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EMERGENT MANAGEMENT OF SCORPION STING

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ABSTRACT

Scorpionism (*syndrome of scorpion stings*) is an important public health problem in many regions of the world, not only in tropics and subtropics. As scorpions may be unintentionally transported to any place in the world and keeping scorpions as pets is becoming more popular, scorpion stings occur also in Poland. Therefore, health professionals should have the knowledge on the management of scorpion stings. This article discusses a case who was stung by scorpion and proposes an algorithm of management with such patients.

Key words: *scorpion, scorpion sting, anti-scorpion venom serum*

INTRODUCTION

Scorpion stings pose a considerable threat for public health in many regions of the world, especially in less-developed countries of tropics and subtropics. A list of high risk areas includes: Saharan Africa, Sahelian Africa, South Africa, the Near and Middle East, South India, Mexico, and South Latin America, to the east of the Andes. Cumulatively, a total of 2.3 billion persons are exposed to scorpion stings. Furthermore, scorpions inhabit also the south areas of the United States and Southern Europe. An estimated 1.2 million persons are stung by scorpion per year. Of them, ca 3,250 persons (0.27%) die. In fact, an actual incidence is unknown as the majority of scorpion stings occur in less-developed countries, in remote rural areas, jungles and deserts, remaining unreported. Furthermore, scorpion stings are not subject to notification (1,2).

As scorpions may be unintentionally transported to any place in the world with air, sea luggage or food transportation and their popularity as pets is on the increase, the natural range of scorpion distribution is becoming blurred. In Poland, a group of hobbyists concentrated around the website: www.scorpiones.pl is composed of more than 500 active users. Relevance of the problem is confirmed by periodic news in media with the examples being: appearance of scorpion in psychiatric ward of hospital in Bolesławiec in September 2013 and subsequent evacuation of patients and finding a scorpion of the genus *Centruroide* in a parcel with

clothing bought online by a female living in Warsaw in October 2013.

CASE PRESENTATION

On 8th May 2006, a 22-year-old female, A.M., living near Łańcut, was transported by ambulance in evening hours to the admission room of the infectious diseases ward in Łańcut. Following evening bath, the patient left shower stall and stood on clothing on the floor with her bare feet. Then, she experienced a painful sting in the shin. Having searched the clothing, a scorpion was found and caught. A previous day, patient's mother bought garden soil and potted plants on the market stall. Then, she placed it in the boxes on the bathroom's windowsills.

On admission, patient complained of severe stinging, stabbing pain of the shin and pain sensation following skin-clothing contact. There were no signs of respiratory or cardiovascular distress. Examination revealed pallor, sweating, accelerated heart rate of 120/min and increased blood pressure of 160/90 mm Hg. At the site of sting, hard, painful and red swelling with a tendency to extend was reported. Stress of the physician on duty was intensified by the fact that the patient was 6 months pregnant.

A standard symptomatic treatment was initiated, assuming that in addition to inflammation and pain, anaphylactic reaction may occur. Intravenous access

was obtained. Patient was administered hydrocortisone, calcium, analgesics and 0.9% NaCl. Ice was applied to the sting site. It was changed systematically. Furthermore, an obstetrician was consulted. Examination and CTG did not reveal any direct threat to the life of foetus.

Physician on duty consulted via telephone a physician at the tropical diseases ward and gynecology & obstetrics at the Institute of Maritime and Tropical Medicine in Gdynia. Patient's management was approved by the consulting physician. Furthermore, he informed that the Institute of Maritime and Tropical Medicine did not have antivenom. He suggested, however, that zoological gardens in Wrocław, Płock, Łódź and the Institute of Tropical Medicine in Hamburg could have it. He gave telephone numbers to aforesaid institutions. Irrespective of multiple attempts, however, none of them was contacted as these telephone numbers were inactive at night hours. Later telephone calls revealed that Polish zoological gardens did not have antivenom. Due to the relatively good general health of patient and predicted difficulties and long time required to transport the serum from Hamburg, it was decided not to contact the Vaccine and Serum Research Institute there.

General health of patient and foetus was stable. Within a few days, it was systematically improved. Patient was discharged after 3 days of hospitalization in good general health and with considerably smaller local skin reaction. Three months later, she delivered a healthy, full-term boy. Any visible sequelae of this incident to a newborn were reported.



Figure 1. Scorpion, which was delivered to hospital in a closed glass container, was transported to a professional terrarium.

