CREM

Collaborative Research into Exercise as Medicine

Canterbury Christ Church University

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The Relative Measure of Oxygen Uptake Alone is not a Good Indicator of Exercise Intensity in Male Post-Myocardial Infraction Patients

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INTRODUCTION

Where possible direct measures of VO_2 for determining exercise intensity in cardiac patients are recommended (1). However, Heart failure patients have been found to produce reduced oxygen consumption per watt of work compared to healthy controls compensated for during recovery (2-4) as EPOC, showing them to be less efficient (4). To our knowledge this has not been widely investigated in post-myocardial infarction (MI) patients, who make up the majority of cardiac patients (5). Therefore the aim of this study was to explore differences in VO_2 parameters during and post cycle ergometry.

ABSTRACT

OBJECTIVE: Measurements of excess post exercise oxygen consumption (EPOC) in post-myocardial infarction (MI) patients have not been widely reported. Therefore the study aim was to explore whether post-exercise measures in post-MI males extended our understanding of exercise intensity in these patients.

PARTICIPANTS: 15 male post-MIs (mean±SD, 64.4±6.5, range 53-73 yrs) from phase IV cardiac rehabilitation and 16 healthy male controls (63.0±6.4, range 51-73 yrs) participated.

METHODS: Participants performed a graded cycle ergometre test (CET) at 50, 75 and 100 watt followed by 10 minutes active (50 watts) and 22 minutes seated recovery. Throughout participants' heart rate (beat/min) (HR), ratings of perceived exertion (RPE) and expired air parameters were measured.

RESULTS: Throughout compared to controls, post-MIs HR values were lower, related to ß-blocker medication ($P<0.05$). Analysis comparing lines of regression showed: During CET: Post-MIs worked at a higher percentage of their anaerobic threshold (AT) ($P<0.01$), with significantly lower oxygen uptake (VO_2) (ml/kg/min) ($P<0.01$) and higher RPE ($P<0.01$). Active recovery (from 100 to 50watts): Post-MIs displayed higher kcal/LO_2/min ($P<0.05$). Seated recovery: Post-MIs showed higher RER ($P<0.01$), VCO_2 L/min ($P<0.05$), and kcal/LO_2/min ($P<0.01$).

CONCLUSION: Despite post-MIs lower VO_2 values during CET they were in fact working at a greater percentage of their AT than the controls, reflected by post-MIs higher RPE values. The post-exercise measures also showed post-MIs to have greater EPOC, increased use of anaerobic processes and expended greater amounts of energy. Therefore AT, RPE and post-exercise measures should be a consideration when determining exercise intensity in post-MI patients.

METHODS AND RESULTS

Participants performed a graded cycle erogmetre test (CET) at 50, 75 and 100 watt followed by 10 minutes active (at 50 watts) and 22 minutes seated recovery. Throughout participants' heart rate (beat/min) (HR), ratings of perceived exertion (RPE) and expired air parameters were measured.

Analysis comparing lines of regression showed:

Throughout, post-MIs HR values were lower, related to ß-blocker medication ($P<0.05$).

During CET (Stage A): Post-MIs worked at a statistically significant higher percentage of their anaerobic threshold (AT) ($P<0.01$), with significantly lower oxygen uptake (VO_2) (ml/kg/min) ($P<0.01$) (see figure 1) and higher RPE ($P<0.01$) (see figure 2).

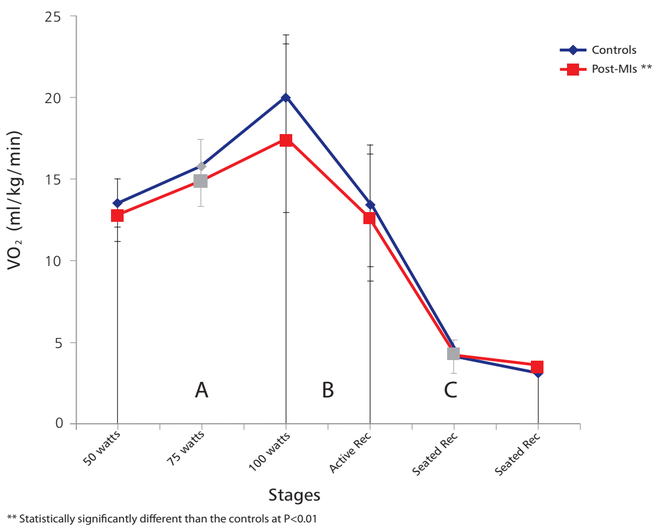
Active recovery (Stage B) (from 100 to 50watts): Post-MIs displayed higher kcal/LO_2/min ($P<0.05$) (see figure 3).

Seated recovery (Stage C): Post-MIs showed higher RER ($P<0.01$) (see figure 5), VCO_2 L/min ($P<0.05$), and kcal/LO_2/min ($P<0.01$) (see figure 4).

