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**DANGEROUS LAND & SEA – BORNE CREATURES POSING
HAZARD TO RECREATIONAL DIVERS
IN THE TROPICAL CLIMATE**

Due to intensively growing international tourism, increasing numbers of people leave for countries with hot climates, where various threats for human health and life exist. Besides climatic and sanitary conditions, a rich fauna, represented by predators and venomous animals, can be included. Based on available world literature and their own observations, the authors present the threats that a tourist can possibly encounter whilst relaxing on the beach or during recreational diving in tropical waters. When staying in water, a large threat is posed by marine fish of prey (sharks, barracuda, muraena), Cnidaria (jellyfish, corals, anemones) and venomous animals (fish, sea snakes). On land, on the other hand, a threat can be posed by venomous arthropoda (scorpions, spiders) and Hymenoptera insects. The study presents the most important representatives of fauna present in coastal areas frequently visited by diving enthusiasts. Also, clinical image and conduct in the case of body injures are discussed.

Keywords: land & sea-borne creatures, diving, tropical climate

**NIEBEZPIECZNE ZWIERZĘTA LĄDOWE I MORSKIE BĘDĄCE
ZAGROŻENIEM DLA NURKÓW REKREACYJNYCH
W KLIMACIE TROPIKALNYM**

W związku z intensywnie rozwijającą się turystyką międzynarodową, coraz więcej osób wyjeżdża do krajów strefy klimatu gorącego, gdzie występują różnorodne czynniki stwarzające realne zagrożenie dla zdrowia i życia człowieka. Oprócz warunków klimatycznych i sanitarnych zalicza się do nich także bogatą faunę reprezentowaną przez drapieżniki i zwierzęta jadowite. Autorzy pracy na podstawie piśmiennictwa światowego oraz własnych obserwacji przedstawiają zagrożenia, z jakimi może spotkać się potencjalny turysta podczas wypoczynku na plaży oraz nurkowań rekreacyjnych w wodach tropikalnych. W czasie pobytu w wodzie duże niebezpieczeństwo dla człowieka stwarza spotkanie z drapieżnymi rybami morskimi

(rekiny, barakudy, mureny), parzydełkowcami (meduzy, koralowce, ukwiały) oraz zwierzętami jadowitymi (ryby, węże morskie). Z kolei na lądzie zagrożeniem są jadowite stawonogi (skorpiony, pająki) oraz owady błonkoskrzydłe. W pracy przedstawiono głównych reprezentantów fauny występującej w rejonach

nadmorskich, często odwiedzanych przez amatorów nurkowania. Omówiono również obraz kliniczny i postępowanie w przypadku doznanych obrażeń ciała.

Słowa kluczowe: zwierzęta lądowe i morskie, nurkowanie, klimat tropikalny

INTRODUCTION

Increasing interest in journeys to countries with a hot climate has been observed lately. In those countries, enthusiasts of exotic adventures combine passive rest with various sports, among which recreational diving plays an important role. Underwater landscapes allow active contact with nature, but, on the other hand, are burdened with the risk of encountering predators or venomous animals. A similar situation exists on land – commune with the local fauna is combined with the risk of being attacked by venomous creatures, such as scorpions, spiders or Hymenoptera insects. In consequence, what is supposed to be a pleasant stay in the tropics could end with a serious, and possibly life-threatening injury. This is usually caused by ignorance and a lack of knowledge of the risks laying in wait under water and on land. The study presents a review of marine and land animals that could be potentially encountered by a tourist on a journey to a country located in the hot climate zone. Clinical image and basic rules of conduct in the case of sustaining injuries as a result of direct contact with animals of prey or venomous ones are discussed.

MARINE PREDATORS

Sharks. Despite being infamous for their aggression, sharks pose a relatively low threat. No more than 150- 200 cases of spontaneous attacks on people are noted annually in the whole world. Only a few of the numerous shark species are dangerous for humans. Those predators have very poor sight and react more on blood or body movements than on the human presence itself. Their poor vision is compensated by excellent smell, allowing them to sense their prey from long distances. They are attracted by electrical impulses produced by living animals. In the case of humans, attacks are usually directed at people swimming alone. Injured or scared sharks become highly aggressive and attack everything around them, including boats or small ships. The risk of a shark attack can be reduced by sticking to some practical and universally known rules. Do not swim at dusk, for this is the sharks' favourite hunting time. Do not swim having open, bleeding wounds. Do not dive in the close vicinity of the places where fish-nets are emptied. If a shark approaches, stay alert and cautious not to touch its skin. Shark skin is rough and touching it can cause bleeding cuts that could trigger an attack [1].

Barracudas. Those fish are one of the most dangerous marine predators. They look like a big pike [1.5-2.0 m]. They have long, sharp teeth that are able to injure or even bite-off fingers or a hand. The wounds inflicted require a long time to heal, and those injured usually require hospitalization. Barracudas usually lie in wait in reefs and rock crevices. A possible attack is provoked not by hunger, but by the protection of

their hunting range. They frequently swim in shoals that could be dangerous to humans.

