



RESEARCH TO
PRACTICE 2018

27-29 MARCH 2018
BRISBANE, QUEENSLAND

CARDIOVASCULAR ORAL FREE PAPERS

Thursday, 29 March 2018

1:30pm – 3:00pm

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Influence of abdominal aortic aneurysm on physical activity levels and cardiorespiratory fitness in older adults

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Introduction and aims: Patients with small abdominal aortic aneurysm (AAA, 30-50 mm) are at an elevated risk of cardiovascular events and mortality compared with other cardiovascular disease populations and older adults. Greater cardiorespiratory fitness (VO_{2peak}) and levels of moderate-to-vigorous intensity physical activity (MVPA) are associated with reduced cardiovascular mortality in older adults. We aimed to determine the impact of AAA on MVPA and VO_{2peak} in patients (AAA, $n=22$, $74\pm 6y$; BMI 28 ± 4) compared with age-matched older adults (CON, $n=22$, $72\pm 5y$; BMI 26 ± 4).

Methods: Daily sitting, standing, stepping, energy expenditure (EE), and MVPA time were assessed with 7-day accelerometry. Participants also underwent an incremental cycling test for determination of VO_{2peak} . An independent *t*-test assessed differences between groups and relationships between variables were assessed via correlation (*r*).

Results: Time standing (AAA, 3.9 ± 0.9 h vs CON, 4.6 ± 1.6 h, $p=0.095$) and step count (7991 ± 2866 vs 9542 ± 2881 , $p=0.081$) were similar between AAA and CON. Sitting time was greater (10.3 ± 1.3 vs 9.4 ± 1.6 h, $p=0.047$), and EE (23.7 ± 1.2 vs 24.4 ± 1.1 MET.h, $p=0.044$) and MVPA (48 ± 25 vs 70 ± 38 min, $p=0.035$) were lower in AAA compared with CON. VO_{2peak} was lower in AAA compared with CON (19 ± 4 vs 28 ± 5 ml.kg⁻¹min⁻¹, $p<0.001$). VO_{2peak} was positively associated with MVPA ($r=0.57$, $p<0.001$), and negatively associated with sitting time ($r=-0.47$, $p=0.001$). An inverse association was observed between maximal AAA diameter, and MVPA ($r=-0.75$, $p<0.001$), EE ($r=-0.57$, $p=0.006$), and VO_{2peak} ($r=-0.36$, $p=0.052$).

Conclusion: Patients with AAA engage in a greater amount of sedentary behaviour and lower levels of MVPA compared to healthy older adults; which is strongly associated with poorer cardiorespiratory fitness and AAA diameter. Early interventions aimed at increasing MVPA and VO_{2peak} in patients with AAA may reduce the high risk of cardiovascular events and mortality in this population.



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Clinical Considerations for High Intensity Interval Training in Cardiac Rehabilitation

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Introduction: High intensity interval training (HIIT) is now recognised in cardiac rehabilitation (CR) exercise guidelines as an appropriate and efficient modality for improving cardiorespiratory fitness, a strong predictor of mortality. To date, HIIT in CR has focused on using objective measures of exercise intensity (such as heart rate (HR) rather than subjective measures (such as rating of perceived exertion (RPE)). RPE is more commonly used in Australian CR as few patients undertake a maximal exercise test to determine their true maximal HR. Additionally dose and timing of beta blockade medication can affect HR response, and adjustments often occur following commencement of a CR program. Our aim was to deliver HIIT using RPE in a hospital CR program, compare RPE with training HR, and develop a framework for prescribing HIIT in clinical settings.

Methods: As part of a randomised controlled trial, forty-two patients with coronary artery disease completed a 4-week HIIT CR program. HIIT involved 4 x 4 minute high intensity intervals at RPE 15-18 interspersed with 3 minutes of active recovery. Patients completed 2 supervised sessions per week and 1 home-based session per week. RPE and HR were monitored and recorded. Peak heart rate (HR_{peak}) was obtained from a maximal exercise test.

