PIT VIPER SNAKEBITE PROTOCOL

COMPLETE GUIDE TO SNAKEBITE CARE

**Specializing in pit viper envenomation,
including information about the latest antivenin**

by

Jon E. Soskis, RN

**Updated April, 2004 for use at Tallahassee Memorial Hospital
Updated May, 2008**

PIT VIPER SNAKEBITE PROTOCOL

1. If the snake is available, determine whether the species is venomous, non-venomous, or unknown.
2. Remove jewelry.
3. Elevate the extremity once an IV is established and antivenin (if indicated) is being administered. Do not apply ice, heat or tourniquets.
4. Cleanse the puncture wounds and administer tetanus prophylaxis if indicated.
5. Note any allergy to sheep protein, papain, chymopapain, other papaya extracts, the pineapple enzyme bromelain, dust mites, latex (4).

VENOMOUS OR UNKNOWN WITH NO SIGNS OR SYMPTOMS OF ENVENOMATION

** ASSESSMENT IS BASED ON LAB VALUES, SIGNS, AND SYMPTOMS **
** HOLD THE ASYMPTOMATIC PATIENT IN THE E.R. FOR 8-12 HOURS FROM THE TIME OF THE BITE.**

6. Notify a snakebite specialist.
7. N.P.O.
8. Bedrest.
9. IV lock in an unaffected extremity.

COLLECT: 1 purple, 1 blue, 1 orange, 1 red top (10 ml), 1 special blue top (for fibrin degradation products).

10. If the patient is wearing a band occluding arterial or venous blood flow DO NOT immediately release the band since this may release a bolus of venom into the systemic circulation. Apply a less constricting band proximal to the tourniquet. Infuse an IV solution of warmed NS or LR for 5 minutes before slowly releasing the tourniquet, then wait another 3 minutes before releasing the constricting band. Consideration should be given to administering antivenin before the constricting band is released.

LABORATORY STUDIES AND BLOOD BANK

11. Apply blood band. Label blood requisition "Snakebite: hold clot tube only". Order type and screen or type and cross only if it becomes necessary. Send blood and requisition to the blood bank.
12. Lab **STAT**: diff; ETOH if indicated
13. Lab **STAT and at 1 HOUR**: CPK (optional)
14. Lab **STAT and at 6 HOURS**:
    a) CBC
    b) platelets
    c) Fibrin degradation products. Do not repeat if the initial result is greater than 40 unless ordered.
    d) Fibrinogen
    e) PT/INR

f) PTT
g) Chemistry panel
h) UA
i) Urine myoglobin. Must be a fresh specimen. **Do not repeat if the initial specimen is positive unless ordered**.

15. Urine dipstick q1h for blood.
16. Foley catheter if unable to void q1h or if menstruating.

17. **OBSERVE EVERY 15 MINUTES FOR:**
    a) signs of shock
    b) pain (0-10 scale; **may be 0 in envenomated diabetics)**
    c) swelling (mark the leading edge plus measure the circumference at 10 cm and 20cm proximal to the bite). **May be none in a severely envenomated patient.**
    d) weakness or faintness
    e) numbness or tingling (face, scalp, tongue, lips, fingers, toes, site of the bite)
    f) change in taste (metallic, rubbery or minty taste in the mouth = rattlesnake envenomation)
    g) fasciculations (most noticeable on the face and over the muscle of the back and neck, as well as the bitten extremity)
    h) nausea/vomiting/diarrhea
    i) diaphoresis
    j) difficulty swallowing
    k) erythema
    l) ecchymosis (appears where skin rubs against skin or where slight injury occurs)
    m) bleeding
18. Report to the physician any signs or symptoms of envenomation or any abnormal lab results.
19. Hold the asymptomatic patient in the Emergency Department for 8 – 12 hours from the time of the bite.

