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High Altitude Physiology and Medicine

21

Circulatory Flow of Oxygen Returning to the Lung During Submaximal Exercise in Altitude Residents

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During muscular exercise the product of the cardiac output ($\dot{Q}$) and the mixed-venous concentration of oxygen ($C\bar{v}_{O_2}$) is constant and independent of the oxygen uptake ($\dot{V}_{O_2}$) (2).

This flow of oxygen returning from the tissues to the lung ($\dot{Q} \cdot C\bar{v}_{O_2}$) is modified by exposure to natural or simulated altitude (Fig. 21-1). In subjects acutely exposed, $\dot{Q} \cdot C\bar{v}_{O_2}$ remains independent of $\dot{V}_{O_2}$, but at a lower level than at sea level. In altitude residents, however, $\dot{Q} \cdot C\bar{v}_{O_2}$ is larger than in sea level residents since polycythemia overcompensates the decrease in arterial oxygen saturation. When a hyperoxic mixture is given, in order to reach an inspired oxygen partial pressure equal to that of sea level, $\dot{Q} \cdot C\bar{v}_{O_2}$ rises above its control value, since cardiac output does not decrease or decreases only slightly. This observation favors the assumption that metabolic demand or oxygen content in mixed-venous blood plays little or no role in cardiac control during exercise.

References

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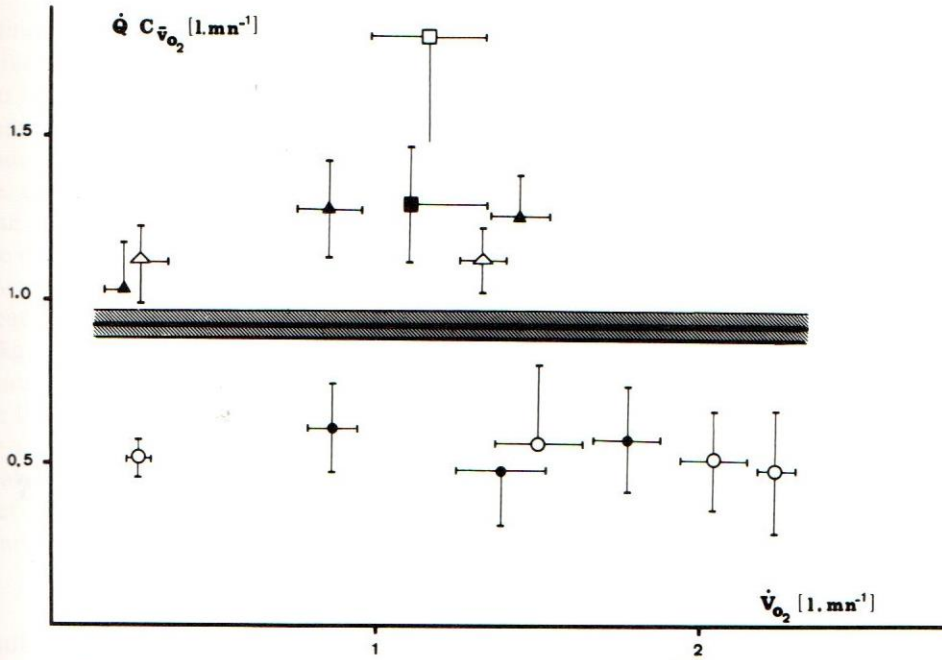
Fig. 21-1. Flow of oxygen returning from the tissues to the lungs ($\dot{Q} \cdot C\bar{v}_{O_2}$) as a function of oxygen consumption ($\dot{V}_{O_2}$) at rest and during submaximal muscular exercise: in sea level dwellers translocated to 3800 m ($\bigcirc$) or at simulated altitude of 4000 m ($\bullet$; data from Stenberg et al. (3)); in altitude residents at 3800 m ($\blacktriangle$) and 4350 m ($\triangle$; data from Banchero et al. (1); and in altitude residents at 3800 m breathing room air ($\blacksquare$) and a hyperoxic mixture: P_{IO_2}, 160 torr; kPa, 21.3 ($\square$). Mean values and standard deviations. The horizontal line and shadowed area indicate mean value and standard error obtained in sea level dwellers at sea level.