Project: Ghana Emergency Medicine Collaborative

**Document Title:** Toxic Seafood Ingestions

Author(s): Jim Holliman, M.D., F.A.C.E.P. (Uniformed Services University) 2012

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# **Toxic Seafood Ingestions**

Jim Holliman, M.D., F.A.C.E.P. Professor of Military and Emergency Medicine Uniformed Services University of the Health Sciences Clinical Professor of Emergency Medicine George Washington University Bethesda, Maryland, U.S.A.

#### **Toxic Seafood Ingestions**

- Ciguatera
- Scombroid
- Shellfish (PSP, NSP)
- Tetrodotoxin
- Clupeotoxin
- Structure-specific toxins
- Miscellaneous toxins
- Parasites

#### **Ciguatera Fish Poisoning**

- Demographics
  - The most commonly reported fish-borne illness worldwide
  - Most common non-bacterial food poisoning in US
  - 90 % of cases from Florida, Puerto Rico, Virgin Islands, Hawaii
  - 400 species of fish implicated
  - Most common species (carnivorous reef fish) : Grouper, barracuda, snapper, sea bass
  - No deaths reported ever from US
  - ? 50,000 cases / year





Ginkgo, <u>Wikimedia Commons</u>

#### Large grouper

### Pathophysiology of Ciguatera Poisonings

- Caused by 5 toxins produced by dinoflagellate Gambierdiscus toxicus
- Concentrated up the food chain ; larger and older fish are more toxic
- Ciguatoxin(s) is heat stable, resistant to gastric acid and freezing ; not harmful to fish itself
- Acts as anticholinesterase, alpha-adrenergic, calcium channel blocker, and other effects

#### **Symptoms of Ciguatera Poisoning**

- Onset 1/2 to 3 hours after ingestion, increased severity over next 3 to 6 hours
- Common at outset : Emesis, watery diarrhea, cramps, usually resolve in 24 to 48 hours
- Neuro Sx : May appear early or even start days later : Pathognomonic : Reversal of hot and cold tactile perception : may last for months ; May have numbness, paresthesias (nondermatomal), vertigo, tremor, blurred vision, ataxia, coma
- Pruritis : may persist for weeks ; Worse with exercise or ETOH use
- Toxin accumulates in humans : so prior illness causes more severe second reaction
- Dx : Clinical only ; no confirmatory tests available. Immunoassay can identify toxin in fish

#### **Rx of Ciguatera Poisoning**

- Supportive only
- Gastric lavage / activated charcoal if caught early
- Prochlorperazine (10 mg) or hydroxyzine (50 mg) IM for GI Sx
- IV LR / NS + IV CaCl2 for hypotension
- Acetaminophen for H/A; Indocin for other pains
- Amitriptylene (25 mg po bid) for paresthesias
- Mannitol (1 gm/kg) IV for neuro Sx
- Avoid any fish ingestion for 6 months

#### **Ciguatera Poisoning Prevention**

- Avoid :
  - Barracuda ingestion
  - Larger (> 5 lbs) fish ingestion
  - Viscera ingestion (higher toxin content)

#### **Scombroid Poisoning**

- Demographics
  - 5 % of all cases of food poisoning reported to CDC
  - Many more cases may be misdiagnosed as fish allergy
  - Most common causative species : Dolphin (mahi-mahi), tuna, mackerel, jacks, bluefish
  - No deaths reported

### Pathophysiology of Scombroid Poisoning

- Due mostly to accumulation of histamine (levels of 50 to > 400 mg/gm) <u>+</u> cadaverine and putrescine in fish meat due to bacterial decomposition of inadequately preserved or refrigerated fish meat
- Dark (red) muscled fish most affected
- Toxins are heat stable ; not affected by cooking
- Fish may taste metallic or peppery, but often taste normal

#### **Symptoms of Scombroid Poisoning**

- Occur in 15 to 90 minutes after ingestion
- Flushing, H/A, dizziness, burning sensation, pruritis, urticaria, <u>+</u> angioneurotic edema, dizziness <u>+</u> N/V/D, <u>+</u> tachycardia / palpitations / hypotension, (mimics MSG sensitivity)
- Sx resolve (even without Rx) in 12 to 24 hours

#### **Rx of Scombroid Poisoning**

- Supportive only
- Antihistamines <u>+</u> cimetidine
- <u>+</u> epi / steroids / Beta 2 aerosols for severe Sx
- No restriction on eating fish subsequently (not an allergy to fish)



**© PD-INEL** Source Undetermined

#### 68 year old male with scombroid poisoning

#### Paralytic Shellfish Poisoning (PSP)

- Demographics
  - Caused by ingestion of bivalve mollusks (clams, oysters, scallops, mussels), limpets, chitons, starfish, reef crabs, marine snails which have accumulated toxins from filtered dinoflagellates Protogonyaulax
  - Occur from May to November ; associated with "red tides"
  - Case fatality rate 8 to 9 %; deaths in 1 to 12 hours from respiratory failure

