Marine Envenomations

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Lindsay Ballard - PADI Master Scuba Diver Trainer
**Definition + Epidemiology**

*Envenomation*: process of introduction of a venom or toxin via bite, sting or puncture

Typically due to direct contact either passive or active

Likely underreported

DAN 2019 annual report: 214 marine envenomations

American Association of Poison Control Centers 2011 annual report: ~1800 aquatic exposures
Pathophysiology is varied:
- Direct trauma or wound
- Mast cell degranulation
- Disruption of cell metabolism
- Neuronal transmission interference
- Myocardial depression
<table>
<thead>
<tr>
<th>Organism</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stingray</td>
<td>Exsanguination</td>
</tr>
<tr>
<td>Spiny fish</td>
<td>Cardiotoxicity, neurotoxicity, hemolysis, edema</td>
</tr>
<tr>
<td>Sea snakes</td>
<td>Paralysis, respiratory failure, rhabdomyolysis</td>
</tr>
<tr>
<td>Box jellyfish (Chironex fleckeri)</td>
<td>Cardiotoxicity, catecholamine surge</td>
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<tr>
<td>Irukandji (Carukia barnesi)</td>
<td>Severe hypertension</td>
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<tr>
<td>Portuguese man-of-war (Physalia physalis)</td>
<td>Respiratory failure, hypotension</td>
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<tr>
<td>Cone snails</td>
<td>Paralysis, respiratory failure, cardiotoxicity</td>
</tr>
<tr>
<td>Octopus (Hapalochlaena maculosa)</td>
<td>Paralysis (without change in mental status), respiratory failure, hypotension</td>
</tr>
</tbody>
</table>
Marine microbes

Polymicrobial, gram negatives, often diagnosed late

<table>
<thead>
<tr>
<th>Antibiotics for Marine-Associated Wound Infections*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For All: Staphylococci and Streptococci Coverage</strong></td>
</tr>
<tr>
<td>First-generation cephalosporin</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>Methicillin-resistant <em>Staphylococcus aureus</em> coverage depending on prevalence</td>
</tr>
<tr>
<td><strong>Seawater Associated: Vibrio Species Coverage</strong></td>
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<tr>
<td>Fluoroquinolone</td>
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<tr>
<td>or</td>
</tr>
<tr>
<td>Third-generation cephalosporin</td>
</tr>
<tr>
<td><strong>Freshwater Associated: Aeromonas Species Coverage</strong></td>
</tr>
<tr>
<td>Fluoroquinolone</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>Trimeprin-sulfamethoxazole</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>Carbapenems</td>
</tr>
</tbody>
</table>

*Patients should receive both an antibiotic from the first column and a second agent from either the second or third column. Most marine bacteria are resistant to cephalosporins and antibiotic combinations are needed for serious infections. Antibiotic choices have not been robustly investigated. Antibiotic sensitivities vary, and in vitro antibiotic susceptibility data and clinical outcomes may not relate. Marine infections are polymicrobial.
Cool photographs
Typical envenomation treatment

- Remove patient from water (scene safety)
- Remove any obvious external debris, leave penetrating barbs/spines if large
- Vinegar for 30 seconds
- Hot water immersion in water up to 43°C (45°C often recommended, but can cause burns) for 20 minutes
- Administer pain medication -- lidocaine often helpful
- Consider radiographs for retained foreign body (or ultrasound)
- Antibiotics, if indicated
- Tetanus prophylaxis, if indicated
- Consider closure by secondary intention (don’t close it!)

Antivenom is available for box jellies, stonefish, and sea snakes
Jellyfish envenomation - the to do list

- Rescue and offer life saving measures as soon as possible when indicated (Basic Life Support, Epinephrine injection, antivenom with or without Magnesium sulfate)

- Wash tentacles off affected areas with seawater and not with fresh water

- Immerse the stung area in vinegar (4-6% acetic acid) for at least 30 seconds
  Only for:
  - *Chrysaora hysoscella* (causing Irukandji syndrome)
  - *Carybdea alata* (Hawaiian box jellyfish)
  - *Pelagia noctiluca*

- Remove clinging tentacles quickly (not with bare hands)

- Immerse the stung area in hot water for 20 minutes
  Unless *Chironex fleckeri* (Australian Box jellyfish) stings

- Consider cold packs

- Tropical stings
  - *Chironex fleckeri* (Australian box jellyfish)
  - If pain persists after using hot water for *Pelagia Noctiluca"
  - Non-tropical stings (Physalia) with Stingose

- Symptomatic treatment
  - Pain Killers
  - Antihistamines
  - Topical Steroids
  - Antibiotics
  - Immuno modulatory drugs

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Figure. Jellyfish sting management flowchart.
Invertebrates
Cnidaria (jellyfish et al)

Creatures that have cnidae, microscopic stinging apparati.
Jellyfish stings -- to pee or not to pee
Cubozoa

