ONLINE FIRST

ISSN: 1641-9251

e-ISSN: 2081-3252

ASSESSING THE CLINICAL MANAGEMENT AND OUTCOMES OF VENOMOUS MARINE ANIMAL INJURIES IN TURKIYE

Authors: YAVUZ ASLAN, AYSE SENA YUMBUL KARDAS, AKIN SAVAS TOKLU

DOI: 10.5603/imh.102261

Article type: Original article

Submitted: 2024-08-25

Accepted: 2024-09-28

Published online: 2025-03-05

ORIGINAL ARTICLE

Assessing the clinical management and outcomes of venomous marine animal injuries in Turkey

Yavuz Aslan[1,*], Ayşe Sena Yumbul Kardaş[2], Akın Savaş Toklu[3]

[1]Department of Underwater and Hyperbaric Medicine, University of Health Sciences, Hamidiye Medical Faculty, Sultan 2. Abdulhamid Research and Training Hospital, Istanbul, Turkey
[2]Department of Underwater and Hyperbaric Medicine, Kutahya City Hospital, Istanbul, Turkey
[3]Department of Underwater and Hyperbaric Medicine, Istanbul Medical Faculty, Istanbul, Turkey

Short title: Yavuz Aslan eta al., Venomous marine animals

Yavuz Aslan, Department of Underwater and Hyperbaric Medicine, University of Health Sciences, Hamidiye Medical Faculty, Sultan 2. Abdulhamid Research and Training Hospital, Istanbul, Turkey, e-mail: yavuzaslan.md@gmail.com

DOI: 10.5603/imh.102261

Received: 25.08.2024 Accepted: 28.09.2024 Early publication date: XX.XX.2024

ABSTRACT

Background and objectives: SCUBA diving is a widely popular activity in Turkey, surrounded by seas on three sides. While most marine creatures in these waters are harmless, a few poses significant risks, necessitating awareness and precautions for divers' safety. This report highlights the various harmful sea creatures found in Turkish waters, their potential injuries, and appropriate first aid responses.

Materials and methods: Data were gathered from workshops, literature reviews, diving activities and case reports.
Results: Notable harmful species include jellyfish, sea anemones, bristle worms, sea urchins, greater weever fish, and others. Injuries range from stings and bites to venom-induced symptoms, requiring immediate and specific medical interventions.
Conclusions: The paper aims to enhance the recognition and management of harmful marine life encounters in Turkish waters, especially among emergency doctors and general practitioners.

Key words: sea creatures, extreme environments, poisonous animals, venomous marine animals

INTRODUCTION

One of the commonly used methods in professional or recreational diving is SCUBA diving, also known as scuba diving, and the term consists of the initials of the English definition “Self-Contained Underwater Breathing Apparatus”. Today, SCUBA is widely used as a general term [1–3]. SCUBA diving involves the use of a portable air source that allows the diver to remain submerged independently of the surface for a period of time [4, 5]. Before the nineteenth century, with limited transportation facilities, oceans were viewed by western society as merely a waterway between continents, and the sea was seen as a large space that was thought to be completely empty and devoid of any features [6]. With the developments in technology and the design of diving suits that provide protection against cold in the twentieth century, many negative effects of diving have become manageable [7, 8].

Recreational SCUBA diving stands out as a popular form of ecotourism today, along with social trends in travel and tourism [9, 10]. Recreational diving is a type of diving that encompasses skills related to a variety of adventure, leisure, and recreational activities and is distinct from commercial, military, public safety, or scientific diving. The increasing demand for SCUBA diving as a recreational-adventure activity has also led to an increasing interest in leisure activities that take place in natural underwater environments, as well as in fauna and flora habitats, artificial and natural reef formations, various geological formations, close to the local ecosystem [11, 12].

In addition, as popular culture increased interest in recreational SCUBA diving, television documentaries, films and books of leaders such as Hans and Lotte Haas and Jacques-Yves Cousteau attracted diving enthusiasts [13]. Diving has become a much more common activity today.

