Guideline 9.4.5 - First Aid Management of Marine Envenomation

Summary

Who does this guideline apply to?

This guideline applies to adults, children and infants.

Who is the audience for this guideline?

This guideline is for use by bystanders, first aiders and first aid training providers.

Summary of Recommendations

The Australian and New Zealand Committee on Resuscitation (ANZCOR) makes the following recommendations [all Good Practice Statements]:

1. Send for an ambulance (call 000 in Australia and 111 in New Zealand).
2. Commence cardiopulmonary resuscitation (CPR) if the person is unresponsive and not breathing normally (Refer to ANZCOR Guideline 8).
3. In all cases of marine envenomation remain with the person if possible and monitor for worsening symptoms.
4. Remove the person from the water.
5. Consider dousing the stung area for 30 seconds with household vinegar if potentially lethal species of jellyfish sting, but not bluebottles.
6. Remove any remaining tentacles from the skin.
7. Apply cold or ice pack to treat pain except bluebottle, stone fish, stingray or similar fish spine envenomation.
8. Bathe the area in hot water (45˚) for 20 minutes to treat pain for bluebottle, stone fish and stingray stings.
9. Treat sea snake bites as for land snake bites (Refer to ANZCOR Guideline 9.1.1).
10. Use pressure immobilisation technique (Refer to ANZCOR Guideline 9.4.8) for cone shell and blue ringed octopus envenomation.
11. Continue to monitor the person until medical help arrives.

1.0 | Introduction

Marine envenomation is a significant problem worldwide and in Australia as well as New Zealand to a lesser extent. Data published by Surf Life Saving Australia in 2022 noted an average of 40,128 jellyfish stings per annum throughout Australia. However, there were just 4 deaths due to jellyfish stings compared to 60 deaths from contact with other marine organisms (most of which were from sharks and crocodiles) in the period 2004 to 2022,[1] and a tenth of the rate for snake bite envenomation in a similar period.[2]

Marine envenomation falls into 4 main categories:

- Stinging by pelagic (floating) organisms such as jellyfish.
- Puncture wounds such as from fish spines and stingrays.
- Bites such as from sea snakes.
- Blue ringed octopus and cone shell envenomation.

These envenomations will be considered in separate sections below, although the first aid for many species across the different categories is the same. There is controversy over the first aid for potentially fatal jellyfish envenomation. This is described in detail at the end of this guideline in the section titled 'Research on jellyfish envenomation'.

2.0 | Jellyfish

Readers of this guideline should note that part of this guideline is intended for treatment of potentially lethal species of jellyfish found in Australian waters (including *Chironex fleckeri* and *Carukia barnesi*, among others) and that the treatment of stings from different species found elsewhere in the world may be different from the species in Australian waters.

Potentially fatal envenomation is caused by two jellyfish types in Australian waters.

2.1 | Box Jellyfish

The adult Australian box jellyfish, *Chironex fleckeri*, the adult has a large (box-like) bell up to 20 x 30cm and multiple tentacles. It inhabits estuarine and on-shore coastal waters, usually in the tropics in summer, but has been seen further south and out of summer.[3,4] Contact with tentacles causes severe immediate pain and whip-like marks on the skin. A sting with several metres of tentacles can cause respiratory and cardiac arrest within a few minutes. More than 80 deaths have been recorded worldwide, although it is likely that there have been many unrecorded deaths from similar species, especially in some developing countries.[5,6] Antivenom is available for *Chironex fleckeri* and other multi-tentacled box jellyfish stings. In tropical coastal areas, hospitals keep and

ambulances carry antivenom.

