

UAMS MEDICAL CENTER
ACS SERVICES MANUAL

SUBJECT: Management of Snakebites and Envenomation

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UPDATED: 12/2022

EFFECTIVE: 12/15/2022

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CONCURRENCE(S): Emergency Medicine

APPROVAL: 12/15/2022

PURPOSE: To provide a treatment algorithm for the management of snakebites and envenomation.

INCLUSIONS:

- Adult patients with bites from venomous snakes including common Arkansas denizens such as the **cottonmouth** AKA water moccasin (*Agkistrodon piscivorus*), the **copperhead** (*Agkistrodon contortrix*), **western diamondback rattlesnake** (*Crotalus atrox*), **timber rattlesnake** (*Crotalus horridus*), **western pigmy rattlesnake** (*Sistrurus miliarius*), and **Texas coral snake** (*Micrurus tener*)
- OR adult patients with bite from unknown species and local tissue reaction that is concerning for envenomation.

BACKGROUND:

Arkansas is home to 6 types of venomous snakes, all but one of which are classified as Crotalinae (pit vipers). The vast majority of envenomations by this subfamily of snakes are non-lethal, but can result in soft tissue damage and loss of limb function.¹ Crotaline polyvalent immune Fab (CroFab[®], BTG International) is a snake antivenin used for treatment of North American pit vipers (which includes the rattlesnakes, cottonmouths, or copperheads seen in Arkansas). CroFab is effective in mild or moderate envenomation injuries at preventing further tissue loss and limb function.² It is also effective in mitigating systemic toxicity in severe cases of envenomation.³ CroFab is derived from inoculating sheep with one of four snake venoms and purifying antigen-binding proteins from the sheep serum. These are then mixed so that the final product has all four venom fragmented antigen-binding proteins. The majority of envenomations in Arkansas are from copperhead snakes per local data from the National Poison Data System, and these rarely cause systemic toxicity. Thus, mitigation of soft tissue injury and pain are of primary concern.⁴ Hematologic toxicity is also exceedingly rare in that population, though remains a risk in envenomation from other crotalid snakes.^{5,6,7}

CROFAB ADMINISTRATION:

Because it is an animal-derived protein, there is risk of allergic or anaphylactic reaction with CroFab, and patients should be monitored for adverse reactions. Acute hypersensitivity reactions are thought to have a prevalence of less than 10%.⁸ CroFab should be administered within 6 hours of envenomation for best result,⁹ though may still be beneficial when given in delayed fashion. The usual initial dose is 4-6 vials mixed in 250ml of normal saline. Be vigilant not to shake the lyophilized powder while reconstituting, as this can lead to foaming and interfere with administration.¹⁰ For more severe envenomation with systemic symptoms, shock, or active bleeding, an initial dose of 8-12 vials can be used,¹¹ though this is less common outside of rattlesnake envenomations. This initial dose can be repeated at 1 hour if there is no response. Maintenance dosing can still be considered, as recommended on the package insert. However, newer evidence suggests that this may not improve outcomes when compared to as-needed dosing and lead to more CroFab administration and lead to longer length of stay.¹² If maintenance dosing is pursued, standard dosing is 2 vials every 6 hours for a total of 18 hours.

MANAGEMENT ALGORITHM:

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- Initial evaluation and determination of need for antivenom should be investigated by the emergency department physician
 - Assess injury for evidence of bite marks, degree of swelling, tissue loss.
 - Immediately remove rings or other items that may constrict an affected digit or limb should swelling progress
 - Assess injured extremity for compartment syndrome, if applicable
 - Routine vitals and lab work plus assessment of coagulopathy including PT/INR, PTT, fibrinogen, and ROTEM (if bite marks plus signs of envenomation are present).
 - Administer tetanus vaccination if indicated by most recent available vaccination status
 - Objective evidence of initial exam should be documented, including outlining borders of swelling and photographs in the electronic medical record.
- If there is minor or no envenomation (minor swelling or tissue injury, no systemic signs of shock, no coagulopathy), do not administer antivenom and the patient can be placed in CDU for observation from 12-24 hours. This is the likely pathway for known copperhead bites.
 - If swelling/tissue loss does not progress, discharge home
 - If swelling/tissue loss progresses, re-assess need for antivenom CroFab and consult surgery.
 - Please engage the Arkansas Poison and Drug Information Center on all cases: 1-800-222-1222.
- If there is need for antivenom CroFab (major swelling or tissue loss, systemic signs, evidence of coagulopathy), proceed with administration and consult trauma surgery team for evaluation and admission. This is the likely pathway for known rattlesnake or cottonmouth bites.
 - All envenomation injuries requiring admission should be admitted to the trauma service unless extenuating circumstances such as complex co-management of medical conditions.
 - Patient should be evaluated every 6 hours by the trauma team to assess need for re-dosing of CroFab and assessed for compartment syndrome of the affected extremity if applicable.
 - If there are any signs of systemic shock or active bleeding, labs should be repeated at 6 hour intervals until resolved.
- See flowsheet below for full algorithm¹¹ with the following modifications:
 - 4-vials of CroFab would be appropriate initial dosing in cases where there is no severe or systemic toxicity. This is the most common initial dose for copperhead envenomations.¹ Severe envenomations and rattlesnake envenomations may merit consideration of a 6-vial starting dose.
 - Maintenance dosing is typically not required¹² and can be considered on an as-needed basis.
 - Please make effort to avoid fasciotomy, which is now rarely indicated if antivenom is available.^{13,14} If exam is suggestive that fasciotomy may be needed, further antivenom should be administered, and compartment pressures should be measured. If there are elevated compartment pressures (>30mmHg) there should be challenge with more antivenom prior to possible surgical intervention,¹⁵ which is again controversial. Please notify poison control 1-800-222-1222 so that they may provide further guidance.
 - Coagulopathy is rare in copperhead bites.^{5,6} To conserve resources, no need for follow-up labs on patients with confirmed copperhead bite and no initial demonstrated coagulopathy
 - Despite some recommendations, evidence suggests NSAIDs are safe in *copperhead* envenomations^{16(p),17} as part of a strategy of multimodal pain control. NSAIDs should be used with caution in potentially coagulopathic patients.
 - Acute hypersensitivity reactions may be treated with antihistamines or other supportive measures, depending on the severity of the reaction.¹⁸ It is also reasonable to consider slowing the infusion rate in these patients.⁸ Anaphylaxis and other severe reactions are thought to be relatively rare in

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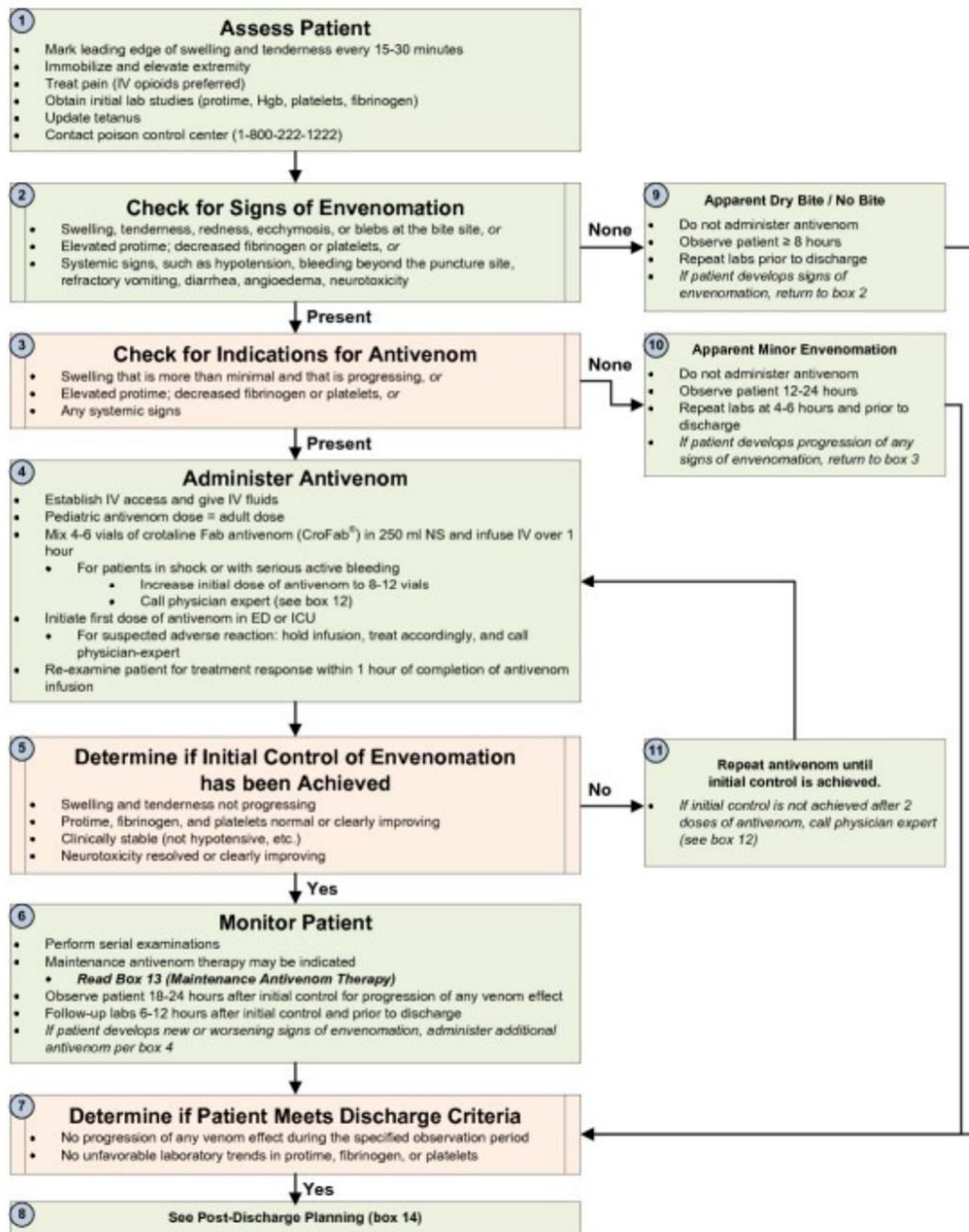
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- these patients:¹⁹ unlike the preceding equine whole IgG antivenom, CroFab is not thought to regularly produce sensitization on subsequent administrations.²⁰
- Follow-up labs should not be necessary unless there was coagulopathy or other derangement noted during the patient's inpatient stay. The patient should be given anticipatory guidance regarding signs of serum sickness (myalgias, arthralgias, subjective fever), which may occur 1-2 weeks out from antivenom administration.⁸ This may be treated with steroids on an outpatient basis by the patient's PCP.
 - Effort should be made to avoid excessive mobilization of the affected joint. In cases of lower-extremity envenomation, the patient should be discharged with crutches.

