
Envenomations from jellyfish and related species

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It is not uncommon for a person to snorkel in Cancun in the morning and be at home in Kansas City the same night. Those who work, play, or explore the oceans are constantly exposed to creatures that release numerous toxins when they sting their victims. Practitioners in coastal environments should be familiar with local marine hazards, and landlubber recipients of seafaring victims should be prepared to manage dermatologic and systemic syndromes associated with marine envenomations. This article reviews stings from jellyfish and related species. For a more comprehensive review, please see the reading list at the conclusion of this article.

Coelenterates (Cnidaria)

There are approximately 10,000 different species of coelenterates, at least 100 of which are dangerous to human beings. Those with venom-charged stinging cells, or nematocysts, are cnidaria (nettle). Coelenterates are predators that feed on other fish, crustaceans, and mollusks. The medusa form is a bell-shaped creature with a floating gelatinous umbrella, an elongated tubular mouth, and marginal nematocyst-bearing tentacles. The stinging nematocysts are located on the outer surfaces of the tentacles or near the mouth and are triggered by contact with the victim's body. The nematocyst is filled with venom and contains a hollow, sharply pointed, coiled-thread tube, which can be between 200 and 400 μm long, and is hardy enough to penetrate a surgical glove.

An encounter between a human being and a large Portuguese man-of-war could conceivably trigger the release of several million stinging cells. The thread penetrates the epidermis and upper dermis, which is where the viscous venom diffuses into the general circulation. When the agitated victim runs in response to the sting, the muscle-pump mechanism helps distribute the venom throughout the body.

Hydroids

Hydroids are feathery or plumelike animals (Figure 1) that sting the victim who brushes against or handles them. After a storm, the branches of the

hydroid may be fragmented and dispersed through the water so that merely diving or swimming in the vicinity can cause itching and burning; a visible skin irritation can also be produced.

In the field, the skin should be rinsed with sea water and gently dried without abrasive activity.

Contact with the nematocysts of a feather hydroid causes a mild reaction, which includes instantaneous burning, itching, and urticaria. If the exposure is brief, the skin rash may not be noticeable or it can be a faint erythematous milium irritation. A second variety of envenomation consists of a delayed papular, hemorrhagic, or zosteriform reaction 4 to 12 hours after contact. Rarely, erythema multiforme or a desquamative eruption may develop. In turbulent waters, or in a strong current, fragments of the hydroid that are washed into a diver's mask or regulator mouthpiece can cause a burning sensation in the conjunctivae or oral mucous membranes. Systemic manifestations, for example, abdominal pain, nausea, vomiting, diarrhea, muscle cramps, and fever, are rarely reported except when a large area of the skin's surface is involved.

Methylated spirits can cause gross discharge of nematocysts. Judicious application of ice (not immersion into ice water) may be effective to treat acute stings.

In the field, the skin should be rinsed with seawater and gently dried without abrasive activity. The application of fresh water and brisk rubbing are strictly prohibited because these actions encourage any nematocysts remaining on the skin to discharge

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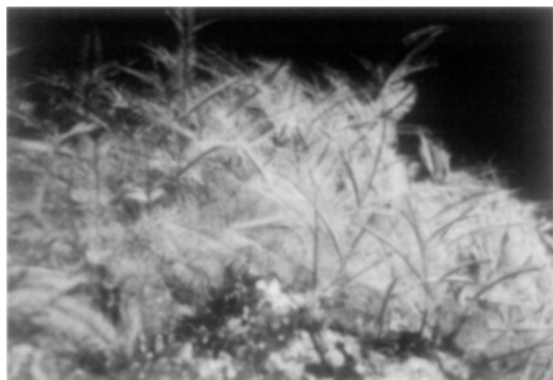


Figure 1

Feather hydroid.

and make the envenomation worse. Applying acetic acid 5% (vinegar) or isopropyl alcohol 40% to 70% to the skin for 15 to 30 minutes has been traditionally recommended to relieve the cutaneous reaction. Methylated spirits cause gross discharge of nematocysts. Judicious application of ice (*not* immersion into ice water) can be effective to treat acute stings.

In 5 to 30 minutes, urticarial wheals develop, marked by redness, warmth, and pruritus. The wheals become moderately edematous and reach their maximum size in 30 to 60 minutes. If left untreated, the wheals will flatten in 14 to 24 hours and will resolve entirely in 3 to 7 days.

After the pain is relieved, a mild steroid cream, such as hydrocortisone 1%, or a moisturizing lotion may be applied. Other topical agents are discussed in the section on therapy for coelenterate stings.

Fire coral

The stony, hydroid, and coral-like *Millepora* species, or fire corals, are not true corals. They are widely distributed in shallow tropical waters. They are found attached to the sea floor in depths of up to 1000 m. They may be mistaken for seaweed because

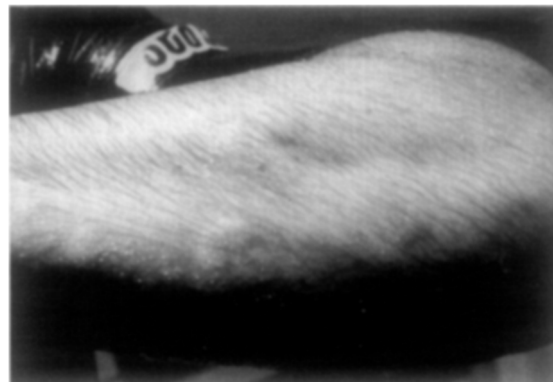


Figure 2

Forearm of the author after a sting from fire coral. Photo courtesy of Kenneth Kizer, MD.

they may attach to pilings, rocks, shells, or coral. Although smaller segments resemble little Christmas trees or bushes measuring 1 to 2 cm in height, they can grow to heights of 2 m.