20. **WHEN TO DISCHARGE**

    Discharge in the absence of swelling, paresthesias, fasciculations, ecchymoses, pain other than minor pain, other signs or symptoms of envenomation, any abnormal laboratory findings, including baseline and 6 hour lab work. (An FDP of 10-40 or greater than 40 can be predictive of a worsening condition).
21. Provide and review with the patient "Information for Patients" instructions.

VENOMOUS OR UNKNOWN WITH SIGNS OR SYMPTOMS OF ENVENOMATION

**** TREATMENT IS BASED ON LAB VALUES, SIGNS, AND SYMPTOMS ****
**** ADMIT MILDLY SYMPTOMATIC PATIENTS AT LEAST 24 HOURS ****

1. Notify a snakebite specialist (see page 13).
2. Admit to an ICU only.
3. N.P.O.
4. Strict bedrest
5. VS's q15 minutes, including pulse oximetry
6. Begin 2 IV's away from the bitten extremity (one IV lock and one large bore warmed LR or NS).

   COLLECT: 1 purple, 1 blue, 1 orange, 1 red top (10 ml), 1 special blue top (for fibrin degradation products)

7. **If the patient is wearing a band occluding arterial or venous blood flow DO NOT immediately release the band since this may release a bolus of venom into the systemic circulation**. Apply a less constricting band proximal to the tourniquet. Infuse the IV solution for 5 minutes before slowly releasing the tourniquet, then wait another 3 minutes before releasing the constricting band. **Consideration should be given to administering antivenin before the constricting band is released.**
8. Mark the leading edge of swelling and measure the circumference at 10 cm and 20 cm proximal to the bite every 15 minutes.
9. EKG for all but minor envenomations, and for all patients over 40 years of age or with a history of heart disease.
10. Foley catheter
11. I & O's
12. Hemoccult all stools.

LABORATORY STUDIES AND BLOOD BANK

13. Apply blood band. Label blood requisition "Snakebite: hold clot tube only". Order a type and screen or type and cross only if it becomes necessary. Send blood and requisition to the blood bank.
14. Lab **STAT**: diff; ETOH if indicated
15. Lab **STAT** and at **1 HOUR**: CPK (optional)
16. **qlh until stable**: H & H with PLATELETS
17. **qlh** urine dipstick for blood

18. Lab **STAT** and **EVERY 4-6 HOURS** (coordinate with #19)
    a) CBC
    b) platelets
    c) Fibrin degradation products (requires a special blue top, not a regular blue top). **Once the FDP is greater than 40 do not repeat unless ordered by the physician**.
    d) Fibrinogen.
    e) PT/INR
    f) PTT
    g) CMP
    h) UA
    i) Urine myoglobin (must be a fresh specimen**). Once the urine myogobin is positive do not repeat unless ordered by the physician**.
19. **One hour after each dose of antivenin has infused repeat (coordinate with # 18**):
    a) C B C
    b) platelets
    c) FDP unless previously greater than 40.
    d) fibrinogen
    e) PT/INR
    f) PTT
    g) UA
    h) urine myoglobin unless previously positive

20. **OBSERVE EVERY 15 MINUTES FOR**.
    a) signs of shock
    b) pain (0-10 scale; **may be 0 in envenomated diabetics**)
    c) swelling (mark the leading edge and measure the circumference at 10 cm and 20 cm proximal to the bite; **may be none in a severely envenomated patient**)
    d) weakness or faintness
    e) numbness or tingling (face, scalp, tongue, lips, fingers, toes, site of the bite)
    f) change in taste (metallic, rubbery or minty taste in the mouth = rattlesnake envenomation)
    g) fasciculations (most noticeable on the face and over the muscle of the back and neck, as well as the bitten extremity)
    h) nausea/vomiting/diarrhea
    i) diaphoresis
    j) difficulty swallowing
    k) erythema
    l) ecchymosis (appears where skin rubs against skin or here slight injury occurs)
    m) bleeding
21. Report to the physician any changing signs or symptoms of envenomation or any abnormal lab values.

