

Snake Bites in WY

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Objectives

- Discuss:

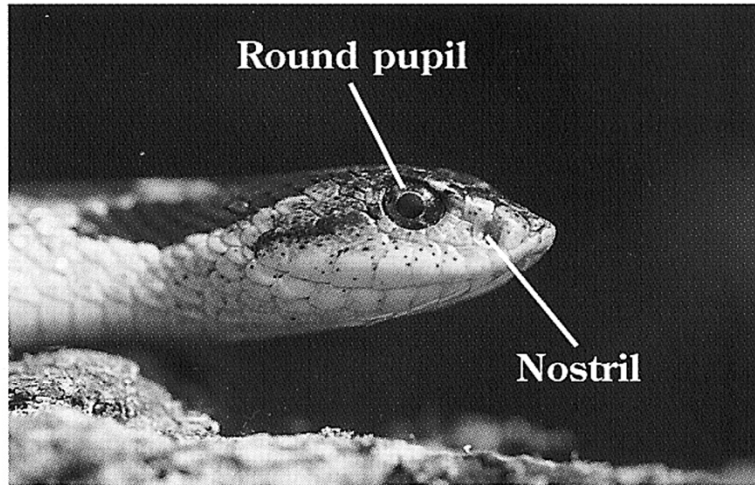
- Taxonomy
- Epidemiology
- Crotalid/Elapid Envenomations

- Review:

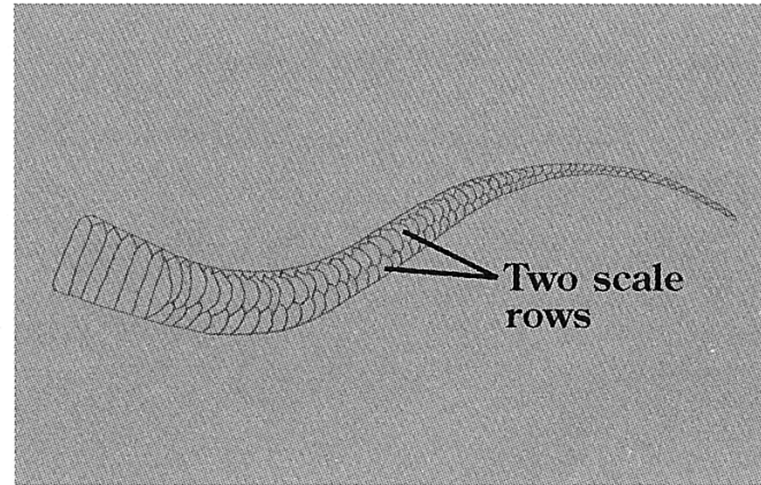
- Prairie rattlesnake
- Midget Faded rattlesnake
- Herpetoculture in WY

- Become familiar with the recognition, evaluation, and management of crotalid snake bites
- Review dosing and preparation of antivenin.

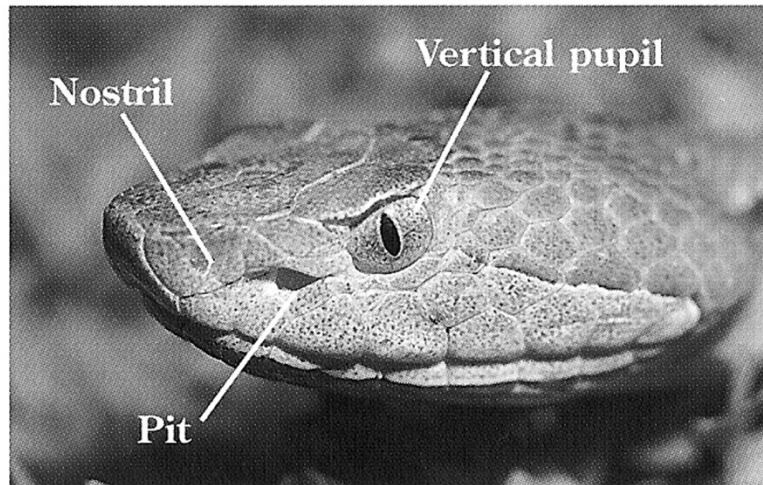
Poisonous or Not??