If the rash becomes eczematous and indolent, it may respond to a course of systemic corticosteroids (prednisone 40 to 80 mg, tapered over a 2-week period).

Immediately after contact with fire coral, the victim has burning or stinging pain, with rare central radiation. Painful pruritus follows within seconds; the victim vigorously rubs the affected area, and the envenomation becomes worse. In 5 to 30 minutes, urticarial wheals (Figure 2) develop, marked by redness, warmth, and pruritus. The wheals become moderately edematous and reach their maximum size in 30 to 60 minutes. If left untreated, the wheals will flatten in 14 to 24 hours and will resolve entirely in 3 to 7 days; occasionally an area of hyperpigmentation will remain that will disappear in approximately 4 to 8 weeks. Without treatment, the pain generally resolves in 30 to 90 minutes. When the victim has multiple stings, regional lymph nodes can become inflamed and painful; however, this does not necessarily indicate that a secondary infection has developed.

The skin should be rinsed liberally with seawater and then immediately soaked with acetic acid 5% (vinegar) or isopropyl alcohol 40% to 70% until the pain is relieved. Additional topical agents are included in the discussion on therapy for coelenterate stings.

Unfortunately, the peak appearance time for both the man-of-war and sea nettle is from July to September, which is also prime beach season.

Residual dermatitis is generally not severe and can be managed using some of the same treatments used for feather hydroid stings. If the rash becomes eczematous and indolent, it may respond to a course of systemic corticosteroids (prednisone 40 mg to 80 mg per day, tapered over a 2-week period).

Man-of-war

The Atlantic Portuguese man-of-war (*Physalia physalis*) inhabits the surface of the ocean. It has a blue or pink-violet iridescent floating sail with multiple nematocyst-bearing tentacles, which can measure up to 30 m in length. The smaller Pacific bluebottle (*Physalia utriculus*) usually has a single fishing tentacle measuring 15 m or less.

The physaliae depend on the winds, currents, and tides for movement, traveling as individuals or in floating colonies that resemble flotillas. They are found in many locations but abound in tropical waters and in the semitropical Atlantic Ocean, particularly off the coast of Florida and in the Gulf of Mexico. Their arrival at the surf's edge transforms a halcyon vacation into a stinging nightmare. Unfortunately, the peak appearance time for both the man-of-war and sea nettle is from July to September, which is also prime beach season.

As with an iceberg, the scene above water does not tell the entire story. Because their tentacles are almost transparent, physaliae are particularly hazardous to the unwary. When the animals move in the ocean, their tentacles rhythmically contract, sampling the water for potential prey. If the tentacles strike a foreign object, the nematocysts will be stimulated and their contents will be discharged into the victim. Each tentacle in a larger specimen may carry more than 750,000 nematocysts. To increase the intensity of the

"attack," the remainder of the tentacle shortens and creates loops and folds, presenting a greater surface area and number of nematocysts for offensive action in what are called "stinging batteries."

Detached moistened tentacles, often found in the thousands fragmented on the beach, carry live nematocysts that are capable of discharging for months. Air-dried nematocysts may retain considerable potency, even after many weeks. Contact with water that contains venom released from stimulated nematocysts can cause dermatitis.

Seabather's eruption

Seabather's eruption, commonly termed "sea lice," refers to a dermatitis that is caused by contact with ocean water. In recent years, it has become more of a problem for ocean-goers in south Florida and across the Caribbean. Seabather's eruption primarily affects the covered areas of the body, for example, the skin beneath a bathing suit, and is thought to be caused by microscopic larvae of the thimble jellyfish *Linuche unguiculata*. Another culprit, which is found in the waters off Long Island, is the larval form of the sea anemone *Edwardsiella lineata*. True sea lice are parasites on marine creatures and do not cause seabather's eruption.

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Swimmers usually complain of stinging soon after contact with larvae. This often happens while they are still in the water or soon after exiting. Applying fresh water to the affected area may intensify the cutaneous reaction. The eruption appears a few minutes to 12 hours after sea bathing and includes pruritic, erythematous wheals, vesicles, or papules (Figure 3) that persist for 2 to 14 days and then spontaneously disappear. The areas involved include the buttocks, genital region, and breasts (women).

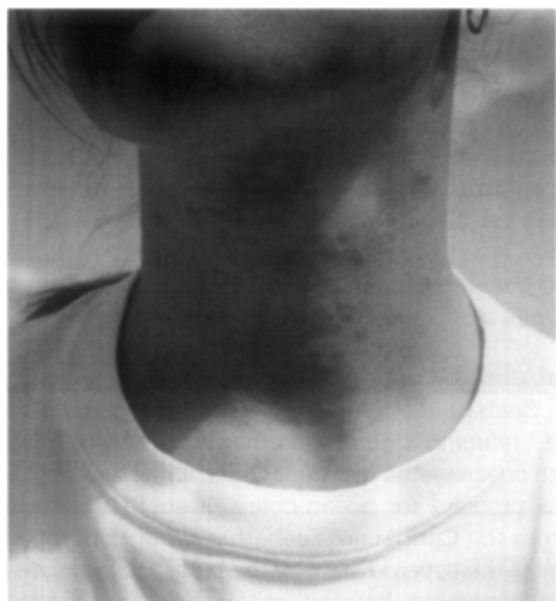


Figure 3

Neck rash typical of seabather's eruption. The rash in this case was caused by thimble jellyfish.

