

Marine envenomation – a risk for travellers

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Although there are many species of jellyfish and venomous marine animals, the first aid and medical treatment of their bites and stings can be grouped simply.

Some of the more important situations causing marine envenomation – that is, jellyfish stings and envenomation from sea animals – are discussed in this article. It highlights common potential marine risks to travellers while they are overseas or travelling around Australia, and details first aid and medical treatment of these animal's bites and stings. A comprehensive review of the subject is beyond the scope of this article.

Basic prevention from marine envenomation can be addressed briefly and simply by:

- not touching any marine animal
- walking into strange waters slowly and carefully, allowing any marine creature to move away (they practically never 'attack', only defend by whatever means they have for protection – that is, sting, bite or envenomate)

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- wearing a lycra suit or protective clothing when entering the sea in any tropical zone of the world (venomous jellyfish do not just occur in northern Australian waters).

No attempt has been made to grade the severity of envenomation, or the variation in each geographical area in this article. Unfortunately, knowledge of this subject from the locals in overseas destinations will almost always be unhelpful, even misleading and negligible.

Jellyfish

A basic introduction into jellyfish ecology can be helpful when explaining to patients some of the problems jellyfish may cause, how to prevent stings and first aid treatment of stings. Jellyfish taxonomy is shown in the flowchart on page 54.

In general, vinegar is used for prevention of further stinging in all box jellyfish (Cubozoans) but not for stings by other jellyfish because the response is unpredictable.¹ Hot water or tap water is never used as first aid treatment for any box jellyfish because this can cause increased envenomation. A guide to first aid treatment for dangerous tropical jellyfish stings is shown in the flowchart on page 55.

Ice wrapped in a waterproof (polyethylene) bag or cold packs wrapped in a cloth and applied to the skin has been an accepted practice worldwide for many years for first aid treatment of stings by button jellyfish, sand jellyfish and Red

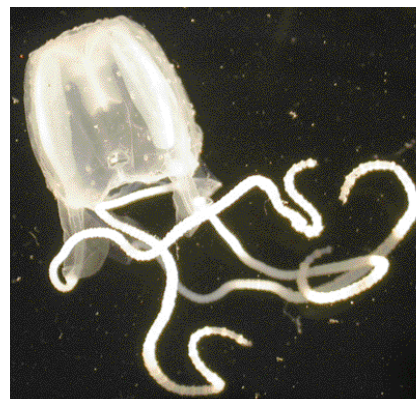


Figure 1. *Carukia barnesi* (Irukandji box jellyfish).

Sea jellyfish. This has been shown to be effective and safe when the ice or cold pack is applied to the affected area for 15 minutes and then reapplied, if necessary.² A guide to treatment for stings from different types of jellyfish, as well as bites/wounds from other marine animals, is shown in the flowchart on page 56.

