

**UNITED STATES MARINE CORPS**  
**FIELD MEDICAL TRAINING BATTALION**  
Camp Lejeune, NC 28542-0042

FMST 208

**Manage Envenomation Injuries**

**TERMINAL LEARNING OBJECTIVES**

1. Given a casualty in any environment, **treat envenomation injuries** to reduce the risk of further injury or death. (8404-MED-2015)

**ENABLING LEARNING OBJECTIVES**

1. Without the aid of reference, given a description or list, **identify common definitions associated with envenomation injuries**, within 80% accuracy, in accordance with FM 4-25.11 First Aid. (8404-MED-2015a)

2. Without the aid of reference, given a description or list, **identify types of venomous snakes**, within 80% accuracy, in accordance with FM 4-25.11 First Aid. (8404-MED-2015b)

3. Without the aid of reference, given a description or list, **identify the proper treatment of venomous bites**, within 80% accuracy, in accordance with FM 4-25.11 First Aid. (8404-MED-2015c)

4. Without the aid of reference, given a description or list, **identify the management of arthropod envenomation**, within 80% accuracy, in accordance with FM 4-25.11 First Aid. (8404-MED-2015d)

5. Without the aid of reference, given a description or list, **identify the treatment for anaphylactic shock**, within 80% accuracy, in accordance with FM 4-25.11 First Aid. (8404-MED-2015e)

## 1. DEFINITIONS

**Envenomation** - an injury or illness caused by the poisonous secretion of an animal, such as a snake, spider or scorpion, usually transmitted by a bite or sting.

**Hemotoxin** - toxin that destroys red blood cells, disrupts blood clotting, can severely damage internal organs and causes tissue degeneration.

**Neurotoxin** - toxin that damages, destroys or impairs nerve tissue and disrupts the brain function.

**Cytotoxin** - typically attacks only a specific type of cell, muscle group or organ.

## 2. TYPES OF VENOMOUS SNAKES

Snake venom affects the human body in a number of ways, depending on the snake, the type of venom, and how much venom is released. Different snakes produce different types of venom, and even within a snake species, the components of venom appear to vary, depending on geographic location. This is why it is important to be able to identify the snake species involved when one is bitten.

### Crotalinae Subfamily

The Crotalinae, commonly known as Pit Vipers, are a subfamily of venomous vipers found in Asia and the Americas. They are distinguished by the presence of a heat-sensing pit organ located between the eye and the nostril on either side of the head. The pit is a highly sensitive organ capable of picking up the slightest temperature variance.

#### Venom

- Hemotoxic

#### Characteristics (see figure 1)

- Retractable fangs
- Heat sensing pit located below the nostril
- Large triangular shaped head
- Slit-like pupils

#### Examples

- Rattlesnakes (U.S. through Central and South America)
- Saw-Scaled Viper (Pakistan, throughout the Middle East to Africa)
- Water Moccasin (Southern and eastern US)

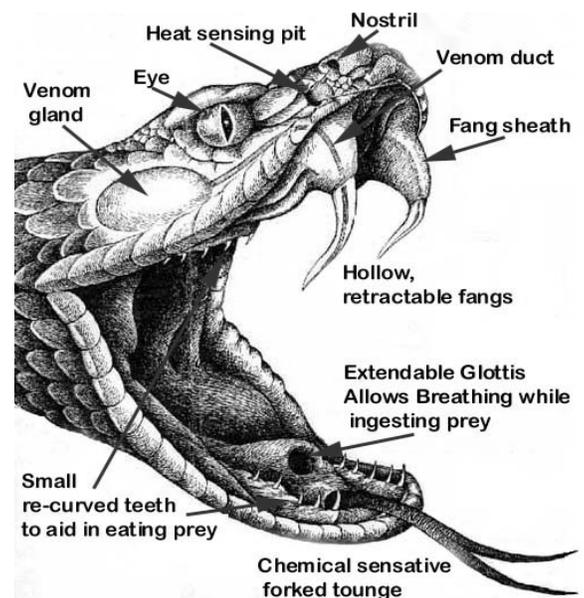


Figure 1. Pit Viper Anatomy

- Copperhead (Eastern U. S.)
- Habu (Southeast Asia, including Okinawa)

