When the Bite is Worse Than The Bark: Bites From Snakes, Dogs, and Rabid Animals...

Stephen Thornton, M.D.
Medical Director
University of Kansas Hospital Poison Control Center

Disclosures

1. Director of the Snake Bite Center at University of Kansas Hospital.
2. Participating site in now closed Crofab sponsored copperhead study.

Objectives

• Upon completing this program, the participant will be able to:
  1. Describe an approach to venomous snake bites.
  2. State the role of antibiotics in dog bites.
  3. Indicate when rabies vaccine should be administered.
A 7 year old is bitten on the right forearm by snake. Pain and significant swelling rapidly develops and spreads. What is the best treatment?
A. Immediately apply tourniquet.
B. Apply ice to bite site.
C. 4-6 vials of antivenom.
D. 15 mg/kg of antivenom.
E. Fasciotomy of the right forearm.

Venomous Snakes in KS and Mo

- All PIT VIPERS (Crotalids)
  1. Agkistrodon contortrix
  2. Agkistrodon piscivorus
  3. Crotalus horridus
  4. Crotalus viridis
  5. Sistrurus catenatus
  6. Sistrurus miliarius
Pit Vipers: Who gets bitten?

- > 70% male.
- > 70% over 20 years of age
- 80% of bites between April and Sept.
- ~50% admitted
- Most bites “illegitimate”


Pit Vipers: Who gets bitten?

- The T’s of Snake Bites:
  - Testosterone
  - Tanked
  - Tattoos
  - Trailer
  - Toothless

Agkistrodon piscivorus
Pit Viper Venom

- Complex mixture:
  - Enzymes
    - Metalloproteases
    - Phospholipases
  - Carbohydrates
  - Ions (Mg, Zn, Ca, Mn)
  - Lipids

Pit Vipers: Effects of Venom

1. Local tissue destruction.
2. Hematologic effects.
3. Neurologic effects.

Crotalus viridis
Pit Vipers:
Tissue Destruction

• Pain
• Swelling
• Ecchymosis
• Hemorrhagic vesicles

Crotalus horridus
Hematologic Effects
- Thrombocytopenia
- Hypofibrinogenemia
- Coagulopathy → Hemorrhage
- Intravascular envenomation → DIC

Intravenous rattlesnake envenomation.

Neurologic Effects
- Fasciculations
- Myokymia
- Paralysis
  - Mojave toxin (A) - Presynaptic
  - β-neurotoxins - Presynaptic

Timber rattlesnake venom-induced myokymia: evidence for peripheral nerve origin.

Pit Vipers: Hemotoxic Effects

Pit Vipers: Neurotoxic Effects
Pit Viper Bites: Management

- Pre-hospital:
  1. Stabilize/Immobilize
  2. “Do No Harm”
  3. Transport to appropriate health care facilities.
Pit Viper Bites: “Do No Harm”

- Don’t CUT it.
- Don’t SUCK it.
- Don’t CONSTRING it.
- Don’t ELECTROCUTE it.

Don’t Need To Bring Snake In!
When to treat?

- Follow standardized treatment protocols.
  1. Serial physical exams measuring swelling and edema.
  2. Serial laboratory exam measuring platelets and fibrinogen.

Pit Viper Bites: At the Hospital

- Identify bite site.
- Measure unaffected extremity
- Make marks at 10 & 20 cm from bite and any major joint.
- Measure serial circumferences (swelling) q15-60mi → q2-4h once better.
- Mark leading edge of swelling q15-60min → q2-4h once better.
- Watch for neuro toxicity.

Physical Exam

1. Identify bite site.
2. Measure unaffected extremity
3. Make marks at 10 & 20 cm from bite and any major joint.
4. Measure serial circumferences (swelling) q15-60mi → q2-4h once better.
5. Mark leading edge of swelling q15-60min → q2-4h once better.
6. Watch for neuro toxicity.
Laboratory Exam

- Measure platelets initially then q2-6h prn.
  - Thrombocytopenia = < 100
- Measure fibrinogen initially then q2-6h prn.
  - Hypofibrinogenemia = < 100
- Measure INR initially then q2-6hr prn.

“Dry Bites”

- 20-30% of bites result in NO envenomation.
- Need to observe for minimum of 8-12 hours.
- Repeat labs prior to discharge.

Pit Viper Bites: Treatment

- Antivenom is gold standard treatment.
- Crotalidae Polyvalent Immune Fab (Ovine) [Crofab]
  - Sheep derived Fab fragments
  - Covers all North America Pit Vipers
  - Safe (low allergic reactions)
  - Doesn’t REVERSE damage.
When to treat?

WHEN To Give ANTIVENOM?