Results: Average training RPE for HIIT patients was 16, corresponding to an average training HR of 92% HR_{peak} . Adherence to the prescribed exercise high intensity intervals was high (86%). A framework was developed containing instructions for how to use objective and subjective measures of exercise intensity together to validate high intensity target zones. The framework also highlights the limitations of using HR as the sole measure for prescribing exercise intensity in clinical populations.

Conclusion: HIIT can be delivered effectively using RPE in a CR program. We aim to present a framework and discuss the clinical considerations for HIIT in CR.





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Does the initial exercise intensity prescribed relate to the exercise capacity of cardiac rehabilitation patients?

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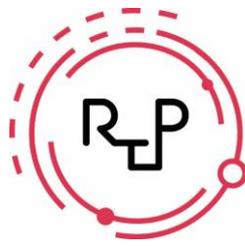
Introduction & aims: Current Australian guidelines for exercise prescription in cardiac rehabilitation do not include standardised determination of aerobic exercise capacity, or discriminate between the treatments received or current exercise capacity of individuals. This study investigated the initial exercise intensity prescribed to patients in a cardiac rehabilitation program in relation to their exercise capacity.

Methods: Patients were categorised as surgical (CABG or valve surgery) or non-surgical (PCI or medical management), and as younger (< 65 years) or older (≥ 65 years) within each treatment category. Exercise capacity was determined by an incremental shuttle walking test (ISWT), with METs calculated from the total distance walked. Aerobic exercise training, including walking and stationary cycling, was prescribed in accordance with the Australian cardiac rehabilitation guidelines. The intensity of aerobic training over the first four exercise sessions was calculated using the ACSM metabolic equations for walking and leg cycling.

Results: Mean (95% CI) exercise capacity was statistically different between surgical (5.7 (5.3 to 6.1) METs) and non-surgical (6.4 (6.0 to 6.8) METs) patients. However, initial training intensities (3.2 (3.1 to 3.4) METs and 3.4 (3.3 to 3.5) METs respectively) were not significantly different. Younger non-surgical patients were prescribed higher exercise intensity than their older counterparts ($p = 0.011$). Despite differences in exercise capacity, there was no difference in the initial exercise intensity between younger and older surgical patients ($p = 0.638$).

Conclusion: Although the exercise capacity of surgical patients was lower than non-surgical patients, the initial aerobic exercise intensity prescribed for rehabilitation was not statistically different. Cardiac rehabilitation clinicians appear to consider symptoms, comorbidities and age before exercise capacity, measured by ISWT, when determining initial exercise intensity.





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Effects of impaired glucose tolerance on whole limb vs. microvascular blood flow during exercise: a pilot study

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Introduction/Aims: Reduced muscle blood flow during exercise is recognised as a potential mechanism for exercise intolerance in individuals with abnormal glucose metabolism. This pilot study sought to determine whether exercise blood flow may be differentially affected at the whole limb- or microvascular level in the setting of pre-diabetes.

Methods: Seventeen healthy older (50+ years) males were screened for prediabetes (oral glucose tolerance test) as part of a comprehensive cardiovascular risk assessment (including cardiorespiratory fitness testing by treadmill VO_2max). Calf blood flow was assessed during light-intensity contractile exercise (plantar flexion; ~25% of 1-repetition maximum) – at the whole-limb level (venous occlusion plethysmography) and at the microvascular level (contrast-enhanced ultrasound imaging).

Results: Of the 17 participants, normal vs. impaired glucose tolerance (NGT vs. IGT) was identified in 11 and 6 individuals, respectively (none had impaired fasting glucose). Groups were well-matched according to age, body mass index, blood pressure, treadmill VO_2max , and calf muscle strength (1-repetition maximum). Exercising calf blood flow trended lower in the IGT group at the whole limb level ($18 \pm 25\%$ lower; $p=0.47$) and the microvascular level ($25 \pm 14\%$ lower; borderline significant at $p=0.093$) compared with NGT. However, there was no apparent divergence in the extent of reduction between whole-limb and microvascular flow ($p>0.10$; based on a comparison of between-group differences in blood flow expressed as z-scores [i.e. for scale standardisation across the two techniques]).