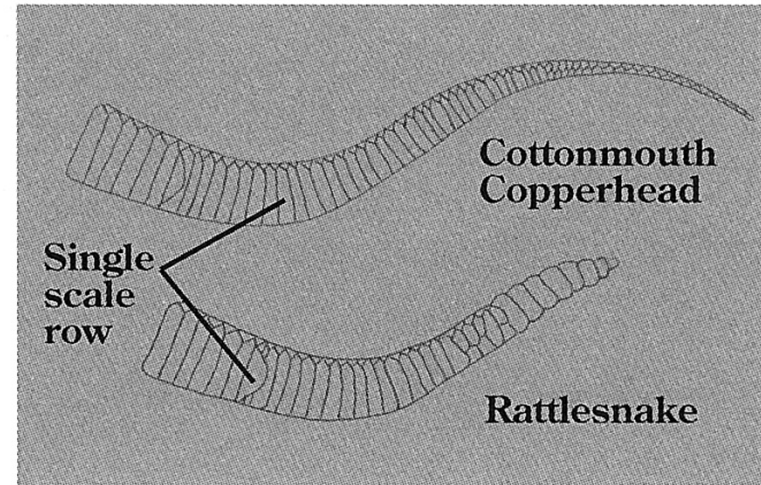
Head of nonvenomous snake



Tail of nonvenomous snake



Head of venomous snake



Tail of venomous snake

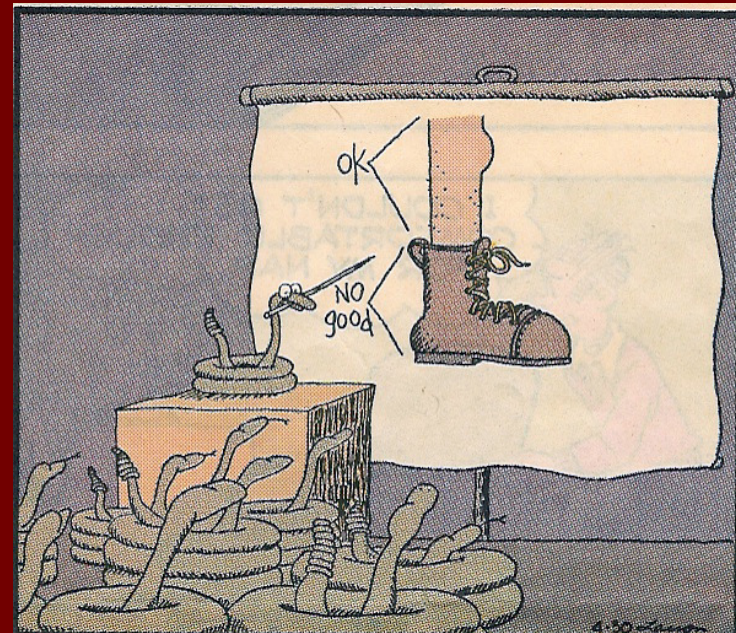
Venomous Snakes

- Around 3000 species of snake
- Around 600 known to be venomous
 - ONLY TWO IN WY
 - 4 families:
 - Colubridae
 - Atractaspidae
 - ELAPIDAE
 - VIPERIDAE



