

Shellfish Poisoning: Danger in a Half Shell

Shellfish poisonings are types of food poisoning that occur through the ingestion of mollusks (bivalve mollusks are commonly implicated such as mussels, clams, and oysters) that accumulate toxins through filtering or ingesting large amounts of toxin-producing dinoflagellates and diatoms. Cases of shellfish poisoning are most prevalent in warmer months between May and August when dinoflagellate and diatom reproduction is at its peak. There are four types of shellfish poisoning: diarrhetic, neurotoxic, paralytic, and amnestic.

Diarrhetic shellfish poisoning (DSP) is caused by okadaic acid produced by dinoflagellates from the *Prorocentrum* and *Dynophysis* genera (*Mar Drugs*. 2013;11(11):4328-4349). Okadaic acid is a potent inhibitor of protein phosphatases, causing apoptosis and cytotoxicity in the gastrointestinal (GI) tract. Symptoms can occur within 30 minutes to 4 hours from ingestion and include diarrhea, nausea, vomiting, abdominal pain, and chills which can persist for approximately three days (*Mar Drugs*. 2013;11(11):4328-4349). DSP is considered non-lethal as there are no reported human fatalities, and symptoms tend to resolve without hospitalization.

Neurotoxic shellfish poisoning (NSP) is caused by brevetoxin produced by the species *Karenia brevis* (*Mar Drugs*. 2008;6(3):431-455). Brevetoxin works by opening voltage-gated sodium channels prevalent in the central nervous system, causing excitotoxicity. Onset of symptoms typically occur within 30 minutes to 3 hours. GI symptoms such as nausea, vomiting, and diarrhea are often reported. Neurologic symptoms seen in NSP include numbness or tingling in the face or extremities, sensitivity or reversal of hot and cold sensation, ataxia, loss of coordination, and dysarthria (*Mar Drugs*. 2008;6(3):431-455).

Paralytic shellfish poisoning (PSP) is caused by saxitoxin produced by the dinoflagellate genera *Alexandrium* and *Gymnodinium* (*Toxins*. 2024; 16(8):338). Saxitoxin, much like tetrodotoxin found in pufferfish (fugu), inhibits voltage-gated sodium channels, thus blocking neuromuscular transmission and resulting in paralysis. Symptom onset typically occurs within 5 to 30 minutes from the time of ingestion. Not only can patients experience GI effects such as vomiting, diarrhea, and abdominal cramps, but they can also experience numbness in the face and extremities, ataxia, dysphagia, dysarthria, and in severe cases, respiratory failure and death (*Western Pac Surveill Response J*. 2015;6(2):22-26). In 2013, 31 cases of PSP were identified from Taranganan, Western Samar in the Philippines. Patients who consumed at least one cup of contaminated mussel broth developed symptoms (*Western Pac Surveill Response J*. 2015;6(2):22-26).

Amnestic shellfish poisoning (ASP) is caused by domoic acid produced by the diatom *Pseudo-nitzschia* (*Mar Drugs*. 2008;6(2):180-219). Domoic acid is structurally similar to glutamic acid and interacts with glutamate receptors, inducing excitotoxicity (*Mar Drugs*. 2008;6(2):180-219). In 1987, 107 cases of ASP were reported from Prince Edward Island, Canada. GI symptoms typically occur within 24 hours and involve vomiting, diarrhea, and abdominal pain while neurologic symptoms can develop within 48 hours and involve confusion, short-term memory loss, and disorientation (*J Food Prot*. 1993;56(1):69-83). In severe toxicity, patients can experience seizures, hemiparesis, abnormalities of arousal ranging from agitation to coma, and memory loss lasting for years (*N Engl J Med*. 1990;322(25):1781-1787).

Supportive and symptomatic care is the mainstay of treatment for shellfish poisonings as there is no known antidote for these toxins. Activated charcoal may be reasonable if administered within four hours of ingestion. The toxins associated with shellfish poisoning are not denatured through cooking processes as they are heat-and-acid stable; nor are they detectable through taste, smell, or appearance. Shellfish harvested during warmer months from bodies of water with large algal blooms pose a greater risk of causing shellfish poisoning.

These illnesses are reportable to local health departments due to the risk of outbreaks. If shellfish poisoning is suspected or for guidance on management, call your local poison center at 1-800-222-1222.



Did you know?

Cyanobacteria ("blue-green algae") mats or blooms are often found in freshwater sources such as lakes or rivers and can potentially cause toxicity through the production of microcystins and saxitoxin (*Mar Drugs*. 2010;8(5):1650-1680).

Microcystins are peptides that cause hepatotoxicity by inhibiting protein phosphatases and disrupting the formation of the cytoskeleton in hepatocytes. Toxicity is uncommon in humans but can occur from ingesting unfiltered water from these sources, ingesting the algae itself, or through inhaling aerosolized toxins from large blooms. It is important to keep children and pets away from these algae blooms and rinse off with tap water if exposed to contaminated water.

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