

First Aid Treatment of Jellyfish Stings in Australia: Response to a Newly Differentiated Species.

Fenner PJ, Williamson JA, Burnett JW, Rifkin J.
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Vinegar has been shown to inhibit nematocyst discharge in *Chironex fleckeri*, the deadly north Australian box-jellyfish, and application of vinegar has become accepted first aid, not only for box-jellyfish stings, but also for stings by other Australian jellyfish. However, in a newly differentiated species of *Physalia* in Australian waters, which causes severe envenomation, vinegar was found to cause discharge in up to 30% of nematocysts. In treating these stings, the use of vinegar is not recommended as it may increase envenomation. Stings from the single tentacled *Physalia utriculus* (the "bluebottle") are not severe, tentacles with unfired nematocyst rarely adhere to the victim's skin and vinegar dousing is not required. Vinegar treatment is therefore an unnecessary step in the first aid management of any *Physalia* sting but remains an essential first aid treatment for all Cubozoan (box) jellyfish tested to date.

Currently there is confusion about the role of topical vinegar as a first aid treatment for jellyfish stings. Vinegar's role has always been to prevent further envenomation from undischarged nematocysts (stinging capsules) on the skin or within remaining tentacles of Cubozoan (box) jellyfish that may still be adherent to the victim's skin. The confusion has in part resulted from the following observations:

- The nematocysts of different jellyfish species behave differently on exposure to vinegar.
- Different investigators studying *Physalia* stings in Australia have observed different responses when either the tentacles, or the skin pain from such stings, are treated with vinegar.

The first aid treatment for any jellyfish sting after resuscitation or stabilisation when necessary is prevention of further stinging. This step is especially important if there are adherent tentacles, which invariably contain many undischarged nematocysts that may continue to fire and cause increased envenomation.

Prevention of further stinging requires rapid nematocyst inhibition, usually by chemical means. In 1980 Hartwick *et al* showed that vinegar (4%-6% acetic acid in water) completely inhibited nematocyst discharge within 30s in *Chironex fleckeri*, the deadly north Australian box-jellyfish. Since then vinegar has been shown to inhibit nematocyst discharge in all other box-jellyfish species so far tested. This safe easy and cheap treatment became well accepted, not only for cubozoans (box-jellyfish), but also for stings by other coelenterates, even though there were conclusive data showing that vinegar caused discharge of nematocysts in jellyfish other than the box-jellyfish.

Turner *et al* reported in 1980 from Sydney that vinegar appeared to ease the skin pain from eastern Australian *Physalia* ("bluebottle") stings, although nematocyst discharge and *Physalia* morphology were not studied. Hartwick *et al* had stated that vinegar caused no nematocyst discharge in *Physalia*, collected in north Queensland, although only small numbers were tested. This finding was confirmed in 1985 by Fenner (unpublished observations), again for north Queensland specimens (with only a single "main" tentacle). (The term "Main" tentacle used in this article describes the normally easily distinguished *Physalia* tentacle which is always much thicker, usually a much darker blue and usually much longer than the other tentacles.)

However, in 1988, studies by Exton found that vinegar caused discharge in up to 30% of nematocysts in specimens of *Physalia* captured at Noosa in south Queensland.' No species description was given. It had also previously been shown that vinegar caused massive nematocyst discharge in *Cyanea capillata* (the "hair" jellyfish) from the eastern coast of Australia' and in the north American *Chrysaora quinquecirrha* ("sea nettle").'

Because of these variable responses, and pending further research, it seemed reasonable that the use of vinegar should be restricted to the prevention of nematocyst discharge of cubozoan (box-jellyfish) stings.

The immediate treatment of a fresh non-cubozoan sting, as recommended by Surf Life Saving Australia, was fresh or seawater dousing to rinse off any remaining, adherent tentacles. (This step is probably unnecessary if adherent tentacle material is not present, as is the case with most jellyfish stings, except those of the box jellyfish, *Chironex fleckeri*.)

In our experience of many experiments over several years, fresh water has not been shown to cause nematocyst discharge. Barnes, however, found that envenomation could suddenly become more severe if fresh water showers were taken several hours after the original envenomation.

Whether or not water dousing is used, the next action in non-cubozoan stings was application of cold packs or ice, as they have been shown to be effective (in uncontrolled studies) for the relief of local skin pain of many different jellyfish stings."

Vinegar remained the essential first aid treatment to prevent increased envenomation from *Chironex fleckeri* and other cubozoan jellyfish stings. In *Carukia bamesi* stings, although there is no visible remaining tentacle material, unfired nematocysts are still present and, without vinegar dousing, may discharge and increase the already severe symptoms.

Initially, cold packs had seemed inadequate for the savage skin pain of severe *Chironex fleckeri* stings;" however, they recently gave total pain relief from two stings from *Chironex fleckeri* with severe pain and blistering on both feet in lifeguards in north Queensland (Surf Life Saving Australia, unpublished sting reports, 1991).

Unfortunately recommendations for the use of either or none of the two dousing solutions (vinegar or water), depending upon the species of offending jellyfish and the presence or not of adherent tentacles, confused many first aiders. In an attempt to simplify matters, the Australian Resuscitation Council (ARC) recently released a policy statement stating (with partial reservation) that "vinegar ... should therefore be used in any jellyfish sting".

