OXYGEN PRE-TREATMENT DURING SIMULATED DIVES: HYPERBARIC VS. NORMOBARIC. EFFECTS ON BUBBLE FORMATION AND PLATELET ACTIVATION.

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Introduction

- It has been suggested that the micronuclei may be present within the living tissue under normal conditions. These micronuclei may expand and grow to form gas bubbles and activate platelets during decompression.
- Bubble formation and platelet activation are two major factors contributing to the development of decompression sickness (DCS).
- According to Fick diffusion principle, the micronuclei's content in inert gas can be exchanged with the inert gas dissolved in the tissue.
- Therefore, change of nitrogen with oxygen in the breath mixture gas would replace the nitrogen in micronuclei.
- Metabolic processes will consume the oxygen, and liquid then replaces the consumed oxygen in micronuclei, consequently reduces the chance for forming gas bubbles during decompression.
- A recent study suggested that hyperbaric oxygen may eliminate most of such micronuclei in the decompressed prawns.
- In the present study, we evaluated the effect of pre-treated with normobaric or hyperbaric oxygen (NBO or HBO) on the decompression-induced bubble formation and platelet activation in simulated dives.

Materials and methods

Ten healthy volunteer (age: 33.6±2.9 yr, BW: 71±8 kg) participated in a two day protocol.

On day 1:
all subjects were compressed with air to 4 ATA for 25 minutes. They were then decompressed at a rate of 10 m/min. As soon as 1.0 ATA surface pressure's reached, the precordial ultrasonic Doppler was used to detect air bubbles atT 20', 50', and 80' venous blood samples're obtained immediately before and after pressure exposure.

On day 2:
5 subjects're pretreated with HBO (100% oxygen at 1.6 ATA) for 45', then decompressed to surface pressure at a rate of 10m/min, while other 5 subjects were pretreated with NBO (100%) as shown in Photo. When 1.0 ATA surface pressure reached, both groups're treated with the same protocol as day 1. With flow-cytometry, platelet activation was determined by surface expression of activation-dependent glycoproteins CD62p, CD63, CD41a and CD42a.
Data were expressed as M±SE and analyzed with non-parametric Mood Median Test for air bubble and ANOVA for platelet.

Photo: NBO pre-treatment

Results

Decompression in our simulated divers induced bubble formation and platelet activation.
Pretreated with HBO significantly reduced deco-induced air bubbles at 20min (see Table 1).

Subjects	A	B	C	A	B	C	A	B	C
1	20	I+	I-	40	I	I	80	I-	I-
2	20	II-	I+	40	I	I	80	I-	I-
3	20	I	I	40	II-	I+	80	I-	I-
4	20	II	I+	40	I+	I	80	I-	I-
5	20	II	I+	40	I-	I-	80	I-	I-

Table 1
A: Doppler recording time (min); **B:** decompression; **C:** HBO pre-treatment and decompression

Platelet activation revealed itself to be more significantly decreased in HBO pre-treatment protocol than in the no HBO pre-treatment protocol (5.38±0.54% vs. 11.34±0.74%, p<0.01).

Pre-treated with normobaric oxygen showed a decreased platelet activation (5.8±0.49% vs. 9.52±0.56%, p< 0.05), but no any variation as per bubble numbers at the fixed intervals (20', 50' and 80 min.).

Conclusions

Our study suggests that those pre-treated with both hyperbaric and normobaric oxygenation may show a reduced development of DCS.
The potential of the hyperbaric pre-oxygenation would seem to be more effective in that.

Poster # A28

41st UHMS Annual Scientific Meeting
26-28 June 2008, Salt Lake City - Utah - USA