Turkey consists of a peninsula surrounded by sea on three sides. Although most of the creatures living in our seas are harmless to humans, a limited number of them can cause some problems. Although all safety precautions are taken during diving, it would be beneficial for divers to recognize and avoid contact with harmful sea creatures for their own health and safety.

Harmful marine creatures can cause traumatic injuries or poisoning with their toxins. Many marine creatures are equipped with poison systems for defensive or hunting purposes. We aimed to point out the marine creatures in our country's seas that are not well known and that may cause injuries to divers and fishermen, and the species that come from tropical seas and continue to live in our seas, and to emphasize the precautions that should be taken in case of injury with these creatures.

MATERIALS AND METHODS

For this compilation, the Workshop on Harmful Marine Creatures in Turkish Seas was held at the Bodrum Chamber of Commerce on May 5, 2014, and all topics were carefully evaluated and various articles and writings about the creatures were examined and compiled in detail [14].

DAN Europe (Divers Alert Network Europe, European Diving Safety Foundation) is a non-profit international medical and research organization dedicated to the health and safety of SCUBA divers. These issues are discussed in detailed in the book "DAN First Aid for Harmful Marine Life Injuries", which was first published in January 2000 and its last edition was December 2017 [15]. Harmful sea creatures: They were examined separately under headings such as those that affect health with their poisons, those that cause traumatic wounds by biting, and those that cause poisoning due to eating seafood. Points to be taken into consideration to prevent injury from harmful marine creatures are stated. It was emphasized that basic life support should be given first in case of injury, and the first aid and advanced aid that should be given according to each different type of injury were specified. DAN also has a certificate program for divers on "First Aid for Harmful Marine Creatures and Injuries".

Harmful sea creatures are also mentioned in a separate section in the latest edition of the United States Navy Diving Manual (USN Diving Manual), which contains the most accepted and valid information about today's underwater diving activities [16].

Information obtained from all these sources and case reports of harmful marine creatures recorded in Turkish waters were discussed [31, 35, 40, 41].

RESULTS

The most common jellyfish in our country's waters is called Moon jellyfish (*Aurelia aurita*, Fig. 1). This species, which is a relatively non-poisonous jellyfish, is usually seen in polluted areas of the seas and on the coasts. Rarely, they can also be found in brackish waters. Burning capsules called nematocysts are located on their outer surfaces called tentacles, and they cause burning and redness on contact [17]. Washing the contact skin with heated sea water will reduce these effects. Freshwater should never be used. It is extremely important for the injured person to be calm and still to prevent the blood flow rate from increasing. Sticky tentacles should be removed. Depending on the situation, cold compresses should be applied to the affected area. If no benefit is achieved, it should be immersed in 42–45°C water for 30 minutes or until the pain subsides. If the onset of systemic symptoms cannot be prevented or if the pain does not decrease but becomes more intense, the injured person must be admitted to the hospital [18]. In local cases, oral painkillers such as acetaminophen or ibuprofen are sufficient. Local anesthetics, topical antihistamines and glucocorticoids, and systemically applied analgesic and antihistamine drugs are preferred after jellyfish injuries. Immediate intervention is essential in case of systemic reactions (shock, breathing difficulties, etc.). In a life-threatening situation, oxygen administration with airway support, intravenous fluid support and sympathomimetics for extreme hypotension are necessary. For hypersensitivity reactions, glucocorticoids are administered to the patient systemically. Patients showing systemic signs and symptoms should be kept under observation for at least eight hours [18, 19, 20, 21, 22].

Clues to the type of jellyfish include the geographic region where the sting occurred, common types of jellyfish washed ashore, distance from shore, and the tentacle pattern on the skin. For many patients, the specific species of stinging jellyfish is unclear, and management is based on species common in the area. It is important not to touch jellyfish during activities such as swimming and diving [23].

Sea anemone (*Parazoanthus axinellae*). These animals are found in most diving spots and can cause itching, burning, redness and blister formation on contact. Their treatment is similar to that of jellyfish, but the symptoms take longer to resolve [24].

