Diving

Traveler Summary

Key Points

- Travelers should only dive with an operator certified by the Professional Association of Diving Instructors (PADI).
- Pre-scuba medical evaluations should ensure the absence of significant pulmonary, cardiac, sinus, ear, metabolic, or psychological illness.
- Barotrauma is common and is caused by trapped air in the ears, sinuses, and lungs as well as in the gastrointestinal tract. Ear trauma or ear drum rupture can be prevented by pausing during ascent to equalize the pressure (try exhaling with the mouth closed and nose pinched). Any nasal or sinus congestion precludes effective equalization and increases risk.
- Lung barotrauma can be life-threatening and is caused by pressure build up in the lungs on ascent when the diver fails to exhale. Air can be forced into the skin, abdomen, or chest, with the latter resulting in a collapsed lung or air embolus. Lung barotrauma is prevented by blowing bubbles during a slow ascent.
- Cold climate or winter diving requires specialized diving suits to prevent hypothermia.
- For malaria chemoprophylaxis, Malarone (atovaquone-proguanil) has fewer side effects than other antimalarials.
- Flying can lead to decompression sickness because it is a form of rapid ascent. Risk depends on time from last dive to flight time, frequency of dives, and whether decompression stops were necessary. The minimum dive-to-fly interval is 12 hours but may be up to 24 hours.
- All divers should have evacuation/accident insurance and a membership in the Divers Alert Network.

Introduction

Millions of people travel out of their home countries each year to dive. Travelers should be aware of the potential hazards associated with scuba diving, especially when traveling to the tropics or developing nations to dive.

Travelers who plan to dive should visit a travel medicine provider well before departure; the provider can advise on one's overall fitness to dive, vaccination needs, and prevention of malaria, travelers' diarrhea, barotrauma, and other issues related to travel and diving.

In many places, children younger than 12 years may not be eligible for certification.

Fitness to Dive

Travelers should ensure that they are physically able to dive, especially persons who are older, pregnant, taking certain medications, or have certain underlying medical conditions.

The following persons should not dive:

- Pregnant women, due to possible air embolism affecting the placenta
- Persons with a history of previous spontaneous pneumothorax (collapsed lung)
- Persons taking narcotics, anti-psychotics, and anticonvulsants
    - Caution is advised for persons taking any mildly sedating drugs.
    - New drugs should not be started before a dive trip.

The following travelers may be able to dive under certain conditions:

- Persons with heart disease should have sufficient exercise tolerance demonstrated by being able to reach 13 metabolic equivalents (METS) on a stress test.
- Asthma should be well-controlled, with a normal spirometry.
- Diabetics who have been on a stable insulin dose for more than 1 year or a stable dose of oral hypoglycemic agents for more than 3 months and have had no episodes of hypoglycemia or hyperglycemia for 1 year can usually dive. There should be no diabetic complications present.
- Persons older than 40 years should be tested for coronary artery disease before diving.

Malaria and Insect Precautions

When malaria preventive medication is needed, Malarone (atovaquone and proguanil) is the drug of choice for divers. Malarone is as effective as mefloquine or doxycycline but has fewer side effects. (See also ***Malaria***).

Some cruise ships and live-aboard dive boats visit ports in countries where malaria is endemic, particularly on the South American coast, the eastern and western coasts of Africa, and in Oceania. They commonly offer day trips to local destinations, with passengers returning to the ship in the evening. In this situation, risk during the evening and night is very low because passengers are in a controlled environment; thus, preventive malaria medication is normally not necessary.

- Preventive malaria medication should be considered, however, if spending even 1 night on shore or more than 1 day in port on an island or in an area with high transmission of malaria.
- Any fever in a cruise or dive passenger returning from these ports must be investigated for malaria.

The surfacing diver is at definite risk for insect bites. Although the mosquito that transmits malaria bites during the evening, there are daytime biters that also can transmit diseases, including dengue and yellow fever. Divers should use a waterproof repellent any time mosquitoes are present. See also ***Insect Precautions***.

Vaccinations

Regardless of the purpose of the trip, travelers should have all vaccination needs evaluated by a travel medicine provider well in advance of departure. Routine vaccinations should be up to date, and travel-related vaccines may be needed. Hepatitis A and typhoid vaccines may be recommended if diving in potentially polluted (fecally) waters.

Other Travel Medical Concerns

Divers should be aware of the risks of travelers' diarrhea, freshwater exposure to schistosomiasis, sunburn, drowning, hypothermia, motion sickness, and injuries from boat propellers.

Other issues include barotrauma (see below) or problems related to pressure changes associated with being underwater; pressurized gases and the problems with breathing them at depth; and hazardous marine life, including creatures that bite, sting, shock or poison. See ***Marine Hazards***.

Barotrauma

Thirty percent (30%) of first-time divers will experience barotrauma. Inner ears, sinuses, dental fillings (with small amounts of trapped air), and the gastrointestinal tract can all be "squeezed," even in water as shallow as 1 m (3 ft). Divers must learn to "equalize" pressures (early and often) while descending. Equalization is achieved by pinching the nostrils shut, closing the mouth, and attempting to exhale, forcing air up the Eustachian tubes into the middle ear air spaces. It only takes 1 dive to appreciate the pain and potential hazard of diving with nasal or sinus congestion, conditions that do not allow equalization to occur.

