The venomous bites and stings: overview for travel medicine physicians

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Abstract. Envenoming is one of major health threat especially in developing countries. Basic principles in management of the patient are prompt and accurate identification; addressing immediate life-threatening condition, assess airway, breathing and circulation and support as indicated with emphasis on prioritizing management of impaired cardiac and or respiratory function. Identification of injury should able to address the possibility of envenoming and whether anti-venom is available. First aid management is crucial in preventing venom spread and the next step in hospital emergency room. Anti-venom available for selective envenoming and region should be introduced in significant signs present. Preventive measures from envenoming should be incorporated in travel medicine consultation.

1. Introduction
Numerous animal produces venom, a chemical toxin, which is used for killing preys, and also a defensive mechanism against predators. The venom is produced in glands attached to a distinct delivery apparatus such as fangs and stingers, and should be differentiated from poison of poisonous animals which not directly deliver their toxins to the victim.

Envenoming, a direct delivery of venom by bites or stings from terrestrial or aquatic being, is contributed as one of major problems worldwide, and developing countries in Sub-Saharan Africa, South Asia and Southeast Asia have higher burden compared to developed ones. World health organization (WHO) listed envenoming from snake bites as category A of the Neglected Tropical Disease (NTD) in 2017 [1] after previously abolished [2]. The incidence rate of venomous injuries from bite and stings were varied by region [3,4] and the highest burden of injury were injuries due to snakes and arthropods. Snake bites estimated harm 5.4 million people annually with up to 2.7 million envenoming leading to 81000 – 138000 death and as many as three times disability due to amputation and other permanent damage [3,4]. Scorpion stings exceeds 1.2 million case per year globally, leading to 3250 deaths [5]. Jellyfish stinging rate is estimated 150 million and resulted in fatal injury of 20 – 50 death annually [6,7].

Indonesia has over 700 species of snakes [8] among those 22 are categorized as highly venomous of medically important by World Health Organization [9]. The snake bite case rate in Indonesia was estimated 0.49 per 1000 population, and five of every 100 case were fatal [10]. Those numbers may be underestimated; the data on venomous injuries and deaths were underreported since the fatal cases prior to reaching health care facility rarely recorded. Although rarely recorded, some adventurous activities
during visit to Bali may result in envenoming either by terrestrial snake or marine creatures such as sea snake, jellyfish, stonefish and sea urchin.

The challenge in managing envenomed patient is that in most cases, the culprit has not been reliably identified by patients and bystander, and not available for identification. The availability of anti-venom is also a major concern especially in restricted resources of developing countries. Previously the specific treatment for envenoming is targeted anti-venom that formulated for specific venomous species. This will require exact identification of perpetrator and availability of various anti-venoms; this is an impossible task to be fulfilled. Indonesia, for example, with numerous venomous snakes inhabitants only have one polyvalent anti-snake venom sera formulated for neurotoxic venom (Kobra – *Naja sputatrix*, Banded krait – *Bungarus fasciatus*) and hemotoxic venom (Malayan pit viper – *Angkistrodon rhodostoma*) with lower efficacy compared to other commercially available anti-venom in South East Asia [11]. Recently a research was published on pan-specific antiserum to answer that challenge [12] and may cut the cost in managing envenoming.

Given the expanse of the problems and current level of international mobility, it is essential for travel medicine physician to be able to provide advice on prevention, first aid and clinical management of envenoming.

### 2. Identification of an injury

A travel medicine physician while managing suspected envenomed patient, have to address two crucial questions in timely manner: is envenoming implicated in the injury and for which specific anti-venom available?

Venom and poison are part of biological toxins produced by living creatures, in which small amount is capable of causing harm. Based on delivery mechanism, injury profile and transfer mechanism, toxins divided into three types: the venom which delivered via creation of wounds, poison in which without delivery mechanism and toxungen that delivered without wounds [13,14] Medically important venomous animals consist of six major groups: species from venomous terrestrial and sea snakes, scorpions, spiders, hymenopterans species, species from cnidarians phylum and venomous fishes [7].

![Figure 1. Identification of injury from suspected envenoming.](image)

Late outdoor activities in tropical agricultural region during warm season carries higher risk for terrestrial snakebites and envenoming as most of venomous snakes are nocturnal. Envenoming from marine creatures may accidental by contact while diving or skimming [6,15]. Identification of ecological location when injury takes place, whether terrestrial or aquatic will accommodate in narrowing down the possible aetiology to the medically important venomous species in the region. The list of medically
important venomous animals based on geographic location available on World Health Organization (WHO) site [16] and elsewhere [7,17,18].

The type of presenting injury Figure 1 and accompanying symptoms may assist early assessment of possible perpetrator in suspected envenoming case [19].

3. Management

Basic principles in managing patient with suspected bites or stings from potentially venomous animals are prompt and accurate identification; address the immediate life-threat, assess airway, breathing and circulation and support as indicated. Whenever impaired cardiac and or respiratory function is present, the management should be prioritized.

3.1. First aid management

The aim of first aid management is to delay the absorption of venom. Fast acting venom (e.g. Inland taipan – *Oxyuranus microlepidotus*, Black mamba – *Dendroaspis polylepis*, Funnel web spider – *Atrax and Hadronyche*) should be managed by bandage and splinting method. Routine arterial tourniquet has no role in delaying the spreading since venom transport in superficial lymphatic system and capillaries. Firm bandage should be applied over bitten area to proximal of the affected limb and then splinted. If the bite is located at truncal area; firm pressure should be administered over the bitten area and then firm bandage applied over the pressure. Muscle activity will enhance the systemic absorption of venom, in which the ambulation should be limited and the patient carried to ambulance or hospital. This method of localizing venom may lead to local detoxification. Envenoming by species with late life-threatening effect (e.g. stone fish *Synanceia*, redback spider *Latrodectus hasselti*, *Loxoscele*, most of scorpions) not requires bandage and splinting since the procedure may enhance the pain.