Bristleworms (*Hermodice carunculata*, Fig. 2) are slow-swimming and non-aggressive. The most common cause of sea bristle worm-related injuries occurs when careless divers encounter these worms. The hairs they carry can inject a powerful neurotoxin when they come into contact with the skin. The most common symptom is a raised, red and itchy rash on the skin with a burning and stinging sensation. Redness and itching may last 2 to 3 days. All large visible hairs should be removed carefully to avoid breaking the spines or embedding them further. Their treatment is similar to that of jellyfish stings [25].

Long-spined sea urchin (*Diadema setosum*, Fig. 3). It is one of the species that came to our country from the Red Sea. It is common, and its spines are very fragile due to their calcium carbonate structure. Some have an acetylcholine-like toxin. In case of stinging, redness, swelling and pain occur; the thorns must be removed before they break or increase tissue damage. After injury, thorn tips can cause a black spot on the skin. The wound site should be immersed in salt water at the highest tolerable temperature [45°C (113°F)] as soon as possible and continue this application for 30 minutes (maximum 90 minutes) or until the pain subsides. Pain can be addressed with oral opioids or local anesthesia. The main problem in these injuries is the thorn fragments that may remain at the sting site and their removal. Soft tissue radiography, ultrasound, or MRI can be used to detect the presence and location of fragments. The patient should be followed up appropriately, and if symptoms persist, removal of any remaining particles should be considered. Late-formed granulomas, caused by thorn tips breaking off and remaining in the wound, may require lesion excision. Stinging of the thorn in the joints may cause synovitis [26, 27].

Greater weeverfish (*Trachinus draco*) and streaked weeverfish (*Trachinus radiatus*). The spines behind its pectoral and dorsal fins contain toxins and are hidden in the sand in the evening. In case of contact, it causes severe and sudden pain, redness and widespread swelling. The pain usually reaches an unbearable point within 30 minutes, and it may take up to one month for the symptoms to subside. It may also cause systemic symptoms such as headache, dizziness, fever, cold sweat, delirium, nausea, vomiting, bruising, joint pain, loss of speech, bradycardia, palpitations, mental depression, convulsion, and dyspnea. Secondary infections are common when appropriate treatment is not applied. In such cases, antibiotics are required. The treatment involves removing foreign objects and applying the highest tolerable temperature (about 45 degrees) to the affected area for 30–90 minutes to remove the

remaining poison. Cold application increases pain. Usually, simple pain relievers such as acetaminophen or ibuprofen will provide relief, but if not, morphine may be necessary. Local painkiller injection or regional nerve block can be applied. However, hot water should be applied to patients whose pain is relieved with this method. Protection against tetanus is provided. In cases of allergic shock, steroids should be given to the patient. Additionally, traconia antidote was produced in 1968 and has been manufactured ever since. The use of such an antidote is limited to patients who do not respond to other treatment [28–31].

Economically valuable fish such as slender Rockfish (*Scorpaena elongata*) and Red Scorpionfish (*Scorpaena scrofa*) have toxin-containing glands on their dorsal fins. If stung, they cause local symptoms with severe pain. Their toxins are effective even after the fish has died. The treatment is similar to that of a sting from a striking fish [25].

Monkfish (*Lophius piscatorius*). The liquid covering the body of fish found in the Aegean and Mediterranean regions causes contact dermatitis. Topical steroids are used, and if the symptoms do not regress, oral or parenteral steroid treatment is applied [25].

Stonefish (*Synanceia verrucosa*) originating from the Red Sea. A stonefish caught off the coast of Yumurtalik (Iskenderun Bay) is reported for the first time from Turkey and for the second time from the entire Mediterranean. Stonefish, known for the powerful poison they carry in their spines, pose a potential danger to human health if they form successful populations in the region. The treatments is similar to that of a sting from a striking fish. If the injured area goes into necrosis, surgical debridement may be required [25].

