Marine Biotechnology

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Emergency Medical Management of Scorpionfish, Stonefish and Lionfish Envenomation

LIONFISH - (Pterosis Species)

Red Lionfish

Lionfish Distribution

Lionfish & Stonefish

Stonefish (Synanceia verrucosa)

Stonefish

- Family: Synanceiidae
- Genus: Synanceia
- Species: Synanceia alula, Synanceia horrid, Synanceia nana, Synanceia platyrhyncha, and Synanceia verrucosa
- Length: Up to 50 cm
- Weight: nearly 5 pounds or 2400 grams
- Diet: Carnivorous, primarily small fishes and shrimps
- Life Span: 5 to 10 years
- Nature: Venomous, dangerous and even fatal to humans
- Habitat: Coral reef, near and about rocks, mud or sand in tidal inlets
- Range: Coastal regions of Indo-Pacific oceans and northern Australian waters

Stonefish Marine Toxins

- The venom of a stonefish is made of a mixture of proteins, like the haemolytic stonustoxin, the proteinaceous verrucotoxin and the cardioactive cardioleputin.
- Its glands have neurotoxins at the base of its needle-like dorsal fin spines, 13 of them. The stonefish emits toxins when it feels threatened or is disturbed.
- Depending on the depth of the penetration of its poisonous spines, the poison takes less than 1- 2 hours to kill a human being after driving him into severe pain, tissue death and paralysis.

Four Marine Toxins

1. Primary Toxin = antigenic heat-labile protein

2. Acetylcholine = a neurotransmitter

3. Neuromuscular Toxins

4. Low Molecular weight non-proteinaceous icthyotoxin

Scorpionfish (Scorpaena Species)

- Scorpion Fish rank 2nd only to Stingrays in total number of estimated envenomations.
- 50,000 cases annually
- Climate change ↘

  Change in environmental

  Oceanic conditions ↘

  Distribution of these

  venomous species of fish

California Scorpionfish

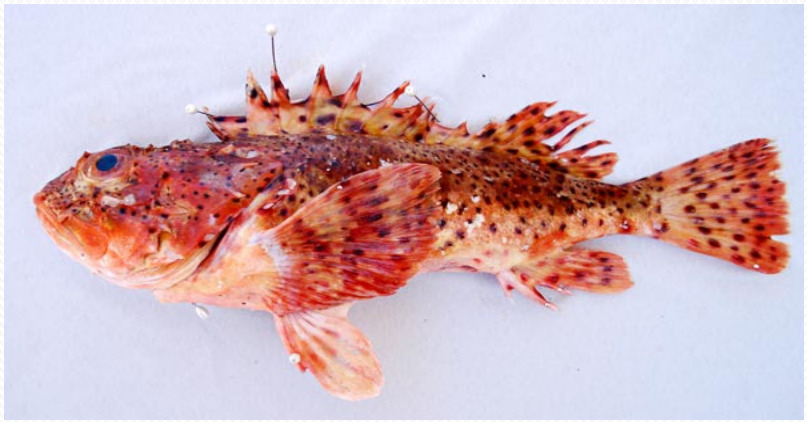
Also known as Sculpin, Scorpaena guttata

