

# Aquatic Antagonists: Sea Urchin Dermatitis

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Sea urchins can be found in all oceans, and the urchins usually cause human injuries on the foot when stepped on. There are approximately 800 different species of sea urchins, and most of them are capable of causing human disease when spines are broken off on contact. Some urchins also have stinging pedicellariae containing neurotoxins. Injuries from sea urchins often are misdiagnosed because most clinicians lack familiarity with the common clinical, radiological, and histologic findings.<sup>1</sup> For example, sea urchin granulomas may mimic infectious granulomas; penetration injury may result in chronic joint symptoms that may be misdiagnosed as arthritis; and neurologic symptoms may be attributed to another marine envenomation because the stinging pedicellariae of sea urchins do not leave the telltale pigment tattoo associated with spine injury.

## Identifying Features

Sea urchins (Figure 1) belong to the phylum Echinodermata and class Echinoidea. Urchins live on the sea bottom, primarily wedging themselves in coral crevices during the day and moving around at night. They are not aggressive; therefore, injuries are accidental. The mouth of the sea urchin is located on the animal's underside, and it feeds mainly on kelp, algae, or dead animals.<sup>2</sup> Its anus, also called its *vent*, is located on the dorsum. The

urchin has no eyes or brain and only a few sensory organs. Its body is round with a radially symmetrical calcite skeleton that is usually made up of tightly interlocking plates that form a rigid structure called the *test*. The test is covered with a thin ciliated epithelium.

Urchins have multiple spines that connect at ball-and-socket-like joints. Muscle fibers wrap around each base to facilitate movement when the associated nerve ring is stimulated. Spines are normally solid and blunt but may be hollow and contain toxins in some species. Spines may be sharp enough to penetrate neoprene suits and gloves.<sup>2</sup> Pedicellariae are small fanglike organs used to inject venom.<sup>2,3</sup> The pedicellariae are scattered among the spines and deliver venom even after separation from the sea urchin.

One particularly dangerous urchin is the flower sea urchin (*Toxopneustes pileolus*). Instead of long spines, it is covered with numerous soft flowerlike pedicellariae. The flower sea urchin most commonly is found off the coast of Japan where it has caused paralysis and drowning in some cases. The pantropical shallow-water sea urchins of the genus *Tripneustes* (eg, collector urchin: *Tripneustes gratilla*) also have pedicellariae but contain a less potent venom. The pedicellariae appear to be delicate structures supported by a long stalk and interspersed among nonvenomous spines. Other regional threats include the black long-spined urchin (*Diadema antillarum*), found off the coasts of Florida, Texas, and the Yucatan peninsula, and the purple sea urchin (*Paracentrotus lividus*), which is abundant off the coast of southern Europe.

In general, most venomous species of sea urchins are found in tropical and subtropical regions, though spines of most species are capable of producing injury if the skin is punctured. The diffusible violet pigment of dark species typically leaves a telltale visible tattoo. Long-spined species like *Diadema paucispinum* are prone to injuring human skin with the release of toxins when the

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Figure 1. Sea urchin.

brittle skin ruptures during a puncture. Urchins belonging to the genus *Echinothrix* release venom from hollow spines. Short-spined urchins belonging to the genus *Phormosoma* produce envenomation after the integument surrounding the spine ruptures. *Asthenosoma* and *Araeosoma* urchins have venom-delivering organs on the end of their spines.

Some urchins are collected because of their dramatic appearance. Within the order Diadematoida, *Diadema setosum* (black-spined urchins) have blue radial lines and spines that are black with white stripes. These urchins thrive in warm bays and lagoons. The spines may grow up to 30 cm, are brittle, and often break off in flesh. The *Heterocentrotus mammillatus* species also is known as the pencil urchin (Figure 2) because of its thick spines. This urchin generally grows to no more than 20 cm in diameter and lives at depths of 10 m. Because of its blunt spines, the pencil urchin rarely is associated with any pathology and frequently is found in the “touch and feel” areas of public aquariums. Urchins of the *Asthenosoma varium* species are known as pinhead or fire sea urchins, have bright red poisonous spines with white or blue tips that inflict severe pain and may lead to prolonged infection, and often are found near shipwrecks.

### Signs and Symptoms

The severity of symptoms from sea urchin injuries depends on the species involved, the location and depth of the injury, the type of human tissue involved, and the number of urchin spines involved.

Sea urchins most commonly come into contact with a person’s hands or feet often due to falling because of the force of a wave while beachcombing or when swimming or snorkeling. The patient may not be aware of the source of the injury. Divers or aquarium owners handling the animals are at risk of injury because sea urchins are in contact with their hands.

After an injury from a sea urchin spine, humans initially experience minor discomfort. Pain generally peaks within 15 to 30 minutes and lasts for several hours. Redness and swelling are typical, and peripheral neuropathy may be present.<sup>4</sup> Dye from the spines that is visible in the skin is an important clue when diagnosing a sea urchin injury. The spines themselves may be palpable or visualized radiologically. Delayed granulomatous reactions occur and are characterized by nodules that appear 2 to 12 months after an injury.<sup>2,3</sup> These 2- to 5-mm lesions often are slightly erythematous or purple and may have central umbilication.<sup>2,3</sup> Histologically, the response may be granulomatous or suppurative and may represent a reaction to the protein sheath that surrounds sea urchin spines or to slime or bacteria associated with the spine.<sup>1</sup> Mycobacterial infection also has been described in association with penetrating urchin injuries.<sup>5</sup>

With toxin-producing species, signs and symptoms of a systemic reaction include nausea, respiratory distress, muscle weakness, ataxia, syncope, or paresthesia. Normally, such a reaction only occurs as a result of multiple simultaneous wounds. The most severe reactions occur with the flower urchin.



**Figure 2.** Pencil urchin.

Pain characteristically is out of proportion to physical findings. Purple or black staining of the skin may be confused with residual spines. The soluble pigment usually is absorbed within 24 to 48 hours, and any color remaining after 48 hours generally represents spine fragments. Foreign body, sarcoidal, tuberculoid, and necrobiotic granulomas may be seen histologically.<sup>6</sup> Arthritis, tenosynovitis, and bursitis are not uncommon.<sup>1</sup> A foreign body reaction to a spine lodged in the synovium may not manifest until several weeks after the injury. Some spines are not radiopaque but may be visualized on gadolinium-enhanced magnetic resonance imaging.<sup>7</sup>

### Treatment

As with most marine venoms, pain can be controlled effectively by immersing the affected area in hot (not scalding) water for 30 to 90 minutes. The water should be 40°C to 41°C or as hot as the patient can tolerate. Heat is believed to inactivate the heat-labile toxins associated with sea urchins.<sup>4,8</sup> Pain also can be treated symptomatically with acetaminophen or ibuprofen. Visible spines

may be removed, but the body often absorbs spine fragments within 1 to 3 weeks. The spines can be extruded as well. Erbium:YAG laser ablation also has been used to destroy embedded spines.<sup>9</sup> Pedicellaria attached to the skin may be removed by applying shaving cream to the skin and gently scraping with a razor.<sup>10</sup> Associated marine vibrio infection may require treatment with oral or intravenous antibiotics. In addition, all individuals require tetanus prophylaxis.

The average duration of sea urchin granulomas without treatment is 7.5 months.<sup>6</sup> The lesions may respond to corticosteroids or excision.<sup>6</sup> Granulomas at the nail bed may cause nail deformity and may be addressed with intralesional injection or excision.<sup>11</sup> Patients with associated tenosynovitis may require a synovectomy.<sup>1</sup>

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