Irukandji box jellyfish

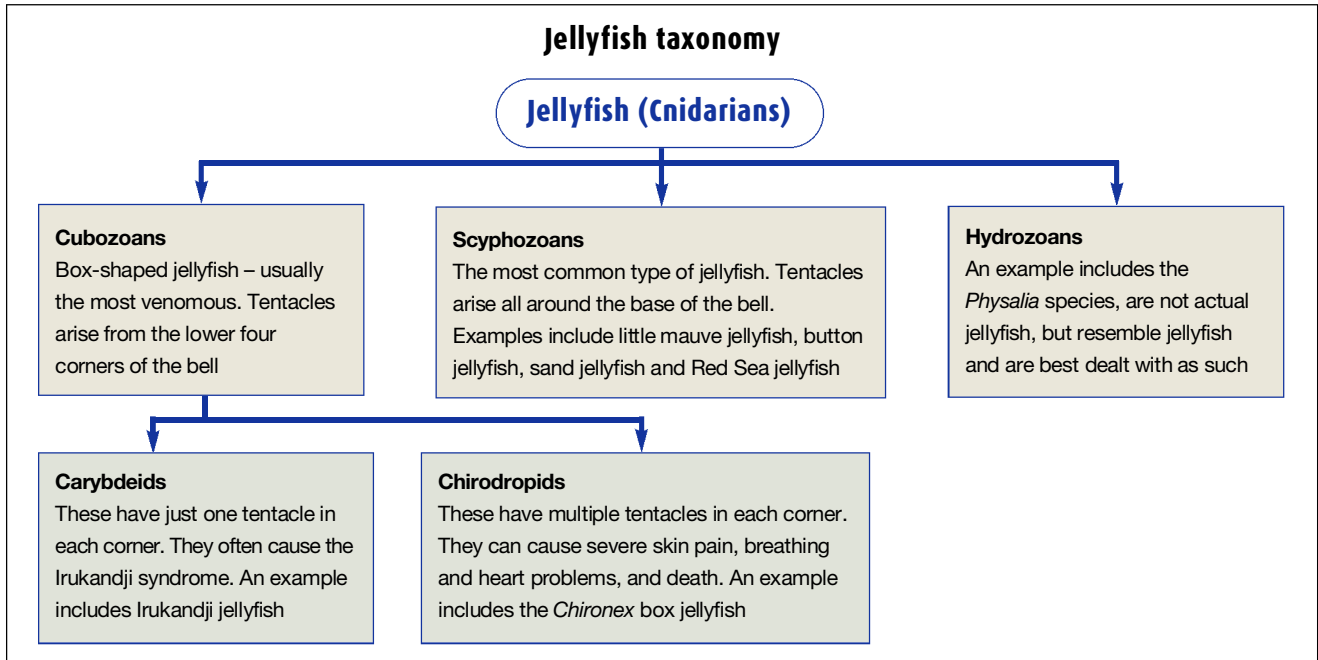
The original Irukandji (*Carukia barnesi*) is a small box jellyfish with just four tentacles, one in each lower corner of the bell (Figure 1).³ The transparent bell is usually approximately 12 mm in diameter, making it almost impossible to see in the water. There are now at least nine species of Irukandji and the name is more of a group name, with various small and large species.⁴ Irukandji is now generically used to refer to all jellyfish causing the Irukandji syndrome.

Envenomation – the Irukandji syndrome

The initial skin sting of Irukandji jellyfish is usually characteristically mild with a faint pink mark that may be missed. Goose pimples and slight sweating may also occur. About 30 minutes later victims develop distressing systemic symptoms, with some or all of the effects of the classic Irukandji syndrome, including those noted below.

- Pain – severe 'boring' low back pain with incapacitating cramping pains moving into the legs, abdomen and

continued



chest. These are described as unbearable and come on in ‘waves’ (similar to labour pains), although it never fades completely. The chest pain or tightness is caused mainly by spasm of the intercostal muscles and occasionally by cardiac muscle pain,



Figure 2. *Chironex* box jellyfish.

- with elevated troponin levels suggesting cardiac muscle damage.
- Catecholamine excess – results in localised or generalised sweating that may be profuse and drenching; piloerection; severe headache; nausea and vomiting; rapid and ‘sighing’ breathing; tremor and tachycardia (often with ventricular extrasystoles); anxiety, restlessness and a ‘feeling of impending doom’.

Some stings from larger Irukandji-like jellyfish can cause life-threatening hypertension, acute pulmonary oedema, toxic heart failure and even death, with two fatalities documented.⁵ These symptoms usually only occur with offshore and reef stings.

Geographical area

Irukandji jellyfish occur in tropical Australian waters from the south around the Agnes Water area in central Queensland, north and westwards around the north Australian coast and then down as far south as Broome, West Australia. Stings occurring in the coastal areas are rarely life threatening, except in the Broome area. (Irukandji jellyfish mainly occur in

deep-water reef areas but they can be swept inshore by prevailing currents.) A similar syndrome has been described in the Thai/ Malaysian peninsulas, the Caribbean, the Red Sea and various other areas around the world.⁶

