 hours after envenomation
- The elimination half-life of FabAV is approximately 15 hours, which is shorter than the potential venom effects.

Dosing FabAV (CroFab) Antivenum

- The response to antivenom determines whether further and/or increasing doses are required.
  - Improvement in vital signs, including decreases in tachycardia, tachypnea, and hypotension.
  - Improvement in other systemic findings such as vomiting, diarrhea, pain, oral paresthesia, or altered mental status.
  - Lack of progression of tissue swelling and ecchymosis adjacent to the bite site.
  - Partial or complete reversal of hematologic toxicity based upon repeated laboratory studies performed one hour after each dose of antivenom.

FabAV (CroFab) Treatment

- Approximately half of antivenom-treated patients require more than one dose of antivenom to achieve initial control.
- Because fibrinogen and platelet levels change rapidly after antivenom administration, coagulation studies and platelet counts should be rechecked within one hour of antivenom dosing.
- If initial control of the envenomation syndrome is achieved, the patient can be observed, either as an inpatient or in a clinical observation unit, to make certain that this clinical response is maintained.
- If the first dose of antivenom does not succeed in producing initial control, the initial dose should be repeated. Failure to achieve initial control after two doses of antivenom is uncommon.

CroFAb

- The larger volume of distribution (compared with IgG and Fab2AV) results in more rapid decline in circulating antivenom levels.
- Because approximately 50 percent of patients in the first phase of the clinical trial developed recurrence of local venom effects, routine maintenance doses in the first 18 hours are recommended for control of local effects.
- The half-life of FabAV is approximately 15 hours and shorter than Crotalinae venom substances, which may be detected for more than two weeks post-envenomation. Thus, recurrent toxicity is possible despite initial control of systemic effects and may necessitate repeated FabAV administration.
- FabAV is indicated for the treatment of envenomations of all North American Crotalid snakes. FabAV appears most effective when given within six hours of envenomation.

FabAV (CroFab) Adverse Events

Most common adverse events include urticaria, rash, nausea, and pruritus

Less common adverse events include infusion reactions, anaphylaxis, and delayed serum sickness

Fab2AV (Anavip)

- FDA approved for the treatment of North American rattlesnake envenomation.
- This antivenom is produced from two snake species native to South America, *Bothrops asper* and *Crotalus durissus*.
- The extracted venom is used to immunize horses, yielding immunoglobulins that are subsequently cleaved with pepsin to produce F(ab')2 fragments.

Fab2AV (Anavip)

Fab2AV consists of the purified $F(ab')_2$ fragments of equine IgG raised against the venom of *Bothrops asper* and *Crotalus durissus.*

When infused, these $F(ab')_2$ fragments bind venom in the intravascular space. Because of the smaller volume of distribution compared with FabAV, circulating antivenom concentrations do not decline as rapidly, and routine maintenance doses in the first 18 hours following initial control are not required.

Because the molecular weight of Fab2AV is above the threshold for renal clearance, these fragments are not cleared renally and have a longer half-life (133 hours) than FabAV . Thus, recurrent hematologic toxicities occur at a lower rate than with FabAV.

Fab2AV (Anavip)

- Similar to FabAV, F(ab')2 is dosed by the number of vials.
- F(ab')2 fragments have a long elimination half-life of approximately 133 hours.
- F(ab')2 is formulated in lyophilized vials that can be reconstituted rapidly.

Dosing **Fab2AV (Anavip)**

- The initial dose of F(ab')2 is 10 vials in a total volume of 250 mL of 0.9% sodium chloride injection to be administered over 1 hour.
- It should be administered initially at 25 to 50 mL/hr, with dosing increased after 10 minutes to 250 mL/hr if the patient does not develop an acute hypersensitivity reaction.
- If initial control is not achieved, additional doses of 10 vials may be administered until control is achieved.
  - Once initial control is achieved, it is recommended to observe the patient for 18 hours.
  - During this observation period, if any venom-related symptoms appear, it is recommended to give 4 vials as needed.
  - No scheduled maintenance doses are required for this product.

