Non-Snake Reptile Bites

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KEY POINTS

- Alligator and crocodile bites may inflict significant internal injury and should be managed as major trauma.
- Gila monster bites may leave teeth in the wound that are not visible by radiography.
- Patients with a Gila monster bite should be observed for 8 hours after the bite because of the risk for systemic toxicity.
- The Komodo dragon has joined the Gila monster and the beaded lizard as the only known venomous lizards of medical significance; its bites are known to cause hypotension and coagulopathy, in addition to infections.
- Green iguanas and snapping turtles may carry Salmonella.
- Delayed wound closure and prophylactic antibiotics should be considered in all patients with reptile bites.

EPIDEMIOLOGY

Crocodilians account for more human injuries and fatalities worldwide than any other non-snake reptile. Three of the largest species are known for unprovoked attacks on humans: the American alligator (Alligator mississippiensis), the saltwater crocodile (Crocodylus porosus), and the Nile crocodile (Crocodylus niloticus). From 1928 through 2008, 567 reports of adverse encounters with American alligators resulted in 24 deaths in the United States. Most injuries were due to a single bite.1,2 In Australia, 80% of unprovoked attacks by the saltwater crocodile involved people who were either swimming or wading in water. The Nile crocodile of Africa, though smaller and less territorial, probably accounts for more human fatalities than all other 23 species of crocodilians combined.3

Most Gila monster bites are nonaccidental and occur as a result of handling the reptile. Accidental bites have become exceedingly rare. No deaths from Gila monster bites have been reported in the United States in the past 50 years.4,5 The Komodo dragon is now known to have a venom apparatus similar to that of the Gila monster, and deaths have been reported as a result of their bites.

CROCODILIANS

PATHOPHYSIOLOGY

Crocodilians survived the Ice Age and are the dominant predators in many of the world’s tropical waterways. The American alligator may be found in the southeastern United States, from North Carolina to Louisiana. The saltwater crocodile is found in Southeast Asia and Australia, with males reaching lengths of up to 23 feet (7 m). Victims of crocodilian attacks sustain trauma from a combination of penetrating, blunt, and sheer force. The saltwater crocodile can generate 2000 psi when it bites. The sheer magnitude of the jaw muscle force sustained with extensive penetrating injuries devitalizes large areas of tissue, thereby making such injuries slow to heal and susceptible to infection. Bites must be considered to be heavily contaminated with multiple bacteria, including Aeromonas hydrophila, Pseudomonas, and Proteus (Fig. 141.1).

PRESENTING SIGNS AND SYMPTOMS

Crocodilian bites are characterized by punctures and tears. Their teeth are conical and not designed for chewing but for grasping their prey. Among survivors, the extremities were the most commonly injured site, with less than 10% sustaining torso trauma.6,7 Crocodilians may also roll their entire body (known as the “death roll”) to disorient and drown the victim, as well as to tear pieces from the victim’s body.7 The force of the massive jaws may lead to extensive internal injury, but even when bite wounds are not present, the force of the animal’s movement—or even blunt trauma from its tail—may also inflict significant internal trauma. Initial survivors of severe attacks may exhibit hypotension from massive hemorrhage, in addition to respiratory distress from submersion injury.

DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

Victims of crocodilian bites often have injuries comparable with those sustained in a severe motor vehicle collision. Prehospital care should start with movement of the patient to a safe environment well away from water’s edge. The provider should make sure that airway control, breathing, and circulatory support are adequate with use of the advanced trauma life support (ATLS) protocols. External hemorrhage should be controlled with direct pressure or packing, and chest wounds should be dressed to prevent the development of tension physiology. Extremity fractures should be splinted and suspected major pelvic deformities bound or sheeted. Resuscitation in the hospital should continue according to ATLS protocols, including a focused assessment with sonography for trauma.

A secondary evaluation should be done to determine the extent of tendon, neurologic, and vascular injuries and possible internal organ damage. Underlying fractures and dislocations should be considered, particularly in light of the force and shearing mechanism of the animal’s bite. Depending on
the nature and location of the bite, radiographs can aid in evaluation for bony injury. Computed tomography may be useful to evaluate for internal injury.

**PRIORITY ACTIONS**

**Reptile Bite Wounds**
- Treat all victims of crocodilian bites as major trauma patients with the potential for massive internal injuries.
- Extremity bites should be evaluated for underlying vascular, tendon, nerve, or bone injury.
- Copiously irrigate and débride all wounds, especially crocodilian and Komodo dragon bites.
- Facial wounds and others with significant cosmetic concern should be closed if the patient is seen early after the bite and does not show signs of infection.
- Ensure tetanus prophylaxis.
- Consider a 5-day course of prophylactic antibiotics with close outpatient follow-up to monitor for signs of infection.

**TREATMENT**

Specialists should be consulted to evaluate and treat internal injuries, nerve and tendon damage, fractures, and major lacerations. Local wound care techniques are mandated to cleanse what are typically very contaminated wounds. Because of the high incidence of infection, all significant wounds need exploration, preferably in the operating room, where débridement of devitalized tissue and thorough decontamination can be accomplished. Prophylactic broad-spectrum antibiotic therapy may be necessary to prevent wound infection. The patient’s tetanus status should be checked and brought up to date.

