Contact Hours: 2

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Course Objectives - Upon completion of this course the nurse will be able to:

✓ Recognize the signs and symptoms of snake bites
✓ Understand how a particular type of snake bite is diagnosed
✓ Become knowledgeable in the use of antivenin in treating snake bite victims
✓ Identify proper treatment protocols for victims of snake bites
✓ Understand how to prevent snake bites from occurring
You are standing in your backyard and suddenly you feel intense pain in your ankle. You look down and see a snake slithering away. You start to panic as you realize that you have just been bitten by a snake!

As our cities expand, we continue to encroach upon the surrounding environment forcing animals to leave their natural habitats and attempt to survive in an urban setting.

Despite the fact that snakes “creep most people out”, there is only a one in a fifty million chance of a person dying from a snake bite in the United States. In the U.S., the odds of a person being bitten by a venomous snake are 1 in over 37,000. *An important thing to remember is that venomous doesn’t always mean lethal.*

**POISONOUS VERSUS VENOMOUS**

“Animals that inject venom are called venomous, and not poisonous. The terms are sometimes used synonymously. There are no true poisonous snakes, only venomous snakes. If we eat certain things that are poisonous, we can get sick. Animals that are venomous inject venom, usually through fangs, stingers, or spines (like lionfish, sea urchins, spiders, and snakes). Venom serves as a way to help animals eat, subdue prey, and sometimes as a means of defense. Poison, however, is usually a defensive mechanism that prevents organisms from being eaten. Frogs, toads, salamanders, plants, mushrooms, and poison ivy are all poisonous.”  ([http://infinitespider.com/copper-head-snakes-water-snakes/](http://infinitespider.com/copper-head-snakes-water-snakes/))

**Snake Bites**

Snakebites frequently go unreported. Approximately 8,000 bites are reported in the United States annually, with approximately 2,000 delivered by venomous snakes. North Carolina has the highest frequency, with 19 bites per 100,000 persons. The national average is approximately 4 bites per 100,000 persons. Mortality from snakebites is rare, with no more than 12 cases of death due to venomous snake bites per year reported between the years of 1960 and 1990.

Generally, only localized reporting of international data is available. Most snakebites and deaths due to snakebites are not reported, especially in the developing world. An estimated 1.8-2.5 million venomous snakebites occur worldwide each year, resulting in an estimated 100,000 to 125,000 annual deaths, but this
may be underreported. Worldwide, snakebites disproportionately affect low socioeconomic populations in more rural locations. They are often seen as bites to the lower extremities by farmers or workers who step on or disturb a snake in the field or rice paddies, or they can present as a bite to the head or trunk in individuals sleeping outside on the ground.

**Types of Venomous Snakes**

Most snakebites are harmless and are delivered by nonvenomous species. **North America is home to 25 species of poisonous snakes.** In order to receive prompt and correct treatment of a snake bite, it is important that the patient describe the appearance of the snake as much as possible to the medical staff so if needed, the correct antivenin can be administered.

**Globally, only about 15% of the more than 3000 species of snakes are considered dangerous to humans.** The family Viperidae is the largest family of venomous snakes, and members can be found in Africa, Europe, Asia, and the Americas. The family Elapidae is the next largest family of venomous snakes. In North America, the venomous species are members of the families Elapidae and Viperidae, subfamily Crotalidae. The subfamily Crotalidae **(pit vipers)** includes rattlesnakes, cottonmouths, and copperheads. Elapidae includes the coral snakes.

Cobras, mambas, and kraits are also members of the family Elapidae but are not native to the Americas. However, an increasing number of exotic species are kept by both zoos and private collectors, making bites by nonindigenous species increasingly common.

**Prognosis**

Full recovery is the rule, though local complications from **envenomation** may occur. Death occurs in less than 1 bite in 5000.
**Mortality/Morbidity**

A 20-year review of data from the U.S. National Vital Statistics Systems identified 97 fatalities. The state of Texas had the most fatalities (17), followed by Florida (14), and Georgia (12).