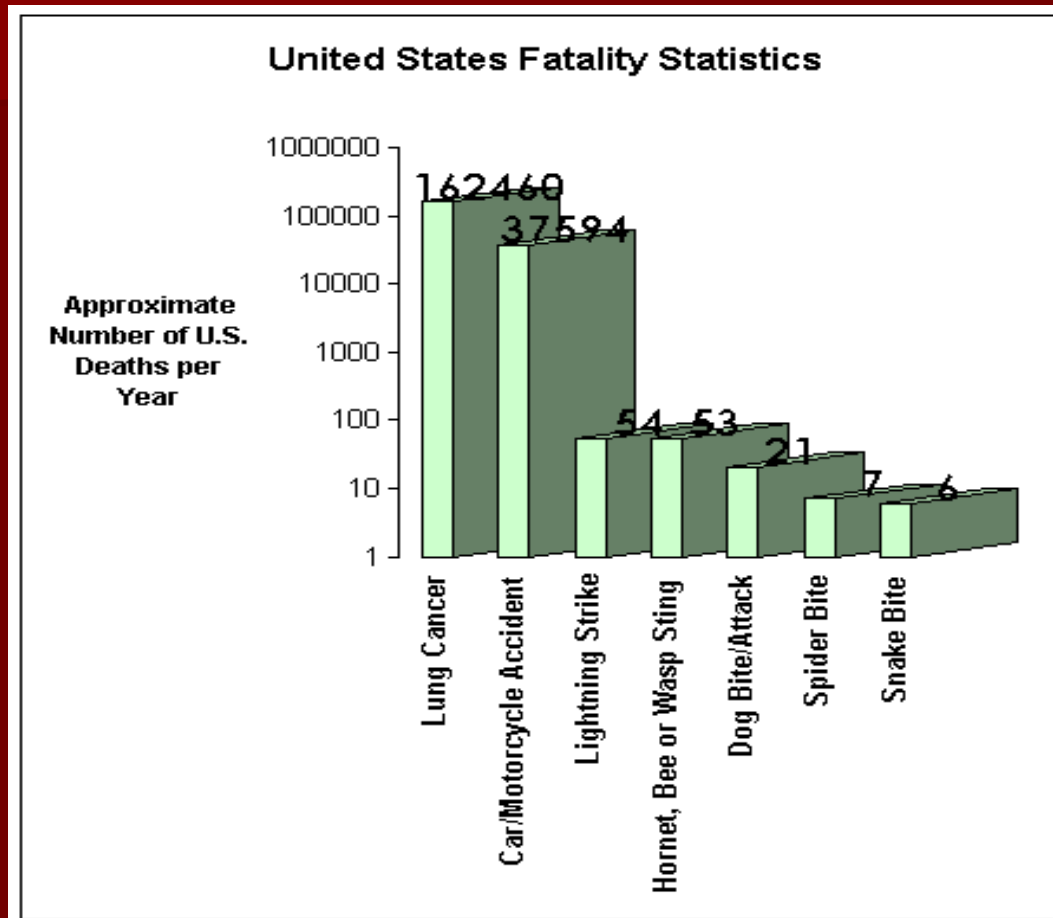
Epidemiology of Snakebite

- Study group of 86 patients
- 87% male, 13 % female
- 74% between 18-50 years old
- 56% alcohol associated
- 73% of upper extremity bites were illegitimate
- 56.6% of bites were illegitimate
- Tattoos not officially studied



Curry SC, Horning D, et. al.; The Legitimacy of Rattlesnake Bites in Central Arizona; Ann Emerg Med June 1989 18:6 pp. 658-663

US Fatalities 2011



Snake Bite Mortality by ME Data

Table 1. State death counts

Alabama 4
Arizona 7
Arkansas 1
California 6
Colorado 2
Florida 14
Georgia 12
Idaho 2
Kansas 1
Kentucky 4
Louisiana 1
Maryland 1
Mississippi 2
New Mexico 2
New York 1
North Carolina 2
Ohio 1
Oklahoma 2
South Carolina 4
South Dakota 1
Tennessee 2
Texas 17
Virginia 3
Washington 2
West Virginia 2

Wyoming 1

Snake Bite Mortality ME (2)

Table 2. Sex as percentage of total deaths from reptile envenomation
Raw death Percentage death Sex count count (%)

Female	21	22
Male	76	78
Total	97	100

White/F	14%
White/M	77%
Black/F	6%
Black/M	1%
Other/F	1%
Other/M	1%

Snake Bite Mortality by ME (3)

- Divided by age/gender
 - 20% deaths in males 25-34
 - 12% deaths male 35-44
 - 13% deaths male 45-54
 - 11% deaths male >65

Frequency of Snakebite (U.S. Poison Centers, 2011)

- 3,584 snake bites nationwide (NPDS)
 - 1,218 rattlesnake
 - 68 fatalities

WY snake bite epidemiology

- Data from Nebraska PCC/NPDS
 - 2005-2013
 - 2 animal bites
 - 79 human bites
 - 76 admitted
 - 71 were rattlesnakes
 - 2 (+) ID prairie rattlesnake
 - 45 received AV
 - NO FATALITIES

Prairie Rattlesnake

- Usually 35-45 inches long
- Weigh approx 1 lb
- Gray – green with greenish blotches
 - Blend with prairie landscape
 - Bites usually not fatal



