MARINE ENVENOMATION & FOOD POISONING

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DISCLOSURES:

None relevant to this presentation.

MARINE TOXIN EXPOSURES COVERED TODAY:

ENVENOMATIONS:

- NONPENETRATING:
  - Box jellyfish
    - Irukandji syndrome
  - Portuguese man-of-war
- PENETRATING:
  - Stingrays
  - Venomous fish
    - Lionfish
    - Stonefish
  - Blue-ringed octopus

FOOD POISONING:

- Tetrodotoxin
- Scombroid
- Ciguatera

CASE:

10M brought in by his mother from a nearby Florida beach with severe pain in his R foot that began 25 minutes prior. He was walking along the shoreline through washed-up seaweed and drift material when he stepped on something “slimy” that caused immediate, severe, “burning” pain. He denies difficulty breathing or LOC and has no PMHx.

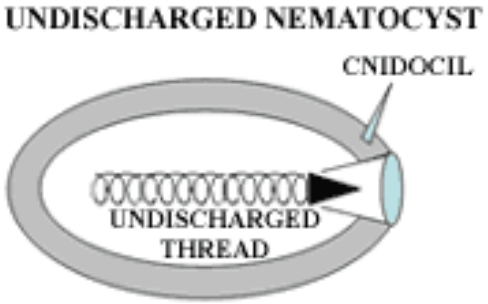
VS: BP 90/60 | HR 110 | RR 20 | T 99F | SpO2 98% on RA

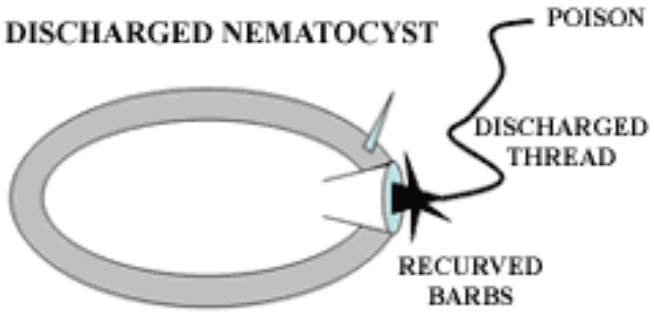
He’s crying throughout; Skin exam of the sole and both sides of his R foot reveals several erythematous band-like marks with what appear to be beads of raised welts along them.

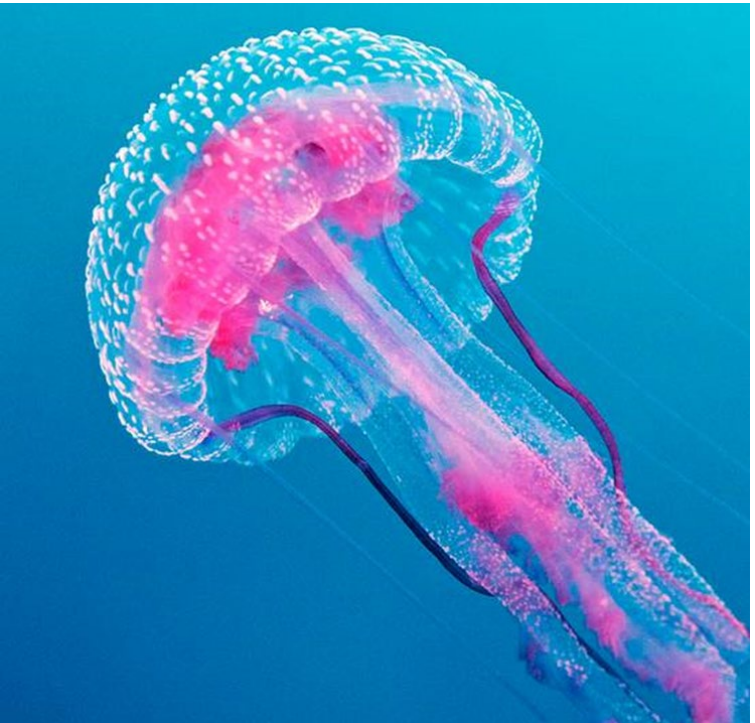
MARINE ENVENOMATIONS

VENOM PROTEINS:

- High molecular weight
- HEAT-LABILE
    - Compared to food poisoning toxins which are heat-stable







JELLYFISH

Cnidaria

- Invertebrates
- All *Cnidaria* have **cnidae**
  - Some are just stronger than others
- Nematocyst (a.k.a. "cnidocyst")
  - Thousands of cnidae
  - "Cnidocil" discharges nematocyst in response to pressure, osmotic change, etc.

