Avaliação Subjectiva da Percepção de Esforço em Programas de Reabilitação Cardíaca: com que Podemos Contar para Prever a Tolerância ao Esforço?

Subjective Ratings of Perceived Exertion in Cardiac Rehabilitation Programs: what can we Rely on to Predict Exercise Tolerance?

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Resumo

Introdução: A Percepção do Esforço (PE) segundo a Classificação de Borg é um método simples de monitorização da intensidade do exercício. Contudo, é baseado na sensação subjectiva de esforço e fadiga durante o exercício, e como tal apresenta grande variabilidade inter e intra-individual.

Objectivo: Avaliar os determinantes da tolerância ao esforço no início de um programa de reabilitação cardíaca (PRC) em doentes coronários.

Métodos: Doentes integrados em PRC na sequência de síndrome coronário agudo, recrutados entre Setembro de 2008 e Outubro de 2010. O perfil psicossocial na admissão foi avaliado através da aplicação da "Hospital Anxiety and Depression Scale (HADS)" e do componente mental sumário da escala "Medical Outcomes Study Short Form – 36 (SF-36)". A depressão clínica foi definida por um score HADS-depressão≥8 e a ansiedade por um score HADS-ansiedade≥8. A capacidade funcional foi avaliada através da aplicação dos componentes físicos da escala SF-36 e dos equivalentes metabólicos (METS) obtidos na prova de esforço basal. Para estimarmos a PE indexada ao nível de exercício no início do PRC utilizamos o *peak exercise perception score* (PEPS), que equivale à razão entre a PE na escala de Borg e a intensidade do exercício estimada em METS.

Resultados: Foram analisados 175 doentes, 160 (91,4%) eram do sexo masculino, com idade média [média (DP): 53 (9) anos] e baixo nível de escolaridade [P50 (P25-P75): 6(4-11) anos]. Após o evento coronário agudo, 144 (82,3%) doentes foram tratados com revascularização coronária percutânea, 19 (10,9%) por cirurgia de revascularização coronária e 12 (6,9%) foram submetidos apenas a tratamento médico. A capacidade funcional foi, no componente físico sumário da SF-36, de 46,2 (8,1); e na prova de esforço basal 10,0 (2,0) METS. Nas sessões iniciais o PEPS aumentou 2,27 (0,6) na PE por cada aumento de 1 METS na intensidade do exercício. As determinantes univariadas da percepção do exercício foram o sexo (b=-0,23; p=0,003), a escolaridade (b=-0,32; p<0,001), volume máximo ventilado (VMV) (b=-0,29 por cada 10% de aumento no VMV; p<0,001), capacidade funcional na admissão [componentes físicas do SF-36 (b=-0,34; p<0,001), MET máximo durante a prova de esforço (b=-0,32; p<0,001)] e o perfil psicossocial na admissão [HADS≥8 (b=0,18; p=0,02), componente mental sumário do SF-36 (b=-0,20; p=0,009)]. Da análise multivariada, ajustada para a idade e para o sexo, verificou-se que a escolaridade (b=-0,24; p=0,001), o VMV (b=-0,19 por cada 10% de aumento no VMV; p=0,008), os componentes físicos do SF-36 (b=-0,19; p=0,011) e os METS na prova de esforço (b=-0,20; p=0,009), constituem variáveis preditoras.

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Conclusão: A PE é multifactorial, dependendo de uma interacção complexa entre as capacidades físicas e os aspectos psicossociais. A identificação dos seus principais determinantes poderá auxiliar na optimização e melhor individualização das intervenções nos programas de recondicionamento ao esforço, resultando num melhor recuperação funcional, participação social, reinserção profissional e qualidade de vida.