Coalescence indicates a large inoculum. Individual lesions resemble insect bites.

In surfers, lesions develop on the areas of the body (chest and anterior abdomen) that come into contact with the surfboard. The rash can also appear beneath bathing caps and swim fins, or along the edge of the cuffs of wet suits. Fever is common in children who have extensive eruptions. Other symptoms include headache, chills, fatigue, malaise, vomiting, conjunctivitis, and urethritis. Itching is often worse at night and awakens the victim from sleep. Wearing clothing that has been contaminated with the larvae can cause recurrent reactions.

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Seabather's eruption rarely lasts for more than 10 days. Treatment is palliative and includes applying calamine lotion with 1% menthol to the affected area. Oral or parenteral antihistamines or systemic corticosteroids may be given in more severe cases.

A thorough soap and water scrub (not a casual rinse) after leaving the water will provide partial pro-

phylaxis against seabather's eruption. Other suggestions include ocean bathing in abbreviated swimwear to decrease larval entrapment, maintaining occlusive cuffs on dive skins and wet suits, changing swimwear as soon as possible after leaving the water, and using caution during high season for *L. unguiculata* (from April to July off south Florida) or *E. lineata* (from August to November off Long Island) and when there are strong onshore winds.

Jellyfish

Jellyfish are armed with some of the most potent venoms in existence. They may be transparent or multicolored, and range in size from a few millimeters to more than 2 m in width across the bell, with tentacles measuring up to 40 m in length. Larger jellyfish can have up to 1200 tentacles that can be more than 100 feet long.

Box-jellyfish

The dreaded box-jellyfish (*Chironex fleckeri*), often misnamed the "sea wasp," is the most venomous of all sea creatures; its potent sting can cause death in minutes. It ranges in size from 2 cm to 10 cm across the bell. Although these creatures seem to prefer quiet, protected, shallow areas (Figure 4), chiefly in the waters off northern Queensland, Australia, they are also found in the open ocean. Frequently, the victim is an aboriginal child who is bathing in shallow,

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remote coastal waters and does not recognize the small semitransparent submerged creature that may approach as a member of a small armada.

Most stings are minor; however, stings from tentacles measuring more than 6 to 7 m (Figure 5) can cause severe reactions or death. These stings are intensely painful and victims usually struggle purpose-

fully for only 1 to 2 minutes before collapsing. Toxic skin reactions may be quite intense, with rapid formation of wheals, vesicles, and a darkened reddish-brown or purple whiplike flare pattern (Figure 6) with stripes measuring 8 to 10 mm wide. With major stings, skin blistering begins within 6 hours with superficial necrosis 12 to 18 hours after the sting. Occasionally, a pathognomonic "frosted" appearance with a transverse cross-hatched pattern may be present. Women and small children have more severe reactions and increased mortality from stings; this has been attributed to their lower body mass and greater body surface area not covered by hair. Death is attributed to hypotension, profound muscle spasm, muscular and respiratory paralysis, and subsequent cardiac arrest.

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Stings from the jellyfish's lesser cohorts, such as *Carybdea rastoni* or *Pelagia noctiluca*, rarely cause severe prolonged reactions or death, but they can cause dramatic immediate reactions. Envenomation by *Chiropsalmus quadrumanus* resulted in sudden death in a child at Crystal Beach, Texas, at the Gulf of Mexico. Death was attributed to acute dysrhythmia, cardiogenic shock, and pulmonary edema.

In the case of a known or suspected box-jellyfish envenomation, the victim's breathing must be rapidly assessed and supported using an airway and artificial ventilation if necessary. The victim should be moved as little as possible. Acetic acid 5% must be immediately applied liberally to any adherent tentacles before removing them; flooding the skin with acetic acid paralyzes the nematocysts and will not make the envenomation worse. This does not significantly relieve pain. Although most nematocysts cannot pene-



Figure 4
Box-jellyfish (*Chironex fleckeri*) in its natural habitat. Photo courtesy of John Williamson, MD.

trate the thickened skin of the human palm, rescuers should protect their own skin.

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Some authorities recommend immediate application of a constriction bandage proximal to the site of an extremity sting to impede lymphatic and superficial venous return. The bandage should be loosened for 90 seconds every 10 minutes and should be completely removed after 1 hour. An arterial tourniquet should never be applied. The recently popularized pressure-immobilization bandaging technique (wrapping an extremity with an elasticized bandage and then splinting) could be used to prevent the absorp-

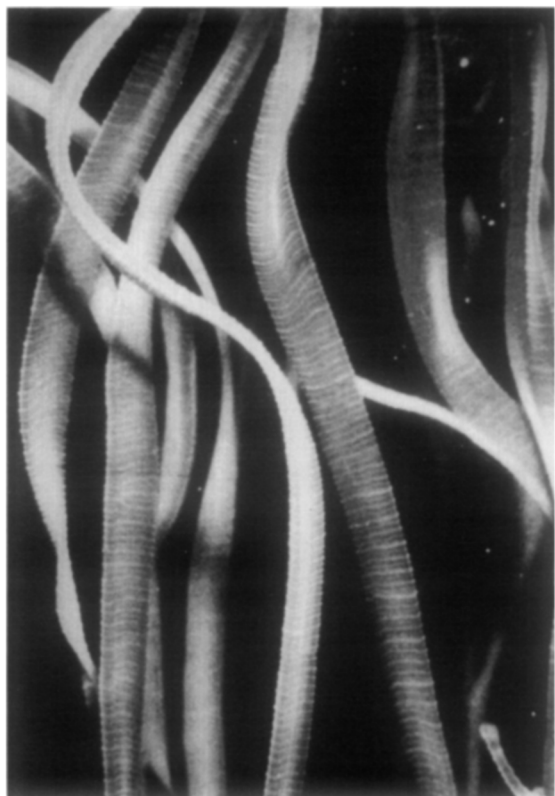


Figure 5

Broad-banded tentacles of the box-jellyfish. Photo courtesy of John Williamson, MD.

tion of *Chironex* venom; however, this theoretically might increase pain and skin damage by stimulating local nematocyst discharge. This technique should only be used after vinegar has been applied to inactivate the nematocysts.