Table 1: Participant characteristics at baseline, mean±SD (range)

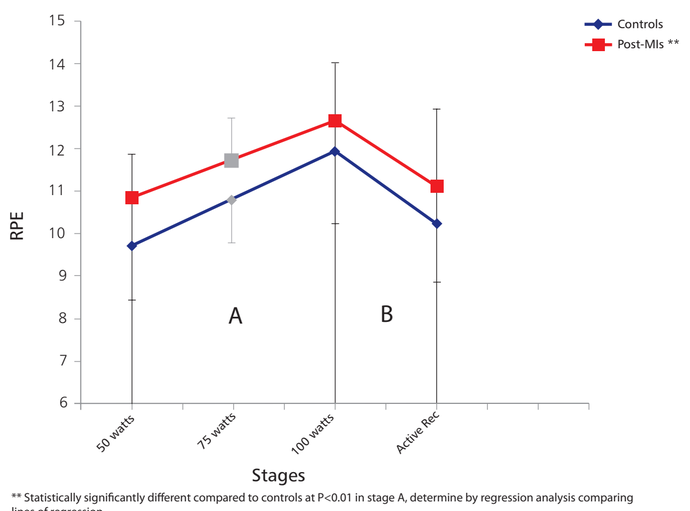
Participant characteristics	Post-MIs n=17	Non-cardiac n=17
Age (yrs)	64.4±6.5 (53-73)	54.9±8.0 (38-73)
Height (m)	1.78±0.06 (1.64-1.91)	1.76±0.07 (1.63-1.85)
Body Mass (Kg)	88.4±13.5 (64.5-113)	83.1±10.05 (65.5-98)
BMI (kg/m²)	27.7±3.7 (20.6-36.5)	26.6±3.2 (18.9-32.0)
Weekly physical activity • 30 min sessions at moderate intensity • 20 min ssesions at vigorous intensity	4.6±2.0 (1-7)** 1.6±1.2 (0-5)	2.8±1.8 (0-7) 1.4±1.5 (0.4)

**Statistically significantly different from controls at $P<0.01$, determined by one way ANOVA.



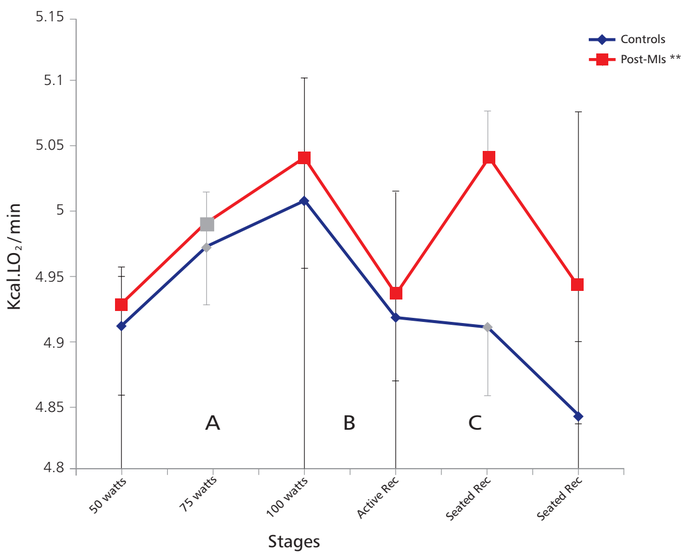
** Statistically significantly different than the controls at $P<0.01$

Figure 1: VO_2 (ml/kg/min) during CET and, active and seated recovery



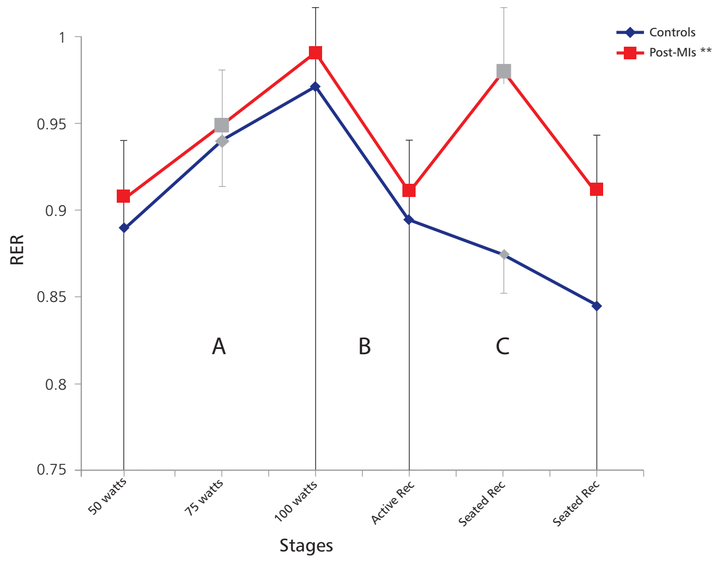
** Statistically significantly different compared to controls at $P<0.01$ in stage A, determine by regression analysis comparing lines of regression

Figure 2: Ratings of perceived exertion (RPE) during CET and active recovery



** Statistically significantly different compared to controls at $P<0.05$ in stage B & C, determine by regression analysis comparing lines of regression

Figure 3: Kcal (LO_2/min) during CET and, active and seated recovery



** Statistically significantly different compared to controls at $P<0.01$ in stage C, determine by regression analysis comparing lines of regression

Figure 4: Respiratory exchange ratio (RER) during CET and, seated and active recovery

SUMMARY AND CONCLUSION

Despite post-MIs lower VO_2 (ml/kg/min) during CET they were in fact working at a greater percentage of their AT than the controls, reflected by post-MIs higher RPE values. Post-exercise measures revealed post-MI to have greater EPOC, increased use of anaerobic processes and to have expended greater gross amounts of energy, indicating these post-MIs to be less efficient than the controls during the exercise. Consequently our findings indicate that using VO_2 measure alone are likely to under estimate exercise intensity and energy expenditure in post-MIs and therefore for these uses it is suggested that VO_2 measures be used in conjunction with other measures of exercise intensity/ energy expenditure.

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