Seafood Poisoning and Marine Envenomations

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Objectives

- Describe the clinical presentation following common marine envenomations
- Develop a treatment plan for these envenomations
- Be able to discuss mechanism of toxins from seafood poisoning
- Demonstrate techniques to minimize seafood poisoning

Scombroid

• Most common reported fish-borne illness in USA
• Result of improperly refrigerated dark muscle fish
• Classically described in Scombroidae species e.g., tuna, mackerel, bonito but seen in many others

Scombroid-Associated Fish

Scombroid Mechnism of Toxicity

• High concentrations of histidine in flesh
• Various bacterial species proliferate without refrigeration
  • e.g., Proteus, Morganella, Klebsiella, Aerobacter, Escherechia
• Liberate histidine decarboxylase converting histidine to histamine and saurine
• Heat stable

Scombroid Clinical Presentation

• Onset within minutes of eating can be delayed
• Meal often described as “peppery”
• Initial flushing of face and upper torso
• “Burning” sensation of oropharynx and throat
• Headache common
• Nausea and vomiting
• Multiple persons
• Urticaria, bronchospasm, hypotension RARE consider true allergic reaction
Scombroid Treatment

- Self-limiting
- Lasts 8 to 12 hours
- H1 and H2 blockers
- IVF crystalloid
- Antiemetics
- Monitor airway
- Activated charcoal?

Ciguatera

Second most common behind Scombroid in USA

Most commonly seen in Indian Ocean, South Pacific, Caribbean worldwide

In USA in Hawaii and Florida

Reported in fish caught between +35 and -35 latitudes BUT more in +32 and -32

Flash frozen fish

Ciguatera Areas

Why Ciguatera Occurs

- Blue green algae dinoflagellate
  - Gambierdiscus toxicus
- Adheres to coral eaten by small herbivore fish
- Larger fish eat smaller fish bio-concentrated up food chain
- Over 400 different species have been reported even jellyfish
- Classic fish
  - Grouper, Snapper, Amberjack, Sea Bass, Mahi Mahi

Ciguatera Mechanism of Toxicity

- Three major ciguatoxins
  - CTX-1, CTX-2, CTX-3 possible additional toxins
- Heat stable, odorless, tasteless
- Increase sodium permeability leads to spontaneous firing of neurons
- Also cholinergic receptors and calcium channels
Ciguatera Classic Presentation

Hot/Cold reversal

More correctly “cold allodynia”

“Loose painful teeth”

Ciguatera Clinical Presentation

• Initial gastrointestinal N/V/D, abdominal pain seen within 1 to 24 hours
• Followed by neurologic within 3 to 72 hours
• Paresthesia e.g., perioral, extremities
• Headache
• Ataxia
• Vertigo

Ciguatera Clinical Presentation

• Cardiovascular
  – Orthostatic hypotension and bradycardia can be followed by hypertension and tachycardia
• Other
  – Pruritis
  – Myalgia
  – Hiccups
  – Dyspareunia
  – Infant from breast milk

Ciguatera Treatment

• Supportive care
• IVF crystalloid
• Antiemetics
• Lidocaine (sodium channel blocker)
• Cyclic antidepressants (sodium channel blocker and antimuscarinic)
• Nifedipidine (calcium channel blocker)
• Neostigmine, Edrophonium (may worsen)

Mannitol
• Controversial
• Dose 1 g/Kg 20 % mannitol
• Randomized control trial showed no benefit
• May worsen dehydration
• Theories
  – Competitive inhibitor of CTX
  – Free radical scavenger
  – Decrease Schwann cell edema

Don’t eat fish locals will not eat

**Tetrodotoxin**

• Classic “Puffer fish”
• However, multiple species contain TTX
  • e.g., newts, Blue Ringed Octopus, Poison Dart frogs
• Most cases in Japan “Fugu”
• San Diego

**FUGU**

• Several deaths each year in Japan
• Chef training
  • Several years
• Flesh contains small concentrations
• Ovaries, liver, testes contain most TTX
• Heat stable
• Goal is to leave some TTX