Photo by Steve Thompson



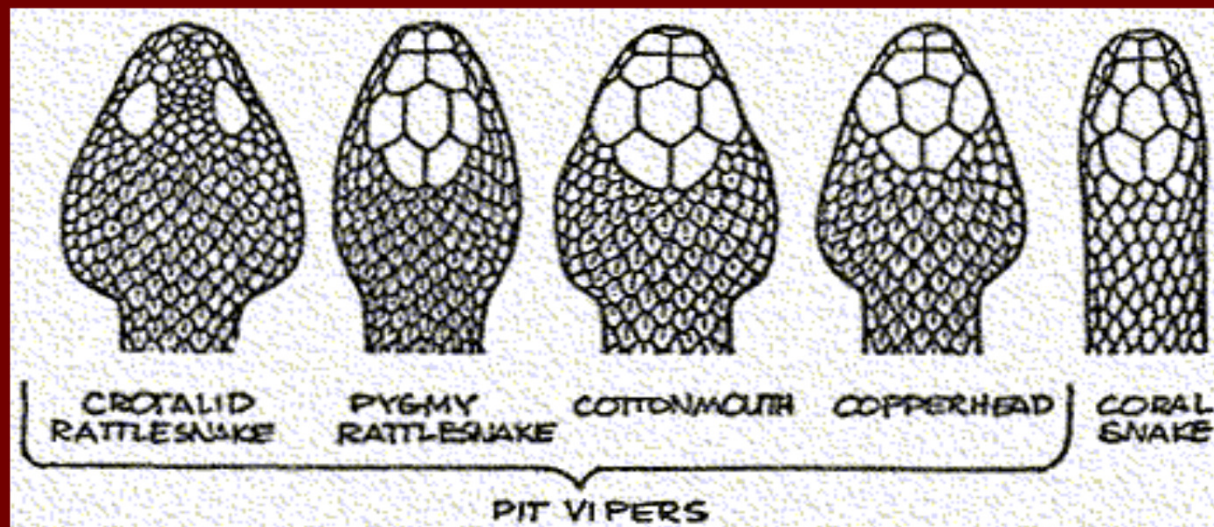
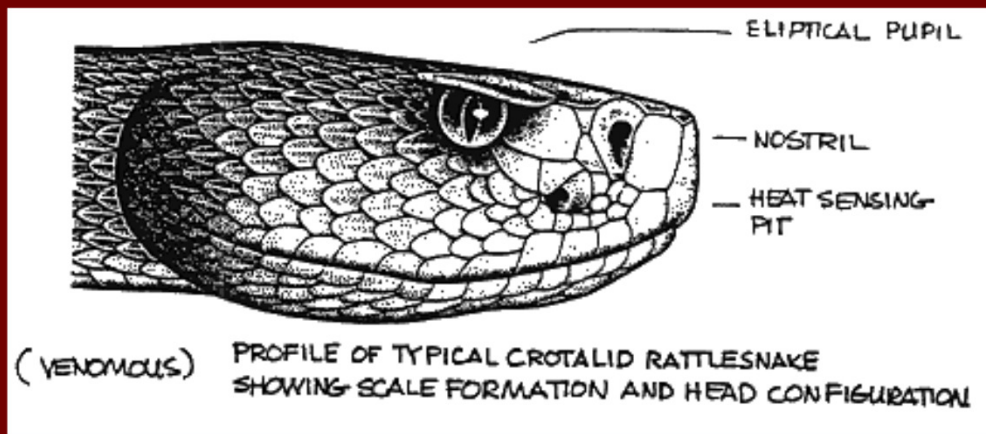
Midget Faded Rattlesnake

- One of smallest rattlesnakes in region
 - Commonly protected
 - Collect/transport w/o permit is felony violation
 - Looks like Hopi rattlesnake
 - Approx 28 inches in length
 - Cream to yellow brown
 - Blotches are darker and fade with age
 - Venon high in neuro/myotoxin
 - ? Most toxic of western clade

