

Marine Envenomations

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MARINE VENOMS

- Denature membranes
- Catabolize cyclic 3', 5'-AMP
- **Degranulate mast cells**
- **Provoke histamine release**
- Initiate arachidonate metabolism
- Accelerate coagulopathies
- Disrupt cellular transport
- Impede neuronal transmission
- Induce anaphylaxis and shock

STINGRAYS LIFE AND HABITS

- Most commonly incriminated group of fishes with respect to human envenomation
- 11 species found in U.S. coastal waters
- 1 to 4 venomous stings on the dorsum of caudal appendage
- Spine is retroserrated vasodentine substance with associated venom glands
- Injuries are most common to lower extremity with laceration and envenomation
- Integumentary sheath is ruptured, releasing venom into the wound

STINGRAY ENVENOMATION CLINICAL ASPECTS

- Immediate intense pain with central radiation
- Spine tip(s) may break off and remain in the wound
- Thorax or abdomen may be penetrated
- Wound is edematous and hemorrhagic, occasionally dusky or mottled
- **Rapid fat and muscle hemorrhage and necrosis**
- Systemic effects include: nausea, vomiting, diarrhea, diaphoresis, vertigo, headache, seizures, syncope, fasciculations, paralysis, hypotension, arrhythmias, and death

THERAPY FOR STINGRAY ENVENOMATION - I

- Extract spine(s), spine fragments and shards of integumentary sheath
- **Immerse the wound(s) into nonscalding hot (113° F or 45° C) water to tolerance for 30 to 90 minutes or until there is significant pain relief**
 - If pain recurs, repeat the immersion
 - **Do not use cryotherapy**
- Local anesthetic (without epinephrine) infiltration or nerve block to control pain
- **Debride and explore to remove foreign material**
- Irrigate with warmed saline

THERAPY FOR STINGRAY ENVENOMATION - II

- X-ray to visualize radiopaque foreign body
 - Consider an advanced imaging technique (e.g., MRI)
- Operate to remove all retained foreign material
- Do not suture wound(s) closed if at all possible; leave open for delayed primary closure; consider beraplermin gel (Regranex) containing human-derived growth factor
- **Administer a prophylactic antibiotic**
- Observe the victim for 4 hours for onset of systemic effects

THE MARINE ENVIRONMENT

Ocean water: a saline milieu for microbes

- Sodium chloride
- Sulfates
- Magnesium
- Potassium
- Bicarbonate
- Bromine
- Boric acid
- Strontium
- Fluorine

BACTERIA ISOLATED FROM MARINE WATER, SEDIMENTS, MARINE ANIMALS AND MARINE-ACQUIRED WOUNDS

- *Acinetobacter*
- *Actinomyces*
- *Aeromonas*
- *Alcaligenes*
- *Alteromonas*
- *Bacillus*
- *Bacteroides*
- *Chromobacterium*
- *Clostridium*
- *Deleya*
- *Enterobacter*
- *Erysipelothrix*
- *Legionella*
- *Mycobacterium*
- *Pasteurella*
- *Proteus*
- *Pseudomonas*
- *Salmonella*
- *Staphylococcus*
- *Streptococcus*
- *Vibrio*

MARINE BACTERIA - ANTIBIOTIC THERAPY

Minor Abrasions or Lacerations

- Prophylactic antibiotics not required in normal host with uncomplicated wound
- Persons who are chronically ill (e.g., diabetes, hemophilia, thalassemia), immunosuppressed (e.g., leukemia, AIDS, chemotherapy, glucocorticoids, extensive burns), or with serious liver disease (e.g., hepatitis, cirrhosis, hemochromatosis) require prophylactic antibiotics
- Use ciprofloxacin (can substitute another fluoroquinolone), trimethoprim-sulfamethoxazole, or doxycycline/tetracycline