Please contact the Arkansas Poison and Drug Information Center for assistance in these cases: 1-800-222-1222. The medical director shall be available 24/7 to provide further guidance via telephone if requested.

Emergency Department and Hospital Management of Pit Viper Snakebite

Includes: Rattlesnakes, Copperheads, and Cottonmouths (Water Moccasins)



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12 When to Call a Physician-Expert

Direct consultation with a physician-expert is recommended in certain high-risk clinical situations:

- **Life-threatening envenomation**
 - Shock
 - Serious active bleeding
 - Facial or airway swelling
- **Hard to control envenomation**
 - Envenomation that requires more than 2 doses of antivenom for initial control
- **Recurrence or delayed-onset of venom effects**
 - Worsening swelling or abnormal labs (protime, fibrinogen, platelets, or hemoglobin) on follow-up visits
- **Allergic reactions to antivenom**
- **If transfusion is considered**
- **Uncommon clinical situations**
 - Bites to the head and neck
 - Rhabdomyolysis
 - Suspected compartment syndrome
 - Venom-induced hives and angioedema
- **Complicated wound issues**

If no local expert is available, a physician-expert can be reached through a certified poison center (1-800-222-1222) or the antivenom manufacturer's line (1-877-377-3784).

15 Treatments to Avoid in Pit Viper Snakebite

- Cutting and/or suctioning of the wound
- Ice
- NSAIDs
- Prophylactic antibiotics
- Prophylactic fasciotomy
- Routine use of blood products
- Shock therapy (electricity)
- Steroids (except for allergic phenomena)
- Tourniquets

16 Notes:

- All treatment recommendations in this algorithm refer to **crotalidae polyvalent immune Fab (ovine) (CroFab[®])**.
- This worksheet represents general advice from a panel of US snakebite experts convened in May, 2010. No algorithm can anticipate all clinical situations. Other valid approaches exist, and deviations from this worksheet based on individual patient needs, local resources, local treatment guidelines, and patient preferences are expected. **This document is not intended to represent a standard of care.** For more information, please see the accompanying manuscript, available at www.biomedcentral.com.

13 Maintenance Antivenom Therapy

- Maintenance therapy is additional antivenom given after initial control to prevent recurrence of limb swelling
 - Maintenance therapy is 2 vials of antivenom Q6H x 3 (given 6, 12, and 18 hours after initial control)
- Maintenance therapy may not be indicated in certain situations, such as
 - Minor envenomations
 - Facilities where close observation by a physician-expert is available.
- Follow local protocol or contact a poison center or physician-expert for advice.

14 Post-Discharge Planning

- Instruct patient to return for
 - Worsening swelling that is not relieved by elevation
 - Abnormal bleeding (gums, easy bruising, melena, etc.)
- Instruct patient where to seek care if symptoms of serum sickness (fever, rash, muscle/joint pains) develop
- Bleeding precautions (no contact sports, elective surgery or dental work, etc.) for 2 weeks in patients with
 - Rattlesnake envenomation
 - Abnormal protime, fibrinogen, or platelet count at any time
- Follow-up visits:
 - Antivenom not given:
 - PRN only
 - Antivenom given:
 - Copperhead victims: PRN only
 - Other snakes: Follow up with labs (protime, fibrinogen, platelets, hemoglobin) twice (2-3 days and 5-7 days), then PRN

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