THREE DIFFERENT REBREATHING METHODS FOR MEASURING CARDIAC OUTPUT AT REST

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Introduction: The non-invasive determination of cardiac output (Qt) is of value in human physiology, especially clinical cardiology. Popular methods today are the carbon dioxide (CO2) rebreathing method (or indirect Fick) and inert gas (nitrous oxide and sulphur hexafluoride) rebreathing method. The indirect measurement of mixed venous partial pressure of carbon dioxide (PCO2) using CO2 rebreathing technique can be estimated by the exponential method described by Defares (1) or by the equilibrium method described by Collier (2). Previous studies comparing the equilibrium and exponential method during both rest and exercise have produced significantly different results. The aim of the present study was to examine any differences between the equilibrium, exponential and inert gas rebreathing method for measuring Qt at rest and to evaluate reproducibility of these three methods. Methods: Following local ethics committee approval and informed consent, 17 healthy adults (10 males and 7 females, means and SD, age 37 + 11 years, height 172 + 8.8 cm, weight 74 + 17.3 kg) visited the exercise laboratory on separate days. Qt was measured in a sitting position. Two measurements were repeated with a five minutes rest. The exponential and the equilibrium methods were performed using an automated gas analyser (CardioO2, Medical Graphic Corp, St Paul MN, USA), while the inert gas rebreathing method was performed using the Innocor (Innovation, Denmark) metabolic system. Results: One-way ANOVA revealed that Qt measured at rest was significantly different between the three methods. The exponential method produced significantly higher (p<0.01) estimates at rest (averaging 10.5 l.min-1) compared with the equilibrium method (averaging 6.4 l.min-1) and the inert gas rebreathing method (averaging 5.0 l.min-1). There was a non significant difference (p<0.05) in repeated measures for either method. The exponential method had a larger variability (5.3%) than the inert gas rebreathing method (4.8%), with the equilibrium method having the least variability (4.1%). Conclusion: Based on previous literature that the resting Qt for healthy adults is to be 5 l.min-1 (3), it is reasonable to say from this study that the inert gas rebreathing method is more valid than the exponential and equilibrium method for measuring Qt at rest. The data support existing evidence that the equilibrium method is more valid compared with the exponential (4). This study also showed that all three methods produced highly reliable values of resting cardiac output based on repeated measures.

References:
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