Harmful Algal Blooms (HABs)

Information for physicians:

Harmful algal blooms occur when several types of bacteria (known as cyanobacteria) grow in fresh, or brackish waters. Under certain conditions and with sufficient nutrients, some of these bacteria can rapidly reproduce and grow into large, visible blooms that may produce harmful toxins.

Hepatotoxins:

Microcystin and Cylindrospermopsin are both hepatotoxins. Cylindrospermopsin is also a nephrotoxin. Microcystin is the most commonly encountered HAB toxin.

Neurotoxins:

Anatoxin-A acts as a nicotinic acetylcholine receptor agonist that can cause tremors or seizures.

Saxitoxin is a sodium channel receptor blocker that can cause paralysis.

Symptoms: Typical symptoms of illness from exposure to HAB toxins can include gastrointestinal (nausea), neurologic (dizziness) and skin rashes. Higher levels of exposure can result in neurological (tremors or seizures), respiratory distress, nephrotoxicity and hepatotoxicity, depending on the toxin, though these more severe intoxications are rarely known to occur in humans.

For patients presenting with non-specific gastrointestinal, neurological or skin irritation symptoms and a recent history of exposure to a freshwater waterway, consider the possibility of a HAB toxin exposure.

Treatment: Treatment options for HAB illnesses vary depending on the toxin. There are no specific antidotes for these toxins in event of poisoning. Treatment is supportive and described in further detail on the next page.

Reporting: It is important to identify suspected HAB illnesses so that public health officials can increase public awareness to reduce additional HAB illnesses in affected recreational waters.

To report a HAB illness, click on this link https://mywaterquality.ca.gov/habs/do/bloomreport.html, or contact the State Water Resources Control Board (SWRCB), your local County Public or Environmental Health or the California Department of Public Health.

INFORMATION FOR PHYSICIANS

Microcystins

Targets:	Liver, kidney, testes, thrombocytes
Mechanisms:	Inflammation, hepatocellular hemorrhage, glutathione depletion
Symptoms/signs:	Headache, sore throat, skin rash, abdominal pain, GI upset nausea/vomiting, acute hepatitis, elevated liver enzymes, coagulopathy
Treatment*:	Cholestyramine[1], N-acetylcysteine[2], vitamin K[2], supportive care

Cylindrospermopsin

Targets:	Kidney, liver, lungs
Mechanisms:	Glutathione depletion, activated by liver CYP enzymes, inhibition of protein synthesis, induction of inflammatory immune response[3]
Symptoms/signs:	Fever, headache, vomiting, bloody diarrhea, hemolysis, kidney and liver damage, wheezing, respiratory distress (if aspirated)
Treatment*:	N-acetylcysteine[4], anti-inflammatories[4,a], supportive care

Anatoxin-A

Targets:	Central nervous system
Mechanism:	Nicotinic acetylcholine receptor agonist
Symptoms/signs:	Tingling, numbness, incoherent speech, respiratory paralysis
Treatment*:	Activated charcoal[5], benzodiazepines or barbiturates[5] to control seizures; assistance with ventilation as needed, supportive care