Not a TRUE jellyfish, although they look like an archetypical jelly

Square shaped top, evenly spaced tentacles, well shaped eyes

Greatest morbidity and mortality of Cnidaria

20 species known, most famously...
**Chironex fleckeri - box jellyfish**

**Problem:** called “world’s most venomous animal” and has tentacles

**Presentation:** severe pain, dermatitis, frosted ladder rash, nausea, vomiting, headache, fevers, muscular spasm, arrhythmia, respiratory arrest, cardiovascular collapse

**Treatment:**
- ABCs
- Decontamination
- Symptomatic control
- Antivenom for severe events
Carukia barnesi - Irukanji jellyfish

Problem: Can be deadly to humans; Irukanji syndrome

Presentation: initially asymptomatic, then pain, hypertension, tachycardia, diaphoresis, spasms

Treatment:
ABCs + decontamination
Vinegar
Control pain and blood pressure
EKG + troponin
Hydrozoa - Portuguese man of war + fire coral

Problem: painful stings.
Tentacles
Presentation: pain

Treatment: NO vinegar
Decontamination, symptomatic control
Hot water immersion
Scyphozoa - true jellies

Problem: all over the world, increasing blooms

Presentation: stinging, pain, wheal, pruritis

Treatment:
Vinegar (unless hydrozoa)
Hot water immersion
Symptomatic control
Anthozoa + Porifera

Problem: everywhere, easy for inadvertent contact

Presentation: pain, stinging, abrasions

Treatment: almost always solely symptomatic
Cephalopoda - octopus, squid, cuttlefish

Problem: so cute looking!

Presentation: mild pain, wheal, diplopia, aphona, dysphagia, weakness, ataxia, flaccid paralysis, death

Treatment: ABCs, lymphatic occlusion, symptomatic control, wound management, tetanus

Can have near total reversal of paralysis in 23-48 hours
Gastropoda - cone snails

Problem: people touch shells, they have pretty shells

Presentation: stinging, pain, cyanosis, numbness, can progress to rapid death

Treatment: ABCs
Pressure immobilization
Hot water immersion
Symptomatic control + wound care
**Echinodermata** - sea urchins, stars, sand dollars, cucumbers

**Problem:** ubiquitous, inadvertent contact with bottom

**Presentation:** puncture, pain, dermatitis

**Treatment:**
- Symptomatic + wound care
- Hot water immersion
- X-rays for retained foreign body
- Antibiotics + tetanus
Vertebrates
Chondrichthyes - stingrays

Problem: tail has barbs, stingrays sit in the sand, unintentional contact

Presentation: puncture, laceration, pain

Treatment:
symptomatic control/hemostasis
hot water immersion
xray for evaluation of retained foreign body
antibiotics + tetanus
**Scorpaenidae - Stonefish/lionfish**

**Problem:** Stonefish blend in - incidental contact, lionfish are hunted

**Presentation:** Pain, spines in hands

**Treatment:** Stonefish: antivenom
Symptomatic control/hemostasis
Hot water immersion
Consider imaging, antibiotics, tetanus
Trachinidae - weeverfish

Problem: most venomous fish in the temperate zone, incidental contact

Presentation: excruciating pain

Treatment:
Symptomatic control/hemostasis
Hot water immersion
Consider imaging, antibiotics, tetanus
Sea snakes

Problem: snakes

Presentation: bite, pain, weakness, myalgias, dysphagia, trismus, ptosis

Treatment:
immobilization of extremity
Antivenom
symptomatic control
Eels

Problem: They reside in holes where lobsters also live

Presentation: Bite, pain

Treatment:
Symptomatic wound care
Radiographs for retained foreign body
Antibiotics and tetanus
Sharks

Problem: they have teeth

Presentation: mass hysteria, trauma

Treatment:
ABCs
ATLS
How likely is death by shark attack?

Death risk during one’s lifetime

20%
Heart disease
Cancer
Stroke
Flu
Car accidents
Accidental poisoning
Falls
Drowning
Shark attack

0.000003%
Train crash
Bike accident

Source: University of Florida. Risk was calculated using 2003 population data.
Scombroid
Ciguatera

Histamine fish poisoning: inadequate refrigeration
Symptoms within 30 minutes of eating fish
“Peppery” taste, flushing, headache, N/V/D, palpitations

Treatment: anti-histamine

Toxin from larger fish that eat smaller fish that eat dinoflagellates
Odorless, tasteless, heat stable
N/V/D, abdominal pain, ataxia, cold/heat reversal, tooth looseness sensation, hypotension, bradycardia

Treatment: symptomatic


French LK, Horowitz Z. Marine Vertebrates, Cnidarians, and Mollusks. In: Critical Care Toxicology. Brent et al, eds. 2nd ed. DOI 10.1007/978-3-319-17900-1_148 Accessed 15 Nov 2018


Siladan Resort and Spa “Bunaken’s Deadliest Critter” <https://www.siladen.com/bunakens-deadliest-critter/> 15 Nov 2018


Rosh Review questions