✓ Symptoms
  ▪ Increasing Edema/Swelling
  ▪ Neurological symptoms.
  ▪ Pain?
✓ Thrombocytopenia (less than 100)
✓ Fibrinogenemia (less than 100)
✓ Evidence of coagulopathy
✓ Hand/Feet bites*

Pit Viper Bites: Antivenom Treatment

• 4-6 vials initially then
  – 2-6 vials PRN q1-2hrs
  • Goal is STABILIZATION
• Then: 2 vials q2h prn
  OR
  2 vials q6h x 3
• PEDIATRIC DOSING THE SAME!
• Have wait 12 hours from last dose of antivenom before discharge.

On the Horizon…
Pit Viper Bites: Tidbits

- Swelling lasts ~2-6 weeks.
- "Recurrence" risk with rattlesnakes.
- Anaphylaxis to venom can occur.
- Fasciotomies don’t help.
- HBO doesn’t help.
- Bites don’t get infected.
  – Update tetanus.

A 7 year old is bitten on the right forearm by a dog. Which is true?
A. Dogs bites #1 cause of rabies in US.
B. Prophylactic antibiotics always needed.
C. Can cause Pasteurella infection.
D. Primary closure contraindicated.
E. Most pediatric bites are on arms and legs.
Dog and Cat Bites

- Dog bites account for ~90% of all animal bites.
  - Cats: 5-10%
- Children – face/neck bites
- Adults – extremity bites

Risk from Dog and Cat Bites

- Local tissue injury/ destruction.
  - Dog = crush injuries
  - Cats = puncture wounds.
- Infection rates: 50% cat, 25% dog
- Bacterial Infection risk:
  - *Staph* and *Strep* species: Common
  - *Pasteurella multocida*: Cats & Dogs!
- Rapid developing infection
  - *Capnocytophaga canimorsus*: Both

**Capnocytophaga canimorsus: an emerging cause of sepsis, meningitis, and post-splenectomy infection after dog bites**

R. Stimler 2016


**Abstract**

Capnocytophaga canimorsus is a facultative pathogen found in the oral cavity of healthy dogs and cats. It is transmitted to humans via bloodborne exposure by dog bites. This review summarizes all laboratory-confirmed cases, animal sources, and clinical attributes to describe the pathogenesis, clinical features, and pathogenesis to understand potential risk factors for infection. The report aims to improve the recognition and management of this rare infection.
Management of Dog and Cat Bites

1. Report to appropriate authorities.
   – Missouri mandates reporting within 24 hours.
   – Kansas rules vary by locale.
2. Clean wound – Best way to prevent infection.
   ➢ High pressure irrigation.
3. Consider primary closure/repair

To Close or Not To Close?

Management of Dog and Cat Bites

4. Update tetanus
5. Antibiotic prophylaxis:
   – Only for high risk wounds:
Prophylactic Antibiotic Choices:

- All for 5 days
- 1. Amoxicillin/clavulanate 875/125 q12h
- 2. Clindamycin 300 mg TID + Ciprofloxacin* 500 mg BID
  - *Trimethoprim/sulfamethoxazole 8 to 10 mg per kg for children.
- 3. Doxycycline 100 mg BID
  - Azithromycin for pregnant patients allergic to PCN.

- A 2 year old is found unattended in a room with a bat. What treatment is indicated?
  - A. Augmentin PO BID x 5 days.
  - B. HRIG 20 IU/kg in gluteus.
  - C. Bactrin PO BID for 5 days.
  - D. Rabies vaccine 4 shot series.
  - E. Rabies vaccine 5 shot series.

Rabies

- Acute, rapidly progressive zoonotic encephalitis.
- Caused by Lyssaviruses (12 species).
- Any mammal can be host/infected.
  - Most rabid animals are wildlife:
    - Raccoons vs Bats for #1
    - Bats cause most human cases.
  - For domestic animals
    - Cats > Dogs
Cases of rabies among wildlife by year and species, 1983 to 2014

Any Mammal Can Be Rabid

Rabies
- Transmitted by saliva (not blood)
- Cases of transmission by cornea and solid organ transplants.
- Variable (usually weeks) and sometimes prolonged (year) incubation period.
- Once symptoms develop 99.9% fatal.
Symptoms of Rabies

Distinguishing characteristics of rabies encephalitis
1. Episodes of altered arousal, behaviors, cognition, and dysautonomia interspersed with complete enuresy
2. Pain, pruritis, and dysesthesias referable to the bitten limb
3. Myoclonic jerks, paresis referable to the bitten limb
4. Dysphagia, hydrophobia, and aerophobia
5. Dysautonomia, including catecholamine surges, bradyarrhythmias, hypermetabolism, piloerection, sweating, and pigrism.
6. Guillain-Barré-like syndromes that include urinary and fecal retention or other dysautonomia
7. Orofacial dyskinesias and myokymia

