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One opinion on the oxygen toxicity front is that one might have to defend not using methyl prednisolone; a free radical scavenger. The viewpoint on use of helium was not crisp in either direction; Des Gorman is seeing the need for fewer follow-up treatments. It is hard to do a blinded study since the voice gives it away. (If it's my spine I'll take it. Ed. *Pressure*) Likewise the room seemed a bit divided on the value of the "Hawaiian spike", a fast and deep recompression to start a treatment as described by Bob Overlock. Some see merit in it, but by no means all; the case against any deep treatment, say 6 atm, did not come out strongly, however. Still another uncertainty is the benefit of lidocaine, promising to some but neurologist David Warner and others are skeptical, but say to keep studies going. Philip James hypothesized that one of the reasons fluids seem to be beneficial is that they are unsaturated and they allow a redistribution of gas. Saturation "treatments" with a nitrogen-based atmosphere are not gaining ground, in part because the nature of the disruption to an active clinical HBO facility; here the tendency is to go with something like Comex 30. Counterdiffusion is not a problem with a switch to heliox if compression is done simultaneously. Dave Youngblood, who has as much experience as anyone in the room, strongly advises against "unwarranted" saturation.

Considering that several controversial situations have developed over the use of high-tech imaging techniques, mainly due to big decisions based on preliminary data, this session moved comfortably through this. The benefit of psychological testing is not universally accepted, but techniques may be getting better developed. Sometimes imaging is used to track "tailing" techniques of giving daily treatments for days to weeks and basing the benefit on scans as well as symptoms. The suggested notion that this might work on "punch-drunk" divers is intriguing. Keith Van Meter's chamber does an average of 13 tailing treatments, but they stop immediately when it is no longer effective; Paul Harch admitted that "tincture of time" might play a role. This caused less obvious controversy than one might have expected. Dick Vann's comprehensive review of DAN data concluded that additional treatments help, but none had complete relief after 15 treatments.

Like the monoplace, in-water oxygen treatment drew less flak than it would have a couple of years ago, possibly because by now this group is firmly indoctrinated on the benefits of prompt treatment. Carl Edmonds laid out his current procedures, which are similar to those in the first two editions of his book but now require a 2-hour linear ascent from the 9-msw treatment depth. This is likely to make this approach unacceptable where the sea is rough. Among the contraindications is reluctance on the part of the diver (or team), a good point since thermal protection has to be better than that for most dives. Surface oxygen is acknowledged to be beneficial, but there were warnings that it can be abused and used to avoid proper treatment. It can be helpful after a treatment.

In an interesting coincidence, the Great Lakes UHMS chapter has planned a mini-symposium on "Different treatments for different people". This was not planned as a follow-on to this workshop, but it asks a quite cogent set of questions. And speaking of chapters, kudos to the Gulf Coast chapter for a major contribution to this Workshop, there are few better ways to put your chapter's earnings to good use.

The facilities at the Colony's conference centre were excellent, with good projection and light control (never too dark), handy coffee, and bearable chairs. This Workshop was nicely done and undoubtedly very rewarding for all those who attended. Kudos to Jane Dunne particularly for doing the intensive organising that made it happen.

Key Words

Decompression illness,hyperbaric oxygen, treatment, reprint.

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The address of UHMS is Undersea and Hyperbaric Medical Society, 10531 Metropolitan Avenue, Kensington, Maryland 20895, USA.

The full proceedings of this meeting will be available for sale at the 1996 UHMS meeting in Anchorage, Alaska.

BS-AC GIVES THE OK TO NITROX

Chris Allen

At DOC 94, BS-AC NDO Tony Hoile announced that a Working Group had been set up to review the BSAC's position on nitrox. Here, Chris Allen, Chairman of the Working Group, describes how the review was conducted and explains the BSAC's decision to sanction the use of nitrox in Club activities and to launch its own nitrox training program.

The possible use of nitrox (oxygen-enriched air) for sport diving was first examined by a BS-AC working group set up at the end of 1991. Having examined the advantages and disadvantages in some detail, the group concluded that the use of nitrox mixes was a legitimate technique which could be carried out safely, given proper training and sensible precautions in gas mixing and testing. However,

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while the use of nitrox offered some advantages in the middle depth range, it was concluded that for most sport divers on most dives the disadvantages of nitrox use outweighed the potential benefits.