Palavras-chave: Doença Coronária, Reabilitação Cardíaca, Percepção de Esforço

Abstract

Background: *Borg's Rating of Perceived Exertion (RPE) is a simple and convenient method for monitoring exercise intensity. However, it's based on subjective feeling of exertion and fatigue during exercise, and possible factors that influence perception are highly variable inter and intra-individually.*

Objective: *To evaluate the predictors of a higher RPE at the beginning of a cardiac rehabilitation program (CRP).*

Methods: *Patients enrolled in a cardiac rehabilitation program after an acute coronary event between September 2008 and October 2010. Psychosocial profile at admission was characterized using Hospital Anxiety and Depression Scale (HADS) and the Medical Outcomes Study Short Form – 36 (SF-36). Functional status was estimated using both physical components of the SF-36 and exercise intensity in metabolic equivalents (MET) achieved at baseline exercise stress testing (EST). We used peak exercise perception score (PEPS=RPE/MET) to determine level of fatigue indexed to exercise intensity level during the first exercise training session.*

Results: *One-hundred seventy five patients were analysed, 160(91,4%) were male, mean age [mean(SD): 53(9)] years and had low level of education [P50(P25-P75):6(4.-11)]. Treatment after the acute coronary event consisted of percutaneous coronary revascularization in 144 (82,3%), coronary artery bypass graft surgery in 19 (10,9%) and 12 (6,9%) patients received only medical treatment. Mean exercise capacity was 10 (2,0) MET at baseline EST and the perception of overall physical ability in daily activities scored 46,2 (8,1) in summary physical component of SF36.*

During initial exercise training sessions, we found a 2,27(0,6) increase in RPE per 1 MET increase in exercise intensity. Univariate determinants of exercise perception were gender (b=-0.23; p=0.003), years of education (b=-0.32; p<0.001), maximum volume ventilation (MVV) (b=-0.29 per 10% of MVV increase; p<0.001), functional status at admission [SF-36v2 physical domains (b=-0.34; p<0.001); peak MET level at EST (b=-0.32; p<0.001)] and psychosocial profile at admission [HADS≥8 (b=0.18; p=0.02); SF-36 summary mental component (b=-0.20;p=0.009)]. Age and sex-adjusted multivariate analysis identified level of education (b=-0.24; p=0.001), MVV (b=-0.19 per 10% of MVV increase; p=0.008), SF-36v2 physical domains (b=-0.19; p=0.011), MET level at EST (b=-0.20; p=0.009), as predictor variables.

Conclusions: *Effort perception is multifactorial depending upon a complex interplay between psychosocial and physical capacities. Indentifying their main determinants may allow for more individualized interventions in CRP resulting in a better functional recovery, social participation and quality of life.*

Keywords: *Coronary Heart Disease; Cardiac Rehabilitation; Physical Exertion.*

Introduction

Borg's Rating of Perceived Exertion (RPE) is a simple and convenient method of monitoring exercise intensity. The theorical premise of RPE is that a person will give a numerical value on a scale from 6 to 20, representing a verbal expression of effort during exercise[1]. The American College of Sports Medicine (ACSM) has recommended using RPE since 1986 for both fitness and cardiac rehabilitation purposes[2]. RPE allows for exercise intensity adjustments both during formal cardiac rehabilitation and guidance of home-exercise programs[3]. It can be used either individually or conjunctively with heart rate monitoring.[4]

Cardiac rehabilitation personnel should make sure patients comprehend the definition of RPE, in that it should incorporate both peripheral muscular (eg, fatigue) and central cardio-respiratory (eg, breathing) sensations and that there is no right or wrong rating but a true representation of subject felling[5]. Physician should pay attention on the verbal descriptors of the scale as much as the numerical values[5].

Despite RPE being a composite of central and peripheral factors[6,7] it's based on subjective feeling of exertion and fatigue during exercise and possible factors that influence perception are highly variable inter and intra-individual. Furthermore, using RPE for assessment and monitoring of exercise tolerance should take into consideration the level of exercise intensity. Peak exercise perception score (PEPS), a ratio between RPE and exercise intensity [measured in metabolic equivalents (MET)], has been suggested as a

marker of functional capacity [8]. The aim of this study was to identify predictors of PEPS at the beginning of a phase II hospital-based cardiac rehabilitation program.

Methods

A prospective cohort study of 175 patients enrolled in a cardiac rehabilitation program after an acute coronary event, recruited between September 2008 and October 2010. We used the American College of Sports Medicine recommendations to determine patient s for phase II CRP [9].

