

OREGON PUBLIC HEALTH DIVISION • DEPARTMENT OF HUMAN SERVICES

ALGAE BLOOMS: AN EMERGING PUBLIC HEALTH CONCERN

Marine algal blooms are increasing in frequency and severity around the world, and freshwater blooms are predicted to worsen with warmer temperatures brought by climate disruption and increases in nutrient pollution.¹ While most species of algae are not harmful, a few dozen are capable of producing potent toxins. As algal blooms increase, so does the likelihood that public health and private physicians will see increased cases of illness attributable to algal toxins.

CASE REPORT 1

A 38-year old man swam for 45 minutes in a Lane County reservoir while an active cyanobacteria bloom was in progress. Within an hour he experienced onset of itching, and within 24 hours became lightheaded with a “pins and needles” tingling in his upper extremities. Symptoms lasted 5 to

6 days and resolved without medical attention. The individual had no pre-existing health conditions. The bloom underway was *Anabaena*, a species of cyanobacteria known to produce anatoxin-a, a neurotoxin that can produce symptoms similar to those experienced by this case.

CASE REPORT 2

A 42-year old man swam in a Douglas County reservoir shortly before it was posted for a cyanobacteria bloom. By nightfall he experienced GI symptoms, including nausea, vomiting, diarrhea, and abdominal pain that lasted several days. The symptoms are consistent with microcystin, a hepatotoxin associated with *Anabaena*. Unfortunately, no clinical specimens or environmental samples were taken that enabled confirmation of microcystin poisoning.

OREGON’S HARMFUL ALGAE BLOOM SURVEILLANCE PROGRAM

These are two of the 18 human and animal suspect illness reports attributable to exposure to toxic freshwater algae that have been received by the Public Health Division’s Harmful Algae Bloom Surveillance program in 2009. Also of note this year, the Harmful Algae Bloom Surveillance program recorded the first confirmed dog death in Oregon due to anatoxin-a exposure, produced by cyanobacteria. The report follows numerous anecdotal accounts of dog deaths that have been received over the years. In time, these dog deaths may become regarded as sentinel events, portending future human health impact.

ALGAL TOXINS AND HEALTH EFFECTS

Exposure to high concentrations of algal toxins can cause rapid onset of acute symptoms in otherwise healthy

Toxins produced by algal species found in the Pacific Northwest*

Toxin	Source	Vector	Acute Symptoms	Diagnosis
Anatoxin-a	Contaminated fresh water	Cyanobacteria	Progression of muscle fasciculations, decreased movement, abdominal breathing, cyanosis, convulsions, death (animals).	History of swimming in bloom waters; head immersion or accidental swallowing of water. Algal cells in feces; toxin in blood (other tissues and body fluids at autopsy such as liver and vitreous fluid).
Ciguatoxins	Warm marine water	Many fish species: eel, grouper, mackerel, snapper	Hypotension, bradycardia, blurred vision, dyspnea, paresthesias of the extremities and circumoral region, diarrhea, nausea, vomiting, abdominal pain, arthralgias and myalgias.	Consumption of tropical and subtropical fish and neurologic symptoms with or without GI symptoms.
Domoic Acid (Amnesic Shellfish Poisoning)	Marine water	Shellfish: crab, clams, scallops, mussels, oysters	Headache, short-term memory loss, hemiparesis, visual abnormalities, ophthalmoplegia, seizures, myoclonus, confusion, lethargy, agitation, coma, mutism, areflexia, hypotension, peripheral vasodilation, pulmonary edema, nausea, vomiting, abdominal cramps, diarrhea, anorexia.	Consumption of shellfish and GI symptoms and neurologic symptoms.
Microcystins	Contaminated fresh water	Cyanobacteria	Hepatotoxicity, elevated gamma glutamyl transpeptidase, vomiting, diarrhea, abdominal pain, malaise, rash.	Evidence of hepatic dysfunction and history of cyanobacterial bloom exposure.
Saxitoxins (Paralytic Shellfish Poisoning)	Marine water	Shellfish: clams, cockles, mussels, oysters, whelk; or pufferfish	Nystagmus, iridoplegia, jaw and facial muscle incoordination, tachycardia, T wave changes, numbness, ataxia, headache, dizziness.	Consumption of shellfish or pufferfish and rapid onset of neurological symptoms with or without GI symptoms.