MARINE BACTERIA - ANTIBIOTIC THERAPY II

Injuries with High Infection Potential

- Large lacerations, particularly with crush and significant contamination
- Extensive burns
- Deep puncture wounds, particularly of hands or feet
- Retained organic foreign material
 - Use prophylactic antibiotics
 - If surgery or hospitalization is necessary, parenteral antibiotic choices include trimethoprim-sulfamethoxazole, ciprofloxacin (or an alternative fluoroquinolone), tobramycin (or an alternative aminoglycoside), cefoperazone, cefotaxime, or ceftazidime
 - If outpatient treatment is elected, use ciprofloxacin (can substitute another fluoroquinolone), trimethoprim-sulfamethoxazole, or doxycycline/tetracycline

MARINE BACTERIA -ANTIBIOTIC THERAPY III

Infected Wounds: Anticipate *Vibrio* Infection

- Rapidly progressive cellulitis and/or myositis indicates *Vibrio vulnificus* or *V. parahaemolyticus* infection
- Culture for aerobes and anaerobes
- Pending culture results, parenteral antibiotic choices include
 - Imipenem-cilastatin or meropenem
 - Tobramycin/amikacin/gentamicin plus cefoperazone or piperacillin

CATEGORIES OF SCORPIONFISHES

- Genus *Pterois*
 - zebrafish, lionfish, tigerfish, turkeyfish, scorpionfish, firefish
- Genus *Scorpaena*
 - scorpionfish, bulltrout, sculpin
- Genus *Synanceja*
 - stonefish, stargazer, warty ghou

SCORPIONFISHES LIFE AND HABITS

- Venom organs; 12 to 13 (of 18) dorsal, 2 pelvic and 3 anal spines
- Pectoral spines are not venomous
- Each spine is covered with integumentary sheath and carries associated venom glands
- Animals are often extremely well camouflaged and difficult to locate, even for experienced divers

SCORPIONFISHES ENVENOMATION CLINICAL ASPECTS

- Immediate pain from puncture wounds
- Pain peaks at 60 to 90 minutes and persists up to 12 hours
- Wound initially ischemic, then cyanotic, then warm, red, and swollen
- Vesicles may form
- With severe sting, may have tissue necrosis and sloughing
- Indolent wounds require months to heal
- Systemic effects include: headache, tremors, maculopapular rash, nausea, vomiting, diarrhea, abdominal pain, diaphoresis, pallor, delirium, seizures, paralysis, lymphangitis, arthritis, fever, hypertension, respiratory distress, arrhythmias, congestive heart failure, pericarditis, hypotension, syncope, and death

THERAPY FOR SCORPIONFISH ENVENOMATION - I

- Extract spine(s), spine fragments, and shards of integumentary sheath
- Immerse the wound(s) into non-scalding hot (113° F or 45° C) water to tolerance for 30 to 90 min or until there is significant pain relief
 - If pain occurs, repeat the immersion
 - Do not use cryotherapy
- Local anesthetic (**without epinephrine**) infiltration or nerve block to control pain
- Debride and explore to remove foreign material
- Irrigate with warmed saline

THERAPY FOR SCORPIONFISH ENVENOMATION -II

- X-ray to visualize radiopaque foreign body
 - Consider an advanced imaging technique (e.g. MRI)
- Operate to remove all retained foreign material
- Do not suture wound(s) closed if at all possible; leave open for delayed primary closure
- Administer a prophylactic antibiotic
- Observe the victim for 4 hours for onset of systemic effects
- Consider administration of antivenom

OTHER MARINE VERTEBRATES THAT STING AND CAUSE INJURIES SIMILAR TO SCORPIONFISHES

- | | |
|----------------------------|-------------------|
| • Weeverfishes | • Rabbitfishes |
| • Catfishes | • Stargazers |
| • Dragonfishes | • Squirrelfishes |
| • Venomous (horned) sharks | • Sea robins |
| • Ratfishes | • Flying gurnards |
| • Toadfishes | • Goosefishes |

SEA URCHIN VENOM AND VENOM APPARATUS

- Free-living echinoderms with egg-shaped, globular, or flattened bodies
- Covered by tightly arranged spines and triple-jawed pedicellariae (seizing and envenoming organs)
- Spines can be brittle, hollow, sharp, and venom-filled
- Most persons envenomed when they step upon or brush against urchin