**Tetrodotoxin Mechanism of Toxicity**

• TTX blocks sodium channels preventing initial depolarization and neurotransmission
• Also direct effect on vascular smooth muscle causing vasodilation

**Tetrodotoxin Clinical Presentation**

• Onset within one hour but may be delayed
• Oral paresthesia followed by face and extremities
• N/V, abdominal pain
• Hypersalivation
• Bronchorrhea
• Bulbar paralysis
• Extremity paralysis
• Respiratory paralysis
• Bradycardia and AV nodal blockade, hypotension

Tetrodotoxin Treatment
• Aggressive supportive care
• Early airway management
• Gastric lavage?
• Activated charcoal?
• Atropine
• Transvenous pacemaker
• Admit for 24 hours
• Long term sequelae rare

Shellfish Poisonings

Paralytic Shellfish Poisoning
• Dinoflagellates “Red Tide”
• Bivalves
  – e.g., mussels, clams, scallops, oysters
• Saxitoxin
  – Decreases sodium channel permeability
  – Inhibiting neuromuscular conduction

Paralytic Shellfish Poisoning Presentation
• Generally onset within 20 to 60 minutes
• Paresthesia of mouth and extremities
• Ataxia
• Headache
• Dysarthria, dysphonia, dysphagia
• N/V/D
• Respiratory weakness less common than TTX but can be fatal

Paralytic Shellfish Poisoning Treatment
• Supportive care
• Activated charcoal?
• Prevention
  • Only eat shellfish in months with letter R

Neurotoxic Shellfish Poisoning
• Different toxin than PSP
• Also from “Red Tide”
• Brevitoxin
  – Stimulates sodium transmission
• Eating bivalves, whelks

Neurotoxic Shellfish Poisoning Presentation
• Onset within minutes to hours
• N/V/D, abd pain, “rectal burning”
• Paresthesia of mouth, face, extremities
• Muscle weakness, vertigo, ataxia
• Seizures
• Respiratory failure very rare

Neurotoxic Shellfish Poisoning
• Less severe than Paralytic Shellfish Poisoning
• Supportive care
• Self-limited
• Lasts less than three days

Large “red tide” blooms can aerosolize Brevitoxin
Cough, rhinorrhea, bronchospasm
Treat supportively
Avoid

Diarrhea Shellfish Poisoning

- Toxin Okadaic acid and others
- From dinoflagellates
  - Most common May through August
- Rapid onset of diarrhea after eating shellfish usually within 30 minutes to 2 hours
- Can also see N/V, abdominal pain
- Resolves 1 to 3 days
- Supportive care

**Stingray Envenomation**

22 species of stingrays in U.S.

Cartilaginous fish in same class as sharks

Wide, flat fish with wing-like fins and sharp spine at base of whip-like tail

These spines puncture and envenomate

Spines covered by integumentary sheath ruptures on impaling allowing venom into wound

**Stingray Envenomation**

Stingrays bury themselves in sand of shallow water where they may be stepped on by swimmers
Stingrays reflexively whips tail upward and forward impaling spine into leg or foot
Commonly causing jagged bleeding wound and envenomation of venom
Spine may break off in the wound therefore must explore wound for foreign bodies

**Clinical Effects**

Immediate severe pain

Often out of proportion expected from laceration

Very rarely local tissue necrosis requiring surgical debridement and/or prolonged healing times

Systemic effects may include syncope, hypotension, tachycardia, nausea, diaphoresis, weakness, and nervousness

Deaths extremely rare generally from penetrating injuries to thoracic or peritoneal cavities

**Treatment**

Immediate treatment focused on pain relief with hot water and analgesics

Venom is heat labile therefore affected limb submerged in water hot as patient can tolerate (105–113°F) for 30–90 min
NB: Caution not to cause thermal injury especially if preexisting neuropathy

Rarely, nerve blocks or local skin infiltration with local anesthetics are needed but are treatment options