WHEN TO INITIALLY TREAT WITH ANTIVENIN

Do not wait hours before treating, since local tissue is preserved only by early treatment. If unsure whether to treat or re-treat, consult a snakebite expert (see list page 13).

Treat in the presence of <u>any</u> of the following:

a) frank bleeding
b) shock
c) paresthesias
d) progressive pain
e) definite change in taste
f) fasciculations
g) ecchymoses progressing beyond the local site
h) rapid swelling or swelling which fails to localize within 30-60 minutes from the time of the bite.
i) **SINGLE** component coagulopathy:
   low **FIBRINOGEN** (less than **50** ug/ml) without history of familial afibrinogenemia
   or FIBRINOGEN trending significantly downward
   or low **PLATELETS** (less than **25,000**/mm3) without history of thrombocytopenia
   or PLATELETS trending significantly downward
   or INR greater than **3.0** without history of taking anticoagulants
   or PTT greater than **50** seconds
   or PTT or INR trending significantly upward
   or low **H & H** without history of anemia
   or H & H trending significantly downward
j) **MULTICOMPONENT** coagulopathy:
   same as single component coagulopathy except **fibrinogen** less than **75** mg/dL and **platelet count** less than **50,000** cubic mm
k) positive FDP (possibly treat)

TREATMENT

AVOID nasogastric tubes, arterial punctures, aspirin containing products, ice or heat application, tourniquets.

22. **IF IN SHOCK: Intubate, ventilate aggressively, infuse warmed IV fluids, administer antivenin (10 vials - see PROCEDURE). SEEK IMMEDIATE CONSULTATION.**

NOTE: The use of Crotalidae Polyvalent Immune FAB in patients presenting in shock from envenomation has been experienced only to a limited extent to this time. One should be prepared to administer further doses of 10 vials before initial control is achieved.

23. If the urine myoglobin is positive, evaluate the need for forced diuresis.
24. Remove any constricting tourniquets and elevate the extremity once an IV is established and antivenin (if indicated at this time) is being administered.
25. Have a crash cart in the room.
26. Permit for antivenin administration if possible.

DOSAGE

*****The effective half life of Crotalidae Polyvalent Immune FAB (Ovine) is only about twelve hours.*****

SEVERE ENVENOMATION is treated differently. With rapid progression of symptoms (swelling in your presence, vomiting, fasciculations, strong taste changes, hypotension, tachycardia of 130 or greater, weakness or faintness, systemic bleeding, shock) **administer 10 vial doses to gain initial control rather than the routine 6 vial doses (see below). Further, rather than the routine maintenance dose of 2 vials q6h x 3 doses, a higher dose should be given q6h for 24-36 hours (7).**

Generally, the less time between the bite and the onset of the above more severe symptoms, the greater the venom load may be.

For lesser envenomations see below.

27. **TO LESSEN THE INCIDENCE OF LOCAL AND COAGULOPATHY RECURRENCE THE RECOMMENDED INITIAL DOSE IS 6 VIALS CROTALIDAE POLYVALENT IMMUNE FAB (OVINE)(l). IF INITIAL CONTROL IS NOT ACHIEVED BY THE FIRST DOSE, AN ADDITIONAL DOSE OF 6 VIALS SHOULD BE REPEATED UNTIL INITIAL CONTROL OF THE ENVENOMATION SYNDROME HAS BEEN ACHIEVED (1). See NOTE.**

NOTE:

The package insert defines INITIAL CONTROL as "complete arrest of local manifestations and the return of coagulation tests and systemic signs TO normal". Taken too literally this can lead to the use of too much antivenin in an attempt to gain initial control. A better definition might be "complete arrest of local manifestations and return of coagulation tests and systemic signs TOWARD normal"(3) in nonbleeding patients.

AFTER INITIAL CQNTROL HAS BEEN ESTABLISHED, ADDITIONAL 2-VIAL DOSES OF CroFab EVERY 6 HOURS FOR UP TO 18 HOURS (3 DOSES) IS RECOMMENDED (4).