EMERGENT MANAGMENT

A case discussed constitutes a reason for whose healthcare workers in Poland should know the consequences of scorpion stings and the principles of man-

agement of such patients. It also confirms that such information should be easily accessible, e.g. on websites.

Of 1,500 scorpion species, exclusively 50 are considered to be dangerous for humans. All of them, except for *Hemiscorpius*, belong to the family of *Buthidae*. Generally, scorpions are not aggressive. They do not hunt for prey but wait for it. They are active at night. Thus, scorpion stings in humans are primarily due to accidental contact when scorpion is touched or stepped on. Usually, feet or hands are sting sites (2,3).

Scorpion venom is a water-soluble, heterogenous mixture of multiple toxins and other compounds. It contains neurotoxins, cardiotoxins, nephrotoxins, hemolytic toxins, phosphodiesterases, phospholipases, hyaluronidases, glycosaminoglycans, histamine, serotonin, tryptophan and cytokine releasers. The most important effects of envenomation refer to neuromuscular system and autonomic nervous system. Scorpion venom modifies the function of ion channels, especially sodium channels by maintaining sodium channels open and subsequently leading to prolonged neuron hyperexcitability. Consequently, it affects neuromuscular system and hinders normal transmission of nerve impulses. Then, it contributes to an excessive release of neurotransmitters such as epinephrine, norepinephrine, acetylcholine, glutamate and aspartate. Concomitantly, short-chain polypeptide neurotoxin blocks potassium channels (4).

Furthermore, serotonin, which is present in venom, triggers severe pain. Effects of venom are of reversible and finite nature. Duration of venom activity, however, depends on the quantity of venom injected, sting site and human's individual susceptibility (4,5).

Dependent on the species, scorpion sting may cause a multitude of symptoms, ranging from mild, temporary local reactions to multiple organ failure (4,5).

Fatal cases due to scorpion sting result most commonly from respiratory or cardiovascular failure within 24 hours following sting. The highest risk of death is observed in children and the elderly, i.e. ca 20%, 10% and 1% in untreated small children, school children and adults, respectively. Disparities in envenomation course result from individual genetic predisposition. No race-related differences are observed (1).

Following scorpion sting, a sharp, severe, burning pain at the sting site is reported. It lasts for 30 minutes and may be accompanied by local inflammation and tissue swelling. Other symptoms occur 30 minutes or even 4-12 hours following sting. Their severity progresses within 24 hours. These are: paresthesia, burning and stabbing sensation in the region of hands, feet, face and scalp, skin hypersensitivity to contact with clothing and bedclothes and sound hypersensitivity. Furthermore, ataxia, failure of muscular coordination, abnormalities of gait, involuntary movements, tremor and muscle weakness are reported. Heart rate increases

up to 100-150 beats per minute, especially in case of *Parabuthus granulatus* while it decreases below 50/min with *Parabuthus transvaalicus* envenomation. Increased heart rate is accompanied by an increase of blood pressure. Furthermore, dysphagia, speech disorders, excessive sweating, headache, nausea, vomiting, diarrhea, ptosis, retention of urine, finally respiratory disorders which may lead to death are observed (3). Venom of *Hemiscorpius* may result in severe haemolysis. High concentration of venom may also lead to severe coagulopathy (5).

Due to possible occurrence of scorpion stings in our latitude, the authors of the present paper propose an algorithm of management with such patients and principles of hospital care.

Emergent management:

1. Assessment of the airway, breathing and circulation (ABC algorithm).
2. Venom extraction from the sting site using suction mini pumps (Aspivenin, Venimex) applied in case of insect stings. Effectiveness of such method has not been analyzed. It is not allowed to extract the venom by mouth.
3. Application of ice to the sting site is recommended.
4. Intubation and IV access, if necessary.
5. Detailed review of the medical history; if it is feasible, a scorpion should be preserved to determine its species, such information is required to select proper antivenom (5)

In-patient hospital care

In all cases, symptomatic treatment should be initiated. Administration of venom is required in severe cases. To assess the severity of symptoms, specific scales are employed (i.a. envenomation severity scale for *Centruroides*, HECTOR Emergency Scale for *Androctonus australis* and others).

As clinical symptoms and their severity may differ, it is required to monitor the patient to identify life-threatening symptoms. Of importance is to ensure a patent airway and homeostasis functions. Antivenom should be administered and symptomatic treatment should be initiated provided it is required.