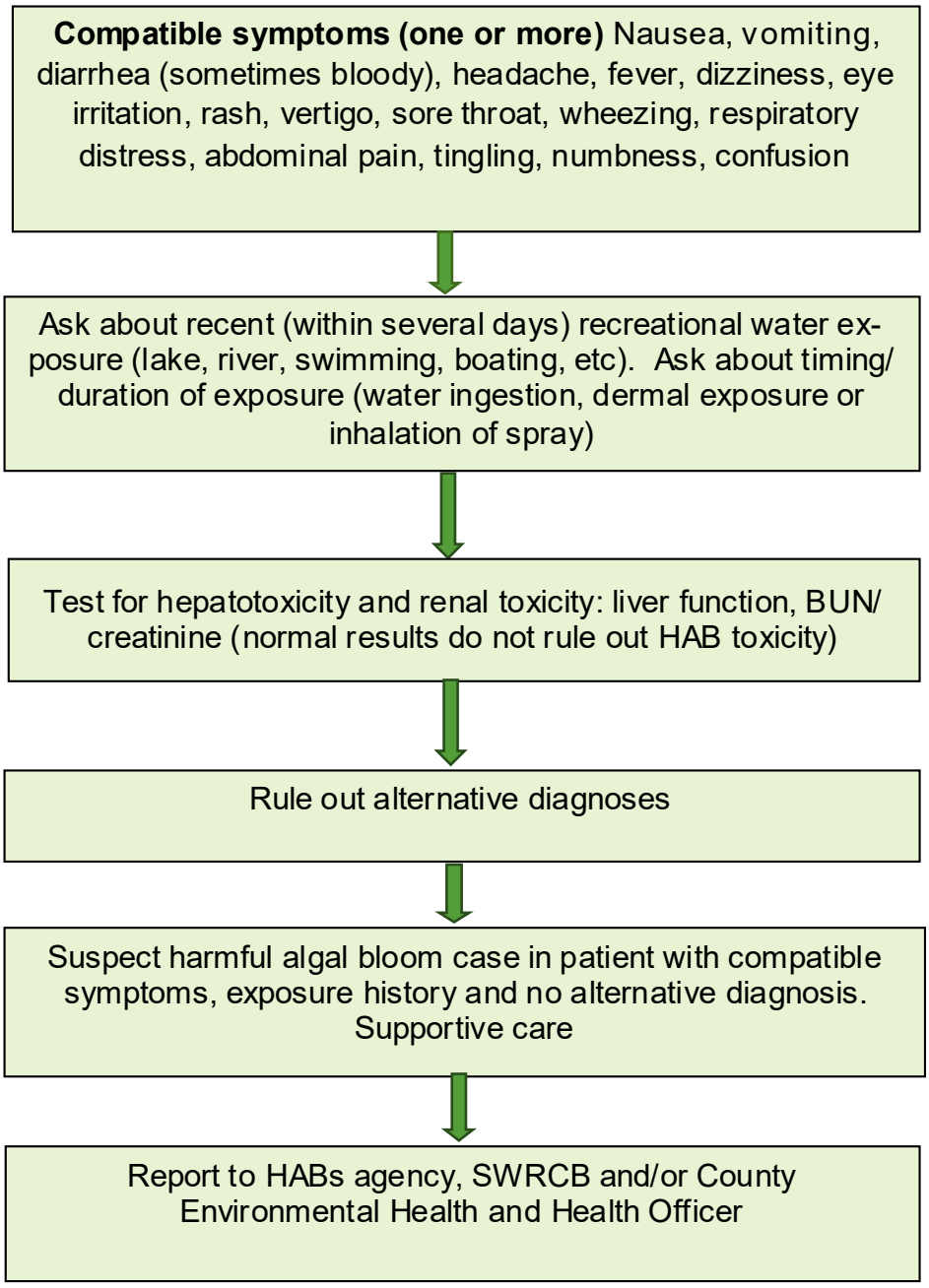
Saxitoxin

Targets:	Central nervous system
Mechanism:	Sodium channel blocker
Symptoms:	Nausea/vomiting, muscle weakness, vertigo, respiratory paralysis
Treatment*:	Activated charcoal[6], prompt assistance with ventilation[6], supportive care

Note - Human data are not available for some toxins. Specific treatments may be based largely on experimental animal and veterinary medicine case reports.

[a] Long term use of non-steroidal anti-inflammatories should accompany liver and kidney function assessment

PHYSICIAN ALGORITHM FOR POSSIBLE HAB TOXICITY



Resources:

California Harmful Algal Blooms Web Portal: https://mywaterquality.ca.gov/habs/

CDPH HABs page: https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/EAS/PAGES/

References

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2. Bautista AC, Moore C, Lin Y, Cline M, Benitah N, and Puschner B. 2015. Hepatopathy following consumption of a commercially available blue-green algae dietary supplement in a dog. *BMC Vet Res* 11:136.
3. Kubickova B, Babica P, Hilscherova K, and Sindlerova L. 2019. Effects of cyanobacterial toxins on the human gastrointestinal tract and the mucosal innate immune system. *Environ Sci Europe* 31(31). doi.org/10.1186/s12302-019-0212-2
4. Oliveira V, Avila M, Carvalho G, Azevedo S, Lima L, Barreiro E, Roncally A, and Zin W. 2015. Investigating the therapeutic effects of LASSBio-596 in an *in vivo* model of cylindrospermopsin-induced lung injury. *Toxicon* 94:29-35.
5. Puschner B. 2018. Cyanobacterial (Blue-Green Algae) Toxins. Veterinary Toxicology (3rd Ed). Elsevier Publishing 57:763-777.
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Prepared by the California Department of Public Health.
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