Rock fish shape – red in deeper water, brown in shallow water

12 – 17 inches long, depth range 30m – 183m

Habitat = shallow rocky areas, often in caves & crevices

Heat labile toxin delivered through dorsal spines



Brazilian Scorpionfish

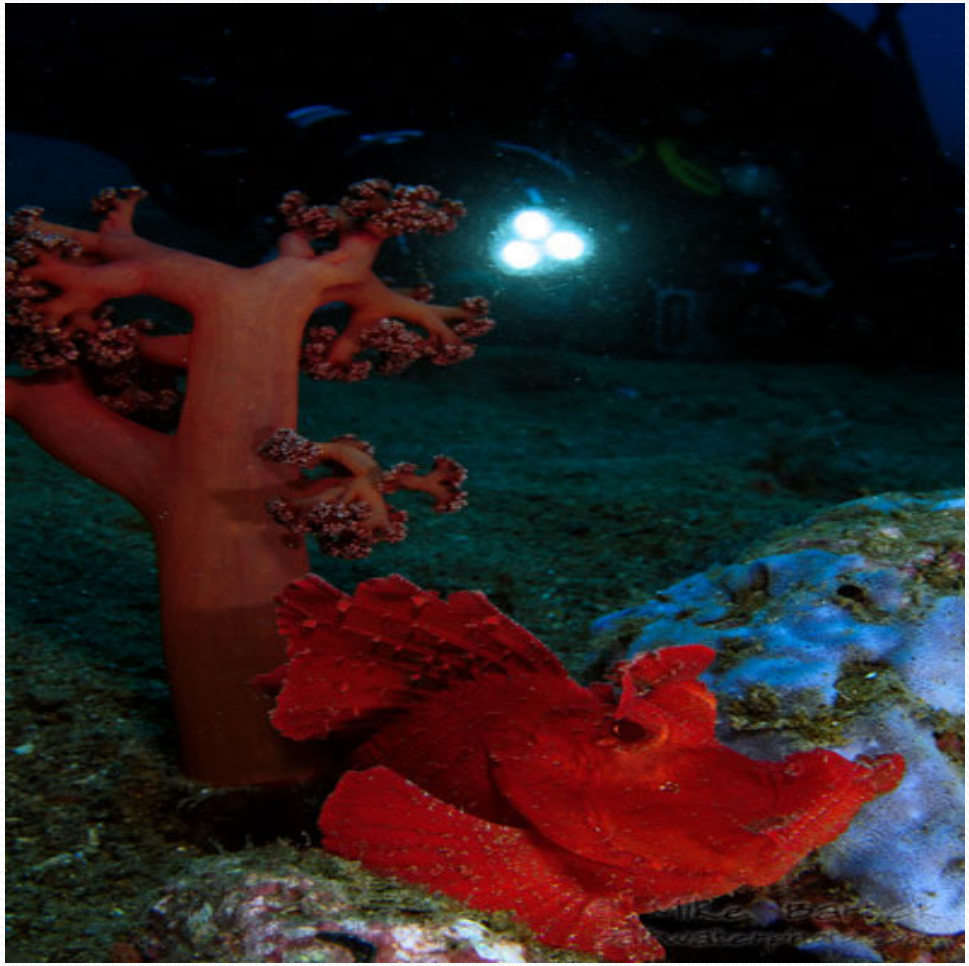
- Scorpaena plumieri, Scorpaena brasiliensis
- Venom is lethal (LD50) in mouse 0.28 mg/kg, i.v.
- Displays 3 activities –
    1. Hemorrhagic
    2. Hemolytic
    3. Proteolytic
- Endothelial Barrier Dysfunction, microvascular hypermeability & CV effects = change in BP + HR

Scorpionfish Venom

- Potential hemolytic toxin (Sp-CTx-121 kDa)

  Scorpaena plumieri venom
- Isolated from an Atlantic Scorpionfish
- Mass Spectrometry: AA sequences in Sp-CTx shared by other piscine hemolytic toxins
- Hemolytic activity of Sp-CTx on rabbit RBC's attenuated by osmotic protectants (PEG Polymers), and molecules larger than 6 nm in diameter inhibited cell lysis = Sp-CTx maybe pore-forming protein

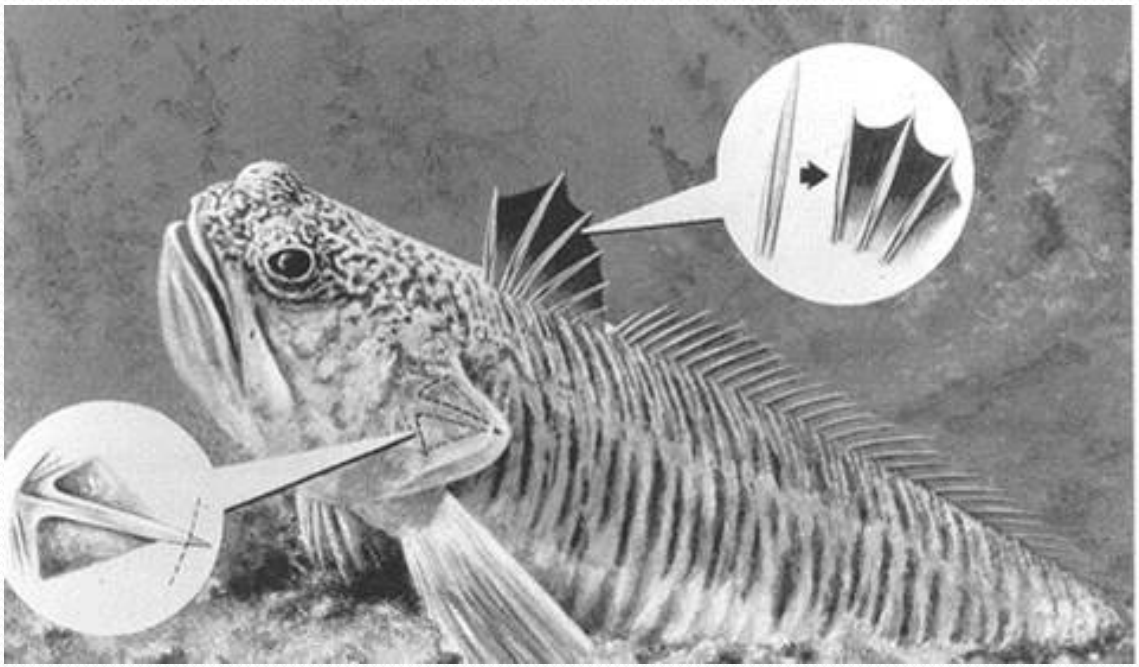
Scorpionfish near coral formation



Clinical Manifestations

- Intense pain at site of contact
- Edema, Erythema, occasional skin Necrosis
- Adenopathy
- Nausea, vomiting, diarrhea
- Neuromuscular effects
- Agitation, malaise, sweating
- Cardiovascular – tachycardia & arrhythmias

