

# Relieving the Pressure

You've just completed your last dive of the day, and as you're packing your gear you notice a twinge in your shoulder. Recalling that the seas were a little rough and you had some difficulty climbing up the ladder, you pass it off as muscle spasms. At this point, you have entered the 'first phase' of decompression illness (DCI) - denial.

Later that evening after a hot shower, a relaxing meal and a stop by the local watering hole, you notice that the pain has increased to a noticeable ache. Your dive buddy recommends that you call DAN's Diving Emergency Hotline - just to be safe, he says - since you're both longtime DAN members.

## **Good advice. What's next?**

Calling DAN

You pick up the phone and make the call. After explaining the situation to the on-call specialist at DAN, you learn that your aches may signal decompression sickness (DCS) and that a complete neurological evaluation is a good idea.

Your mind starts turning. 'A complete neuro what? I can't be bent - I was within my computer limits,' you think.' How long is a treatment? you may ask. While following up on numerous dive accidents, one of the most frequent comments we hear from divers who have experienced DCS was that they had absolutely no idea what to expect when they arrived at the chamber facility.

## **Getting Assessed**

Just as with other health problems, you have the best chance of recovery from a diving illness when you seek immediate evaluation and treatment. On the flip side, when you move quickly you may have very little time to plan ahead. Though diving injuries are rare, knowing what happens when someone gets treated for DCS can help ease the anxiety that naturally occurs with this type of event.

The evaluating physician (at the closest emergency room or chamber facility) will begin the initial assessment by establishing an event timeline and personal health history. You'll have to answer questions regarding your immediate dive history: number of dives, depths, bottom times, surface intervals and the time you left the water.

Though your dive profile is not a factor in determining treatment, it is helpful information in determining a possible diagnosis. Keep your dive computer handy to play back details or download to a PC later. You'll need to describe symptoms: Do you have pain? Is it localized? Can you pinpoint it? Are there any areas of numbness and tingling? Do you have any fatigue or vertigo? When did you first notice the symptoms: before, during or after the dive? Has there been any increase, decrease or change in symptoms since the time you first noticed them? The physician will also ask questions about your medical history: Have you experienced previous DCS, surgeries, musculoskeletal injuries? What are your current medications or allergies?

Following the initial assessment, you'll get a complete neurological examination. This exam provides a baseline, or starting point, for a diving accident assessment. During the neurological examination, your mental status, coordination and cranial nerve function will be tested. You'll also be tested for strength, reflexes and any loss of sensation.

So, you've been poked, prodded, pushed and made to walk back and forth across the room. The physician has decided the history and symptoms are consistent with decompression sickness. You need hyperbaric treatment in a recompression chamber.

## **Treatment Tables**

The standard for treatment in the United States and in many other countries as well follow protocols established by the U.S. Navy. As stated in the U.S. Navy Diving Manual, recompression therapy is necessary to accomplish three primary objectives:

1. To compress gas bubbles to a small volume, thus relieving local pressure and restarting blood flow,
2. To allow sufficient time for bubble reabsorption, and
3. To increase blood oxygen content and thereby oxygen delivery to injured tissues.

Navy treatment protocols are based on classifying decompression sickness as either Type I DCS or Type II DCS. Type I DCS means that you have joint and / or muscle pain. Type II DCS, or neurological DCS, can include numbness, tingling and muscle weakness or bladder problems. Cardio-respiratory symptoms may also include chest pain and an irritating cough. Type II DCS symptoms can range from mild to serious and life-threatening.

The protocols recommended for the initial treatment of decompression sickness have been designated by the U.S. Navy. They are Treatment Tables 5 and 6, and were developed in 1965. Each treatment table includes a basic schedule of treatment with the possibility of extensions as warranted by symptoms. According to DAN statistics compiled from 1998 through 2000, a Treatment Table 6 was chosen for approximately three-quarters of recent injuries, similar to the past 11 years of data.

A Table 6 treatment lasts a minimum of four hours and 45 minutes and is used whenever oxygen is available, because breathing oxygen while under pressure in a chamber helps speed the washout of nitrogen from tissues. The treatment time can be extended up to eight hours according to the severity of the symptoms.

During these treatments you will breathe 100 percent oxygen in the chamber and switch to breathing air via a mask, or you'll wear a clear hood that encapsulates your head and delivers a high flow of oxygen into the hood. Chamber attendants and your attending physician often call for breaks in oxygen breathing, when you breathe chamber air. This helps lower the risk of oxygen toxicity (an infrequent occurrence). You can eat and drink during these breaks.

A Table 6 treatment begins with a 'descent', or increase in chamber pressure, to a pressure equivalent of 60 feet (fsw - or 18 meters of seawater, msw). After the specified amount of time, you will be brought up to the pressure equivalent of 30 fsw (9 msw) at the rate of 1 fsw (0.3 msw) per minute.

The longest part of the treatment is spent at 30 fsw. Following this, you are brought to surface pressure again at the rate of 1 fsw per minute. If symptoms persist, follow-up treatments - generally shorter in duration - can be given. A Table 5 treatment pressurizes you to 60 fsw. At 'depth' you breathe oxygen for two periods of 20 minutes, separated by a five-minute break to breathe air. The Treatment Table 5 is generally used for pain-only DCS.

## **Chamber Configurations**

Just as there are different types of treatments, there are also different types of chambers. Hyperbaric chambers are basically divided into two categories. The most prevalent in the United States is the monoplace chamber, which is essentially a clear tube about 3 feet (1 m) in diameter and 7 feet (2 m) long, capable of holding a single patient.

With a monoplace chamber, the patient must lie down throughout the treatment and movement is limited. Only the patient is inside the chamber during the treatment - the attending chamber technician remains outside the tube. A unique feature of the monoplace is that the entire chamber is filled with nearly 100

percent oxygen during compression and oronasal mask is used for the air breaks.

The second type of chamber is the multiplace chamber, which is larger, typically made of steel or aluminum, and can accommodate multiple patients and an attendant. Multiplace chambers have two or more sections that can be pressurized independently to allow personnel to enter and exit the chamber, all the while keeping you at the required depth. Sizes can range from 4 feet / 1.2 meters in diameter to that of a large room.

No matter which type of facility is used to treat your diving emergency, always remember that time is of the essence. The effectiveness of the treatment decreases as the length of time between the onset of symptoms and initial treatment increases. If you're in doubt, call DAN we can help get you on the way to recovery.

Though each facility may vary in how it operates, you now have an idea of what to expect when a diving emergency occurs. Hopefully, some of the anxiety that occurs in this situation will be eased for you or a dive buddy when you have a 'neurological evaluation'. And, yes, some of the larger chambers do have bathrooms.