



Asthma and Diving

DAN Discusses the Fact That Some Individuals With Asthma Should Not Dive

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The Diver:

A 49-year-old open-water diver planned a diving vacation to Mexico with family and friends. He had been diving on and off for 10 years, making a total of 20 dives during the four years before his current trip.

The diver, a medical practitioner, had from time to time experienced stress- and exercise-induced asthma. He was not taking any medication at the time of his dives and had not used a bronchodilator for a year. He experienced no asthma symptoms prior to his dive. A non-smoker, he was in generally good health despite the latent asthma.

The Dives:

The first dive of the day went to approximately 12 metres, and lasted some 40 minutes. The diver experienced no equipment or buoyancy problems, and his air consumption was within normal ranges. His ascent to the surface was slow, with no incidents.

The Complications:

At the surface, he became dizzy. He vomited and then felt a deep tingling sensation over his entire body. He noted later that he wanted to call for help but couldn't lift his arm to remove his regulator.

At this point, he bit down hard on his regulator mouthpiece and then felt himself sinking below the surface. He didn't remember subsequent events: not his rescue by his divemaster, being brought on board, making the trip to shore or arriving at the hyperbaric chamber.

The Treatment - Stage One:

Evaluation by the physician at the chamber showed findings consistent with arterial gas embolism: impaired consciousness and partial paralysis to his left side.

treatment is designed to reduce the size of bubbles in the cerebral arteries that may have blocked the flow of oxygenated blood, producing symptoms. The diver's total chamber time was five and a half hours.

When the diver left the chamber, he noted that he still felt extremely weak. Shortly afterwards, he experienced a seizure and paralysis to his left side. He was readmitted to the hyperbaric clinic, where, during the evening, he regained some strength.



The following morning he was treated with USN Treatment Table 6 (with an initial compression to 18 metres for 20 minutes). After the treatment, four hours and 45 minutes later, he regained some movement on his left side, but he was still unable to speak.

Approximately two hours after the diver surfaced, he entered the hyperbaric chamber for his first treatment: a U.S. Navy Treatment Table 6A (with an initial compression to 50 metres). This

The Treatment - Stage Two:

Although the diver was not a DAN member, DAN became involved at this time, assisting in the evacuation of the diver and his family to Houston, Texas, where he could receive continued hyperbaric care, hospitalization and further medical testing.

There, the injured diver received two USN Table 5 treatments (a two-and-a-half-hour treatment), with improvement after each session. He received two more treatments on a standard, shorter protocol for wound healing. In all, he received a total of six treatments in six days. His final treatment did not produce any noticeable change in his symptoms.

The Outcome:

The diver returned to his home, and his symptoms continued to improve during the next month although he still experienced weakness on his left side. He was unsteady on his feet at times, navigating with a broad-based walk. He also experienced some tingling and numbness in his left arm, hand and leg. Eventually his symptoms resolved, and he returned to his job.

The Discussion:

The divemaster who had accompanied the man on his dive confirmed that he had experienced no problems and made no procedural errors during his dive. Additionally, his depth-time exposure was unlikely to produce decompression sickness. His warning signs - rapid onset of weakness and unconsciousness within minutes of surfacing - were

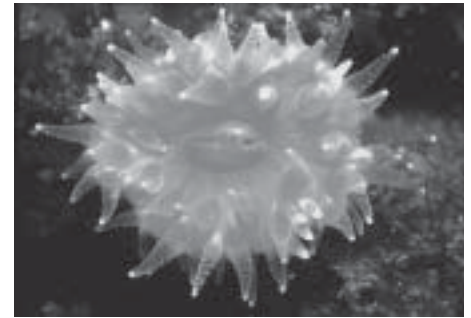
almost certainly due to arterial gas embolism (AGE). In the absence of a rapid ascent or breath-holding during ascent, the most plausible explanation is that he experienced AGE due to his asthma.

On Asthma:

Asthma is a disease of the bronchi, the breathing tubes in the lungs through which gas moves to and fro between the mouth / nose and the alveoli. This is where oxygen and carbon dioxide diffuse across a membrane, separating gas from blood. Individuals with asthma have a propensity for the airways to constrict excessively in response to various stimuli, such as smoke, pollen, cold air, inhalation of water droplets or exercise.

When the bronchi constrict, the resistance to the flow of gas increases, and gas flow is reduced, particularly during exhalation. Thickening of the walls of the bronchi and excessive mucus production can further increase gas flow resistance in individuals with asthma. In divers, this is compounded by the increase in density of the breathing gas. For example, at a depth of 10 metres, the breathing gas density is twice as high as at the surface.

During ascent, a diver with asthma may not exhale alveolar gas rapidly enough. The remaining gas can expand and possibly rupture the alveolar wall, forcing gas into the blood vessels - AGE. This can cause pneumothorax, or lung collapse.



A gas embolism does not occur with every individual who has asthma. A conference held under the auspices of the Undersea and Hyperbaric Medical Society in April 1995 - called "Are Asthmatics Fit to Dive?" - concluded that if a person with asthma has a normal breathing test before and after a provocative maneuver such as exercise, then the risk of gas embolism or pneumothorax is low.

Before undertaking scuba training, however, individuals with any breathing problems should carefully consider their decision. Anyone, who in the past few years has experienced symptoms such as wheezing, cough, chest tightness or shortness of breath, or anyone who is taking medication for asthma, should be specifically evaluated by a diving physician. In Australia, all dive students are required to have a diving medical examination in accordance with AS4005.1 2000. This examination should preferably be conducted by a doctor who has undergone suitable training in diving medicine.

NOTE: For more information on this topic, see the January/February 1997 issue: "Asthma and Diving," by DAN Assistant Medical Director Dr. Guy de Lisle Dear.