

Acclimatization to neurological decompression sickness in rabbits

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摘要

Abstract

Diving acclimatization refers to a reduced susceptibility to acute decompression sickness (DCS) in individuals undergoing repeated compression-decompression cycles. We demonstrated in a previous study that the mechanism responsible for this acclimatization is similar to that of stress preconditioning. In this study, we investigated the protective effect of prior DCS preconditioning on the severity of neurological DCS in subsequent exposure to high pressure in rabbits. We exposed the rabbits ($n = 10$) to a pressure cycle of 6 absolute atmospheres (ATA) for 90 min, which induced signs of neurological DCS in 60% of the animals. Twenty-four hours after the pressure cycle, rabbits with DCS expressed more heat-shock protein 70 (HSP70) in the lungs, liver, and heart than rabbits without signs of disease or those in the control group ($n = 6$). In another group of rabbits ($n = 24$), 50% of animals presented signs of neurological DCS after exposure to high pressure, with a neurological score of 46.5 (SD 19.5). A course of hyperbaric oxygen therapy alleviated the signs of neurological DCS and ensured the animals' survival for 24 h. Experiencing another pressure cycle of 6 ATA for 90 min, 50% of 12 rabbits with prior DCS preconditioning developed signs of DCS, with a neurological score of 16.3 (SD 28.3), significantly lower than that before hyperbaric oxygen therapy ($P = 0.002$). In summary, our results show that the occurrence of DCS in rabbits after rapid decompression is associated with increased expression of a stress protein, indicating that the stress response is induced by DCS. This phenomenon was defined as "DCS preconditioning." DCS preconditioning attenuated the severity of neurological DCS caused by subsequent exposure to high pressure. These results suggest that bubble formation in tissues activates the stress response and stress preconditioning attenuates tissue injury on subsequent DCS stress, which may be the mechanism responsible for diving acclimatization. Copyright 2004 American Physiological Society