Marine bites and stings
first aid and medical treatment

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

PETER FENNER
(MD) London, DRCOG, FACTM, FRCGP

Dr Fenner is Associate Professor, School of Medicine, James Cook University, Townsville; National Medical Officer, Surf Life Saving Australia, and a general practitioner in North Mackay, Qld.

Bites and stings from jellyfish and other marine creatures can cause severe morbidity and, in rare cases, death. Venomous marine creatures found in Australian waters include *Chironex* box jellyfish, Irukandji jellyfish, stingrays, stonefish, sea snakes and cone shells. First aid and medical treatments for these animals' bites and stings are discussed in this article.

Jellyfish

Jellyfish and their stings can be subdivided into the following groups:

- *Chironex* box jellyfish, which can cause severe envenomation and human fatality
- Irukandji and Irukandji-like jellyfish, which can cause severe and unpleasant systemic symptoms, but which have not yet been associated with any deaths
- other jellyfish, which can cause skin pain of varying intensities; although most cause few or no systemic symptoms, there are some that produce quite severe systemic effects.

Chironex box jellyfish

Chironex box jellyfish (*Chironex fleckeri*, Figure 1) are multi-tentacled jellyfish that occur in the shallow coastal waters of tropical Australia. They are found from an area just north of Agnes Water, Queensland, extending up through Queensland, across the Northern Territory and down the western coast to Exmouth, Western Australia (Figure 2). They appear in the hot summer months as the sea temperature rises, with the jellyfish season longest closer to the equator; the further south from the equator, the correspondingly shorter the jellyfish season (Figure 3).[1] In Darwin stings have been reported in every month of the year and fatalities have occurred in all months except July.

Although its bell size may be up to 25 to 30 cm in diameter, the *Chironex* box jellyfish is transparent and cannot be seen easily in the water. It has up to 15 tentacles in each corner (hence the name 'box'), which can extend to 3 metres in length (a possible total tentacle length of 180 m). A sting caused by just 1.2 m of tentacle has resulted in the death of a child, earning this jellyfish its reputation as 'the most deadly animal in the world'.[1]

Envenomation

Chironex envenomation occurs in shallow water. The jellyfish come into shallow water when the

IN SUMMARY

- **The use of ice or cold packs will help to reduce the skin pain caused by jellyfish stings.**
- **Pressure immobilisation bandaging is useful to retain large amounts of venom in one area, reducing absorption into the body until medical treatment is obtained.**
- **Heat treatment (with hot water) relieves the pain of penetrating spines caused by animals such as stingrays and stonefish.**
- **Antivenom is available for *Chironex* box jellyfish, sea snake, and stonefish envenomation.**
- **Cardiopulmonary resuscitation may be necessary for severe cases of marine envenomation.**

Figure 1. *Chironex fleckeri* (box jellyfish).

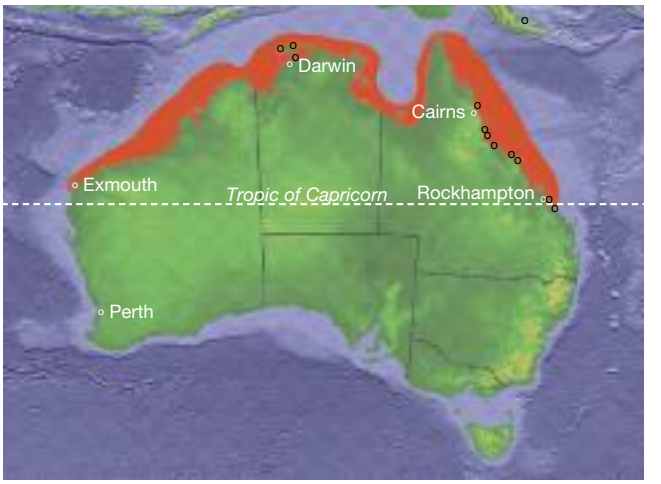

Figure 2. Distribution of *Chironex fleckeri* around Australian (red). Deaths from *Chironex* stings have occurred in the areas circled (black).

wind is light and hot and the water calm. Unsuspecting victims usually walk, or run, into tentacles trailing behind the jellyfish bell.

