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Title: Dyspnea in divers at 49.5 ATA: mechanical, not chemical in origin

Authors: Spaur, WH
Raymond, LW
Knott, MM
Crothers, JC
Braithwaite, WR
Thalmann, ED
Uddin, DE

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Abstract: Pulmonary function was studied in six divers living in a hyperbaric chamber at a pressure nearly fifty times normal (49.5 atmospheres absolute (ATA), equivalent to 488 m or 1600 ft seawater (fsw)). As expected, ventilatory function was reduced. At 49.5 ATA, maximum voluntary ventilation (MVV) was 45percent less than the control value. Instantaneous rates of gas flow during forced expiration were similarly reduced, especially those flow rates measured high in the lung volume. These reductions occurred despite an apparent increase in functional residual capacity (FRC) and the use of transpulmonary pressures considerably greater than those exerted during the same maneuvers at normal (sea-level) pressure. During underwater work at 49.5 ATA, the divers rapidly became exhausted at moderate levels of oxygen consumption (1.9 liters/min), showing severe dyspnea and impending syncope. These symptoms were not due to retention of carbon dioxide, nor to hemodynamic or metabolic causes. Thus, dense gas breathing, like asthma, exemplifies a state in which severe dyspnea may occur with normal or low arterial carbon dioxide and normal oxygen transport. The physiological

	adjustments the divers employed were similar to those seen in acute asthma, imposing an elastic load in addition to the flow-resistive work of breathing a gas mixture eight times as dense as air. Although men can do moderate work under conditions similar to those of this experiment, they will have only a limited physiological reserve available to meet the possibilities of emergencies or respiratory infections.
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