Season

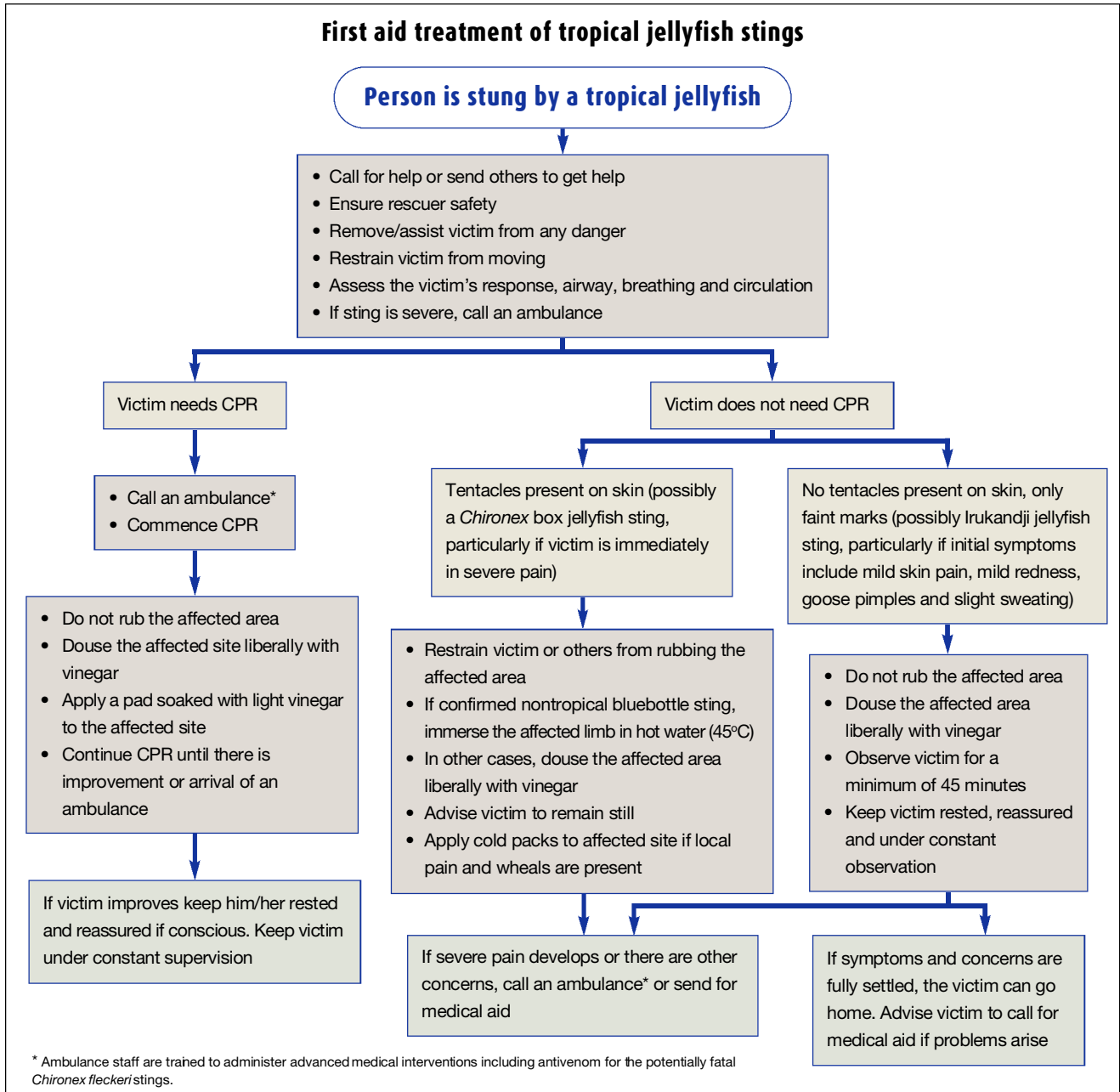
The season for Irukandji in Australia is mainly the summer months of December and January, although stings can occur in mid-November and continue through to May.

Treatment

The minor initial skin sting of Irukandji species is frequently missed but vinegar should be poured on the area as soon as possible. Hospital admission is necessary for victims with systemic symptoms, and intravenous magnesium is the preferred treatment for these patients.⁷

***Chironex* box jellyfish**

The *Chironex* box jellyfish (*Chironex fleckeri*) has a large box-shaped bell up to 30 cm in diameter, but is transparent and cannot be seen easily in the water (Figure 2). In each



of the lower four corners of the bell there are up to 15 ribbon-like tentacles, which arise in bundles. Contracted tentacles are thick and are up to 10 cm in length, but can extend up to 3 metres in length when the jellyfish is fishing for prey. These tentacles are practically invisible and can envenomate people who are swimming or wading through them in the water.⁸

Sting

The *Chironex* box jellyfish causes instant agonising skin pain. The sting marks appear like whip marks or linear burns on the victim's skin. Pinkish-brown adherent tentacles usually remain on the skin. Victims may rapidly lose consciousness and stop breathing and/or their pulse may become irregular and

stop. Deaths can occur in less than a few minutes.⁸

Geographical area

In Australia, the *Chironex* box jellyfish occurs in shallow, tropical waters from around Agnes Waters, Queensland, extending up through the Northern Territory and down the western coast around

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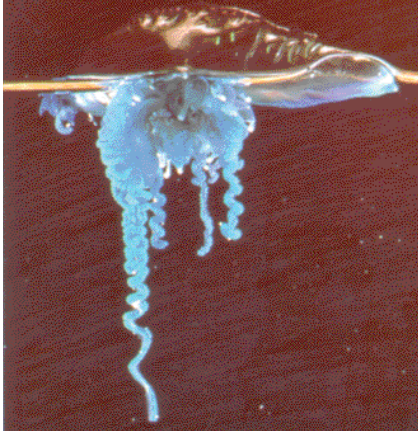


Figure 3. Blue bottle (*Physalia utriculus*).