Treatment

- Plain films may be helpful as spines are radiopaque
- Wound should be left open to heal by secondary intention or occasionally delayed primary closure
- Tetanus prophylaxis and prophylactic antibiotic therapy for marine injuries is commonly recommended
- Cover Gram-negative bacteria, e.g., Vibrio sp., and Streptococcus and Staphylococcus e.g., 5-day course of a quinolone

Scorpaenidae

Pterois sp. commonly known lionfish and turkeyfish

Pterois volitans inadvertently introduced into the southern Atlantic and causing massive ecosystem changes

Also common in home saltwater aquariums as ornate fish

Therefore envenomations becoming more common

Lionfish and Other Scorpaenidae

~12 venomous dorsal spines covered with integumentary sheath similar to stingrays

Venom released following puncture from spines

Severe pain similar to stingray envenomation

- Lasts 6 to 24 hours

Systemic effects very rare but can be seen with large envenomations

- Nausea, vomiting, abdominal pain, headache, hypotension, and weakness are most commonly reported

Treatment

Prevention is key, avoid handling

Plain films may be helpful for spines

Wound should be left open to heal by secondary intention or occasionally delayed primary closure

Tetanus prophylaxis and prophylactic antibiotic therapy for marine injuries commonly recommended

Cover Gram-negative bacteria, e.g., Vibrio sp., and Streptococcus and Staphylococcus e.g., 5-day course of quinolone

North American and Hawaiian Jellyfish

- Many different species
  - Man-o-war or Bluebottle (Physalia sp.)
- Hawaiian Box (*Carybdea alata*)
  - Different than Australian Box (*Chironex fleckeri*)
- Irukandji (*Carukia barnesi*)
- Multiple other venomous species
  - Contain nematocysts → open by changes in hydrostatic pressure or physical contact → venom

**Clinical Presentation**

Generally painful but self-limiting

- Immediate burning pain
- Throbbing sensation
- Red, brown marks on skin "print" of tentacle’s contact with your skin
- Pruritis
- Paraesthesia

**Severe Envenomation**

- Muscle spasms
- Weakness
- Dyspnea
- Paralysis
- Dysrhythmia
- Loss of consciousness
- Cardiac arrest
- Can result in drowning

**Jellyfish Treatment**

- Many folklore therapies recommended
  - Vinegar, Baking Soda, Ammonia, Urine
  - None of these is supported by literature in North American species
  - Goal of therapy is to treat pain and local tissue effects from venom itself
  - But also prevent further discharge of nematocysts to allow removal intact
- Treatment
  - Vinegar may provide relief from Australian Box jellyfish (*Chironex fleckeri*)
Studies show increased pain and nematocyst discharge with vinegar in multiple species. One study showed acetic acid beneficial in Pacific _Physalia_ but worsened pain in Atlantic _Physalia_.

**Treatment**

- Current recommendation hot water and topical lidocaine
- Sea water and using credit card to scrape off nematocysts may be beneficial if intact
- NB: For certifying exams probably still recommend vinegar (acetic acid)

**Irukandji Syndrome (Carukia barnesi)**

- Small jellyfish therefore identifying difficult
- Initially sting appears minor
- Within 30 minutes toxin causes massive catecholamine release
- Clinically see severe muscle cramps, diaphoresis, agitation, severe hypertension, myocardial infarction, cardiomyopathy, cardiopulmonary arrest
- Treatment supportive alone although intravenous magnesium may have a role

**Rapid Review**

**Scombroid**

*Acute onset, flushing, peppery taste, resp uncommon*

**Ciguatera**

*Initial GI sx, Hot/Cold, Mannitol?*

**Tetrodotoxin**

*Initial paresthesia, paralysis, intubate early*

**Rapid Review**

**Paralytic shellfish**

*Acute onset paresthesia, paralysis, respiratory possible*

**Neurotoxic shellfish**

*Acute onset, less severe but can see seizures*

**Diarrhea shellfish**

*Acute onset within hours, supportive care*

**REPORT IF SUSPECT**