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The effect of hypoxia on intra-ocular, mean arterial, retinal venous and ocular perfusion pressures

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Abstract: INTRODUCTION: High altitude hypoxia is linked to decreased blood oxygen saturation with a related increase of Endothelin-1 (ET-1) blood plasma levels. As a consequence of such elevated ET-1 levels, alterations of retinal venous and ocular perfusion pressures are suspected. PURPOSE: To measure the effect of hypoxia on intra-ocular pressure, mean arterial pressure, retinal venous pressure and to calculate ocular perfusion pressure. METHOD: An experimental, prospective cohort study with 33 healthy subjects was conducted in which the subjects were confronted with long-term (days) environmental hypoxia at high altitudes. Mean arterial pressure, arterial blood oxygen saturation, intra-ocular pressure, retinal venous and ocular perfusion pressure were measured at 300 m/1'000 ft (baseline), 4200 m/13'800 ft and 6000 m/19'700 ft above sea level. RESULTS: Arterial oxygen saturation ($-13.06\% \pm 4.69$, $p < 0.001$; $-23.46\% \pm 5.7$, $p < 0.001$), retinal venous pressure ($+7.16 \text{ m Hg} \pm 8.2$, $p < 0.001$; $+9.9 \text{ mm Hg} \pm 8.5$, $p < 0.001$) and ocular perfusion pressure ($-8.49 \text{ mm Hg} \pm 10.6$, $p < 0.001$; $-6.02 \text{ mm hg} \pm 11.2$, $p = 0.006$) changed significantly from baseline at both high altitude of 4200 and 6000 m. Intra-ocular pressure did not change significantly at all altitudes ($+1.16 \text{ mm Hg} \pm 4.5$, $p = 0.227$; $+0.84 \text{ mm Hg} \pm 4.8$, $p = 0.286$) and mean arterial pressure changed significantly only at an altitude of 6000 m ($+3,8 \text{ mm Hg} \pm 21.1$, $p = 0.005$) from baseline. CONCLUSION: As hypoxia increases with higher altitude, arterial oxygen saturation and ocular perfusion pressure decreased, retinal venous pressure increased, intra-ocular pressure remains stable and mean arterial pressure was elevated only at 6000 m. **Keywords:** Hypoxia, intra-ocular pressure, retinal venous pressure, ocular perfusion pressure, mean arterial pressure, Endothelin, Ophthalmo-Dynamometry, high altitudes, hypobaric