### **Signs and Symptoms**

- Symptoms vary depending on the type of snake and the amount of venom deposited
- Excruciating pain at the bite site
- Discoloration and tissue swelling usually begins five to ten minutes after the bite and may continue for up to an hour with enough severity to break the skin
- Destruction of blood cells and other tissue cells, may present as hematuria
- Tingling or numbness
- Headache
- Nausea/vomiting
- Death may occur within 6-48 hours if left untreated. Even with treatment, there is the possibility of loss of affected extremity.

### **Colubrinae Subfamily**

The Colubrinae are a subfamily of the largest family of snakes, which includes about two-thirds of all snakes worldwide. Most are completely harmless to man; the Boomslang is the only one that has caused human deaths.

### **Venom**

- Hemotoxic

### **Characteristics** (see figure 2)

- Fixed fangs in rear of mouth
- Egg-shaped head
- Large eyes



Figure 2. Boomslang

### **Signs and Symptoms**

- Symptoms may not manifest until hours after the bite
- Hemorrhaging to the gums, nose or other orifices
- Headache
- Nausea
- Blood in the stool, urine or saliva
- Death due to internal bleeding

### **Example**

- Boomslang (Sub-Saharan Africa)

### **Elapinae Subfamily**

Members of this family are found in the tropical and subtropical regions of the world and are represented on every continent with the exception of Antarctica.

### **Venom**

- Neurotoxic

### **Characteristics**

- Front, fixed, hollow fangs
- Round pupils
- Head width is proportionate to body size

### **Signs and Symptoms**

- Stiffness, muscle aches, and spasms
- Severe headache, blurred vision, and drowsiness
- Moderate to severe pain to the affected limb
- Nausea, vomiting, and diarrhea
- Chills with rapid onset of fever
- Respiratory paralysis and death

## **Examples**

- Coral Snakes (Southern US, through South America, and parts of Asia) see figure 3.
- Cobra (South Asia through Middle East and North Africa) see figure 4.
- Krait (South Asia, including Pakistan) see figure 5.



Figure 3. Coral Snake



Figure 4. Cobra



Figure 5. Krait

## **Hydrophiinae Subfamily**

Also known as sea snakes, this group of venomous snakes inhabit marine environments (see figure 6). Though they evolved from terrestrial ancestors, most are extensively adapted to a fully aquatic life and are unable to move on land. They are found in warm coastal waters from the Indian Ocean to the Pacific.

### **Venom**

- Neurotoxic

### **Characteristics**

- Fixed fangs
- Flat paddle-like tail
- Most are brightly colored



Figure 6. Sea Snake

### **Signs and Symptoms**

- Bites are usually painless and may not even be noticed when contact is made. Teeth may remain in the wound.
- There is usually little or no swelling.
- The most important symptoms are rhabdomyolysis (rapid breakdown of skeletal muscle tissue) and paralysis. Early symptoms include:
  - Headache
  - Thick-feeling tongue
  - Thirst

- Sweating
- Vomiting
- Symptoms that can occur after 30 minutes to several hours post-bite include:
  - Generalized aching
  - Stiffness and tenderness of muscles all over the body.
  - Paralysis of voluntary muscles. Paralysis of muscles involved in swallowing and respiration can be fatal.
- After 6 to 12 hours the result of muscle breakdown can lead to cardiac arrest.