Deaths secondary to snakebites are rare. With the proper use of antivenin, they are becoming rarer still. The national average has been less than 4 deaths per year for the last several years.

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**How to Differentiate Venomous Snakes from Non-Venomous Snakes**

1. Look at the head shape. Non-venomous snakes, with the exception of brown water snakes, have rounded heads, while venomous snakes have triangular heads.

2. There is a small and shiny cap of scales between the eyes, and over the nose of venomous snakes. Nonvenomous snakes have a smooth shiny cap that covers most of their head.

3. Venomous snakes have movable fangs that can retract into their head. Nonvenomous snakes have fixed teeth.

Snake venoms are generally produced in specific venom glands. The venom, once produced, is delivered by a duct to the fang base, where it is transported into the victim either by a groove in the fang, or through a fang duct. Fangs can grow to 20 mm in large rattlesnakes. Contraction of muscles around the gland producing intra-glandular pressure are the usual mode of venom transport, often allowing the snake to “fine-tune” how much venom is expended in a given bite. This may explain, in part, why many venomous snakes exhibit the “dry bite” phenomenon, whereby a bite fails to inject enough venom to cause medically significant envenoming.
**TYPES OF SNAKE VENOM**

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<th>Toxin type</th>
<th>Clinical effects</th>
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<tr>
<td><strong>Neurotoxin</strong></td>
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| Presynaptic Anticholinesterase | Flaccid paralysis  
Resistant to late antivenin therapy  
Often reversal with antivenin therapy  
Fasciculation               |
| **Myotoxin**                | Systemic skeletal muscle damage                                                  |
| **Hemotoxin**               | Interfere with normal hemostasis, causing either bleeding or thrombosis          |
| **Nephrotoxin**             | Direct renal damage                                                             |
| **Cardiotoxin**             | Direct cardiotoxicity                                                           |
| **Necrotoxin**              | Direct tissue injury at the bite site/bitten limb                                |

**SOME OF THE COMMON TYPES OF VENOMOUS SNAKES FOUND IN THE U.S. THAT CAN ACTUALLY CAUSE SIGNIFICANT HARM TO VICTIMS ARE:**

**Coral Snakes** – These are one of the most commonly found snakes in the United States. Often confused with King Snakes without venom, their bite is dangerous. Coral snakes have red bands and yellow bands running all over their skin, with the former and the latter touching one another. Their favorite places to hide include burrows, under dead leaf piles, under rocks, and under bushes.

**Geographic Region:** Wooded, sandy, or marshy areas of the Southeastern United States.

**Venom Type: Neurotoxin.** Coral snakes may leave a small wound that later results in respiratory failure from systemic neuromuscular blockade.

**CORAL SNAKE RHYME FOR IDENTIFICATION:**

- Red touches yellow – Kills a fellow
- Red touches black-Venom lack
- Yellow touches red -Soon you’ll be dead
- Red touches black-Friend of Jack

*While not very scientific, it can help you in the identification of a coral snake. If you don’t remember the rhyme, know this: If the snake has a black nose, it’s a coral snake.*
There is currently no effective anti-venin to treat a Coral Snake bite. Coral Snakes do not have fangs and in order to deliver a venomous bite to their victim, they have to “chew” or make a relatively long bite in order to release their venom. The longer the snake is attached to the bite site, the better the odds that it will inject their venom. It is estimated that 40% of all Coral Snake bites to humans contain little to no venom.

Copper Heads – Copperheads vary in color from reddish to golden tan. The colored bands on their body are typically hourglass-shaped. Most adults are 18–36 inches long. They are not usually aggressive, but will often freeze when frightened. Peoples are more likely to be bitten when they unknowingly step on or near a copperhead. Copperheads are often found in forests, rocky areas, swamps, or near sources of water like rivers.

U.S. Geographic Region: Eastern states, extending as far west as Texas.

