Marine Envenomations & Toxins
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Mechanism of Injury
- Traumatic Injuries
- Venomous bites and stings
- Toxic Ingestions

Traumatic Injuries

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<th>Sharks</th>
<th>Barracudas</th>
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<td>Moray Eels</td>
<td>Giant Grouper</td>
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<td>Sea Lions</td>
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<td>Killer Whales</td>
<td>Alligators &amp; Crocs</td>
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Venomous Bites and Stings

- Vertebrates
  - Stingrays, Catfish, Lionfish, Stonefish, Scorpionfish

- Invertebrates
  - Coral
  - Sea Urchins
  - Coelenterates
    - Hydrozoans – Portuguese Man-of-War
    - Scyphozoans – True Jellyfish
    - Anthozoans – “Hells Fire Sea Anemone”

Venomous Stingray Injuries

- Rays do not attack man
- Injuries usually from stepping on the animal
- Fishermen are also often injured
- Injuries usually on the feet or lower leg

Venom Apparatus

- Striking organ (spine)
  - Serrated appearance
  - Covered with glandular venom tissue
  - Covered by epidermis

  - Venom is injected by tearing off the venom tissue which may remain in the wound
  - Broken spines are regenerated
Clinical Signs of Envenomation

- Deep lacerations are common
- Penetrating puncture wounds occur frequently
- Pain not severe at time of incident
  - Intense pain develops over 30-90 minutes
- Profuse bleeding occurs from initial contact
- Edema may develop, but is not consistent
- SEVERE DISTRESS due to local pain is the most common problem in stingray injuries
Signs of severe envenomation

- Nausea
- Vomiting
- Syncope
- Excessive salivation
- Muscle cramps
- Convulsions
- Circulatory collapse

First Aid

- Wash wound with sea water to remove venom and gland tissue
- Bathe the part in hot water
  - Venom is heat labile
  - Do not scald, temp not > than 110 F
  - May continue up to 2 hours
Clinical Treatment
- Pain meds as necessary
- Wound explored and debrided
  - Leave open initially
- Tetanus prophylaxis
- Antibiotic prophylaxis

Fish stings
- Lionfish
- Scorpionfish
- Weeverfish
- Catfish
- Stonefish
  - Most toxic fish

Lionfish
- Ornate lionfish produce mild poisoning.
- Camouflaged scorpionfish cause moderate to severe poisoning.
- The motionless stonefish causes severe to life-threatening poisoning.

Catfish Spines

Sea Urchin Spines
Signs and symptoms

- Intense throbbing pain peaks in 1-2 hours and lasts 12 hours.
- Redness, bruising, swelling, numbness, tingling, and tissue sloughing at the wound site may also occur.
- Severe reactions include nausea, vomiting, abdominal cramps, tremors, abnormal heart rhythms, weakness, shortness of breath, seizures, decreased blood pressure, fainting, and paralysis.
- Death may occur.

Treatment

- Immerse the wound in water as hot as the victim can tolerate for 30-90 minutes. Repeat as necessary to control pain.
- Remove any spines or sheath remaining in the wound.
- Cleanse the wound and then flush the affected area with fresh water.
- Antivenom is available for stonefish.
Most Venomous Sea Creature on the Planet?

- Found predominately in Australian and South Asian waters
- Can be found in the open ocean
- Mortality rates from exposure approach 20%
- Carry enough venom to kill several adult humans

The Box Jellyfish!

- Chironex fleckeri (a.k.a. sea wasp or stinger)
  - Most venomous of all stinging marine life
  - Over 100 documented fatalities
    - Can cause death in 5 minutes from respiratory failure
  - Antivenom available in Australia
Stinging apparatus

- **Nematocyst**
  - Present by the thousands to millions on the tentacles
  - Each contains a microdose of venom
    - Combines the mechanical functions of a harpoon gun and an injection syringe
  - Discharges in response to mechanical or chemical stimulation (sticky feeling when touched)
  - Adult jellyfish may have 4 to 5 million nematocysts on its tentacles
Envenomation process

- Simultaneous discharge of thousands of nematocysts
  - Rapidly absorbed, quickly rising blood levels of venom
- Massive envenomation may result from entanglement in the tentacles

Portuguese Man-of-War

Nematocyst Inhibition
“How do I stop the stinging”? 

