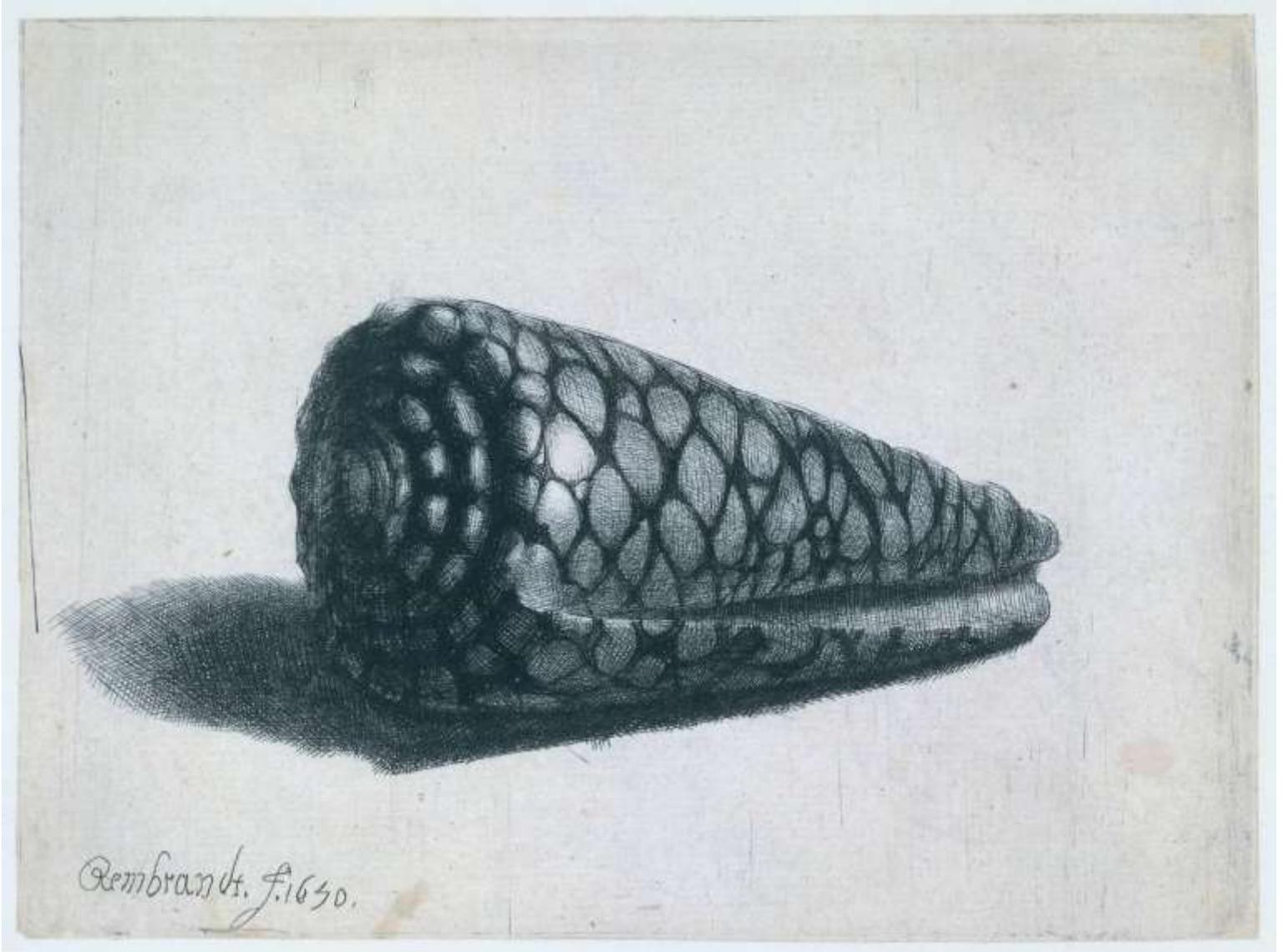


CONE SHELLS



Cone Shell, (Conus marmoreus) Rembrandt van Rijn 1650, Etching, engraving and drypoint. Rijksmuseum, Amsterdam, Holland.

Introduction

Cone shell animals (snails) are a group of carnivorous **marine gastropods**.

The cone snail family (Conidae) is entirely marine and world-wide consists of approximately **500 - 600** living species of which about **160** occur in Australian waters. No less than 133 of these have been recorded from Queensland alone.



Conus textile (photo by Bruce Livett, University of Melbourne)

These animals can cause potentially lethal envenomation

Their shells are brightly and beautifully coloured and patterned and so they frequently attract the attention of unsuspecting beachcombers, especially young children.

All cone snails should be considered venomous.

Treatment of envenomed patients is supportive.

Because of their extreme variety, conotoxins have recently become the focus of much interest in regard to the potential development of pharmaceutical agents. They may, however, also have the potential for bio-weapons development.

Cone shells are prized by shell collectors the world over because of their intricate patterning and beauty, (see **Appendix 1 below**).

History

The first recorded case of cone snail envenomation is believed to have been by the German Naturalist G. E. Rumphius in his book, “The Ambonese Curiosity Cabinet” published in Dutch in 1705.

The only definite death from a Cone snail envenomation in Australian waters occurred on 27th June, 1935 at Hayman Island, of the far Northern Queensland coast.³

Biology

Taxonomy

Their scientific taxonomy is:

- Kingdom:** Animalia
Phylum: Mollusca.
Class: Gastropoda.
Subclass: Orthogastropoda.
Superorder: Caenogastropoda.
Order: Sorbeoconcha.
Suborder: Hypsogastropoda.
Infraorder: Neogastropoda.
Superfamily: Conoidea.
Family: Conidae

Classification

The cone shell species as a group are readily recognized by their **conic shape**.

