D1

The measurement of cardiac power output using a non-invasive rebreathing method

L.D. Hodges, D. Jakovlijevic and D.A. Brodie

Research Centre for Health Studies, Buckinghamshire Chilterns University College, Buckinghamshire, UK

Tan (1987) has advocated the use of cardiac power output as an overall measure of cardiac function because it includes both pressure and flow in its determination. It is not only a major determinant of exercise capacity but is also a powerful predictor of prognosis in patients with heart failure. The method requires careful management, especially as many patients will have compromised cardiovascular systems in which repeat testing could be burdensome. This demonstration will explain the procedure in detail and give the opportunity for methodological discussion. The first stage is to assess peak oxygen consumption on a breath by breath basis using standard on-line expiratory gas analysis, e.g. CardiO2 (Medical Graphics Corp., St Paul MN, USA). Following an adequate rest period (usually a minimum of 30 min), patients are rapidly brought to within 5% of the previous peak oxygen consumption and cardiac output is measured using the exponential carbon dioxide rebreathing method (Defares, 1958). This involves the subject breathing the gas mixture from a 6 l anaesthetic bag at a rate of 40 breaths per second for a maximum of 15 seconds, during which an exponential capnograph trace is produced. This demonstration will show how the open circuit CO_2 rebreathing system is switched to a closed circuit CO_2 rebreathing system using a two-way valve. The first and last breaths are normally discarded and the angle of the slope of the interpolated peaks is the key to assessing cardiac output. Cardiac power output is then calculated by CPO = (QT x MAP)x K, where CPO is the cardiac power output in watts (W), QT is the cardiac output in l min^{-1}, MAP the estimated mean arterial pressure in mmHg, and K the conversion factor (= 2.22 x 10^{-3}) (Cooke et al. 1998). The demonstration will conclude by comparing the alternative methods of measuring cardiac output and showing that the CO_2 rebreathing procedure is both effective and minimally intrusive.

Cooke GA, Marshall P, Al-Timman JG, Wright DJ, Riley R, Hainsworth R & Tan LB (1998). Heart 79, 289-294.

Defares, JG (1958). J App Physiol 13, 159-164.

Tan LB (1987). Cardiovasc Res 21, 615-622.

Where applicable, the authors confirm that the experiments described here conform with the Physiological Society ethical requirements.