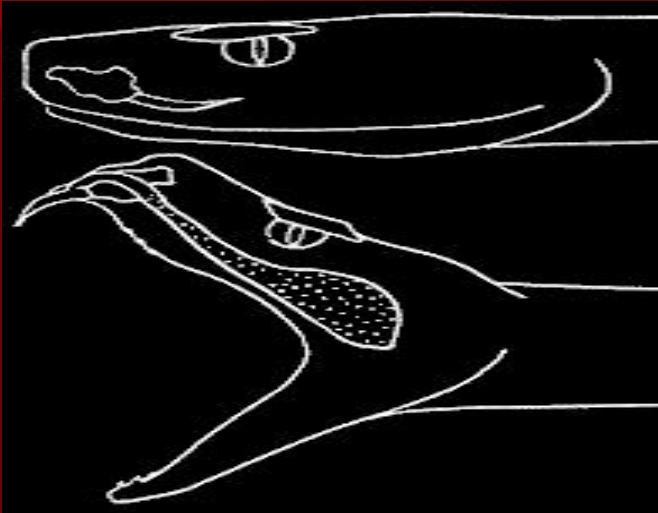


Crotalide/Pit Viper Characteristics

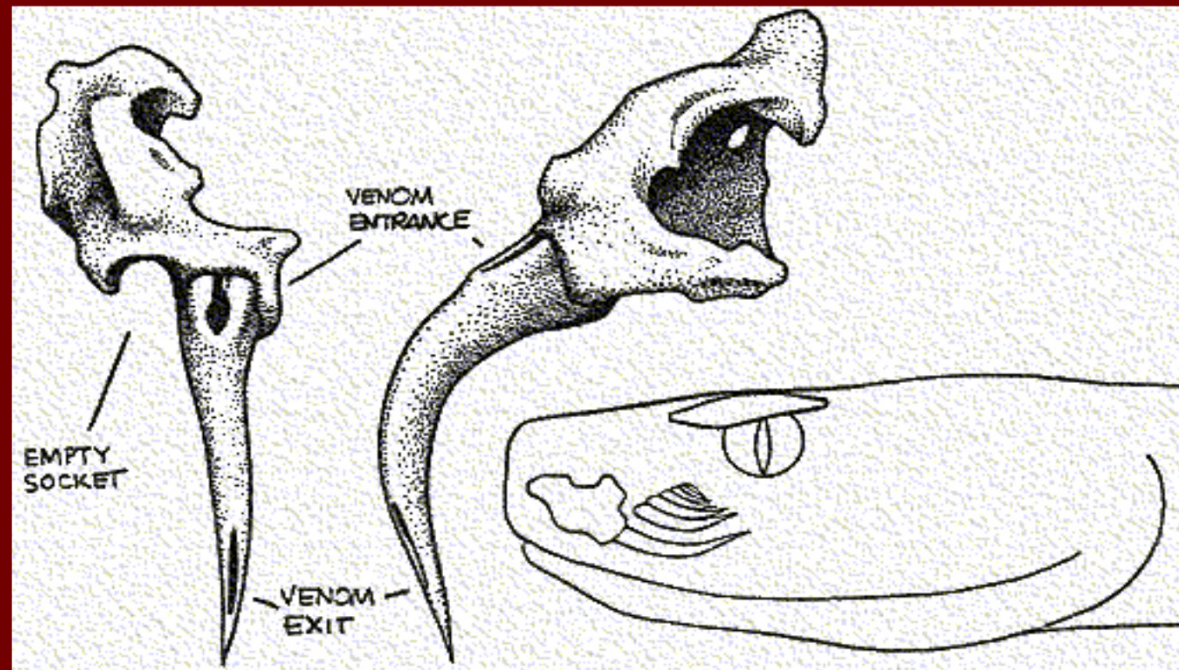
Crotaline head shape



Crotalide fangs/venom apparatus

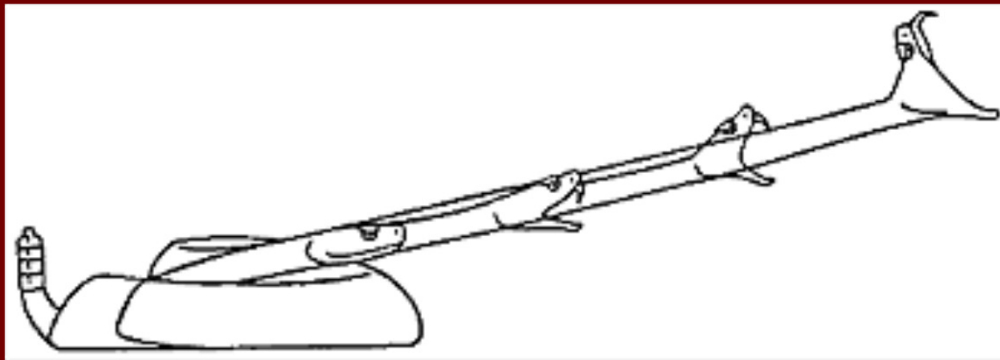


- Fangs are 1-1.5 cm long
- Fangs turned over constantly



Strike Characteristics

- Strike from any position
- May or may not give warning
- Up to 1/3 of their body length



Bite characteristics

- Venom usually injected SQ
 - Rarely IM
 - Rarely IV (rapid systemic sequelae)
- Puncture wounds, lacerations or abrasions may be evident
- May not get history of a bite or accurate ID of the snake

Crotalide Venom

- Mixture of proteins, peptides, amines
- The exact composition varies:
 - Species
 - Geographical location
 - Time of year/time of day
 - Last feeding
- None, some or all of the venom may be injected (20% end up being “dry” bites)



Venom characteristics

- RNA-ase and DNA-ase
- Kinins
- Leukotrienes
- Histamine
- Phospholipase
- Serotonin
- Acetylcholinesterase
- Collagenase
- Metallic ions
- Unidentified:
 - Procoagulants
 - Anticoagulants
 - Cardiotoxins
 - Hemotoxins
 - Neurotoxins

• Significant cross-reactivity between species

Pathophysiology

- Increase permeability of capillaries → extravasation of blood, albumin and electrolytes; effects on RBC membranes can result in hemolysis
- Increase in inflammatory mediators
- Leukocyte migration
- Coagulopathy

Clinical Effects (Viperidae)

Three main types:

1. Local
2. Systemic
3. Hematologic

Symptoms can be delayed (hours)!

Local Effects

- Puncture wounds (1-4) may be present



Local Effects

progress over time



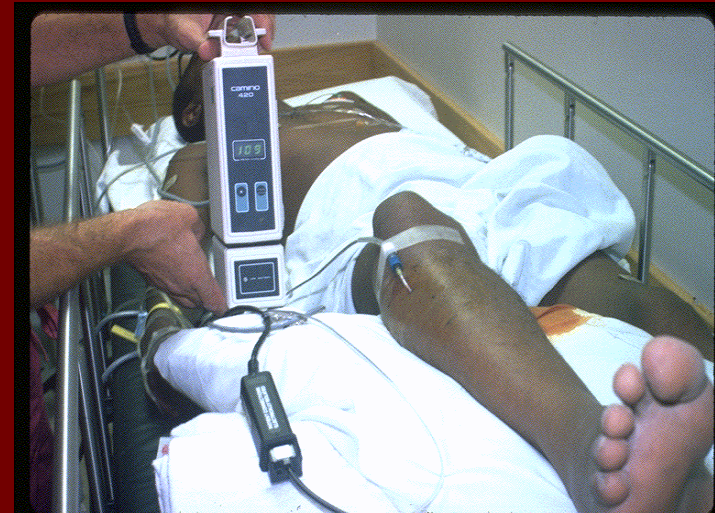
Local Effects (severe)

Blistering and compartment syndrome (rare) may occur



Compartment Syndrome

- If muscle injury does occur, it is most likely due to myotoxins and not elevated compartment pressures
- Antivenin decreases compartment pressures
- Compartment pressure $> 30-50$ mm Hg:
 - Confirmed subfascial
 - consider fasciotomy
- Routine fasciotomy not recommended!!!