### 3. **TREATMENT OF A SNAKE BITE**

#### **Diagnosing a Snake Bite**

- Fang Marks may be present as one or more well defined punctures, or as a series of small lacerations or scratches, or there may not be any noticeable or obvious markings where the bite occurred. The absence of fang marks does not exclude the possibility of envenomation, especially if a juvenile snake is involved.
- Rattlesnake envenomation - fang marks are invariably present and are generally seen on close examination. Bleeding may persist from the fang wounds. The presence of fang marks does not always indicate envenomation; rattlesnakes, when striking in defense, will frequently elect not to inject venom with the bite, resulting in a “dry bite.” Younger rattlesnakes tend to dispense all of their venom, as opposed to a larger, older rattlesnake dispensing either none or a small amount.
- Snake venoms are complex chemical mixtures of proteins, which have mostly enzymatic properties. Some snake venom may include elements that produce both a hemotoxic and neurotoxic effect. The quantity, lethality and composition vary with the species and the age of the snake, the geographic location and the time of the year. Venom is highly stable and is resistant to temperature changes, drying, and drugs.

**Manifestations of signs and symptoms of envenomation are necessary to confirm diagnosis of a snake venom poisoning.**

## Treatment

- Most definitive care for envenomation is anti-venom.
- Keep the victim calm and reassured. If possible, allow the limb to rest in a neutral position level with the victim's heart.
- Locate the bite site. If the bite is on the hands or feet, immediately remove any rings, bracelets, watches or any constricting items from the extremity.
- If the bite is on an arm or leg, place a constricting band above and below the bite (see figure 7). If the bite is on the hand or foot, place a single band above the wrist or ankle. The band should be tight enough to stop the flow of blood near the skin, but not tight enough to interfere with circulation.
- Apply a splint and check distal pulses.
- Monitor and TACEVAC.

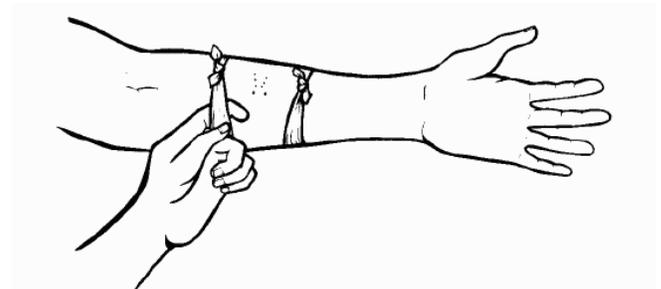


Figure 7 Constricting Band

## Things You Should Not Do:

- **DO NOT** cut or incise the bite site.
- **DO NOT** apply ice or heat to the bite site.
- **DO NOT** apply oral (mouth) suction.
- **DO NOT** remove dressings/elastic wraps.
- **DO NOT** try to kill snake for identification as this may lead to others being bitten.
- **DO NOT** have the victim eat or drink anything.

## Prevention of Snake Bites

- **LEAVE THE SNAKE ALONE!! This is the best way to avoid a snakebite.**
- Most snakes will only bite if threatened. Most snake bites occur when the victim is attempting to catch, kill or play with a snake.
- Keep hands out of areas that you cannot see (i.e. holes, under rocks and under logs).

#### 4. **ARTHROPOD ENVENOMATION**

An arthropod is an invertebrate animal having an exoskeleton, a segmented body and jointed appendages. Arthropods include insects, arachnids and crustaceans. The arthropod body plan consists of repeated segments, each with a pair of appendages. They are so versatile that they have become the most species-rich members of all ecological guilds in most environments. They have over a million described species, making up more than 80% of all described living animal species.

**Common Wasp and Bees** - primary effect is from the strong histamine reaction they cause. Honey bees only sting once and leave the stingers and venom sac embedded in the skin. Wasps, hornets and bumble bees can sting multiple times.

##### **Signs and Symptoms**

- Pain
- Itching/burning sensation
- Wheal (raised, inflamed skin)
- If patient is allergic, monitor for anaphylactic reaction

##### **Treatment**

- Stingers should be removed immediately to prevent more venom from entering the victim. Remove the stinger by scraping across the skin with a knife blade or similar object. Do NOT use tweezers to grasp stinger, this only injects the remaining venom into the victim.
- Apply ice to the affected area
- Apply Hydrocortisone Cream 1% to affected area BID (twice a day)
- Monitor for Anaphalaxis

**Ants** - some species of ants, especially the fire ant, can bite repeatedly (see figure 8). Some also have stingers at the tip of their abdomen.