Lionfish (*Pterois miles*, Fig. 4) originating from the Red Sea. It has poisonous spines located on its pectoral fins. The injured person must be removed from the water and taken to a safe area. Visible thorns and all other foreign objects should be carefully removed. For pain management, the wound area should be immersed in 40-degree water for 30–90 minutes. The injured area should be elevated to reduce swelling. Allergic and anaphylactic reactions should always be considered. Antihistamine, corticosteroid, adrenaline and medication should be administered quickly if necessary. Basic vital signs, temperature, pulse, blood pressure, respiratory rate and rhythm, central venous pressure, pulse oximetry should be monitored, and necessary interventions should be made in case of deterioration. For severe and extensive lesions, radiological evaluation can help evaluate significant tissue damage and necrosis in the wound. In such case, surgical debridement should be performed immediately [32, 33].

Red Sea-origin puffer fish (*Lagocephalus sceleratus*). It is often found on rocks and lives at depths of 10 to 50 meters. The fish found in Turkish waters is poisonous. Its spines and viscera contain tetrodotoxin, which block neuromuscular junction transmission, causing

muscle paralysis. Twenty minutes after eating the fish, numbness begins in the tongue and lips. Paralysis develops in the face, arms and legs. Headache, nausea, vomiting and abdominal pain occur. In the next stage, speech difficulty, breathing difficulties occur, heart arrhythmias and death occur [34, 35].

Rough tail stingrays (*Dasyatis centroura*) are known for their spiny tails, which include a single large poisonous spine. They can sting people with this spine. Most injuries involve the feet and legs. The wound resulting from the sting is both deep and poisonous. Pain from a stingray wound can be excruciating and may be accompanied by bleeding, weakness, vomiting, headache, fainting, and shortness of breath. Patients with jellyfish or sea anemone stings do not have puncture wounds. In the first intervention, the wound should be washed with sea water and the wound area should be immersed in water (45°C) hot enough not to burn for 30–90 minutes. This may provide a pain-relieving effect. Hot water immersion should not be used for more than 90 minutes.

Patients may receive nonsteroidal anti-inflammatory drugs (e.g., ibuprofen) or acetaminophen for mild pain, and opioids (e.g., intravenous morphine) may be used for moderate to severe pain. If pain persists, local or regional anesthesia may also be required. The patient who has been given local or regional anesthesia should not be immersed in hot water. If the stingray's spine remains inside and can be removed without damaging other tissues, it can be removed. However, if the spine has damaged a vein or penetrated the rib cage or abdomen, it should be left in place until the patient reaches the hospital, regardless of the pain. It must be removed surgically after additional evaluation methods in the hospital. Tetanus prophylaxis should be administered if necessary. It should be done for small and clean wounds if there have been less than 3 doses or if there are 3 or more doses but 10 years or more have passed. In large and dirty wounds, if less than 3 doses of vaccine have been received or if the patient does not know, human tetanus immunoglobulin should be administered. If there have been three or more doses but 5 years or more have passed, a tetanus vaccine should be given [27].

Patients with deep puncture wounds, especially those with foreign body involvement and penetrating wounds caused by stingrays, require prophylactic antibiotics effective against Vibrio species and skin flora until the results of wound cultures are available. Empiric antibiotic therapy for water-exposed wounds typically consists of either a first-generation cephalosporin (e.g., cephalexin or cefazolin) or clindamycin plus levofloxacin in patients at risk for Methicillin-resistant Staphylococcus aureus or penicillin allergy. Patients exposed to seawater should also receive doxycycline for coverage of Vibrio spp. Tetracycline antibiotics

can cause permanent tooth discoloration in children younger than 8 years when used repeatedly. However, doxycycline binds less readily to calcium than other tetracyclines and can be used for ≤ 21 days in children of all ages. Fluoroquinolones may also be acceptable for use in children in this situation due to the lack of other options that allow oral therapy.

Additionally, infections from marine injuries may be caused by normal skin flora. Therefore, antibiotic coverage should also include antibiotics with activity against Staphylococcal and Streptococcal species (e.g., cefazolin or cephalexin when the likelihood of clindamycin, vancomycin, or methicillin-resistant *Staphylococcus aureus* is low) [36–39].