They may be classified according to their prey and size.

The larger species prey on fish, while the intermediate sized species prey on molluscs and the smaller species on worms.

The large species may grow up to 25 cm in length.

1. **Piscivorous: Fish eaters, including:**

- Conus geographus
- Conus striatus
- Conus magnus
- Conus catus
- Conus tulipa

2. **Molluscivorous: Mollusk eaters, including:**

- Conus textile
- Conus marmoreus

- Conus pennaceus

3. Vermivorous: Worm eaters:

There are many including:

- C.imperialis/ C.eburneus / C.quercinus / C.lividus / C.tessulatus / C.ventricosus / C.parvatus / C.rattus / C.flavidus / C.generalis / C.arenatus

Habitat

The cone shell gastropods are **nocturnal feeders**, rarely being seen during daylight hours.

During the day they generally lie **buried** beneath the sand.

Although they are *most prolific* in **warm tropical** and **subtropical** areas they also occur in the temperate waters of Southern Australia.

They are shallow water dwellers mainly inhabiting tidal reefs.

They are especially seen around the **Great Barrier Reef**.

Colder southern waters have smaller worm eating species which are not dangerous.

Toxinology

All species are venomous to varying degrees.

Fatalities have been recorded.

Conotoxin

The Conidae as a group are veritable factories of exotic toxin production.

To date almost 70,000 different **conotoxin peptides** have been identified in different groups of cones.

These potent peptides largely target ion channels, either voltage or ligand gated receptors and transporters in excitable cells.

These **conotoxin** venoms principally contain:

1. Neurotoxins:

- These block neuromuscular transmission at a number of pre and post synaptic sites.

2. Skeletal muscle toxins:

- Cardiac and smooth muscle are *not* greatly affected.

Because of their extreme variety, conotoxins have recently become the focus of much interest in regard to the potential development of pharmaceutical agents.

They may, however, also have the potential for bio-weapons development.

Method of envenomation:

Like all gastropods, cone snails propel themselves along the ocean floor or reefs by a muscular foot

The conidae possess a single “radicular tooth”, (**radula**) which is used as a hypodermic syringe for injecting venom.

The radula is a dartlike, hollow, chitinous barb, formed in the radular sheath and delivered, after receiving venom in the buccal cavity, by an extensible proboscis.

The muscular cone proboscis is highly distensible and in the larger species can reach most if not all parts of the shell. It projects from the *narrow* end of the shell.

The radula remains attached to the cone by a cord, (similar therefore to a **harpoon**) - an attack occurs with phenomenal speed (milliseconds).

Cone radulae can penetrate a 5 mm neoprene wetsuit

Once the prey is paralyzed, the gastropod retracts the cord and engulfs the prey through the radular opening into its distensible stomach

Clinical Features

In general terms it is the **larger fish eating conidae** that are the most dangerous to humans.

Based on the rarity of cone snail envenomation and the lack of data, it is uncertain whether death is the result of respiratory toxicity, cardiovascular toxicity, or a combination of the two.

The effects of envenomation also vary based on the specific peptides within the venom and as a result, the exact effects can be unpredictable.

Symptoms however are largely neurological.

In significant envenomations, symptoms may take **several weeks** to resolve.

Death may occur from respiratory paralysis.

Clinical features include:

1. Wound site:
 - Pain
 - Numbness / parasthesiae
 - The wound may appear trivial or not seen at all
 - The wound may also be contaminated with marine organisms
2. Nausea and vomiting.
3. Neurological:

Paresthesias:

 - Perioral and generalized.

Cranial nerve involvement:

 - Dysarthria
 - Dysphagia
 - Diplopia
4. CVS:
 - Tachycardia and ectopy
5. Haematological:
 - Disseminated intravascular coagulation (DIC) may occur
6. Respiratory:
 - In severe cases respiratory paralysis and death.

Investigations

None are routinely required

Any investigation will be directed at ruling out alternative diagnoses or secondary complications.

Radular teeth are small and will likely be missed on plain radiography.

Management

Prevention

A commonly believed fallacy is that grasping a cone at the large end is safe.

The proboscis *especially in the larger species is highly distensible* and can reach most parts of the shell.

A cone shell on the beach may still have a living animal inside it.

When found in the water the animal is almost certainly still alive.

Use a stick if you are curious, or better still, leave it alone!

They should only be handled by an experienced person with properly designed gloves.

Treatment:

Cone snail envenomation is rare, and so optimal management is unknown. All cases should be discussed with a **Clinical Toxinologist**.

Treatment of cone shell envenomation is supportive:

1. Immediate attention to any ABC issues, as required.
 - Airway, ventilatory and cardiovascular support will be the keystones of supportive management.
2. Pressure bandage & immobilization:
 - This is a vital aspect of the first aid management of a cone shell bite.
3. Analgesia:
 - Give as clinically indicated.
4. Antivenom:
 - There is no current antivenom available for cone shell envenomations.

The complexity and extreme variety of conotoxins has prevented the production of an effective anti-venom.

Appendix 1



C.eburneus



C.generalis



C.rattus



C.ventricosus



Conus catus



Conus geographus



Conus imperialis



Conus marmoreus



Conus striatus



Conus tessulatus



Conus arenatus



Conus pennaceus



Conus quercinus

References

1. Shepherd SM, Conidae in eMedicine Website, Emergency/ Environmental, March 2017.
2. Queensland Museum:
 - www.qm.qld.gov.au/
3. Flecker HB. Cone shell mollusc poisoning, with report of a fatal case. Med J Aust. 1936;464 - 6.

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