

From: Eric Fattah                      29/03/04  
Subject: CO2 narcosis/blackout

It seems that people who blackout on the bottom as opposed to the shallow water blackout are likely victims of having too much CO2 in their blood (resulting from too much effort at depth?).

This topic brings back lots of emotions for me. You see, most people that suffer from CO2 blackouts don't live to tell the tale, so we know little about the causes or symptoms. However, CO2 is a real danger. In fact, I myself nearly died from too much CO2, and that incident changed my attitude towards deep safety forever. After the accident on July 27, 2001, I sent out many e-mails to the pure-apnea lists trying to warn other divers. It had no effect. Within two months, two divers suffered from CO2 incidents (Martin Stepanek and Herbert Nitsch).

The famous study at Duke University gave us the most important info to date on CO2 toxicity. The study found that once your PaCO2 goes over 90mmHg, the symptoms of CO2 narcosis begin, and you have about 90seconds before you suffer a 'narcoleptic event' (i.e. falling asleep from too much CO2).

Now, in order to actually blackout from CO2, you need elevated O2 levels. Elevated O2 levels can be reached either by breathing enriched air on the surface (as done in the study), or by descending down under water to hyperbaric pressure. Doing a dry static on the surface, it is almost impossible to black out from CO2 narcosis. You run out of O2 far earlier.

In addition, extreme cold has a dramatic amplifying effect on CO2 poisoning and blackout. Divers who are very cold will lose consciousness at a lower CO2 level. It is common knowledge that the activity of the CO2 receptors changes with temperature, but now it seems that this is more than just a subjective feeling.

The symptoms of CO2 narcosis are subtle. The symptoms range from euphoria to dizziness, to altered perception, to sleepiness. The most dangerous symptom is simply forgetting about where you are, and what you're doing, which can lead you to delay your ascent, or even worse, forget that you need to ascend.

During my accident, I was ascending from a constant weight dive (88m), where the water at the bottom was black and freezing cold (4C). The only illumination was 30W scuba lights along the line. I had already experienced mild CO2 narcosis on shallower dives, but on this dive, when I reached 53m on the ascent, I got so narked that I forgot about everything. I experienced an inability to move, and I forgot to keep kicking. I was experiencing 'dreamlets', where your mind is a thousand miles away, and I lost awareness of where I was, and I forgot that my life depended on continuing the ascent. The deepest safety freediver was waiting at 25m, which was nearly 30m/100ft away! I started sinking again down into the blackness. A contraction woke me up. I suddenly realized that I was in deep trouble, and I knew that my safety freediver was nearly a hundred feet above me. I eventually reached the surface on my own, without assistance, and in fact I had much more O2 left than on some previous successful dives. This shows that you don't need to be in a dive where you 'stayed down too long' to get this problem. I didn't stay down too long.

After reading the symptoms described in the Duke study, I am convinced I was a hair away from losing consciousness, which would have been fatal. CO2 narcosis is not the same as nitrogen narcosis, even though CO2 can amplify N2 narcosis. As an example, Mandy Cruickshank (PADI instructor) had experienced N2 narcosis on countless scuba dives, but when she first experienced CO2 narcosis on a 58m free immersion dive in cold dark

water, she did not recognize it. She thought she injured her ear, which caused 'dizziness', but in fact her ears were fine.

Herbert Nitsch reported an 89m dive where he surfaced thinking that he had turned at the 72m marker, when according to his gauge he had gone 17m deeper. My friend Tyler Zetterstrom tried for a 45m pb here in the cold Vancouver water, and his dive lasted for almost double the planned time. He ascended spiraling around the line from dizziness, and according to his gauge, he spent 15 seconds on the bottom, which he doesn't remember. Martin Stepanek spent nearly a minute at 83m, claiming there was a huge fish down there who was parked right in front of his face! His safety freediver nearly blacked out having to wait for 2.5 minutes for him.

I want to make it clear that even though CO<sub>2</sub> can build up between repetitive dives, in my case my accident happened on my very 1st dive; I didn't do any warm up dives. So CO<sub>2</sub> accumulation was not the problem.

So, this brings us to the question: how can the average diver minimize his risk of CO<sub>2</sub> narcosis/blackout?

This brings up a controversial answer. Freedivers are a dogmatic group that always advocate against hyperventilating. After all, hyperventilating increases the chance of a blackout in many ways, the most dramatic being the destruction of the bohr effect, and less dramatic being the delay of the breathing stimulus. However, hyperventilating does have one small advantage; if you hyperventilate and dive, any problems will happen on the ascent, typically very close to the surface, in range of a buddy if the buddy is waiting. On the other hand, doing exactly the opposite, not hyperventilating, and not even taking many breaths, causes a much worse danger; the chance of blacking out when you're down there, which is almost certainly fatal. Now, I'm not saying people should start hyperventilating. I am saying that during repetitive dives, or before a very deep dive, the diver must make a choice; he must choose between where the problem, if any, will occur. If he is diving down a descent line, and he knows that there is safety near the surface, but no safety down deep, then his chance of survival may improve by more aggressive ventilation. In my case, when doing deep training dives on a descent line without scuba divers, first of all I refuse to go over 70m, and even then I overventilate. This often results in a samba or near-samba upon recovery at the surface, but it dramatically reduces my chance of blacking out on the bottom. I don't recommend having sambas either, but in my case if it's a choice between a samba at the surface with people spotting me, or blacking out deep, I choose the samba at the surface.

Remember that if you are cold, and making either repetitive dives or a very deep dive, keep in mind the dangers of CO<sub>2</sub>. Don't always assume that a problem will happen near the surface.

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