BOX JELLYFISH

Chironex fleckeri

- "Sea wasp"
- Indo-pacific box jellyfish

- 1-15 tentacles each up to 7 meters long at each of its 4 corners
- Found along northern coast of Australia and the tropical pacific
- Responsible for >80 deaths in past century
  - Highest morbidity and mortality of all Cnidaria

BOX JELLYFISH

- Millions of nematocysts/jellyfish tentacle
- Venom
  - Cardiotoxic/myotoxic
  - Increases intracellular Na/Ca
- Most stings are minor
  - Death possible within 5 minutes with severe envenomations

BOX JELLYFISH

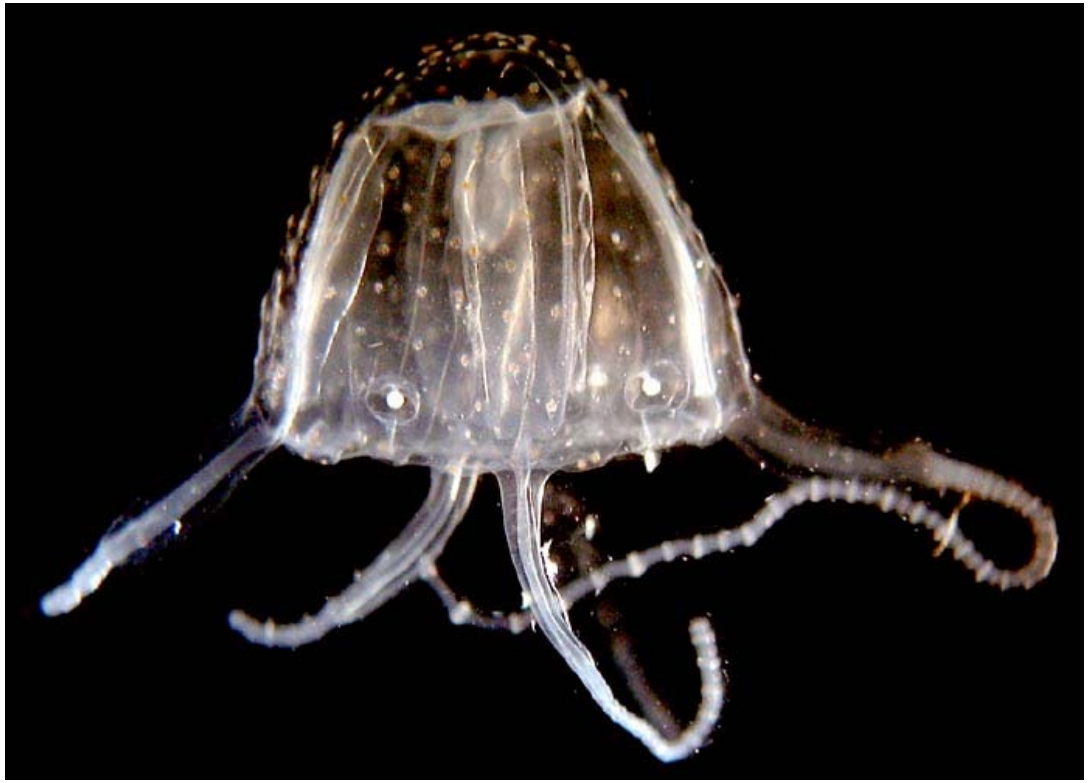
- Clinical Manifestations
  - Immediate pain
  - Skin wheals/vesicles with wide banding
    - Pathognomonic “frosted ladder”
  - Delayed hypersensitivity reaction common
  - Hypotension/cardiac arrest
    - Children

BOX JELLYFISH

- ANTIVENOM
  - Give IMMEDIATELY
  - Can help control pain
  - 3 ampules IM above the sting sites

IRUKANDJI SYNDROME

- *Carukia barnesi*
- *Carybdea alata*
- *Malo maxima*
- *Alatina mordens*



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SYMPTOMS

- Often delayed and there may be little to no local symptoms
  - Initial sting hardly felt
  - Syndrome onset ~ 30 minutes later