#### Pathophysiology of PSP

- Due to saxitoxin : inhibits Na channels in membranes
- Estimated lethal dose : 0.3 to 1 mg
- Single mollusk may contain 30 to 50 mg
- Toxin is heat stable
- No assay available

#### **Symptoms of PSP**

- Start in 30 minutes
- Paresthesias of mouth and limbs
- Then lightheadedness, ataxia, vertigo, weakness, sensation of loose teeth
- May progress to flaccid paralysis / respiratory failure
- GI Sx uncommon

#### **Treatment of PSP**

- Toxin less stable if alkaline, so IV bicarb may help
- Respiratory support (intubate, ventilate) for respiratory insufficiency

#### **Neurotoxic Shellfish Poisoning**

- Caused by brevitoxin from Ptychodiscus dinoflagellate
- Milder than PSP ; usually does not progress to paralysis ; Otherwise same info applies as for PSP
- Toxin aerosolized by surf from red tide can cause respiratory Sx like asthma and rhinorrhea ; Sx abate when leave the beach ; Rx if needed just like asthma

#### **Tetrodotoxication**

- Caused by tetrodotoxin in puffer fish (Fugu), porcupine fish, ocean sunfish, blue-ringed octopus
- Case fatality rate of 50 to 60 % in Japan (Fugu is delicacy there prepared by specially licensed chefs)
- Reason for its popularity is that a sublethal dose causes a "high"

#### Symptoms of Tetrodotoxication

- Onset 10 min to 4 hours
- Oral paresthesias
- N/V/D/ abdominal pain, weakness, ataxia
- Progresses to paralysis, seizures, bronchospasm, coma, hypotension, respiratory failure ; May cause DIC

#### **Treatment of Tetrodotoxication**

- Gastric lavage if within 4 hours ; activated charcoal
- IV fluids / dopamine for hypotension
- Respiratory support as needed
- Edrophonium 10 mg IV or neostigmine 0.5 mg IM (cholinesterase inhibitors)

#### **Clupeotoxin Fish Poisoning**

- Demographics
  - Due to plankton-feeding fish which ingest blue-green algae and dinoflagellates ; rarely reported
  - Implicated fish : Herrings, sardines, anchovies, tarpons, bonefishes, deepsea slickheads
  - Viscera highly toxic
  - Toxin does not impart unusual taste or odor to the fish

#### **Symptoms of Clupeotoxin Poisoning**

- Onset "violent" in 30 min to 2 hours
- Metallic taste N/V/D/ abdominal pain
- Next : Chills, H/A, paresthesias, cramps, vertigo
- Then : Hypotension, CHF, death
- Mortality up to 45 %
- Rx : supportive only

#### Miscellaneous Shellfish Poisonings

- Abalone poisoning (Japanese abalone)
  - Sx : Urticaria, erythema, pruritis, edema, skin ulceration
  - Rx : Supportive
- Tridaona clam poisoning
  - Giant clams from French Polynesia
  - Sx : N/V/D, tremor, ataxia ; Can be fatal
  - Rx : Supportive
- Whelk poisoning / ivory shell poisoning (Japan)
  - Sx : N/V/D/ abdominal pain, H/A
  - Rx : Supportive

#### Misc. Shellfish Poisoning (cont.)

- Diarrhetic shellfish poisoning (DSP)
  - Caused by shellfish contaminated with dinophysistoxins from dinoflagellates
  - Sx : Rapid onset diarrhea/N/V/ abdominal pain/ chills
  - Self limited ; may last 2 days
- Callastin shellfish poisoning
  - Due to cholinergic compounds in the ovaries of the Japanese Callista clam, only in May to September (spawning)
  - Sx : (Cholinergic crisis) onset in one hour : pruritis, urticaria, facial numbness and paralysis, hypersalivation, diaphoresis, fever, N/V/D, bronchospasm, bronchorrhea
  - Rx : Supportive + atropine (0.5 mg IV q 5 to 10 min to 2 mg)

#### Misc. Shellfish Poisoning (cont.)

- Venerupin shellfish poisoning
  - Due to Japanese lake-harvested oyster or clam
  - Sx : Initial GI distress then liver failure at 48 hours (like acetominophen toxicity)
  - Fatal in 33 %
  - Rx : Supportive ; no specific antidotes or preventives
  - If suspected, hospitalize for 48 hours at least

#### Misc. Shellfish Poisoning (cont.)

- Gastroenteric shellfish poisoning
  - Pressure-cooker steaming causes shells to open at 60 seconds but takes 4 to 6 min of steaming for internal mollusk temp. to reach > 100<sup>o</sup> C which kills most bacteria and viruses except polio virus
  - Potential pathogens from raw or poorly cooked shellfish : (also transmissible from accidentally swallowed seawater while swimming or diving) :
    - Bacteria : Salmonella typhi, campylobacter, shigella, enteropathogenic E.Coli
    - Vibrios : Vibrio cholerae, V. Vulnificus, V. Parahemolyticus
    - Viruses : Hepatitis A & B, coxsackie, Norwalk, polio

