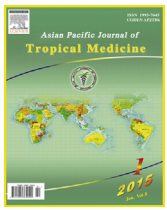
HOSTED BY

ELSEVIER

Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Medicine

journal homepage: http://ees.elsevier.com/apjtm



Original research https://doi.org/10.1016/j.apjtm.2017.10.024

Faunal data and envenomation emergency first aid of cone snails (*Conus* spp.) in Qeshm Island, the Persian Gulf

Mehdi Khoobdel[1], Hadi Dehghani[2], Ali Mehrabi Tavana[3], Mohammad Ghasemi[1], Seyyed Mohammad Dakhteh[4], Majid Askari Hesni[5], Mohsen Rezaie-Atagholipour[1]✉

[1]*Health Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran*

[2]*Department of Marine Biology, Faculty of Science, University of Hormozgan, Bandar Abbas, Iran*

[3]*Health Management Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran*

[4]*Environmental Management Office, Qeshm Free Area Organization, Qeshm Island, Iran*

[5]*Department of Biology, Faculty of Science, Shahid Bahonar University of Kerman, Kerman, Iran*

ARTICLE INFO

Article history:
Received 27 Aug 2017
Received in revised form 26 Sep 2017
Accepted 25 Oct 2017
Available online xxx

Keywords:
Envenomation symptoms
Subtropical coastal waters
Sandy shores
Venom

ABSTRACT

Objective: To investigate the fauna of a highly venomous marine species group, the cone snails (Family Conidae), in the shores of Qeshm Island, of evaluating the possibility of envenomation in the area and summarize recommendations for emergency first aid.

Methods: Shores surrounding Qeshm Island were surveyed to collect cone snails during cold (February and March) and warm (May and June) seasons of 2017. Collected snails were identified to the species level. Abundance and species richness were estimated in shores of different structures, including muddy and sandy-rocky shores. Also, the most updated medical literature was reviewed to summarize related emergency first aid.

Results: Three cone snail species were recorded from southern sandy-rocky shores of the Island, in decreasing order of abundance, included crowned cone (*Conus coronatus*) (65%), feathered cone (*Conus pennaceus*) (28%), and frigid cone (*Conus frigidus*) (7%). Abundance of these species were significantly higher in cold season compared to the warm season ($P < 0.05$). No cone snails were recorded along the northern muddy shores of the Island.

Conclusions: Envenomation can cause various symptoms ranging from minor local pain to systemic paralysis and death due to respiratory failure. We recommend an awareness programme for the seashore visiting public.

1. Introduction

Human-marine wildlife interaction is an occasional or daily occurrence for many people all around the world, including fishermen, divers, swimmers, boaters, surfers, etc. However, this interaction is not always safe as many species of marine wildlife are potentially capable of causing serious and fatal human injuries [1,2]. According the type of the injuries, these hazardous marine species fall into four groups, including traumatogenic animals (causing traumatic injuries using spines, stingers and teeth), strongly electric fishes (causing shock injuries), poisonous animals (causing deleterious effects when they are ingested or touched by the victim), and venomous animals. The fourth and last group includes animals which can cause marine envenomation, as they can inject toxins into the body of a human victim using an apparatus such as spines, stingers or teeth. These toxins have diverse deleterious effects on the victim including proteolysis, myotoxicity, hemotoxicity, cytotoxicity and neurotoxicity [1,3]. Marine envenomations annually cause a lot of emergency situations for humans worldwide [1], especially throughout the tropical coastal waters of the Indo-West Pacific [4]. Immediate first aid before full medical treatment is critical to mitigate the dangerous consequences of marine envenomations [1,2,5,6].

First author: Mehdi Khoobdel, Health Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran.
E-mail: khoobdel@yahoo.com
✉Corresponding author: M. Rezaie-Atagholipour, Health Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran.
E-mail: rezaie1986@gmail.com
Peer review under responsibility of Hainan Medical University.

Please cite this article in press as: Khoobdel M, et al., Faunal data and envenomation emergency first aid of cone snails (*Conus* spp.) in Qeshm Island, the Persian Gulf, Asian Pacific Journal of Tropical Medicine (2017), https://doi.org/10.1016/j.apjtm.2017.10.024

Cone snails, also known as cone shells (family Conidae), are marine predatory snails of the genus *Conus* spp., the largest genus of marine invertebrates. These marine gastropods occur throughout all tropical and subtropical coastal waters around the world, but are most diverse in the Indo-West Pacific region [7]. Cone snails have a specialized venom apparatus containing several venomous biological harpoons. In contact with a prey or predator, the snail is able to extend its proboscis and spear its victim with one of those harpoons [7,8]. With an estimated number of 140 000 to 700 000 cone snails' venom peptides, also known as conopeptides [8], it is not surprising that 700 species of the genus *Conus* containing the largest and most clinically important pharmacopoeia of any animal genus on our planet [9]. Not all, but some of these peptides have toxic effects on humans causing various consequences ranging from minor local pain to systemic paralysis and death due to respiratory failure [8].

Therefore, this study was carried out to investigate local medically important venomous fauna present in coastal waters surrounding Qeshm Island, the largest Island in the Persian Gulf. Further, the study presents putative symptoms and emergency first aid for envenomation of these venomous species, through a review of the most updated literature.