Psychosocial profile at admission was assessed using Hospital Anxiety and Depression Scale (HADS) and mental summary component of the Medical Outcomes Study Short Form – 36 (SF-36). Clinical depression and anxiety were defined by HADS-depression score ≥ 8 and HADS-anxiety score ≥ 8, respectively. To estimate functional status we used a composite approach: an objective measure of functional capacity (MET reached at baseline EST) and a subjective feeling of overall physical capacity for daily-life activities (physical domains of SF-36). Peak exercise perception score (PEPS=RPE/MET) was used to assess exercise tolerance during initial exercise training sessions.

CRP consists of a biweekly 60-minute exercise training session. Each session consisted of 40 minutes of aerobic training, with intensity set to 50-70% of heart rate reserve, obtained in baseline EST, and to an exercise perception of 11-13 in RP; we used a low-intensity high-volume strengthening exercise program (40-50% 1RM, 2 sets, 10-15 repetitions). Exercise sessions also included flexibility exercises and relaxation techniques. Every patient received detailed verbal instructions on how to use Borg's Rating Scale both at initial appointment and immediately before the exercise session.

Predictors of perceived exertion were identified using univariate linear regression, and significant predictors were included in age and sex-adjusted multivariate model to adjust for potential confounders. To allow for comparison of the relative predictive valued between modeled variables we used the standardized beta regression coefficients.

Results

The cohort consisted of 175 patients, predominantly male young-aged and low-educated (Table 1). They had mostly been subject to percutaneous coronary revascularization with lower than 20% having either medical treatment alone or coronary artery bypass graft surgery. Functional capacity and quality of life perception was remarkably good for patients with recent acute coronary event (Table 1). PEPS showed a 2,27(0,6) increment per 1 MET change in exercise capacity.

Univariate linear regression analysis identified as determinants of exercise perception gender, years of education, maximum volume ventilation (MVV), functional status at admission and psychosocial profile at admission – Table 2.

Age and sex-adjusted multivariate analysis identified level of education, MVV, SF-36 physical domains and MET level at EST as predictor variables – table 3. Psychosocial variables failed to achieve statistical significance although their contribution to the

Table 1 - Patients characteristics at admission

BASELINE VARIABLES	Total Sample (n=175)
Sociodemographics	
Age (years) mean (SD)	53(9)
Male gender, n (%)	160 (91,4)
Level education (years), [P50 (P25-P75)]	6 (4-11)
Type of treatment	
Medical treatment, n(%)	12 (6,9)
Percutaneous coronary revascularization, n(%)	144 (83,0)
Coronary artery bypass surgery, n(%)	19 (10,9)
Functional status	
Peak MET level at baseline EST	10 (2,0)
SF36 - summary physical component	46,2 (8,1)
PEPS in the first sessions of the CRP, mean (SD)	2,3 (0,6)

Table 2 - Univariate regression analysis
Only significant regression coefficients are expressed

	b	*P*
Gender (male vs female)	-0,23	0,003
Age (per 10 year increase)	0,11	0,15
Level of education (years)	-0,32	<0.001
MVV (per 10% increase)	-0,29	<0.001
Functional status		
Peak MET level at baseline EST	-0,34	<0.001
SF36 - summary physical component	-0,32	<0.001
Psychosocial profile		
HADS≥8	0,18	0,02
SF-36 - summary mental component	-0,20	0,009

Table 3 - Multivariate regression analysis (age and sex-ajusted)
Only significant regression coefficients are expressed

	b	*P*
Level of education (years)	-0,24	0,001
MVV (per 10% increase)	-0,19	0,008
Functional satus		
Peak MET level at baseline EST	-0,20	0,009
SF36 - summary physical component	-0,19	0,011

predictive model was considerable [HADS-depression (≥8 vs <8): b=0,15; p=0,07; HADS-anxiety (≥8 vs <8): b=-0,16; p=0,07].

