

## Chlorine Inhalation Exposures

Chlorine, a greenish-yellow gas, is widely used in industrial bleaching operations, sewage, swimming pool and drinking water treatment, and has been used in chemical warfare. Calls to poison centers concerning chlorine gas inhalation often involve mixing bleach with acid-containing household cleaners in poorly ventilated rooms, and exposures to swimming pool products. It is a strong pulmonary irritant and may be caustic to mucous membranes. It has intermediate water solubility (generating hydrochloric and hypochlorous acids), contributing to the severity of pulmonary symptoms. It was once believed to produce reactive oxygen species but that is now controversial. The extent of toxicity depends on chlorine concentration, duration and location of exposure and moisture content of exposed tissue. Unintentional home exposures are not likely to cause severe or caustic symptoms, unless prolonged and in areas with inadequate ventilation.

Initial effects of poisoning occur within minutes. Symptoms include cough, shortness of breath, burning sensation in the throat, eye and nasal irritation, choking, dizziness, abdominal discomfort, and headache. Severe poisoning may cause pulmonary edema, pneumonia, persistent hypoxemia, respiratory failure, acute lung injury, and metabolic acidosis. At high levels, chlorine displaces atmospheric oxygen, which may lead to potentially fatal asphyxia.

Immediately move victims to fresh air and give supplemental oxygen. Patients with only mild symptoms require no treatment beyond removal from the exposure. Patients with persistent respiratory symptoms for 4–6 hours should be evaluated in health care facilities. Bronchospasm usually responds to inhaled beta agonists. Nebulized sodium bicarbonate ( $\text{NaHCO}_3$ ; 3.75%) has been shown to improve mild-to-moderate symptoms. Its use was associated with significantly better  $\text{FEV}_1$  values and quality of life compared to placebo (*Inhal Toxicol* 2006; 18:895-900). Chest X-ray and arterial blood gases should be obtained in patients unresponsive to therapy or those with severe respiratory distress. Respiratory failure usually responds to positive-pressure ventilation; necessity for mechanical ventilation indicates a poorer prognosis. Respiratory monitoring should continue until the patient is symptom-free. The use of corticosteroids remains controversial.

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### ***DID YOU KNOW THAT... a strong chemical odor emanating from a swimming pool indicates there isn't enough chlorine in the water?***

A strong chlorine-like odor indicates the presence of chloramines in an unhealthy pool and is not the result of too much chlorine. Chloramines form when chlorine combines with perspiration, urine, saliva, body oils, lotions and other wastes introduced into pools by swimmers. Chloramines render chlorine less effective in killing bacteria. High levels may cause skin, eye, or respiratory irritation. Chlorine should be regularly added to the pool and levels tested daily, at a minimum.