Venom Type: Hemotoxin. Copperhead bites generally are limited to local tissue destruction.
Rattlesnakes — There are many species of rattlesnakes in the United States. Rattlesnakes are the largest of the venomous snakes in the United States. They can accurately strike at up to one-third their body length. Rattlesnakes use their rattles or tails as a warning when they feel threatened. Rattlesnakes may be found sunning themselves near logs, boulders, or open areas. These snakes may be found in most work habitats including the mountains, prairies, deserts, and beaches.

**U.S. Geographic Region:** Across the United States.

**Venom Type:** Hemotoxin. Rattlesnakes can leave impressive wounds and cause systemic toxicity.

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**The Eastern Diamondback Rattlesnake** is the largest venomous snake in the Americas. Some have been recorded to be up to 8 feet in length. This snake has a black diamond pattern offset by yellow borders to aid in identification. This snake is very dangerous to humans with a fatality rate of 10-20% caused by their bite.

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**Water Moccasin** — or Cottonmouth snakes average 50–55 inches long. The adult snake’s skin is dark tan, brown, or nearly black, with vague black or dark brown cross bands. Juveniles have a bold cross banded pattern of brown or orange with a yellow tail. Cottonmouths are frequently found in or around water. They do not scare easily and will defend themselves when threatened.

**U.S. Geographic Region:** Wetland areas, rivers, lakes, etc., in the southeastern states.

**Venom Type:** Hemotoxin.
Venomous Snakebite Symptoms

**Rapid clinical assessment and treatment is essential in caring for a venomous snakebite victim.**

*Signs or symptoms associated with a snake bite will vary depending upon the type of snake, and amount on envenomation but may include:*

- A pair of puncture marks at the wound (not for coral snake bites)
- Redness and swelling around the bite
- Severe pain at the site of the bite
- Tachycardia
- Tachypnea
- Hypotension
- Weakness
- Pallor
- Dyspnea (in extreme cases, full respiratory arrest may occur)
- Increased salivation

**First Aid**

- Seek medical attention as soon as possible (dial 911 or call local Emergency Medical Services.)
- Try to remember the color and shape of the snake, which can help with treatment of the snake bite.
- Keep still and calm. This can slow down the spread of venom.
- Apply first aid if you cannot get to the hospital right away.
  - Lay or sit down with the bite below the level of the heart.
  - Wash the bite with soap and water.
  - Cover the bite with a clean, dry dressing.

**Do NOT do any of the following:**

- Do not pick up the snake or try to trap it.
- Do not wait for symptoms to appear if bitten, seek immediate medical attention.
- Do not apply a tourniquet.
- Do not slash the wound with a knife.
- Do not suck out the venom.
- Do not apply ice or immerse the wound in water.
- Do not drink alcohol as a painkiller.
- Do not drink caffeinated beverages.
• Diaphoresis
• Numbness or tingling around the face and/or limbs
• Confusion
• Bleeding from wound
• Severe edema of the affected limb
• Blurred vision
• Burning of the skin
• Convulsions
• Diarrhea
• Vertigo
• Loss of consciousness
• Fever
• Increased thirst
• Loss of muscle coordination
• Nausea and vomiting
• Metallic taste in the mouth (from pit viper bites)
• Tissue necrosis at bite site
• Skin discoloration
• Shock

SYMPTOMS OF CORAL SNAKE ENVENOMATION are different from pit viper envenomation. Initially, the patient may deny pain at the bite site. There may not be any swelling, but there may be localized numbness. There will be any noticeable fang marks. Systemic symptoms can be delayed, often not appearing for up to 18 hours after the bite occurred.

Once symptoms do appear, however, they can be much more serious due to the fact that coral snake venom is a neurotoxin. Neurotoxic effects may include eyelid drooping, dysphagia, diplopia, diaphoresis, and tremors. Other symptoms are fatigue, salivation, weak muscles, dyspnea, euphoria, and respiratory depression. The patient may develop paralysis, respiratory failure, and death.

