

The Diving Medical Advisory Committee

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The Use of Heliox in Treating Decompression Illness

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There are many ways of treating decompression illness (DCI) at increased pressure. In the past 20 years, much has been published on the use of oxygen and helium/oxygen mixtures at different depths. There is, however, a paucity of carefully designed scientific studies. Most information is available from mathematical models, animal experiments and case reports.

During a therapeutic compression, the use of a different inert gas from that breathed during the dive may facilitate bubble resolution. Gas diffusivity and solubility in blood and tissue is expected to play a complex role in bubble growth and shrinkage. Mathematical models, supported by some animal studies, suggest that breathing a heliox gas mixture during recompression could be beneficial for nitrogen elimination after air dives.

In humans, diving to 50 msw, with air or nitrox, almost all cases of DCI can be adequately treated at 2.8 bar (18 msw), where 100% oxygen is both safe and effective. Serious neurological and vestibular DCI with only partial improvements during initial compression at 18 msw on oxygen may benefit from further recompression to 30 msw with heliox 50:50 (Comex therapeutic table 30 – CX30). There have been cases successfully treated on 50:50 heliox (CX30), on the US Navy recompression tables with 80:20 and 60:40 heliox (USN treatment table 6A) instead of air and in heliox saturation. The rationale for deep treatments is strongest when there is a high inert gas supersaturation (e.g. blow-up). Animal studies on cardiopulmonary decompression sickness have failed to demonstrate the advantageous effects of heliox in comparison to air or oxygen, but this kind of DCI does not occur frequently.

When decompression illness occurs *during* decompression from saturation, divers should be treated with increased partial pressure of oxygen and/or recompression. No industrial standard has been established for such treatment, but repeated cycles of 20-30 min of breathing treatment gas (1.5-2.5 bar pO₂) with recompression 0-30 msw depending on symptom severity is commonly recommended. DCI symptoms appearing after finished saturation decompression can normally be treated using USN treatment table 6 (but the chamber gas may be heliox).

Heliox has been used as a therapeutic breathing gas during recompression for many years predating the introduction of short oxygen tables. The use of helium-oxygen during therapeutic recompression might be theoretically advantageous, however experience with the use of deeper treatment tables with either helium or nitrogen as inert gas in a treatment mixture with oxygen, has not consistently demonstrated an advantage of helium. However, there is growing evidence that helium is biochemically not inert and has biological effects on organs and tissues. In experimental research helium reduces ischemia-reperfusion damage in the brain, which is one of the mechanisms in DCI and therefore heliox mixtures in treatment of DCI could have advantages and enhance treatment results.

At the present time there is insufficient knowledge to recommend the routine use of heliox in the treatment of DCI occurring after air dives or after finished heliox saturation dives. Inert gas shift is not recommended if symptoms of DCI occur during heliox saturation dives and in such cases, the inert gas component of the treatment gas should be helium.

DMAC advises that, based on their expertise and practical experience in combination with the type of diving, company medical advisers prepare the treatment plans for DCI. Recompression options may include shallow oxygen or heliox treatment tables. In addition, DMAC recognises the need for further scientific work to validate the treatment algorithms for DCI.

References

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