REVIEW ARTICLE

Recreational and Commercial Catfishing Injuries: A Review of the Literature

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Catfish injuries are increasingly common from the recreational activities of hobbyists, fishermen, and “noodling” enthusiasts as well as in the commercial catfish industry, most commonly in Brazil. Injuries can range from mild skin abrasions to life-threatening infections and tissue damage requiring urgent treatment. Most injuries and subsequent morbidity associated with catfish encounters involve the dorsal and pectoral fins. These injuries are most often lacerations involving the upper extremities. Deep, penetrating catfish spine injuries can lead to serious injuries, including arterial and nerve lacerations. Catfish venom is released when a spine is torn. The venom may cause reactions that include erythema, edema, local hemorrhage, tissue necrosis, and muscle contractions. When “finned” by a catfish, the fish’s spine may separate from the fish, which can cause a foreign body embedment. Some injuries are not thought to be severe enough at the time of injury to require medical care, although symptoms may arise years later. In this literature review of catfishing injuries, references were obtained through a PubMed search of the following terms: catfish injuries, fishing, envenomation, spine, and aquatic infection. Articles were chosen for citation based on pertinence to the topic of catfishing.

Keywords: catfish, fish spine, envenomation, aquatic infection

Introduction

Over 1000 species of catfish exist in the world at the present time. They are found in all types of bodies of water and on every continent except Antarctica. Catfish have been farmed as food for centuries in Africa, Asia, Europe, and more recently in South and North America.¹ Injuries from catfish are increasingly common both in the commercial catfish industry and in recreational activities. Injuries can range from mild skin abrasions to life-threatening infections with tissue damage requiring urgent treatment. Despite this, the literature comprises only small case series with no consensus on a standardized treatment algorithm. We recently reported a case of catfish-related injury in a teenager “noodling” for a catfish,² and now report a more extensive review of catfish-related injuries in North and South America.

Injuries

Catfish species (class: Osteichthyes; subclass: Siluroidea) can live in both freshwater and saltwater; some prefer inhabiting caves or living underground.^{1,3} Catfish have the unique feature of long whiskerlike barbels located on their mouth that, contrary to common belief, provide sensory function and are harmless.⁴ Virtually all catfish have spines on their dorsal and pectoral fins; these fins can become erect and swordlike when a fish feels threatened (Figures 1 and 2). Most injuries and subsequent morbidity associated with catfish encounters involve these dorsal and pectoral fins. Injuries from these spines can vary in their characteristics and severity depending on the specific catfish species. Examples of injuries include puncture wounds, lacerations, and even envenomation. Unusual injuries do occur. Very small catfish from the Amazon (Candiru) are known to be attracted to urine. They can enter and lodge in the human urethra, resulting in significant discomfort and necessitating surgical removal.⁵ The most commonly reported injuries are to the hands.^{6–11} Lacerations to the proximal upper extremities and lower extremities are less common.^{11–14}

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Figure 1. Catfish anatomy.

Noodling, a type of fishing that involves only the fisherman's hands, started as a folk tradition in the southern states.¹⁵ Other names for this practice include hand fishing, cat fisting, grabbling, graveling, hogging, cat-daddling, dogging, gurgling, tickling, and stumping. Noodling is legal in the following states: Alabama, Arkansas, Georgia, Illinois, Kentucky, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Wisconsin. In states where it is illegal, one may be fined up to \$1000 and be sentenced to one year in jail if caught.¹⁶ During spawning season, early May through late July, catfish lay eggs in a protected area, and the male fish stays to fan the eggs. These areas are often blind underwater enclosures such as holes, hollow logs, or rocky crevices.⁸ When noodling, the fisherman extends a hand into a crevice and grabs hold of the fish through its mouth. When the catfish bites the noodler's hand, he or she then can bring it to the surface. Catfish spin and thrash as a natural reaction to being trapped and, depending on the size of the catfish, can exert a fair amount of blunt force trauma.¹ Flathead catfish have villiform teeth on their upper and lower jaws and also erect their dorsal and pectoral spines, leading to multiple injuries (Figures 3 and 4).

