A NOVEL NON-INVASIVE METHOD OF ASSESSING CARDIOVASCULAR FUNCTION USING MAGNETIC RESONANCE AUGMENTED CARDIOPULMONARY EXERCISE TESTING

Poster Contributions
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Background: Reduced exercise capacity is a common feature of many cardiovascular diseases. Quantitative assessment of exercise capacity is usually achieved by conventional CPET measuring peak oxygen consumption (VO2). However this neglects different components of reduced exercise capacity namely reduced cardiac output (CO) and oxygen extraction (ΔcO2). This study aims to demonstrate a comprehensive approach to simultaneously measure VO2 and CO and then calculate ΔcO2.

Methods: 17 healthy volunteers (21-55 years) underwent Magnetic Resonance Cardiopulmonary Exercise Testing (MR-CPET). Exercise was performed on MR-compatible ergometer (Lode, Groningen, The Netherlands) and VO2 was assessed using a commercial respiratory gas analyser (Ultima, MedGraphics, St. Paul, USA) with a modified sampling tube that was MR compatible. Aortic flow was continuously measured using a previously validated UNFOLD-SENSE spiral PCMR sequence. Images were reconstructed using a graphical processing units card and analysed using an in-house plug-ins for OsiriX software. Conventional CPET was also performed within 2 weeks of MR-CPET. For both test, participants were asked to rate i) concern ii) comfort and iii) perceived helplessness.

Results: 15 out of 17 volunteers completed exercise; exclusions were due to claustrophobia (n=1) and inability to master exercise technique (n=1). Reported concern and discomfort was higher with MR-CPET, although still within acceptable limits. Peak VO2, peak VCO2 and VE showed strong correlation between conventional CPET and MR-CPET: VO2 peak (r=0.94, p<0.001); VCO2 (r=0.87, p<0.001); VE (r=0.88, p<0.001). Multiple linear regression analysis demonstrated that both peak CO and ΔcO2 were independent predictors of peak VO2 measured during MR-CPET (beta=0.73 and 0.38 respectively, p<0.001) and conventional CPET (beta=0.78 and 0.28 respectively, p<0.001).

Conclusion: MR-CPET is feasible, well tolerated and demonstrates physiology not apparent with conventional CPET. In this study, we have shown that MR-CPET allows assessment of the differing contributions of CO and ΔcO2 to variation in peak VO2.