ENDEAVOUR MEDICAL

MARINE LIFE INJURIES : WHAT YOU NEED TO KNOW

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INTRODUCTION TO MARINE LIFE INJURIES

A vast array of flora and fauna inhabits the waterways, lakes, rivers and oceans which crisscross and surround Earth's continents. The World Register of Marine Species has formally identified approximately 250,000 species with many more not yet formally reported. [1]

Whereas the majority of marine species are harmless to humans, there are a significant minority of marine creatures which are capable of causing harm. This harm falls across a broad spectrum from the mildly irritating to the severe and life-threatening. This risk of marine life injuries varies greatly depending on region, environment and human activities being undertaken in the area.

Before engaging in an environment where injuries from marine life could pose a significant risk, healthcare practitioners must consider:

- What dangerous species may be present in the area of travel?
- What preventative measures can be taken to minimise the risk these species pose to the patient population, including system measures (e.g., choice of location) and individual measures (e.g., education).
- How likely is an incident leading to marine creature injuries to occur, and if an incident should occur, what are the injuries / pathology likely to be suffered by the patient? What medical equipment may be required to manage these?
- What additional support may be required to deal with marine like injuries and how can it be accessed? (e.g., secondary-care for further

treatment and monitoring, national centres for consideration of anti-venoms).

Due to the gamut of potentially dangerous marine species and leading to marine life injuries, this article is a non-exhaustive list covering some of the more well known dangerous marine species which the medic may have to familiarise themselves with in certain environments.

MARINE LIFE INJURIES : IDENTIFYING THE SPECIES AND POTENTIAL DANGERS

SHARKS : UNDERSTANDING THE ACTUAL RISKS

Unfortunately, sharks have been unfairly maligned. They are largely harmless to humans and only four (great white, tiger, bull and whitetip) of over four hundred species have been involved in unprovoked attacks on humans. **These attacks were most likely because the victims were mistaken for the shark's typical prey**. There are an average of 70 shark attacks,both provoked and unprovoked worldwide every year [2].

Sharks are found in all of the world's oceans, typically preferring coastal regions between the tropics. Bull sharks exist in both seawater and freshwater.

Marine life injuries from sharks are likely to be bites or puncture wounds, with the extent of the injury varying from minor to extensive. Treatment depends on the extent of tissue disruption and underlying structures which might have been damaged. Consider antibiotics to prevent secondary infection. Any penetrating or significant injuries necessitate secondary-care involvement.

To minimise your risk [3]:

- Avoid areas where sharks are known to be present! This can include sewage outlets and fishing boats.
- Stay in groups when swimming.
- Avoid the water between dusk and dawn when sharks are most active.
- Sharks have excellent olfaction: don't enter the water if bleeding. Extra caution is advised if menstruating.
- Don't wear bright colours or jewellery: reflected light imitates the sheen of fish scales.
- Don't splash excessively: it imitates struggling prey. If you see a shark and are able to, then swim smoothly away.

Tiger shark

Illustration by Mark Dando, image from the Shark Research Institute.

Taken from: https://www.sharks.org/tiger-shark-galeocerdo-cuvier [https://www.sharks.org/tiger-shark-galeocerdo-cuvier]

CROCODILES AND ALLIGATORS : UNDERSTANDING THE NATIVE HABITATS AND RISKS

Alligators are only native to the USA, Mexico and China and are generally considered less aggressive than crocodiles. Species of crocodile can be found throughout Central America, Africa, India, Southeast Asia and Australia. Crocodile attacks on humans are not uncommon. The Nile crocodile and saltwater crocodile are the most prolific, attacking humans which they view as prey in East / Sub-Saharan Africa and Southeast Asia / Australia respectively.

Crocodiles are ambush predators that can move surprisingly quickly and **cause harm by biting down and clamping onto their prey with their jaws as they try to drag them into the water**. A crocodile can exert almost 1000 kg of force with their bite [4].

Should someone survive the initial ambush from a crocodile – when **the principal risks are drowning [https://endeavourmedical.co.uk/drowning/] and major trauma** – then there is likely to be extensive, significant disruption to soft tissue and skeletal structures with injuries both penetrating and blunt-force. Fractures, bleeding and nerve injury are all to be considered. Extremities

are most commonly affected (as a target of convenience which the crocodile latches onto). Wounds are considered heavily contaminated and require surgical debridement. Secondary care is required.

Marine life injuries, such as those caused by crocodile attacks, often present logistical challenges.: whereas shark bites typically happen near well-populated and easily accessible coastal areas, crocodile attacks most often occur in remote, difficult-to-reach areas.

Preventative measures include [4]:

- Avoid areas where crocodiles are known to be present! Clarify this with local services if necessary.
- Don't camp near the water's edge if crocodiles inhabit the area.
- Don't leave food scraps out or near water. Don't collect water from the same site on multiple occasions.
- Don't swim or wade in water which has any risk of crocodile infestation.

