

Case Histories – In-Water recompression (found on website)

Case #1. Hawaii.

"Four fisherman divers were working in pairs at a site about 165 f/51 m to 180 f/55 m. Each pair alternated diving and made two dives at the site. Both divers of the second pair rapidly developed signs and symptoms of severe CNS decompression sickness upon surfacing from their second dive. The boat pilot and the other diver decided to take both victims to the U.S. Navy recompression chamber and headed for the dock some 30 minutes away. During transport, one victim refused to go and elected to undergo in-water recompression, breathing air. He took two full scuba tanks, told the boat driver to come back and pick him up after transporting the other bends victim to the chamber, and rolled over the side of the boat down to a depth of 30 f/9 m to 40 f/12 m. The boat crew returned after two hours to pick him up. He was asymptomatic and apparently cured of the disease. The other diver died of severe decompression sickness in the Med-Evac helicopter en route to the recompression chamber." (Hayashi, 1989)

Case #2. Sussex, England.

Twelve experienced divers conducted an 18-minute dive on a wreck in about 215 f/66 m. They surfaced following 38 minutes of air decompression, at which time two of the divers reported "incomplete decompression." These two divers obtained additional supplies of air and returned to the water in an apparent effort to treat DCI symptoms. They never returned to the boat, and their bodies were recovered two weeks later.

The reason for their deaths remains a mystery. It is possible that they were suffering from neurological DCI symptoms, and drowned as a result of these symptoms. The tragedy of this case lies in the fact that they most likely would have survived had they not re-entered the water. The boat was equipped with 100% oxygen (surface-breathing) equipment, and the incident occurred in an area where emergency air-transport could have delivered the divers to a recompression chamber less than an hour after surfacing. The water temperature in this case was about 61-63 F (16-17 C), and the surface conditions were relatively rough (3-5 ft seas). Whether or not these divers perished as a direct result of DCI symptoms, they would, in all likelihood, have survived the incident had they not returned to the water.

Case #3. Hawaii.

After ascending from his second 10-minute dive to 190 f/58 m, a diver followed the decompression `ceilings` suggested by his dive computer. As he was nearing the end of his computer's suggested decompression schedule, he suddenly noticed weakness and incoordination in both arms, and numbness in his right leg. He immediately descended to a depth of 80 f/26 m where, after 3 minutes, the symptoms disappeared. After a total of 8 minutes at 80 f/26 m, he slowly ascended over a period of 50 minutes to 15 f/4.6 m (his companion supplied him with fresh air tanks). He remained at this depth until his decompression computer had "cleared." He felt tired after surfacing, but was otherwise asymptomatic.

Case #4. Central Pacific.

A diver had partially completed his decompression following 15 minutes at 200 f/61 m, when he suddenly became aware of the presence of a very large and somewhat "inquisitive" Tiger Shark. Initially, the diver maintained his composure, fearing DCI more than the threat of attack. When the shark rose above, passing between the diver and the boat, the diver reconsidered the situation and opted to abort decompression. After a rapid ascent from about 40 f/12 m, the diver hauled himself over the bow of the 17-foot Boston Whaler (without removing his gear). Anticipating the onset of DCI, he instructed his startled companion to quickly haul up the anchor and drive the boat rapidly towards shallower water. By the time they re-anchored, the diver was experiencing increasing pain in his left shoulder. He re-entered the water and completed his decompression, emerging asymptomatic.

Case #5. Australia.

After spending 18 minutes at a depth of 220 f/68 m, a diver experienced a serious malfunction of her Buoyancy Compensator inflation device which resulted in the rapid loss of her air supply and a sudden increase in her buoyancy. Additionally, she became momentarily entangled in a guide line, further delaying ascent, and was freed from the line with the assistance of her diving companion. As they ascended, they were met by a second team of divers just beginning their descent. Although one of the members of the second team was able to provide her with air to breathe, he was unable to deflate her over-expanded B.C., and both ascended rapidly to the surface. Within 4 minutes, she returned to a depth of 20 f/6 m where she breathed 100% oxygen for 30 minutes. She then ascended to 10 f/3 m, where she completed an additional 30 minutes of breathing oxygen. Upon surfacing, she was taken to a nearby recompression chamber facility, breathing oxygen during the 30 minutes required for transport. Arriving at the facility, she noticed no obvious symptoms of DCI, but was diagnosed with mild "Type II" DCI and treated several times in the chamber. She suffered no apparent residual effects.

Although no DCI symptoms developed prior to recompression, serious symptoms undoubtedly would have ensued had recompression not been immediate, given the extent of the exposure and the explosive rate of ascent. It is interesting that a modified version of the Australian Method was employed. Recompression depth was limited to a maximum of 20 f/10 m due to concerns of oxygen toxicity at greater depths. The victim was monitored continuously while breathing oxygen underwater by at least two tending divers.

Case #6. Northern Australia.