Sandbar shark (*Carcharhinus plumbeus*). In attacks on surface swimmers, 70% of injuries occur below the knee. Since sharks do not have the ability to chew, they tear off the piece they bite. The important thing in case of injuries caused by sharks is to quickly get the diver out of the sea to prevent severe tissue injury and hemorrhagic shock. Patients may be exhausted, hypothermic, and near drowning. The patient should be taken out of the water long enough to perform emergency resuscitation practices. In the hospital setting, treatment should be given the same level of priority as other major traumas. For diagnosing possible fractures, periosteal stripping, and foreign materials such as tooth fragments that may be trapped in the wound, plain radiographs of all wound sites should be taken, and samples should be taken for culture.

Although small wounds can be treated with irrigation and topical antibiotics, operating room conditions may be required for intervention in large wounds. Tissues that have lost their circulatory connection should be reconnected and the wound should be washed with plenty of water. Plastic surgery and repeated surgeries may be required even months after the attack [40–42].

A high rate of wound infection occurs with atypical microorganisms. Prophylactic antibiotic administration is required for all shark bites. Antibiotic selection should include coverage for Vibrio, Staphylococcus and Streptococcus species. The presence of enteric and anaerobic organisms should be considered in patients with abdominal injuries. Tetanus vaccination should be given if necessary.

The most common reasons why attacks result in death are the lack of resuscitation, hemorrhagic shock or suffocation from the injury site to the hospital.

Moray eel (*Murena helena*) is a species that generally lives in cavities. Although it does not have toxins, it can cause infection if it bites due to poor oral hygiene. For diagnosing foreign substances such as tooth fragments that may remain in the wound, plain radiographs of all wound areas should be taken, and samples should be taken for culture. If the hand is

near a joint in the foot, antibiotic prophylaxis should be initiated. Ciprofloxacin, trimethoprim-sulfamethoxazole or doxycycline may be preferred against Vibrio bacteria. A moray eel bite is not primarily sutured; it is left for secondary healing. If necessary, tetanus vaccination is given [25, 43].

DISCUSSION

In Turkish waters, injuries due to poisonous sea creatures such as jellyfish, greater weeverfish, scorpionfish, lionfish and puffer fish have been frequently reported. In an article written by an author from Israel, which has a coast on the Mediterranean, the injuries were caused by stingrays (30%), wild fish (22%), rabbit fish (13%) and sea catfish (10%), a new Red Sea immigrant [44].

The last report of a non-fatal attack by a shark in Turkey was on August 26, 2019. Two divers who were diving for routine inspection and cage cleaning were attacked by sandbar shark. The shark attacked divers while they were cleaning dead fish from outside the cages. Although the sea bottom where the fish farm's cages are anchored is 47–68 meters, the attack occurred at a depth of approximately 20 meters. These events were thought to be caused by the presence of dead farmed fish [40].

A total of 13 shark attacks were reported between 1930 and 1983, and two attacks were fatal [41].

In another case, a 30-year-old male patient working in a fish restaurant applied to the emergency room with complaints of pain, swelling and redness in the third finger of his right hand after he was stung while cleaning a fish. The patient had complaints of dizziness, severe pain in the right arm, nausea and sweating [31].

Accident reports in Turkish waters are compiled from case reports and newspaper clippings. While the poisonous creatures living in Turkish waters are known, there is no statistical data on how swimmers, divers and fishermen are affected by these creatures.

Scombroid poisoning occurs after eating fish that has spoiled because it was not stored properly. Initially, its relationship with tuna and mackerel fish in the subgroup Scombridae was described, and later it was determined that poisoning could also occur with other dark-fleshed fish. It is necessary to distinguish food poisoning from poisoning caused by eating fish. Diagnosis is based on history and clinical appearance. However, if confirmation is necessary, histamine levels can be measured in uneaten parts of the suspected fish [45–48].