DOSAGE IN RETREATMENT

OPTIMAL DOSING FOLLOWING THE 18-HOUR SCHEDULED DOSE OF CroFab HAS NOT BEEN DETERMINED. ADDITIONAL 2-VIAL DOSES MAY BE ADMINISTERED AS DEEMED NECESSARY BY THE TREATING PHYSICIAN, BASED ON THE PATIENT'S CLINICAL COURSE (4). SEE PAGE 9, NUMBER 40 FOR RETREATMENT LABORATORY PARAMETERS.

28. **PROCEDURE**

A. Reconstitute each vial with 10cc of sterile water for injection. **Mix gently to avoid foaming**. To hasten mixing, any remaining vacuum in the vial may be removed by inserting a needle into the vial and removing it.

B. **IN ADULTS**, add these six reconstituted vials to 250 ml NS**. If the patient's cardiac or renal status, size, or age precludes the use of this much fluid or salt, toxicology consultation should be immediately obtained.**
IN CHILDREN, reduce the amount of IV FLUID (not vials of antivenin) in proportion to weight.

C. With the physician at the bedside, initially infuse slowly for 10 minutes (**PUMP SETTING**: 30cc/hour with a limit of 5 cc), observing for hypotension, urticaria, sneezing, dyspnea, apprehension, flushing, coughing, cyanosis, vomiting, wheals, pruritis, wheezing, edema of the face, tongue or throat, or frank anaphylactic shock.

D. In the absence of hypersensitivity symptoms, gradually increase the rate of infusion over the next 5 - 10 minutes to a rate that will infuse the entire initial dose of antivenin in one to two hours. **Patients with more apparent signs and symptoms or more severe coagulopathy should receive antivenin over one hour if possible; others may benefit from a slower infusion since rate of infusion seems to be linked to the likelihood of untoward reactions**.

INPATIENT FOLLOW-UP AFTER 18 HOUR DOSING IS COMPLETED

29. When swelling stops, continue to measure and mark every 1/2-2 hours for the next 48 hours.
30. Continue to monitor all symptoms and signs on the same schedule as for the monitoring of swelling.
31. Continue the foley and qlh urine dipsticks for blood. **(Do not discontinue the foley prematurely, as it is an important visual monitoring tool which can serve as an early warning of coagulopathy).**
32. Continue q4-6h labs; observe for downward trends.
33. If envenomation is severe or if the wound were incised, suctioned, or both, use broad spectrum antibiotics for at least 7 days.
34. Lightly immobilize the extremity in the position of function on a well padded splint. Cleanse the fang wounds daily with an antiseptic solution and cover with a dry, sterile dressing. Debride blebs, vesicles, and superficial necrotic tissue aseptically on the 4th or 5th day if coagulation values are normal.
35 Begin active and passive rehabilitation therapy as soon as the patient is able to tolerate it to prevent contractures. Consult rehabilitation therapy on the day of admission. (Swelling usually subsides within ten days if antivenin therapy has been adequate).
36. Observe for serum sickness (4 - 20 days). If present in adults, administer Prednisone 10 mg PO q6h at the onset of pruritis and urticaria. In children, administer Prednisone 2 mg/kg/day divided into two doses.
37. For sedation and pruritis, in children Atarax 1mg/kg q4-6 h prn.

FOLLOW-UP AFTER DISCHARGE

38. For prophylaxis against serum sickness consider the use of methylprednisolone (2 week supply) at the time of discharge.

39. **LAB WORK**

Until more data on follow-up are available, we recommend that all FabAV recipients be reevaluated at least once within 5 days after antivenom treatment; if laboratory values remain normal during this time, recurrence is unlikely. Patients at risk for recurrence (those with abnormal coagulation during the first 36 hours) should be reassessed more often--approximately every 48 hours after the last antivenom dose, until coagulation values are clearly stable or improving for several days. If coagulation values become significantly abnormal on follow-up, or if there is a definite downward trend, then laboratory test results should be monitored daily and consideration should be given to retreatment with antivenom (2).

