



# Jellyfish Stings

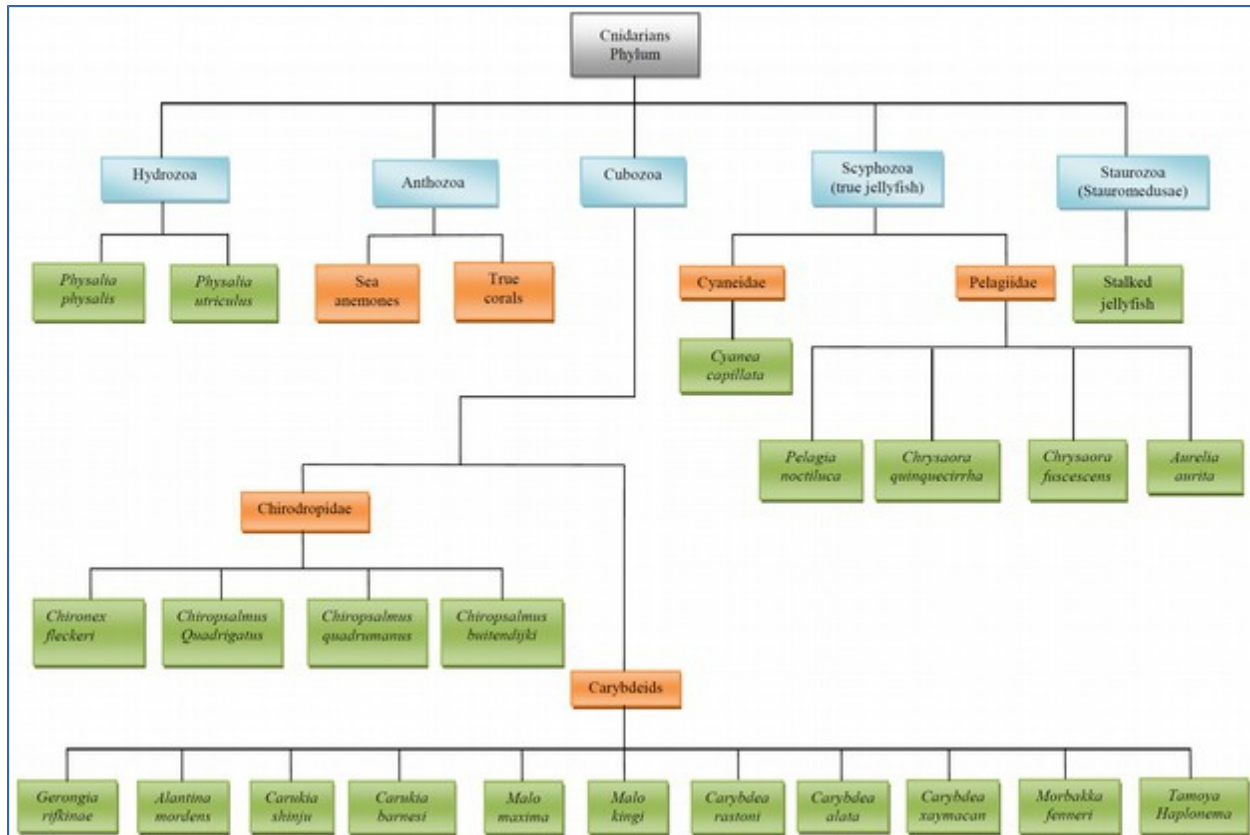
By

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Jellyfish are free-swimming marine animals found in waters all over the world. They have stinging tentacles used to capture prey, and some species can deliver a painful sting to humans. It is estimated there are approximately 150 million jellyfish stings a year, typically near coastal beaches.<sup>[1]</sup>

## Taxonomy<sup>[1]</sup>

Jellyfish come from the class Scyphozoa or true jellyfish which includes Cyaneidae and Pelegiidae. Other jellyfish-like members of the Cnidarians phylum have venomous tentacles but taxonomically are not considered true jellyfish. These include Staurozoa or stalked jellyfish, Cubozoa or box jellyfish, Hydrozoa of which the Physalia physalis or Portuguese man-of-war (PMOW) is a member. The PMOW and the Physalia utriculus (Bluebottle) are classified as siphonophores or animals made up of a colony of organisms working together. Both of the Physalia species have gas filled bladders that float above the water.<sup>[2]</sup> For linguistic simplicity jellyfish and jellyfish-like organisms will be referred to as jellyfish in this article.