2. Material and methods

Qeshm Island, with an area of about 1 390 km^2, hosts about 149 000 residents. Further, thousands of Iranian and foreign tourists visit the Island annually as it is famous for several natural national monuments and protected areas. Furthermore, Qeshm Island has been designated a Free Trade Zone by the Iranian government, and is therefore of interest for thousands of Iranians, who immigrate to the Island seeking labor opportunities. The central part of this large island is mostly covered by deserted, non-residential areas. On the other hand, the coastline surrounding Qeshm Island, with a length of about 290 km, hosts the highest proportion of the residents, immigrant and tourist populations [10]. All these people when visiting the shores and coastal waters could be potentially exposed to natural threats existing in the Persian Gulf, in which one of those is marine envenomation [2]. The shores of Qeshm Island can be divided into two different types. The northern shore (of the island) is a sheltered area located at a narrow channel between Qeshm Island and the Iranian mainland, where it is covered by mud flats and mangrove forests. On the other hand, the southern shore of the island is an open area exposed to waves, and is covered by sandy and rocky habitats.

In this study, both the northern and southern shores of the Island were monitored through planned and off-effort field surveys in both the cold (February and March) and warm (May and June) seasons of 2017. Cone snails were collected by walking through the intertidal zone during highest low tides and checking under rocks and rubbles. The snails were picked up carefully and fixed in 75% ethanol for later examination. Due to the fact that most species of this genus are threatened by population decline [9], only one specimen from each putative species was collected for next laboratory examination, and all other specimens released at their own habitat after examination. Collected specimens were identified to the species level using appropriate identification keys [11].

Simpson's diversity index-1 (SDI-1) was used to estimate species dominance in the cone snail community of Qeshm Island. The formula of the index is as follows [12]:

$$\text{SDI-1} = \left[\sum_{i=1}^{N}\left(\frac{n_i}{N}\right)^2\right] - 1$$

where n_i is the number of species i, and N is total number of all species in the sample collection. The SDI-1 value ranges between 0 and 1, of which 0 shows lowest and 1 shows highest species richness [12]. Further, differences in abundance of cone snails between cold and warm seasons were tested using Mann–Whitney U test; $P < 0.05$ was assumed as significant.

After collecting faunal data from the study area, the most updated and cited medical literature was reviewed to gather some information about the risk of envenomation by the identified species, envenomation symptoms and first aid options for emergencies.

3. Results

3.1. Distinguishing cone snails from similar species in the area

Several harmless species of marine snails occur along the intertidal shores of Qeshm Island which morphologically resemble venomous cone snails. The shells of *Conus* species could be distinguished from these similar harmless shells (e.g., *Conomurex* spp) using the two following diagnostic characters:

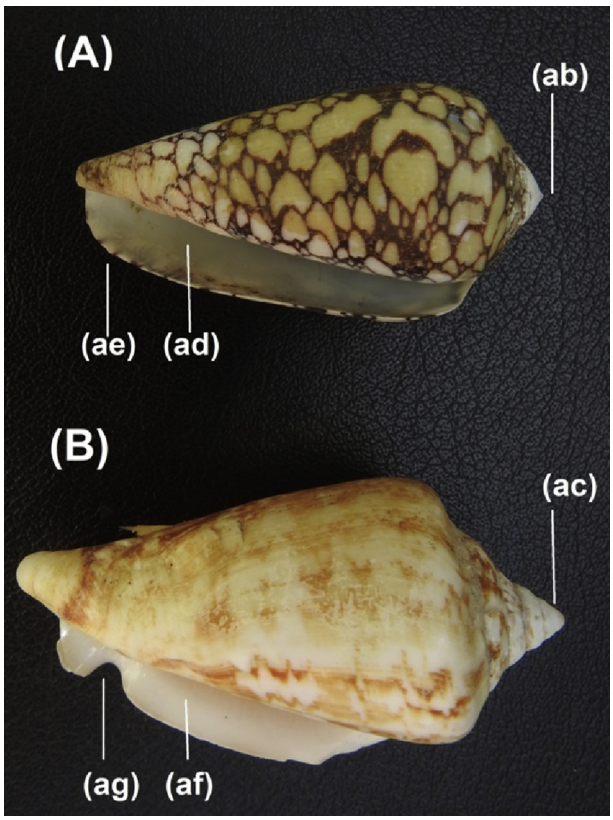


Figure 1. Comparison between (A) a venomous cone shell (*Conus pennaceus*) and (B) a harmless conch shell (*Conomurex* sp).
Both specimens were collected from intertidal shores of southern Qeshm Island. The shells distinguished from each other using the two diagnostic characters: 1) *Conus* spp. have a cone-shaped shell with a low broad conical spire on the apex (ab), whereas *Conomurex* spp. have a sharp and separated short spire on the apex (ac); 2) *Conus* spp. have a long and narrow aperture (ad) and a straight lip (ae), whereas *Conomurex* spp. have a shorter aperture (af) with an untidy lip (ag) that usually has a notch on its anterior end (ae).

Please cite this article in press as: Khoobdel M, et al., Faunal data and envenomation emergency first aid of cone snails (*Conus* spp.) in Qeshm Island, the Persian Gulf, Asian Pacific Journal of Tropical Medicine (2017), https://doi.org/10.1016/j.apjtm.2017.10.024