“Wilderness Medical Society Practice Guidelines for the Treatment of Pitviper Envenomations in the United States and Canada.”

An expert panel convened and developed a set of evidence-based guidelines for the prevention and treatment of North American pitviper envenomations. The majority of crotaline envenomations occur during intentional interaction. Most at risk of life threatening envenomations – white males, 25-34 years old; intentional envenomations mostly occur on the upper extremities, fewer on lower extremities, and rarely on face. Unintentional encounters are mostly on lower extremities. Almost all bites to humans are defensive.

Field management

- The first priority after a snake bite is safety for the patient and for those around them. Move away from the snake calmly. If a picture can be taken, then do so, but don’t jeopardize your safety to get the footage.

- Field first aid should **not** delay transport of the patient to an appropriate facility that has antivneom. Note the time of the bite and measure the circumference of the extremity above and below the bite to assess amount of swelling later on. Also mark the area of erythema and note any other local symptoms experienced by the patient. Remove jewelry that may cause constriction later.

- As with any other wound or laceration, copious irrigation should be performed and a sterile dressing applied, if it does not interfere with transfer of the patient.

- Keep the extremity at the level of the heart in a functional position. Immobilizing the extremity with splinting techniques may be performed, but have not been validated through trials.

- Systemic systems should be monitored including hypotension, bleeding, angioedema, vomiting, and neurotoxicity are indications of a more serious envenomation. The patient should be watched for signs of bleeding such as petechiae, ecchymosis, gingival bleeding, epistaxis, or signs of intracranial or intraabdominal hemorrhage.

Myths of field management:

- Oral suction is not recommended in field management of snake bites, as it can introduce oral flora into the wound and increase the risk of infection.

- Mechanical suction can increase local tissue damage and lead to necrosis if used.

- Laceration or bleeding of the bite by enlarging the wound to increase blood flow often causes tissue damage

- Electrotherapy to denature the wound causes harm to the patient

- Cryotherapy to prevent the spread of venom causes local tissue damage and can be harmful to the patient

- Tourniquet placement can lead to limb ischemia or gangrene

- Pressure bandaging has not been shown effective in crotaline envenomations, but has been seen to be effective in Australian elapids

Important notes:

- Don’t assume that the patient has experienced a dry bite.

- Duration of fang contact affects the amount of envenomation, but defensive bites, although quite variable, are often larger envenomations that predatory bites. The age of the snake does not correlate to amount of venom introduced.

- Presumptive dry bites must be monitored with repeat exams and labs.

Emergency Department Management

- Always begin with ABCs then continued monitoring of swelling and erythema of the limb should occur every 15 to 30 minutes until progression ceases. Wound infections occur in only 3% of pitviper bites.

- Prophylactic antibiotics are not currently recommended, but should be administered if signs of infection develop such as purulent drainage.

- Open wounds should be treated with moist dressings and largely debrided areas should be treated with a large pressure dressing.

- Opioids should be provided for pain control; NSAIDs and aspirin are contra-indicated due to possible risk of bleeding.

- Patients should also receive tetanus.

- IV access should be obtained and labwork sent off including CBC, CMP, coagulation factors, fibrinogen, d-dimer, creatine kinase, and urinalysis.

- If the patient is complaining of chest pain or dyspnea, EKG, CXR and cardiac markers can also be done. Evaluate the patient for rhabdomyolysis. Repeat neurological exams should be performed and CT head scan should be done if a deficit is identified. If the patient presents with a concerning abdominal exam, an ultrasound or CT can be performed.

- If a dry bite is expected, a complete set of labs should be drawn 8 hours after arrival to monitor for possible envenomation. If negative and vitals are stable, patient can be discharged home with follow up. - For minor envenomations, patients should be observed for 12 to 24 hours with repeat labwork done every 4 to 6 hours. Moderate to severe envenomations should receive antivenom and have repeat bloodwork done at 4 hours to evaluate efficacy of treatment.

- Ovine derived Crotalidae polyvalent immune Fab antivenom has been approved by the FDA and has less side effects than previous equine-derived polyvalent product. FabAV works to neutralize venom in the intravascular space, as well as travels into the interstitium to prevent progression of local tissue injury.

- FabAV should be administered in any patient who displays progression of symptoms (>2cm erythema expansion), abnormal lab results, or evidence of systemic toxicity (hypotension, systemic bleeding, or neurotoxicity) after Crotaline snakebite.

- Dry bites and mild envenomation should be monitored for progression and not given FabAV until progression occurs.

- If the bite occurred at more high-risk areas (hands, joint, or face), the threshold for given FabAV may be lowered to prevent long-term sequelae.

FabAV

- The initial dose of FabAV is 4 to 6 vials and each vial is reconstituted in 25mL of sterile NS and then gently rotated 180 degrees back and forth until it dissolves. Then it is further diluted in 250mL NS. The first 25mL should be given over 10 mins and the remainder given over an hour, if no reaction occurred.

- If allergic reaction occurs, then epinephrine, steroids, antihistamines, or airway management should be performed. After stabilization, FabAV is still the mainstay treatment of envenomation.

- Dosing is based on the amount of venom, NOT the weight of the patient.

- If patient is allergic to papain or papaya extract, patient can be pretreated and then given the FabAV, as the risks outweigh the benefits of not receiving the antivenom.

- Repeat labwork should be done 1 hour after administration to show the effects of the medication. If worsening labwork or symptoms, 4 to 6 more vials can be given at that time. Titrate until a response is achieved. These patients will be admitted and placed on maintenance dosing of FabAV (2 vials q6hr x 3 doses). If symptoms recur, then redose FabAV until control regained.

- Patients who are stable for discharge should have normal vital signs and laboratory studies.

- Patients need to be evaluated 2 to 3 days, as well as 5 to 7 days after the final administration of FabAV to assess for delayed onset or recurrent coagulopathy. Contacts sports, as well as tattoos/piercings, dental work, and elective surgery should be avoided for a minimum of 2 weeks.

- Rarely do wounds require surgical intervention for debridement. If indicated, however, early surgery is contraindicated and debridement should be delayed 3 to 5 days after initial injury.

- Compartment syndrome is difficult to diagnose in conjunction with Crotaline snakebites, as their presents are similar. Fasciotomy is rarely indicated and FabAV is still the mainstay to decrease swelling in affected limbs. If there is a concern after adequate administration of FabAV, then compartmental pressure can be measured. If elevated above 35 to 40mmHg, surgical consult should be made.

Special populations

- Pregnant females should still receive FabAV in conjunction with an obstetrician, as well as close fetal monitoring.

- Pediatric patients should receive the same dosing as an adult. Dosing is based on amount of venom and not by patient’s weight. FabAV has been shown to be safe to use in pediatric populations, as well as infants.

- Critically ill patient still receive FabAV is the mainstay treatment of Crotaline bites. Supportive fluids, or if necessary, vasopressors may be used for hemodynamic support. Those presenting with paralytic features may necessitate intubation, as this may be a life saving measure. Aggressive fluid hydration is used to combat rhabdomylosis. Transfusion of blood product may help improve numbers if the patient is severely bleeding, but it will not reverse the coagulopathies as antivenom does.