In 2001, *Okie Noodling*, a documentary about a catfish noodling championship in Oklahoma, was released. A television series (*Hillbilly Handfishin'*) later aired on Animal Planet from August 2011 to August 2012. Multiple companies that offer professional noodling experiences exist in southern states like Alabama,

Oklahoma, and Kentucky. Websites too numerous to count offer stories and advice on hand fishing, and YouTube offers thousands of videos of people of all age groups practicing the ancient art of noodling. As with all activities involving the potential for personal harm, caution must be exercised to avoid injuries when noodling. Multiple case reports have been published of injuries that occurred while fishing for catfish. These reports have analyzed the commonality, cause, and location of injuries in addition to the socioeconomic consequences of injuries.^{2,4,6,8-14,17-22}

The increase in commercial catfish farms has resulted in another source of catfish injuries, which occur when manually removing catfish from the nets used for harvesting. Studies show that injuries seen in professional fishermen are common in Brazil.^{12,23,24} Proper handling of smaller catfish involves grabbing the fish behind the pectoral fins, keeping the dorsal spine covered with the palm of the hand, and grabbing the gill plate in larger catfish.⁸ A study of professional fishermen injured by *Pseudoplatystoma*, a South American genus of catfish, in 2 towns in the Pantanal region of Brazil, determined that the most common cause of injury was carelessness or negligence of fishermen handling the fish. Unnecessary lower extremity exposure from not wearing protective boots also led to injuries.⁶ A study from Brazil showed that, of professional fisherman injured by a catfish, over half of injuries were recurrent in nature. As much as 40% of fisherman missed time from work after an injury, ranging up to 1 week of absence.⁶ In the cases reported, pain, erythema, and edema are the most common reasons patients seek medical care.^{4,8-11,13,14,17-22,24}

Deep, penetrating catfish spine injuries can lead to serious neurovascular injuries. A case report has described a radial artery laceration.¹⁹ When an arterial injury occurs, it is important to apply direct pressure or a tourniquet above the injury to minimize blood loss. At presentation to an emergency department, broad-spectrum antibiotics should be started to cover both gram-positive and gram-negative bacteria.^{10,19} The injury should be formally irrigated and debrided in the operating room by either a vascular surgeon or plastic surgeon adept at vascular repair. Serial washouts and debridements may be necessary to achieve a culture-negative wound and to fully define the complete zone of injury. Close observation with serial examinations of the extremity postoperatively is necessary to ensure the integrity of the vascular repair and viability of the distal extremity. In the case of a radial or ulnar artery laceration, the relative contributions of the radial and ulnar arteries to the superficial and deep palmar arches can be variable. Understanding the patient's specific anatomy and arterial contributions to hand perfusion is important.

Figure 2. Channel catfish.

Figure 3. Channel catfish pectoral spine.

Additionally, there has been a report of an ulnar nerve transection at the wrist in a 12-year-old boy while releasing a previously caught catfish.²¹ He reported no initial neurologic deficits, although on presentation 1 month later, he was found to have clinical signs of distal ulnar neuropathy. He developed loss of sensation in the ring and small finger and hand intrinsic motor weakness, atrophy, and minimal pinch strength in the hand. Surgical exploration revealed the transected nerve. The zone of injury was also found on microscopic analysis to be grossly avascular and fibrotic, likely a response to the catfish toxins. The injured nerve segment was resected, and a lateral antebrachial cutaneous graft was successfully used to repair the nerve.

Envenomation

In venomous species of catfish, venom is released when the integumentary sheath surrounding the spine is torn (Figure 2). North American catfish implicated in venomous injuries include those from the Aridae family in marine habitats and Ictaluridae family in freshwater habitats. Species of venomous North American catfish include the brown bullhead (*Ictalurus nebulosus*), Carolina mad tom (*Noturus furiosus*), channel catfish (*Ictalurus punctatus*), blue catfish (*Ictalurus furcatus*), and white catfish (*Ictalurus catus*).²⁵ South American catfish implicated in venomous injuries include the Doradidae and Pimelodidae families; both inhabit freshwater habitats in the Amazon.¹⁷ The venomous glands are located within the integument that encloses the dorsal and pectoral spines; this delicate membrane is torn as the spine enters the skin, releasing the venom through the puncture wound.²⁶ The barb of the spine can be serrated, making removal difficult and often requiring surgical removal (Figure 4).^{4,22,27}

The purpose of these envenomations is self-defense rather than food gathering.⁴ The specific characteristics of venom vary among species and can include hemolytic, dermonecrotic, inflammatory, and vasoconstrictive toxins.^{9,27–29} A second source of toxin, crinotoxin, is

Figure 4. Pectoral spine of Ictaluridae.

released by the epidermal cells of catfish skin, often upon agitating the fish.^{30,31} Once they enter a wound, both catfish venom and crinotoxin are known to cause mainly local reactions that include pain, erythema, edema, local hemorrhage, tissue necrosis, and muscle contractions.^{17,28,29,32,33} Hot water is considered an effective first aid mechanism, likely because these toxins are heat labile and therefore heat sensitive. Denaturation of the toxins from heat results in pain relief.^{18,34–36} Toxins of catfish (eg, *Plotosus lineatus*) also can cause neurological symptoms. In one case report, a tropical fish store worker was finned on the hand by a coral catfish, resulting in prolonged pain, numbness, and tingling. The puncture wound was on the distal phalanx of the third digit of his right hand, and the numbness and paresthesia spread proximally to his elbow.³⁷ Despite the neurological symptoms seen as a result of this injury, the cause was catfish toxin and not an electrical shock. Unlike the Egyptian catfish *Malapterurus*, no American catfish are capable of delivering electrical shocks.¹

In the case of injuries suspicious for necrotizing fasciitis, venomous toxins are the likely cause of the tissue necrosis when the culture results are negative.¹⁸ However, we recommend continuing empiric antibiotic coverage regardless of an initial negative culture result

because the long-term morbidity of an untreated bacterial infection can be substantial.

