NEW WAVE AND TECHNICAL DIVING
WOT WE NEEDED WAS NITROX

Ian Skelton

Key Words

Nitrox, technical diving.

Ian Skelton recalls the frustrations experienced by members of Plymouth Sound BSAC, investigating a 200 year old wreck with air in their tanks. Nitrox gives them longer bottom times on their 33 m dives to the vessel.

Squeezed side by side between walls of silt, my buddy and I excavate among the collapsed timbers of the 200-year-old brigantine. Our airlift, rising vertically between us, spills plumes of sediment down tide. The time passes quickly but, like all good amateur archaeologists, we resist the urge to dig faster. Unlocking the secrets of the Metta Catharina is not something to be hurried.

In disbelief, I stare at my computer. Twenty-six minutes at 33 m. We have four minutes left before we must drag ourselves away.

My reverie is broken by a Jaws-like grip on my arm. My buddy is pointing at something glinting in the dark weal of silt. I spot the lower half of a wine glass, its fluted stem set alight by the nodding beams from my buddy's helmet lamp. A tingle of excitement passes between us like static electricity. Three minutes later our gently probing fingers signal the bad tidings: the bowl of the glass is trapped. It will require several more minutes of careful work to free it, and our time is up.

Disappointed, we endure the usual tedious deco hang on the lazy shot. I soon become bored with counting holes in my buddy's gloves, and instead, reflect on our situation. Diving regularly on the wreck site of the Metta Catharina, we suffer a recurring problem, too little bottom time and too much deco. My mind reaches back to things I have heard and read recently about that wonderful new gas, nitrox. New? This gas has been around since a certain Mr Beddoes started tinkering with it in 1794.

Enriched air nitrox (EANx), was first used for diving during the pre-WW I era. In those far off days German and British diving and engineering companies experimented with breathing mixtures that would reduce the amount of nitrogen in air and so reduce the decompression commitment at shallower depths.

Generations later the National Oceanographic and Atmospheric Administration (NOAA) became aware of the significant benefits offered by nitrox. They published tables and procedures for its use in their 1979 diving manual. More recently the scientific and advanced level sport diving community have increasingly begun to utilise the advantages of nitrox.

Which brings us to the present, and the decision of the BS-AC to give a green light for the use of nitrox in Branch activities.

My chilled digits claw for the slate on the lazy shot, and I scribble a barely legible message: "Wot we need is nitrox!" My buddy nods furiously. Nitrox is firmly at the top of the agenda at our next Archaeological Section meeting.

The Archaeological Section of our Club, Plymouth Sound BS-AC, was founded way back in June 1973. Our brief at that time was to locate and investigate ancient wrecks in the Plymouth area. Success came quickly. In October of that year we found the wreck site of the Danish brigantine Die Frau Metta Catharina von Flensburg. Blown into Plymouth Sound during a severe gale on 10 December 1786, the 122 ton vessel was en route from St Petersburg for Genoa laden with a cargo of reindeer hides. She struck a reef off Drake's Island and became a total loss.

Buried in dense black silts in the deep-water channel of Plymouth harbour, the Metta Catharina's final resting place was marked only by her bronze bell and a thin scatter of cargo. During a pre-disturbance survey we discovered that most of the reindeer hides remained intact tightly jammed together deep within the vessel's two main cargo holds.

When excavation began, some of this wonderfully preserved cargo was sold to help fund the archaeological project. For this generous concession the team members will always be grateful to the Metta Catharina's present day owner, His Royal Highness Prince Charles.

Working the wreck site to current archaeological standards is a painfully slow process, not helped by poor underwater visibility, contrary tides, and above all by the depth, 29-34 m.

It was because of this depth problem that I believed nitrox should be addressed, and I had no reservations about advocating its use to the lads in the Archaeological Section. In 22 years, the lads have never been slow to adopt new ideas and practises, especially where new safety measures are concerned.