Jellyfish Taxonomy[1]

## How Jellyfish Sting and Adverse Effects of Envenomation

Some jellyfish have a jellylike substance surrounding internal structures, others have a gas bladder or an umbrella-shaped bell. The tentacles are of varying size, ranging from a few millimeters to over 40 meters in length depending on the species. One type of cell in the tentacle is called the nematocyst which is a capsule containing a tightly coiled filament immersed in venom. Tentacles can contain thousands of nematocysts. Jellyfish venom discharge is triggered by mechanical stimuli, such as rubbing against a person or fish. These stimuli lead to the uncoiling of the filament, which can penetrate tissue, and cause the nematocyst to discharge venom into or onto whatever has caused the activation. **Nematocysts can function even when separated from the jellyfish or if the jellyfish is dead.**[1]

The most common adverse effect of jellyfish stings is a skin reaction. The toxin carried in the tentacles can produce linear, urticarial, painful, or erythematous lesions initially. Stings can also be inconspicuous marks with red flaring, goosebumps, wheals, or just sweating at the site.[3] Later on, the injured areas can become vesicular, hemorrhagic, or even necrotic.[4] The tentacles can become adherent to the skin and potentially cause more venom to be released, even if the jellyfish body is no longer attached. The wounds eventually scab over and may leave permanent scars. Delayed eczematous skin reactions have also been observed in victims days to months after exposure.[4]

Conjunctivitis, iritis and corneal ulcerations may occur with ocular stings.[4]

Seabather's eruption is a pruritic dermatitis due to jellyfish larvae that get inside a swimsuit and can cause repeated symptoms if the swimsuit is worn again without proper washing.[4]



Box Jellyfish Linear Lesions



Sea Nettle Urticarial Rash

Systemic symptoms can include abdominal pain, nausea/vomiting, muscular pain and muscle spasms. Severe envenomation may produce neurological symptoms such as headache, drowsiness, fainting, or confusion. Dyspnea, respiratory distress and chest pain may also be seen. Symptoms vary by species, and some jellyfish have cardiotoxins able to produce ventricular dysrhythmias and/or cardiac arrest. Neurotoxins may cause respiratory failure and respiratory arrest. Intravascular hemolysis can lead to acute renal failure.[1]

While many jellyfish can potentially cause systemic symptoms, severe illness is more likely to be seen in Cubozoans, or box jellyfish stings, which are the most toxic jellyfish.

One species, *Chironex fleckeri* is found in the waters around Australia. It is transparent and not easily seen in the water. Many of the stings are mild with minimal symptoms, but severe cases can result in dyspnea, hypotension, unconsciousness, arrhythmias and cardiopulmonary arrest. If lethal, death usually is a result of cardiac asystole from a cardiotoxin.[1]

Irukandji syndrome is most commonly caused by *Carukia barnesi*, a small box jellyfish found around Australia. It typically begins about 30 minutes after a relatively minor sting, and causes diaphoresis, agitation, vomiting, severe muscle cramps and pain, especially of the lower back, hypertension, and in severe cases acute heart failure.[1]

## Prevention

Prevention of stings can be achieved by avoiding swimming in jellyfish infested waters, or use of a lycra whole body stinger suit.[1] A repellent cream of octyl methoxycinnamate and zinc oxide, sold commercially in some countries has been demonstrated to reduce the severity of jellyfish stings as well as providing sunburn protection.[1] Another commercial jellyfish sting inhibitor and sunblock, that contains octinoxate, titanium dioxide and multiple other ingredients has also been demonstrated to reduce sting severity.[1,6,7]

## Treatment

Treatment of jellyfish stings differs depending on the species, degree of envenomation, and which geographic area the sting occurred in. There are much conflicting data and opinions on the best treatment of jellyfish stings.

There have been a number of remedies suggested for stings including covering the attached tentacles in fresh water, meat tenderizer, ethanol, ammonia or sand.[5,6] All have been found to potentially cause the nematocysts to fire and increase the envenomation. Urine has also been advocated as a treatment, but has not been found to be effective, and may stimulate nematocyst discharge.[4] Seawater appears to be relatively safe to apply to the nematocysts.[1,3,4,5,11]

If gloves are not available, adherent tentacles may be removed with bare fingers, which will only cause relatively harmless prickling, due to the thick palmar skin.[1,3] Tweezers may also be used for tentacle removal.[1] Using seashells or a credit card to scrape off the tentacles has also been suggested, but one study of box jellyfish found more discharged nematocysts after scraping rather than pulling the tentacles off.[8]