##### **Signs and Symptoms**

- Pain
- Itching/burning sensation
- Vesicles on skin



Figure 8. Fire Ant Bites

- Multiple bites can produce the following signs and symptoms:
  - Vomiting
  - Diarrhea
  - Generalized edema
  - Hypotension due to vasodilation

### **Treatment**

- Apply ice to the affected area
- Apply Hydrocortisone Cream 1% to affected area BID (twice a day)
- Monitor for anaphylaxis

**Millipedes** - some millipedes secrete a toxin on their skin, other large species can squirt secretions from distances up to 32 inches (see figure 9). They secrete their toxin as a defensive mechanism.



Figure 9. Millipede

### **Signs and Symptoms**

- Dermatitis (itching and burning) that begins with a brown stain on the skin.
- Secretions in the eye can cause immediate pain, lacrimation and blurry vision.

### **Treatment**

- Wash skin with soap and water to remove secretions.
- If toxin is secreted in the eyes, irrigate with water or saline; an ophthalmologic evaluation is mandatory.
- Monitor for anaphylaxis

**Centipedes** - any centipede whose fangs can penetrate human skin can cause local envenomation. Contrary to popular folklore, centipedes **do not** inject venom with their feet or head. Their injury is caused by a bite (see figure 10).



Figure 10. Centipede

### **Signs and Symptoms**

- Burning pain, tenderness
- Erythema (redness)
- Local swelling
- Superficial necrosis and ulceration may sometimes occur

### **Treatment**

- NSAIDS
- Infiltrate area with lidocaine or other anesthetic
- Monitor for anaphylaxis

**Caterpillars** - venomous caterpillars have venom in hollow hairs all over their bodies (see figure 11). Their venom is purely defensive.

### **Signs and Symptoms**

- Dermatitis (severe burning, pain)
- Erythema and edema
- Conjunctivitis
- Necrosis



Figure 11. Caterpillar

### **Treatment**

- Use scotch tape to remove hairs from skin.
- Do not rub area
- Monitor for anaphylaxis

**Black Widow Spider** - glossy black with a red hourglass on the underside of the abdomen. Only the bite of the female is poisonous but all have a red hourglass pattern on the abdomen (see figure 12).



Figure 12. Black Widow Spider

### **Venom**

- Neurotoxic

### **Signs and Symptoms**

- Initial pain is not severe, but severe local pain rapidly develops
- Pain gradually spreads over the entire body and settles in the abdomen and legs

- Weakness
- Sweating
- Excessive salivation
- Rash may occur
- Tremors
- Nausea/vomiting
- Respiratory muscle weakness combined with pain may lead to respiratory arrest
- Anaphylactic reactions can occur but are rare
- Symptoms usually regress after several hours and are usually gone in a few days

### **Treatment**

- Clean site with soap and water
- Intermittent ice for 30 minutes each hour
- Supportive care and antibiotics if needed

**Brown Recluse Spider** - they are small, light brown and have a dark brown violin design on the top of their thorax (see figure 13).

### **Venom**

- Hemotoxic
- Cytotoxic

### **Signs and Symptoms**

- Painless bite. Most often, the victim does not know they have been bitten.
- A painful red area with a cyanotic center appears after a few hours. If prompt treatment is not initiated, and sometimes in spite of, tissue damage can occur. The following represents the aftermath of a Brown Recluse Spider bite (see figure 14).