After a second dive to 100 f/31 m, a diver omitted decompression due to the presence of an intimidating Tiger Shark. Within minutes of surfacing, he "developed paraesthesia, back pain, progressively increasing incoordination, and paresis of the lower limbs." After two unsuccessful attempts at air IWR, arrangements were made to transport the victim to a hospital 100 miles away. He arrived at the hospital 36 hours after the onset of symptoms, and due to adverse weather conditions, he could not be transported to the nearest recompression chamber (2,000 miles away) for an additional 12 hours. By this time, the victim was "unable to walk, having evidence of both cerebral and spinal involvement", manifested by many severe

neurological ailments. The diver was returned to the water to a depth of 26 f/8 m, where he breathed 100% oxygen for 2 hours, then decompressed according to the Australian Method. Except for small areas of hypoaesthesia on both legs, all other symptoms had remised at the end of the IWR treatment.

This case suggests that in-water oxygen treatment in depths as little as 26 f/8 m can have positive effects on DCI symptoms even after much time has elapsed. It also underscores the fact that it may be the *only* treatment available in remote areas where recompression chamber facilities are many thousands of miles and several days away.

Case #7. Solomon Islands.

Fifteen minutes after a 20-minute dive to 120 f/37 m, and 8 minutes of decompression, a diver developed severe neurological DCI symptoms, including "respiratory distress, then numbness and paraesthesia, very severe headaches, involuntary extensor spasms, clouding of consciousness, muscular pains and weakness, pains in both knees and abdominal cramps." No significant improvement occurred after 3 hours of surface-breathing oxygen. She was returned to the water where she followed the Australian Method. Her condition was much improved after the first 15 minutes, and after an hour she was asymptomatic, with no recurring symptoms.

Case #8. Caribbean.

A young diver experienced pain-only symptoms of DCI after an unknown dive profile. He made three successive attempts at IWR (presumably breathing air), each time worsening his condition. After the third attempt, his condition had degenerated into quadriplegia. Because of transport delays, he did not arrive at a recompression chamber until about three days after the incident. Saturation treatment yielded no improvement in his condition, and he remained permanently paralyzed.

Case #9. Hawaii.

Shortly after a third dive to 120 f/37 m-160 f/49 m, a diver developed "uncontrollable movements of the muscles of his legs." Within a few minutes, his condition deteriorated to the point where he was paralyzed, numb from the nipple-line down, and unable to move his lower extremities. He was able to hold a regulator in his mouth, so a full scuba tank was strapped to his back and he was rolled into the water to a waiting tender diver. The tender verified that the victim was able to breathe, and proceeded to drag him down to 35 f/11 m-40 f/12 m. When the symptoms did not regress, the victim was pulled deeper by the tender. At 50 f/15 m, he regained control of his legs and indicated that he was feeling much better. He was later supplied with an additional scuba tank, ascended to 25 f/8 m for a period of time, and then finished his second tank at 15 f/5 m. Except for feeling "a little tired" that evening, he regained full strength in his arms and legs and remained asymptomatic.

Case #10. Central Pacific.

In this previously unpublished case, four aquarium fish collectors ascended rapidly from their second 200 f/61 m dive of the day, aborting essentially all decompression. All immediately began experiencing nausea and varying degrees of neurological DCI symptoms. Three of the divers returned to a depth of about 50 f/15 m, but the fourth opted instead to stay in the boat. When the three completed their abridged attempt at IWR (after which all three felt noticeably improved), they headed for shore. Help was summoned, and additional scuba tanks and 100% oxygen were obtained and loaded into the boat. By this time, one of the divers felt only pain in his shoulders, and the other three were experiencing varying degrees of neurological DCI symptoms. The worst of these was diver who did not attempt IWR: he was unable to move his arms or legs and was having difficulty breathing. The other three attempted to assist him back in the water, but they eventually gave up, fearing that he might drown (due to his inability to hold the regulator in his mouth). The other three continued IWR, breathing both air and 100% oxygen at 30 f/9 m-40 f/12 m, until nightfall forced them out of the water. That night, all four took turns breathing 100% oxygen on the surface while waiting for the emergency evacuation plane to arrive. The following day, the three who had attempted IWR were flown to Honolulu, where they experienced varying degrees of recovery after treatment in a recompression chamber. The one who did not attempt IWR died before the plane arrived.

Case #11. Northeastern United States.

After spending 25 minutes at a maximum depth of 147 f/45 m, a diver ascended following decompression stops required by his tables. He began feeling a tingling sensation and sharp pain in his right elbow as he arrived at his 30 f/9 m decompression stop. He completed an additional 30 minutes at 10 f/3 m beyond what was called-for by his tables, and then surfaced. His symptoms subsided somewhat after an hour of breathing 100% oxygen on the boat, but persisted enough to prompt the diver to attempt IWR. He returned to the water with an additional cylinder containing EAN-50 and descended to 100 f/31 m for a period of 10 minutes. He ascended to 20 f/6 m over a 10-minute period, and remained there for 68 minutes. He spent an additional 5 minutes at 10 f/3 m, then surfaced asymptomatic, with no recurrence of symptoms.

This case illustrates another fundamental risk associated with IWR; that of acute CNS oxygen toxicity. During the deepest portion of above IWR profile, the diver was breathing an oxygen partial pressure of 2.02, considerably greater than what is considered safe. The diver was aware of the potential for acute CNS oxygen toxicity and had an additional cylinder of air with him, just in case. Furthermore, he was exposed to this excessive oxygen partial pressure for only 10 minutes.