## Vinegar

Vinegar (5–8% acetic acid) has historically been recommended as treatment to be applied to the nematocysts before trying to remove them from the skin,[1,9] but its universal use is now questioned.[1,5] Vinegar deactivates undischarged nematocysts in some species, so they don't fire when removed,[10] but vinegar also has been found to

increase venom release from already discharged *Chironex fleckeri* nematocysts.<sup>[11]</sup> Some authorities suggest initially applying the vinegar in a small area after a sting to see if pain or symptoms worsen before using more diffusely.<sup>[9]</sup>

The general recommendation of the Australian Resuscitation Council is to use vinegar for tropical jellyfish stings, but not for ones in non-tropical areas. This is due to the presence of species such as a multi-tentacled *Physalia utriculus* (Bluebottle) living in Australian waters where vinegar was found to cause activation of nematocysts.<sup>[3]</sup> The American Red Cross guidelines suggest that since vinegar has been confirmed to



cause discharge of the nematocysts of some species of jellyfish, it is no longer recommended for most jellyfish stings in U.S. coastal waters.<sup>[12]</sup>

## Baking Soda

For *Chrysaora quinquecirrha*, also known as the sea nettle, a baking soda slurry made with seawater is the recommended therapy to inactivate the nematocysts by some experts.<sup>[1,5]</sup> Conversely, the American Red Cross 2016 guidelines removed baking soda slurries as a recommended therapy for U.S. jellyfish stings.<sup>[12]</sup>

## Heat Use

A Cochrane review found heat immersion provided better pain relief than ice packs for *Physalia*, *Carybdea alata* (Hawaiian box) and the *Carukia* species.<sup>[13]</sup> A trial comparing hot water immersion to ice packs found that 20 minutes of 45°C hot water immersion did significantly improve pain over ice packs for bluebottles and PMOW.<sup>[14]</sup> However, a study of *Chironex fleckeri* stings found heat had no improved effect on pain control over ice packs.<sup>[15]</sup> One animal study found that exposure to heat reduced the lethality of *Chironex fleckeri* venom.<sup>[16]</sup>

## American Red Cross Scientific Advisory Committee First Aid Recommendations<sup>[12]</sup>

Recommendations by the American Red Cross Scientific Advisory Committee for tentacle removal and initial pain control vary for different geographic regions of North America.

- In Hawaiian waters, gently lift up or scrape to remove any remaining tentacles with a blunt object, to avoid further stings. The blunt removal object that is

recommended is a seashell combined with washing the tentacles with seawater. Rinse the affected area with seawater and follow by application of hot water (approximately 106-113°F) or hot pack. If a hot pack is not available a cold pack can be used to attempt to relieve the pain.

- In U.S. coastal Pacific Ocean waters, the recommendation is to treat as for Hawaiian stings. Gently lift up or scrape to remove any remaining tentacles with a blunt object, to avoid further stings. Rinse the affected area with seawater and follow by application of hot water or hot pack (approximately 106-113°F). If a hot pack is not available a cold pack can be used to attempt to relieve the pain.
- In coastal Atlantic Ocean waters, gently lift up or scrape to remove any remaining tentacles with a blunt object, to avoid further stings. The blunt removal object that's recommended is a seashell combined with washing the tentacles with seawater. If topical lidocaine is available, this can be applied to inhibit further nematocyst discharge and provide pain relief. This should be followed by application of hot water or hot pack (approximately 106-113°F). If a hot pack is not available a cold pack can be used to attempt to relieve the pain.
  - Lidocaine for pain control and possible nematocyst inactivation is only specifically discussed in the Atlantic Ocean section of the Red Cross recommendations, but it is recommended as an option for pain control for all geographic areas in the summary section.
- Heat can be applied to the affected area, preferentially by hot water immersion or in a shower in a range of 106-113°F, or practically as hot as the patient can tolerate without scalding them. If a tub for hot water immersion or a shower is not available, a chemical heat pack can be applied. Heat application should take place for a duration of up to 20 minutes or until pain is relieved. Cold packs are felt to be less beneficial than heat packs in relieving pain but may be of some benefit when heat or lidocaine are not available.
- Salt seawater, according to these guidelines, has not been found to cause nematocysts discharge and thus is recommended for rinsing a sting site prior to applying heat or hot water.