Broome, West Australia. It is a coastal jellyfish and is not found offshore. These lethal jellyfish occur in most tropical waters of the world but are most common and dangerous in the Indo-Pacific area, especially Thailand, the Philippines, Malaysia and nearby coastal countries.¹

Season

The *Chironex* box jellyfish appears in the summer months in the cyclone or

typhoon seasons (northern Hemisphere) – for example, late December to March in the Tropic of Capricorn. In equatorial regions, including the far north of Australia and around the equator, *Chironex* stings often start to occur in mid-November and continue through to May; however, they have been reported all year round. Local warning signs should be observed and if there is any doubt, it is best not to enter the water.¹

Treatment

The first aid treatment for *Chironex* stings is as follows:

- assess the victim’s response, airway, breathing and circulation; CPR may be necessary
- pour vinegar over the affected area for 30 seconds to detoxify (deactivate) the tentacles, which will shrivel and fall off. The longer the tentacles are in contact with the skin, the greater the envenomation becomes as more stinging cells are brought into action. If vinegar is unavailable, pick the tentacles off with the fingers, remembering to wash hands after (the pads of fingers are thick and

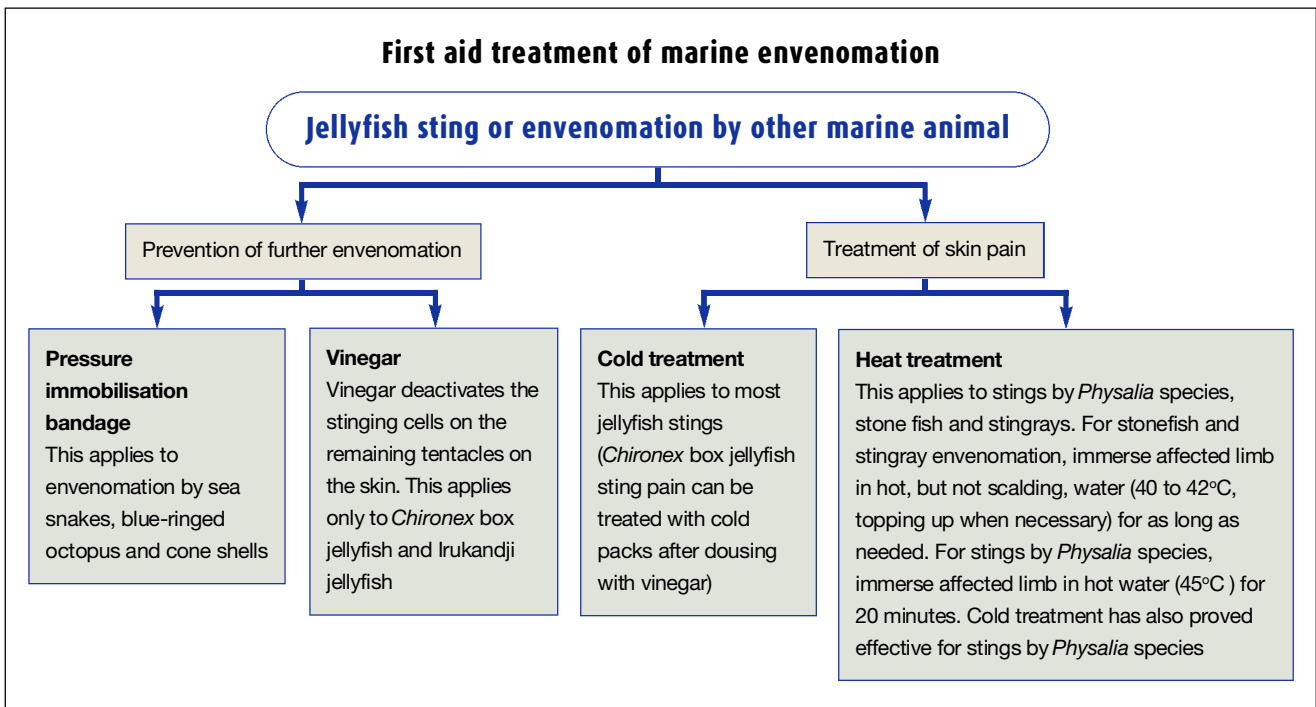
do not cause envenomation to the rescuer). This causes increased envenomation but less so than if the tentacles are left *in situ*, especially if ground into the skin when the person is moved.