SEA URCHIN ENVENOMATION CLINICAL ASPECTS

- Intense local pain, radiating deep into the muscle
- Erythema and swelling
- Purple discoloration may represent spine dye or retained spine
- Entry into joint induces severe synovitis
- Metacarpal or MCP proximity can cause distal fusiform digit swelling
- Multiple punctures or pedecellarial envenomation can cause nausea, vomiting, paresthasias, local paralysis, syncope, hypotension, and respiratory distress

THERAPY FOR SEA URCHIN ENVENOMATION-I

- Extract easily grasped spine fragments
Do not crush spines within the soft tissues
- If pedicellariae are attached, remove these with a sharp edge using shaving cream
- Immerse the wound(s) into non-scalding hot (113° F or 45° C) water to tolerance for 30 to 90 minutes or until there is significant pain relief
 - If pain recurs, repeat the immersion
- Use local anesthetic for pain control
- Locate additional punctures by infiltrating locally and observing egress of fluid

THERAPY FOR SEA URCHIN ENVENOMATION - II

- Debride and explore to remove foreign material
- Obtain x-ray to identify a residual radiopaque foreign body
 - Consider an advanced imaging technique (e.g., MRI)
- Operate to remove spines situated near joints or near significant neurovascular structures
- Manage dermatitis with a topical antipruritic
- If a puncture wound is more than superficial, consider a prophylactic antibiotic

CNIDARIA CLASSIFICATIONS

- Approximately 9,000 species, at least 100 of which are dangerous to humans
- Possess stinging organelles
- CNIDARIA
 - Hydrozoans (e.g., fire coral, Portuguese man-of-war)
 - Scyphozoans (e.g., true jellyfish)
 - Anthozoans (e.g. anemones, soft corals)

CNIDARIAN VENOM APPARATUS

- Nematocyst is a stinging organelle produced by cnidocyte
- Millions of cnidocytes on tentacles or near the mouth
- Stinging organelle contains a coiled thread tube with venom-laden "darts"
- Thread tube may attain a length of 200 to 400 microns
- Exocytosis of thread tube stimulated by contact or hypotonic exposure
- Velocity of thread tube ejection estimated at 2 m/sec and 40,000 x gravity
- Skin is struck and injected with a force of 2 to 5 lbs/sq in
- Upper dermis penetrated and venom diffuses into circulation

DERMATOLOGICAL THERAPY FOR COELENTERATE ENVENOMATION - I

- Rinse the wound with seawater or 3N saline if decontaminant not immediately available
- **ANTICIPATE ANAPHYLAXIS**
 - Do not rinse with freshwater
 - Do not rub the wound
 - Wear protective gloves (double thickness surgical glove)
- If sting is from box-jellyfish (*Chironex fleckeri*), flood the area with topical acetic acid 5% immediately in continuous application for minimum 30 minutes
 - **DO NOT** apply the pressure-immobilization technique
- Remove gross tentacle fragments with forceps

DERMATOLOGICAL THERAPY FOR COELENTERATE ENVENOMATION - II

- Other topical decontaminants, depending on coelenterate species, include isopropyl (rubbing) alcohol 40 to 70%, powdered bicarbonate (baking soda), unseasoned meat tenderizer or papain solution, papaya latex (juice)
 - Do not apply organic solvents
 - Do not apply baking soda and vinegar simultaneously
- Apply dry (no external moisture) cold packs
 - Hot water immersion may be beneficial
- After decontamination, remove adherent nematocysts by applying shaving cream or a paste of baking soda and shaving with a sharp edge

DERMATOLOGICAL THERAPY FOR COELENTERATE ENVENOMATION - III

- Apply a topical corticosteroid for a mild skin reaction. Use local anesthetics sparingly
- For moderate or severe inflammation, administer an oral or parenteral glucocorticoid
- Administer standard anti-tetanus prophylaxis
- Observe closely for development of wound infection
- If sting is from *Chironex fleckeri* and skin reaction is severe, administer antivenom. However, note that this is beginning to become controversial in the literature.

SAFE SEA™

Jellyfish Sting Protective Lotion with sunblock