## **Australian Resuscitation Council(ARC) First Aid Recommendations<sup>[3]</sup>**

Current recommendations for tentacle removal and initial pain control are:

- Due to the different jellyfish species around Australia, there are separate recommendations depending on whether the sting occurred in a tropical or non-tropical region.
- In Australian tropical areas apply vinegar for 30 seconds, except if it is a Bluebottle (*Physalia utriculus*), where vinegar increases nematocyst discharge. Then pick off the tentacles, applying ice packs after. (*There is a theoretical concern that heat, by increasing blood flow, may potentially increase venom absorption of some tropical jellyfish.*)<sup>[1]</sup> Seawater may be used to cleanse the area, but fresh water should not be used.

- In non-tropical areas, and for bluebottle stings, the ARC recommends picking off the tentacles and washing with seawater, followed by immersing the area in hot water. For immediate treatment of pain after jellyfish stings, ice packs can be used, but hot water(45° C) or hot showers were found to decrease pain in some species better than ice packs.

### **Other Post-Sting Treatments**

- BLS or ACLS interventions as required for severe life-threatening envenomations. [12]
- Anti-venom for *Chironex fleckeri* and other box jellyfish is available in Australia.[3] It can be administered in severe cases of cardiopulmonary instability, cardiac arrest, cardiac arrhythmias, or severe pain not relieved by opiates.[3] In animal models it was found that magnesium sulfate may also be helpful for cardiac instability in combination with the antivenom.[17]
- Over-the-counter analgesics or if the pain is severe, narcotic medications may be needed for pain relief.[4]
- Antihistamines can be used for urticaria or allergic-type symptoms.[4]
- Consider tetanus immunization if the victim's immunization status is not up-to-date. [4]
- An elastic compression bandage, or wrap was previously recommended for the affected extremity to try to limit venom circulation similarly to snake bites, but several studies found it actually increased envenomation and its use has been curtailed.[18]
- Some references recommend prophylactic topical antibiotic ointments after a sting. Oral and intravenous antibiotics are only needed for confirmed infections. [4]

**There are some commercial products available with limited scientific evidence for their use.**

- A commercially sold solution of 20% aluminum sulfate and surfactant, was found to be significantly more effective than seawater as a painkiller in testing.[1]
- In an inventor authored study, a commercial spray of copper gluconate, urea, magnesium sulfate and 3% acetic acid, was found to be effective in neutralizing *Alatina alata* (a Hawaiian box jellyfish) venom, and assisting with removal of nematocysts.[19]

## Common Jellyfish in U.S. Waters<sup>[12]</sup>

- In the Pacific Ocean near Hawaii, the most common stings are due to the box jellyfish (*Carybdea alata*), and Portuguese man-of-war (*Physalia physalis*).



Portuguese Man-of-War

- The pacific sea nettle, *Chrysaora fuscescens* is found widely on the Pacific coast. A box jellyfish, *Carybdea marsupialis* can be occasionally found off Southern California in the late summer or fall.
- The most abundant species of jellyfish in the Gulf of Mexico are the sea nettle and moon jellyfish (*Aurelia aurita*), which typically swarm during summer months. The Portuguese Man-of-war is also commonly reported in the Gulf.



Sea Nettle





Sea Nettle

- *Chrysaora quinquecirrha*, the Atlantic Sea Nettle, can be found along the entire U.S. east coast, particularly in the Chesapeake Bay. The box jellyfish, *Carybdea marsupialis* is occasionally found in the Atlantic ocean and has been reported as far north as New York. The Portuguese man-of-war has been reported along the southern Florida Atlantic Coast and can be carried by the Gulf Stream as far north as New York. Moon jellyfish (*Aurelia aurita*) are commonly found in the tropical waters surrounding Puerto Rico and the Virgin Islands.



Box Jellyfish

## Key Recommendations

Treatments for jellyfish stings have variable responses and conflicting results depending on the study and species tested. A treatment that works for one species' sting may worsen an envenomation from another. This creates considerable confusion about which therapeutic modalities are best for jellyfish stings, even when the species is known.

The American Red Cross and the Australian Research Council (ARC) first aid recommendations vary in some respects. The Red Cross recommends either lifting or scraping off the adherent tentacles, and the ARC recommends only pulling them off. The ARC has recommendations for vinegar use in tropical stings, while the Red Cross recommends not using it for stings in the U.S. Heat is the recommended first choice of therapy for all U.S. stings, while ice packs are recommended for tropical Australian stings. Part of the disparity is due to the different species and toxicity of local jellyfish, but part is also due to the contradictory literature on the treatment of jellyfish stings. However, one can use these official recommendations as a general guide to jellyfish sting treatment. Using other therapies will depend on if there is definitive identification of the stinging species, what treatments are available, the expertise of the rescuer, and the predominant jellyfish species in the geographic area of the sting.

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