Antivenom is available for *Chironex* stings and hospital admission is necessary for victims of large stings. Skin necrosis and scarring are normal, and secondary allergic appearance of the tentacles with severe itching is a relatively common occurrence after chirodroid stings. This is best treated with oral prednisone or ultrapotent cortisone creams.

Blue bottles and Pacific man-o’-war jellyfish

Physalia species are in fact a hydroid, a siphonophore colony, but they are often regarded as jellyfish. There are two main types of *Physalia* species, which include:

- the blue bottle (*Physalia utriculus*), a common Australian species, with a single long, coiled, retractable tentacle hanging under the bell. They have an obvious characteristic blue, gas-filled sac, which floats on the surface



(Figure 3). Tentacles may be only a few centimetres long but can grow up to 10 metres in length. They appear in swarms in the summer

- the Pacific man-o'-war (*Physalia physalis*), a larger species with a blue bell up to 15 cm in length with multiple long retractable tentacles hanging underneath. The bell may have a 'fringe' or sail that may be a deeper blue or mauve in colour. This species causes a more severe skin sting and has unpleasant systemic effects. In Australia it is referred to as the 'Pacific man-o'-war' to distinguish it from its 'big brother' the Portuguese man-o'-war, which in the tropical Atlantic sea can grow up to 25 cm in bell length with tentacles that may extend up to 20 metres.

Sting

The blue bottle has a characteristic sting appearance consisting of a long line of beads of white wheals, matching the appearance of the curled-up, elasticised tentacle with its 'button' appearance. Skin pain is uncomfortable but not severe. Pain is also often felt in the draining lymph glands – the groins or axillae.

Pacific and Portuguese man-o'-war stings cause much more painful and distressing skin pain, gland pain, and nausea and vomiting. Some victims experience symptoms of a moderate Irukandji-like syndrome (see above) consisting of low back pain and muscle cramps in the limbs, abdomen and chest, which causes painful breathing (from the chest wall muscles when breathing), but not breathlessness.

All *Physalia* species can occasionally cause severe or bizarre symptoms.

Geographical area and season

Blue bottles occur mainly on the eastern and western coasts of Australia in the summer months when swarms may be blown on to swimming beaches after a change in the prevailing wind, resulting in thousands of stings. Worldwide they occur in temperate zones and are common and severe

in large numbers in Florida, USA, and the east Atlantic coasts from June to August, with severe stings reported at this time. They are also common around Goa, India, around the same time.

Treatment

Currently, *Physalia* species are the only 'jellyfish' whose sting can be effectively treated with heat in tightly controlled conditions.⁹ However, this has been challenged because the combination of heat and freshwater is problematical and should not be used on any stings except confirmed blue bottle stings, and then with the caveat that it is going to make the sting worse (fresh water causes further stinging) while simultaneously greatly reducing the pain of the skin (Dr Lisa-Ann Gershwin, personal communication 2009). The recommended temperature is 45°C for 20 minutes, but this can be very uncomfortable and accurate monitoring of the temperature is needed because higher temperatures will cause scalding and lower temperatures may not be effective for the pain.

Ice/cold packs have also been shown to be effective but, although safer, have proven inferior to heat at the recommended temperature for these types of stings.

Little mauve jellyfish

Little mauve jellyfish (*Pelagia noctiluca*) typically have a mauve bell approximately 10 cm in width with many 'frilly' tentacles beneath the bell (Figure 4).

Sting

Pelagia species produce a painful sting with bright red wheals and blistering occurring on the victim's skin within 30 minutes. Victims may feel nauseated. Skin pain and blistering from these jellyfish may take several weeks to settle down.

Geographical area and season

Pelagia species commonly occur in huge swarms in the Mediterranean, south European Atlantic coasts and the Red Sea/Gulf of Oman areas in the summer months.

