Research on Jellyfish Stings

Stinging by jellyfish is caused by the simultaneous discharge of many thousands of microscopic stinging capsules called nematocysts. These are located usually on the surface of tentacles of the jellyfish and in some species on the body of a jellyfish. Nematocysts (also called cnidae, the venom sacks with darts) can be likened to coiled threads (tubules) loaded with venom. Upon contact, the nematocysts 'discharge' their tubules to a depth of up to 1mm into the person's skin like mini-harpoons. However, not all venom may be injected on initial discharge.[1,2] The more tentacles which make skin contact, the more venom is injected.[3-6]

Stings may cause immediate, sharp pain and an acute inflammatory skin reaction at the sting site consisting of redness, wheal and swelling which may progress to local skin destruction. Some stings cause rapid collapse. In Australia, life-threatening stings generally occur in tropical areas, with few in southern regions. Because of their smaller body size, children are greater risk of the effects of envenomation.

There is considerable uncertainty regarding the optimal treatment for potentially lethal jellyfish envenomation. The available research on first aid for jellyfish envenomation contains contradictory results even within the same species.[1,6-8] Most research is indirect (not conducted with human patients in first aid environments), and some is focused on species different to the common species in Australian waters. Much of the contradictory evidence relates to laboratory studies using different experimental models, although the original recommendation to douse stings in household vinegar (4% acetic acid) for 30 seconds did involve laboratory studies on human volunteers.[6] A recent systematic review of the treatment of all jellyfish stings reported "We are unsure of the effectiveness of any of the treatments evaluated in this review given the very low certainty of all the evidence."[9] Also, the reality that predominantly northern species may occasionally be found further south makes constructing advice on the first aid treatment of jellyfish envenomation in Australia more difficult.

ANZCOR acknowledges the low certainty of evidence for any of the available interventions. Available human data suggests hot water may reduce the pain of envenomation of many species but theoretically may increase the systemic absorption of lethal venom from the more dangerous species, although human data is lacking. There is some evidence from a randomised trial in humans who presented to an emergency department within 4 hours of envenomation by *Chironex fleckeri*,[8] indicating that hot water was not superior to ice packs for the purpose of pain relief. Despite evidence that freshwater stimulates discharge of marine nematocysts, neither

intervention was associated with clinical deterioration in this trial (although it is unclear what effect the delay to treatment had, if any). Also, it should be noted that at the time of the initial sting, neither technique may be practical given the unco-operative nature of most persons due to the pain. Recorded lethal envenomation is rare and the risk of fatality appears to most closely correlate with the dose of toxin (measured by length of tentacle exposure) delivered[6]. The majority of recent deaths after jellyfish sting have occurred very rapidly after envenomation, emphasizing the need for high quality CPR at the scene initiated as soon as cardiac arrest is apparent.

This is a summary of the evidence on the use of vinegar for jellyfish stings

- Vinegar (4-6% acetic acid) inhibits nematocyst discharge of box jellyfish[6] but does not provide pain relief from the venom already injected.[6] It may also increase discharge from already ejected but not exhausted nematocysts.[1] but this is the subject of controversy[10,11]
- Although not proven to inhibit nematocyst discharge of all jellyfish causing Irukandji syndrome, its use has been considered good first-aid practice.[3-5,12]
- Some research has demonstrated a reduction in pain and skin reaction with the application of vinegar to *Physalia spp* (bluebottle) stings[13] and inhibited discharge of nematocysts in *Physalia spp* [14], other authors have found that vinegar causes nematocyst discharge of some species of jellyfish, including *Physalia spp* [15] and vinegar should only be considered for stings that may be due to box jellyfish and jellyfish that may cause Irukandji syndrome.

Important gaps in the understanding of the treatment of jellyfish envenomation include:

- The determinants of lethal toxicity after envenomation.
- The clinical course after non-lethal envenomation, and the role of first aid interventions in modifying this course.
- High quality evidence regarding the effectiveness of different interventions.
- Evidence regarding potential harms of different interventions.

Given the uncertainty of evidence on treatment of jellyfish stings, it is reasonable for first aid providers to continue to provide any of the potentially beneficial therapies (including vinegar in areas where potentially lethal jellyfish are present and hot water or ice packs for pain), while more certain evidence is awaited. Improving our understanding of therapies for jellyfish envenomation is an important research priority. In the meantime, the provision of any of the available therapies is reasonable.

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