Systemic Effects

- Hypotension, tachycardia
- Nausea/vomiting
- Diaphoresis
- Light-headedness
- Metallic taste
- Painful adenopathy
- Neurologic effects with some bites (eg. Mojave)
- Rhabdo

Effects - Hematologic

- Thrombocytopenia
- Coagulopathy (elevated PT/PTT)
- Low fibrinogen (increased FSP)
- Bleeding
- Recurrence common

Severity of Envenomation

	Minimal	Moderate	Severe
Local Effects	Limited to bite site	Limited to affected extremity	Extend beyond affected extremity
Systemic Effects	None	None or Mild: nausea, emesis, oral paresthesias, altered taste	Marked: altered mentation, tachycardia, hypotension, respiratory distress
Coagulation Parameters	Normal	May be abnormal, but no bleeding	Abnormal, with serious or potentially serious bleeding

Elapidae



Typical Elapid Body

- More slender
- Head less triangular, less distinct
- Larger, fewer scales
- Smaller fangs

Clinical Effects (elapidae)

- Neurotoxic flaccid paralysis (3-12 hrs)
 - Typical progression:
 - Ptosis → ophthalmoplegia → dysarthria → poor tongue protrusion → dysphagia → drooling → limb weakness → diminished DTRs → respiratory paralysis
- Rhabdo possible
- Can see local effects (cobras), coagulopathy rare
- Corneal irritation, blurry vision

Treatment - Field/Pre-hospital

- Many purported field treatments:
 - Incision and suction
 - Tourniquets
 - Electric shocks
 - Ice
 - Alcohol
 - Poultices and folk remedies
- None have any proven benefit
- Potentially harmful



Field/Pre-hospital (2)

- What to do in the field?
 - Stay calm!
 - Consider lymphatic band
 - Immobilize extremity
 - Avoid activity
 - BLS principles
 - *Rapid* transport
- Most patients will survive if they get to medical care

Treatment - In-Hospital

- All bites treated alike
- ABCs
- Monitor local effects
 - Hash marks q 15-30 minutes
- Monitor vital signs
- Elevate limb
- Analgesia
- Monitor for coagulopathy
 - PT/INR, platelets, fibrinogen q 6-8 hrs or after antivenom dose
- ICU vs floor admission
- Tetanus
- No prophylactic antibiotics
 - (except elapids)
- “Dry Bite” or no progression – DC home after obsv.



Serial Measurements

Virginia Poison Center
Crotaline Envenomation Flowsheet

Patient Name _____ Age _____ MR # _____

Date and Time of Bite: 5/2 1830 Previous A/V: Y^N Type: _____

Bite Location: Ⓡ ANKLE - MEDIAL MALLEOLUS

Circumferential Measurements (cm) - place tape measure BETWEEN marks

Location	FOOT	ANKLE	CALF	KNEE
Unaffected limb (control)	25 cm	23.8	37.5	38.5
Envenomated limb				
Time measured				
1900	26.5	25.0	37.5	38.5
1915	27.0	26.0	37.5	38.5
1930	27.2	28.3	38.0	38.5

AV Treatment



US Crotaline Antivenom

Wyeth: Historical Treatment

- Older (1954)
- Equine
- Mixed monovalent IgG
- Less pure
- Greater incidence of serious allergic reactions, serum sickness
- Skin test recommended
- Takes longer to go into solution
- No longer produced

CroFab:DOC

- Newer (2000)
- Ovine
- Mixed monovalent Fab
- Affinity purified
- Lower incidence of serious allergic reactions
- No skin test
- Goes into solution quicker
- More frequent dosing
- \$\$\$\$\$

Antivenom

- Made from animals immunized against various pit viper venoms
- Immunoglobulins or Fab fragments
- Bind to venom components and inactivate them



Crotalide Ovine Fab Antivenin

- Prospective multicenter clinical trial (1993)
- N = 11 patients (age > 10)
- Mild-moderate crotalid bite within 6 hours
- Exclusions:
 - **Copperhead bites**
 - Severe envenomations
- Results – all patients improved after Fab
 - Subsequent progression in 3 patients
 - No acute reactions
 - No serum sickness (1 mild delayed allergic rxn)

Dart et al, Ann Emerg Med, 1997.