Most stings are minor and cause only severe local pain; larger stings are rare (Figure 4), but may be life threatening.

The skin pain is instant and severe; victims feel as if they have been whipped or branded by a red-hot poker. Most stings occur on the lower legs and body. Tentacles usually adhere to the victim; their marks look severe, with blistering and skin necrosis occurring over the next few hours.

In cases of the rarer large stings, rapidly absorbed venom causes respiratory and cardiac effects. Victims may rapidly stop breathing, sometimes within a few minutes of the initial envenomation, and death occurs quickly unless prompt first aid and medical treatments are available.[1]

Since 1884 the *Chironex* box jellyfish has been responsible for 67 reported deaths in tropical Australia.[1] The latest fatality was of a 5-year-old boy who died near Cairns in January 2000. Rapid deaths are usually caused by cardiac failure.

First aid

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

- Retrieve the victim from the water, and restrain him or her if necessary.
- If other people are available, immediately send them to call for an ambulance or seek medical help.
- Check the victim's airway, breathing and circulation. If necessary treat with expired air resuscitation or cardiopulmonary resuscitation.
- Adherent tentacles are invariably present on the skin; the longer they remain here, the greater the envenomation. Pour vinegar (4 to 6% acetic acid) over the affected area for a minimum of 30 seconds to totally inactivate any remaining stinging cells present on adherent tentacles.[2] If vinegar is unavailable, pull tentacles off with the fingers (only a faint, harmless prickling will be felt).
- If the sting is minor, alleviate skin pain by applying cold packs to the area for 20 minutes and repeat when necessary.[3]
- Major stings are those that cover an

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Darwin	■	■	■	■	■	■	■	■	■	■	■	■
Cairns					■	■	■	■	■	■	■	■
Townsville						■	■	■	■	■	■	
Mackay						■	■	■	■	■	■	
Rockhampton						■	■	■				

Figure 3. *Chironex* box jellyfish season in Australian areas.

Figure 4. Major *Chironex* box jellyfish sting.

area of more than half of one limb or cause impairment of consciousness, breathing or circulation. For these stings, after vinegar application, apply compression bandaging and immobilise the limb. [1,3] Compression immobilisation bandaging is recommended by the Australian Resuscitation Council, but another group does not recommend it.[4] Although the value of pressure immobilisation for *Chironex* stings remains unproven, anecdotal evidence suggests it does offer clinical benefit for major stings.[5]

- If available, box jellyfish antivenom should be given to all victims with major stings. Three ampoules may be given intramuscularly by qualified personnel on the beach. One ampoule may be given intravenously by a doctor or qualified paramedic. Antivenom seems to help ease the severe skin pain;[6] inhaled nitrous oxide (Entenox) and methoxyflurane have little effect.

Figure 5. *Carukia barnesi* (Irukandji).

Figure 6. Blubber *Catostylus*, the most common rhizostome jellyfish in Australia. Usually it causes a mild sting with slight skin irritation; rarely more severe stings may occur.

Figure 7. Large sting from *Cyanea*, the most common jellyfish worldwide.

Medical treatment

Intravenous fluids should be started, and further antivenom given intravenously as necessary; up to 12 ampoules may be administered if needed clinically.[3]

Any developing respiratory failure and/or cardiac problems should be treated according to the usual guidelines, and may include the use of oxygen, diuretics, opiates, continuous positive airway pressure by mask, inotropes, central venous monitoring and endotracheal intubation with assisted breathing.

