Jellyfish Envenomation in Thailand : Field and Prehospital Management

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Jellyfish are invertebrates belonging to phylum Cnidaria. Several classes existed and considered to be of medical and/or public health importance in Thailand. Class Scyphozoa (True jellyfish) is well-known to be the most common jellyfish. Some are edible but some are venomous jellyfish which are so called "Fire Jellyfish" e.g. *Pelagis panopyra* and *Chrysaora spp.* (not known species yet). Hydrozoa is another class of venomous species which includes *Physalia utriculus* (Bluebottle or Portuguese man-of-war) and *Porpita porpita* (blue button jellyfish). Lastly, class Cubozoa which are considered to be of most public concern since several cases of fatal jellyfish envenomation are reported. Cubozoan may simply classified into multi-tentacle box jellyfish and single-tentacle box jellyfish. Multi-tentacle box jellyfish in Thailand are *Chironex spp.* (not *flekeri* as Australian, but currently labelled as *sp.A, B and C), Chiropsoides buitendijki, Chiropsella spp.* and one unidentified genus resembles *Chirodectes* (currently labelled *Genus A*) which was identified as causative agent in severe envenomation in Thailand. Single-tentacle box jellyfish in Thailand are *Morbakka spp.* (currently labelled *sp.A, B and C), Carybdea spp.* (currently labelled *sp.A*) and *Copula cf. sivickisi* which are considered to be causative agents for Irukandji-like syndrome in Thailand.

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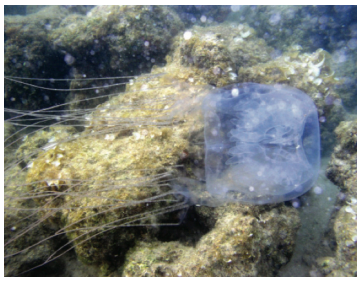


Pictures 1

Pictures 2

Pictures 3

Pictures 1-3 species of jellyfish found in Thailand. (Left to right; Multi tentacle box jellyfish at Koh Samui; *Chironex spp.* (Copyright by Sakanan Plathong), single-tentacle box jellyfish at Moo Koh Surin (not known species) (Copyright by Tanawat Supanitayanon) and Bluebottle at Phuket beach; *Physalia utriculus*

Jellyfish Envenomation

Jellyfish envenomation seems to be the most common marine envenomation encountered by recreational coastal water environments in Thailand. Human trunk or extremities in contact with jellyfish's tentacles may receive venom from the stinging cell called nematocyst which will discharge the venomous content of the cell through the contacted skin or mucosa of the victims and some will manifest clinical symptoms immediately or shortly thereafter. Unfortunately, fatal jellyfish envenomation has been reported in both Andaman sea and Gulf of Thailand. Most of the fatal cases were considered to be from multi-tentacle box jellyfish, but the others may result in severe debilitating injury from Bluebottle jellyfish and single-tentacle box jellyfish which causes Irukandji syndrome. The importance of the emergency medical response is needed to save lives of seriously injured patients. Mechanisms of injury and the pathophysiology of jellyfish envenomation were described in details elsewhere. Most of the victims who had a history of jellyfish sting have little or no evidence of the causative agent, but in some cases, dead specimens which were believed to be the cause of envenomation were found and identified. The clinical symptoms of the envenomated patients will likely first notice a burning pain on their skin which varies from mild to excruciating pain. Severe cases will develop cardiovascular collapse within minutes of contact, but Irukandji-like symptoms may develop later from 5 - 120 minutes (an average of 25 - 40 minutes) with or without notification of burning sensation of the skin or discomfort

on the affected area. Irukandji-like syndrome manifests severe generalized pain and muscle cramping associated with autonomic overactivity such as nausea, vomiting, sweating, restlessness, and shaking followed by fever, tachyarrhythmias, and hypertension and may develop life-threatening hypertension resulting in pulmonary edema and hypertensive intracerebral haemorrhage. In some cases, causative agents were not identified especially box jellyfish because of their clear and colorless characteristic. They only signify painful striped-appearing wound with or without remaining tentacles stucked on the skin but the burning pain in some cases may suggest cardiovascular complications which is considered to be a severe jellyfish envenomation from multi-tentacle box jellyfish.