Muraenas. Resemble eels, but their body is more oblate and their jaws are more massive. They can be encountered among stones, underwater rocks and coral reefs, where they wait for their prey in caves and crevices. If we approach too close or put our arm into a crevice where there is a muraena, the fish will attack, defending its territory. As the fish also live in shallow water, they are also dangerous for people paddling in water, where rocks and reefs are present [2].

In the case of injuries inflicted by the fish, a wound should be immediately cleaned and washed with soap and water. Next, the wound should be disinfected, for example with iodine, and covered with a sterile dressing. In the case of larger wounds, especially those lacerated, or post-traumatic amputation, surgical intervention is necessary. If a wound is improperly dressed, it can take a long time to heal, usually leaving disfiguring scars [3].

VENOMOUS FISH

The majority of these fish use their venom glands for defence. Stingrays have one or more serrated stings, located on their whip-like tails that may exceed 30 cm in length. *Weever fish*, which are found in the Mediterranean and Eastern Atlantic coastal waters, possess venomous stings on their gill covers and in the dorsal fins [4]. Numerous species of venomous fish lead a settled way of life in the shallows. Whilst paddling in shallow water a man can accidentally step on a venomous fish, which usually leads to injury to the lower extremities. This is one of the main reasons for not walking barefoot in shallow waters. A tourist should buy special, lightweight shoes in order to protect the feet against injuries on sharp rocks, and also against possible contact with marine fauna. Divers could be endangered by slow-swimming, venomous *lionfish* that can attack suddenly if their territory is trespassed upon [5].

Precautions should be also observed buying venomous fish in fish-markets. The venom in fresh fish can still be active even after fish have been killed [6].

The bite of venomous species causes extremely intense pain. Mechanical injury leads to tissue damage as a consequence of the necrotic action of venom. In the case of a deep bite, the venom can penetrate large blood vessels or nerves, resulting in life-threatening symptoms [7].

A basic preventive measure in shallow waters is to carefully observe the marine bed, swimming instead of paddling and keeping away from swimming fish. As panic resulting from the intense pain caused by a venomous animal bite, and the occurrence of ensuing symptoms in the injured increase the risk of drowning, victims should be immediately taken to the land. Plunging the injured limb in warm water (<45°C) is effective first medical aid [8]. Painkillers, surgical wound debridement and anti-tetanus medication are the first choice therapy. Antibiotic therapy is necessary in the case of a secondary infection. A serum is available only in the case of a venomous *stone fish* [9].

CNIDARIA

Cnidaria constitute a large group of marine animals belonging to coelenterates (*Coelenterata*). Because of their venomous characteristics jellyfish, anemones and corals are important from a medical point of view. Coelenterates use an effective venom system consisting of numerous nematocysts containing capsules filled with toxic fluid. During contact with an aggressor or a victim, nematocysts shoot out threads which penetrate the body surface, and then paralysing liquid is injected [5].

Corals, anemones and the majority of jellyfish cause a local irritation of the skin in the form of a burn or erythema in people. An example could be the effects of contact with a jellyfish *Pelagia noctiluca*, frequently found by divers swimming in Mediterranean waters [10-12]. Some jellyfish have venom, which acts very strongly, causing the onset of general symptoms or deep local lesions, including necrosis. Cases of that kind can be the result of encountering a *Physalia sp.* in the Caribbean and Pacific waters. In the Indian Ocean and Atlantic, divers are endangered by Portuguese man-of-war (*Physalia physalis*). Diving enthusiasts highly value the region of the Great Coral Reef by the coast of Australia, where contact with *Chironex fleckeri* has caused several dozens of deaths [4]. This jellyfish, called the sea wasp, has a very strong venom that can lead to the death of a human being within just several minutes. In the tropical waters by the Australian coast there are also *Carukia barnesi*, a small jellyfish, size of a human finger, which causes the so-called Irukandji syndrome, connected with the release of catecholamines [13]. Cnidaria can cause type I pathologies of the hypersensitivity kind, including anaphylactic shock [14,15].

In waters where coelenterates are present, swimming or diving should be done only in diving suits providing protection for the skin. An effective nematocyst-deactivating agent, used for first aid in the case of inflammatory changes of the urticaria type and erythema, is vinegar, freely available in special containers located on Australian beaches [16]. Of course, vinegar is not the panacea for injuries inflicted by all jellyfish. In the case of *Physalia physalis* vinegar can even cause the activation of nematocyst and aggravation of the lesions. In cases when the speed and seriousness of the onset of symptoms, could be life threatening, immediate CPR is frequently the only therapy. All lifeguards employed on tropical beaches should know how to perform CPR. Anti-venom serums are also effective, but their use is limited by the fact that they can be used only for a particular cnidaria species, for example *Chironex flexneri* [17].

SEA SNAKES

There are approx. 50 species of snakes belonging to the *Elapidae* family living in a marine environment. Some of them prey in estuaries. *Pelamis platurus* drifts the abysses of the Indian and Pacific Ocean, covering vast distances with marine currents. Other species prey in coastal waters. Those most frequently encountered include *Enhydrina schistosa* and *Hydrophis cyanocinctus*. Sea snakes pose a threat especially for fishers of tropics and sub-tropics, who can be bitten during emptying their nets or when paddling in shallow waters [5].