40. **RETREATMENT**

Until more data are available, we recommend consideration of retreatment with FabAV in the following circumstances: (a) fibrinogen concentration less than 50 ug/ml, platelet count less than 25,000/mm3, INR greater than 3.0, or a PTT greater than 50 seconds; (b) multicomponent coagulopathy with abnormal laboratory values of a lesser degree **(see note);** (c) a clear worsening trend at follow-up in patients who had a severe early coagulopathy; or (d) high-risk behavior or comorbid conditions (2).

NOTE:
Frank bleeding should be treated with additional antivenom, regardless of whether the laboratory criteria have been exceeded. Antivenom therapy is recommended when asymptomatic patients develop multicomponent coagulopathy that reaches critical values (eg, INR greater than 3.0, a PTT greater than 50 seconds, fibrinogen concentration less than 75 mg/dL, and platelet count of less than 50,000/cubic mm) (6).

INFORMATION FOR PATIENTS

Upon discharge from the hospital you should rest in bed and be observed for at least 24 hours. Avoid contact sports and other hazardous activities, elective surgery and dental work until advised by your doctor. Elevate the affected limb continually. Take medicines as directed. Ask your doctor when to restart any blood thinners or aspirin you may have been taking, and do not restart them until your doctor advises you to do so.

You should immediately report any shortness of breath, unexpected sweating, faintness, dizziness or unquenchable thirst, renewed swelling, vomiting, numbness or tingling, unusual taste, muscle twitching, increasing pain, darkening or bloody urine, rash, itching, whelps, unusual bruising, nosebleed, excessive bleeding after brushing your teeth, dark or bloody stools, excessive menstrual bleeding, persistent oozing from minor injuries, fever, or any other symptom about which you are concerned.

You should return to your doctor's office for a recheck in 1 2 3 4 5 days. Further lab work may be required at that time, depending on your lab results while you were in the hospital. Further treatment with antivenin may be required, depending on your exam and lab studies (if any).

Please contact your doctor or the doctor on call at _____should you have any questions or concerns.

TREATMENT OF UNTOWARD REACTION AND RESTARTING ANTIVENIN

**** Treatment with antivenin is not stopped for rash or itching, but is held until the reaction subsides, usually about thirty minutes. Wheezing may be an indication of too rapid infusion of antivenin ****

1. Hold the antivenin.

2. **FOR AIRWAY SYMPTOMS** (cough, wheezing, stridor) **or collapse** notify physician immediately and administer:

   ADULTS: Epinephrine **1:1000** 0.3-0.5 ml subcutaneously STAT. May repeat at 20-30 minute intervals up to 3 doses. Maximum dose for the elderly is 0.3 ml.

   If unresponsive to the above: Epinephrine 1:**10,000** 3-5 ml IV over 5 minutes or by endotracheal tube. May repeat at 5 - 10 minute intervals. Maximum dose for the elderly is 3 ml.

   PEDIATRIC: Epinephrine **1:1000** 0.01 ml/kg subcutaneously or IM STAT. Maximum dose 0.3 ml.

   If unresponsive to the above: Epinephrine 1**:10,000** 0.1 ml/kg IV over 5 minutes. Maximum dose 3 ml. May be repeated in 10-15 minutes if no improvement (every 3 minutes in severe reactions).

3. **ANTIHISTAMINES (Administer both Benadryl and Tagamet)**

   ADULTS: Benadryl 50-100 mg IV STAT and q6h and PRN during antivenin administration and following antivenin administration q6h for at least two doses. May be given undiluted over 2-5 minutes if the patient is stable, faster if necessary, regardless of dosage.

   Tagamet 300 mg IV STAT and q6h during antivenin administration and following antivenin administration for at least two doses. NO SUBSTITUTE. Dilute in 20cc NS and administer over at least 5 minutes.

