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CLINICAL LETTER

Grouped vesicles from the Middle East

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Dear Editors,

A 59-year-old female patient presented to our clinic at the end of April immediately after her return from the United Arab Emirates (UAE). One week earlier, she had fallen ill there with an itchy but painless, blistering rash on her extremities and occasionally on her trunk. After the first night in the hotel and a morning swim in the sea, the patient had felt a tingling and burning sensation on her skin. She had not noticed any suspicious sea creatures and, according to the local beach warden, it was not 'jellyfish season' anyway. Our patient had worn a swimsuit and a full-face mask. The next morning, the skin burning worsened after her swim, again without any recognizable cause, despite an increased search for jellyfish or other sea creatures.The

FIGURE 1 Overview of the skin lesions at the trunk, upper extremities and in magnification: Bulging vesicles and bullae, surrounded by a narrow, deep red erythema, in a mostly linear and partially two-row grouped arrangement.

TABLE 1 General measures for cnidarian injuries.

- Cover the affected areas with damp sand directly from the beach, then allow to dry briefly in the sun and scrape off at an acute angle with a knife, credit card or similar.
- Rinsing affected areas with seawater may be sufficient (not with fresh water, as remaining, intact cnidarian capsules will otherwise discharge due to the osmotic gradient).
- Do not touch dried cnidarian fragments on the beach with bare hands.
- Do not use wine vinegar, alcoholic drinks, papaya or pineapple juices indiscriminately (as they have only been tested for selected cnidarian species and may promote discharge).
- Most effective protection in all marine areas: Jellyfish protection suits (stinger suits).

accompanying husband (who had also swum in the sea) showed no dermatosis. The findings on admission consisted of bulging vesicles and bullae, each surrounded by a narrow, rich red erythema, in a mostly linear, often suggestive double-row grouping, predominantly localized on the neck and upper extremities, but also on the trunk and legs (Figure 1). The patient was also known to have atopy (Erlanger Atopy Score: 12 points).

Based on the clinical picture, we rejected the external referral diagnosis of 'bullous pemphigoid' and primarily considered an aquatic dermatosis (e.g. stinging). However, due to the repeated failure to identify the corresponding marine animals, an arthropod reaction (e.g. bedbug bites) also appeared possible. Corresponding investigations for a bullous autoimmune dermatosis (direct immunofluorescence, antibodies in the serum) were also negative.

Histologically, the upper and deep dermis showed a wedge-shaped, downwardly tapering lymphocytic infiltrate with abundant eosinophilic granulocytes, consistent with an arthropod reaction. However, the distribution of the vesicles and bullae led us to consider the possibility of marine-induced dermatitis.

One of the many aquatic (marine) skin diseases acquired in the sea is a seabather's eruption caused by planula larvae, an early, free-swimming (planktonic) developmental stage of marine scyphozoan jellyfish (*Scyphozoa*).[1] However, the distribution of the welt-like skin reactions outside the swimwear (Figure 1) argued against this in this case. Only the absence of jellyfish spoke against toxic dermatitis caused by discharging cnidarian (*Cnidaria*) capsules floating in the sea. However, stinging is also possible due to fragments of tentacles covered with cnidarian cells that have been ripped off from jellyfish and that drift freely in sea. Therefore, the diagnosis of toxic dermatitis caused by freely drifting cnidarian (*Cnidaria*) cnidocyte fragments was made.

Stinging cnidarian fragments can be found floating in all oceans and often travel long distances due to drifting currents and wind. They can often be found far beyond the native habitat of the species to which they belong. The patient's holiday region is situated on a strait that connects the Persian Gulf with the Gulf of Oman. Strong ocean currents from November to April make a high occurrence of cnidarian fragments likely there.[2–4]

These tentacles are also known as 'stinging threads' due to their often thin diameter. Their translucent, usually colorless structure makes them practically invisible to the human eye in the sea. It is therefore usually not possiblefor water sports enthusiasts and swimmers to avoid entanglement. Furthermore, under these circumstances, it is almost never possible to identify the cnidarian behind the sting.