Delayed allergy

Some 10 to 14 days after a sting, an itchy papular rash may suddenly appear in the same area, although the initial marks may have faded. This is probably an allergic reaction from remaining discharged nematocyst thread tubes in the skin. Ultra-potent topical corticosteroid creams usually help, however, systemic corticosteroids may be needed for a few days.[3]

Irukandji

The Irukandji (*Carukia barnesi*) has a tiny 12 mm transparent bell with four tentacles, one in each corner (Figure 5). Its distribution is similar to that of *Chironex*, occurring in tropical waters from Gladstone, north Queensland and extending northwards and west to Exmouth, Western Australia, in the hot summer months.[3]

Envenomation

The initial skin sting by Irukandji is mild. However, about five to 40 minutes later (usually 30 minutes) the severe systemic symptoms known as the 'Irukandji syndrome' start with a severe 'boring' pain in the sacral area.

Other symptoms quickly develop and include muscle pains or cramps, moving rapidly into all four limbs and the abdominal and chest wall muscles. The pain is described as severe, unbearable and coming in 'waves' (similar to labour pains), although it never fades completely. Chest pain or tightness occurs from both spasm of the intercostal muscles and cardiac muscle pain.

Signs and symptoms associated with the Irukandji syndrome resemble those of an adrenal medullary tumour (phaeochromocytoma), with excessive release of catecholamines into the bloodstream. These include:

- sweating, either localised or generalised, often profuse and drenching
- localised or generalised piloerection
- anxiety and wretchedness with the victim feeling 'absolutely dreadful' and often with 'a feeling of impending doom' (a feeling often shared by the treating first aider)
- marked restlessness with the victim unable to stay still or get comfortable
- intense frontal or global headache, which may be incapacitating
- nausea, often with severe, intractable vomiting
- increased respiratory rate, often of a 'sighing nature'
- tremor
- pallor, or peripheral cyanosis
- oliguria due to reduced renal

perfusion and fluid loss from sweating and/or vomiting
- tachycardia, often irregular with ventricular extrasystoles
- hypertension,[7] with levels occasionally reaching as high as 280/160 mmHg in previously normotensive victims.

In some cases late complications may be acute pulmonary oedema, usually occurring 15 to 18 hours after envenomation (occasionally less), and secondary toxic global cardiac dilatation with left ventricular dysfunction evident on echocardiography.

First aid

There is no current proven first aid treatment for Irukandji envenomation.

Medical treatment

The medical treatment of Irukandji envenomation includes:[8]

- giving morphine 5 mg intravenously every five minutes as required or morphine infusion, both with oxygen saturation monitoring
- controlling hypertension and catecholamine-like effects with a bolus of phentolamine (Regitine) 5 to 10 mg (for adults), repeated as necessary, or 0.075 to 0.15 mg/kg by infusion; do not use beta blockers
- treating pulmonary oedema conventionally with some or all of the following: oxygen, diuretics, glyceryl trinitrate infusion, opiates, continuous positive airway pressure by mask, inotropes, and endotracheal intubation; central venous monitoring may be necessary to monitor severe cases
- checking full blood counts, erythrocyte sedimentation rates, respiratory function, cardiac enzymes (including creatine kinase–myocardial bound and troponins), ECG
- checking chest x-ray and echocardiography if breathing and/or heart problems arise or are suspected.

Other Australian jellyfish

There are many varieties of jellyfish in Australia; however, their main effect is skin pain at the site of envenomation. Some cause systemic symptoms, but the Australian species rarely cause symptoms severe enough to require treatment (Figures 6 and 7). General principles for treatment of these symptoms can be followed as above.

First aid

General first aid measures for jellyfish stings include removing any remaining tentacles by flushing the area with seawater. Fresh water should not be used and the area should not be rubbed; this can increase stinging and pain.[1] If necessary the tentacles may be picked off the skin with the fingers (as described above).