Conclusions: Despite micro- rather than macro-angiopathy tending to be a more prominent/earlier feature of prediabetes/diabetes, our pilot data indicated no mismatch between exercising blood flow measured at the microvascular level as compared with whole-limb flow.





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The effects of combined aerobic and resistance exercise training in adults with a history of a Fontan procedure

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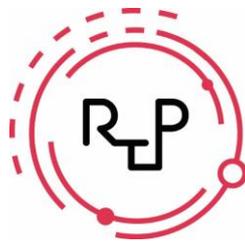
Introduction & Aims: Children born with a single heart ventricle can survive well into adulthood following the Fontan procedure, but have impaired exercise capacity which adversely affects quality of life and clinical outcomes. The aim of this pilot study was to investigate the feasibility and efficacy of community-based exercise in this group.

Methods: 12 participants (6 males), aged 26.9±5.6 yrs (mean±SD) with a history of a Fontan procedure completed a multiple baseline study with assessment at entry, after 12 weeks of usual activity (control) and subsequently following 12 weeks of combined aerobic (70-80% maximum measured HR) and resistance (50-70% 1RM) exercise. Exercise was undertaken at a community gym prescribed by an AEP. Aerobic capacity (peak oxygen consumption; VO_2peak), quadriceps and biceps torque (Biodex), flow-mediated dilatation (FMD) and self-efficacy were measured at each time-point. Anthropometry (DEXA) and 1RM strength for 7 exercises involved in training were measured pre- and post-training. Statistical analysis was performed using general linear models with Bonferroni post hoc correction. Statistical significance was set at $P < 0.05$.

Results: No adverse events occurred during training. VO_2peak increased from pre- to post-training (26.4±7.7 vs 29.4±8.0ml/kg/min; $P < 0.05$) with the difference between intervention and control periods approaching significance ($P = 0.06$). Combined 1RM strength increased (251±156 vs 305±188kg), but quadriceps and biceps torque, FMD, lean body mass and self-efficacy were all unchanged from pre- to post-training.

Conclusion: Community-based exercise training is feasible and well tolerated in adults with a history of a Fontan procedure and is associated with improved aerobic capacity. In this condition with limited medical options, exercise training is feasible in a non-clinical setting and may be an important therapeutic intervention. Larger trials of community exercise training are warranted in the Fontan population.





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Predicting VO₂max from a perceptually-regulated exercise test (PRET): effect of sympathetic blockade

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The rating of perceived exertion (RPE) is often taken but seldom used as the controlling variable during exercise testing. Studies have shown the efficacy of the submaximal perceptually-regulated exercise test (PRET) to predict maximal oxygen uptake independent of heart rate response. However it remains unclear whether this protocol is affected by chronotropic medications. This study aimed to compare effects of β -blockade on predictions of VO₂max from a PRET compared to conventional heart rate (HR) based methods.

Sixteen healthy adults (27 \pm 3 years) completed a graded exercise test (GXT) and PRET, each under beta-blockade (oral 100mg Metoprolol) and placebo conditions. Participants were exposed to the condition 60 min prior to testing and were blinded to condition allocation. The PRET protocol comprised four 3-min bouts at self-regulated intensities of RPE 9, 11, 13 and 15 on the Borg 6-20 RPE scale. In all tests, HR and VO₂ were measured continuously RPE measured each minute. VO₂ at the end of each stage were regressed against the corresponding RPE and extrapolated to RPE 19/20. Similarly, predictions were made to age-predicted HRmax using Tanaka's equation and Brawner's adjusted equation for use in β -blockade.

VO₂max and HRmax during the GXT were 7 and 20% lower with β -blockade. Repeated measures ANOVA showed no difference across conditions for VO₂max predicted from RPE values, but significantly higher predictions from HR measures during control trials. Predictions based on RPE accurately predicted VO₂max in both conditions, while predictions to Tanaka's HRmax significantly overestimated VO₂peak during the experimental condition and predictions to Brawner's HRmax significantly underestimated during the control condition.

Predictions of VO₂max from PRET appear to remain stable during β -blockade, despite large fluctuations in HR response. These findings have significant implications for exercise testing in clinical populations and those taking chronotropic medications.