Hot water immersion (HWI) using 45 degree Celsius water for 30 – 90 minutes, as first aid management on marine creatures envenoming especially due to penetrating lesion (e.g. sea urchin, stone fish envenoming) and recently for *Cnidarians* (jellyfishes) injury [15,20–22]. The heat accommodate in ameliorate pain by dilatation of blood vessels and disrupt the heat labile venom proteins; for that reason the HWI approach may benefit of use as first aids management. Application of 3 – 6 percent acetic acid (vinegar) will activated nematocysts from *Cnidarians* stings; dousing area afflicted with jellyfish sting for 30 seconds is crucial to terminate the stinging apparatus activity [6,7,23,24].

3.2. Management in emergency room

Management in hospital’s emergency room is depending on first aid measure that has been taken and the patient symptoms. Patients who are not received any first aid, the treatment only indicated if there are signs of significant envenoming. The wound should be bandaged, immobilization and give the definitive treatment. For those with no or only minor symptoms, the decision plan is observation for at least 6 hours for adults and 24 hours for children.

Patients who are bandaged and splinted should be given definitive treatment if signs of envenoming present, otherwise remove bandage and observe the clinical condition.

The patients who are on arterial tourniquet and without symptoms: removed tourniquet and observe. During observation if minor symptoms present then prepare the definitive treatment: remove tourniquet and depending on the result either treat or observe. if features of significant envenoming present, the definitive treatment should be given prior to removing tourniquet [7,15,25,26].

Indication for tetanus prophylaxis should be assessed in penetrating wound, and administered as indicated followed with updating the tetanus vaccine afterwards.

3.3. Anaphylaxis

Physicians should be aware that snake handlers, zoo keepers, veterinarian and patients that previously have been bitten, may develop anaphylaxis to venom and anti-venom. This condition will complicate diagnosis and management. Venomous injury due to Portuguese man-of-war, wasp, bee, and ant sting are more likely fatal due to allergic than toxic means. Symptoms with hypotension and tachycardia
should warrant investigation of anaphylaxis. The mast cell tryptase assays, if available, can confirm the anaphylaxis in reaction to venom of snakes and Hymenoptera [20,26,27].

3.4. Anti-venom
Administration of anti-venom is indicated only if evidence of significant envenoming present and should not wait for life-threatening symptoms. Pre-treatment administration of parenteral antihistamine or intra muscular epinephrine prior to anti-venom appears to reduce the adverse reaction to anti-venom although no clinical trial supporting this practice. Physicians should note and assess the risk of intracranial haemorrhage before employ the pre-treatment epinephrine. Dosing of anti-venom should be governed by the amount of venom injected, diluted in 500 millilitres saline by slow infusion and patients should be on careful monitoring. Definitive treatment with anti-venom should result in prompt improvement, continuing deterioration or failure to improve may results from inadequate dosing or incorrect anti-venom. Adjunctive treatment for preventing serum sickness after administration of polyvalent or large dose anti-venom using five days course of steroid has lack of evidence but recommended by some [26,27]. List of specific anti-venom based on species and region can be accessed via WHO website [16].

4. Prevention
Preventing envenomed by bite and stings should be one of aspect to be incorporated in travel medicine consultation, especially if the activities mostly outdoor or adventurous in nature. Preventive measures that can be done is to ensure the routine vaccine is up to date, including for tetanus; required vaccine administered and consider selective vaccine for specific activity and destination. Travel kit components should be tailored based on patient condition, destination and type of travel activities.

4.1. Preventive measures from terrestrial envenoming
Travel medicine physicians should inform the traveller on medically important venomous beings at destination, especially if the activity poses significant risk for encounter one. Advised on raising beds above floor level and use mosquito net impregnated with insecticide; the net should be completely tucked in under the sleeping mat to guard against centipedes, scorpions, and snakes as well as mosquitoes and other ectoparasites. Watchful while walking, step on to rocks or logs rather than straight over them as snakes may be sunning themselves on the other side, especially after rain. Avoid putting hands or poking into holes, nest or any hiding places where venomous animals might be resting. For camping activities: the grass is kept short or ensure the ground is clear around camping area, listen to animals around because they often warn of a snake nearby, and do not collect firewood at night in the bush or countryside. Wear garment and proper footwear while walking through bushes or forestry, the trousers should be tucked inside boot. Be careful when handling dead or apparently dead snakes: even an accidental scratch from the fang of a snake’s severed head may inject venom. Drivers or cyclists should never intentionally run snakes over on the road because the snake may not be instantly killed and pose a risk to pedestrians and other cyclists. The snake may also be injured and trapped under the vehicle, and crawl out once the vehicle has stopped or has been parked in a compound [7,20,28].

4.2. Preventive measures from aquatic envenoming
If destination is surrounded by water and the activity involving adventure in water’s edge, ocean, sea, or river; the traveller should be informed of medically important animals in the area. Ensuring to always wear protective water shoes when wading, note that thin shoes offer little protection against animals with spines, like stonefish. When beachcombing, only put the hands where can be seen and avoid putting hands or feet under ledges where animals could be hiding. Advised to do not touch, feed, or engage with aquatic animals, especially the wildlife ones. The first aid kit should be reachable during the outdoor activities [15,20,28].
5. Conclusions
Identification of possible injury with risk of envenoming is integral part in managing patients with lesion. The presence of penetrating wound, ecological nature of injury acquisition, type of lesion and presenting symptoms will assist in first care and hospital management. Preventive measures should be merged in travel medicine assessment and consultation prior to travel.

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