The severity of the corresponding skin reactions depends on the degree of entanglement, the cnidarian species and toxicity of the cnidarian venom as well as the immune status of the stung victim.[5] A particular sensitivity in atopic diathesis is the subject of debate.[6] However, dense body hair is thought to protect against stinging,[7–9] in the majority of all fatal cases of stinging children or women are affected. The husband's lack of symptoms may therefore be explained by his increased body hair and the absence of atopic diathesis. The Amuska jellyfish (*Sanderia malayensis*) is widespread in the coastal area mentioned here. The strong cnidarian venom in the tentacles of this jellyfish causes welt-like skin reactions, often interspersed with vesicles and bullae. Extensive stinging can lead to skin necrosis and cardiovascular reactions.[9,10]

Treatment measures that can generally be applied to all injuries caused by cnidarians are listed in Table 1. However, a number of other acute measures following contact with scyphozoan jellyfish or their tentacles are only applicable to individual species. For example, treatments that are always successful for a particular species of jellyfish may lead to fatal discharge from additional stinging capsules in another species of jellyfish. A selection of important aquatic dermatoses in seas and oceans, which must also be distinguished by differential diagnosis, can be found in Table 2.[11,12]

In our patient, all skin lesions healed quickly, completely and permanently within 3 weeks under symptomatic therapy with prednisolone 1 mg/kg body weight for 3 days and a topical glucocorticoid.

TABLE 2 Differential diagnoses of common aquatic dermatoses.[11,12]

Cnidarians (*Cnidaria*)	***Trigger***	For example, true jellyfish (*Scyphozoa*), flower animals (*Anthozoa*), hydrozoans (*Hydrozoa*) or box jellyfish (*Cubozoa*)
	Agent	Cnidarial toxins (species-specific, generally inhomogeneous group of toxins with highly variable chemical compositions and pH values, different clinical effects and therapeutic responsiveness)
	Clinic	Species-specific stinging patterns in the contact area with tentacles or, in rare cases, cnidocyte-covered umbrella domes, due to chemically different toxins (e.g. extensive or limited areas, streaky or patchy, urticarial, erosive, necrotic)
	Histology	Depending on the toxicity of the jellyfish venom and the clinical severity of the stinging, histological signs of urticaria or contact dermatitis, possibly also epidermal necrosis with vesicle formation and dermatitis with oedema, vasodilatation, and erythrocyte extravasation, possibly also with fragments of the venom tubules of stinging capsules (nematocysts) in the stratum corneum
	Therapy	Rinse off nettles with plenty of sea water, apply damp beach sand, allow to dry, scrape off! (NO fresh water, see Table 1) *Acute dermatitis*: topical steroids. *Subacute/chronic dermatitis*: e.g. calcineurin inhibitors For further measures, precise knowledge of the corresponding cnidarian species is required, e.g. treatment of envenomations of the Australian sea wasp (*Chironex fleckeri*) with household wine vinegar 5%, but envenomations of the lion's mane jellyfish (*Cyanea capillata*) common in the North and Baltic Seas with baking soda (sodium bicarbonate, diluted 50: 50 with seawater; little hint: take a small package of baking powder with you to the beach)
Nematocyst predators (Kleptocnidae)	***Trigger***	Cnidarian predators that incorporate cnidocytes and use them for defence, e.g. marine nudibranchs (*Nudibranchia*) such as the Atlantic blue sea dragon (*Glaucus atlanticus*) and the pilgrim hervia (*Cratena peregrina*), which is mainly found in the Mediterranean
	Agent	Stinging toxins of the prey animal, for example from incorporated siphonophore stinging cells (*Siphonophorae*), such as the Atlantic Portuguese man o' war (*Physalia physalis*)
	Clinical picture	Typical circumscribed envenomation in the area of contact with the triggering nudibranch, possibly with a highly inflammatory appearance
	Histology	See above
	Therapy	See above
Sea bather's eruption	***Trigger***	Planula larvae = larval stage of cnidarians (*Cnidaria*)
	Agent	*Cnidarian toxins*: for example, the West Atlantic/Caribbean thimble jellyfish *(Linuche unguiculata)* and the Northwest Atlantic lined anemone *(Edwardsiella lineata)*
	Clinical picture	Days to weeks after contact with the planula larvae eruption of very itchy red papules (1 mm-1 cm) in the contact area of water-permeable clothing in which the larvae become trapped.
	Histology	See above
	Therapy	See above
Aquagenic urticaria	***Trigger***	Fresh and saltwater contact at any temperature
	Agent	Unknown trigger leads to intradermal mast cell activation
	Clinical picture	Within 30 min eruption of small-spotted urticaria in the contact area
	Histology	Superficial perivascular dermatitis with eosinophils, neutrophils, lymphocytes, and some mast cells. Severe dermal edema
	Therapy	H1 receptor antagonists (H1 antihistamines), also prophylactically Topical steroids in the short term if necessary, creams containing capsaicin in the medium or long term
Infection caused by marine bacteria	• ***Marine gram-positive cocci***	
	Trigger	Staphylococci and streptococci as component of the bacterioplankton
	Agent	for example *Staphylococcus aureus, MRSA, PVL-forming staphylococci*; for example β-hemolytic streptococci of group A (*Streptococcus pyogenes*)
	Clinical picture	Occurring mostly only after injuries; severe infections are rare and mostly restricted to immunocompromised patients. Folliculitis, boils, impetigo, ecthyma, abscesses, carbuncles, phlegmon, possibly septicaemia, necrotising fasciitis due to streptococci; toxin formation leads to systemic complications from gastroenteritis to staphylococcus toxic shock syndrome

