Title: Effects of hydrostatic pressure, H2, N2, and He, on beating frequency of rat atria

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Abstract: Hydrostatic compression to 15 MPa caused a drop in spontaneous beating frequency (BF) of isolated rat atria kept in tris solution at 37 degrees C by 30.6 +/- 7.2%. Introduction of superfusing solutions equilibrated with hydrogen (PH2: 4.9, 9, and 14 MPa, respectively), increased the BF in proportion to the hydrogen content. A hydrogen partial pressure equal to the hydrostatic pressure was calculated to reduce the bradycardia by 52.0 +/- 19.5%. Effects of nitrogen (PN2: 5 and 14 MPa) and helium (PHe: 13 and 14 MPa) were also tested. Nitrogen was found to be 1.7-2 times and helium 0.2 times as effective as hydrogen in reducing the bradycardia. Preparations compressed at 27 degrees C exhibited a more pronounced bradycardia than those kept at 37 degrees C, but 5 MPa N2 and 9 MPa H2 reversed the bradycardia to the same extent at 27 degrees C as at 37 degrees C. Tests with 4 MPa H2 showed the effect on BF to be similar, whether the gas was added during an intermediate stop in the compression (4.6 MPa) or at 10 MPa pressure. An additional hydrostatic pressure increase from 10 to 12.5 MPa eliminated the BF increase of 4 MPa hydrogen added at 10 MPa. The findings are discussed in view of the possible use of hydrogen as a breathing gas in deep sea diving.

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