Chironex antivenin should be administered intravenously as soon as possible; this method of administration is preferred to intramuscular injection. The antivenin is supplied in ampules of 20,000 units by Commonwealth Serum Laboratories, Melbourne, Australia. The dose is one ampule (diluted 1:5 to 1:10 in isotonic crystalloid; dilution with water is not recommended) administered intravenously in 5 minutes or three undiluted ampules given intramuscularly. Although the antivenin is prepared from hyperimmunized sheep, the risk of anaphylaxis or serum sickness should be assumed to be the same as for equine hyperimmune globulin preparations. It cannot be overemphasized that the timely administration of antivenin can save lives. Antivenin can also markedly reduce pain and decrease skin scarring. It can be given once or twice every 2 to 4 hours until there is no in-

crease in skin discoloration, pain, or systemic effects. When adults receive large stings, two ampules of the antivenin may need to be given initially. The antivenin may also be used to neutralize the effects of a *Chiropsalmus* envenomation. The antivenin should be stored in a refrigerator with a temperature of 2° to 10° C and must not be frozen. The concomitant administration of a corticosteroid, for example, IV hydrocortisone

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200 mg, is often recommended because of its anti-inflammatory activity but it is not a substitute for antivenin. Even with successful treatment skin irritation may persist for months, marked by discolored striae, intermittent desquamation, and pruritus.

Sea nettle

Sea nettles, for example *Chrysaora quinquecirrha* and *Cyanea capillata*, are less lethal animals and can be found in both temperate and tropical waters, particularly in the Chesapeake Bay. Although they are not as dangerous as the Indo-Pacific box-jellyfish, they can still inflict a moderately severe sting. The

Although most nematocysts cannot penetrate the thickened skin of the human palm, rescuers should protect their own skin.

clinical presentation of a sea nettle envenomation is similar to that of the *Physalia* species but with perhaps more systemic complications. Rarely does a victim die from the sting of a sea nettle.

The sting of the blubber jellyfish (*Catostylus* species) produces a relatively mild reaction including



Figure 6

Skin lesions immediately after envenomation by the box-jellyfish. Photo courtesy of John Williamson, MD.

the formation of wheals, erythema, and pruritus at the site. Systemic effects are exceedingly rare. *Cyanea* species carry long, thin tentacles that cause a similar effect, with occasional muscle aching, nausea, and drowsiness, particularly in small children. The wheals produced by a sting from the *Pelagia* species are more circinate or irregularly shaped and may not follow a linear pattern. The venom is sufficiently toxic to cause severe generalized allergy including bronchospasm and pruritus.

Treatment for a sea nettle envenomation is similar to that for the sting of a member of the *Physalia* species. Baking soda may be a more effective initial detoxicant than acetic acid or alcohol.

Anemones

Sea anemones are abundant (1000 species) multicolored animals composed of stalked, fingerlike projections (Figure 7) capable of stinging and paralyzing passing fish. Anemones are attractive creatures and are often found in tidal pools, where the unwary brush up against them or inquisitively touch them. Small children may either accidentally or intentionally ingest the tentacles. As with other coelenterates, the tentacles of anemones are loaded with one or more variations of nematocysts. When these are stimulated, they wreak havoc on unfortunate victims. Some nematocysts are adhesive and both hold and envenom the prey.

The dermatitis caused by contact with an anemone is similar to the dermatitis caused by contact with fire coral or a small man-of-war; it has been compared to a bee sting. The variation in skin reaction is related to the specific toxicity of the venom; al-



Figure 7

Sea anemone.

though stings from animals of the *Actinia* species produce painful urticarial lesions, the venom from those of the *Anemonia* species cause paresthesias, edema, and erythema. Often, initial skin lesions are centrally pale with a halo of erythema and petechial hemorrhage. This is soon followed by edema and diffuse ecchymosis. If the envenomation is severe, intense local hemorrhage, vesiculation, necrosis, skin

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ulceration, and secondary infection can develop and the reason for the name "Hell's fire sea anemone" (*Actinodendron plumosum*) becomes readily apparent. Systemic reactions are less likely after the sting of an anemone than after that of a man-of-war. Signs and symptoms include fever, chills, somnolence, malaise, weakness, nausea, vomiting, and syncope.

In most cases, mild envenomations resolve in 48 hours. More severe reactions, characterized by discoloration and vesicle formation, can become indolent with eschar leading to residual hyperpigmentation, hypopigmentation, or keloid formation.

Sponge fisherman's (diver's) disease is caused by contact with an anemone that attaches itself symbiotically to the base of a sponge. A few minutes after

contact with the sponge, the skin begins to itch and burn; erythema and small vesicles develop. The area becomes dark purple and the victim complains of headache, nausea, vomiting, fever, chills, and muscle spasms.

Treatment for anemone envenomations is similar to the treatment for the sting of a member of the *Physalia* species. The dermatitis is frequently more severe, and may require prolonged wound care including debridement and antibiotic therapy to treat secondary infection. Anemone stings heal slower than man-of-war envenomations.

