Rattlesnake Envenomation in Arizona

By Geoffrey Smelski, PharmD, DABAT
Clinical Education Director
1. **Biology & Mythbusting**
   - Rattlesnake Behavior
   - Venom

2. **Public Health Surveillance & Education**
   - AzPDIC
   - Snake Season

3. **Pre-Hospital Interventions**
   - Do’s & Don’ts

4. **Inpatient Course**
   - Diagnosis: Laboratory vs Clinical
   - Treatment: Antivenom & Supportive Care
   - Discharge Criteria

5. **Outpatient Follow-Up Care**
   - Venom Recrudescence Monitoring
   - Physical Recovery
   - Psychiatric Sequelae
   - Financial Burden
Who is the AzPDIC?

- **Physicians / Pharmacists / Public Health: 24/7/365**
  - **Clinical Care:** 14 counties, 63 hospitals
    - Medications / chemicals / radiation
    - Drugs of abuse
    - Environmental / occupational
    - Bites & stings / plant / mushrooms
    - Exposure during pregnancy / lactation
  - **Public Health:** surveillance / education
  - **Clinical Education:** students / residents / fellows
  - **Research:**
    - Over 200 publications, posters, abstracts and newsletters on rattlesnakes to date.
    - Participated in clinical trials for both FDA approved rattlesnake antivenoms as well as the current PLA2 Inhibitor.
Spring 2020, work began developing a Toxicosurveillance network and data registry for rattlesnake bites.

To date, \( \approx 4,500 \) cases reviewed, spanning a quarter century of data.

For comparison, phase 2 & 3 studies for Crofab & Anavip, included a combined total of 156 patients.
NEWS FROM THE PIT
Arizona Poison and Drug Information Center

MONTHLY NEWSLETTERS

- 2022

January - Bleeding Out (hemotoxicity from rattlesnake venom)
February - The Things We Do For Blood (management of bleeding in rattlesnake envenomations)
March - Keeping Thin (antiplatelets and anticoagulants in rattlesnake envenomation)
April - Platelets and Pain (NSAIDs in rattlesnake envenomation)
May - Bothrops lanceolatus (the snake that literally gives you a heart attack)
June - It's in the Blood: DIC and VVCC
July - Thick and Thin (treatment of thrombosis in snake envenomation)
August - Platelets and Fibrinogen
September - Antivenom Index

azpoison.com/content/news-pit
Western Diamondback
*Crotalus atrox*

Arizona Black
*Crotalus cerberus*

Mojave Rattlesnake
*Crotalus scutulatus*
Sidewinder
*Crotalus cerastes*

Rock Rattlesnake
*Crotalus lepidus*

Black-tailed
*Crotalus molossus*

Tiger Rattlesnake
*Crotalus tigris*
Rattlesnake Features

- Triangular Head
- Elliptical Pupils
- Heat Sensing Pits
- Fangs
- Forked Tongue
- Rattle
Typical Patient

- Male in 20's
- Drunk
- Messing with Snake
- Bitten on Hand
Typical Patient

- Male in 20’s
- Drunk
- Messing with Snake
- Bitten on Hand

False:
- Male 68.6% (well, mostly false)
- Age 60+yrs 26.1%
  - 20-29yrs 11%
  - 50-59yrs 16.2%
- Unaware Prior 83.9%
- Lower Extremity 50.6%
**Rattlesnake Aggression**

“Rattlesnakes are aggressive predators, attacking humans.”

“If you are lucky, you will encounter a nice one that will give you a warning rattle first.”
Rattlesnake Aggression

“Rattlesnakes are aggressive predators, attacking humans.”

“If you are lucky, you will encounter a nice one that will give you a warning rattle first.”

False: They are ambush predators and will defend themselves, typically rattling after striking.
The Life of a Rattlesnake

- Predator Avoidance

- Breeding Season

- Temperature Dependent
  - Hot -> Shelter
  - Cold -> Hibernate
  - Warm -> Bask
  - Rain -> Drink

- Ambush Predator
  - Strike, Release, Track, Eat
  - Venom Immobilizes Prey

PMID: 26433731
When Do Snakebites Happen?

FAILS TO WAKE YOU UP: YOU HATE IT

WAKES YOU UP: YOU HATE IT
When Do Snakebites Happen?

Time of Day
16:00-22:00 49.5%

Time of Year
Aug-Sept 39.3%

Location
At Home 60.8%
Avoid Being
Our Next Patient.....

Situational Awareness

• Don’t put your hands or feet in places that you can’t clearly see

• Keep doors to your house / garage closed

• When you see one, leave it alone or have it professionally removed
Baby Snakes

“Bites are worse because they are not able to control how much venom they inject.”
“Bites are worse because they are not able to control how much venom they inject.”

False: Venom results in dose dependent toxicity, more venom equals worse symptoms.

PMID: 20591373
What exactly is snake venom?
Venom Composition

Varies by species, diet, age, and geography.

Enzymatic toxins mimic endogenous enzymes or generate oxidative damage.

Non-enzymatic toxins disrupt cell signaling.

Dose Dependent Toxicity

PMID: 22446891
No Venom = Dry Bite
Little Venom = Minor Bite

No Antivenom Needed, Right?

Just waiting for whatever is about to go wrong.
True Dry Bites = No AV ≈ 5%

Minor Bites: ARE NOT PREDICTABLE

Case History
- Arrived at hospital < 1-hr
- AV held 4hrs for “minor” bite
- Rapid decompensation
- Necessitating transfer
- AV first given at 8hrs

AV IS PREVENTATIVE
Venom Amplification

Amplification of snake venom metalloproteinase and phospholipase toxicity by endogenous signaling systems

- svMPs
  - Basement membranes, collagen
  - Weakened capillaries
  - Mechanical forces
  - Hemorrhage
  - Massive bleeding
- Prey MMPs
  - Bioactive peptide fragments
- svPLA₂
  - Leukocytes
  - Arachidonic acid
  - Inflammation
  - Coagulopathy
  - DIC
  - Hemorrhage
  - Tissue edema
- svPLA₂
  - Intracellular transport of PLA₂
  - Activation of prey cPLA₂
  - Coagulation factors
  - Calcium release
  - Organelle toxicity
  - Cell death
- Prey PLA₂
  - Release, fasciculations
  - Receptor inactivation/internalization
  - Neuromuscular paralysis

PMID: 31979014
RATTLESNAKES
MAY BE FOUND IN THIS AREA
GIVE THEM DISTANCE
AND RESPECT
Pre-Hospital Care

Proposed “Treatment” Modalities

- Restrict Venom
  - Tourniquet
  - Pressure Bandage
  - Ice
- Remove Venom
  - Suck it Out
  - Cut it Out
- Destroy Venom
  - Electricity
  - Heat
- Not Sure.....?
  - CBD Oil
Pre-Hospital Care

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Increase Tissue Injury
“Self Treatment” is NOT an option