CONCLUSIONS

The cause of accidents and dangerous situations that may occur underwater is usually the diver's own faults and mistakes. In the marine environment, the victim is sometimes accidentally touched without seeing the creature they are exposed to, or even if a stinging fish is seen, the victim may know which species it is. Only a small portion of underwater accidents are caused by sea creatures. Recognition of marine-related infections is often delayed because the possibility of exposure to or injury in the marine environment is often not remembered.

Addressing marine environment injuries begins with getting the victim to a safe environment outside of the water. Afterwards, it is important to control the pain and calm the person down. Meticulous wound care should be performed. The wound should be washed for a long time, the severed tissue pieces are brought together, and any foreign substances remaining in the wound should be detected and removed. It is widely accepted that symptoms and treatments may vary between individuals. For the treatment of marine environment injuries, prophylactic antibiotics should be started, and tetanus prophylaxis should be applied when required.

In the seas of Turkey, which are in the temperate climate zone, there are very few marine creatures that can be considered dangerous compared to those in warmer seas. From this perspective, our seas can be said to be among the safest in the world.

In this paper, we aim to remind readers of the precautions and first aid to be taken in such situations. This is the first article designed to enhance emergency department physicians' and general practitioners' recognition and management of harmful marine life encounters in Turkish waters.

ARTICLE INFORMATION AND DECLARATIONS

Data availability statement: Data is available upon request.
Ethics statement: This study has been conducted according to the ethical rules.
Author contributions: conceptualization, Y.A. and A.S.Y.; methodology, Y.A. and A.S.T.; software, Y.A. and A.S.Y.; validation, A.S.Y. and Y.A.; formal analysis, Y.A.; investigation, Y.A. and A.S.Y.; resources, A.S.Y.; data curation, Y.A. and A.S.Y.; writing original draft preparation, Y.A.; writing, review and editing, Y.A. and A.S.Y.; visualization, A.S.T.;

supervision, A.S.T.; project administration, Y.A. and A.S.T.; All authors have read and agreed to the published version of the manuscript.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. This research received no external funding.

Acknowledgments: Thank to the Professor Doctor Samil AKTAS for their expertise and assistance throughout all aspects of our study and for their help in writing the manuscript.

Conflict of interest: The authors declare no conflict of interest.

Supplementary material: Not applicable.

REFERENCES

1. Dimmock K. Finding comfort in adventure: experiences of recreational SCUBA divers. Leisure Studies. 2009; 28(3): 279–295, doi: 10.1080/02614360902951674.
2. Johansen K. Scuba diving education and training. SCUBA diving tourism. Routledge, Edition1st Edition, ImprintRoutledge, 2013 eBook ISBN9780203121016. Page: 81–96.
3. Lew AA. World geography of recreational SCUBA diving. Scuba diving tourism. Routledge, Edition1st Edition, Imprint Routledge, 2013. Page: 29–51.
4. Dimmock K. Scuba diving, snorkeling, and free diving. Water-Based Tourism, Sport, Leisure, and Recreation Experiences. 2007: 128–147, doi: 10.1016/b978-0-7506-6181-2.50013-0.
5. Garrod B, Gössling S (Ed.). New frontiers in marine tourism: diving experiences, sustainability, Management. Routledge, 2008.
6. Rozwadowski H.M. Ocean's Depths. Environmental History, 2010: 510-525.
7. Diolé, Philippe. 4000 Years Under The Sea: Excursions in Undersea Archaeology. Pan Books.
8. Woodell MJ, Koblick G. Living And Working in The Sea. Vol 252, No 3, page 28-30; 1984.
9. Arin T, Kramer R. Divers' willingness to pay to visit marine sanctuaries: an exploratory study. Ocean & Coastal Management. 2002; 45(2-3): 171–183, doi: 10.1016/s0964-5691(02)00049-2.