Field and Prehospital Management

Field and prehospital management of the envenomated patients (Diagram 1) consists of aquatic rescue of the victims and EMS activation, field management, basic care and advanced life support including post resuscitation care, and en-route care during transportation of the victims to the definite hospital facility.

Aquatic Rescue and EMS activation

Patients who suffer from envenomation may be more endangered if they get drowned and if there is no appropriate immediate removal from water especially patients who quickly developed cardiovascular complications. All patients with jellyfish envenomation should be encouraged to get out of the water for monitoring severe clinical symptoms and to be given further management and interventions. There are several reports of injury of rescuers contact with the same box jellyfish. So the appropriate suit should be worn such as full Lycra suit or equivalent. There is no solid evidence that supports the application of lotion in preventing all jellyfish sting. If patients lost consciousness in the water, the appropriate maneuver should be quickly move the patient to the area for resuscitation. This should be away from the waves, a flat firm surface and parallel to the beach. After the rescue and the patients have severe clinical symptoms, the patient should be closely monitored and should not be left alone to activate the Emergency Medical Services (EMS) because the patients may develop cardio-pulmonary arrest which will need immediate cardiopulmonary resuscitation. EMS (Call 1669 in Thailand) should be activated in all severe cases as basic and advanced life support is important if the patients are in need of the service.

Field Care

If the patients do not show evidence of cardiopulmonary arrest and are conscious and able to respond to pain, they should be advised not to rub the wound or remove the adhered tentacle with their hands or any object such as sand. They need to restrain from touching the wound as they are more likely to activate the remaining undischarged nematocyst in the wound and may result in a more systemic envenomation and even lead to cardiovascular instabilities. There is no universal or single agent to be used for all types of jellyfish envenomation but recently, there are some evidences of neutralizing agents in both box and non-box jellyfish. If available, liberally douse the wound with 4-6% acetic acid (household vinegar) for at least 30 seconds. It may be available at a vinegar pole not far away from the beach. The vinegar will help in deactivating the undischarged nematocyst, but may not lessen the pain. The remaining tentacle which may have firmly adhered to the skin should be removed and it would be easier after dousing with a large amount of vinegar. If the causative jellyfish is Bluebottle jellyfish, the vinegar should not be used as there are some reports of further discharge of the remaining nematocysts as well as the use of normal saline. It is recommended to use sea water when everything is unavailable. In all cases, fresh water should not be used as it will activate the undischarged nematocyst from osmosis resulting in further envenomation. If there are remaining tentacles adhered to the skin, it should be removed by using appropriate tool such as tweezers or forceps, but not using bare hands. Although some experts said palm's skin are protected, there are possibility that the contaminated hand of the rescuers will accidentally rub other skin area or mucosa such as eyes and will prevent them from doing their duty. Pressure Immobilization Techniques (PIT) has been advised to be avoided as it results in pressure and further discharge of the nematocysts. There is an evidence that Hot water immersion (HWI) by immersing the affected part in the non- scalding hot water (45 celsius) for 20 minutes may be used to alleviate the pain from envenomation of Bluebottle jellyfish, but not in case of box jellyfish which may lead to further harm. Cold pack may be more appropriate in box jellyfish case or in case that HWI is not effective. All of the severe case should be sent to the hospital facility. It is advised that the symptoms of the mild case should be closely observed and monitored for at least 2-6 hours as there may be development of serious or severe manifestation such in Irukandji or Irukandji-like syndrome. There is no evidence that supports the use of epinephrine shot such as Epipen because some experts do not believe it is related to anaphylaxis.