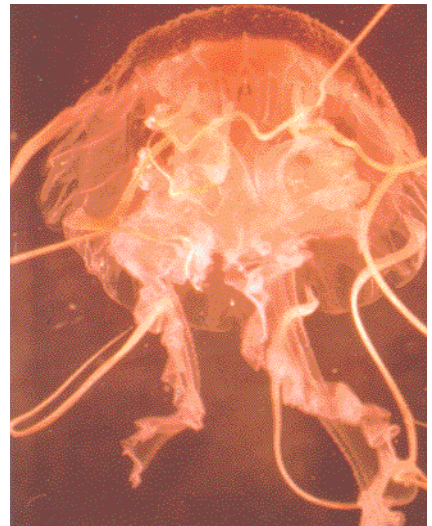


Figure 4. *Pelagia noctiluca*.

They used to be common on the east coast of Australia but now are somewhat rare except around the Sydney area.

Treatment

Treatment of stings by *Pelagia* jellyfish is with cold packs applied for 15 to 20 minutes and reapplied if necessary. Analgesia may be needed for severe stings.

Button jellyfish

Button jellyfish (*Linuche unguiculata*) are small brownish button-sized jellyfish that are 5 to 100 mm in diameter. They are rarely seen and occur in swarms.

Sting

Button jellyfish are often known as 'sea bathers' eruption' and/or 'sea lice'. They tend to be sucked under costumes as the person enters the water, usually causing a rash in covered areas only – for example, groins and buttocks in males, and groins to breasts in females.

Geographical areas and season

Button jellyfish are common in the tropical and subtropical seas of the Atlantic and Pacific in the summer months. They are also common in the Caribbean and the far south east American coast.

continued



Figure 5. Blue-ringed octopus.

Treatment

The recommended treatment for stings by button jellyfish is a cold pack applied to the affected area. Ultrapotent corticosteroid creams stop the itching and rash, which may take up to several weeks to clear.

Sand jellyfish

Sand jellyfish (*Stomolophus nomurai*) have sand-like dots on the outer surface of the large dome-shaped bell, with many long tentacles (0.5 to 1 metre in length) hanging beneath. Mature specimens have bodies over 1 metre in diameter, weighing up to 100 kg. These jellyfish were recently identified in swarms in the Sea of Japan.

Sting

Sand jellyfish cause multiple whip-like skin lesions on their victims. These may be severe-to-mild but are usually severe with burning skin pain, rapidly forming into red papules and then blistering. Severe itching occurs for three to seven days. Systemic symptoms are absent in most cases; however, massive stings can cause an Irukandji-like syndrome, and possibly acute pulmonary oedema leading to death (there have been five reported deaths).

Geographical area and season

Sand jellyfish appear in the temperate waters of Japan, Korea and northern China (north-west Pacific). They occur from June to November.



Figure 6. Cone shell (*Conus geographus*).

Treatment

The recommended first aid treatment for people who have been stung by sand jellyfish is a cold pack applied to the affected area. Patients experiencing these stings often need treatment in hospital to treat complications such as those described above.

Red Sea jellyfish

Red Sea jellyfish are varied and poorly-described, but are commonly large Irukandji-like jellyfish that cause both severe skin stings and severe systemic symptoms similar to an Irukandji-like syndrome. They occasionally cause long-lasting symptoms similar to Guillain-Barré syndrome.

Season

Red Sea jellyfish mainly appear in the summer months all around the Red Sea area. Accredited locals' knowledge should be sought for various risks. Divers are commonly stung.

Treatment

Hospital assessment and appropriate treatment is necessary for victims of the Red Sea jellyfish. However, treatment is prolonged and the response to treatment is frequently poor with effects such as muscle weakness and ataxia, breathlessness, bowel and bladder problems.

Marine animals

Blue-ringed octopus

The blue-ringed octopus may grow up to 15 to 20 cm in diameter with its eight tentacles extended. They are usually yellowish-brown, but when irritated many small

electric-blue rings appear, making it look very attractive (Figure 5).

Envenomation

The blue-ringed octopus produces a minor, often painless bite from a beak that is underneath its body. The venom is injected from its salivary glands. The victim may experience within minutes numbness of the lips and tongue. In serious cases of envenomation, weakness and breathing difficulty develops rapidly, leading to respiratory failure if left untreated. There have been two fatalities from blue-ringed octopus in Australia, and one in Singapore.

Geographical area and season

The blue-ringed octopus appears around southern Australia and the Indo-Pacific area. It is not known exactly what season the blue-ringed octopus appears, but it could be all year round.