A deep puncture wound also has the potential to cause a lethal injury. A case has been reported of a myocardial perforation caused by a catfish spine in a Brazilian fisherman, resulting in death. Witnesses reported that the fisherman was removing a net containing catfish from the water and pressed it against his thorax. He complained of chest discomfort then became submerged under water. The patient died within minutes after removal from the water. On autopsy, a perforation in the heart's left ventricle and significant intrathoracic hemorrhage was noted.³⁸

Embedment of spines

When finned by a catfish, the fish's spine may separate from the fish. This can cause a foreign body embedment to the fisherman's extremity. Embedment most often occurs in the hand^{4,17,22}; not all foreign bodies are identified or removed on presentation. In one case, 2 catfish spines were not found until 13 months after presentation.⁴ Immediate treatment after being finned was limited to a 10-day course of cephalexin. In addition to dorsal hand pain, in the following months a mass developed on the dorsum of the hand between the long and ring finger metacarpals and spontaneously ruptured. At 13 months postinjury, the patient returned to the emergency department with recurrent hand pain. Imaging showed the 2 spines located between the long and ring finger metacarpals. Surgery at this time successfully removed only 1 of the spines. The patient's symptoms never completely resolved, and a subsequent surgery at 15 months postinjury was required to successfully remove the second spine.⁴

Some injuries are not thought to be severe enough at the time of injury to require medical care, although symptoms may arise over time.^{22,34,39} There is a report of an incidental finding of a bone cyst during a bunionectomy that required 11 months of casting, physical therapy, and electrical bone stimulation to completely heal.³⁴ The patient could not recall any traumatic injuries but did note that she had experienced a catfish spine puncture 25 years earlier in the affected foot. There was also a report of a man who experienced index finger stiffness he attributed to sustaining a catfish injury 10 years previously. The symptoms did not improve with steroids and physical therapy. Further investigation found a catfish spine embedded near the proximal phalanx, requiring surgical removal from the finning injury sustained a decade earlier.²² Another case report describes a patient who found a foreign body extruding from his right foot and successfully removed it with tweezers at home. While

fishing, the spine from the pectoral fin of a catfish had penetrated his shoe and foot and remained in the soft tissue around the first metatarsophalangeal joint for 3 months without his knowledge.³⁹

Infections

Health care providers must recognize that infections are a serious complication of catfish-related injuries. In general, freshwater catfish are found in slow-moving and frequently dirty waters, which increases the risk of infection upon puncturing the skin.⁴ In some cases, proper treatment is delayed and symptoms persist for years.^{8,10,11,13,14,20,40–42} Misdiagnosing tenosynovitis as a local tissue reaction has been reported as leading to an unrecognized indolent infection. Multiple case reports have been written on severe infections after injuries due to catfish, some resulting in lifelong morbidity. Treatment of any suspected infection begins with copious irrigation and debridement of necrotic tissue, both emergent and delayed, as well as prolonged antibiotic treatment. In rare cases, amputation is required for local control of the infection.^{8,11}

Secondary infections seen after a catfish injury are most commonly polymicrobial with the majority involving gram-negative bacteria.^{8,10,11,13,20,42} The Table^{8,11,13,14,20,40,42–48} provides a list of bacteria documented in case reports of infections after a catfish-related injury.

In case reports of catfish injuries, the most common gram-negative bacteria causing secondary infection was *Edwardsiella tarda*. *E. tarda* is a gram-negative bacillus most often pathogenic in aquatic environments. The most common extraintestinal complications include wound and soft tissue infections, which may be severe and even life threatening.^{49,50} *E. tarda* is susceptible to nearly all antibiotics commonly used to treat gram-negative infections, including beta-lactam antibiotics, such as cephalosporins, aminoglycosides, and fluoroquinolones.⁵¹ However, despite multiple antimicrobial regimens, mortality has been reported in up to 44% of cases of bacteremia with *E. tarda*.⁵²

The gram-negative strains seen in infection are most likely acquired through the water rather than from the fish itself. However, a study investigating the prevalence of *Vibrio* species on catfish in Galveston Bay, Texas, reported that *V. vulnificus* was detected on 39.0% to 63.2% of fish, and *V. parahaemolyticus* was detected on 84.2% to 95.8% of fish.⁵³ There is a report of a patient who had a polymicrobial secondary infection that included *V. parahaemolyticus*; the catfish was suspected of being the *Vibrio* source.

