Marine Food-Borne Poisoning, Envenomation, and Traumatic Injuries

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stinging organisms in the ocean cause significant morbidity. Less common but more dramatic, attacks by sharks and other large marine organisms cause deaths every year. Thus, it is important for physicians to be aware of the hazards posed by marine organisms and be familiar with appropriate treatment options.

EPIDEMIOLOGY

Poisoning from the ingestion of marine animals such as shellfish and fish constitutes a small but consistent source of food poisoning outbreaks and illnesses. Although mortality is low, morbidity can be significant, with many patients needing to seek medical care. Tetrodotoxin poisoning is an exception, and significant mortality has been reported.

Even though the vast majority of marine sea life is harmless to humans, a small but important percentage does cause human envenomation with resulting morbidity and mortality. It is difficult to quantify the annual number of marine envenomations because most victims will not seek medical care and reporting cases to health departments or poison centers is not mandatory. Some estimate the number of marine envenomations worldwide to be greater than 10 million per year, with the majority being caused by jellyfish. Deaths are reported every year from envenomation by certain species of jellyfish, most commonly the box jellyfish.

The true number of traumatic injuries caused by marine life is difficult to estimate. Most will consist of only minor abrasions and contusions, but occasional fatal traumatic injuries do occur. Attacks by sharks and large predatory fish cause human fatalities every year. Stingray barbs can cause significant direct trauma and death.

MARINE FOOD-BORNE POISONINGS

STING RAYS

As human contact with the ocean and the organisms that live in it continues to increase, the impact of poisonings, envenomations, and direct trauma by these marine organisms will also grow. Marine food-borne poisonings can cause large outbreaks, and direct envenomation by the innumerable stinging organisms in the ocean cause significant morbidity.

KEY POINTS

- Scombroid is thought to be caused by breakdown of histidine into histamine in dark-meat marine fish and can be managed with antihistamines.
- Ciguatera poisoning results from the consumption of large tropical predatory reef fish that have bioaccumulated ciguatoxin; it causes gastrointestinal distress and neurologic symptoms.
- Tetrodotoxin blocks sodium channels and can lead to ascending paralysis and respiratory failure.
- Box jellyfish (Cubozoa), Portuguese man-of-war (Hydrozoa), and other stinging marine invertebrates envenomate humans via nematocysts that contain a stinging barb and venom.
- The box jellyfish (Chironex fleckeri) and related species cause the most morbidity and mortality of all marine envenomations.
- Acetic acid immersion is recommended for the treatment of box jellyfish envenomation but may worsen man-of-war envenomation.
- Hot water immersion appears to be an effective treatment of almost all marine envenomations.
- Sea snake venom is neurotoxic and myotoxic. Treatment with antivenom is effective.
- Evaluation for a retained foreign body should be considered with stingray and spiny fish envenomation.
- Wound infection is a common complication of spiny fish and stingray envenomation, and prophylactic antibiotics effective against common pathogens such as Vibrio species should be considered.
- Direct marine injuries are usually abrasions and contusions, but fatal attacks by sharks and large predatory fish do occur.

PERSPECTIVE

The toxins responsible for the signs and symptoms of marine food-borne illnesses are primarily produced in microorganisms such as dinoflagellates, diatoms, and marine bacteria and are bioaccumulated by shellfish or fish, which are then ingested by humans and result in toxicity. Most of these toxins modulate neuronal and muscle sodium channels. Scombroid is not caused by a preformed toxin but rather by breakdown
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Food-borne poisoning would also need to be considered. The diagnosis of marine food-borne poisoning must be made on a clinical basis because testing for the specific toxins is not readily available.

TREATMENT

Treatment of marine food-borne poisoning is entirely supportive (see Table 142.1). Attention should be paid to fluid resuscitation and control of nausea and vomiting with antiemetics (ondansetron, 4 to 8 mg intravenously as needed). Although scombroid can be treated with antihistamine therapy, no antidotes are available for any other seafood toxin-mediated poisonings.