Barotrauma occurring in as little as 2 m (7 ft) of water may result in rupture or a smaller perforation of the ear drum. Most often (but not always) there is pain, bleeding, hearing loss, or tinnitus (ringing in the ear) from the affected ear. A bloody discharge may be present. For suspected rupture, seek immediate medical attention; in addition, divers should get medical clearance before flying, re-entering the water, or putting any kind of drops in the ear. Fluid entering the middle ear cavity may cause severe and violent dizziness.

Middle ear barotrauma is the most common diving injury, and symptoms usually develop immediately following the dive; on occasion, symptoms may not occur for up to 24 hours. On descent, increased pressure of the middle ear causes fluid and blood to leak into the middle ear, partially or completely filling it. The diver develops a feeling of fullness and muffled or decreased hearing. If this occurs, the dive should stop and medical assistance by an experienced clinician sought. A combination of decongestants and time will result in healing in a few days in most cases. Divers experiencing this condition should not fly until the situation is resolved.

Pulmonary barotrauma while ascending is potentially life threatening. Pulmonary over-pressurization occurs when a diver ascends while holding his or her breath. Divers should never hold their breath; instead, they should "blow bubbles" while rising slowly to the surface. Breaking these rules converts the lungs into a "balloon" (trapped air space) that will expand as the diver ascends. Air can be forced into the skin, chest, and abdomen. Results may be as minor as mild skin irritation or as significant as a collapsed lung (pneumothorax). More disastrous is the result of air being driven into the pulmonary venous circulation, which leads to "air emboli" as these bubbles lodge in the brain or other vital organs.

Symptoms resemble an acute stroke, including confusion, numbness, weakness, or loss of consciousness. Immediate treatment is vital, requiring high flow oxygen and low altitude evacuation to a hyperbaric oxygen treatment facility.

Pressurized Gases: Nitrogen Narcosis and the Bends

This type of diving-related injury results from breathing pressurized gas mixtures at depth and involve changes in the amount of a gas (principally nitrogen) that is dissolved into a liquid (blood or tissue) at different pressures (ocean depth).

Nitrogen narcosis can be prevented by breathing a specialized mixture of gases containing only oxygen and helium (Heliox); however, this is not available to the average sport diver. The average diver only needs to be aware of his or her limitations and to avoid excessively deep dives. The usual recommendation is not to exceed a depth of 30.5 m (100 ft).

"The bends" or decompression sickness (DCS) is a much more hazardous complication of breathing pressurized gas at depth. Breathing nitrogen under circumstances of increased pressure causes more of the nitrogen to be dissolved into tissue. If the diver ascends faster than the nitrogen can be ventilated out through the lungs, bubbles of nitrogen may form in the diver's tissues. This can be prevented by never ascending faster than 0.3 m (1 ft) per second and by rigorously adhering to the commands of the dive computer as to the need for a decompression stop on the way to the surface, depending on the particular dive/depth profile of that dive.

If these recommendations are ignored, the diver may experience a variety of symptoms including rash and itching (as microscopic bubbles form in the skin), joint pain, particularly in the elbows and shoulders (hence the term "the bends"), and/or neurologic symptoms, including numbness or weakness, as bubbles form in the central nervous system. The formation of these bubbles takes time, and the symptoms of DCS usually begin 1-6 hours after surfacing, in contrast to the immediate onset of symptoms associated with pulmonary barotrauma or air embolism described above. Because the long-term effects on the central nervous system, even in those patients with only the mildest of symptoms, may be significant, divers should treat all decompression sickness as a medical emergency. Patients need high-flow oxygen therapy and evacuation to a hyperbaric oxygen treatment center where they can be "dived" again to drive the dangerous bubbles back into their liquid phase.

Flying After Diving

Armed with an understanding of decompression sickness and the risks of an overly rapid ascent, it should be clear that flying (which is also ascending) too soon after diving carries the risk of DCS. This is particularly true for flying after diving while at high altitudes. Unfortunately, there are little data on which to base solid recommendations, so the following guidelines represent the current "best guess" suggestions for a diver who will be flying:

Recommended surface intervals for flying after diving

- Wait 12 hours after a non-decompression dive before flying.
- Wait 24 hours or more after a dive requiring a decompression stop.
- Wait 18-24 hours or more for divers who make daily, multiple dives for several days.

Divers Alert Network

Divers Alert Network (DAN) is the international leader in dive safety. Divers may become members to get dive accident insurance and access to emergency medical evacuation.

Divers should remember that most domestic health insurance will not cover repatriation or treatment in an overseas hyperbaric treatment facility. Divers should check with their domestic health insurance provider to see if hyperbaric treatment within their home country is covered.

DAN can be reached at 919-684-9111 (emergency hotline), 919-684-2948 (Monday through Friday, 8:30 a.m. to 5:00 p.m. EST), or www.diversalertnetwork.org.