

## Copperhead Envenomations

## Clinical Case:

23 year-old gentleman from East Texas was hiking in the woods when he stopped to tie his boots. Patient felt a bite to his right index finger with two fang marks located on the palmar side. He was able to pull out his phone and take a picture of the snake, a 4-foot pale tan snake with a series of crossbands and broad head. He arrived in the ED 1 hour later with significant pain to right index finger and local swelling. The emergency physician identified the snake as a copperhead.

Copperheads are part of the Crotalinae subfamily including rattlesnakes and water moccasins and are indigenous to the **Southeast United States**, particularly Texas. Envenomation by this subfamily of snakes is characterized by **local tissue toxicity and rarely systemic effects**. The venom consists of a complex mixture of digestive enzymes, lipids, and biogenic amines that can lead to local tissue edema, systemic toxicity, and coagulopathy. Most common symptoms are **pain (frequently within 30 minutes), swelling (compartment syndrome is rare because venom is subcutaneous and not fascial), local ecchymosis, and bullae**. Systemic symptoms include **fasciculations, tachycardia, oral paresthesias, hypotension, metallic taste, and anaphylaxis**. The **coagulopathy** induced by this venom includes decreased fibrinogen, elevated PT, and thrombocytopenia.

The effects of copperhead bites are generally less severe than water moccasins and rattlesnakes. A large 2000-2007 study specifically analyzing the effects of copperhead bites showed that 40.5% of patients with copperhead bites had minimal or no clinical effects (dry bites), 46.3% of patients had moderate effects (defined as swelling less than full extremity and non-life-threatening systemic signs) and **3.2% had major effects** (defined as swelling greater than extremity or threatening airway and/or systemic disease including altered mental status, hypotension, coagulopathy) and only 1 death in a study with greater than 7,000 patients. Another study analyzing snake bites from 1995-2010 in East Texas demonstrated that of the 92 patients with copperhead bites, the most common symptoms were **pain (70%), swelling (67%),** nausea (7%), vomiting (1%), and, rarely, hypotension (1%) with 10% developing hematologic lab abnormalities.

Although severe symptoms and coagulopathy is rarely seen with copperhead envenomations, it is widely considered standard protocol to work up patients with bites with **CBC, prothrombin time, partial thromboplastin time, fibrinogen, and fibrin degradation products** at initial presentation and occasionally repeated several hours later. Several recent studies have evaluated the utility of these lab assays in management of these copperhead bites. One study showed that hematologic abnormalities were present in 27% of subjects while no patients had any clinically significant bleeding or death with 90% receiving antivenom. A recent 2014 publication looked at “confirmed or probable” copperhead bites from 1998-2012 (106 total bites) and the coagulation values associated with these bites. Median hematologic values were PT 13.7s, PTT 31s, INR 1.1, platelets 244.5K/mm<sup>3</sup>, and fibrinogen level 247.1mg/dl. The **highest INR recorded was 1.35 while the lowest platelet count was 54K/mm<sup>3</sup>**. None of the subjects developed any bleeding complications. Although rattlesnake envenomations often induce coagulopathy and/or thrombocytopenia, this study showed that **measurement of hematologic studies during an ED visit might not be indicated unless clinically evident**

**bleeding is present.** The study did have several limitations including not revealing the specific lab values of the patients receiving antivenom, the reliability of patients identifying the species of snake, and failing to evaluate for interrater reliability.

Although the data is limited investigating the use of Crotalidae Polyvalent Immune Fab antivenom (CroFab) and copperhead bites, there is promising future research related to this topic. Although copperhead venom is not used to produce CroFab, it is often successfully used to treat copperhead envenomations. The market price for 1 vial of CroFab is **\$1977.22 and often times many vials are used for 1 snake bite**, resulting in tens of thousands of dollars in hospital bills. But does it really improve clinical outcomes in copperhead bites? An observational study evaluating all types of Crotalinae subfamily snake bites demonstrating that of the 81 participants bitten who did not receive CroFab, there was no reported fatalities or long-term morbidity (although 15 patients did develop a coagulopathy). A study is currently underway comparing the recovery of a copperhead snakebite in patients with mild or moderate symptoms, with patients receiving CroFab or a placebo. It will be interesting to see if the results of this future study will change the frequency we use CroFab in copperhead bites without systemic toxicity.

I believe my literature review on copperhead envenomations will definitely affect my clinical practice. Several studies demonstrated to me that it really is not necessary to order coagulation studies and platelets unless the patient is demonstrating clinical symptoms of bleeding. This only applies if the physician can correctly identify the snake is a copperhead, which might be harder than it sounds. Because of the cost and side effects of CroFab, it will be interesting to see how the current study evaluating the clinical outcome of CroFab versus placebo with copperhead bites will alter emergency physician copperhead management.

#### References:

- Ali, A., Horwitz, D., and Mullins, M. *Lack of coagulopathy after copperhead snakebites.* Annals of Emergency Medicine. 2014, pages 1-6.
- Bhakta, N., Morgan, D., and Borys, D. *Copperhead (Agkistrodon Contortrix) Snakebites in the United States: 2000-2007.* Annals of Emergency Medicine. 2009, Volume 54, Issue 3, S19.
- Blok, BK, Cheung, DS, Platts-Mill, TF. *Epistaxis.* First Aid for the Emergency Medicine Boards. 2009: 666-668
- Evans, C., et. al. *Hematologic abnormalities and bleeding in copperhead snakebite.* Wilderness & Environmental Medicine. 2014, Volume 25, Issue 1, 119.
- Mazer-Amirshahi, M., Boutsikaris, A., and Clancy, C. *Elevated compartment pressures from copperhead envenomation successfully treated with antivenin.* Journal of Emergency Medicine. 2014, Volume 46, Issue 1, Pages 34-37.
- Walker, J. and Morrison, R. *Current management of copperhead snakebite.* Journal of the American College of Surgeons. 2011. Volume 212, Issue 4, Pages 470-474.
- <http://www.ncbi.nlm.nih.gov/pubmed/20837254>
- <http://www.ncbi.nlm.nih.gov/pubmed/16029826>