Basic Life Support

Basic life support has been thought to be a key success factor for survivals in severe jellyfish envenomation with cardiovascular instabilities. Several case reports show that victims were successfully revived by cardiopulmonary resuscitation (CPR). Procedures should follow the latest CPR guidelines. There is no specific guideline for modification of BLS in jellyfish envenomation, but 4 - 6% acetic acid should be used to liberally douse the wound continuously for at least 30 seconds then tentacles removal without interruption of the cardiopulmonary resuscitation (CPR) as almost all severe cases may likely be from multi-tentacle box jellyfish. There are no data for the cardiac rhythm of the patients who had cardiopulmonary arrest, but automated external defibrillator should be used following the latest guidelines in CPR and careful handling of defibrillators should be practiced. Make sure that the area for electrode pads must be dry and it is better to move the victim to a dry place and stay away from wetness when delivering shocks as it may injure the rescuers from electrocution.

Advanced Life Support

Prehospital advanced cardiac life support should be commenced following the latest guidelines especially for the post resuscitation care after the return of spontaneous circulation. There should be monitoring of the cardiac rhythm in all severe cases and cases of suspected Irukandji or Irukandnji-like syndrome. Intravenous access and isotonic intravenous fluids should be given. There may be some modification for ACLS recommended by some authorities in Australia e.g. box jellyfish antivenin which was manufactured from sheep (bioCSL Pty Ltd., Australia) (Table 1), but not currently available in Thailand. It was also thought to have no significant advantage in Thailand by some authorities, because there is currently no evidence that this antivenin will be effective in an envenomation from any multi-tentacle box jellyfish except *Chironex flekeri.* It will be a complicated issue to distribute the antivenom to all the prehospital medical transport vehicles to all the beaches in Thailand which requires high amount of budget and antivenin has a short expiry date. There may be a need to have the study on the cost benefit and economic analyses to have a further recommendation in Thailand. Magnesium sulphate has been advised to be prescribed and to have additional benefit in adjunction of Box Jellyfish Antivenom in selected cases and also in Irukandji or Irukandji-like syndrome, but still has conflicting evidence. Glyceryl trinitrate (GTN) spray or Nitrates intravenous drip may be needed if there is no contraindication and is used to control

very high blood pressure such as Systolic Blood Pressure > 200 mmHg or Diastolic Blood Pressure > 120 mmHg in remote setting and during en-route care to the definite hospital facility. Pain medication may be needed to control the pain and opioid derivatives may be used, but not pethidine.

