Pool Chemicals

With the arrival of summer, millions of Americans will visit swimming pools for exercise, fun, and relaxation. However, a recent CDC Morbidity and Mortality Weekly Report estimates that an average of 4,535 visits to emergency departments (ED) related to pool chemicals occur annually in the United States. Fortunately, most of these are relatively minor, as 93.9% were treated and released from the ED and no deaths were reported in the study period between 2008 and 2017. Of these injuries, approximately 90% were inhalational injuries, with chemical burns, conjunctivitis and dermatitis among the other injuries reported. Exposure can occur due to sensitivity to standard chemical concentrations in pools, such as opening the eyes underwater, or accidental exposure to super-concentrated chemicals such as malfunction of a pool chlorinator or accidental inhalation of fumes while opening the storage container for chlorination tablets. Most occurred at a place of residence rather than at a public facility.

Pool sanitation is important to prevent the transmission of disease and the primary way to do this is through the use of chemicals. Chemicals used in pool treatments are typically caustic, with the primarily agent being chlorine, and bromine being an alternative. Chlorine reacts with pool water to form hypochlorous acid, hydrochloric acid and small amounts of other caustic chlorinated hydrocarbons. These caustics are irritants to the skin, eyes and mucous membranes and when aerosolized form gases that are irritants to the respiratory tract.

Following dermal exposure, allergic and irritant contact dermatitis can occur with typical working concentrations of these chemicals. Swimmers that do not wear protective goggles are at risk for developing chemical conjunctivitis. When aerosolized, the halogenated hydrocarbons associated with swimming pools are irritants to the mucous membranes and respiratory tract, primarily through the

Continued next page
production of acids and reactive oxygen species on contact with mucosal fluid. Following exposure, irritation of the airway results in inflammation and potentially mucosal edema, increasing airway resistance and hindering oxygenation. Bronchospasm can occur and may be more prevalent in those with a history of reactive airway. As chlorine has an intermediate water solubility, it can result in damage to both the upper and lower respiratory tracts.

Symptoms of caustic exposure reflect irritation of those tissues involved. Patients may complain of skin burning and itching, and eye, nose or throat pain. In more severe exposures, or those with a prior history of reactive airway, respiratory symptoms may progress to cough, chest tightness, and dyspnea. Skin exam may reveal erythema or rash, in rare instances blistering can occur. Conjunctival injection, lacrimation, and blepharospasm may be noted on ophthalmologic examination. Auscultation of the chest can reveal rhonchi and wheezing suggesting bronchospasm.

Because inhalation injury causes pulmonary and airway damage, for those with moderate to severe respiratory symptom diagnostic studies should focus on assessing oxygenation and ventilation. Depending on the severity of symptoms, pulse oximetry along with an arterial blood gas (ABG) and chest radiography can be considered for evaluation.

Treatment primarily consists of removal from the source and supportive care. Dermal and ocular decontamination should be considered with fresh water or saline to treat irritation or chemical burns. Patients with signs of ocular irritation should have their eyes evaluated for corneal damage. For respiratory symptoms, oxygen can be used to relieve dyspnea and hypoxemia. Nebulized albuterol may improve pulmonary function particularly in those with evidence of bronchospasm. Nebulized bicarbonate has been used for industrial exposures to high concentrations of chlorine, but is unlikely to be necessary in the case of pool exposures. There is no evidence for treatment with steroids in the general population, but steroids may be useful in those with a prior history of asthma. As with chlorine, bromine, is expected to produce symptom similar to that of chlorine and can also be treated similarly.

If you need guidance treating patients suffering from pool chemical exposure, or any other poisoning issue, call the Blue Ridge Poison Center at 1-800-222-1222. Medical toxicology experts are standing by for free consultation 24-hours a day, every day. Healthcare providers may also access the HCP hotline: 1-800-451-1428.