Decompression sickness after a chamber dive to 18 msw for 100 min

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Background

This case study details a reported DCS following an 18 m chamber dive for 100 min. The dive was performed as part of a study on the effects of multi-day dives using the same hyperbaric profile on intra-individual bubble production.

Methods

Twelve experienced recreational divers of both genders were recruited to the study. Following a dive medical examination, one of the participants was excluded from the study population due to poor lung function. The remaining 11 divers were scheduled for four dives each, with at least 72 hrs between each dive.

The dive profile was 100 min at 18 m, following the Norwegian Dive and Treatment tables, which requires a 5 min decompression stop at 6 m and a 15 min stop at 3 m.

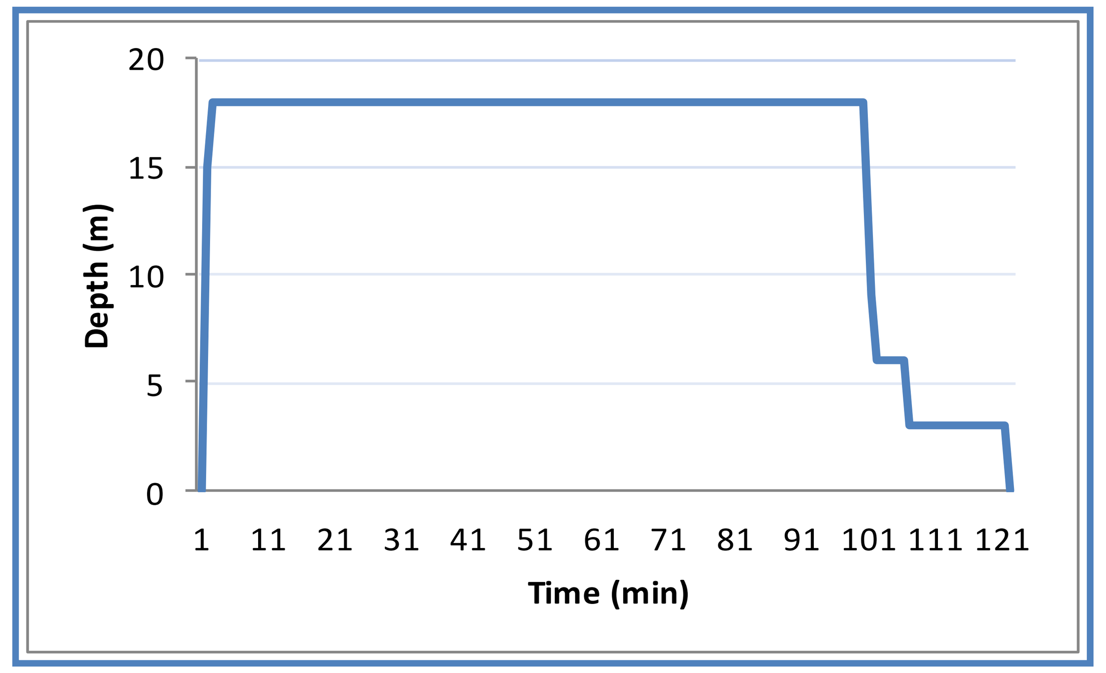
Following the dives, echosonography of the heart was performed every 5th minutes for the first 30 min, and then every 15th min for a total of 120 min. The bubble load was graded using the Eftedal-Brubakk scale (1). Following the echosonography, flow mediated dilation (FMD) measurements were made on the brachial artery, and blood samples were taken.

Diver ID	Sex	Age	Weight (kg)	Height (cm)	VO2 (L/min)	VO2 max	BP	HF peak
1	M	20	55.5	185	3.12	56.2	118/86	213
2	M	36	79.5	180	3.94	49.6	149/85	188
3	M	39	76.0	172	3.78	49.1	151/82	182
4	F	47	60.9	157	2.07	34.0	123/80	183
5	M	27	74.9	186	4.59	61.2	129/69	235
6	F	42	88.0	174	3.32	37.7	149/105*	184
7	M	32	95.5	189	5.08	53.2	122/71	185
8	M	32	83.1	185	4.25	51.1	126/81	198
9	M	44	93.5	183	4.35	46.5	157/106*	196
10	M	30	69.4	175	4.32	62.3	128/79	188
11	M	22	65.3	180	3.75	57.4	141/80	194
Mean		34	76.5	179	3.87	50.8		195
SD		9	13.0	9	0.82	8.9		16

Table adapted from: Eftedal et. al (submitted) - Evaluatin PAI-1 as a biomarker for stress in diving: human serum total PAI-1 is unaltered after 2 h dry exposures to 280 kPa hyperbaric air

Norwegian Diving and Treatment Tables, 18 m profile (2)