Clinical aspects of coelenterate envenomation

The wise clinician suspects a coelenterate envenomation in all unexplained cases of collapse in the surf, diving accidents, and near-drownings. Any victim who is in distress when pulled from marine waters should be carefully examined for a cutaneous lesion(s) that may provide the clue.

Beach patrol members who have been stung by jellyfish (presumably, Portuguese man-of-war) report that an immediate hot shower using a forceful stream of water relieves the pain.

Anaphylaxis

An envenomation or the administration of antivenin can cause an allergic reaction. The signs and symptoms of anaphylaxis can occur within minutes of exposure and include hypotension, bronchospasm, tongue and lip swelling, laryngeal edema, pulmonary edema, seizures, cardiac arrhythmia, pruritus, urticaria, angioedema, rhinitis, conjunctivitis, nausea, vomiting, diarrhea, abdominal pain, gastrointestinal bleeding, and syncope. Most severe allergic reactions occur within 15 to 30 minutes of envenomation; nearly all occur within 6 hours. Fatalities are related to airway obstruction or hypotension.

First aid after coelenterate envenomation

If a person is stung by a coelenterate, the following steps should be taken:

1. Immediately rinse the wound with sea water, *not with fresh water*. Do not rub the wound with a towel or clothing to remove adherent tenta-

cles. Applying fresh water and rubbing abrasively will stimulate any nematocysts that have not already fired. Use forceps or a well-gloved hand to remove the gross tentacles. The keratinized palm of the hand is relatively well protected, but take care not to become envenomed yourself.

Commercial (chemical) cold packs applied on top of a dry cloth are effective for mild to moderate *Physalia* stings. Whether the direct application of ice and the resulting freshwater melt stimulates the discharge of nematocysts has not been determined.

Immersing the area in hot water is generally not recommended because the hypotonic solution will cause nematocysts to fire. Application of hot packs or gentle rinses with hot water are not recommended because they may make the envenomation worse or repeated applications may cause lymphangitis.

However, beach patrol members who have been stung by jellyfish (presumably, Portuguese man-of-war) report that an immediate hot shower using a forceful stream of water relieves the pain. This observation implies that a forceful jet of water that dislodges tentacle fragments and nematocysts can supersede the deleterious effects of fresh (hypotonic) water that lead to nematocyst discharge.

Acetic acid 5% (vinegar) is the treatment of choice to inactivate the toxin.

2. Acetic acid 5% (vinegar) is the treatment of choice to inactivate the toxin. An alternative is 40% to 70% isopropyl alcohol, but this is *not* recommended for a box-jellyfish sting. Perfume, aftershave lotion, and high-proof liquor are less effective and may be detrimental. The detoxicant should be applied continuously for at least 30 minutes or until there is no further pain. Vinegar will not alleviate the pain from a *Chironex* sting, but it will interrupt the envenomation; however, it may not be extremely effective against *Chrysaora* or *Cyanea*. Other substances that have been reported to be effective alternatives are organic solvents such as formalin, ether, and gasoline (all not recommended treatments), dilute ammonium hydroxide, sodium bicarbonate (particularly for stings of the sea nettle, *Chrysaora quinquecirrha*), olive oil, sugar, urine, and papain (papaya latex [juice]), or unseasoned meat tenderizer. There is recent evidence that alcohol

may stimulate the discharge of nematocysts *in vitro*; the clinical significance has yet to be determined.

A commercial aqueous solution of aluminum sulfate 20% and 1.1% surfactant (Stingose) is an alternative. Prior treatment with topical alcohol or methylated spirits reduces the effectiveness of the aluminum sulfate solution; this product seems to be falling out of favor with clinicians in Australia who are jellyfish experts. The pressure-immobilization technique for venom sequestration should be used after vinegar application; a venolymphatic occlusive "tourniquet" should only be considered if a topical detoxicant is unavailable, the victim is having a severe systemic reaction, and transport to definitive care will be delayed.

3. No systemic drugs are of verifiable use. Ephedrine, atropine, calcium, methysergide, and hydrocortisone have all been touted to be effective, but there is no proof that they help. If there is a significant allergic component, antihistamines may be useful. The administration of epinephrine is appropriate only for anaphylaxis.
4. After the wound has been soaked with vinegar or alcohol, the remaining nematocysts must be removed. The easiest way to do this is to apply shaving cream or a paste of baking soda, flour, or talc, and shave the area with a razor or reasonable substitute. If sophisticated facilities are not available, make a sand or mud paste using sea water, apply the paste to the affected area, and then scrape the victim's skin with a sharp-edged shell or piece of wood. The rescuer must take care not to become envenomed; bare hands must be frequently rinsed.
5. Local anesthetic ointments (lidocaine hydrochloride, 2.5%) or sprays (benzocaine, 14%), antihistaminic creams (diphenhydramine or tripeleminamine hydrochloride), or mild steroid lotions (hydrocortisone, 1%) may be soothing. They should be used after the toxin is inactivated. Worsened pain and inflammation after application of benzocaine are rarely noted.
6. Patients should receive standard antitetanus prophylaxis as indicated.
7. Prophylactic antibiotics are not needed. Wounds should be examined for signs of infection at both 3 and 7 days after the injury. Any ulcerating lesions should be cleaned and covered with a thin layer of nonsensitizing antiseptic ointment 3 times a day.

A jellyfish sting to the cornea may cause photophobia, decreased or "hazy" vision, and the sensation that a foreign body is in the eye. Patients should be

referred to an ophthalmologist, who may prescribe steroid-containing eye medications such as prednisolone acetate 1% with hyoscine 0.25%. Traditional skin detoxicants should not be applied directly to the cornea because they are likely to increase the amount of tissue injury.