2.2 | Jellyfish causing Irukandji syndrome

Approximately 10 small to medium-sized offshore and onshore jellyfish (including Carukia barnes and species of the *Carybdea*, *Malo*, *Alatina*, *Gerongia* and *Morbakka genera*) are known or suspected to produce an "Irukandji syndrome".[7-10] The syndrome is more common in tropical waters but has been seen in swimmers as far south as Port Phillip Bay.[11] These jellyfish have only 4 tentacles and some are frequently too small to be seen by the stung person, although others may have bodies up to 25mm in diameter.[3]

A minor sting on the skin with no tentacle visible is followed in 5 to 40 (typically 20 to 30)[7] minutes by severe generalised pain (often cramping in nature), nausea and vomiting, difficulty breathing, sweating, restlessness, and a feeling of anxiety or even "impending doom". The person may develop heart failure and hypertensive stroke.[12]

2.3 | Recognition of potentially fatal envenomation

Since it is usually difficult to recognise which species of jellyfish has caused a sting, management is based on the risk of serious stings in the known geographical distribution of dangerous species combined with recognition of tell-tale signs mentioned above and listed below. Jellyfish able to cause life- threatening stings primarily occur along the tropical coastline of Australia, i.e. from Bundaberg (Queensland) northwards, across the northern coastline and down to Geraldton (Western Australia) shown in this map after Fenner and Harrison in 2000.[4]



However, it should be noted that stings from potentially fatal jellyfish have occurred further south.[13-15]

Tentacles on the skin

- Long and easily visible tentacles on the skin in association with severe pain should be regarded as box jellyfish tentacles when occurring in the regions described.
- In the setting of large numbers of blue jellyfish washed up on the beach or floating on the surface of the water, tentacles are probably from a Physalia species (“Bluebottle”).
- Tentacles from hundreds of other species of jellyfish in Australian waters are difficult to identify. Often no tentacles remain on the skin. However, the skin markings of box jellyfish stings are usually easily recognised.

Skin markings

A variety of skin markings are associated with the stings of various jellyfish species and could include the following:

These images of a typical box jellyfish sting are from the Hartwick et al paper in 1980.[13]





However, other markings may be seen, particularly with species other than box jellyfish:

- An irregularly shaped blotchy wheal.
- White wheals with a surrounding red flare
- Multiple whip-like wheals on the skin or a “frosted ladder pattern” suggest a sting by a box jellyfish.
- Later blistering or darkening of the sting pattern may occur.

- An inconspicuous mark which may develop a red flare.
- An inconspicuous mark with goose pimples or an orange-peel appearance.
- An inconspicuous mark with profuse sweating only at the sting site.

Pain

- Skin pain is generally immediate for box jellyfish and bluebottle stings and varies in intensity from mild irritation to very severe sharp or burning pain, the latter being a characteristic of box jellyfish stings.
- Generalised muscle aches.
- Severe muscle cramps in the limbs, chest and abdomen.
- Onset of pain for Irukandji syndrome may delayed for up to 40 minutes.

Symptoms and signs of severe stings

- severe pain
- profuse sweating, sometimes only in the sting area
- restlessness and irrational behaviour
- nausea and vomiting, headache
- physical collapse
- difficulty or cessation of breathing
- cardiac arrest.

Treatment

Prevention of further stinging by nematocyst inhibition

When a sting occurs, pieces of tentacles and non-discharged nematocysts may be left on the person's skin. In large or life-threatening stings it is important to inhibit non-discharged nematocysts so that subsequent handling or treatment does not cause further envenomation. Nematocysts from different species of jellyfish are either inhibited or stimulated to discharge by different substances used for first-aid.[13,14,16-18] This is discussed further in the accompanying document "Research on Jellyfish Stings" but in summary there is conflicting evidence on whether vinegar results in less or more envenomation from *Chironex Fleckeri*[19,20] based on different experimental techniques.

2.4 | First Aid Measures for Jellyfish stings

There several controversies about treatment of Jellyfish stings as noted in the accompanying document "Research on Jellyfish Stings." The treatment options are in summary:

Vinegar

- Should only be considered for stings that may be due to box jellyfish and Irukandji Syndrome species. It should not be used on bluebottle stings. More detail is given in the accompanying

document “Research on Jellyfish Stings.”

Hot water

- Hot water (45˚C) has been proposed as a suitable first aid measure based on a number of studies.[21-23] However, there is a possibility that this will increase absorption or distribution of the venom increasing the risk of fatality.[24-26]

Ice packs/cold pack

- Application of cold has been advocated,[27] or shown to be equally efficacious or non-inferior to hot water in treating the pain of jellyfish envenomation in some studies[21,24,27] and may be considered if it is available.

