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Toxic Seafood Ingestions

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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
Large grouper

Ginkgo, Wikimedia Commons
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 (non-dermatomal), 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) + 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, + angioneurotic edema, dizziness + N/V/D, + tachycardia / palpitations / hypotension, (mimics MSG sensitivity)
- Sx resolve (even without Rx) in 12 to 24 hours
Rx of Scombroid Poisoning

- Supportive only
- Antihistamines ± cimetidine
- ± epi / steroids / Beta 2 aerosols for severe Sx
- No restriction on eating fish subsequently (not an allergy to fish)
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 brevotoxin 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 Tetrodotoxicication

- 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, deep-sea 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 acetaminophen 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°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 + IV rehydration
  - Prevention: Don't eat suspect fish skin; wash well prior to handling
Ichthyohemotoxicication

- 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, + neuro Sx
- Rx: Supportive
Ichthyoootoxication

- 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 phencyclididine
- Heat stable toxin in head, brain, spinal cord
- Example fish: Chub, mullet, goatfish, grouper, rock cod
- Sx: Onset 5 to 90 min.: dizziness, circumoral paresthesias, diaphoresis, ataxia, hallucinations, nightmares
- Rx: Supportive + haloperidol / diazepam
Gempylotoxicication

- 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, + 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 self-limited 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
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
Fish Tapeworm

Centers for Disease Control and Prevention, Wikimedia Commons
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.
Eustrongyloidoides

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