- Symptoms of catecholamine surge
  - Myalgias
    - Sacral pain initially
  - Nausea, vomiting, headache, diaphoresis
  - Generalized erythematous rash
  - Vasoconstriction → severe HTN
  - Can develop pulmonary edema, CM in severe cases

MANAGEMENT

- Irrigate
  - Vinegar in Indo-pacific waters
  - Sea water or normal saline
- Analgesia
- Irukandji syndrome
  - Magnesium
  - Manage HTN
    - Alpha blocking agent

PORTUGUESE MAN-OF-WAR

PORTUGUESE MAN-OF-WAR

- *Physalia sp.*
  - Responsible for thousands of stings in US
    - Found along Atlantic/Gulf coasts
  - Tentacles may be up to 30 meters
- Most envenomations minor, deaths rare
  - Immediate pain/skin reaction
    - "String of beads"
    - Can develop N/V, chest pain, abdominal cramping in severe cases, often delayed
- *Can use hot water to deactivate venom*

JELLYFISH TREATMENT SUMMARY

- Supportive care
- Irrigate
- Remove tentacles
- Wound care
- Pain meds
- Consider prophylactic antibiotics
- Monitor for delayed reactions

QUESTION:

10M brought in by his mother from a nearby Florida beach with severe pain in his R foot that began 25 minutes prior. He was walking along the shoreline through washed-up seaweed and drift material when he stepped on something "slimy" that caused immediate, severe, "burning" pain. He denies difficulty breathing or LOC and has no PMHx.

VS: BP 90/60 | HR 110 | RR 20 | T 99F | SpO2 98% on RA

He's crying throughout; Skin exam of the sole and both sides of his R foot reveals several erythematous band-like marks with what appear to be beads of raised welts along them.

What should you do for this patient?

- ✓ Give pain medication and immerse the foot in hot water. Monitor for systemic s/s

PORTUGUESE MAN-OF-WAR

The tentacles of the Portuguese man of war have nematocysts that remain active after the creature has washed ashore and appears dead. The band or whip-like streaking with bands of wheals or bullae are characteristic of its sting.

Hot water immersion has been demonstrated to provide superior pain relief, but seawater can be used if hot water is not available. Don't burn pt from prolonged immersion in very hot water.