(Continues)

TABLE 2 (Continued)

	Histology	Microscopic detection of the pathogens (also in the Gram preparation); direct diagnostic measure is bacterial culture: *Staphylococci*: Gram-positive spherical bacteria, arranged in grape or cluster form, no spore formation, size between 0.8-1.2 µm *Streptococci*: Gram-positive spherical bacteria, arranged in chain form, no spore formation, size between 0.5-2.0 µm, some species form mucous sheaths
	Therapy	Folliculitis, impetigo: if possible initially with local antiseptics Phlegmon, erysipelas: systemic antibiotics (beta-lactam antibiotics) Boils, abscesses, carbuncles: surgical drainage and antibiotics only if necessary (cefazolin flucloxacillin, clindamycin, amoxicillin/clavulanic acid, ampicillin/sulbactam)[12]
	• ***Marine, gram-negative curved rods (vibrios)***	
	Trigger	Vibrions as a component of bacterioplankton.
	Agent	Primarily *Vibrio vulnificus* Endotoxin and exotoxin (metalloproteases, haemolysins, cytolysins) producer; forms an outer polysaccharide capsule (virulence factor) Pathogen in marine coastal and brackish water regions (estuaries); ideal growth conditions for Vibrio vulnificus are prolonged water temperatures > 20°C and a low salt content of the seawater (0.5-2.5%). Vibrio vulnificus occurs freely in water and accumulates in seafood
	Clinical picture	*Skin*: complicated (severe) phlegmon or even necrotising soft tissue infection (with toxin-induced ischaemic necrosis) arising from pre-existing small wounds, then with noticeably severe local pain that is disproportionate to the local superficial skin findings; sometimes haemorrhagic-necrotic blisters, fever and chills, symptoms of shock *Gastrointestinal tract*: acute gastroenteritis after ingestion of infected sea food; often also leading to cutaneous bullae and necrosis, with shock symptoms; mortality rate for sepsis approx. 25%
	Histology	Microscopic detection of Gram-negative, rod-shaped, polar flagellated bacteria, 0.8-1.7 µm, encased in a polysaccharide capsule
	Therapy	Ceftriaxone in combination with doxycycline [12]
	• ***Gram-positive rods***	
	Trigger	*Erysipelothrix rhusiopathiae*
	Agent	Zoonotic pathogen, infection occurs in the oceans through marine mammals, fish, but also by opening contaminated seafood, for example oysters (on land mostly via pigs)
	Clinical picture	*Erysipeloid*: Infection route oral, conjunctival or percutaneous via skin wounds. After up to 7 days incubation period localized, painful light to livid red skin infiltrate, spreading centrifugally with a sharp livid red border
	Histology	*Microscopic detection*: slightly curved Gram-positive rod-shaped bacterium of max. 0.4 × 2.5 µm size; can form filaments up to 60 µm long
	Therapy	*Uncomplicated erysipeloid*: systemic penicillin V for 7 days (3 million IU daily) If allergic to penicillin, clindamycin or doxycycline for 10 days
Injuries caused by corals (Anthozoa)	***Trigger***	Especially reef-building hard corals (Madreporaria, syn. Scleractinia)
	Agent	Fragments and percutaneously injected calcium carbonate crystal splinters
	Clinical picture	Smooth-edged cuts Acute inflammation with accompanying infections in the area of the entry site, possibly chronic encapsulation with formation of granulomas
	Histology	Microscopic detection of light-refracting foreign bodies with accompanying inflammatory reaction and possibly connective tissue encapsulation
	Therapy	Surgical removal of foreign bodies; antiseptic measures, topical steroids, later calcineurin inhibitors if necessary
Dermatitis caused by fireworms	***Trigger***	For example, bearded fireworm (Hermodice carunculata), almost worldwide (including the Mediterranean, Atlantic, but not in the North and Baltic Seas)
	Agent	Upon contact with the bristles, the worm injects a neurotoxin through the swimmer's skin, causing severe irritation and a painful burning sensation at the site of contact for hours, as well as nausea and dizziness
	Clinical picture	Urticarial to papulovesicular dermatitis in the contact area