Apply cold packs or ice to the area for five to 15 minutes. Ice, if used, should be wrapped in a polyethylene bag to keep the skin dry. Reapply cold packs or ice as necessary until the pain resolves.[9]

Other marine creatures

Other venomous marine animals can be divided into two groups according to the type of first aid needed to treat the injuries they cause:

- animals that cause penetrating spine injuries that are treated with heat – these include stingrays and stonefish
- animals that deposit large amounts of venom into one area, the absorption of which is reduced by compression bandaging and immobilisation – these include cone shells, sea snakes and blue-ringed octopi.

The box on this page describes the general principles of heat treatment with hot water and compression bandaging and immobilisation.

First aid for venomous marine animals

Heat treatment

The pain of penetrating spines from all marine animals is relieved by immersion of the envenomed limb in hot water.[3] Penetrating spine injuries include severe injury caused by stingrays and stonefish as well as most stinging fish worldwide (including aquarium fish such as lion fish) and spiny echinoderms ('spiky balls') found on southern beaches and rocks.

The water temperature must be as hot as the person can stand – usually 41 to 43ºC; any hotter may cause scalding. Because of the severe pain, the victim should test the temperature with a non-envenomed limb, or the first aider should test it.

As the water temperature drops, the pain will return, so top the hot water up when necessary, each time ensuring it is not too hot. Treatment can continue almost indefinitely, until the victim gets to medical aid. Hot water can be obtained from both inboard and outboard engines if envenomation occurs in inaccessible areas.

Pressure immobilisation bandaging

In cases of marine envenomation where a large amount of venom is injected into one area, compression bandaging followed by limb immobilisation will reduce absorption of venom[3] until the bandage can be removed in hospital under intravenous access and where full resuscitation facilities are available. Examples of marine animals causing this type of envenomation include sea snakes, blue-ringed octopi, and cone shells.

Firmly apply broad bandages (15 cm wide) to cover the full limb (using a pressure similar to that used for a sprained ankle). Start the bandaging directly over the envenomed area, then from top to the distal part of limb. Immobilise the limb using a splint to prevent the 'muscle-pump' effect spreading injected venom.

Figure 8. Stingray barb embedded in victim's toe.

Figure 9. A stonefish.

Figure 10. Stonefish envenomation.

Stingrays

Stingrays may be present in shallow water, lying on the sand. Often injury occurs when a wader treads on the wing flaps, causing a reflex forward whip of the tail. The tail has one or more sharp barbs, which either embed in the skin of the victim (Figure 8) and break off, or glance across the skin, often causing large and/or deep lacerations.[10]

Most wounds occur on the lower limbs and are usually acutely painful. The two recorded Australian fatalities occurred after the barb penetrated the heart;[10,11] other serious injuries may occur if a barb penetrates the chest or abdomen.[12]

First aid and medical treatment

The first aid treatment for stingray injuries is heat, as described in the box on page 29.

The stingray's barb sheath ruptures as it punctures the skin, leaving tissue and venom in the wound; this usually causes later necrosis and infection. Medical treatment involves exploring and excising this tract, removing any remaining foreign material. The resulting crater should be packed with an alginate-based wick, allowing healing by secondary intention.[13] The dressings usually fall out eight to 10 days later, or are easily removed without pain or damage to the healing wound. Using this treatment, the wound appears to heal faster and with fewer complications than when using standard dressings.

Tetanus immunisation is recommended and follow up to exclude secondary infection essential. For small wounds, simple wound toilet may be sufficient.

Cardiothoracic specialists should evaluate chest wounds as soon as possible, using advanced imaging.[11,12]

Stonefish

Stonefish may grow up to 20 to 30 cm in length (Figure 9). They have tough, warty skin, which is usually the colour of their surroundings (often dark brown). Thirteen spines are present on the back, which may penetrate the skin of the victim and inject venom. They can penetrate thin soles of shoes.

In Australia stonefish are found in the tropical and subtropical waters from northern New South Wales to north western areas of Western Australia.