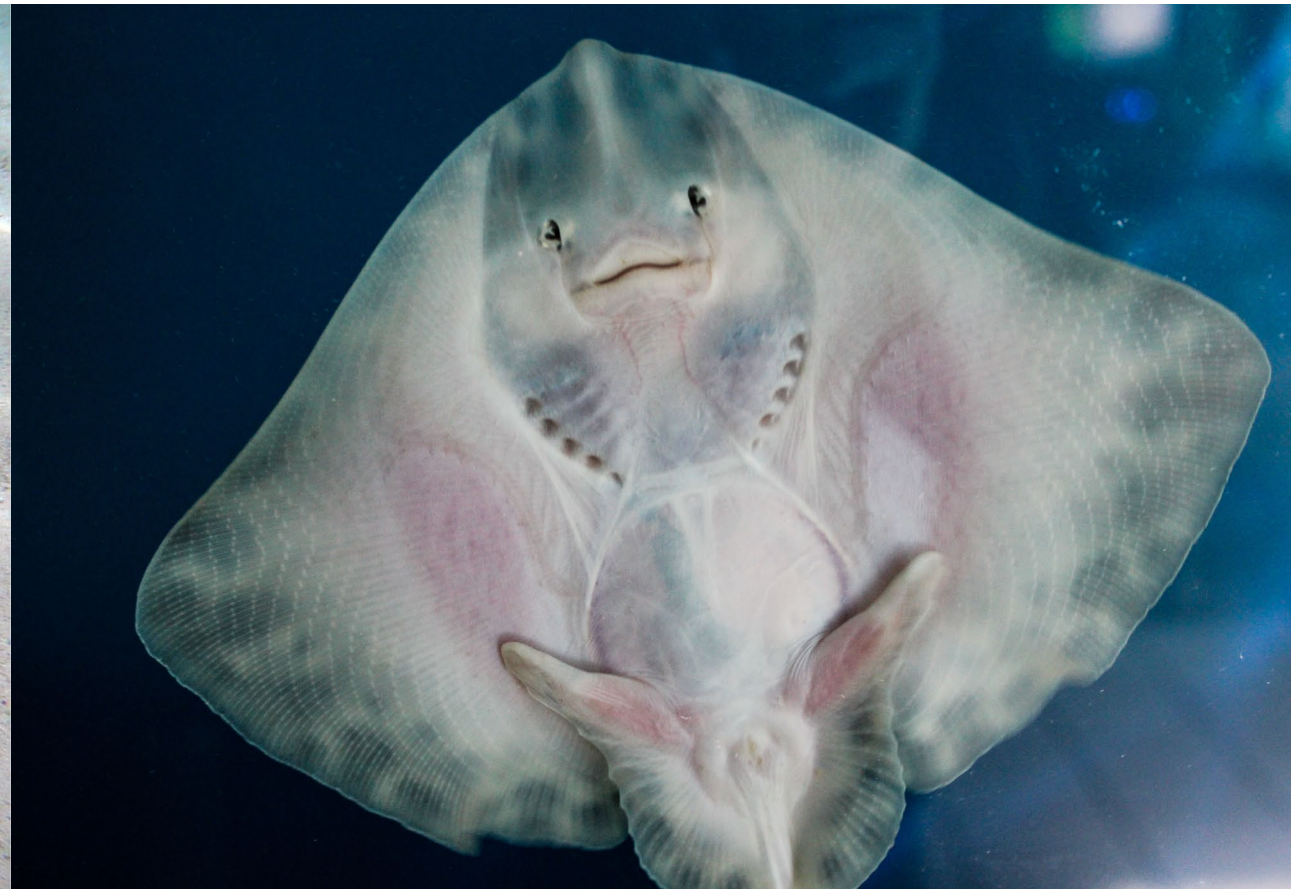
Systemic findings have been reported, including nausea, vomiting and muscle cramps, so the patient should be monitored for 6 hours.

MARINE ENVENOMATIONS

PENETRATING:

- STINGRAYS
- VENOMOUS FISH
  - LIONFISH
  - STONEFISH
- BLUE-RINGED OCTOPUS

STINGRAYS



*STIN*GRAY'S ANATOMY

Subset of cartilaginous fish known as *Rays*

- Flat body, large fused pectoral fins, ventral mouth
  - Several inches → 6.5 ft
  - Can weigh up to 800 lbs.
- The pointy end:
  - Tail has 1-3 spinal blades (aka stingers or barbs)
  - Each blade has rows of flesh-cutting spines
  - Under each spine: cells that store and secrete venom

STINGRAYS

Very common in tropical regions:

- Shallow marine waters, in or near coral reefs
- Freshwaters (e.g., inland rivers)
  - More venom, more toxic

The wounded:

- Men (*more than 80%)*
- Lower extremities
  - Often from accidentally stepping on the stingray
- Majority have low morbidity
  - Freshwater stings have higher rates of serious injury, complications, and fatalities

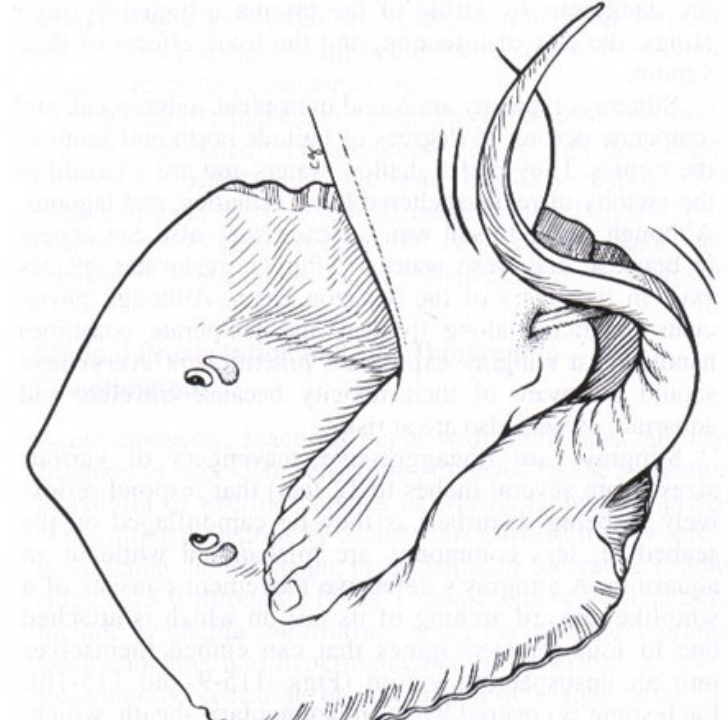
STINGRAYS

Venom:

- Phosphodiesterases, serotonin, 5’-nucleotidase

Presentation:

- Immediate pain, can last up to 48 hr
- Severe bleeding depending on site
- Systemic:
  - Uncommon, thought to be a response to intense pain
  - Onset within 30 minutes
  - Vomiting, dizziness, weakness, diaphoresis, syncope, muscle cramps, tachyarrhythmias, hypotension



LIONFISH

Pterois sp.

- Atlantic, Pacific, Caribbean
- Popular aquarium fish

- 12 or 13 dorsal spines with venom glands
    - Venom poorly characterized

PRESENTATION:

- Severe pain lasting 6-12 hours
- Systemic effects rare

MANAGEMENT: PENETRATING ENVENOMATIONS

Immediate:

- Irrigate wound
- Remove visible foreign bodies
- Control bleeding
- Hot water immersion ASAP
  - T: 110 – 114 F (43.3 – 45.6 C)
  - Provide additional pain relief
    - Topical lidocaine without epinephrine
    - Systemic analgesics
  - *END POINT: until pain is relieved*
    - Often occurs within 10 – 30 minutes

MANAGEMENT: PENETRATING ENVENOMATIONS

Once pain controlled:

- Wound care
  - Clean wound (aseptic)
  - Re-explore for FBs
  - Debride necrotic tissue
- Obtain soft-tissue imaging when possible
- Abx?
  - Only if large wound or considerable FBs

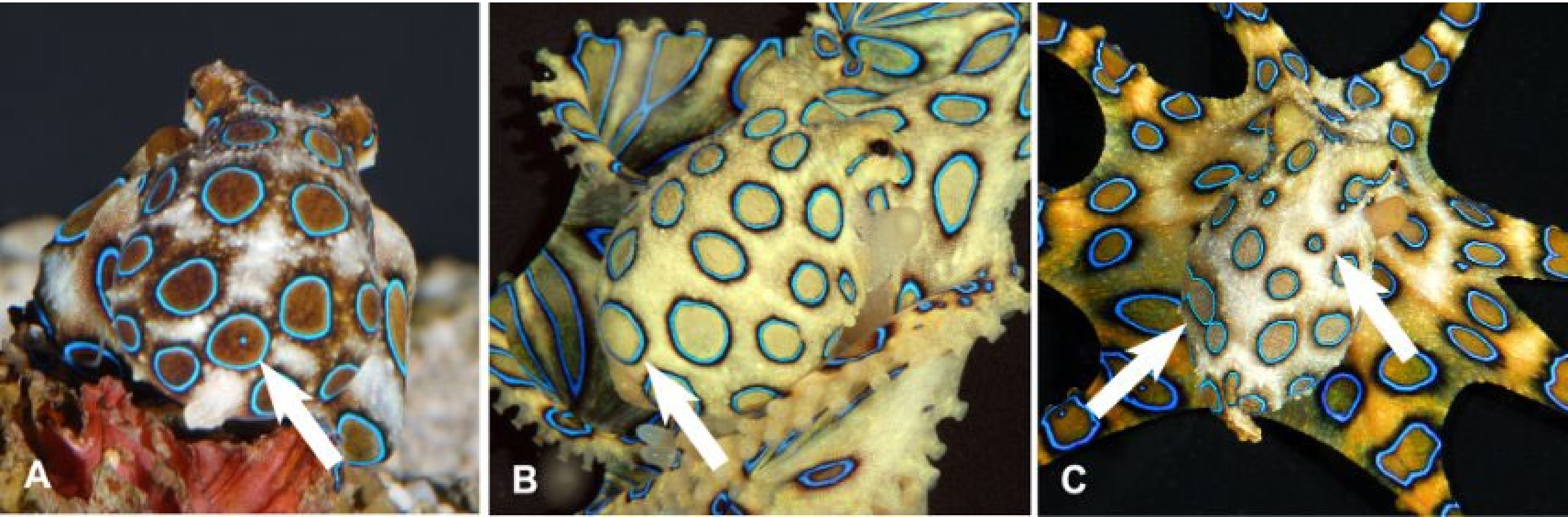
MANAGEMENT: STONEFISH

STONEFISH ANTIVENOM:

- Indication:
  - Severe systemic reactions to stonefish, maybe other venomous fish
- Administration:
  - IV more effective than IM
- Adverse effects:
  - Horse serum
    - ANAPHYLAXIS
    - SERUM SICKNESS

BLUE-RINGED OCTOPUS

Hapalochlaena lunulata



BLUE-RINGED OCTOPUS

- SMALL as a pea up to 8 inches across
- Warm waters around Japan and Australia
- Bites:
    - Upper extremity, usually from picking it up
    - Bite is small, painless, often unnoticed
        - Can turn into non-healing ulcer/scab with regional LAD

Q: What TOXIN is responsible for systemic toxicity?

- Tetrodotoxin
    - Stored in flesh to infect predators/released when bite
    - Sodium channel blockade

BLUE-RINGED OCTOPUS

PRESENTATION

- Majority: no symptoms or only mild local numbness/paresthesias

- SEVERE ENVENOMATION:
    - Nausea & vomiting
    - Progressive flaccid paralysis
        - Respiratory failure
    - Can begin within 10 minutes

BLUE-RINGED OCTOPUS

MANAGEMENT

- Pressure immobilization
    - Lymphatic occlusive bandage until definitive care is reached

- Supportive care
    - Mechanical ventilation
    - No antidote/antivenom
    - Expect full recovery in 1-5 days

MARINE FOOD POISONINGS COVERED TODAY:

- Tetrodotoxin
- Scombroid
- Ciguatera

TETRODOTOXIN

- Pufferfish
- Porcupinefish
- Sunfish (*Mola spp*)
- Mollusks
  - Ivory shell
  - Lined moon shell
  - Calf moon shell
  - Bladder moon shell
  - Trumpet shell
- Australian blue-ringed octopus
- Starfish
- Xanthid crab, Mangrove horseshoe crab
- Ribbon worm, Flat worm

TETRODOTOXIN

- Pufferfish
  - Marine bacteria produce TTX
  - Highest concentration in spawning season
  - Heat-stable, withstands freezing

- Most human exposures: *Fugu*
  - Specially prepared dish of raw pufferfish fillet
  - TTX concentrations:
    - Ovaries > liver >> intestines/skin >> muscle

PATHOPHYSIOLOGY

- Blocks nerve action potentials
  - Voltage-gated, fast sodium channels
  - Stops axonal transmission
    - Without affecting the neuromuscular junction
- Peripheral vasodilation
  - Independent of α- or β- adrenergic receptors
- Dose-dependent

CLINICAL PRESENTATION

- Onset: within 30 minutes (up to 4 hr)
- Initial s/s:
  - Paresthesias of lips and tongue
- Followed by:
  - General: Diaphoresis, weakness, cyanosis
  - GI: N/V, abdominal pain
  - HEENT: hypersalivation, dysphagia, aphonia, blurred vision
    - Initial miosis → mydriasis with poor pupillary reflex
  - Resp: dyspnea, bronchorrhea, bronchospasm
  - Neuro: ataxia, body paresthesias

CLINICAL PRESENTATION

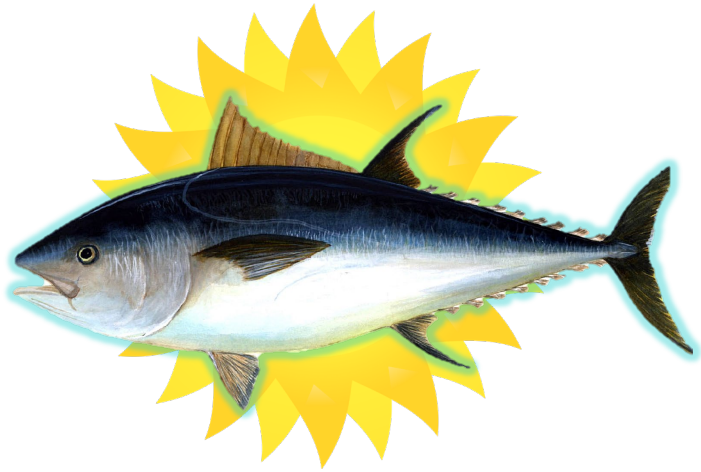
- Life-threatening
  - Disseminated intravascular coagulation-like syndrome
    - Petechial skin hemorrhages → bullous desquamation
  - Hypotension
    - Profound, refractory
  - Bradycardia, AV node conduction abnormalities
  - Respiratory paralysis, CV collapse → death