Necrotizing fasciitis can occur secondary to the initial laceration.¹⁰ Typically, pain, swelling, and fever are the

Table. Bacterial species reported in catfish injuries

Gram negative	Gram positive	Fungus	Atypical mycobacteria
<i>Aeromonas hydrophila</i> ^{8,20}	<i>Enterococcus faecalis</i> ¹³	<i>Sporothrix schenckii</i> ⁴⁸	<i>Mycobacterium marinum</i> ^{4,42}
<i>Citrobacter freundii</i> ²⁰	<i>Micrococcus (corynebacterium)</i> ⁴³		<i>Mycobacterium terrae</i> ⁴⁰
<i>Edwardsiella tarda</i> ^{8,11,20,44,45}	<i>Staphylococcus aureus</i> ^{11,47}		
<i>Enterobacter cloacae</i> ¹¹	<i>Staphylococcus epidermidis</i> ^{11,14,43}		
<i>Escherichia coli</i> ⁸	<i>Streptococcus</i> (unspecified) ⁴³		
<i>Fusobacterium mortiferum</i> ²⁰			
<i>Klebsiella pneumoniae</i> ⁸			
<i>Morganella morganii</i> ^{11,13}			
<i>Proteus vulgaris</i> ⁴⁶			
<i>Providencia rettgeri</i> ¹³			
<i>Vibrio alginolyticus</i> ¹³			
<i>Vibrio cholera</i> ⁸			
<i>Vibrio parahaemolyticus</i> ¹³			

first symptoms seen in necrotizing fasciitis, symptoms all common in patients seeking medical care for catfish injuries. Necrotizing fasciitis is known to have an unfortunately high mortality rate. In a study looking at 8 years' worth of cases of necrotizing fasciitis, approximately 21% of cases resulted in death.⁵⁴ There is a published case of a male patient who survived necrotizing fasciitis after sustaining a puncture wound while disposing of a dead catfish. Treatment included antibiotics, serial irrigations, and debridements as well as a wound vacuum-assisted closure device.¹⁰

Necrotizing fasciitis can be classified into 4 types. Type 1 is described as a polymicrobial/synergistic mixture of anaerobic, aerobic, and facultative anaerobic bacteria. Type 2 is typically monomicrobial and due to gram-positive bacteria, frequently Group A *streptococcus* but sometimes *Staphylococcus aureus*. Type 3 is gram-negative monomicrobial infection, including marine-related organisms. Lastly, type 4 is fungal and quite rare.^{55,56} Group A *streptococcus* and *S aureus* are the predominant pathogens that cause necrotizing fasciitis in the United States and Europe.⁵⁶ Although not all infections from catfish injuries result in necrotizing fasciitis, the infections seen are predominantly polymicrobial in nature. Patients presenting with suspected necrotizing fasciitis should be admitted to the hospital. Immediate surgical consultation for aggressive tissue debridement is important. Serial surgical debridements often are necessary, in conjunction with intravenous antibiotic administration.

The bacteria involved may vary based on the habitat of the catfish. Understanding the typical bacteria found in different habitats will guide proper antibiotic selection. Antibiotics must include coverage for *Aeromonas* species in freshwater and *Vibrio* species in saltwater.^{4,10,13,57,58} All injuries that puncture the skin barrier require antibiotics to

treat *Staphylococcus* and *Streptococcus* infections because those species are implicated in severe infections such as necrotizing fasciitis.¹⁰ *Staphylococcus epidermidis* is one of the most frequently cultured members of the normal skin bacterial microbiome.⁵⁹ Although shown to have potentially beneficial functions for skin health, it is also a possible pathogen, as seen in documented infections related to catfish injuries.^{11,14,43}

There are no official guidelines regarding which antibiotics should be used in the case of a penetrating injury, and varying regimens are seen in case reports of secondary catfish infection. Length of antibiotic treatment varies from 7 days to months and is determined on an individual patient basis. Antibiotic route of administration is also variable and can be intravenous, oral, and intramuscular.^{4,8,10,11,13,14,20,42}

Conclusion

Fishing for and harvesting of catfish are common activities around the world for leisure and vocation, respectively. Although rare, injuries do occur, and some have significant acute and long-term morbidity. Injuries seen most commonly result from the catfish spine and are typically lacerations. The extent of these injuries can easily be underestimated, and it is important to be vigilant whenever a catfish is the suspected cause of injury. Typically, pain management, local wound care, and immediate antibiotic administration are needed. In some cases, more aggressive surgical management may be indicated.

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