- Do not wash off with tap water
  - Enhances discharge
- Many substances used in the past
  - Alcohol, vinegar, paw paw juice, human urine, meat tenderizer, ammonia, and other plant extracts
  - Vinegar (5% acetic acid) is the preferred method used today
Blue Ringed Octopus

Venom Apparatus

- Octopus has a distinct venom delivery system
  - Two sets of salivary glands
  - Parrot like beak
- Venom is a form of tetrodotoxin, a potent neurotoxin
TOXINS

- Ciguatera
- Scombroid
- Fugu

Ciguatera

- Most commonly reported fish-borne illness worldwide
- Normally only found between 35 degree parallels North and South of Equator
- Over 500 species of fish may cause it
- Most common:
  - Barracuda, Grouper, Amberjack, Snapper and Sea Bass

Ciguatoxin

- A heat-stable, lipid-soluble, acid-resistant compound produced by the dinoflagellate Gambierdiscus toxicus
- It lives in and around coral reefs and is eaten by small fish
- The toxin does not harm the fish but is concentrated up the food chain
- It is not altered by cooking, processing, smoking, drying or freezing
**Gambierdiscus toxicus**

**Symptoms**
- Toxin activates sodium channels
- Symptoms begin usually within 6 hours of ingestion (30 minutes to 30 hours)
- Nausea, vomiting, abdominal cramps and watery diarrhea for first 24-48 hrs.
- Bizarre neuro symptoms are “Classic”
  - Reversal of Hot & Cold sensation
  - Paresthesias of lips & extremities
  - Sensation of teeth being loose

**Ciguatera Symptoms (cont.)**
- May also see:
  - Vertigo, Blurred vision, Ataxia
  - Coma, Hypotension, Arrhythmias
  - AV Block, Shock, Respiratory Failure
- Duration: one week but may persist for months
- Symptoms aggravated by ETOH, Fish Oils and nuts
Ciguatera Diagnosis & Treatment

- Diagnosis is purely clinical at present
- Treatment is mainly supportive
  - IV Mannitol appears to be effective in some cases
  - Amitriptyline and Gabapentin have shown some success for chronic paresthesias
  - Avoiding reef fish, ETOH and nuts for 3-6 months is normally advised

Fugu

- Tetrodotoxin
  - Most venom found in the liver, gonads, and skin of the Pufferfish
  - Toxicity from as little as 1.4 ounces
  - Heat stable protein
  - Mortality approaches 50%
  - Served Oct. – March in Japan
- Chefs must be licensed to serve
- Illegal to prepare in U.S.
Signs and symptoms

- Onset from 15 minutes to a few hours
- Initially, lip and tongue paresthesias
  - facial and extremity paresthesias and numbness
- Salivation, N,V,D, abd pain (severe)
- Motor dysfunction with speech difficulties

Death by FUGU

- Rapidly ascending paralysis over 2-4 hours
  - extremity progresses to respiratory
- Finally, cardiac dysfunction, CNS dysfunction, and seizures
- Death usually in 4-6 hours
Treatment

- Dietary history is key to diagnosis
- AC if early
- Aggressive supportive care
  - Airway management
  - Antiarrhythmics, pressors
  - NO ANTIDOTE!

Scombroid

- Food borne illness associated with consumption of improperly handled (i.e. refrigerated) dark-meated, histadine-rich fish
- Most commonly: Tuna, Albacore, Mackerel, Bonito, Mahi-Mahi, Bluefish
- Scombrotoxin is formed when surface bacteria proliferate and degrade free Histadine to Histamine

Histadine

Histamine
Scombrotoxin
- Not destroyed by cooking or heating
- Causes fish to have a “peppery” or “metallic” taste
- Symptoms begin within minutes and usually only lasts about 4 hours
- Causes a classic “Histamine” reaction

Scombroid Symptoms
- Symptoms Include:
  - Facial flushing, Sweating, Burning sensation in mouth & throat
  - Diarrhea, Nausea, Dizziness, Palpitations
  - Headache and sunburn-like rash
- Often misdiagnosed as “Fish-Allergy”

Scombroid Treatment
- Supportive care: Fluids, anti-emetics
  - Consider Activated Charcoal for recent ingestion
  - Benadryl 25-50 mg IV
  - Cimetidine or Pepcid IV
  - Epinephrine and steroids in severe cases
- Course usually benign
- Public Health Concern-Notify OPH
One Final Warning!

- Small Amazonian catfish the “Candiru”
- Known for swimming up and lodging itself in the human urethra during river micturition

Take Home Points

- Know which envenomations respond to warm water treatment vs acetic acid
- Know how to recognize the toxins by their toxidromes
- Know what types of fish or conditions to avoid when contemplating eating seafood