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Disposition is based on the extent of the injuries, but admission should be considered for all patients except those with minor cutaneous extremity trauma. If the patient is discharged, close follow-up is advisable for wound care and to evaluate for wound infection. Prolonged rehabilitation is frequently needed because of the extent of injuries. The public should be advised to contact local wildlife managers about crocodilian activity before recreating in crocodilian-inhabited environments. Care should be taken when swimming, wading in, or approaching water. If attacked, the best defense appears to be to “fight back” by gouging the crocodile’s eyes with thumbs and fingers. If a hand or arm is within the reptile’s mouth, reaching caudally may displace the palatal valve, causing the crocodile to aspirate water and open its mouth.

**GILA MONSTER AND BEADED LIZARD**

**PATHOPHYSIOLOGY**

The Gila monster (*Heloderma suspectum*) and the closely related beaded lizard (*Heloderma horridum*) are native to the southwestern United States and Mexico but may be found throughout the world in zoos and as illegal pets. They are characterized by black beadlike scales mixed with bandlike patterns of yellow, white, or pink scales (Fig. 141.2). These reptiles typically range in length from 9 to 32 inches (22 to 81 cm); the beaded lizard is the larger of the two species.

Unlike pit vipers, which inject their venom through fangs, *Heloderma* species have a very rudimentary venom delivery mechanism. The animal has individual vertical grooves in its lancet-shaped teeth to deliver venom by capillary-type action from anterior mandibular venom glands. The lizards tend to stay attached to their victims by using mastication to augment the delivery of venom. Their venom is similar in some respects to rattlesnake venom and can stimulate the release of vasoactive kinin, which leads to hypotension.

**PRESENTING SIGNS AND SYMPTOMS**

Patients may arrive at the emergency department (ED) with the lizard still attached. Bite wounds are classically indurated
and erythematous. Significant edema may develop at the site of the wound. Patients often describe excruciating pain associated with the bites. In envenomated patients, weakness, hypotension, and tachycardia are commonly seen as a result of systemic effects of the reptile’s venom.\textsuperscript{45}

### Differential Diagnosis and Medical Decision Making

In addition to local pain and swelling, laboratory evaluation assists in determining the severity of envenomation. The most common reported laboratory abnormality in Gila monster bite envenomations is leukocytosis, although coagulopathy has also been reported. Minimum laboratory work-up should include a complete blood count with platelets, basic metabolic panel, and coagulation panel. An electrocardiogram and cardiac enzymes should be considered, especially in symptomatic patients with cardiac risk factors.

Radiographs may be obtained to rule out associated fractures. However, retained teeth do not show up radiographically, and local wound exploration should be performed to rule out this possibility.

### TIPS AND TRICKS

**Animal Removal**

Apply a flame under the animal’s mandible.

Immerse the animal in cold water.

Use a large Kelly clamp or handheld cast spreader to manually disengage the animal’s mouth from the victim.

Place a thin rod across the animal’s mouth between the bite site and the jaw and push back on the jaw.

Avoid pulling the animal off, if possible; this may cause further tissue damage and detach teeth into the wound.

### Treatment

If still attached, the lizard must be removed from the patient. Increased time of mastication can increase the severity of envenomation. A flame placed under the animal’s jaw will usually result in release within 3 to 5 seconds and decreases the possibility of leaving teeth in the wound. Other techniques, such as immersion in cold water, may also be used. Special care should always be taken to prevent reattachment of the animal to the victim or subsequent attachment to the person removing the reptile.

Envenomation may cause hypotension, tachycardia, and generalized weakness. These symptoms generally respond well to intravenous crystalloid administration. Refractory hypotension may require treatment with vasopressors such as dopamine. No antivenom is commercially available for Gila monster or beaded lizard envenomation.\textsuperscript{45,6}

The most important aspect of evaluation of the wound is physical examination for evidence of vascular or tendon injury and local wound exploration for retained teeth from the animal. The pain typically requires large amounts of opiate analgesics; the few patients who have experienced both rattlesnake and Gila monster bites report much greater pain associated with a Gila monster bite. The pain generally peaks between 15 and 45 minutes following the bite and may last for days.\textsuperscript{4,7}

Although the use of prophylactic antibiotics for animal bites remains somewhat controversial, patients may benefit from treatment with broad-spectrum antibiotics, such as amoxicillin-clavulanate (Augmentin) for 3 to 5 days, with specific instructions to watch for signs of infection. Delayed or loose wound closure should be considered to prevent early infection, and the patient should be instructed about local wound care techniques.

### Follow-up, Next Steps in Care, and Patient Education

All symptomatic and potentially envenomated patients should be admitted for monitoring, supportive care, and pain management. Patients who remain asymptomatic and have normal laboratory values may be discharged after a period of 8 hours of observation. Tetanus prophylaxis is necessary if the patient’s immunization status is not up to date. All patients should be reevaluated in 24 to 48 hours for evidence of the development of infection.