MANAGEMENT

- GI Decon:
  - Activated charcoal if no contraindications
- Bradycardia:
  - Atropine
- Hypotension:
  - IV fluids, norepinephrine, phenylephrine
- Respiratory support, ventilation

- Minor intoxication:
  - Paresthesias, mild dysphagia
  - Monitor in ED or ICU for at least 8 hours
    - Can consider discharge after 8 hours IF symptoms are improving

SCOMBROID



- Most common US seafood poisoning reported

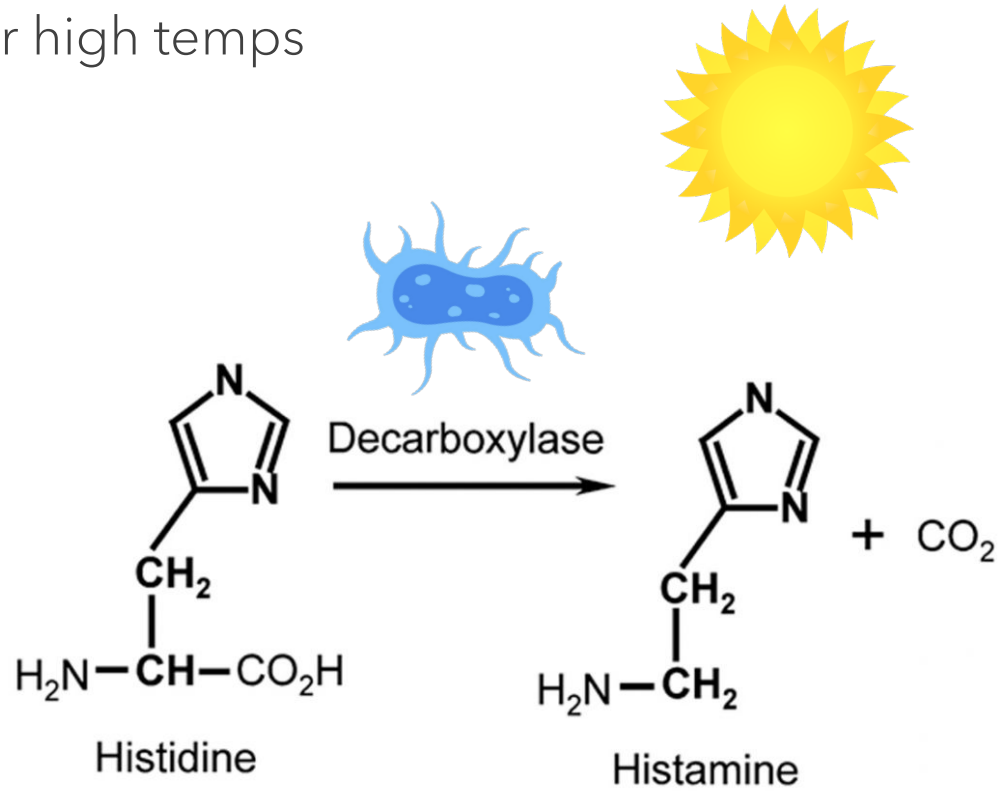
- Scombridae family
  - Tunas
    - Albacore
    - Bluefin
    - Yellowfin
  - Mackerel
  - Saury
  - Needlefish
  - Wahoo
  - Skipjack

- Non-Scombridae
  - Mahi-mahi (dolphinfish)
  - Kahawai
  - Sardines
  - Black marlin
  - Pilchard
  - Anchovy
  - Herring
  - Amberjack (yellowtail or kahala)
  - Australian ocean salmon