PEDIATRIC: Benadryl 1 mg/kg IV q4h. Give undiluted over 3 - 5 minutes if the patient is stable (faster if necessary, regardless of dosage to be given).

Tagamet .

Less than 2 years old:

5 – 7 mg/kg. **Dilute with NS to a total volume of 20 ml and inject over 15 minutes.**

2 years through 16 years:

300 mg. **Dilute in 50 ml D5W and give over 15 minutes.**

17 years and above**:**

Same as adult.

4. **After consultation, if administration of antivenin is to continue**, dilute it to double that of the original solution and give slowly. The dilution may need to be greater than double that of the original solution with severe reactions. Wait until the reaction resolves before restarting the diluted antivenin. Sometimes. merely slowing the rate of administration (without any further dilution of the original solution) will solve the problem. Many patients do well with the single Benadryl/Tagamet combination treatment and need no further treatment as antivenin is continued. IV Benadryl and Tagamet can be given before antivenin is administered and may be of particular value when you need to give large amounts of antivenin in a short time.

FOR CONSULTATION

Rocky Mountain Poison and Drug Center CroFab Line

1-87-SERP-DRUG
(1-877-377-3784)

OR

Contact your local or state Poison Information Center

1-800-222-1222

Physician Consultants

South Georgia Surgical Associates
(Dr's. Ed Hall, Alan Waller, Greg Patterson, James Smith, Geoff Deutsch)
1-229-226-8881
1-800-287-2554

1-800-341-1009
Archbold Hospital
Thomasville,Georgia

Nurse Consultant

Jon E. Soskis, R.N.
(author)
1-850-567-0984

Pharmaceutical

For additional information go to: www.fougera.com or www.savage1abs.com or www.protherics.com

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AVOIDING PITFALLS OF SNAKEBITE TREATMENT

by

Jon E. Soskis

1. Tetanus prophylaxis?
2. Notify a snakebite specialist?
3. Stay tight on labs (every 4-6 hours, sometimes extended to every 12 hours after 2-3 days). You can't feel coagulopathy, and that's how the snake kills its prey. To prove no envenomation one must repeat labs before discharge.
4. Don't underestimate the meaning of an abnormal FDP...it can be a harbinger of things to come.
5. Be cautious of attributing symptoms of envenomation (tingling, numbness) to anxiety.
6. Diabetics may have no pain associated with their bite.
7. Swelling is a great measuring tool, but may not be present at all with a severe envenomation.
8. Swelling comes from the venom destroying vessel walls, leading to hypovolemia, which leads to shock...Stay ahead with warmed normal saline and by administering antivenin. . Elevated heart rate or increasing heart rate or periodic drops in blood pressure call for increasing the fluid rate and for re-evaluating the need for additional antivenin.
9. Did you consider the timing? It's probable that the sooner symptoms appear, especially if rapidly progressing, the greater the venom load.
10. Admit to an lCU (always an ICU)? Snakebite is a complex poisoning, potentially affecting every organ system!
11. Focusing on trends and progression? Trends are identified through lab studies and symptomatology.
12. Keep the foley in... It's a safety net. With the discovery of hematuria through q1h dipsticks for blood, blood studies are repeated before planned, potentially preventing lethal bleeding. Also, myoglobinuria can be identified more readily with a foley in place, which is critical to protecting the kidneys.
13. Remember that the effective half life of CroFab is about 12 hours...The venom lasts many days to weeks. Stay on guard after initial control is achieved. Depending on venom load more antivenin may be required, even after the maintenance dose of 2 vials every 6 hours for three doses.
14. Severe envenomation? The dosage is 10 vials, not 6!
15. Plastic surgery consult instituted? Hands and fingers are particularly important to our futures.
16. Early physical therapy instituted?
17. Be mindful of the potential for recurrence (local and coagulopathy) after discharge. If coagulopathy occurred earlier, follow-up lab should be done at two days, otherwise recheck within 5 days.