Envenomation causes immediate, severe pain, which may make the victim frantic or delirious. Around the puncture site, a bluish discolouration occurs (Figure 10), which often becomes oedematous. Local limb paralysis, nausea and vomiting, and faintness may occur.[3]

There have been no confirmed deaths in Australia from stonefish envenomation; worldwide, deaths are rare and poorly documented.

First aid and medical treatment

First aid treatment for victims of stonefish envenomation is heat.

The severe pain from stonefish envenomation requires medical treatment with parenteral opioids. Stonefish antivenom, if available, will reduce pain and systemic symptoms.[3] Although local anaesthetic (without adrenaline) may be effective, local nerve block, if available, is more efficient. Tetanus immunisation is recommended, and follow up to exclude secondary infection may be necessary.

Cone shell

Cone-shaped, cone shells may be up to 15 cm in length. They occur around the whole coast of Australia but are more common in coral reef areas.[3] They have a slit extending the full length of the shell from which a hollow proboscis, like a blowpipe, can appear.

The proboscis fires a barb, bathed in venom, which penetrates the integument of the victim causing envenomation. Pain can vary from a slight stinging to severe and excruciating pain. Blanching often occurs at the site of envenomation with a surrounding bluish tinge. The whole area usually becomes numb and swollen.

Nausea, vomiting and pruritus often occur, with inco-ordination and muscular weakness. This may develop rapidly

causing difficulty with swallowing, speech, vision and hearing and may progress to fatal respiratory paralysis.[3]

Up to 15 deaths due to cone shell envenomation have been claimed worldwide, but the exact number is uncertain. A death occurred at Hayman Island, in 1935.[14] *Conus geographus* (Figure 11) is responsible for most confirmed deaths, including the Australian case.[3]

First aid and medical treatment

The first aid for cone shell envenomation is compression and immobilisation bandaging. The victim's airway should be maintained, with intubation and assisted respiration if necessary.

There is no specific medical treatment for cone shell envenomation; symptoms and signs should be treated according to the usual guidelines. Tetanus immunisation is advised, and treatment of secondary infection may be necessary.[3]

Sea snakes

Sea snakes are similar in appearance to land snakes except they have a flattened tail to assist swimming. They have no gills, are air breathers, and occur in all oceans except for the Atlantic. In Australia they are more common in tropical and subtropical zones. Sea snakes are inquisitive but not usually aggressive. One notable attack occurred, however, on a young girl in Queensland.[15]

Most bites are 'dry' – fewer than 10% of sea snakes actually inject any venom. Bites are relatively painless. If venom is injected it is followed by symptoms such as drowsiness, nausea and vomiting, weakness, visual disturbances, breathing problems, and muscle pains or stiffness. Renal impairment might occur.[3]

There have been no deaths in Australia from sea snake envenomation.

First aid and medical treatment

First aid for sea snake bites is compression bandaging and immobilisation.

Medical treatment should include the use of intravenous antivenom if symptoms warrant. If sea snake antivenom is unavailable, tiger snake antivenom can be used.[3] Good hydration and maintenance of a good urinary output will help reduce myolysis. Renal failure and/or respiratory failure should be treated along standard lines. Tetanus immunisation should be considered, and follow up to exclude secondary infection may be necessary.

Blue-ringed octopus

The blue-ringed octopus grows up to 15 to 20 cm in diameter with its eight tentacles extended. Usually it is yellowish-brown, but when it is irritated many small electric-blue rings appear (Figure 12), making it look very attractive, especially to children. It is found all around Australia and throughout the Indo-west Pacific.[3]

The blue-ringed octopus produces a painless bite from a beak that is under its body; venom is injected from its salivary glands. Numbness of the victim's lips and tongue may occur within minutes. In serious cases of envenomation, weakness and breathing difficulty develop rapidly, leading to respiratory failure if untreated.[3] There have been two fatalities from blue-ringed octopus in Australia,[16,17] and one in Singapore.[3]

First aid and medical treatment

Compression and immobilisation bandaging is the first aid measure used for blue-ringed octopus envenomation.