At our nitrox meeting, we were lucky to have along as our guest speaker Paul Dart, a senior instructor from Fort Bovisand Underwater Centre. Silence reigned as Paul began detailing the catalogue of benefits we would enjoy if we started to use nitrox. When he pointed out that by using Nitrox 32 (32% oxygen), we would be working at an equivalent air depth of 6 m or so shallower than the actual diving depths, the silence was broken by the lads in the team clamouring for the date of his next course.

Paul obligingly set up a special course for us, structured to run over two evenings. Run under the banner of the International Association of Nitrox and Technical Divers (IANTD), there was a choice between Basic Nitrox, Advanced Nitrox, and Technical Nitrox courses. We opted for the Basic Nitrox.

Planned as a theory-only conversion, it covers matters such as the history and use of nitrox, oxygen physiology, use of decompression tables, gas law revision and basic nitrox equipment handling. A short theory exam wrapped up the sessions. We walked away from Fort Bovisand as fully fledged "Nitrox Divers" with certificates to prove it.

It was time to put the theory into practice. Fortunately, Sandford and Down, Plymouth's oldest established dive shop, had recently made a substantial investment in the new technology needed for nitrox. They very swiftly made the necessary adjustments to our gear. Our cylinders were modified, cleaned and labelled, demand valves were modified and cleaned and the supply of gas was made readily available. All we were required to do was analyse our own mixes. We chose to all stick to 32% oxygen, which at our maximum operating depth of 34 m, would give a partial pressure of oxygen, (PPO_2) of 1.41 bar, comfortably inside the IANTD recommended limit of 1.5 bar.

We have now carried out 6 nitrox dives on the wreck site of the Metta Catharina. The team's enthusiasm for the gas remains unabated. Certainly, no one is talking about going back to air. But neither have they any illusions about nitrox. We are well aware of its limitations and dangers.

However, the benefits are only too evident. Still working within our given depth range, our safety margins have improved, we have longer bottom times and less time spent hanging in mid-water.

The equivalent air depth of Nitrox 32 at our normal maximum working depth of 33 m is 27 m. This means that a 30 minute dive requires a decompression stop of 1 minute at 6 m. We could stay down for an additional 4 minute without requiring a longer stop. This means that we are well inside the limits of the BS-AC '88 tables. An air dive (Nitrox 21) to the same depth would require a stop of 3 min at 6 m. With the average age of the diving team hovering at a near geriatric mid-forty, our only regret is that we waited so long to use a gas which is almost as old as the wreck of the Metta Catharina herself.

From January 1996, BS-AC nitrox courses will be available at a basic level, dealing with no-stop diving; and advanced level, using nitrox as a decompression gas.

Reprinted, by kind permission of the Editor, from DIVER, the magazine of the British Sub-Aqua Club, 1995; 40 (10) October: 77-78

The offices of the British Sub-Aqua Club are at Telford's Quay, Ellesmere Port, South Wirral, Cheshire L65 4FY, United Kingdom.

DIVER is published by Eaton Publications, 55 High Street, Teddington, Middlesex TW11 8HA, United Kingdom. The annual subscription is £ 31.00 which must be paid in English pounds.

GLEANINGS FROM MEDICAL JOURNALS

DECOMPRESSION ILLNESS AND DEATHS

US Navy decompression illness and fatalities 1990-1995. Patterns and trends.

Howsare CR, Jackson RL, Rocca AF and Morrison LJ. *Undersea Hyperbaric Med* 1997; 24 (Suppl): 22

Abstract

Background

The Naval Safety Center (NSC) collects data for the Navy diving programs. The data, with collection driven by mandatory reporting requirements, provides and excellent database for population based studies.

Methods

The NSC collects every Navy dive, fatality and DCI case. A user friendly computerised Dive Reporting System coupled with mandatory reporting requirements enforced by regular safety inspections ensure reasonably complete information for Navy diving. Structured diving incident reports help to standardise DCI reporting. The entire NSC Navy diving database for 1990-1995 was analysed for quality and was examined to look for patterns or trends.