Nile crocodile

Image sourced from Wikipedia: Nile Crocodile article.

Taken from: https://en.wikipedia.org/wiki/Nile_crocodile [https://en.wikipedia.org/wiki/Nile_crocodile]

SEA-SNAKES : UNDERSTANDING THE THREAT

Marine life injuries are not limited to encounters with large aquatic predators but also include incidents with smaller, yet equally dangerous creatures like sea snakes. They are almost all elapids, a family of snakes endemic to tropical and subtropical regions, commonly venomous, most often neurotoxic in nature. Sea snakes, despite their name and excellent adaptation to the water, sea animal injuries involving sea snakes are not uncommon as these creatures commonly prefer shallow, sheltered waters and regularly swim up rivers.

Despite being extremely venomous [5], sea snakes are not known for their aggression and often **only bite when handled**, making these interactions a major cause of sea animal injuries. When they do bite, their venom has nephrotoxic, myotoxic and neurotoxic properties (dependent on species) [5]. Breakdown of skeletal muscle causes **myalgia and rhabdomyolysis with classic Coca-Cola coloured urine.** This is compounded by tubular necrosis as the venom targets the kidneys directly. Finally, envenomation also causes **a progressive paralysis of muscles** including those involved in swallowing and breathing. Onset is gradual and the bite itself may be painless.

If a bite occurs try to reassure and calm the patient. Many snakes bite without injecting venom ('dry bites'). Try to identify the snake if possible but **DO NOT approach it or try to kill it**: even a dead snake can envenomate you. Leave the bite alone. Give analgesia (not NSAIDs which worsen the effects of haemotoxic venoms), remove tight clothing and jewellery from affected extremities. Immobilise the person and, most specifically, the affected site entirely. Use a pressure dressing over the

affected site but make sure distal sensation and pulses are intact. [6]

The above measures slow the spread of the venom. Ultimately, evacuation is necessary, preferably to a site that you have already reviewed during the planning stage and you know stocks antivenom. A patient may simply need observation for a period of time in secondary care:this time is variable dependent on bite-burden and the suspected species. However if they develop complications of envenomation, which may include rhabdomyolysis, paralysis, shock or incoagulable blood, then antivenom may need to be administered.

Antivenom is not ubiquitous: it is a product which varies between regions dependent on the local venomous snake species. It is either monovalent (i.e., specific to a certain venom) or polyvalent (i.e., an antidote to several venoms). **Administration of antivenom, particularly polyvalent preparations, has a high incidence of anaphylaxis** and therefore needs to be administered in a high-dependency setting with close monitoring and adrenaline available. [6] [7]

Preventative measures include:

- Avoiding sites known to have high populations of sea snakes!
- Wear a high-quality wetsuit and boots (difficult for sea snakes to pierce these).
- Don't touch / try to get close to a sea snake should you spot one. It's also worth noting that it's often hard to tell a sea snake's head from its tail.

Black-banded sea krait

Image sourced from Ocean Fauna.

Taken from: https://oceanfauna.com/black-banded-sea-krait/?utm_content=cmp-true [https://oceanfauna.com/black-banded-sea-krait/?utm_content=cmp-true]

JELLYFISH : UNDERSTANDING AND TREATING JELLYFISH STINGS

Jellyfish are organisms with a bell which provides propulsion and tentacles which have stinging cells called nematocysts. The bell alone can range in size from a few millimetres to nearly two metres in length. The tentacles can extend a jellyfish's length to over 30m in some instances. Jellyfish often do well in oxygen-poor waters or regions where other marine life is limited due to human factors such as overfishing and excess land runoff. Here they form 'blooms' – large populations of jellyfish which can migrate en masse. There are many types of jellyfish and their stings are similarly broad in the symptoms they can cause in humans, often resulting in marine life injuries. Two types of jellyfish which are more commonly encountered include the Portuguese Man o' War and Box Jellyfish.

The Portuguese Man o' War is found in the Atlantic, Indian and Pacific Oceans. The name comes from its similarity in appearance to a sixteenth

century Portuguese warship at full-sail. Its tentacles leave raised welts on exposed skin and cause **pain lasting three to four hours**. Death is rare but has been recorded following Portuguese Man o' War stings. This is likely secondary to an increased sting burden, causing significant pain and breathing issues or due to an anaphylactoid reaction. [8] [9]

There are many species of Box Jellyfish, named after the cube shape of their bell. They are found in most tropical and subtropical oceans and typically reside close to shore. The most dangerous species of Box Jellyfish are mainly found in the Indian and Pacific oceans. One notorious species of Box Jellyfish is the Irukandji, found off the coasts of northern Australia. Irukandji are small, translucent and extremely venomous, capable of causing sea animal injuries like '**Irukandji syndrome**' in humans. This syndrome includes **severe myalgia, anxiety, tremor, headache, hypertension, tachycardia, pulmonary oedema and even death**. [6] [9]

Treatment for jellyfish stings focuses on pain management and monitoring the patient's breathing in particular. **Remove any nematocysts from the skin to prevent further envenomation,** a crucial step in dealing with marine creature injuries. Depending on the species, this is best achieved with seawater or vinegar (as is the case with Irukandji) to neutralise them, followed by scraping them away with a razor, credit card or using a gloved hand. There has been some recent controversy about the use of vinegar in Boxfish stings, however it is still currently recommended by the Australian Resuscitation Council [9] [10]. Removal of the nematocysts relieves pain and reduces venom burden. Further analgesia is advised and should the patient develop systemic compromise then a full primary assessment should be re-visited. There

are now antivenoms available for certain jellyfish stings.