Marine Envenomation

Pathophysiology

Envenomation can occur from both marine invertebrates and vertebrates. Members of the Cnidaria phylum, which includes the box jellyfish, true jellyfish, Portuguese man-o-war, and sea...
severe hypertension, and it has caused deaths. The blue-ringed octopus has tetrodotoxin in its venom, which can cause paralysis and respiratory failure. Stonefish envenomation can result in cardiovascular instability and death, although severe local effects are more common. Sea snake venom has both a neurotoxic component, which leads to ascending paralysis, and a myotoxic component, which causes muscle breakdown. Table 142.2 summarizes the signs and symptoms of the more significant marine envenomations.

DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

Frequently, the identity of the offending marine organism will not be known. The geographic location can be a useful predictor, and physicians should be aware of the venomous marine organisms in their local area. It can be helpful to look for physical clues, such as retained jellyfish tentacles and puncture marks. The presence of severe local pain often indicates a Cnidaria or fish envenomation, whereas significant neurologic symptoms, such as weakness, should raise suspicion for cone snail or other neurotoxic organisms.

TREATMENT

Treatment of marine envenomation begins with addressing the patient's airway, breathing, and circulation status. Typically, good supportive care and pain control are all that is needed. Hot water immersion is recommended to control the pain caused by Cnidaria, Scorpaenidae fish, and stingray envenomation and is efficacious because of the heat-labile properties of the neurotoxic component of the venom responsible for the pain. This is typically achieved by immersing the affected body part in water heated to approximately 42°C to 45°C for 20 minutes. Acetic acid may have a role in inactivating the nematocysts of the box jellyfish and Irukandji jellyfish but should not be used on other types of jellyfish because it may worsen these envenomations. Recently, topical lidocaine was shown to help in alleviating the pain and inactivating nematocysts from several different species of Cnidaria, including the Portuguese man-o-war. Antivenom therapy is available to treat poisoning by the Australian box jellyfish, the stonefish, and the sea snake. Evaluation for a retained foreign body should also be considered, especially with stingray and sea urchin envenomation.

PRESENTING SIGNS AND SYMPTOMS

The signs and symptoms of marine envenomation depend on the offending organism. Local pain and irritation are the most common symptoms, especially when nematocysts and spines are involved. However, certain marine organisms can cause severe systemic symptoms and even death. The Australian box jellyfish (Chironex fleckeri) can cause sudden cardiopulmonary collapse. The Irukandji jellyfish (Carukia barnesi) can cause Irukandji syndrome, a condition characterized by severe whole-body pain and spasms, tachycardia, and...
Table 142.2  Signs and Symptoms of Significant Marine Envenomations