Results

There was a peak in the total number of dives in 1992 (N=124,972), then a steady decrease with a lowest number in 1995 (N=70,655) giving a total of 648,488 dives for the 6 year period. The fatality rate was about 1 per 100,000 dives. Analysis of each DCI narrative report (N=382) demonstrates an over reporting/misdiagnosis rate of 32%. Adjusted DCI rates for the 6 year period shows per 10,000 dives an AGE rate of 1.3m a Type 1 DCS rate of 1.3 and a Type 2 DCS rate of 1.3. The highest DCI rates were in 1990 and 1991 with research dives resulting in DCS

accounting for the higher percentage of the cases. Fatalities were equally distributed across the period and the misdiagnosis rates highest in 1990 (39%) and decreased over the period to a low of 23% in 1994 and 1995.

Conclusions

US Navy diving is comparatively safer than recreational scuba diving given the very rough fatalities in Bennett and Elliott's text. Unlike most diving databases, over reporting/misdiagnosis of DCI in the US Navy's is common. With the relatively small number of DCI cases per year an aggressive diving research program or a long, deep salvage operation could skew annual DCI rates.

From

Naval Diving and Salvage Training Center, Panama City, Florida 32407, USA.

Key Words

Accidents, deaths, decompression illness, occupational diving.

Does the dive profile affect the manifestations of decompression sickness?

Ball R, Temple D, Survanshi SS, Parker EC and Weathersby PK. *Undersea Hyperbaric Med* 1997; 24 (Suppl):22

Abstract

Background

The relationship between the dive profile and manifestation of DCS symptoms and signs has never been studied in a large number of human cases in which accurate information about the dive profile and DCS manifestations has been recorded.

Methods

We reviewed the records of the NMRI Decompression Modelling Database and selected over 4,400 sing air or nitrox dives that were conducted in laboratory settings by the US, Canadian or UK militaries between 1949 and 1994. DCS cases were divided into those involving pain or neurological manifestations. We conducted univariate analyses of the effect of depth, bottom time and ascent rate on the proportion of neurological cases. Ascent rate was calculated as the mean ascent rate for no-stop dives and the mean ascent rate to the first stop for dives with decompression stops.

Results

There were 232 cases of DCS: 117 with pain only, 39 with both pain and neurological symptoms or signs, 14 with only neurological symptoms or signs and 2 with only other manifestations. There was a higher proportion of neurological cases (35% vs 18%) when ascent rates were faster than 55 fsw(16.6 m)/min ($p<0.01$). There was a higher proportion of neurological cases at depths > 40 fsw (12 m) (24% vs 10%). The statistical significance in these cases was only marginal($p=0.07$). There was not a higher proportion of neurological cases on dives with short bottom times.

Conclusions

Faster ascent rates and deeper depths tended to be associated with more neurological cases, but the associations were of marginal statistical significance. Only with large numbers of accurately collected dive profiles and DCS case information can the question be answered definitively.

From

Naval Medical Research Institute, Bethesda, Maryland 20889-5607, USA.

Key Words

Ascent, decompression illness, hyperbaric research.

The role of technical input in the investigation of fatal diving accidents.

Calder IM. *Undersea Hyperbaric Med* 1997; 24 (Suppl): 26.

Abstract

Background

Many fatal diving accidents are marked by the end stages of complex physiological changes. These may be further compounded by therapeutic intervention. The use of a multi-disciplinary team may allow an easier solution of a complicated equation.

Methods

A review of 127 professional and amateur diving accidents has shown that 17 were able to be moved from a speculative to a certain cause of death. The fact of drowning in an experienced, trained and disciplined diver suggest more than a simple explanation, especially when human factors have been eliminated. Most biochemical parameters after death are of little value and may be actively misleading. However toxicology per se must be regarded as an important component. The time sequence in fatal diving accidents rarely allows histological changes to take place and at the best morphological changes may be modified by gas artefact. In broad terms the cause of death (other than by trauma by gas) may simply be resolved into a spectrum of anoxia/asphyxia/drowning or hypothermia. It is at this stage that technical input can be of vale and various scenarios evolve.

Continued on page 152