INITIAL MEDICAL TREATMENT OF SNAKE BITE VICTIMS

• Maintain A B C's
• Intubation if necessary
• Obtain baseline vital signs
• Place patient on a monitor
• If bite is on an extremity, position it below heart level
• Mark, measure and record circumference of affected limb and reassess every 15 minutes
NURSING ALERT!

Poison control should be contacted when envenomation is suspected from any type of snake bite, for treatment advice.

- Do neuro checks every 15 minutes
- Neurovascular checks every 15 minutes if bite is on an extremity
- Start IV of normal saline
- Obtain labs: coagulation profile, CBC, electrolyte panel, creatine kinase, blood typing, platelet count, D-dimer, metabolic panel, liver panel and urinalysis.
- Administer oxygen as needed
- Chest x-ray
- EKG
- Pain meds as needed
- Once envenoming has been confirmed, administer antivenin per protocol
- Wound care to bite site
- Tetanus toxin if patient is not up to date
- Antibiotic therapy
- Admit patient for symptom management and observation
- Obtain surgical evaluation for treatment of bite site. Debridement may be indicated if tissue necrosis is present.

Use of Antivenin

Antivenin for coral snakes is no longer being manufactured.

Victims of bites by the Eastern Coral Snake and the Texas Coral Snake should receive general wound care and supportive care, including respiratory support in the event of respiratory failure, due to the neurotoxicity of the venom. The need for ventilator assistance could be required for many days or weeks following serious bites.

Local ER’s should contact poison control for assistance in locating any remaining doses in their area and to obtain the latest location-specific treatment recommendations.

Research is ongoing to find a suitable new antivenin for the treatment of coral snake bite victims in the United States and Canada, and there is a possibility that coral snake antivenin production will resume in the United States at some point in the future.

Giving antivenin is a serious decision as the antivenin can have significant side effects including causing allergic reactions or even anaphylactic shock. However, antivenin treatment is still the treatment of choice but the physician and patient should be aware of the risks.

Antivenin is most effective if given within 6 hours of envenomation.

Envenomation grading of pit viper bites determines the need for the administration of antivenin.
Grades of envenomation are defined as mild, moderate, or severe.

**Mild envenomation** is characterized by local pain, edema, no signs of systemic toxicity, and normal laboratory values.

**Moderate envenomation** is characterized by severe local pain; edema larger than 12 inches surrounding the wound; and systemic toxicity including nausea, vomiting, and alterations in laboratory values (such as decreased hematocrit or platelet count).

**Severe envenomation** is characterized by generalized petechiae, ecchymosis, blood-tinged sputum, hypotension, hypo perfusion, renal dysfunction, changes in prothrombin time and activated partial thromboplastin time, and other abnormal test results defining consumptive coagulopathy.

If initial signs and symptoms are not severe enough to indicate the administration of antivenin, the patient must still be observed for at least eight hours due to the possibility of delayed onset of symptoms.

*Grading envenomation is a dynamic process. Over several hours, an initially mild syndrome may progress to a moderate or even severe reaction.*

The most common antivenin used for pit viper bites is Crotalidae Polyvalent Immune Fab (CroFab).

**Dosage of CroFab**

- Antivenin dosage requirements are dependent upon each individual patient's response to the therapy. **The recommended initial dose of CroFab is 4 to 6 vials.**
- The patient should be closely monitored for the first hour post infusion in order to ensure that envenomation symptoms have improved (as defined by normal vital signs and lab values).
- If improvement is not achieved by the first dose, an additional dose of 4 to 6 vials should be repeated.
- Additional 2-vial doses of CroFab every 6 hours for up to 18 hours (3 doses) is recommended.
- Optimal dosing following the 18-hour scheduled dose of CroFab has not been determined.
- Additional 2-vial doses may be administered as considered necessary by the physician, based on the patient's clinical condition.
Preparation and Administration

- Each vial of CroFab® should be reconstituted with 18 mL of 0.9% Saline and mixed by continuous manual inversion until no solid material is visible in the vial. Do not shake. The contents of all of the reconstituted vials should be further diluted in 250 mL of 0.9% Sodium Chloride and mixed by gently swirling.
- **The initial dose of CroFab diluted in 250 mL of saline should be infused intravenously over 60 minutes.** However, the infusion should proceed slowly over the first 10 minutes at a 25- 50 mL/hour rate with careful observation for any allergic reaction. If no such reaction occurs, the infusion rate may be increased to the full 250 mL/hour rate until completion.
- The reconstituted and diluted product should be used within 4 hours.

