serotonin, and high-molecular-weight toxins, all of which can, among other effects, change the permeability of cells to ions. Victims usually report immediate prickling or burning, pruritus, paresthesias, and painful throbbing with radiation. The skin becomes reddened, darkened, edematous, and blistered and may show signs of superficial necrosis. A legion of neurologic, cardiovascular, respiratory, rheumatologic, gastrointestinal, renal, and ocular symptoms has been described, especially following stings from anemones, *Physalia* species, and scyphozoans. Anaphylaxis is possible. Hundreds of deaths have been reported, many of them caused by *Chironex fleckeri, Stomolophus nomurai, Physalia physalis*, and *Chiropsalmus quadrumanus*. Irukandji syndrome, associated with the Australian jellyfish *Carukia barnesi* and other species, is a potentially fatal condition that most commonly is characterized by hypertension; severe back, chest, and abdominal pain; nausea and vomiting; headache; sweating; and, in the most serious cases, myocardial troponin leak, pulmonary edema, and ultimately hypotension. This syndrome is thought to be mediated, at least in part, by the release of endogenous catecholamines followed by cytokines and nitric oxide.

Rescuers should note that envenomations by different cnidarians (typified by jellyfish) may respond differently to similar topical therapies; thus, the recommendations in this chapter must be tailored to local species and clinical practices. During stabilization, the skin should be decontaminated immediately with a generous application of lidocaine (up to 4%), an all-purpose agent that appears to be useful for relieving pain caused by a large number of species. Vinegar (5% acetic acid), rubbing alcohol (40–70% isopropyl alcohol), baking soda (sodium bicarbonate, especially for sea nettle stings), papain (unseasoned meat tenderizer), fresh lemon or lime juice, olive oil, or sugar may be effective, depending on the species of stinging creature. Household ammonia may in and of itself cause skin irritation.

The pressure-immobilization technique is no longer recommended for venom containment in the setting of any jellyfish sting. For the sting of the venomous box jellyfish (*C. fleckeri*), vinegar should be used. Local application of heat (up to 45°C/113°F), commonly by immersion in hot water, may be as effective. A baking soda slurry (50% baking soda, 50% water) has been recommended for *Cyanea* and *Chrysaora* species. Commercial (chemical) cold packs or real ice packs applied over a thin dry cloth or a plastic membrane have been shown to be effective in alleviating mild or moderate *Physalia utriculus* (bluebottle jellyfish) stings but may be less effective than application of heat. Perfume, aftershave lotion, and high-proof ethanol are not efficacious and may be detrimental; formalin, ether, gasoline, and other organic solvents should not be used. Shaving the skin helps remove remaining nematocysts. Freshwater irrigation and rubbing lead to further stinging by adherent nematocysts and should be avoided.

After decontamination, topical application of an anesthetic ointment (lidocaine, benzocaine), an antihistamine (diphenhydramine), or a glucocorticoid (hydrocortisone) may be helpful. Persistent severe pain after decontamination may be treated with morphine, meperidine, fentanyl, or another narcotic analgesic. Muscle spasms may respond to diazepam (2–5 mg, titrated upward as necessary) or 10% calcium gluconate (5–10 mL) given IV. An ovine-derived IgG antivenom is available from Commonwealth Serum Laboratories (see "Sources of Antivenoms and Other Assistance," below) for stings from the box jellyfish found in Australian and Indo-Pacific waters. However, despite its reported clinical efficacy, one school of thought holds that perhaps the antivenom is unable to bind the venom rapidly enough to account for its effects. Until further notice, current recommendations for its use apply. Treatment for Irukandji syndrome may require administration of opioid analgesics and $MgSO_4$ as well as aggressive treatment (phentolamine, 5 mg IV) of hypertension. All victims with systemic reactions should be observed for at least 6–8 h for rebound from any therapy, and all elderly adults should be checked for cardiac arrhythmias. Patients may suffer postinflammatory hyperpigmentation and persistent cutaneous hypersensitivity in areas of skin contact.

Safe Sea, a "jellyfish-safe" sunblock (*www.nidaria.com*) applied to the skin before an individual enters the water, inactivates the recognition and discharge mechanisms of nematocysts, has been tested successfully against a number of marine stingers, and may prevent or diminish the effects of coelenterate stings. Whenever possible, a dive skin or wet suit should be worn when entering ocean waters.

Sea Sponges Many sponges produce crinotoxins that are present on their surface or in their internal secretions. As a result, touching a sea sponge may result in dermatitis or "sponge diver's disease," a necrotic skin reaction. Irritant dermatitis may result if small spicules of silica or calcium carbonate penetrate the skin. It is impossible to distinguish between the allergic and spicule reactions, so the treatment is the same for both. Afflicted skin should be gently dried and adhesive tape used to remove embedded spicules. Vinegar should be applied immediately and then for 10–30 min three or four times a day. Rubbing alcohol may be used if vinegar is unavailable. After spicule removal and skin decontamination, glucocorticoid or antihistamine cream may be applied to the skin. Severe vesiculation should be treated with a 2-week tapering course of systemic glucocorticoids. Mild reactions subside in 3–7 days, while involvement of large areas of the skin may result in systemic symptoms of fever, dizziness, nausea, muscle cramps, and formication.

Annelid Worms Annelid worms (bristleworms) possess rows of soft, cactus-like spines capable of inflicting painful stings. Contact results in symptoms similar to those of nematocyst envenomation. Without treatment, pain usually subsides over several hours, but inflammation may persist for up to a week **(Fig. 474-4)**. Victims should resist the urge to scratch because scratching may fracture retrievable spines. Visible bristles should be removed with forceps and adhesive tape or a commercial facial peel; alternatively, a thin layer of rubber cement can be used to entrap and then peel away the spines. Use of vinegar or rubbing alcohol or a brief application of lidocaine or unseasoned meat tenderizer (papain) may provide additional relief. Local inflammation should be treated with topical or systemic glucocorticoids.

Sea Urchins Venomous sea urchins possess either hollow, venom-filled calcified spines or triple-jawed, globiferous pedicellariae with venom glands. Venom may also be found within the integumentary sheath on the external spine surface of certain species. The venom contains toxic components, including steroid glycosides, hemolysins, proteases, serotonin, and cholinergic substances. Contact with either venom apparatus produces immediate and intensely painful stings. One or more spines entering a joint can cause synovitis that may, over time, progress to arthritis if the spine(s) remain in or near the joint. If multiple spines penetrate the skin, the patient may develop systemic symptoms, including nausea, vomiting, numbness, muscular paralysis, and respiratory distress. A delayed hypersensitivity reaction 7–10 days after resolution of primary symptoms has been described.

The affected part should be immersed immediately in hot water to tolerance (up to 45°C/113°F). Pedicellariae should be removed by shaving so that envenomation cannot continue. Accessible embedded spines should be removed but may break off and remain lodged in

FIGURE 474-4 Rash on the hand of a diver from the spines of a bristleworm. *(Courtesy of Paul Auerbach, with permission.)*