(Continues)

TABLE 2 (Continued)

	Histology	Nonspecific signs of inflammation
	Therapy	Adhesive tape to remove the spines; dabbing the affected skin area with isopropanol or ethyl alcohol can have a pain-relieving effect Antiseptic measures, topical steroids, later calcineurin inhibitors if necessary
Dermatitis caused by sponges (Porifera)	***Trigger***	for example, the toxic finger-sponge (*Negombata magnifica*), native to the Indian Ocean and the Red Sea
	Agent	*Negombata toxins*: Latrunculin (macrolide toxin) with cytotoxic effect Can cause acute cell damage and programmed cell death in high doses
	Clinical picture	Possibly urticarial to papulovesicular dermatitis in the contact area
	Histology	Possibly light-refracting percutaneously injected calcareous needles (spicules) from the spongy tissue Non-specific signs of inflammation due to sponge toxins
	Therapy	Antiseptic measures, topical steroids, later calcineurin inhibitors if necessary

Dermatitis caused by echinoderms	***Trigger***	**Sea urchins (*Echinoidea*)**	**Starfish (*Asteroidea*)** e.g. crown-of-thorns starfish (*Acanthaster planci*) (Indo-Pacific,	**Sea cucumbers (*Holothuroidea*)**
	Agent	Fragments and percutaneously injected splinters of calcium carbonate Toxin formation of unknown composition, for example in the Diadem sea urchin (*Diadema setosum*) mainly Red Sea and Indo-Pacific spines of sea urchins in North and Baltic sea are not harmful or dangerous.	Fragments and percutaneously injected splinters of calcium carbonate *Acanthaster toxins*: Plancitoxins (37 kDa protein with cytotoxic and apoptotic effect), phospholipases A2 *Other starfish toxins*: Asterosaponins	Some sea cucumbers shoot sticky threads (Cuvierian tubules) as a form of self-defense. These contain, among other things, holothurins (triterpene saponins with erythrotoxic effect) and phospholipases A2
	Clinical picture	*Acute*: painful embedding of a sea urchin spine with numerous natural breaking points *Chronic*: Connective tissue encapsulation, local pain intensification in the affected tissue due to percutaneously applied toxins	*Acute*: painful embedding of a sea urchin spine, with numerous natural breaking points *Chronic*: connective tissue encapsulation	Skin irritation, in case of direct contact with eyes, conjunctiva and cornea irritation possible, even leading to blindness. Upon oral intake, holothurins can lead to gastroenteritis, paralysis and muscle cramps.
	Histology	Fragments with microscopic evidence of light-refractive foreign bodies with accompanying inflammatory reaction and possibly connective tissue encapsulation	Fragments with microscopic evidence of light-refracting foreign bodies and accompanying inflammatory reaction, possibly with connective tissue encapsulation Non-specific signs of inflammation and pain due to toxins of the crown-of-thorns starfish	Nonspecific signs of inflammation
	Therapy	Surgical removal of foreign bodies, superficially located spines are easily removed after application of plasters with salicylic acid		
		Antiseptic measures, topical steroids, later calcineurin inhibitors if necessary		

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CONFLICT OF INTEREST STATEMENT

None.

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