Treatment

Pressure immobilisation bandaging is the first aid measure for blue-ringed octopus envenomation. Medical treatment involves expired air resuscitation, with assisted ventilation if necessary, for four to six hours, after which spontaneous breathing usually recurs. The victim remains conscious during this time, despite needing expired air resuscitation or mechanical ventilation for respiratory paralysis only.

Cone shells

Cone shells (*Conus geographus*) are shaped like a cone and may be up to 15 cm in length, with a slit-like aperture running the full length of the shell (Figure 6).

Envenomation

Pain at the site of envenomation varies from mild to severe and excruciating. The envenomated area on the victim may blanch or develop a bluish tinge, which is followed by numbness and local swelling. In serious cases of envenomation,

inco-ordination and muscular weakness may develop rapidly in the victim, and swallowing, speech, vision and hearing may be affected. Nausea, generalised pruritus and respiratory paralysis may also develop.

Up to 15 deaths have been claimed in the countries listed in the Table but the exact number is uncertain. *C. geographus* is responsible for most of the confirmed deaths (two recent deaths have been reported in Japan) and *Conus textile* has been responsible for one confirmed and one suspected death.

Geographical area and season

Cone shells occur in tropical reef areas in the Indo-Pacific Ocean, usually under rocks and loose coral. They appear all year round.

Treatment

Pressure immobilisation bandaging is the first aid measure for cone shell envenomation. Victims should be transferred to hospital and their symptoms and signs should be treated according to the usual guidelines.

Stonefish

The stonefish (Figure 7) is a large ugly fish of varying colours (usually brownish) and is able to disguise itself against its background (usually rocks). It has 13 sturdy spikes along its back (ventral spine) that act like injectors when compressed, even penetrating shoes and boots of victims, forcing venom to spurt into the punctured wound.

Envenomation

Envenomation from stonefish causes immediate, severe pain that may cause the victim to become frantic or delirious. Local limb paralysis, nausea and vomiting, and faintness may occur.

Deaths from stonefish envenomation are rare. They are also difficult to confirm, with just five deaths reported, three of which were fairly well-documented:

one was at Mahé, Seychelles, the other at Pinda, Mozambique, and a third reported recently when a scuba diver stepped on a stonefish underwater, panicked, and then ascended too rapidly, with death occurring from arterial embolism, not envenomation. In 1915, a death was reported to have occurred on Thursday Island, Australia, several days following envenomation, although doubt as to the causative animal exists.

Geographical area and season

Stonefish occur in the tropical Indo-Pacific Ocean all year round.

Treatment

First aid treatment for victims of stonefish envenomation is immersion of the injured limb in hot, but not scalding, water; to avoid burns it is important that the first aider tests the water temperature, or the victim tests it using a non-envenomed limb. The temperature should be about 42 to 43°C. Further top-ups may be necessary as the water cools and the pain returns, remembering to test the temperature each time.

Antivenom is available and helps reduce the severe pain, but local nerve root block is usually the most effective treatment. Careful wound toilet is needed for removal of remaining venom and antibiotic cover is needed to prevent sepsis. In seawater envenomation cases, oral doxycycline 100 mg twice daily, oral ciprofloxacin or third generation cephalosporins administered parenterally are effective.¹⁰

Sea snakes

Sea snakes are similar in appearance to land snakes, except they have a flattened, oar-like tail (Figure 8). Unlike eels, they have no gills and must surface to breathe air.

Envenomation

Most bites by sea snakes are 'dry' – fewer than 10% of sea snakes actually inject any venom. Bites are relatively painless. If venom is injected into the victim, it is

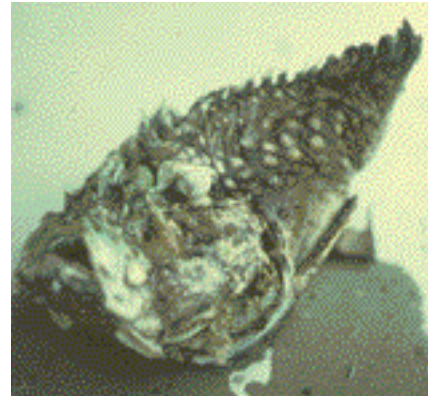


Figure 7. Stonefish.



Figure 8. Sea snake.

followed by symptoms including drowsiness, nausea and vomiting, weakness, visual disturbances, breathing problems and muscle pains or stiffness.