Mild Envenomation

The stings of hydroids and hydroid corals, along with less severe envenomations by jellyfish and anemones, result predominantly in skin irritation. Victims feel an immediate pricking or stinging sensation accompanied by pruritus, paresthesias, burning, throbbing, and pain radiating centrally from the extremities to the groin, abdomen, and axillae. The area involved by the nematocysts will become red-brown-purple, often in a linear whiplike

All victims who a systemic component should be observed for at least 6 to 8 hours because rebound phenomena after successful treatment are common.

pattern that corresponds to "tentacle prints." Other signs are blistering, local edema, wheal formation, and violaceous petechial hemorrhages. The papular inflammatory skin rash is strictly confined to the areas of contact and can persist for up to 10 days. Areas with significant body hair appear to be more protected from contact than hairless areas. If the envenomation is slightly more severe, then the aforementioned signs and symptoms that are evident in the first few hours can progress in a course of days to local necrosis, skin ulceration, and secondary infection. This is particularly true of certain anemone stings.

Untreated, the minor-to-moderate skin reaction will resolve during a 1- to 2-week period, with occasional residual hyperpigmentation for 1 to 2 months. Rubbing can cause lichenification. Local hyperhidrosis, fat atrophy, contractures, and permanent scarring can occur.

Moderate and severe envenomation

The prime offenders in this group are the anemones, *Physalia* species, and jellyfish. The skin manifestations are similar to those seen with mild to moderate envenomations or may be intensified and

are compounded by the onset of systemic symptoms, which may appear immediately or in several hours.

Systemic symptoms

Systemic symptoms in moderate to severe envenomation include the following:

1. *Neurologic*: malaise, headache, aphonia (loss of voice), diminished sensation to touch and temperature, vertigo, ataxia, spastic or flaccid paralysis, mononeuritis multiplex, parasympathetic dysautonomia, plexopathy, radial-ulnar-median nerve palsies, brainstem infarction (not a confirmed relationship), delirium, loss of consciousness, convulsions, coma, and death
2. *Cardiovascular*: anaphylaxis, hemolysis, hypotension, small artery spasm, bradyarrhythmias (including electromechanical dissociation and asystole), tachyarrhythmias, congestive heart failure, and ventricular fibrillation
3. *Respiratory*: rhinitis, bronchospasm, laryngeal edema, dyspnea, cyanosis, pulmonary edema, and respiratory failure
4. *Musculoskeletal and rheumatologic*: abdominal rigidity, diffuse myalgia and muscle cramps, muscle spasm, fat atrophy, arthralgias, reactive arthritis, and thoracolumbar pain
5. *Gastrointestinal*: nausea, vomiting, diarrhea, dysphagia, hypersalivation, and thirst
6. *Ocular*: conjunctivitis, chemosis, corneal ulcers, (iridocyclitis), elevated intraocular pressure, synechiae, iris depigmentation, chronic unilateral glaucoma, and lacrimation
7. *Other*: acute renal failure, chills, fever, and nightmares

Recurrent cutaneous eruptions may develop 2 to 3 weeks after *P. physalis* stings without repeated exposure to the animal. This may take the form of lichenification, hyperhidrosis, angioedema, vesicles, large bullae, nodules that resemble erythema nodosum, granuloma annulare, or a more classic linear urticarial eruption.

Acute regional vascular insufficiency of the upper extremities has been reported after jellyfish envenomation. It can be manifested by acral ischemia, signs and symptoms of compartment syndrome, and massive edema.

Therapy is directed at stabilizing major systemic decompensation, opposing the venom's multiple effects, and alleviating pain. Generally, only severe *Physalia* or *Cubomedusae* stings cause rapid decompensation. In both cases, supportive care is based on the patient's signs and symptoms. Hypotension should be managed with prompt IV administration of

a crystalloid, such as lactated Ringer's solution. At the same time, any nematocysts that are still attached to the victim must be detoxified to limit the perpetuation of envenomation. Hypotension is usually limited to very young or elderly victims who have severe multiple stings and are volume depleted after protracted vomiting. Hypertension is an occasional side effect of a jellyfish envenomation. Excessive catecholamine stimulation is one putative cause that has prompted clinical intervention with phentolamine, an α -adrenergic blocking agent; an initial IV dose is 5 mg.

Bronchospasm may be managed like an allergic reaction. If the victim is in respiratory distress with wheezing, shortness of breath, or heart failure, arterial blood gas measurement may be used to determine the correct dose of supplemental oxygen to be administered by face mask. Seizures are generally self-limited but should be treated with IV diazepam for 24 to 48 hours; seizures rarely occur after this time.

All victims with a systemic component should be observed for at least 6 to 8 hours because rebound phenomena after successful treatment are common. All elderly victims should have an EKG with cardiac monitoring and frequent checks for dysrhythmias. Urinalysis may demonstrate hemoglobinuria, indicating hemolysis. If this occurs, the urine should be alkalized with bicarbonate to prevent pigment from precipitating in the renal tubules while a moderate diuresis (30 to 50 ml/hr) is maintained with a loop diuretic (such as furosemide) or mannitol (0.25 gm/kg intravenously every 8 to 12 hours). Rarely, peritoneal or hemodialysis may be necessary to treat acute progressive renal failure.

If there are signs of distal ischemia or an impending compartment syndrome, standard diagnostic and therapeutic measures apply. These include Doppler ultrasonography, angiography, or both tests for diagnosis, regional thrombolysis for acutely occluded blood vessels, and measurement of intracompartmental tissue pressures to guide fasciotomy. If vasospasm is a dominant clinical feature, reversible regional sympathetic blockade may be efficacious. However, the vasospasm associated with a jellyfish envenomation may be severe, prolonged, and refractory to regional sympathectomy and intraarterial reserpine or pentoxifylline.