Once the physician decides to order antivenin for the patient, the nurse must closely monitor the patient for anaphylactic reactions as well as serum reactions, or delayed hypersensitivity.

Because of the possibility of complications and the frequency of required nursing assessments, CroFab is only administered in the ER or ICU settings.

The nurse must monitor vital signs every 15 minutes during the CroFab infusion. Vascular and cardiopulmonary assessments should be done every 1-4 hours, depending upon the patient’s condition.

Nursing care during and after antivenin treatment includes continual patient assessment, monitoring for systemic complications, and observing for reactions to the medication.

The most common adverse events reported have been rash, urticaria and pruritus, which are treated with Prednisolone and Benadryl.

Patients with allergies to papain, chymopapain, other papaya extracts or the pineapple enzyme bromelain may also be at risk for an allergic reaction to CroFab.

The circumference of the affected limb should be measured at least every 4 hours in order to assess for the development of **Compartment Syndrome**. Depending on clinical scenarios, measure compartment pressures every 30-120 minutes. Fasciotomy can be considered for pressures greater than 30-40 mm Hg. However, fasciotomy has not been shown to improve outcomes, even when compartment pressures are elevated, and is not routinely indicated for crotalid snake envenomation. Occasionally, skin grafting is required to close a defect from fasciotomy, but wounds requiring fasciotomy to reduce compartment pressures from muscle edema are infrequent.

**Other potential complications that can after a venomous snakebite occurs include:** coagulopathy, DIC, renal failure, rhabdomyolysis, wound infection and necrosis.
Upon discharge, the patient should be instructed to return to the hospital immediately if he or she develops any worsening symptoms, especially trouble breathing, changes in mental status, evidence of bleeding, fever, worsening pain, or worsening swelling at the bite site.

The nurse should also instruct the patient on the signs and symptoms of a delayed hypersensitivity reaction to the antivenin, which can occur up to three weeks after administration. Symptoms include fever, joint pain, rash, or unusual bruising or bleeding.

The patient should be instructed on the importance of informing his/her physician and dentist that they were a victim of a snake bite during the first few weeks after the bite occurred, in case any routine dental procedures or emergency surgery is required. Some snake venoms can cause difficulty in blood-clotting for a week or more after the bite.

Additionally, the patient may need follow-up appointments, especially when debridement or fasciotomy is part of the required wound care.

PREVENTION OF SNAKE BITES

- Refrain from going barefoot in areas that you think snakes might live. Wearing sandals is the same as going barefoot, so make sure you wear boots that are able to cover your feet. Long pants over boots are another important precaution for you to take. Snakes look for skin and the less skin that is shown, the lower the chance of a bite.

- Remove dead logs, heavy vegetation, and other debris from your yard as they provide an ideal place for snakes to hide.

- Make sure you stay away from tall weeds. Snakes typically hide under places that they believe are well hidden. If you are on a hiking trail, try to walk in areas where you can see the ground not covered in underbrush.
Although the vast majority of victims bitten by venomous snakes in the United States do very well, predicting the prognosis in any individual case can be difficult. It is rare for someone to die before they are able to reach medical care in the United States. Serious venom effects can be delayed for hours and a victim who initially appears well could become very sick in a few hours. All victims possibly bitten by a venomous snake should seek medical care without delay. The faster the patient is treated appropriately for a venomous snakebite, the better the prognosis.
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