18. Does the patient know in detail what to watch for at home? Provide a discharge information sheet for snakebite victims. .
19. Pretreat highly allergic patients with diphendramine and cimetidine?
20. Renal status OK? Watch for myoglobinuria…Evaluate for the need for forced diuresis. Try not to overload, however…The lungs are susceptible to damage from venom; pulmonary edema can occur.
21. Protecting local tissue requires early and adequate amounts of antivenin.
22. Pediatric? Dosage is the same; fluids are less. Treatment may be required earlier than in adults.
23. Small pit vipers have to eat, too. Their venom has equal effects to that of adult snakes.
24. Decreased platelets calls for antivenin, not platelet administration. Platelets rebound quickly once adequate antivenin is administered.
25. Observe the asymptomatic patient for 8 to 12 hours before discharging (significant symptoms can be quite delayed occasionally).
26. Consider the status of the patient before transferring to the unit if the unit staff is unfamiliar with snakebite.
27. Frequently reevaluate the clinical situation and the need for additional antivenin.
28. Avoid underdosing. It's far better to slightly overtreat than to undertreat.
29. Avoid fasciotomy unless a poison control center concurs with the need. Adequate antivenin given early avoids the need for fasciotomy.
30. Do not fail to administer antivenin in the case of life-threatening envenomation because of an allergic reaction to the antivenin. The question is can you take the risk of <u>not</u> giving antivenin?
31. Pregnancy is not a contraindication to antivenin therapy; however, consultation should be sought.
32. CONSULT CONSULT CONSULT!!

VENOM AND ITS EFFECTS

from

SNAKE VENOM POISONING by RUSSELL

The purposes of venom are to assist the snake with food getting, to aid in digestion, and defense. The venom causes rapid paralysis by attacking multiple body systems simultaneously, with subsequent death.

Some snake venoms, particularly those of the crotalids (rattlesnakes), are composed of as many as twenty different components, while the venoms of elapids (coral snakes) appear to be less complex.

The venoms of snakes are complex mixtures, chiefly proteins, some of which have enzymatic activities. The more lethal venom fractions of snake venoms appear to be peptides and, perhaps, certain nonenzymatic proteins, although the enzyme components certainly contribute to the overall deleterious effects of the crude venom. Sodium, calcium, 'potassium, magnesium, zinc and small amounts of iron, cobalt, manganese and nickel have been found in crotalid venoms. All crotalid venoms so far examined appear to be rich in proteolytic enzyme activity. Rattlesnakes have the most highly developed venoms and best developed delivery system.

Venom composition varies by species, geographic location, size, and age of the snake. Six to twelve month old snakes can be more toxic than adult snakes (drop for drop). Dose generally is related to animal size.

The rate of venom fraction diffusion across membranes is proportional to the pressure gradient and is dependent on lipid solubility, degree of ionization, molecular size and the area of the absorptive surface. Rate of capillary flow is important to the rate of absorption (stay calm, don’t exercise if bitten).

The venom does not cross the blood brain barrier. Thus, aberrant behavior points to hypoxia (intubate early and ventilate aggressively).

The major organ for excretion of snake venom is the kidney. The excretion rate of crotalid venoms is complicated by several factors affecting the kidneys, of which one of the most important is the direct effect of the venom in blood cells and the resulting obstruction of the tubules. In addition, venom has a direct effect on the kidneys (maintain an adequate urine output).

Breakdown of venom occurs in tissue. The amount of toxin that the tissue of various species of animals can metabolize without endangering the organism varies considerably. For the present is seems wisest to consider all snake venoms as complex mixtures containing peptides or polypeptides, enzymes, glycoproteins, and other substances capable of producing several or many pharmacologic activities, some of which are deleterious to living organisms.

For the physician it bears repeating that a snake venom should never be considered solely as a neurotoxin, cardiotoxin, myotoxin or any of the other dozens of loosely articulated synonyms, while dismissing the overall biological activities of the whole venom.