- Descent to 18 m, remain at depth for 100 min.
- Descent rate was 15 m/min
- Ascent to first stop—6 m for 5 min
- Ascent to second stop—3 m for 15 min
- Ascent rate 9 m/min
- Total dive time 121 min

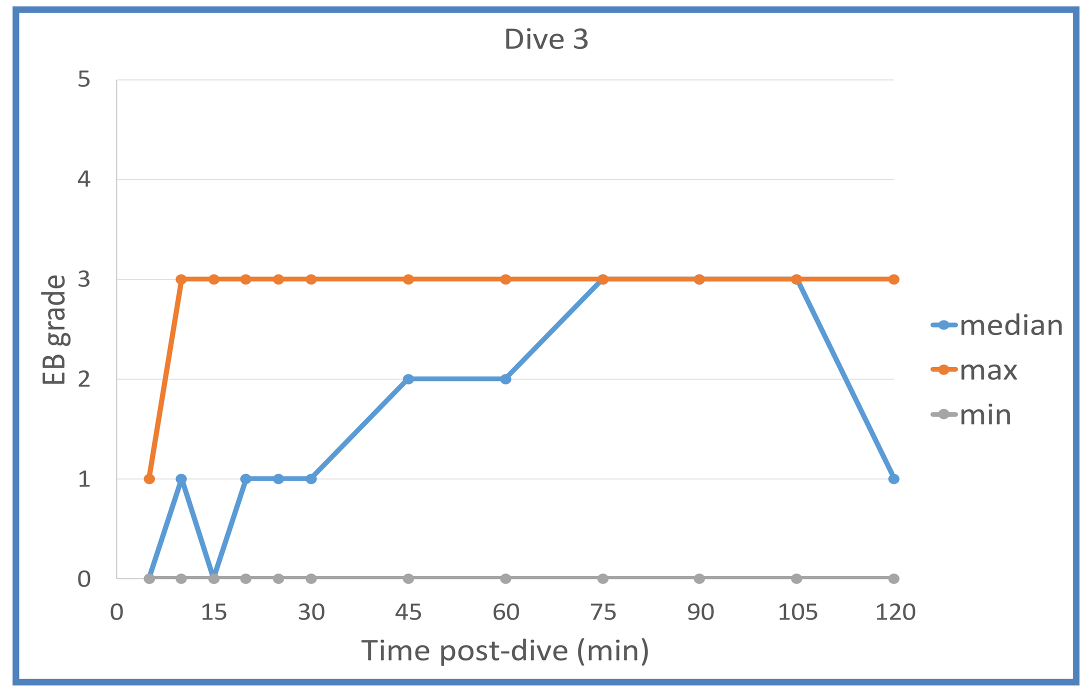


Results

The subject of this case was participating in the third scheduled dive. No echosonography was carried out, as the subject had missed out on the second scheduled dive. Immediately after the dive, the subject was fine and did not report any problems. Blood samples were taken, and after 4.5 hrs the subject went home feeling well.

Approximately 24 hrs following the dive, the subject was in contact with the study leader and reported feeling cold in both feet with bilateral pain in his ankles. As DCS could not be ruled out, the diver was transported to the chamber facility. At 32 hrs after the dive, just before treatment, the symptoms and signs had increased to include pain in both ankles, left knee and elbow, with a slight left sided paresis in elbow, hip, knee and ankle.

Initial treatment following US Navy Table 6 brought partial improvement. The subject was consequently t ransported to Haukeland University Hospital in Bergen, where the regional treatment facilities for treatment of decompression sickness are located. After three additional treatments (100% oxygen for 90 min daily at 2.4 ATA) the diver was symptom free. MRI of cerebrum and spinal cord did not reveal pathological findings.



Dive 3 graph

- Bubble-grades after dive 3 from all participants
- Max EB grade post-dive was 3
- Min EB grade post-dive was 0

Summary

The cause of this outcome is interesting for a number of reasons. The profile used requires decompression, and although limited, a residual risk of DCS remains.

However, the subject missed his second dive due to involvement in a car crash (in which the car was destroyed), after which he said he felt fine. The next day, he made the dive before he returned home. During the evening, he shoveled snow for about two hours wearing ankle-exposing shoes. He reported feeling cold in his feet for the rest of the night.

Coldness and laborious physical activity, well known risk-factors for DCS, may thus have triggered the development of DCS.

The car crash confused the diagnostic considerations, especially regarding the symptom ”pain” (traumatic vs. DCS). However, the additional sympotms and gradual therapeutic response point to a combination of joint and central nervous system DCS as the correct diagnosis. The subject is currently symptom-free.

Conclusion

The case highlights the fact that despite diving according to the table, a small risk of DCS remains. However, limited control of subjects' post dive activities can further increase the risk for DCS. Both factors must be taken into account for research projects on human divers.

References

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