Table 1 Indication and dosage of bioCSL's Box Jellyfish Antivenin

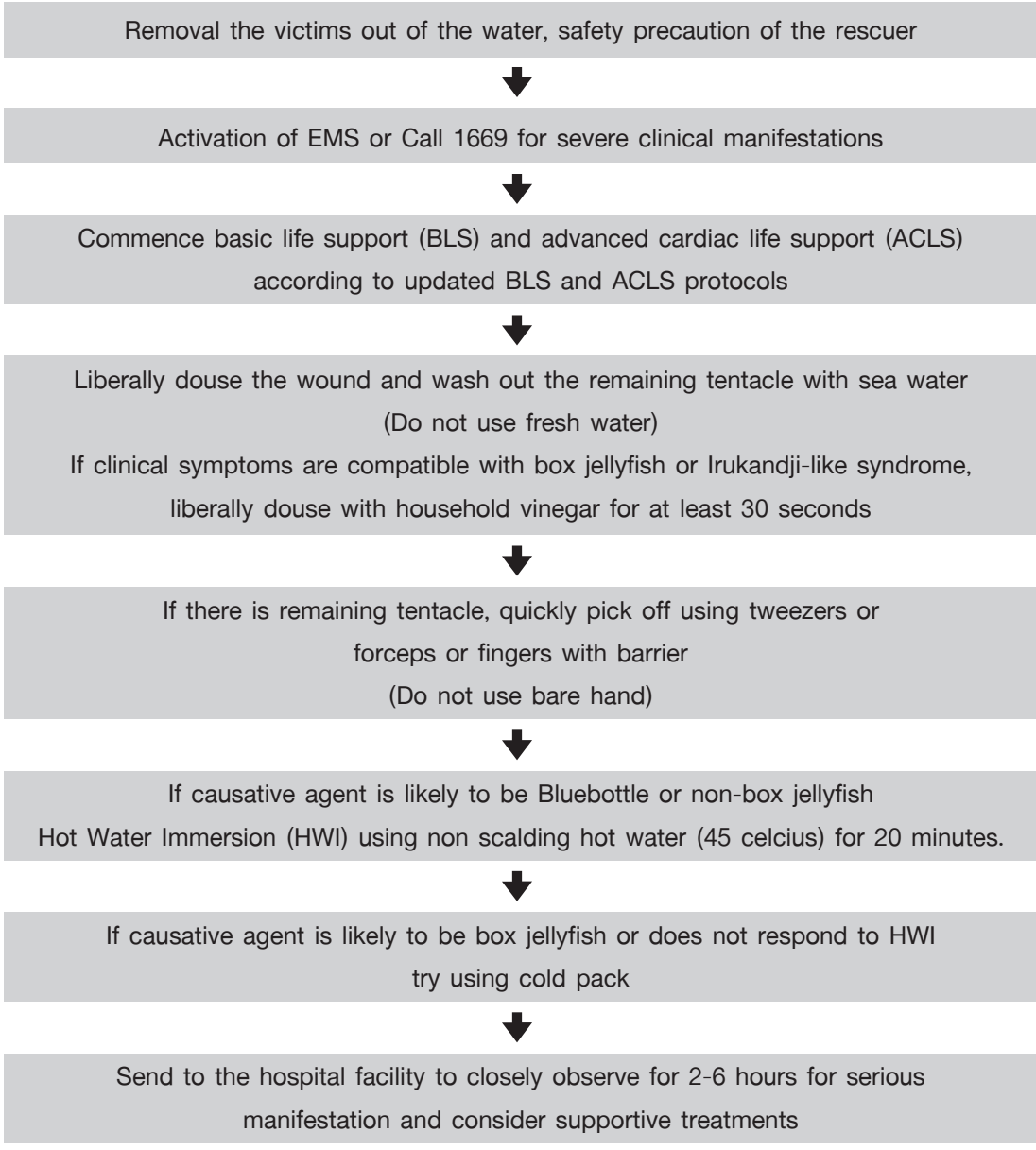
Indication and dosage of bioCSL's Box Jellyfish Antivenin	
- Cardiac arrest. - Cardiac failure. - Unconscious patient. - Respiratory failure.	1-3 vials (20,000 unit/vial) (In cardiac arrest consider 6 vials) undiluted rapid IV push. If it is not possible to give IV, may choose to give 3 vials IM on 3 different sites MgSO4 0.2 mmol/kg (0.05 g/kg) maximum 10 mmol (2.5 g) IV bolus 5-15 min. if there is no response to advanced cardiac life support

En-route care during transportation

The patient may deteriorate during transportation to the hospital facility especially in remote setting. Basic and advanced support capabilities should be maintained during the transportation. Monitoring for cardiac arrhythmias would be important in case of Irukandji-like syndrome and medications provided in an advanced life support. Airways support and assisted artificial ventilation may be required according to the severity of the symptoms. The receiving hospital facility should have capabilities to handle critical care patients and knowledge in handling marine envenomation in the region.

Jellyfish envenomation in Thailand has currently been receiving attentions from both the public and health authorities. The field and prehospital management of health care providers and also by the bystanders in handling severe cases of envenomation and providing an appropriate basic life support will be important to save lives of jellyfish envenomated patients in Thailand.

Diagram 1 Flow Chart of Field and Prehospital Management of Jellyfish Envenomation



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