If a small child finds tentacle fragments on the beach and places them into his or her mouth, he or she will have rapid intraoral swelling and the potential for airway obstruction, particularly in the presence of exceptional hypersensitivity. In such cases, an endotracheal tube should be in place before edema precludes visualization of the vocal cords. If

the airway is not protected, liquids should not be placed in the mouth.

Often the pain can be controlled by treating the dermatitis. However, if pain is excruciating and there are no contraindications (e.g., head injury, altered mental status, respiratory depression, allergy, or profound hypotension), administration of narcotics (IV morphine sulfate, 2 to 10 mg; nalbuphine hydrochloride, 2 to 10 mg intravenously or intramuscularly; a combination of meperidine hydrochloride, 50 to 100 mg and hydroxyzine hydrochloride, 25 to 50 mg intramuscularly; or meperidine hydrochloride 15 to 30 mg with either promethazine hydrochloride 12.5 to 25 mg or prochlorperazine 2.5 mg intravenously) is often indicated. Severe muscle spasm may be relieved by 10% calcium gluconate (5 to 10 ml slow IV push), diazepam (5 to 10 mg IV), or methocarbamol (1 gm, no faster than 100 mg/min).

A delayed reaction at the site of contact may look similar to erythema nodosum and may be accompanied by fever, weakness, arthralgias, painful joint swelling, and effusions. This may recur multiple times during the course of 1 to 2 months. The treatment is a 10- to 14-day tapering schedule of prednisone, starting with 50 to 80 mg. This regimen may need to be prolonged or the treatment course repeated with each flare of the reaction.

Postinflammatory hyperpigmentation is common after stings of many jellyfish and other coelenterates. A solution of hydroquinone 1.8% in a glycol/alcoholic base (70% ethyl alcohol, n-propylene glycol mixed at a 3:2 ratio) twice a day as a topical agent for 3 to 5 weeks has been used successfully to treat hyperpigmentation after a *Pelagia noctiluca* sting.

Sting prophylaxis

Unfortunately, there is no agent that can be applied to the skin that will reliably protect the user from receiving a sting. Failed topical barriers include petrolatum, mineral oil, silicone ointment, cocoa butter, and mechanic's grease.

If a jellyfish is sighted, it should be given a wide berth because its tentacles may trail great distances from its body. All swimmers and divers in hazardous areas should be on constant alert. Walking into jellyfish-infested waters is far safer than diving in head

first. Bathers should wear protective clothing in infested areas such as "stinger suits" or a double thickness of panty hose. Divers should remain deeper than 20 feet under water to avoid surface concentrations of the animals and should check snorkel and regulator mouthpieces for tentacle fragments when diving in endemic areas. In areas inhabited by anemones and hydroid corals, protective gloves should be worn when handling specimens. Beached, dead jellyfish or tentacle fragments washed ashore after a storm can still inflict serious stings. Any person stung by a jellyfish should leave or be assisted out of the water because of the potential risk of drowning.

To gather prospective data, The International Consortium for Jellyfish Stings has been formed with representatives primarily from the United States and Australia. At the time of this writing, a marine sting or bite report form can be obtained from Joseph W. Burnett, MD, Department of Dermatology, University of Maryland Hospital, 405 West Redwood St., 6th Floor, Baltimore, MD 21201-1703. The Australian contacts are John Williamson, MD, Hyperbaric Medicine, Royal Adelaide Hospital, South Australia 5000, and Peter Fenner, MD, P.O. Box 3034, North Mackay, Queensland 4740, Australia.

Prompt clinical advice regarding specific patient management can often be obtained by calling the Divers Alert Network at Duke University Medical Center. The telephone number is (919) 684-8111; collect calls are accepted on the new hotline number (919) 684-4326.

Recommended reading

- Auerbach PS. A medical guide to hazardous marine life. 3rd ed. Flagstaff (AZ): Best Publishing Company; 1997.
- Auerbach PS. Marine envenomation. In: Auerbach PS, editor. Wilderness medicine. Management of wilderness and environmental emergencies. 3rd ed. St Louis: Mosby-Year Book; 1995. p. 1327-74.
- Auerbach PS. Aquatic skin disorders. In: Auerbach PS, editor. Wilderness medicine. Management of wilderness and environmental emergencies. 3rd ed. St Louis: Mosby-Year Book; 1995. p. 1417-28.
- Williamson JA, Fenner PJ, Burnett JW, Rifkin JF, editors. Venomous and poisonous marine animals: a medical and biological handbook. Sydney: University of New South Wales Press; 1996.