PATHOPHYSIOLOGY

- Inadequate preservation or refrigeration
  - Several hours of ambient or high temps
  - Bacterial decomposition

- High amounts of histamine
  - Heat stable
  - Metallic or peppery tase
  - Appears normal



CLINICAL PRESENTATION

- Symptoms onset: minutes
- Pseudo-allergic reaction
  - Headache
  - Diffuse erythema, pruritus, sensation of warmth
  - Flushing of the head, neck, and torso
  - N/V/D, Abdominal pain
  - Conjunctival injection
  - Burning of the mouth/oropharynx
  - Dizziness

CLINICAL PRESENTATION

- *Rare*:
  - Bronchospasm
  - Hypotension
  - Dysrhythmias
  - Generalized urticaria

- Caution
  - In underlying respiratory or CV disease
  - Taking Isoniazid

MANAGEMENT

- Self-limited illness
  - Average duration: 6-12 hours

- Can try a combo of H1 & H2
  - H1 receptor antagonists
    - Diphenhydramine, Hydroxyzine
  - H2 receptor antagonists
    - Famotidine, Ranitidine

- Other supportive care:
  - Ondansetron, analgesics, IV fluids, bronchodilators

PREVENTION

- Only effective measure:
  - Consistent temperature control < 40 F (4.4 C)

- Warning signs
  - Improper handling
  - Ammonia smell
  - “Dull” packaged fish
    - Fresh fish appear sheen/oily rainbow

- Notify local public health authorities if sick

CIGUATERA

- Subtropical and tropical Indo-Pacific and Caribbean
- Toxin found in warm water, bottom-dwelling reef fish
  - Fish species examples: barracuda, sea bass, parrot fish, red snapper, grouper, amber jack, kingfish and sturgeon
- Incidence: about 50,000 - 500,000 cases per year
  - Most occur in Pacific islands but increasing number in mainland US

CIGUATOXIN

- Produced by microalgae genera Gambierdiscus and Fukuyoa
- Multiple ciguatoxins: CTX-1A to CTX-4B
  - Starts as CTX-4B in microalgae
  - Big fish eats the smaller fish…
    - Each transfer results in biotransformation
      - CTX-4B ultimately converted to CTX-1B (most toxic)
        - Heat stable
        - lipid soluble
        - acid stable
        - odorless
        - tasteless

PATHOPHYSIOLOGY

- Binds voltage-sensitive Na channels = increased Na permeability
  - Na influx causes both depolarization and cellular swelling
- Clinical features suggest affinity for sensory afferent nerve fibers
- Variety of ciguatoxins = variable symptoms and severities

CLINICAL EFFECTS

- General:
  - Profuse diaphoresis, headaches, myalgias and arthralgias
- Gastrointestinal:
  - Abdominal pain/cramps, nausea, vomiting, profuse watery diarrhea
  - Lasts 24-48 hours
- Cardiovascular:
  - Bradycardia and orthostatic hypotension
- Respiratory:
  - Respiratory paralysis only in severe cases

CLINICAL EFFECTS

- Genitourinary:
  - Dyspareunia and vaginal/pelvic discomfort

- Neurological:
  - Seizures
  - Peripheral dysesthesias/paresthesias, reversal of temperature discrimination***
  - Numbness of tongue, lips, throat and perioral area
  - Pruritis
  - Feeling of loose/painful teeth, metallic taste
  - Ataxia, weakness, vertigo
  - Visual disturbance

- Can last days to weeks and have relapsing symptoms

DIAGNOSTIC STUDIES

- Diagnosis is clinical
  - GI symptoms followed by paresthesias, cold dysesthesia and pruritus after eating seafood
- Rule out other causes

- Can send out Ciguatera specific testing:
  - ELISA test for Ciguatera toxin
  - High-pressure Liquid Chromatography
  - In development: dipstick immunobead assay test for field use to test fish

TREATMENT

- Supportive care
  - GI symptoms common- IV fluids & electrolyte replacement
- Activated charcoal may be of some benefit
- Atropine for bradycardia, can also help with diarrhea
- Anti-histamines for pruritus
- IV Mannitol?
- Amitriptyline, gabapentin and pregabalin have variable beneficial effect on long-lasting neurological dysfunction

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THANK YOU

QUESTIONS?

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