Title: Protective effect of oxygen and heliox breathing during development of spinal decompression sickness

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Abstract: A rat model of spinal decompression sickness (DCS) allows study of spinal cord function for at least 3 h after decompression to 1 atm abs (101 kPa) after an exposure to air at 3.8 atm abs (385 kPa) for 1 h. During these 3 h, spinal evoked potentials (SEPs) elicited by peroneal nerve stimulation may be reduced or disappear, and histologic lesions in the spinal cord are observed. Three groups of animals were given either air, oxygen, or heliox (80/20) to breathe at 1 atm abs for 3 h after decompression. Both oxygen and heliox breathing impeded the development of DCS significantly as judged by the mortality of the animals and disappearance of the SEPs. The effect of heliox seemed to be superior to that of oxygen. The latency time from stimulation to the first SEP peak increased significantly during both air and oxygen breathing, whereas no significant increase was seen during heliox breathing. Histologic examination of the spinal cords of animals breathing air, oxygen, or heliox (80/20) showed focal lesions in the white and gray matter. In the white matter, degenerated myelin sheaths as well as expanded extracellular spaces compatible with bubble formation were seen. In the gray matter, perikaryal degeneration was

observed. The extracellular space in the white matter was increased in all decompressed animals compared with controls ($P < 0.01$). Oxygen and heliox breathing caused a smaller increase in extracellular space as compared with air-breathing animals ($P < 0.05$) and ($0.10 > P > 0.05$), respectively. It is concluded that breathing of oxygen or heliox (80/20) at 1 atm abs has a preventive effect on the development of DCS when compared with air breathing; the effect of heliox seems to be superior to that of oxygen.

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