

Venomous mollusks: the risks of human accidents by *Conus* snails (Gastropoda: Conidae) in Brazil

Moluscos peçonhentos: riscos de acidentes em humanos pelo molusco *Conus* (Gastrópode: Cunidae) in Brazil

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ABSTRACT

Mollusks of the genus *Conus* present a venomous apparatus composed of radulae, a chitin structure linked to glands, which injects potent neurotoxic peptides, causing serious human envenomation and even death, associated with the blockage of certain receptors and muscular paralysis. No reported envenomation has occurred in Brazil, but certain populations are at risk of accidents.

Key-words: *Conus*. Venomous animals. Venomous mollusks. Human envenoming. Brazil.

RESUMO

Os moluscos do gênero *Conus* apresentam um aparato venenoso composto de uma rádula quitinosa ligada a glândulas de peçonha, causando envenenamentos humanos graves e mesmo óbitos pela ação neurotóxica indutora do bloqueio de vários receptores e paralisia muscular. Não há casos descritos de envenenamento no país, mas determinadas populações correm risco de acidentes.

Palavras-chaves: *Conus*. Animais peçonhentos. Moluscos venenosos. Envenenamentos humanos. Brasil.

Mollusks include some of the most well-known invertebrates. Phylum species present a specialized chitin tooth-like feeding structure (the radulae) that can grind through the shells of other animals¹⁹. The class Gastropoda includes marine, terrestrial and freshwater snails, limpets, nudibranchs, slugs and abalones.

CONUS SNAILS

The most specialized gastropods may be the cone snails, genus *Conus*, in which the radulae is reduced to a few isolated venom-injecting teeth, the so-called toxoglossate radulae, that are linked to venomous glands. The harpoon-like teeth are discharged from the end of a long proboscis that can be

ejected rapidly to capture its prey (Figures 1 and 2). The *Conus* genus presents a unique spiraled shell.

The great majority of cone snails feed on other mollusks and bristle worms. However, some species are piscivorous, presenting the most potent toxins and they can cause fatal envenomation in humans⁷⁻¹³. The most important piscivorous *Conus* are present in the Indo-Pacific area, such as *C. geographus* (the species most associated with human deaths), *C. aulicus*, *C. marmoreus*, *C. striatus*, *C. textile* and *C. tulipa*. There are about two dozen *Conus* species in Brazil and the most important are *C. centurio*, *C. clenck*, *C. clerii*, *C. ermineus*, *C. jaspideus*, and *C. regius*¹⁰. Moreover, species like *C. clerii*, *C. jaspideus* and *C. regius* feed actively on marine worms and present active toxins². The worm-eating *Conus* offer less danger to human beings, but some species that provoke serious accidents are not piscivorous, such as *C. marmoreus*.

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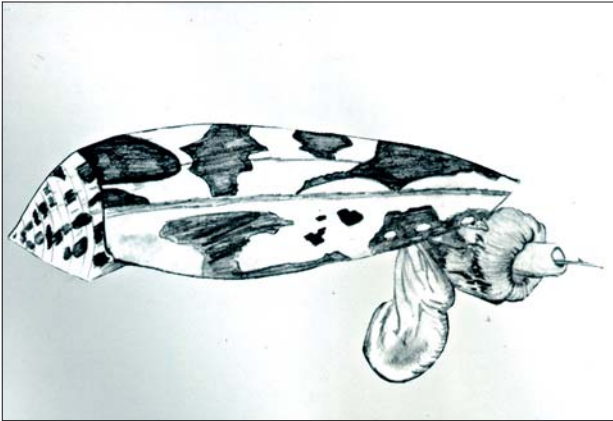


Figure 1 - *Conus* snail in attack position, showing the proboscis and the radulae, structures capable to envenoming with gravity human beings.



Figure 2 - A live specimen of *Conus* of Mozambique - Indian Ocean - showing the proboscis (probable *Conus imperialis*).

VENOM ACTION OF THE *CONUS* SNAILS

The venom of the *Conus* species is composed of conotoxins, which are neurotoxins of low molecular weight. Their action is extremely fast, which is compatible with the slowness of the snail in its environment and the consequent difficulty involved in capturing the poisoned prey.

The action of the conotoxins occurs by blockage of muscular and neural receptors⁷. There are two different toxin

effects in the venom. The first, the "lightning-strike" effect, causes immediate immobilization of the injected prey through peptides that inhibit voltage-gated sodium channel inactivation, as well as peptides that block potassium channels. Together, this combination results in a massive depolarization of any axons in the immediate vicinity of the venom injection site, causing an effect similar to electrocuting the prey. The second effect is achieved more slowly and involves total inhibition of neuromuscular transmission through conopeptides, which act at sites remote from the venom injection site, such as neuromuscular junctions. The motor cabal effect, found in all fish-hunting *Conus* venoms examined so far, includes peptides that inhibit the presynaptic calcium channels that control neurotransmitter release, the postsynaptic nicotinic receptors, and the sodium channels that underlie the muscle action potential²⁰.

Currently, conotoxins are a valuable tool of scientific research, due to the intense pharmacological activity presented by the peptides. One of the drugs in clinical tests is ziconotide, which is a peptide that blocks the neuronal calcium canals with excellent effect in the treatment of chronic and severe painful processes¹⁶.

CLINICAL ASPECTS OF THE ENVENOMATION

The exact number of proven deaths caused by envenomation by *Conus* shells is not known, though about 50 supposed occurrences are cited. Envenomation can simulate other causes of death, like myocardial infarction or cerebral ischemia, and may not always be correctly identified. The index of mortality observed in envenomation by *Conus* shells reaches 25%⁷.

A typical accident involving *Conus* shells, initially presents intense burning pain at the site of the sting, which evolves in about one hour to progressive paralysis of the body muscles without other local symptoms or signs. History of contact with the mollusk associated with intense muscular weakness should raise suspicion of an accident. In later phases, the patient can develop palpebral ptosis, blurry vision and speech and deglutition difficulties, unconsciousness and dyspnoea, with possible evolution to respiratory arrest that can be fatal and occurs 40 minutes to 5 hours after the sting^{3 7 9 12 13 15 17 18}.

In Brazil, three species of *Conus* of large diameter are potentially dangerous: *C. regius*, *C. centurio* and *C. ermineus*, the last of which is piscivorous^{3 11}. *C. ermineus* was identified in the Fernando de Noronha Islands⁶, when studies regarding its high toxicity and the potential risk for human envenomation already existed^{18 4}. Currently, however, there is no safe clinical information regarding the species of *Conus* found in Brazil or the occurrence of possible accidents, although the possibility of envenomation, especially for Biology professionals and shell collectors exists.

Diagnosis of the injuries caused by venomous mollusks is based on clinical observation. There is no antidote for the toxins and severe envenomation should be treated with artificial ventilation, the only effective measure, since no

available antivenom exists at present¹⁵. Severity depends on the time passed since envenomation and of the full installation of the manifestations, with some consideration given to the sting site. A lack of medical resources also influences the prognosis. Envenomation by the *Conus* genus is rare, but it is possible in risk populations and the gastrointestinal and neuromuscular symptoms in patients should not be confused with alimentary poisoning.

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