Local treatment consists in applying ice to the sting site, immobilization of extremity and positioning it below the heart line to limit the spread of venom; calming the patient (high blood pressure and tachycardia accelerate the distribution of venom). An injectable or topical anesthetic may be applied to the region of sting site. In case of possible infection, local or systemic administration of antibiotics may be used. If recommended, tetanus prophylaxis and muscle relaxants for severe muscle spasms should be administered (5,7).

If local treatment is not sufficient enough and general symptoms occur, a patent airway should be

established and, if necessary, intubation or mechanical ventilation should be applied. Of importance is to establish ventilation and perfusion equal to the needs of patient. Patient should be routinely monitored while unstable patient should be monitored using invasive methods. Passive or active oxygen therapy should be initiated. For hypercapnia, intubation or mechanical ventilation are to be instituted. Intravenous administration of fluids should be applied to prevent hypovolemia resulting from vomiting and diarrhea (5).

Occurrence of hyperdynamic cardiovascular symptoms (tachycardia, hypertension) requires expert administration of a combination of beta-blockers with alpha-adrenergic-antagonists. Beta-blocker-based monotherapy should be avoided to prevent alpha-adrenergic effect. In case of hypertension and myocardial ischemia, nitrates (nitroglycerin, sodium nitroprusside) may be applied (6,7).

In case of hypodynamic symptoms, fluid infusion is applied with afterload reduction using drugs such as prazosin, nifedipine, sodium nitroprusside, hydralazine, or angiotensin-converting-enzyme inhibitors. Prazosin is a drug whose effectiveness is documented to the largest extent. It is a cheap drug. Furthermore, contrary to antivenom, it is available even in poor regions of the world. In contrast to antivenom, it is of cardioprotective effect. It also prolongs patient's survival (6-9).

Digitalis is of no clinical effect while dopamine aggravates the damage of cardiac muscle. To obtain optimal inotropic effect, dobutamine is used. If effect is too weak, norepinephrine should be administered (6,7).

Atropine should be applied to prevent the symptoms of excessive activity of parasympathomimetic nervous system.

Novel data suggest that insulin may be used for the purpose of enhancing the tissue metabolism. These reports, however, are not confirmed by studies on humans. Provided a patient is excessively stimulated, barbiturates and benzodiazepines should be administered. Benefits resulting from the administration of steroids aimed at reducing shock and swelling have not been proven (6,7,8).

Administration of antivenom is the treatment of choice in severe envenomation. Due to disparities in venom composition of scorpions belonging to particular species, administration of proper antivenom is required. Thus, it is very important to catch and preserve scorpion for its identification. Attempts to produce one antivenom which would have an effect of venoms of several scorpion species are undertaken. So far, no human studies have been conducted in this respect. Another difficult issue consists in determination of proper dose of antivenom – too small doses would not ensure a desired effect while overdosing may lead to hypersensitivity (6-9).

Administration of antivenom reduces the concentration of circulating venom within a few hours. It does not, however, neutralize toxins which are already bound to organ receptors. Therefore, administration of antivenom is applied concomitantly with symptomatic treatment (8-11).

Severe neurologic symptoms disappear within 15-30 minutes after administration of antivenom to *Centruroides* venom while other symptoms resolve in 45-90 minutes. Having considered antivenom to non-*Centruroides* venoms, severe pain reverse in the first hour; other symptoms such as agitation, sweating and hyperglycemia disappear within 6-12 hours while cardiovascular symptoms - 6-24 hours following antivenom administration (10,11).

Compared to other antivenoms, occurrence of anaphylactic reaction following administration of anti-scorpion venom serum is considerably less probable. It results from a large release of endogenous catecholamines induced by scorpion venom toxins .

In countries, where scorpion stings are reported frequently, antivenom is available in poison centres which are localized in large cities. In the United States and Mexico, Anascorp (RDT) is used. Pursuant to producer's instructions, initial dose of Anascorp is 3 vials which should be administered as soon as possible after scorpion sting, i.e. within 10 minutes. Provided symptoms are still present, additional doses may be used at intervals of 30 to 60 minutes. Other antivenoms are also available with the examples being Scorpion Antivenom Product in the Kingdom of Saudi Arabia and Scorpion Antivenom in the Republic of South Africa [10, 11].

From the telephone interviews performed by the authors transpires that currently no zoological gardens in Poland have anti-scorpion venom serum. Thus, in case of scorpion sting exclusively symptomatic treatment may be initiated.

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