<table>
<thead>
<tr>
<th>MARINE ORGANISM</th>
<th>METHOD OF VENOM DELIVERY</th>
<th>CLINICAL FINDINGS</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian box jellyfish (Chironex fleckeri)</td>
<td>Nematocysts</td>
<td>Linear rash, severe local and generalized pain, muscle spasms</td>
<td>Supportive care, Pain management, Hot water immersion, Acetic acid irrigation, Antivenom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rare: rapid cardiopulmonary collapse, death</td>
<td></td>
</tr>
<tr>
<td>Irukandji jellyfish (Carukia barnesi)</td>
<td>Nematocysts</td>
<td>Irukandji syndrome: tachycardia, tachypnea, hypertension to hypotension, whole-body muscle spasms, pain</td>
<td>Supportive care, Pain management, Hot water immersion, Acetic acid irrigation, Vasodilators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rare: hemolysis, shock, death</td>
<td></td>
</tr>
<tr>
<td>Sea nettle (Chrysaora quinquecirrha)</td>
<td>Nematocysts</td>
<td>Local pain and irritation</td>
<td>Supportive care, Pain management, Hot water immersion, Lidocaine spray</td>
</tr>
<tr>
<td>Portuguese man-o-war (Physalia physalis)</td>
<td>Nematocysts</td>
<td>Severe local pain, bullae, necrosis</td>
<td>Supportive care, Pain management, Hot water immersion, Lidocaine spray, Vasodilators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rare: hemolysis, shock, death</td>
<td></td>
</tr>
<tr>
<td>Thimble jelly (Linuche unguiculata)</td>
<td>Nematocysts</td>
<td>Sea bather’s eruption: pruritic popular eruption on the skin covered by a bathing suit</td>
<td>Supportive care, Hot water immersion, Pain management</td>
</tr>
<tr>
<td>Fire coral (Millepora alcicornis)</td>
<td>Nematocysts</td>
<td>Local pain and irritation</td>
<td>Supportive care, Hot water immersion, Pain management</td>
</tr>
<tr>
<td>Sea anemones (class Anthozoa)</td>
<td>Nematocysts</td>
<td>Local pain and irritation, GI upset</td>
<td>Supportive care, Hot water immersion, Pain management</td>
</tr>
<tr>
<td>Blue-ringed octopus (Hapalochlaena sp.)</td>
<td>Beak</td>
<td>Flaccid paralysis, respiratory failure, death</td>
<td>Supportive care, Respiratory support</td>
</tr>
<tr>
<td>Cone snails (Conus spp.)</td>
<td>Modified radula</td>
<td>Rapid paralysis, respiratory failure, death</td>
<td>Supportive care, Respiratory support</td>
</tr>
<tr>
<td>Sea urchin (class Echinoidea)</td>
<td>Multiple spines</td>
<td>Local pain and irritation</td>
<td>Supportive care, Hot water immersion, Pain management, Wound care, Foreign body removal, Antivenom</td>
</tr>
<tr>
<td>Stonefish (Synaceia sp.)</td>
<td>Spines in dorsal, pelvic, anal fins</td>
<td>Severe local pain and edema, GI upset, cardiovascular instability, death</td>
<td>Supportive care, Hot water immersion, Pain management, Wound care, Antivenom</td>
</tr>
<tr>
<td>Other Scorpaenidae fish (Pterois sp. and Scorpaena sp.)</td>
<td>Spines in dorsal, pelvic, anal fins</td>
<td>Local pain and swelling, GI upset</td>
<td>Supportive care, Hot water immersion, Pain management, Wound care</td>
</tr>
<tr>
<td>Stingray (class Chondrichthyes)</td>
<td>Serrated tail barb</td>
<td>Severe local pain and edema</td>
<td>Supportive care, Hot water immersion, Pain management, Wound care</td>
</tr>
<tr>
<td>Sea snakes (genus Hydrophiidae)</td>
<td>Small, front fangs</td>
<td>Ascending paralysis, muscle pain and breakdown, respiratory failure, death</td>
<td>Supportive care, Respiratory support, Antivenom</td>
</tr>
</tbody>
</table>

GI, Gastrointestinal.
traumatic marine injuries. Control of bleeding and wound irrigation are important. Because infections can complicate these injuries, prophylactic antibiotics should be considered. Injuries to tendons, ligaments, and other vital structures should be evaluated and addressed.

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

All the marine food-borne illnesses are self-limited, although amnestic shellfish poisoning has been linked to long-term neurologic sequelae. Patients with suspected tetrodotoxin poisoning should be admitted to the hospital for observation. Most other patients who are asymptomatic after treatment can be discharged. Those with ongoing or severe symptoms should be admitted. The local public health department should be informed of suspected cases of marine food-borne poisoning.

The vast majority of marine envenomations will be self-limited and resolve with simple supportive care. Infection from sea urchin spines, fish spines, and stingray barbs is well documented, and prophylactic treatment with antibiotics effective against pathogens such as *Vibrio* species should be considered. Patients with persistent or severe pain may need to be admitted, as will any patient with envenomation by a potentially neurotoxic organism.

Serious injuries may need treatment by a trauma or orthopedic surgeon, either on an emergency basis or as an outpatient. Otherwise, good wound care measures should be explained to the patient and return precautions focusing on signs and symptoms of infection stressed.

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

The offending organisms may or may not be known to the victim, and concomitant envenomation should be considered. Radiographic evaluation may be needed. The most important medical decision to be made is whether the injury is severe enough to warrant specialist care by a trauma, vascular, or orthopedic surgeon.

**TREATMENT**

After initially addressing the airway, breathing, and circulation, direct wound care is usually sufficient to treat most cutting nature of the teeth. The severity of direct injuries from stingray barbs depends on the location where the victim was impaled.

**SUGGESTED READINGS**


REFERENCES