It is wisest for the clinician who is faced with a case of snake venom poisoning to consider his patient as having a complex poisoning and to be prepared to institute treatment for cardiovascular dysfunction (including shock), renal failure, hemorrhage, respiratory distress or failure, and tissue destruction, among other things.

(Comments in parentheses are those of Jon E. Soskis)

TREATMENT OF PATIENTS WITH FINGER OR HAND ENVENOMATION BY PIT
VIPERS

Jon E. Soskis

February 1998

Envenomation of the finger or hand is treated more aggressively than most other areas of the body for the following reasons: the venom has less volume in which to immediately distribute, resulting in greater and early local tissue damage; the structure of the hand and fingers is intricate and more subject to incomplete healing after snakebite if treatment is delayed or the dose of antivenin is inadequate; to not have full function of the hand may keep us from adequately performing our chosen occupation.

Progression of circumferential or linear (leading edge) swelling measuring one centimeter per hour is considered to be significant, regardless of where bitten. Without early and adequate treatment swelling and healing can take weeks to get back to a level of maximum improvement. The early use of antivenin in adequate amounts is the mainstay of snakebite treatment. It is therefore important to not wait hours to see how far swelling progresses before beginning antivenin administration, since further and perhaps irreversible tissue destruction would be occurring during that time. Swelling can occur haltingly as the venom dissolves different types and layers of tissue, and can be thought to have stopped, only to become obvious again. One should not wait for multiple episodes of such a pattern to pass before beginning treatment. Early treatment of hand envenomations is particularly important for the reasons mentioned above.

If swelling has localized within thirty minutes to an hour of the bite, and does not progress beyond that point after that time, it may be that no antivenin is necessary. It is very important to remember that it is **LAB VALUES AND SYMPTOMATOLOGY** that guide treatment, and that swelling is only one of many signs that must be considered, and may not even be present at all in a severely envenomated patient. The basic question is: "Can one take the risk of NOT administering antivenin?"

If treatment is or becomes necessary it is more likely than not that the patient will have no serious problems accepting the newer antivenin CroFab if not administered too rapidly. Six vials administered over one to two hours is a reasonable rate in less impressive envenomations, while an attempt should be made to administer antivenin over one hour in the more impressive envenomations.

If a reaction occurs stop the antivenin infusion, administer diphenhydramine and cimetidine intravenously (see pages 11-12), and seek immediate consultation from a poison control

center or known expert on the treatment of the snakebite. If antivenin is to be continued, wait for the reaction to subside, then re-start the administration of antivenin at the test rate initially. Increase the rate of administration at a slower pace than before to no faster than the original rate less about twenty-five percent. Frequently repeated doses of diphenhydramine may be needed. Epinephrine should be reserved for those with respiratory compromise, or for prophylactic use in patients known to be acutely sensitive to antivenin or its components and who have a life threatening envenomation.

The patient who has a hand or finger envenomation and whose life is not yet known to be in danger faces the decision of whether or not to accept early treatment. A clear, unhurried explanation to the patient by someone comfortable with the treatment of snakebite is essential if he or she is to make an informed decision. The basic conversation should include the following:

(a) that the purpose of antivenin administration is to stop the progression of symptoms and signs (b) that the earlier the antivenin is administered the more tissue will be preserved (c) that no one can predict how much damage will occur without treatment since the extent of damage is dependent on the amount of venom injected by the snake and by the tissue's ability to neutralize the venom (d) that without treatment swelling can take weeks to resolve and that healing will likely take weeks to reach the point of maximum improvement (e) that the administering of any medication, including CroFab, can result in life threatening allergic reactions (f) that if indicated one can" wait and see" for a limited amount of time, but with tissue damage being the cost of delayed treatment (g) that "serum sickness" may occur days or several weeks from the time of treatment, and that this is preventable and treatable and not an overriding reason to avoid antivenin administration.

Finally, if possible a consent form should be signed prior to administration of antivenin.