Alveolar-arterial gas tension differences during graded exercise

BRIAN J. WHIPP AND KARLMAN WASSERMAN

Respiratory Disease Division, Harbor General Hospital, Torrance, California 90509; and University of California School of Medicine, Los Angles, California 90024

Whipp, Brian J., and Karlman Wasserman. Alveolar-arterial gas tension differences during graded exercise. J. Appl.Physiol. 27(3) 361-365. 11969

Five normal male subjects performed graded exercise on a cycle ergometer to the point of exhaustion. Each level of exercise was kept constant for 6 min, at the end of which arterial blood was sampled for the purpose of obtaining measurements of alveolar-arterial oxygen difference ((A-a)PO2) and arterial- end-tidal CO2 difference ((a-ET)PCO2). Simultaneous measurements of oxygen consumption, carbon dioxide production, physiological dead space, and minute ventilation were made. (A-a)PO2 decreased as work intensity increased until the very heavy work intensities were reached. Thereafter (A-a)Po2 increased. In contrast to the biphasic change in (A-a)PO2, (a- ET)PCO2 decreased as described in previous studies. The combined observations suggest that the initial reduction in (A-a)PO2 is due to evening of ventilation-perfusion relationships throughout the lungs, whereas the secondary increase observed at very heavy work rates is possibly due to a greatly reduced oxygen tension in the venous blood of a normal small anatomical shunt or a diffusion limitation to 02 transport. The data indicate that during sea-level exercise diffusion might limit 02 transport only at the very heavy work rates and then to such a small degree as to not affect 02 content significantly.

alveolar-arterial 02 tension difference; arterial-end-tidal CO* tension difference; graded exercise; ventilation-perfusion relationships