Discussion

After age and sex-adjusted multivariate analysis we found no association between psychosocial profile and RPE. This is in contrast with previous reports which found anxiety and depression to be strong determinants of effort perception and patient's ability to accurately interpret sensations during physical activity[5,10]. Psychosocial problems can cause fatigue and low motivation that are typical symptoms of depression, and can cause a low tolerance to exercise typical of anxiety because patients are worried about physiological reactions during effort, such as palpitations and hyperventilation. Our study sample consisted mainly of young males with relatively low levels of anxiety and depressive symptoms and therefore underestimation of psychossocial profile influence over PEPS is probable.

Low-level of education was identified as a predictor of a higher RPE at the beginning of CRP. Low-education was strongly associated with age (spearman correlation coefficient, *rho*=-0,225; p=0,003) with older less-fit patients having fewer years of education. Furthermore, these patients usually showed more difficulties in interpreting Borg's Rating Scale and no specific assessment of cognitive status was performed.

Unsurprisingly, functional status at program initiation was a strong predictor of effort perception. Individual experience regarding the acute coronary syndrome, including severity of index event, degree of social and family support and patient's coping skills, influence the impact of the cardiac illness in the patient's ability to perform activities of daily living, leading to overestimation of exertion effort. Conversely, the level of functional capacity achieved in baseline EST reflect both physiological and psychological limitations, hence the direct association to effort perception. And as the baseline EST is often the first experience of moderate to higher intensity physical exertion, patients may have increased RPE to gain some control over the testing situation[5].

Besides the limitations described above, there was significant underrepresentation of females, older patients and restriction of the sample to only preserved to moderately impaired left-ventricular systolic function, which significantly affect external validity of the results. Furthermore, we did not perform standard cardiopulmonary exercise testing to determine the cause for the exercise limitation, so no conclusions can be drawn whether exercise limitation was of cardiac, pulmonary, peripheral origin or only due to poor effort.

Conclusion

Effort perception is multifactorial depending upon a complex interplay between psychosocial and physical capacities. A high level of perceived exertion during exercise is negatively associated with participation in physical activity. So, indentifying main determinants of effort perception may conduct to optimize and individualize interventions in CRP resulting in a better functional recovery, social participation, reintegration and quality of life. All of these factors cannot be ignored when developing a well-designed RCP.

Referências / *References*:

1. Borg G. Perceived Exertion as an indicator of somatic stress. Scand J Rehabil Med. 1970; 2: 92-98.
2. American College of Sports Medicine. ACSM s Guidelines Testing and Prescription. 3d ed. Philadelphia: Lea & Fabiger; 1986.
3. Karavatas SG, Tavakol K. Concurrent Validity of Borg s Rating of Perceived Exertion in African-American Young Adults, Employing Heart Rate as the Standard. internet J Allied Health Sci Pract. 2005.
4. Womack L. Cardiac rehabilitation secondary prevention programs. Clin Sports Med 2003. 22: 135-160.
5. Buckley JP, Sim J, Eston RG. Reproducibility of ratings of perceived exertion soon after myocardial infarction: responses in the stress-testing clinic and the rehabilitation gymnasium. Ergonomics. 2009; 52(4): 421-427.
6. Balady G, Berra K, Golding L, et al. In: Franklin B, editor. ACSM s guidelines for exercise testing and prescription. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2000.p.166-7.
7. Fletcher G, Balady G, Amsterdam E, Chaitman B, Eckel R, Fleg J, et al. AHAH scientific statement: exercise standarts for testing and training. Circulation. 2001; 104: 1694-819.
8. Terziyski K, Marinov B, Hodgev V, Tokmakova M, Kostianev S. Standardized peak exercise perception score: validation of a new index of effort perception. J Cardiopulm Rehabil Prev. 2010; 30(1): 40-6.
9. Balady G, Berra K, Golding L. ACSM s guidelines for exercise testing and prescription. 6th ed. Philadelphia: Lippincott Williams and Wilkins; 2000:166-7.
10. Knapen J, Van de Vliet P, Van Coppenolle H, Peuskens J, Pieters G. Evaluation of cardio-respiratory fitness and perceived exertion for patients with depressive and anxiety disorders: a study on reliability. Disabil Rehabil. 2003; 25(23): 1312-15.