At the time, this seemed a reasonable compromise. The rationale was that vinegar would be beneficial therapy for the more significant box-jellyfish stings (e.g., those from *Chironex fleckeri*), whereas the possibility of further nematocyst discharge in cases of envenomation by other, non-fatal jellyfish (*Cyanea*, *Chrysaora* and the Australian *Physalia*) was of little account. The first aider could thus proceed with therapy without having to first attempt identification of the jellyfish from the sting appearance.

Unfortunately, since this ARC policy statement was published, the identification of a larger, more dangerous *Physalia physalis* in Australian waters has cast doubt upon the wisdom of this advice (see "A newly differentiated species of *Physalia physalis* in Australia" on page 500).

Experiments with the nematocysts of the newly differentiated Australian *Physalia physalis*

A previously described technique was used to experimentally expose tentacles from the "new" Australian *Physalia* specimens to vinegar. Discharge occurred in up to 80% of the nematocysts in the more proximal parts of the tentacles of some, but not all, of the specimens. Conflicting results were obtained if other parts of the tentacles were tested, even from the same jellyfish. Thus, approximately 30% of the total number of tentacle pieces tested in this way showed some nematocyst discharge. This effect cannot be fully explained, although nematocysts may possibly be "switched off" and unable to discharge, as appears to happen with *Chironex fleckeri*. "

If tentacles from these jellyfish, in which vinegar provoked discharge, were subsequently rubbed on skin, pain and whealing still occurred. This suggests that vinegar neither causes nor inhibits discharge of the remaining nematocysts, which may thus still envenomate.

DISCUSSION

The results with vinegar reported here apparently conflict with the previous experiments of Hartwick and colleagues and Fenner (unpublished observations 1985). However, they closely resemble Exton's results. Because of this, the specimens originally tested by Exton were re-examined by one of us (J R). They were found to be specimens of the then undifferentiated, Australian *Physalia physalis*, with a float length of 3-4 cm and multiple main tentacles, identical to the Australian species captured in Mackay and newly described in this report.

First aid treatment for jellyfish stings

Cubozoan (box) jellyfish

1. Remove victim from water and restrain
2. Send others for help as soon as possible
3. Monitor airway, breathing, and circulation and treat if necessary
4. Douse stung area for a minimum of 30 s with at least 2L of vinegar
5. Apply compression bandage for a major sting
6. Give *Chironex* antivenom for a major sting
7. Apply cold packs/ice for a minor sting

Other jellyfish

1. Remove victim from water if necessary
2. Monitor airway, breathing, and circulation and treat if necessary
3. Wash off any remaining fresh, adherent tentacles with seawater
4. Apply cold packs/ice for a minor sting

In retrospect, this suggests an explanation for the contradictory results with vinegar reported by other authors. These workers did not at the time realise the existence of two different Australian *Physalia* species. It also may explain why some patients from the Noosa area, at the time Exton did his vinegar experiments, required hospital admission for severe systemic symptoms; and why occasionally hospital admissions are needed for some *Physalia* stings causing "breathing trouble". Such problems with stings from the Australian "bluebottle" with the single main tentacle are very uncommon."

There have now been three confirmed deaths in the United States from the Atlantic *Physalia physalis*, which has multiple "main" tentacles. These animals are much larger than any Australian *Physalia* with a float length of up to 25 cm and as many as eight thick main tentacles and many other thinner ones"

In the newly identified Australian specimens the float length is smaller, and the tentacles are shorter and not as numerous, compared with the Atlantic species, even though they are apparently fully mature. However, any action that may increase envenomation should be avoided, as the systemic symptoms of envenomation may be severe and unpleasant.

While the skin appearances of a fresh "bluebottle" (*Physalia utriculus*) sting are diagnostic to the trained eye," relatively few people have the ability to identify any jellyfish sting correctly. The comparative skin features of a fresh *Physalia physalis* (Australia) sting have yet to be documented, but can be expected to bear sufficient similarity to a *Physalia utriculus* sting to make differential diagnosis for the firstaider difficult.

It would thus seem logical that vinegar should not be used for stings produced by any Australian *Physalia* spp. If remaining adherent tentacles are present on a recent sting, initial treatment may still involve prevention of further stinging by dousing with seawater (or fresh water if sea water is not readily available). The tentacles of the new multi-tentacled *Physalia* species seem to be much more adherent and not so easily rinsed off; they may have to be pulled off with the fingers (slight harmless stinging of the rescuer's fingers may be noticed with this manoeuvre) and the stung area subsequently doused.

Cold packs or ice should then be applied for a minimum of 15-20 minutes to reduce skin pain. As ice seems to give only slow relief of skin pain in the severe stings treated to date, early ambulance assistance should be sought.

The administration of "Entonox" which is carried by ambulance officers may have some contributory analgesic effect, but the victim should be transported to medical aid, especially if any further systemic symptoms develop.

The application of heat (up to 41 °C) on skin welts from the American Atlantic *Physalia physalis* has resulted in visibly increased lymphangitis" and is thus not recommended treatment for any *Physalia* sting.

CONCLUSION

Vinegar is indicated as a nematocyst inhibitor and first aid treatment for all box-jellyfish stings (especially the deadly *Chironex fleckeri* and Philippine *Chiropsalmus quadrigatus*). It should *not* be used in the first aid management of any Australian "blue-bottle" stings, as it will be impossible for most people to differentiate between stings from the single or multi-tentacled *Physalia* sp. Cold packs or ice remain the treatment of choice for the skin pain from any coelenterate Jellyfish sting." (See first aid instructions in the Box.)