A single nationwide recommendation for first aid for all jellyfish cannot be made because of differences between species around Australia and New Zealand. Although some potentially dangerous species have occasionally been found in temperate waters, currently potentially lethal jellyfish are mainly found in tropical or sub-tropical waters as shown in the map above. The general treatment principles are:

- In most cases, first-aid providers are unlikely to be able to identify the jellyfish, but the stings of box jellyfish are often identifiable as noted above.
- If there is a risk (even if small) that the person has been stung by a potentially lethal jellyfish, the priority must be to preserve life. If the species causing the sting cannot clearly be identified as harmless, or due to a “bluebottle”, it is safer to assume there is a risk of death and continue close observation.
- Outside the tropics, where huge numbers of non-life-threatening stings occur, the primary objective is pain relief with heat or cold.

If there is a risk of potentially fatal envenomation:

- Remove the person from the water
- **The most important part of first aid for a potentially fatal jellyfish sting is to watch for cardiac arrest, treat with CPR (Refer to ANZCOR Guideline 8) if this occurs, and expedite transfer to definitive care including anti-venom.**
- If the person has more than a localized single sting, or looks/feels unwell, send for an Ambulance and seek assistance from a lifesaver/lifeguard if available.
- If the person is unresponsive and not breathing normally, send for an ambulance and commence CPR (Refer to ANZCOR Guideline 8).
- For all other persons, consider liberally douse/spray the stung area with vinegar for 30 seconds to neutralise invisible stinging cells[15,19,23,28-30] then pick off remaining tentacles
- If vinegar is unavailable, pick off any tentacles (this is not harmful to the rescuer)[28] and rinse the sting well with seawater (not fresh water).
- Apply a cold pack or ice in a dry plastic bag for analgesia.[24,31] Do not apply fresh water directly onto the sting because it may cause discharge of undischarged nematocysts.[28]
- Persons who initially appear stable but experience severe symptoms in the following 30 minutes may be suffering Irukandji syndrome and need urgent medical care.

- Antivenom is available for *Chironex fleckeri* and other multi-tentacled box jellyfish stings. In tropical coastal areas, hospitals keep and ambulances carry antivenom. Hence the need to expedite transfer to more advanced care.

[Good Practice Statements].

2.5 | Treatment of Bluebottle Sting:

If the person has **clearly** been stung by a "bluebottle" (see above) and is assessed as having a localized sting, is stable and not requiring ambulance, they should be managed primarily for pain relief.

- Keep the person at rest, reassure and keep under constant observation.
- Do not apply vinegar.[15,30,32]
- Do not rub or allow rubbing of the sting area.
- Pick off any tentacles (this is not dangerous to the rescuer) and rinse sting area well with seawater to remove invisible nematocysts.
- Bath the stung area in hot water, between 43 and 45˚C for up to 30 minutes but ensure that the person can tolerate this temperature and that no burn results from this treatment
- If local pain is unrelieved by heat, or if hot water is not available, apply a cold pack or ice in a dry plastic bag.
- If pain persists or is generalised, if the sting area is large (half of a limb or more), or involves sensitive areas (e.g. the eye) send for an ambulance and seek assistance from a lifesaver/lifeguard if available.

[Good Practice Statements].

3.0 | Fish Stings

Introduction:

Many fish have spines with attached venom glands. When trodden upon, the spines of the marine Stonefish (*Synanceia spp*) and the freshwater Bullrout (*Notesthes robusta*) penetrate deeply and deposit venom causing excruciating pain. General cardiovascular toxic effects can occur but are rare. Handling these or similar fish is also potentially dangerous.

The barbed spines on the tails of stingrays can inflict a serious gash or penetrating stab injury with subsequent venom-induced tissue death or death from injury to vital organs. Organs and blood vessels may be damaged and fragments of spine may remain in the wound requiring surgical removal. Injuries usually occur when the person stands on an unseen fish, pulls a captured fish into a boat or swims too closely over a fish on the sea-floor.

Recognition

Symptoms and signs may include:

- intense pain, leading to irrational behaviour
- swelling
- sometimes a local grey/blue discolouration
- an open wound
- bleeding.

