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Commentary: Arterial blood gases in SCUBA divers at depth

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A Commentary on

Arterial blood gases in SCUBA divers at depth

By Paganini M, Zucchi L, Giacon TA, Martani L, Mrakic-Sposta S, Garetto G, McKnight JC, Camporesi EM, Moon RE and Bosco G (2024) *Front. Mar. Sci.* 11:1445692. doi: 10.3389/fmars.2024.1445692

In a recent interesting study (Paganini et al., 2024), arterial PO_2 was measured while diving to 15 m and 42 m of freshwater (mfw). It was explored whether calculation of arterial PO_2 at depth could use the arterial/alveolar [partial pressures of oxygen ratio (a:A ratio)] at 1 ATA, as suggested by Moon et al. (1987). The a:A ratio calculated from the baseline arterial blood gases obtained at rest, out of the water, adequately predicted the PaO_2 at depth. However, at the greater depth of 22 mfw, the calculation proved to be inaccurate. In addition, Weaver and Howe (1992) presented higher PaO_2 than that predicted by the a:A ratio.

Although the slower diffusion while breathing dense gas should increase the alveolar–arterial difference in PO_2 (A-a)DO_2, it is well documented that breathing dense gas begets an opposite result and reduces the (A-a)DO_2. During the breathing cycle, pressure reduction at inspiration causes an increase in venous return. Thus, during normal breathing, lung perfusion increases by 18% at inspiration. With the increase in gas density, breathing resistance is increased, and so there is an increase in pressure swings during the breathing cycle. This would cause an increase in tidal perfusion in the lung. When the increase in alveolar PO_2 during inspiration meets an increased perfusion, higher oxygenation is expected. Thus, the decrease in (A-a)DO_2 can be related to better timing

between perfusion and elevated PAO_2. Modeling this assumption in a single-compartment lung, Arieli and Farhi (1985) presented that at dense gas breathing, (A-a)DO_2 was reduced by 2 torr. Expanding the model to nine vertical differently perfused lung compartments, Arieli (1992) calculated a decreased (A-a)DO_2 by 4–5 torr. The increase in cycling perfusion of the lung at a high pressure would explain why the a:A prediction would be inaccurate at the high pressure. Therefore, I claim that in any discussion of arterial PO_2 at high pressure, cycling perfusion in the lung must be considered.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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