The findings of the working group were published in Diver and the NDC Bulletin and were presented at the 1992 Diving Officers' Conference. Having considered the report, the BS-AC National Diving Committee decided that the use of nitrox would not be permitted during BS-AC activities. Since publication of the 1992 report, the National Diving Committee has continued to monitor progress in this and other related areas. At the end of 1994 it was decided to establish a second working group to review the BSAC's position in the light of new developments. Other members of the working group were Lizzie Bird (Southern Region Coach), Dave Crockford (NDC), Alison Farrow (Coach for North Scotland) and Dave Mitchell (First Class Diver Chief Examiner). The working group also received input from other members of the National Diving Committee and other specialists in the fields of diving medicine, decompression research and diving computer design.

As the subject of nitrox use by sports divers is still somewhat controversial and can give rise to heated debate, the working group's approach was to be as objective as possible. In particular, a conscious effort was made to obtain as much factual or statistical information as possible.

A number of initiatives were put in place to examine the five main areas of interest which were felt to be central. Firstly, to try to determine the actual size of the potential benefits from nitrox use, in terms of safety or reduced decompression requirements. Secondly, to carry out a review of accident and incident performance during the period since the first report. Thirdly, to establish as accurately as possible the number of divers using or wanting to use nitrox. Fourthly, to obtain feedback from BS-AC members on the subject of nitrox. Finally, to review recent developments in equipment and to examine the size and quality of the existing specialist nitrox training organisations.

In order to quantify the safety benefit, Dr Bill Hamilton, a decompression expert from the USA, agreed to carry out a small project to perform a Maximum Likelihood Analysis and compare the predicted DCI risk levels on air against other nitrox mixes, for a set of typical dive profiles performed using air decompression tables.

At the same time, the BSAC's own incident database was analysed to establish both the number and type of incidents which have occurred using nitrox and also whether decompression incidents were occurring on air in the depth range where nitrox can be seen to provide a benefit.

Surveys of all delegates and all diving officers present at DOC '94 were carried out to establish the degree of existing usage of nitrox and to obtain DOs' views on the subject. This was backed up with similar questionnaires distributed through the Coaching Scheme to check the validity of the DOC results. The nitrox training organisations were contacted for details of the number of certifications they had performed, and a survey of dive shops and other facilities offering nitrox training and gas sales was conducted to determine the level of current infrastructure available to support nitrox use.

In summary, the results of all these investigations showed that, while the laws of physics and physiology had obviously not changed since the time of the first report, there had been significant advances in equipment, particularly with the appearance within the last few months of nitrox dive computers and better oxygen analysers.

The appearance of nitrox dive computers is particularly important for two reasons. Firstly, they allow useful extensions of bottom time to actually be realised. Secondly, where they include an oxygen toxicity alarm, they are able to offer at least a partial solution to the increased risk of oxygen (0_2) toxicity which arises when using oxygen-enriched mixtures. Up to now the theoretical additional bottom time available when using a nitrox mixture, other than air, has not necessarily been achieved in practice.

Divers using an air dive computer have been able to match, or even exceed, the bottom time available from the common nitrox mixtures for which only tables assuming a square profile dive were available. In other words, in terms of extended bottom time, the benefit of a multi-level calculation performed by the computer was equal to, or even greater than, the benefit of using a nitrox mixture rather than air. However, a nitrox computer which can perform the same multi-level calculation, but base it on the nitrox mix being used, makes the additional bottom time a reality.

On the safety side, too, nitrox computers can offer a big advantage. One of the greatest concerns with nitrox use is the risk of oxygen toxicity through straying too deep and exceeding the partial-pressure threshold. This risk, of course, is also present with air but because the depth at which it occurs (66m+) is well outside the normal diving range of most sports divers, in practice it does not present a problem. However, with an enriched-oxygen mixture the threshold of O_2 toxicity can occur at a depth of 30 metres or less, right in the middle of the sports diving range. Computers which offer an oxygen-toxicity alarm provide at least a partial solution to this problem. Some computers, such as the Aladin Nitrox, which also monitor gas consumption are even able to adjust the oxygen clock for the diver's work rate, which can be an important factor in oxygen toxicity.