Medical treatment involves assisted ventilation for four to six hours, or possibly up to 12 hours, after which spontaneous breathing usually recurs. The victim remains aware and conscious during this time, despite needing expired air resuscitation or mechanical ventilation.[3]

Conclusion

The treatment of marine bites and stings involves the use of ice or cold packs to reduce the skin pain of any jellyfish sting and heat to reduce the tissue pain from penetrating spiny injuries. Further envenomation (from either jellyfish tentacles or penetrating injuries) should be prevented by:

- pressure immobilisation bandaging of the affected limb – this traps the venom locally until the victim can be treated at a major first aid or medical centre
- dousing the skin with vinegar over the area where any tentacles remain to prevent further stinging. MT

Figure 11. Conus geographus.

Figure 12. Blue-ringed octopus.

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

Further information

www.marine-medic.com

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PETER FENNER (MD) London, DRCOG, FACTM, FRCGP

References

1. Fenner PJ, Williamson JA. Worldwide deaths and severe envenomation from jellyfish stings. Med J Aust 1996; 165: 658-661.
2. Hartwick R, Callanan V, Williamson J. Disarming the box-jellyfish: nematocyst inhibition in *Chironex fleckeri*. Med J Aust 1980; 1: 15-20.
3. Williamson JA, Fenner PJ, Burnett JW, Rifkin JF, eds. Venomous and poisonous marine animals - a medical and biological handbook. Fortitude Valley: University of New South Wales Press Ltd & Surf Life Saving Queensland Inc, 1996.
4. Pereira PL, Carrette T, Cullen P, Mulcahy RF, Little M, Seymour T. Pressure immobilisation bandages in first-aid treatment of jellyfish envenomation: current recommendations reconsidered. Med J Aust 2000; 173: 650-652.
5. Beadnell CE, Rider TA, Williamson JA, Fenner PJ. Management of a major box jellyfish (*Chironex fleckeri*) sting: lessons from the first few minutes and hours. Med J Aust 1992; 156: 655-658.
6. Williamson JA, Callanan VI, Hartwick RF. Serious envenomation by the northern Australian box-jellyfish (*Chironex fleckeri*). Med J Aust 1980; 40: 13-15.
7. Fenner PJ, Williamson J, Callanan VI, Audley I. Further understanding of, and a new treatment for, 'Irukandji' (*Carukia barnesi*) stings. Med J Aust 1986; 145: 569-574.
8. Fenner PJ, Carney I. The Irukandji syndrome: a devastating syndrome caused by a north Australian jellyfish. Aust Fam Phys 1999; 28: 1131-1137.
9. Exton DR, Fenner PJ, Williamson JAH. Ice packs: an effective first aid treatment for Physalia and other painful jellyfish stings. Med J Aust 1989; 151: 625-626.
10. Fenner PJ, Williamson JA, Skinner RA. Fatal and non-fatal stingray envenomation. Med J Aust 1989; 151: 621-625.
11. Wright-Smith R J. A case of fatal stabbing by stingray. Med J Aust 1945; 2: 466-467.
12. Weiss BF, Wolfenden HD. Survivor of a stingray injury to the heart. Med J Aust 2001; 175: 33-34.
13. Fenner PJ. Stingray envenomation: a suggested new treatment. Med J Aust 1995; 163: 665.
14. Flecker H, Cotton BC. Fatal bite from octopus. Med J Aust 1955: 2; 329-332.
15. Mercer HP, McGill JJ, Ibrahim RA. Envenomation by a sea snake in Queensland. Med J Aust 1981; 1: 130-132.
16. Hopkins DG. Venomous effects and treatment of octopus bite. Med J Aust 1964; 1: 81-82.
17. Lane WR, Sutherland SK. The ringed octopus bite: a unique medical emergency. Med J Aust 1967; 2: 475.