### Miscellaneous Marine Organisms Toxic Ingestions

- Ichthyocrinotoxication
  - Produced by ingestion of glandular (non-venom) secretions usually from skin secretions, foams, or slimes
  - Examples : Lampreys, hagfish, moray eels, toadfish, puffer fish, porcupine fish, trunk fish
  - Sx : N/V/D/ abdominal pain, weakness
  - May take 3 days to resolve
  - Rx : Supportive <u>+</u> IV rehydration
  - Prevention : Don't eat suspect fish skin ; wash well prior to handling

#### Ichthyohemotoxication

- Due to toxic effects of undercooked blood in fish
- Mainly in eels
- Causes mostly GI symptoms
- Usually self-limited

#### Ichthyohepatotoxication

- Toxic liver of fish ; rest of fish may be OK
- Mainly in mackerel, sea bass, skates, rays, tropical sharks
- Part of toxicity may be due to hypervitaminosis A
- Sx : N/V/D, H/A, <u>+</u> neuro Sx
- Rx : Supportive

#### Ichthyootoxication

- Due to toxic fish gonads ; toxin not inactivated by heat
- Example fish : Sturgeon, gar, salmon, minnow, carp, catfish, perch, sculpin
- Sx : N/V/D, H/A ; can cause hypotension & death
- It's OK to fondle gonads but don't eat them

#### **Ichthyoallyeinotoxication**

- Induces hallucinatory fish poisoning ; No fatalities reported ; similar to phencyclidine
- Heat stable toxin in head, brain, spinal cord
- Example fish : Chub, mullet, goatfish, grouper, rock cod
- Sx : Onset 5 to 90 min. : dizziness, cirumoral paresthesias, diaphoresis, ataxia, hallucinations, nightmares
- Rx : Supportive <u>+</u> haloperidol / diazepam

#### Gempylotoxication

- Due to oil with purgative effect in pelagic mackerels
- Sx : Cramps, bloating, diarrhea ; often no "toxic" sx
- Resolves over 12 to 18 hours

#### **Miscellaneous Poisonings**

- South Pacific green or brown anemones : if ingested can cause rapid onset coma ; respiratory failure, hypotension, death ; No known antidote ; Rx : supportive
- Cephalopod poisoning ; in Japan : due to some squid and octopus ; Sx : N/V/D, H/A, <u>+</u> paralysis, Sz ; Can cause death
- Grass carp gall bladder poisoning : raw gallbladder of the Asian freshwater grass carp eaten as an antirheumatic ;
- Sx : (After several hours) : N/V/D, abdominal pain, elevated LFT's, ARF (ATN) ; May require dialysis for support

#### Miscellaneous Poisonings (cont.)

- Sea cucumber poisoning
  - Holothurin in these can cause selflimited gastroenteritis
- Chelonintoxication : due to toxins in marine turtle meat
  - Sx : N/V/D, ulcerative stomatitis, hepatic necrosis, renal failure ; 30 to 40 % mortality
  - Rx : Supportive only





Daphne, Wikimedia Commons



#### **Parasites From Ingested Fish**

- Fish tapeworm (Diphyllobothrium latum) from uncooked fish, esp. salmon
  - Sx : Abdominal pain, N/V/D, weight loss, megaloblastic anemia
  - Dx : Stool for O & P
  - Rx : Niclosamide ; available from CDC in Atlanta



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## Fish Tapeworm

#### Anisakiasis

- Nematodes found in viscera and muscles of fish such as herring, Pacific cod, coho salmon, rockfish, Pacific perch
- Seals and whales are also definitive hosts
- Sx : (If uncooked fish ingested) severe epigastric pain, N/V ; Cause gastritis initially ; May get into intestine and mimic appendicitis or SBO
- Rx : Endoscopy and pull worms out with forceps ; Any remaining worms usually die in a few days ; Chemo Rx agents not effective

#### Anisakiasis

 In the Netherlands, Scandinavia, and the Orient, Anisakis larvae ingested with sushi or herring have caused changes that stimulate Crohn's disease, eosinophilic enteritis, acute appendicitis, gastric tumor, or an acute abdominal crisis

#### Eustrongyloides

- Nematodes that parasitize minnows
- If ingested (uncooked minnows), can grow and then penetrate intestinal wall causing peritonitis ; may need surgical Rx



Source Undetermined

Eustrongyloides emerging from protective sac that enables parasites to live in marrow

### Toxic Seafood Ingestions Lecture Summary

- Seafood is best enjoyed cooked, but unfortunately not all toxins are heat inactivated
- Watch out if you're eating seafood in Japan
- You're nuts if you eat sushi after hearing this lecture