CroFab vs Anavip

CroFab vs Anavip

- CroFab Half-life is 15 hours vs Anavip half-life of 133 hours
- Initial dose CroFab is 4 to 6 vials (12 vials if severe) vs 10 vials for Anavip
- CroFAb requires maintenance doses of 2 vials every 6 hours for 3 doses vs Anavip with no scheduled redosing
- Observation Time 18 hours with Anavip and can discharge if stable
- Crofab treated patients have a recurrent coagulopathy rate of 29.7%* to about 50%** with Anavip being 7.8 % of all patients
- CroFab works for Rattlesnakes, Cottonmouth/Water Moccasin and Copperhead vs Anavip only approved for Rattlesnakes
- Cost is similar
- CroFAb needs refrigerated storage vs Anavip which can be stored at room temperature

Dosing Antivenum

- CroFAb
  - **Moderate envenomation:**
    4 to 6 vials; repeat dose if initial control of local and systemic venom effects not achieved
  - **Severe envenomation:**
    8 to 12 vials; repeat with higher number of vials if insufficient response
  - Maintenance dose: 2 vials every 6 hours for 3 doses
- Antivip
  - **Moderate or severe envenomation:**
    10 vials; repeat dose if initial control of local and systemic venom effects not achieved
  - Maintenance dosing not required; may give 4 additional vials for recurrent local or systemic effects

Antivenom Complications

- Anaphylaxis
- Serum Sickness
  - 5 to 10 days of therapy. Serum sickness causes fevers, joint aches, itching, swollen lymph nodes, and fatigue.

Allergic reactions to antivenom

- Signs of immediate hypersensitivity to antivenom are observed in 5 to 6% of patients treated with ovine Fab antivenom.
- Most of these reactions are relatively minor and do not preclude antivenom therapy.
- Halt the antivenom infusion and administer antihistamines, corticosteroids, and fluids as needed until signs of hypersensitivity have resolved. Epinephrine may be required for severe reactions.

Inpatient Management

- Experts recommend that patients be observed in the hospital for 18 to 24 hours following initial control of the envenomation syndrome, with serial examinations performed approximately every 6 to 8 hours during this interval.
- Experts recommend that most patients have laboratory studies (prothrombin time, hemoglobin, platelet count, and fibrinogen level) measured twice prior to discharge: once 6 to 12 hours after initial control, which appears to be the time at which the risk of recurrent hematologic venom effects is greatest, and again prior to discharge.
- In the current FDA-approved prescribing information, the manufacturer of antivenom recommends administration of additional 2-vial doses of antivenom given 6, 12, and 18 hours after initial control is achieved.

Rattle snake envenomation and blood products

- The coagulopathy associated with Crotalinae envenomation is due to thrombin-like glycoproteins within the venom as well as thrombocytopenia. This pathophysiology is in contrast to true disseminated intravascular coagulation (DIC), where fibrinolysis is activated by increased levels of endogenous thrombin. Thus, antivenom administration, and **not** coagulation factor replacement, is the primary treatment for Crotalinae-induced coagulopathy.
- Transfused platelets and coagulation factors in fresh frozen plasma are inactivated by Crotalinae venom and should be avoided in patients with Crotalinae-induced coagulopathy unless the patient has significant bleeding that is uncontrolled by high-dose antivenom administration.

After Discharge

- At discharge, patients who have received antivenom should be scheduled for recommended follow-up and be told the following:
  - Seek care if they develop symptoms of serum sickness (fever, rash, muscle pain, arthralgia, or arthritis).
  - If they had coagulopathy during their care or were victims of a rattlesnake envenomation, they should avoid contact sports, surgery, or dental work for two weeks.
  - Patients bitten by a rattlesnake or water moccasin (cottonmouth) should also have PT, fibrinogen, hemoglobin, and platelets measured two to three days and five to seven days after the bite.

Conclusion

- Snake bites are seldom deadly if antivenom is given early
- Less is more in prehospital treatment
- Dry bites are common and antivenom is expensive
- Options for antivenom now available
- Limit your risks for snake bites by not being a drunk young male intentionally playing with snakes