Management

- Send for an ambulance
- If the person is unresponsive and not breathing normally, start CPR (Refer to ANZCOR Guideline 8).
- If the sting is to the trunk (chest, abdomen), assess the person for signs of bleeding and treat as per ANZCOR Guideline 9.1.1 Principles of Control of Bleeding for First Aiders, because occasionally spines (mostly stingray) penetrate deeply and cause internal bleeding.
- If there is an embedded object (e.g. a barb from a stingray sting), do not remove it as it may be plugging the wound and restricting bleeding. Place padding around or above and below the object and apply pressure over the pads.
- If the sting is to a limb, place the person's stung hand or foot in hot water (no hotter than the rescuer can comfortably tolerate).[33-38] The local application of heat decreases pain in the majority of cases, probably due to heat inactivation of the venom.[36] The Pressure Immobilisation Technique is not used for fish stings because the venom remains localized at the wound.
- Transport the person to a medical facility. Antivenom is available for stonefish.

[Good Practice Statements].

4.0 | Blue-ringed Octopus and Cone Shell

Introduction

Blue-ringed octopuses (*Hapalochlaena spp*) inhabit all Australian coastal waters and are often found in tidal pools. If handled, these small animals may inflict a potentially fatal bite, injecting venom stored in salivary glands.
Cone shells (*Conus spp*) are found throughout Australian waters although potentially dangerous species are mainly found in tropical and sub-tropical waters. They may fire a dart-like barb to deliver venom when handled

Although different, venoms from both these creatures can cause paralysis and death from respiratory failure within 30 minutes. Following envenomation by either the blue ringed octopus or cone shell, prompt application of the Pressure Immobilisation Technique will trap most of the

venom at the bite site. When absorbed, the venoms cause muscle paralysis leading to breathing failure without direct effects on the heart. Paralysis may be long lasting (hours) and cardiopulmonary resuscitation must be continued until the person is in the care of a health professional.

Recognition

Symptoms and signs may include:

- a painless bite: a spot of blood visible
- numbness of lips and tongue
- the progressive weakness of muscles of respiration leading to inadequate or cessation of breathing.

Management

- Send for an ambulance
- If the person is unresponsive and not breathing normally, start CPR (Refer to ANZCOR Guideline 8).
- Keep the person at rest, reassured and under constant observation.
- Use the Pressure Immobilisation Technique Guideline 9.4.8 if possible.[39]
- Transport the person to a medical facility, preferably by ambulance.

[Good Practice Statements].

Note:

Despite being unable to move, the person may be able to hear spoken comments.

5.0 | Sea Snakes

Sea snakes in Australian waters may be venomous and bites do occur occasionally. These bites should be managed as for other venomous snake bites in Australia with the addition of the need to get the person out of the water to institute the treatment (Refer to ANZCOR Guideline 9.4.1).

For other advice on envenomation

Call the Poisons Information line on 131126 in Australia and in NZ call 0800 764 766

Abbreviations

Abbreviation	Meaning/Phrase
ANZCOR	Australian and New Zealand Committee on Resuscitation
CPR	Cardiopulmonary Resuscitation

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About this Guideline

Search date/s	Scoping search 1 January 2000 – 10 December 2023. Evidence update 10 July 2024
Questions/PICOs:	P – adults, children and infants I –Heat OR cool OR vinegar OR (pressure bandage and immobilisation) OR (other interventions) C – Other OR no intervention O - mortality/morbidity (pain, admission to hospital, LOS) S – Any including case studies and grey literature T – 1 January 2000 and later
Method:	Scoping search from 1 Jan 2000 and backwards citation searching to find additional studies relevant to PICOST, yielding some papers before 2000, back to 1952
Principal reviewers:	Finlay Macneil and Ned Douglas
Major changes from previous Guideline	Conflicting evidence on the role of vinegar for treatment of potentially lethal jellyfish envenomation Research on Jellyfish Stings
Other Consultation:	N/A
Approved:	June 2025

Guidelines Superseded:	9.4.5 (2010), 9.4.6 and 9.4.7 (2014)

Referencing this guideline

When citing the ANZCOR Guidelines we recommend:

ANZCOR, 2026, Guideline 9.4.5 - First Aid Management of Marine Envenomation, accessed 29 September 2026,
https://www.anzcor.org/home/first-aid/guideline-9-4-5-first-aid-management-of-marine-envenomation