Rabdomyolysis and respiratory failure frequently set in after being bitten by a sea snake. Early symptoms include pain and amyotonia. The muscles become paralysed and the kidneys fail. In the majority of cases no bite marks are visible, but the general symptoms caused by the neurotoxic action of the venom are plain to see.[8]. The condition of the injured person is usually serious and hospitalization is necessary, with dialysis and support for the respiratory function [18].

SCORPIONS

They are arthropods commonly found in the hot climate zone. People become bitten usually as a result of unwittingly trespassing on their territory. Scorpions prey at night, close to human residences. They can also be encountered inside (in bed-sheets, clothes, shoes). The majority of species from the *Buthidae* family, are the most interesting, from the medical point of view [19]. Local symptoms such as pain, skin reddening and oedema most frequently follow a scorpion bite. Only a few species have venom strong enough to kill an adult human. Most frequently cases of death are noted

among children and the elderly. Scorpions are not aggressive and do not attack humans unprovoked. Bites are mostly accidental. The animals shouldn't be touched or picked up, for they can attack very fast, using a sting located in the tip of their abdomen [20]. General symptoms are caused by scorpions belonging to the *Centruroides* family (found in the USA and Mexico), *Tityus* (Brazil and Trinidad), *Androctonus*, *Buthus*, *Leiurus* and *Nebo* (North Africa, Middle East), *Parabuthus* (South Africa), *Mesobuthus* (Indian Sub-continent) [19]. Symptoms develop in two phases. During the cholinergic phase, the dominating symptoms include vomiting, sweating, sialorrhoea, bradycardia and arterial hypotension, carried on to the adrenergic phase, with the following symptoms: arterial hypertension, tachycardia and circulatory insufficiency, accompanied by respiratory failure [21-23].

The basic precaution measure for a scorpion bite is the habit of checking the bed-sheets, shoes and reaching only visible places with a hand. Therapy is based on analgesics combined with wound disinfection and anti-tetanus procedures. In the USA, apart from the above, actions are supplemented by the administration of serum against the venom of particular species of scorpions [24-26].

SPIDERS

Not many spiders pose a serious threat to humans, from a medical point of view. The majority of species produce venom causing a local inflammatory reaction, without systemic changes. Some of them can be, however, very dangerous. The bite of the South American *bird spiders* can lead to the paralysis of the respiratory muscles. The Neurotoxic venom of a *black widow* belonging to the *Latrodectus* family, an inconspicuous spider of approx. 15 mm in length, occurring commonly between 50°N and 45°S latitude, causes lesions in the circulatory and respiratory system, including life-threatening changes [27]. Spiders of the *Phoneutria* family found in South America and *Atrax* and *Hadronyche* of South-East Australia, have venom acting similarly to scorpion venom (catecholamines become liberated). Brazilian *banana spiders* (*Phoneutria nigriventer*) can travel with bunch of bananas to distant countries and various climatic zones. Biting a human there they can even cause death. Just like in the case of scorpions, bites usually happen in regions inhabited by people (especially spiders of the *Latrodectus* and *Loxosceles* family) [28-30]. Prophylactics and first aid are based on the same principles, as in the case of a scorpion bite [31,32].

HYMENOPTERA INSECTS

Among *Hymenopterans*, bees and wasps are especially common, occurring both in a continental and tropical climate. Many people have been bitten by one of those insects at some point of their lives. Hymenoptera bites are especially dangerous for people hypersensitive to their venom, and in the case of a bite in the neck/throat area. Usually, single bites do not lead to life-threatening conditions, and in non-hypersensitive individuals less than 5% of those bitten die. [33]. People allergic to Hymenoptera venom should be immediately administered adrenalin, which should be present in a first-aid kit of any person suffering from allergies. Bee stings should be immediately removed from the stung body, for they are able to penetrate tissues even after the insect has been killed [33].

Non-allergic people feel pain, oedema and skin reddening in the sting area. Numerous bites can lead to hypovolaemia, haemolysis and neurological disorders. Hymenoptera insects' venom is dangerous especially for people who suffer from allergies, posing a real life threat. In the population of America, 3.3% adults and 0.8% children are allergic to bee and wasp venom. For those suffering from allergies the first

pathological symptoms include: tachycardia, intestinal colic or diarrhoea, and appear several minutes after the bite. If drugs are not administered immediately, hypotension becomes aggravated, followed by coma and death. The basic medication includes: adrenalin, steroids and antihistamines. 0.1% adrenalin administered intramuscularly at a dose of 0.5 – 1.0 ml for adults, and 0.01 ml/kg of body weight in children is a life-saving procedure in the case of progressing anaphylaxis [33].

In conclusion, land reptiles should also be mentioned. 50 to 100 thousand people die every year because of venomous snake bites, and even more suffer from the disability caused by a bite. Tourists in the tropics are relatively infrequently bitten by snakes, but, bearing in mind the real threat of death or disability, the presence of venomous reptiles in a local ecosystem should be considered [34].

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