Figure 13. Brown Recluse Spider

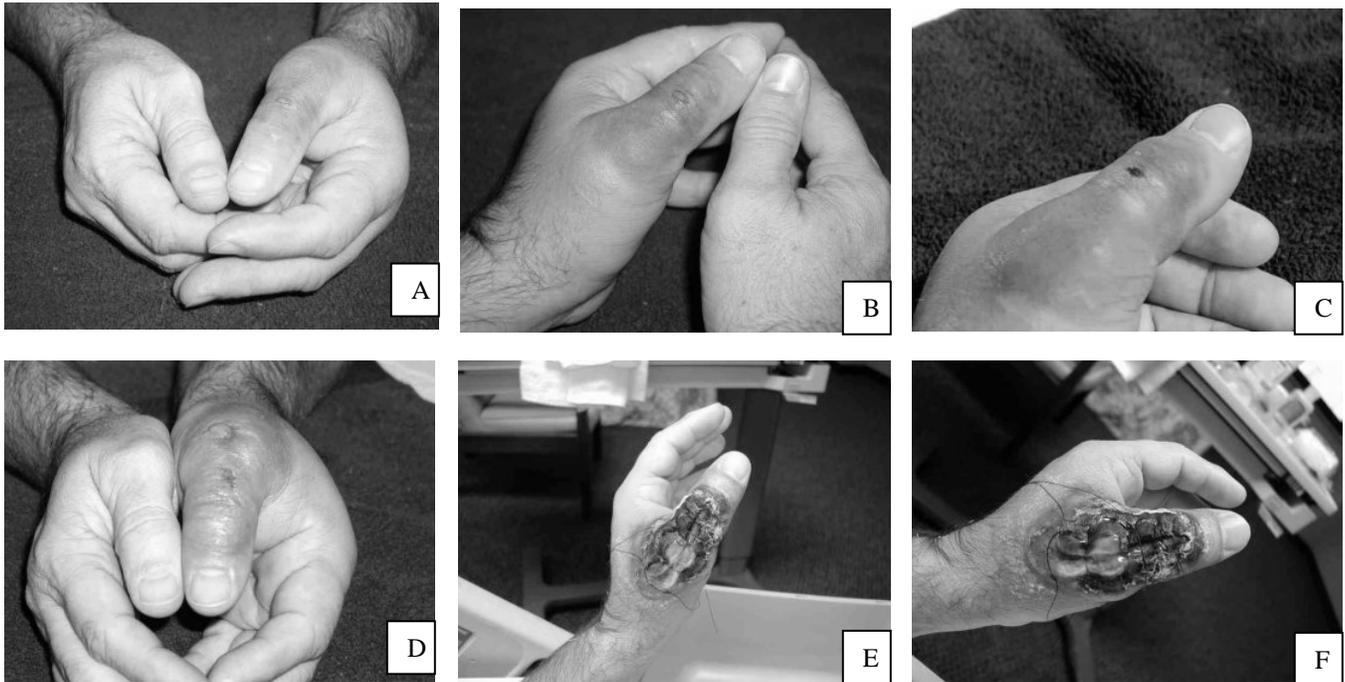


Figure 14. (From top left to right in order). A) Day three after initial spider bite. B) Notice swelling and erythema indicating infection. C) Extreme erythema and underlying tissue damage. D) Day 6, after antibiotic treatment. E) After incision and draining. F) Day 10, the wound looks as bad as it will look. Although it will be months before it is completely healed. Only time will tell if any permanent damage to the skin, muscles, or nerves.

### **Treatment**

- Cold compresses intermittently
- Provide supportive care as necessary
- Refer to Medical Officer as it is necessary to excise all the indurated (hardened) skin and fascia before healing will begin
- Tetanus prophylaxis and antibiotics are necessary to control secondary infection
- Anaphylactic reactions may occur

**Scorpions** - Scorpions are predatory arthropod animals that have eight legs and are easily recognized by the pair of grasping claws and the narrow, segmented tail, often carried in a characteristic forward curve over the back, ending with a venomous stinger. Scorpions range in size from 9 mm to 21 cm and are found widely distributed over all continents.