Approaching Potential Rabies Bites

- Clean wound aggressively.
  - Irrigate with betadine.
- Update tetanus.
- Post-exposure prophylaxis:
  - Appropriate and timely PEP is considered 100% effective and safe.
  1. Humans Rabies Immunoglobulin
  2. Vaccine

On Saturday, 16, 2016, the Missouri Department of Health and Senior Services (MDHSS) was notified of a new potential human case of rabies in a Warren County resident. The patient is a male, aged 72 years, residing in a rural, unincorporated area, and for eight years and has not lived in the county in several weeks.

The MDC Health Department, in conjunction with the Rural Health Department, performed a risk assessment and determined that the potential rabies bite was not likely to result in disease in the human.

The MDHSS is working to identify the animal that may have been the source of the rabies virus, and the patient is being treated with rabies immune globulin and rabies vaccine.
**Post-Exposure Prophylaxis**

- HRIG: 20 IU/kg IM
  - Only for those that have not previously been vaccinated.
  - Give at least half around the wound then rest in site distant from vaccine administration.

**Post-Exposure Prophylaxis**

- Rabies vaccine
  - 2 Types: Human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV)
  - Equally effective
  - Dose: 1.0 mL, IM (deltoid area)
    - 4 Doses: Days 0, 3, 7, 14.
    - Consider 5th dose on day 28 for immunocompromised patients.

**CDC recommendations**

---

---
### Who Needs PEP?

<table>
<thead>
<tr>
<th>Animal type</th>
<th>Evaluation and disposition of animal</th>
<th>Rabies prophylaxis recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogs, cats, and ferrets</td>
<td>Healthy and available for 10 days observation</td>
<td>Should be given no matter how long the delay from bite/exposure.</td>
</tr>
<tr>
<td></td>
<td>Riled or suspected rabid</td>
<td>Consider immediately prophylaxis.</td>
</tr>
<tr>
<td></td>
<td>Unknown (e.g. unexposed)</td>
<td>Consider prophylaxis.</td>
</tr>
<tr>
<td>Shrews, rice voles, shrews,</td>
<td>Regarded as valid unless avant proven negative by laboratory tests</td>
<td>Consult public health officials.</td>
</tr>
<tr>
<td>and other rodents, bats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock, small rodents (rabbits and hares), large rodents (woodchucks and beavers), and other mammals</td>
<td>Consider individually</td>
<td>Consult public health officials.</td>
</tr>
</tbody>
</table>

- Should be given no matter how long the delay from bite/exposure.
  - Except if symptoms have started!

---

### The Bat Problem

**Bats in the Bedroom, Bats in the Belfry: Reanalysis of the Rationale for Rabies Postexposure Prophylaxis**


- The #1 vector.
- Majority of cases no bite reported.
- Exposures to claws might be risk.
  - One of the most common bat RABV variants has an ability to replicate in non-neural cells.
**CDC recommendations**

- Any direct contact between a human and a bat should be evaluated for an exposure.
- If the person can be reasonably certain a bite, scratch, or mucous membrane exposure did not occur, or if the bat is available for testing and is negative for presence of rabies virus, **PEP is not necessary.**

**CDC recommendations**

- **PEP may be indicated for:**
  - Finding a bat in the same room as a person who might be unaware that a bite or direct contact had occurred (e.g., a deeply sleeping person awakens to find a bat in the room or an adult witnesses a bat in the room with a previously unattended child, mentally disabled person, or intoxicated person).
  - **NOTE:** Other household members who did not have direct contact with the bat or were awake and aware when in the same room as the bat should not be considered as having been exposed to rabies.

**Treating Rabies**

- No effective treatment.
  - Milwaukee protocol
    - Controversial
    - http://www.mcw.edu/Pediatrics/Infectious-Diseases/Patient-Care/Rabies.htm
  - Highlights importance of PEP
Take Home Points

• Pit Vipers (copperheads, rattlesnakes, cotton mouths) can cause local tissue, hematological and neuro toxicity.
  – Call Poison Center.
  – Antivenom (Crofab) is the treatment.
• Cat bites are puncture wounds and should always get prophylactic antibiotics.
• Only “high risk” dog bites need prophylactic antibiotics.

Take Home Points

• Rabies PEP (HRIG + Vaccine) is potentially life saving and should be initiated for bites by any suspected rabid animal or animals that can’t be observed/tested.
• All bat exposures should be considered for PEP unless physical contact can be ruled out or bat tests negative for rabies.

Questions?

BITE FIRST
ASK QUESTIONS LATER.