



ORIGINAL ARTICLE

Cardiac rehabilitation after acute coronary syndrome: Do all patients derive the same benefit?



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KEYWORDS

Acute coronary syndrome;
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Abstract

Introduction: Cardiac rehabilitation (CR) has been demonstrated to improve exercise capacity in acute coronary syndrome (ACS), but not all patients derive the same benefit. Careful patient selection is crucial to maximize resources.

Objective: To identify in a heterogeneous ACS population which patients would benefit the most with CR, in terms of functional capacity (FC), by using cardiopulmonary exercise testing (CPET).
Methods: A retrospective analysis of consecutive ACS patients who underwent CR and CPET was undertaken. CPET was performed at baseline and after 36 sessions of exercise. Peak oxygen uptake (pVO_2), percentage of predicted pVO_2 , minute ventilation/ CO_2 production (VE/VCO_2) slope, VE/VCO_2 slope/ pVO_2 and peak circulatory power (PCP) (pVO_2 times peak systolic blood pressure) were assessed in two moments. The differences in pVO_2 (ΔpVO_2), % pVO_2 , PCP and exercise test duration were calculated. Patients were classified according to baseline pVO_2 (group 1, <20 ml/kg/min vs. group 2, ≥ 20 ml/kg/min) and left ventricular ejection fraction (group A, $<50\%$ vs. group B, $\geq 50\%$).

Results: We analyzed 129 patients, 86% male, mean age 56.3 ± 9.8 years. Both group 1 ($n=31$) and group 2 ($n=98$) showed significant improvement in FC after CR, with a more significant increase in pVO_2 , in group 1 (ΔpVO_2 4.4 ± 7.3 vs. 1.6 ± 5.4 ; $p=0.018$). Significant improvement was observed in CPET parameters in group A ($n=34$) and group B ($n=95$), particularly in pVO_2 and test duration.

Conclusion: Patients with lower baseline pVO_2 (<20 ml/kg/min) presented more significant improvement in FC after CR. CPET which is not routinely used in assessment before CR in context of ACS, could be a valuable tool to identify patients who will benefit the most.

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PALAVRAS-CHAVE

Síndrome coronária aguda;
Reabilitação cardíaca;
Prova de esforço cardiorrespiratória

Reabilitação cardíaca após síndrome coronária aguda – terão todos os doentes o mesmo benefício?**Resumo**

Introdução: A reabilitação cardíaca (RC) melhora a capacidade funcional (CF) de exercício na síndrome coronária aguda (SCA), contudo nem todos os doentes apresentam benefício idêntico. A criteriosa seleção de doentes é crucial para a rentabilização de recursos.

Objetivo: Identificar na população heterogénea de SCA quais os doentes que mais poderiam beneficiar em termos de capacidade funcional (CF) após programa de RC, através de prova de esforço cardiorrespiratória (PECR).

Métodos: Realizámos uma análise retrospectiva de doentes consecutivos com SCA que foram submetidos a RC e PECR. A PECR foi realizada previamente e após 36 sessões de treino de exercício. Parâmetros avaliados: consumo de oxigénio no pico (pVO₂), percentagem do pVO₂ previsto (%pVO₂), declive ventilação minuto/CO₂ produzido (VE/VCO₂), declive VE/VCO₂/pVO₂, potência circulatória no pico (PCP) (pVO₂ x pressão arterial sistólica no pico). Foram calculadas as variações de pVO₂ (Δ pVO₂). Os doentes foram analisados de acordo com o pVO₂ basal (G1 < 20 versus G2 \geq 20 ml/kg/min) e fração de ejeção do ventrículo esquerdo (FEVE) (GA < 50% versus GB \geq 50%).

Resultados: Analisámos 129 doentes, 86% homens, idade média 56,3 \pm 9,8 anos. Ambos, G1 (n=31) e G2 (n=98) apresentaram melhoria significativa na CF após RC, com maior aumento significativo de pVO₂ no G1 (Δ pVO₂ 4,4 \pm 7,3 versus 1,6 \pm 5,4; p=0,018). Verificou-se melhoria dos parâmetros da PECR em GA (n=34) e GB (n=95), particularmente no pVO₂ e duração da PECR.

Conclusão: Doentes com menores pVO₂ (<20 ml/kg/min) apresentaram, após programa de RC, melhoria mais significativa da CF. A PECR, que não é rotina na avaliação de SCA pré RC, poderá constituir um instrumento valioso na identificação dos doentes que mais beneficiam de RC.

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%pVO ₂	percentage of predicted pVO ₂
ACS	acute coronary syndrome
CPET	cardiopulmonary exercise testing
CR	cardiac rehabilitation
ET	exercise training
LV	left ventricular
LVEF	left ventricular ejection fraction
PCP	peak circulatory power
pVO ₂	peak oxygen uptake
VE/VCO ₂	minute ventilation/CO ₂ production

Introduction

Cardiac rehabilitation (CR) has long been considered a cornerstone in secondary prevention after acute coronary syndrome (ACS). It is a coordinated multidisciplinary intervention that aims to improve the cardiac patient's physical, psychological and social functioning. CR programs include exercise training and strategies to reduce modifiable cardiovascular risk factors such as hypertension, dyslipidemia, diabetes and smoking, and to improve adherence to pharmacologic and non-pharmacologic therapy.^{1,2}

CR has been shown to reduce reinfarction, cardiovascular and non-cardiovascular readmission and death^{3,4,2,5} and

to improve health-related quality of life, and to be cost-effective.^{1,6}

Exercise training programs increase patients' cardiorespiratory fitness, reducing symptoms and improving physiologic responses to physical effort.⁷ As a consequence, heart rate and blood pressure decrease during physical activity, reducing myocardial oxygen demand.¹

The positive effects of CR in cardiovascular disease include stabilization of the progression of atherosclerosis and improvement in endothelial function, resulting in increased coronary compliance, elasticity and flow.^{1,8-11}

Exercise testing is essential before CR to assess exercise capacity, to prescribe exercise training programs, to stratify cardiovascular risk and to estimate prognosis. After CR, it provides an objective measure of the program's effect on functional capacity.

Achievement of higher functional capacity is clinically significant because it not only impacts on health-related quality of life but it also is prognostically valuable, strongly predicting the risk of death. Assessing fitness at baseline and after CR is important since an improvement in functional capacity lowers the risk of death.¹²

Cardiopulmonary exercise testing (CPET) is the best tool for this purpose, providing a detailed assessment of functional capacity through the analysis of respiratory gas exchange during exercise. Among important CPET parameters is peak oxygen uptake (pVO₂), which is an accurate measure of exercise capacity and an important predictor of

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