Prevention includes:

- Paying attention to local guidelines regarding where and when to swim.
- Swim in netted areas (which mostly keep jellyfish out) in at-risk areas.
- Wear protective clothing in the water e.g., wetsuits.
- Don't approach even dead jellyfish or tentacles no longer attached to the body: both are still very much capable of stinging.
- Take care when surfacing if diving underwater and remember to check above you.

Box jellyfish

Image sourced from Encyclopedia Britannica.

Taken from: https://www.britannica.com/animal/box-jellyfish [https://www.britannica.com/animal/box-jellyfish]

STONEFISH : DEALING WITH THE MOST VENOMOUS FISH

Stonefish, more properly called Synanceia, are found in the Indian and Pacific Oceans and are the most venomous fish known to science [11].

They derive their name from their camouflaged appearance which makes them appear similar to rocks. Their camouflage unfortunately is what makes them dangerous to humans: swimmers often don't notice the stonefish and thus step on them, causing the stonefish to sting the swimmer.

The venom is a neurotoxin which initially causes intense pain on envenomation, a typical marine animal injury. **Subsequent symptoms can include respiratory weakness, cardiovascular compromise, paralysis and death**. Treatment includes hot water (to denature the venom) and, in severe cases, antivenom. Spines often break off in the wound, so will need to be removed, when possible, to avoid further complications from these sea creature injuries. [6]

Prevention includes:

- Be aware of local distributions of stonefish (some areas are more heavily affected than others).
- Wearing footwear in the water.
- Entering the water slowly with a shuffling gait: this gives the fish plenty of time to move away from you and reduces the risk of stepping directly onto one.
- Disturb the water ahead of you e.g., with a stick: again, this gives the fish plenty of warning.

Stonefish

Image sourced from Encyclopedia Britannica

Taken from: https://www.britannica.com/animal/stonefish-Synanceiidae-family [https://www.britannica.com/animal/stonefish-Synanceiidae-family]

BLUE-RINGED OCTOPUS : A SMALL BUT SIGNIFICANT CONTRIBUTOR OF MARINE LIFE INJURIES

Small, cute, deadly. Blue-ringed octopus are found in the Pacific and Indian Oceans and, as their name suggests, have beautiful iridescent colouring which makes them irresistible to the unwary, curious human. They are typically less than 20cm in size and will try to retreat if they feel threatened. If retreat doesn't work, then they employ their **powerful toxin, tetrodotoxin, leading to severe marine life injuries.**

Tetrodotoxin is neurotoxic and targets sodium channels. Envenomation is painless and symptoms develop in minutes, starting as **nausea and progressing to whole-body paralysis including the diaphragm.** Thus, death is secondary to a respiratory arrest. There is no antivenom or cure for tetrodotoxin, therefore respiratory function must be artificially supported until the venom clears the system. [6] [12]

Preventative measures include:

- Don't touch cute, bright, innocuous looking creatures!
- Be careful around rock pools or reefs, where they may be harder to

distinguish.

- Keep your distance: Blue-ringed octopus are shy and prefer to retreat. Give them that option.

Blue-ringed octopus

Image sourced from The Natural History Museum

Taken from: https://www.nhm.ac.uk/discover/blue-ringed-octopus-small-vibrant-deadly.html [https://www.nhm.ac.uk/discover/blue-ringed-octopus-small-vibrant-deadly.html]

MARINE LIFE INJURIES : TAKE HOME MESSAGES

1. There are many species of marine life dangerous to humans. The nature and severity of the danger varies greatly, and it is important to research the dangerous animals which may inhabit your area of work prior to being confronted by a patient suffering from their ministrations.
2. Prevention, as always, is better than cure. Once you have identified the potentially hazardous marine life in your area of work, consider how you may be able to minimise that risk. There are likely to be both systemic and individual factors which contribute to this.
3. A lot of conditions require secondary care, but often for different reasons. Consider your evacuation plans in the event of different issues

arising whilst in the field.

Are you interested in learning more about marine creatures and other water related conditions?

If so, why not check out our Marine Medicine [https://endeavourmedical.co.uk/marine-medicine-course/] course? Whilst you're there, why don't you take a look at our other courses [https://endeavourmedical.co.uk/expedition-medicine-courses/] too?

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