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Having reviewed and analysed all the information collected, the working group has recommended that the BS-AC should permit the use of nitrox during BS-AC activities and that BS-AC courses should be developed and offered through the Coaching Scheme and BS-AC Schools. As a result, it has been decided that suitably qualified members will be permitted to use nitrox during BS-AC activities with effect from 1 May 1995. BS-AC Courses will be available from the end of 1995.

In order to be considered qualified to use nitrox from May onwards, members must have a recognised qualification from one of the nitrox training organisations and fulfil the BSAC's own minimum qualification requirements.

In order to use enriched air nitrox (EANx) 32 or EANx 36, Club members should be qualified to a minimum level of Sports Diver, with a further 20 open water dives logged since qualification, and hold either the IANTD Basic EANx Diver, TDI Nitrox Diver, or ANDI Complete Safe Air User qualifications.

In order to use nitrox mixes other than 32% or 36%, and specifically to use EANx 40 or EANx 50 as a decompression gas, members must be qualified to at least BS-AC Advanced Diver standard and EANx Diver, TDI Extended Range Diver, or ANDI Technical Safe Air Diver qualifications. Further guidance on entry requirements for BS-AC courses and equivalences between BS-AC and other qualifications will be published in due course.

The practical aspects of dive planning and organisation particularly the marshalling of mixed groups of air and nitrox divers, are of course very important. Once again, detailed guidance will be provided via the NDC Bulletin, but in summary the working group's recommendations are as follows.

As far as the use of decompression tables and computers for nitrox is concerned, the advice varies according to the reason for choosing to use nitrox. If the aim is to achieve a safety benefit, then it is recommended that nitrox mixtures are used (within their depth limit), with either the BS-AC '88 Tables or an air dive computer. If the aim is to obtain an extended bottom time or a reduced decompression requirement, then it is recommended that a nitrox dive computer is used.

For mixtures up to 40% O_2 content, normal diving equipment may be used without special precautions unless this would be contrary to the manufacturer's advice. If, during the gas mixing process, items of equipment such as cylinders are exposed to oxygen concentrations greater than 40 per cent, then extra precautions are required.

Where mixtures with an O_2 concentration greater than 40% are being used or encountered during mixing, special care is required to ensure that all equipment is suitable for oxygen service. This means that all components must be compatible with oxygen service and be oxygen clean before use.

Nitrox cylinders should be dedicated to that use, colour coded yellow with a 10 cm green band, marked clearly NITROX. They should also be prominently labelled with the mixture details.

Every diver must be responsible for the gas in their cylinder and have full knowledge of the contents. It is therefore strongly recommended that the diver should witness testing of their gas at the mixing station and that he or she should personally verify the gas analysis by re-testing immediately before use.

In the event of a diving accident or case of decompression illness in someone who has been diving with nitrox, the treatment of the casualty should be exactly the same as for an air diver. There is no reason not to administer O_2 to the casualty or to carry out a normal recompression treatment, though the details of the dive and the gas mixture being used should, as always, be given to the treatment centre.

Dive Marshals responsible for organising and marshalling a group of divers using nitrox mixtures should have a clear understanding of the implications of nitrox use. Ideally they should themselves be qualified in nitrox diving to the level appropriate to the dive being performed. As a minimum, the marshal must be aware of the percentage of oxygen in the nitrox mix and the maximum depth to which can be safely used.

The BS-AC is the first major training organisation to develop its own nitrox courses. This, we believe, underlines both the quality of BS-AC training and the fact we are the most "technical" of the major training agencies in the world. However, it also imposes upon us a responsibility to ensure that we do it safely and professionally.

The safe use of nitrox does require increased knowledge and diving discipline. If you want to be involved, you will need to invest a certain amount of time and money to obtain the proper training and equipment. Nitrox diving will not be suitable for everyone. However for those who want it, the BS-AC offers the chance to acquire the necessary knowledge and skills within the Club system.

Key Words

Equipment, nitrox, physiology, safety, training.

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