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OBJECTIVES

Completion of this article will enable the reader to:

1. Discuss first aid for a victim of coelenterate envenomation
2. List signs and symptoms of mild jellyfish envenomation
3. List signs and symptoms of severe jellyfish envenomation
4. Describe the immediate care necessary when envenomation is caused by the "box-jellyfish"
5. Discuss sting prophylaxis

TEST ITEMS

1. What is the first step in assisting a victim of jellyfish sting?
 - a. Rinse the area with clean fresh water and quickly brush off any nematocysts or "tentacles."
 - b. Use any liquid that is available; and rub the area briskly to remove tentacles.
 - c. Rinse the area with copious amounts of seawater and gently dry without abrasive activity.
 - d. Have the victim scrub the area hard during a hot shower.
2. The preferred solution to inactivate the toxin in nematocysts is:
 - a. sodium bicarbonate solution.
 - b. 5% acetic acid.
 - c. any alcohol (wood alcohol, solvent, antifreeze).
 - d. isopropyl alcohol.
3. Vinegar is the treatment of choice to:
 - a. paralyze the nematocysts.
 - b. prevent further envenomation.
 - c. inactivate the toxin.
 - d. all of the above
4. Ice can be used for acute stings:
 - a. carefully after removal of nematocysts to localize areas.
 - b. by immersing the area for 10 to 15 minutes.
 - c. before removal of the nematocysts to stop spread of the toxin
 - d. only if no liquid is available.
5. The most potent venom, which can cause death in minutes, is from the:
 - a. Hell's fire sea anemone.
 - b. sea wasp or box-jellyfish.
 - c. sea lice.
 - d. Atlantic Portuguese man-of-war.
6. Which of the following are pathognomonic for the box-jellyfish?
 - a. Frosted transverse cross-hatched appearance
 - b. Centrally pale skin with a halo of erythema
 - c. Concentric rings
 - d. Irregularly shaped purple lesions
7. A jellyfish sting:
 - a. should be suspected in all unexpected cases of collapse in the surf.
 - b. should be treated aggressively.
 - c. can be life threatening.
 - d. all of the above
8. Systemic reactions often include:
 - a. rebound reactions up to 8 hours after the sting.
 - b. abdominal pain, nausea, and vomiting.
 - c. the need for antivenin.
 - d. all of the above
9. Wheals with mild envenomations:
 - a. generally resolve in 3 to 7 days.
 - b. require prophylactic antibiotics.
 - c. must be treated with antibiotics.
 - d. are always followed by systemic reactions.
10. Application of a constriction bandage proximal to the site of an extremity sting:
 - a. should be used with any suspected severe sting.
 - b. should not be loosened until the patient reaches the hospital.
 - c. can be used to "kill" the tentacle.
 - d. is used only after vinegar has been used.
11. *Chironex* antivenin is:
 - a. always given in divided doses.
 - b. usually given intravenously but can be given intramuscularly.
 - c. should be diluted 1:5 with sterile water.
 - d. must not be refrigerated.
12. Prompt use of the *Chironex* antivenin:
 - a. is contraindicated because of possible allergic reactions.
 - b. will lead to permanent scarring.
 - c. can be combined with corticosteroids for quicker action.
 - d. can reduce pain and skin scarring.
13. Sea bather's eruption is associated with:
 - a. generalized edema and bronchospasm.
 - b. urethritis and skin rashes on bathing suit area.
 - c. diarrhea.
 - d. large boils.

14. When areas are known to have sea anemone larvae precautions should be taken; these include:
 - a. wear bathing shoes to avoid stepping on tentacles.
 - b. wear more abbreviated swimwear.
 - c. always wear a wet suit.
 - d. when leaving the beach, immediately rinse skin with fresh water.
15. Envenomation from sea nettles causes:
 - a. systemic complications, such as generalized allergy and bronchospasm.
 - b. paralysis and death within 30 to 60 minutes.
 - c. local itching with wheals developing.
 - d. skin blistering with superficial necrosis.
16. A common drug administered for a systemic reaction is:
 - a. sodium bicarbonate.
 - b. hydrocortisone.
 - c. atropine sulfate.
 - d. none of the above.
17. In coelenterate envenomation, once the wound has been flooded with vinegar the next step is to:
 - a. administer an antihistamine.
 - b. remove the remaining nematocysts with tweezers.
 - c. apply shaving cream and shave the area.
 - d. flood the area with isopropyl alcohol 40% to 70%.
18. Further treatment for coelenterate envenomation should include:
 - a. standard antitetanus inoculation.
 - b. antibiotic therapy.
 - c. prophylactic administration of antihistamines.
 - d. debridement of wounds.
19. Mild envenomations caused by hydroids:
 - a. are compounded by the onset of systemic symptoms.
 - b. untreated, will resolve in 1 to 2 weeks.
 - c. usually result in recurrent cutaneous eruptions for 2 to 3 weeks.
 - d. are best left untreated.
20. Therapy for severe envenomations caused by jellyfish and *Physalia* species:
 - a. always includes mechanical ventilation because of respiratory failure.
 - b. should be directed at preventing scarring.
 - c. should be directed at alleviating pain and stabilizing major systemic decompensation.
 - d. should be directed at alleviating pain and elevation of the limb to prevent spread of toxins.
21. Elderly patients:
 - a. are more likely to have hypertension after severe envenomation.
 - b. are less likely to be stung because they usually stay in shallow water.
 - c. should have an EKG and cardiac monitoring.
 - d. usually require close monitoring for intraoral swelling and potential airway obstruction.
22. Pain from coelenterate envenomations is most often controlled by:
 - a. administering calcium gluconate and meperidine hydrochloride.
 - b. treating the dermatitis.
 - c. aspirin or acetaminophen.
 - d. applying ice to the area of the sting.
23. If jellyfish are seen in the water:
 - a. stay out of the water; do not attempt to swim.
 - b. cover your skin with petroleum jelly or cocoa butter before entering the water.
 - c. bathers should walk into rather than dive into the water.
 - d. divers should never go deeper than 20 feet.
24. Emergency nurses should understand the dangers of jellyfish envenomation and treatment because:
 - a. practitioners in coastal environments should be thoroughly familiar with local marine hazards.
 - b. patients can vacation in coastal areas and return home before a reaction begins.
 - c. everyone who works, plays, and vacations in the oceans is constantly exposed to numerous toxins.
 - d. all of the above

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