IMMUNIZING VENOMS



Conventional Antivenom

Western Diamondback Rattlesnake <i>Crotalus atrox</i>	Western Diamondback Rattlesnake <i>Crotalus atrox</i>
Eastern Diamondback Rattlesnake <i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake <i>Crotalus adamanteus</i>
Mojave Rattlesnake <i>Crotalus scutulatus</i>	South American Rattlesnake <i>Crotalus durissus terrificus</i>
Cottonmouth <i>Agkistrodon piscivorus</i>	Fer-de-Lance (South America & Costa Rica) <i>Bothrops atrox</i>

Antivenom Indications

■ Hard

- Progressing local symptoms
- Coagulopathy
- Thrombocytopenia
- Systemic signs and symptoms
- Neurologic symptoms or known elapid bite

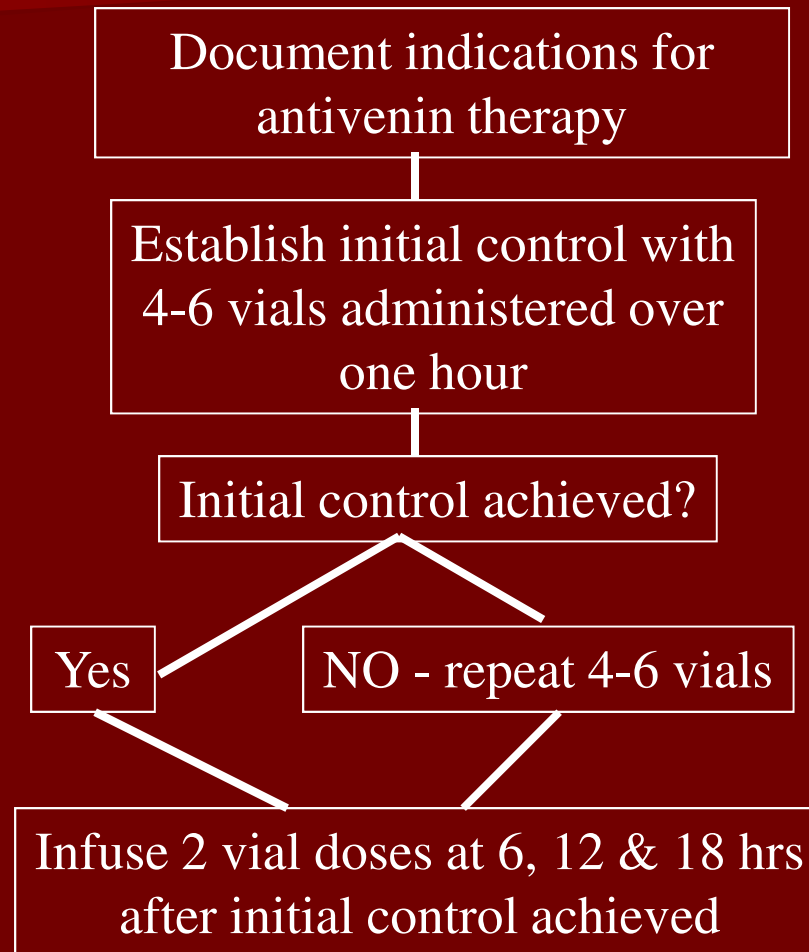
■ Soft

- One cell line out
- Recurrence
- Nausea, vomiting

Crofab Dosing

- 4-6 vials
 - (+) initial control → go to maintenance
 - (-) initial control → repeat dose
- Maintenance
 - 2 vials q6 hr x 3
 - (often not needed, esp with copperhead)
- Recurrence
 - 2 vials

Dosing Algorithm



Adverse Reactions

Parameter	Crotalidae Polyvalent	Cro-Fab
Skin test	Yes	No
Anaphylaxis	Yes	No
Acute reactions	23-56%	14%
Serum sickness	15-86%	16%*