Inflammatory & Vasoactive Effects of Marine Toxins & Venoms



Symptoms & Signs- Local

- Intense pain -site of puncture on patient's extremity.
- Erythema and edema also due to initial histamine-like allergic reaction to proteinaceous ichthyotoxin from Lionfish, Scorpionfish, Devil Firefish & Stonefish
- Surrounding rings of bluish cyanotic tissue due to potent, potentially fatal Stonefish envenomation
- Vesicle formation, especially in softer connective tissue and skin of hands, along with warmth which may spread to entire affected limb
- Thereafter – rapid tissue Sloughing, - Cellulitis
- Surrounding hypesthesia

Systemic Effects

- Nausea
- Muscle weakness
- Dyspnea
- Hypotension

Stonefish Envenomation

- Bradycardia
- Syncope
- Cardiogenic Shock
- Congestive heart failure
- Pulmonary Edema

Differential Diagnosis

- Decompression Sickness
- Anaphylaxis
- Serum Sickness
- Echinoderm envenomations
- Stingray envenomations
- Urticarial eruptions
- Dysbarism
- Sea snake envenomations
- Spider bite

Imaging

- *Soft tissue Radiographs with double marker*
- *Ultrasound*
- *CT Scanning & MRI imaging*

Emergency Management & Therapeutic Modalities

1. **Pre-hospital Emergency Management-**

- Proper diagnosis
- Gentle removal of visible spines with gloved hands
- Direct pressure to control bleeding
- Adequate Analgesia
- Anti-emetic if necessary – for nausea
- Also – prompt recognition of serious potentially life-threatening systemic symptoms and signs, followed by immediate CPR
- Treatment of Anaphylaxis

Referral

2. **Appropriate Triage-**

- Level 3 & 4 UCM Clinics ought to transfer to higher level of care, after initial stabilization and Tetanus Prophylaxis
- Level 1 & 2 UCM Clinics may initiate primary care including – parenteral analgesia, antiemetic, I.V. fluids if necessary, antibiotics – only if indicated , wound debridement, Antihistamines, Corticosteroids

Immediate Treatment

3. **Hot Water Immersion Technique**:

- Continuous immersion in non-scalding hot water of affected region of body (up to max 114 degree F, or 45 degree C) and up to 20 minutes, should inactivate heat-labile venom in Lionfish, Scorpionfish and devil fish. Pain relief in 97% of patients

4. **Local, Regional Analgesic & Sedation**

- Tordol
- Opiate analgesics – parenteral only in the absence of hypotension
- Bupivacaine – as local and / or regional block anesthesia for long-acting analgesia. Increases electrical excitation threshold slowing nerve impulse propagation, reduces action potential and prevents generation and conduction of nerve impulses.
- Lorazepam or Midazolam – for procedural sedation as needed.
- Intravenous fluids for hypotension.

Stonefish Antivenom

- IM / IV administration of hyperimmunized equine (Australian CSL) Antiserum
- With: pre-treatment subcutaneous epinephrine parenteral antihistamine, corticosteroid
- for Intravenous Use: careful dilution – slow administration of:
  - 1 ampoule (2000 U) for every 1-2 punctures
  - 3 ampoules for more than 4 punctures
- Dilution: 50-100 mls – isotonic NaCl – slowly over 20 minutes on calibrated infusion pump.
- Wound debridement, irrigation and anti-sepsis
- Possible admission to hospital, possibly ICU

"If we can't BEAT them, let's EAT them"

- NOAA: 2007 promoted a Lionfish cookbook
- FDA: Discouraged this campaign –

However, from tests conducted on more than 200 Lionfish, more than 25% exceed federal levels of ciguatera fish toxin; or more than 0.1 parts per billion. Nevertheless, other reports have dismissed these findings as "negligible and not clinically significant".

Conclusion

- Moreover, rapidly evolving climate change and disruption of the delicate ocean Biome and fragile ecosystems necessitate growing awareness of this escalating biomedical challenge, with dire environmental consequences.

- http://nas.er.usgs.gov/sitingreport.aspx

Tracking and Cataloging Non-native Invasive Marine Species.

Proactive conservation measures to protect delicate marine ecosystems.

Sea Orbiter