*CDC case definitions for algal toxin-related disease; adapted from Harmful Algal Blooms, Centers for Disease Control and Prevention (reference 2).



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people (Table, *verso*). If the patient ate shellfish, swam in or ingested water affected by an active algal bloom, toxic poisoning should be considered as a diagnosis. The only treatment for these illnesses is supportive care.

In Oregon, marine algal blooms are typically associated with a "red tide." Dinoflagellate blooms can produce saxitoxin, which may cause Paralytic Shellfish Poisoning. Diatom blooms can produce domoic acid, which may cause Amnesic Shellfish Poisoning.³ During a red tide, the public is warned not to eat shellfish from affected waters. If they experience neurological symptoms, such as tingling or numbness in the hands and lips or difficulty breathing after consuming seafood, they are advised to seek immediate medical attention. Paralytic Shellfish Poisoning and Amnesic Shellfish Poisoning are serious illnesses that are legally reportable to public health authorities.

Less well known to the general public, and physicians, are the health effects from exposures to freshwater cyanobacteria. Freshwater cyanobacteria are capable of producing a variety of toxins, including those classified as hepatotoxins, neurotoxins and skin irritants. Microcystin, a hepatotoxin, and anatoxin-a, a neurotoxin, are the most common toxins associated with freshwater algae blooms in Oregon. Common to all freshwater blooms are lipopolysaccharides, which can lead to skin irritation.

DIAGNOSING CYANOBACTERIA ILLNESS

The true incidence of illness due to fresh water cyanobacteria exposure

is not known, mostly because symptoms are often mild and self-limited and people do not seek medical care. Others who suffer more serious illness may be misdiagnosed because of lack of awareness of the presence of cyanotoxins in Oregon waters. Additionally, the patient's symptoms are usually non-specific. The lack of specificity in symptoms results in common differential diagnoses such as pesticide poisoning, cholinesterase inhibitor poisoning, microbial food poisonings and food allergies.

If a patient presents in your office with acute symptoms, a history of how the illness came about will help with diagnosis. A key question to ask is whether the person has either been recreating in or drinking water that is described as scummy or discolored, or for which a health advisory has been issued.**

ALGAE AND THE FUTURE: A GROWING CONCERN

Cyanobacteria blooms appear to be increasing in frequency and duration in Oregon, and are becoming more widespread across the state. This year the Public Health Division (PHD) posted 20 advisories for cyanobacteria in fresh water bodies across the state, breaking the 2008 record of 14 advisories. It is also worth mentioning that not all waters are actively monitored,

** When algae blooms capable of producing toxins are detected in Oregon fresh waters, the Public Health Division issues advisories that recommend avoidance of affected water through contact, ingestion or inhalation of droplets.

so there may be additional blooms for which we have no record.

While acute exposures and recreational water illnesses is the major focus of the Harmful Algal Bloom Surveillance program, we are also investigating public health concerns regarding chronic health effects from potential impacts to drinking water. A future goal is to identify and prioritize water systems that may require preventive action.

If a patient presents with comparable symptoms, accompanied by contact with water where there has been an algae bloom, alert the Local County Health Department of the suspected illness, and the Public Health Division at 877-290-6767 so we can take a complete history, including environmental conditions and exposure information.

We appreciate the assistance of readers in helping us characterize this growing problem. To dive further into harmful algae blooms via the Web, visit us at www.oregon.gov/DHS/ph/hab/.

Disease reporting information can be found at www.oregon.gov/DHS/ph/acd/reporting/disrpt.shtml.

REFERENCES

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3. Van Dolah, Frances M. Marine algal toxins: Origins, health effects, and their increased occurrence. *Environmental Health Perspectives* 2000; 108 Supplement 1.