Crofab and Severe Bites

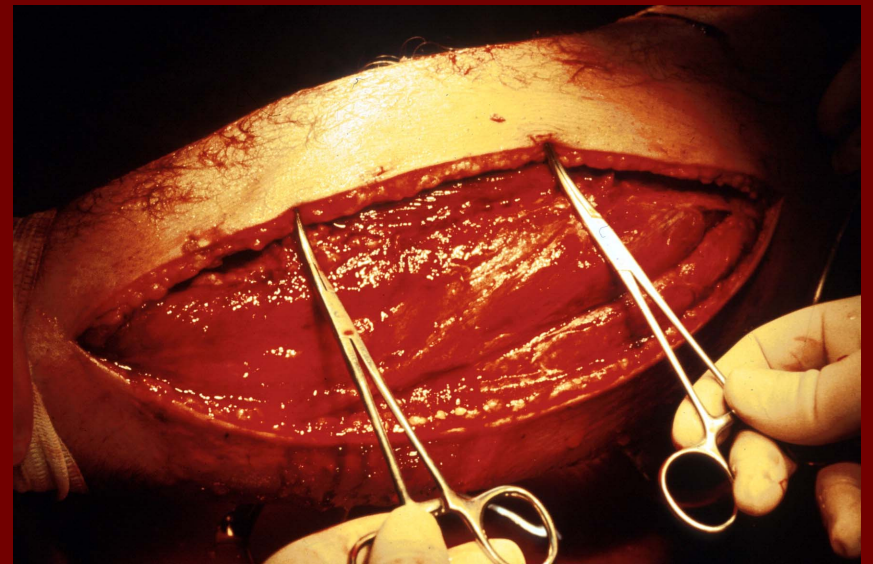
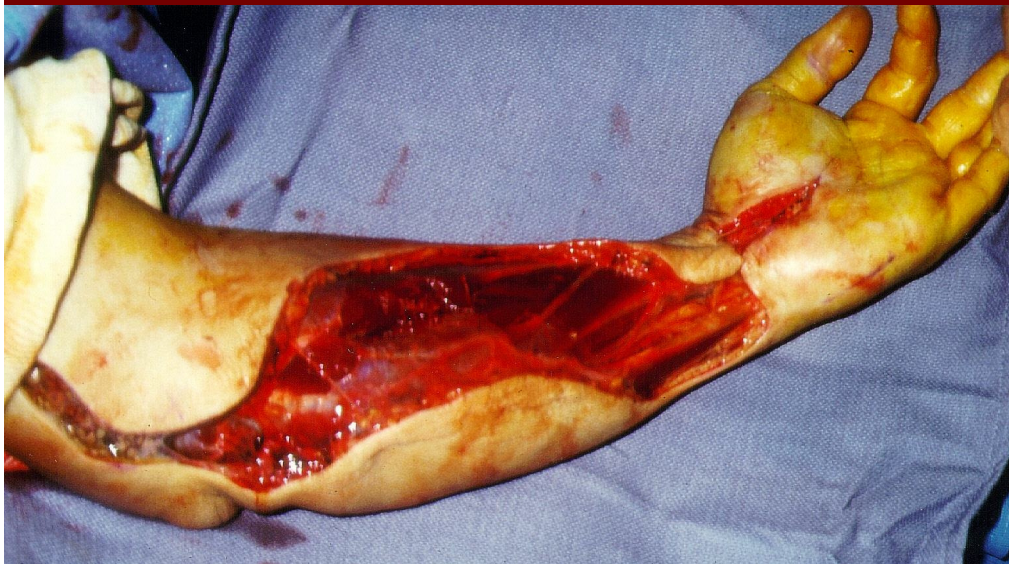
- No standard definition
- Chart review from 17 hospitals
- 265 patients treated with AV (94% Fab)
- 28 (12%) classified as severe
- 53.6% due to rattlesnakes; 46.4% unknown snake
- Median loading dose: 12 vials in 2 doses
- 57% achieved initial control after LD
- Severity score: $5.3 \pm 0.4 \rightarrow 1.3 \pm 0.9$ after LD
- 8/11 (73%) patients evaluated had recurrence of symptoms
- No fasciotomies; no fatalities

Dart et al, unpublished.

Treatments to Avoid

- **Cryotherapy**
- **Cut and suck**
- **Tourniquet**
- **Electric shock**
- **Fasciotomy**
 - **Except in rare circumstances**

Remember Beware of surgeons (no offense)



WY Herpetoculture

- <https://www.facebook.com/pages/Breeders-against-United-States-Herpetoculture-Alliance-Inc/119327808236493>

Who am I?

- I live in the southwest US. I have a venom that causes severe soft tissue damage and coagulopathy.



Name this snake!

- I am the largest venomous snake in N. America. I have a bad disposition, cause a severe coagulopathy and tissue necrosis, and love that Florida sun.



Eastern Diamondback Rattlesnake
Crotalus adamanteus

Image courtesy of Steve Bennett,
SC Dept. of Natural Resources

www.snakesandfrogs.com

Do you know my name?

- I love the desert southwest. I am a pit viper with neurotoxic venom.



Name that snake!

I enjoy the hot/humid and swampy south. I love to swim.



What about me?

- I like the mid-Atlantic region and the south. Some say my bites are whimpy and only cause local soft tissue effects. But what I lack in toxicity I make up for in quantity. I am responsible for more bites in the US than any other snake.



Exotic or Non-Indigenous Snakebites Managed by Virginia Poison Center

- **Black Pakistani cobra (2001)**
- **Python (2002, 2002)**
- **Canebrake rattlesnake (2002)**
- **Western diamondback (2003)**
- **Boa constrictor (2004, 2006, 2007)**
- **Eastern diamondback (2005)**
- **Arizona black rattlesnake (2006)**
- **Indian cobra (2007)**



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