10. Davis D, Tisdell C. Recreational scuba-diving and carrying capacity in marine protected areas. Ocean & Coastal Management. 1995; 26(1): 19–40, doi: 10.1016/0964-5691(95)00004-l.
11. Lew AA. World geography of recreational scuba diving. In: Scuba diving tourism. Routledge, 2013 P: 29–51.
12. Ghazali M. Dimmock, K (Ed.). Scuba diving tourism. Abingdon: Routledge 2013.
13. Kelsey J. Scuba diving education and training. In: Scuba diving tourism. Routledge, 2013: 81–96.
14. https://tudav.org/calismalar/denizel-biyocesitlilik/biyolojik-yayilim/turkiye-denizlerinde-zararli-deniz-canlilari-calistayi/.
15. https://dan.diverelearning.com/files/d0h0ynfwz903ajzais8jb/dan-hmlı-student-handbook.pdf.
16. https://www.navsea.navy.mil/portals/103/documents/supsalv/diving/us%20dıvıng%20manual_rev7.pdf?ver=2017-01-11-102354-393 Appendıx 5c Hazardous Marine Creatures..
17. Cegolon L, Heymann WC, Lange JH, et al. Jellyfish stings and their management: a review. Mar Drugs. 2013; 11(2): 523–550, doi: 10.3390/md11020523, indexed in Pubmed: 23434796.
18. An updated checklist of poisonous fishes of Turkish Aegean Sea. Journal of Coastal Life Medicine. 2015; 3(7), doi: 10.12980/jclm.3.2015j5-37.
19. Clark RF, Girard RH, Rao D, et al. Stingray envenomation: a retrospective review of clinical presentation and treatment in 119 cases. J Emerg Med. 2007; 33(1): 33–37, doi: 10.1016/j.jemermed.2007.03.043, indexed in Pubmed: 17630073.
20. Alparslan M, Özalp HB, Doğu S. Poisonous marine organisms in Turkey and first medical aids. In: Second international symposium on sustainable development (Issd 10). 2010 June, P:8-9.
21. Montgomery L, Seys J, Mees J. To pee, or not to pee: a review on envenomation and treatment in european jellyfish species. Mar Drugs. 2016; 14(7), doi: 10.3390/md14070127, indexed in Pubmed: 27399728.
22. https://www.uptodate.com/contents/jellyfish-stings.
23. Öztürk N. Türkiye Denizlerinde Zehirli Denizanaları Ve Toksik Etkileri. Aquatic Sciences And Engineering. 2017; 32(3): 154–169.
24. Brown TP. Diagnosis and management of injuries from dangerous marine life. MedGenMed. 2005; 7(3): 5, indexed in Pubmed: 16369231.

25. Gözcelioğlu B. Yumbul Kardaş AS, Türkiye'nin Zehirli Deniz Canlıları - Tanıma, İlk Yardım Ve Tedavi Yöntemleri ISBN978-625-398-791-6. Nobel Bilimsel Eserler : 2023.
26. https://dan.org/wp-content/uploads/2020/07/hmli-dan-dive-medical-reference.pdf.
27. https://www.uptodate.com/contents/marine-envenomations-from-corals-sea-urchins-fish-or-stingrays?topicref=2752&source=see_link.
28. Eryılmaz M, Durusu M. Menteş MÖ, T. Yiğit. Envenomation Caused By Weever Fish. Turkish Journal Of Emergency Medicine. 2006; 6(3): 142–145.
29. Yıldız T, Karakulak F. Toxic effects of weever fishes among poisonous fishes along the coast of Turkey. Aquatic Sciences and Engineering. 2018: 20–24, doi: 10.18864/ase201804.
30. Dinçer Ü, Çakar E, Kıralp MZ. Çarpan Balığı (Trakonya) İle Yaralanmaya Bağlı Kompleks Bölgesel Ağrı Sendromu: Bir Olgu Nedeniyle. Fiziksel Tıp Ve Rehabilitasyon Bilimleri Dergisi. 2008; 11(1): 27–29.
31. Bozkurt S, Güler S, Aksel G. Çarpan Balığı: Denizden Uzakta Deniz Canlıları İle Zehirlenme Vakası. Turk J Emerg Med. 2012; 12(4): 182–184.
32. Aktaş Ş, Mirasoglu B. Lionfish envenomation: clinical aspect and management. J. Black Sea/Mediterranean Environment. 2017; 23(1): 81–87.
33. Sümen SG, Mirasoğlu B, Aktaş Ş. Lionfish envenomation epidemiology, management and prevention. Lionfis h invasion and its management in the mediterranean sea. Turkish Marine Research Foundation (Tudav) Publ. 2018; 49: 70–87.
34. Özdemir L. Kirpi Balığı Yedikten Sonra Gelişen Parestezi Olgusu. Turk J Intensive Care. 2021; 19: 144–7.
35. Sümen SG, Bılecenoğlu M. Traumatic finger amputation caused by lagocephalus sceleratus (Gmelin, 1789) bite. Journal Of The Black Sea/Mediterranean Environment, 2019, 25; 3: 333–338.
36. Byrkit BN, LaScala EC, MenkinSmith L, et al. Characterization of prophylactic antimicrobial therapy practices for patients with marine-associated injuries in the emergency department. J Pharm Pract. 2023; 36(1): 53–59, doi: 10.1177/08971900211021058, indexed in Pubmed: 34098786.
37. Dıaz JH. Emerging causes of superficial and invasive infections following marine injuries and exposures. The Journal Of The Louisiana State Medical Society, 2014, 166; 3: 103–109.

