Gas Embolism

Definition

Gas embolism, also called air embolism or arterial gas embolism, is the presence of gas bubbles in the bloodstream that obstruct circulation.

Description

Gas embolism may occur with decompression from increased pressure. It typically occurs in ascending divers who have been breathing compressed air. If a diver does not fully exhale upon ascent, the air in the lungs expands as the pressure decreases, overinflating the lungs and forcing bubbles of gas (emboli) into the bloodstream. When gas emboli reach the arteries to the brain, the blood blockage causes unconsciousness. Gas embolism is second only to drowning as a cause of death among divers.

In rare cases, gas embolism may also result from trauma or medical procedures, such as catheterization and open heart surgery, that allow air into the circulatory system.

Sometimes, the term "the bends" is used to describe any manifestation of decompression sickness, including gas embolism. Specifically, the bends refers to a condition caused by dissolved nitrogen leaving the tissues too quickly on ascent during a dive. It is manifested by pain, often in the limbs and joints.

Causes and symptoms

Gas embolism occurs independently of diving depth. It may occur in as little as 6 ft (2 m) of water if the swimmer has access to a source of air and takes even one breath underwater. Gas embolism is frequently caused when divers hold their breath during ascent. It may also result from an airway obstruction or other condition that prevents a diver from fully exhaling.

The primary sign of gas embolism is immediate loss of consciousness, which may or may not be accompanied by convulsions.

Diagnosis

Any unconscious diver should be assumed to be the victim of gas embolism, regardless of whether consciousness was lost during or promptly after ascent. A doctor may also find pockets of air in the victim's chest around the lungs and, occasionally, a collapsed lung from overinflation and rupture. Coughing up blood or a bloody froth around the mouth are visible signs of lung injury.

Treatment

Prompt recompression treatment in a hyperbaric (high-pressure) chamber is necessary to deflate the gas bubbles in the bloodstream, dissolve the gases into the blood, and restore
adequate oxygenated blood flow to the brain and other organs. Transport to a suitable recompression chamber should take precedence over nonessential procedures.

Recompression by returning the diver to deeper water will not work, and should not be attempted. The patient should be kept lying down and given oxygen while being transported for recompression treatment.

Before the diver receives recompression treatment, other lifesaving efforts may be necessary. If the diver is not breathing, artificial respiration (also called mouth-to-mouth resuscitation or rescue breathing) should be administered. In the absence of a pulse, cardiopulmonary resuscitation (CPR) must be performed.

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**KEY TERMS**

**Compressed air**—Air that is held under pressure in a tank to be breathed underwater by divers.

**Compression**—An increase in pressure from the surrounding water that occurs with increasing diving depth.

**Decompression**—A decrease in pressure from the surrounding water that occurs with decreasing diving depth.

**Emboli**—Plural of embolus. An embolus is an object that blocks the blood flow in a blood vessel, as in a gas bubble, a blood clot, a fat globule, a mass of bacteria, or other foreign body.

**Hyperbaric chamber**—A sealed compartment in which patients are exposed to controlled pressures up to three times normal atmospheric pressure. Hyperbaric treatment may be used to regulate blood gases, reduce gas emboli, and provide higher levels of oxygen more quickly in cases of severe gas poisoning.

**Recompression**—Restoring the elevated pressure of the diving environment to treat gas embolism by decreasing bubble size.

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**Prognosis**

The prognosis is dependent upon the promptness of recompression treatment and the extent of the damage caused by oxygen deprivation. Gas embolism may cause a stroke.

**Health care team roles**

A gas embolism is an emergency situation. Any unconscious diver should be assumed to be the victim of gas embolism. Maintaining air supply is the most crucial step, and artificial
respiration or CPR should be administrated as needed. Fluids should be administered, either orally if the patient is conscious, or intravenously.

Prevention

All divers should receive adequate training in the use of compressed air and a complete evaluation of fitness for diving. People with a medical history of lung cysts or spontaneous collapsed lung (pneumothorax), and those with active asthma or other lung disease, must not dive, for they would be at extreme risk for gas embolism. Patients with such conditions as alcoholism and drug abuse are also discouraged from diving. Individuals with certain other medical conditions, such as diabetes, may be able to dive safely with careful training and supervision.

Resources

BOOKS


PERIODICALS


ORGANIZATIONS


Undersea and Hyperbaric Medical Society. 10531 Metropolitan Avenue, Kensington, MD 20895. (301) 942-2980. <http://www.uhms.org>.

Jennifer F. Wilson