Scorpions number about 1,752 described species. Scorpion venom has a fearsome reputation and about 25 species are known to have venom capable of killing a human being.



Figure 15. Scorpion

### **Venom**

- Neurotoxic

### **Signs and Symptoms**

- Erythema and edema
- Local pain and/or parasthesia (an abnormal touch sensation such as burning or prickling often in the absence of external stimulus) at site of sting.
- Cranial nerve dysfunction - blurred vision, wandering eye movements, hypersalivation, trouble swallowing, tongue twitching/spasms, problems with upper airway, and slurred speech.
- Somatic skeletal neuromuscular dysfunction - jerking of extremity(ies), restlessness, and severe involuntary shaking that may be mistaken for a seizure.

### **Treatment**

- Based on the level of envenomation
- Ice applied to the site for 30 minutes each hour until symptoms subside
- Oral analgesics
- Monitor for anaphylaxis

### **Prevention of Arthropod Envenomation**

- Leave them alone
- Avoid nesting sites and hives
- Personnel with known allergies should carry an Epi-pen or Ana-kit
- Shake out sleeping bags and clothing and check boots before putting them on.
- Wear shoes
- Many scorpions inhabit brush and debris piles in search of prey. If you come in contact with this type of material, it is wise to wear gloves.
- Remove wood and rubbish piles around camp

- Cracks and recesses in rural desert dwellings should be filled

## 5. ANAPHYLACTIC SHOCK

**Definition** - life threatening reaction to an allergen. This reaction may have a rapid and severe onset. Without immediate emergency medical care, the patient may die.

**Causes** - exposure to an allergen that causes hypersensitivity reaction. Such exposure can be introduced to the body by the following:

- Injections (tetanus antitoxin, penicillin)
- Stings (honeybee, wasp, yellow jacket, hornet)
- Ingestion (medications and foods such as shellfish, chocolate, peanuts, etc.)
- Inhalation (dusts, pollen)
- Absorption (certain chemicals)

### **POINT TO REMEMBER:**

*Anaphylactic Shock is **NOT** just caused by insect stings. It may also be caused by the other reasons!*

### **Signs and Symptoms**

All signs & symptoms get progressively worse:

- Skin (Itching, redness and hives)
- Respiratory depression
- Sense of fullness in the throat, anxiety, chest tightness, shortness of breath and lightheadedness
- Decreased level of consciousness (LOC), respiratory distress and circulatory collapse
- In general, signs and symptoms begin within 60 minutes of exposure to an allergen. One-half of anaphylactic deaths occur within the first hour. **The faster the onset of symptoms, the more severe the reaction.**

### **Treatment**

- Maintain ABC's
- Diphenhydramine Hydrochloride (Benadryl), a single injection of 25-50mg IM, used for skin allergies, urticaria and other mild anaphylactic reactions to allergens.
  
- **Epinephrine Injection** - the **most valuable drug** for the emergency treatment of severe allergic reactions such as asthma attacks characterized by wheezing, dyspnea and inability to breathe. Other symptoms may include bronchoconstriction, sneezing, hoarseness, urticaria, erythema and pruritis.
  - Epi-pen autoinjector delivers a single dose of 0.3 mg epinephrine IM
  - Repeat in five minutes if no improvement
- Fluid Resuscitation
- Documentation of the amount of medications and the times they were given is necessary in order to prevent an overdose of medication.
- TACEVAC

## **REFERENCES**

FM 4-25.11 First Aid

### Envenomation Review

1. Describe the difference between a hemotoxin and a neurotoxin.

2. Identify three characteristics of Pit Vipers.

1)

2)

3)

3. Name four signs or symptoms of an Elapinae bite.

1)

2)

3)

4)

4. What is the most definitive care for a venomous snake bite?

5. Describe the treatment for a bee/wasp sting.

6. List three signs or symptoms of scorpion envenomation.

1)

2)

3)

7. What are the two medications used to treat anaphylaxis? Which is the most valuable for severe reactions?

1)

2)