Fatalities from sea snake envenomation have occurred in the countries listed in the Table. Estimates of the fatality rates worldwide are around 3% – possibly 150 deaths annually; however, most are undocumented (Prof David Warrell, personal communication 1996).

Geographical area and season

Sea snakes occur in Australia (east and west coasts) Burma, Malaysia, Madras (India), Java (Indonesia), Okinawa (Japan), Oman and, especially, Vietnam. A near-fatal sea snake envenomation occurred on Bondi Beach, Sydney, although this was a very unique occurrence.¹¹ There is no set season for sea snakes.

Table. Worldwide location of deaths from marine animal envenomation

Blue-ringed octopus

Australia, Singapore

Cone shells

Australia, Fiji, Banda (India), New Caledonia, Okinawa (Japan), Vanuatu

Sea snakes

Burma, Malaysia, Madras (India), Java (Indonesia), Okinawa (Japan), Oman, Vietnam

Stingrays

Australia, California, Colombia, Fiji, New Zealand, Suriname, Texas

Stonefish

Australia (unconfirmed; Thursday Island), East Africa, Japan, Seychelles

puncture main arteries.

The wound from stingrays is usually (although not always) acutely painful due to the retained venom. Most wounds occur on the lower limbs but there have now been three deaths in Australia after the barb penetrated the heart.¹² Other serious injuries have also occurred after the barb penetrated the chest or abdomen.

At least 17 fatalities from stingrays have occurred worldwide, including Australia, New Zealand, Suriname, west Atlantic, Texas, Fiji, California and Colombia. Trunk wounds produce most fatalities, acute exsanguinations have produced at least two fatalities, and one death has occurred due to tetanus complicating a lower leg wound.¹

Geographical area and season

Stingrays occur worldwide but are more common in tropical and subtropical oceans. They appear all year round.

Treatment

The first aid treatment for stingray injuries is firstly to control the bleeding as this may be life threatening if an artery has been punctured. Careful cleaning of the affected area is essential. If there is no bleeding, the injured limb should be immersed in hot, but not scalding, water (to avoid burns it is important that the first aider tests the water temperature, or the victim tests it using a non-envenomed limb). The temperature should be about 42 to 43°C. Further top-ups may be necessary as the water cools and the pain returns, remembering to test the temperature each time.

Often there is remaining barb present in the wound, which must be removed. Almost all victims with wounds from stingrays will need an ultrasound assessment to see if any remaining barb is present. If no remaining barb is present then actual excision of the tract and removal of tissue that is contaminated with venom and integument from the

Useful website resources

Marine Medic

www.marine-medic.com.au

Australian Venom Research Unit

www.avru.org/firstaid/firstaid_main.html

The Australian Resuscitation Council Online

www.resus.org.au/ (see guidelines 4-7, 8.9.1, 8.9.6-8)

barb gives the best results. Failure to do this results in chronic infections, even osteomyelitis.¹ The tract should be left open for healing by first intention. It is recommended to pack the tract with kaltostat as this decreases the healing time.¹³ Victims of stingray injuries will need to take antibiotics, such as doxycycline 100 mg twice daily, ciprofloxacin orally or third generation cephalosporins parenterally, to prevent infection from sea water contamination.

Conclusion

The world of marine envenomation and its treatment is enormous. Treatment of jellyfish stings is one of the most common first aid treatments in the world. This article is only intended to be a very basic guide to the first aid and medical treatment of marine envenomation, and areas of the world in which there is most risk to travellers. Some recommended websites for further research of this area are included in the box on this page. **MT**

References

A list of references is available on request to the editorial office.

COMPETING INTERESTS: Associate Professor Fenner: None. Dr Cohen is the Medical Director of Travel Clinics Australia and author of 'The Traveller's Pocket Medical Guide and International Certificate of Vaccination'.

Treatment

Treatment of wounds by sea snakes is pressure immobilisation bandaging. Sea snake antivenom is available in some countries including Australia. Tiger snake antivenom, available in Australia, is also effective.

Stingrays

Stingrays, large flat-shaped fish, have flaps or 'wings' up to 2 to 3 metres in width and a whip-like tail with one to seven backwards-facing barbs.

Envenomation

Stingrays often burrow under the sand in shallow water. The usual method of injury occurs when a wader treads on the wing flaps, causing a reflex forward whip of the tail. This drives one or more of the tail barbs into the skin of the victim, leaving a track of integument and venom. Alternatively, the serrated barbs may glance across the skin, causing lacerations that may be quite deep and extensive and may even

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