### Komodo Dragon

Native to the islands of Indonesia, the Komodo dragon (Varanus komodoensis) is the largest lizard in the world; it can reach lengths greater than 10 feet (3 m) and weigh as much as 300 lb (136 kg) (Fig. 141.3). These lizards can move as fast as 13 mph (20 km/hr) over short distances and take down prey as large as water buffalo. Komodo dragons’ teeth are sharklike, with posterior serrations that create deep open wounds to facilitate envenomation. Its venom is known to cause coagulopathy, increased vascular permeability, and vasodilation.\textsuperscript{8} Victims bleed profusely from large wounds. Hypotension and shock develop rapidly and lead to death. If the initial attack does not kill the victim, infections from multiple pathogenic bacteria in the Komodo’s saliva can lead to sepsis and death.\textsuperscript{9}
Most evaluations of Komodo dragon bites in the United States would expectedly come from exposure at zoos or zoologic parks. These bites typically occur on the extremities and produce puncture wounds and lacerations of the skin, along with the potential for local tendon, bone, and neurovascular damage. Bleeding from the wounds may be significant because of envenomation and subsequent coagulopathy. Patients who delay medical evaluation of their wounds will most likely show signs of local and/or systemic bacterial infection. Komodo dragon attacks in the wild may result in multiple large lacerations and areas of tissue loss, not unlike victims of shark attacks. The combination of extensive tissue loss and venom toxicity can lead to hypotension, exsanguination, and sudden death.8

FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION

Survivors of significant Komodo dragon attacks should be admitted to an intensive care unit. Victims of domestic attacks have required admission and specialty care as a result of underlying tendon and neurovascular injury from extremity wounds. As with all bite wounds, delayed closure of the wound may be required.

Outpatient treatment of simple lacerations or puncture wounds includes tetanus prophylaxis, broad-spectrum antibiotics, and close follow-up to monitor for signs of wound infection. Hospitalization for intravenous antibiotics should be considered because of the high risk for significant infection in these wounds.

GREEN IGUANA

PATHOPHYSIOLOGY

The green iguana (Iguana iguana) is native to Central and South America. It is the most common lizard sold as a pet in the United States (Fig. 141.4). Feral iguana populations can now be found in Florida, Hawaii, and southern Texas. Iguanas are usually docile but can cause injuries with their teeth, claws, and tail. They can also be a source of Salmonella infection.10 No specific venom is associated with iguana bites.
Snapping turtles will bite out of self-defense when cornered or cut off from their aquatic environment. Most bites tend to occur when victims put their fingers near the turtle’s head. These turtles may be as long as 20 inches (50 cm) and have a long neck that may extend up to two thirds the length of their body. These freshwater turtles live in habitats ranging from southeastern Canada to Mexico and Ecuador.

**PRESENTING SIGNS AND SYMPTOMS**

As with any bite, the physician should look for underlying tendon and neurovascular injury. Associated bone damage is rare with iguana bites. 11

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

When performing the physical examination, the physician should be aware of the potential for damage to nerve, tendon, vascular, and bony structures because of the force of a snapping turtle’s bite. Edema may be present and bleeding should be controlled with local wound pressure. Plain radiography may be helpful to evaluate for injury to bones.

**SNAPPING TURTLE**

Both the common and the alligator snapping turtles have powerful beaklike jaws without teeth but with sharp occlusal surfaces adapted for cutting and holding prey. They are not aggressive but curious about activity occurring around them.

**PATHOPHYSIOLOGY**

Extensive diagnostic testing is not generally necessary in cases of iguana bites. Blood and local wound cultures may be useful for patients with established wound infections and systemic signs and symptoms. During physical examination the physician should look for underlying tendon and neurovascular injury. Associated bone damage is rare with iguana bites. 11

**TREATMENT**

As with any animal bite wounds, delayed closure should be considered and any underlying neurovascular or tendon injuries treated as appropriate. Prophylactic antibiotics remain somewhat controversial, but a 3- to 5-day course of ciprofloxacin should be considered in light of the Salmonella typically carried by the green iguana. In patients with wound infections, treatment with intravenous ceftriaxone may be beneficial. Tetanus prophylaxis is important.

All patients should be educated on the signs of infection and the need for elevation of any injured extremity. Reevaluation of the patient should be scheduled for 24 to 48 hours after discharge.

**FACTS AND FORMULAS**

**Antibiotic Therapy**

- Crocodilian—multiple pathogens: Broad-spectrum coverage, such as with amoxicillin-clavulanate (Augmentin)
- Gila monster—multiple pathogens: Broad-spectrum antibiotic coverage, such as with amoxicillin-clavulanate (Augmentin)
- Komodo dragon—multiple pathogens, including Escherichia coli and Staphylococcus spp.: Consider hospitalization for intravenous broad-spectrum antibiotics, such as ampicillin-sulbactam (Unasyn), because of the high risk for infection
- Green iguana—may carry Salmonella spp.: Salmonella coverage, such as with ciprofloxacin
- Snapping turtle—may carry Salmonella spp.: Salmonella coverage, such as with ciprofloxacin

**SUGGESTED READINGS**


**REFERENCES**

References can be found on Expert Consult @ www.expertconsult.com.
REFERENCES