38. Savini V. Skin and soft tissue infections following marine injuries. In: The microbiology of skin, soft tissue, bone and joint infections. Academic Press, 2017: 21(3), 207–213.
39. Finkelstein R, Oren I. Soft tissue infections caused by marine bacterial pathogens: epidemiology, diagnosis, and management. Curr Infect Dis Rep. 2011; 13(5): 470–477, doi: 10.1007/s11908-011-0199-3, indexed in Pubmed: 21785929.
40. Ergüden D, Ayas D, Kabasakal H. Provoked Non-Fatal Attacks To Dıvers By Sandbar Shark, Carcharhınus Plumbeus (Carcharhınıformes: Carcharhınıdae), Off Taşucu Coast (Ne Medıterranean Sea, Turkey). In: Annales: Series Historia Naturalis. Scientific And Research Center Of The Republic Of Slovenia. 2019; 30(1): 1–8.
41. Kabasakal H, Gedikoglu SO. Shark attacks agaınst humans and boats in turkey's waters in the twentıeth century/attacchı dı squalı a uomını e barche in acque turche nel ventesımo secolo. In: Annales: series historia naturalis. Scientific And Research Center Of The Republic Of Slovenia. 2015; 25(2): 115.
42. Scharf M. Cutaneous injuries and envenomations from fish, sharks and rays. Dermatologic Therapy. 2002; 15(1): 47–57, doi: 10.1046/j.1529-8019.2002.01510.x.
43. Fisher A.A. Atlas Of Aquatic Dermatology. 1978 American Cynamid Company.
44. Gweta S, Spanier E, Bentur Y. Venomous fish injuries along the Israeli Mediterranean coast: scope and characterization. Isr Med Assoc J. 2008; 10(11): 783–788, indexed in Pubmed: 19070287.
45. https://www.who.int/classifications/classification-of-diseases.
46. https://www.uptodate.com/contents/scombroid-histamine-poisoning?topicref=2745&source=see_link.
47. Mater S, Bayhan B, Atabey Ş. Scombroid Balık Zehirlenmesi. Su Ürünleri Dergisi. 2001; 18(1): 293–299.
48. Taymaz T. Skombroid Balık Zehirlenmesine Ait Üç Olgu Sunumu. The Journal Of Turkish Family Physician, 2017, 8; 1: 11–14.

Figure 1. Moon Jellyfish (*Aurelia aurita*)

Figure 2. Bristleworm (*Hermodice carunculate*)

Figure 3. Long-spined sea urchin (*Diadema setosum*)

Figure 4. Lionfish (*Pterois miles*)