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Heart rate recovery after exercise in chronic heart failure: Role of vital exhaustion and type D personality

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KEYWORDS

Chronic heart failure;
Exercise;
Heart rate recovery;
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Summary

Objective: Vital exhaustion and type D personality previously predicted mortality and cardiac events in patients with chronic heart failure (CHF). Reduced heart rate recovery (HRR) also predicts morbidity and mortality in CHF. We hypothesized that elevated levels of vital exhaustion and type D personality are both associated with decreased HRR.

Methods: Fifty-one patients with CHF (mean age 58 ± 12 years, 82% men) and left ventricular ejection fraction (LVEF) $\leq 40\%$ underwent standard exercise testing before receiving outpatient cardiac rehabilitation. They completed the 9-item short form of the Maastricht Vital Exhaustion Questionnaire and the 14-item type D questionnaire asking about negative affectivity and social inhibition. HRR was calculated as the difference between heart rate at the end of exercise and 1 min after abrupt cessation of exercise (HRR-1). Regression analyses were adjusted for gender, age, LVEF, and maximum exercise capacity.

Results: Vital exhaustion explained 8.4% of the variance in continuous HRR-1 ($p = 0.045$). For each point increase on the vital exhaustion score (range 0–18) there

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was a mean \pm SEM decrease of 0.54 ± 0.26 bpm in HRR-1. Type D personality showed a trend toward statistical significance for being associated with lower levels of HRR-1 explaining 6.5% of the variance ($p < 0.08$). The likelihood of having HRR-1 ≤ 18 bpm was significantly higher in patients with type D personality than in those without (odds ratio = 7.62, 95% CI 1.50–38.80).

Conclusions: Elevated levels of vital exhaustion and type D personality were both independently associated with reduced HRR-1. The findings provide a hitherto not explored psychobiological explanation for poor cardiac outcome in patients with CHF. © 2008 Japanese College of Cardiology. Published by Elsevier Ireland Ltd. All rights reserved.

Introduction

Patients with chronic heart failure (CHF) have a markedly reduced heart rate recovery (HRR) after exercise [1]. This reduction is a reliable predictor of poor clinical outcome including heart failure-related hospitalizations [2,3] and all-cause mortality [4–6]. The clinical role of decreased vagal tone in the manifestation and outcome of cardiovascular diseases is increasingly acknowledged [7,8]. HRR during the first minute after the termination of physical exercise (HRR-1) primordially reflects parasympathetic activation with sympathetic withdrawal increasingly contributing to the decline in heart rate beyond 1 min after exercise cessation [9]. While parasympathetic measures of heart rate variability such as high frequency power reflect vagal modulation confined to the heart, HRR-1 is a particularly easy-to-obtain proxy measure of overall vagal tone of the human organism [9,10]. Identifying pertinent correlates of HRR-1 might therefore advance our understanding about clinical variables potentially modulating vagal tone and associated prognosis of CHF.

Behavioral cardiology research shows that psychosocial factors are associated with clinical outcome of CHF [11,12]. Specifically vital exhaustion and type D personality are now established psychosocial risk factors of cardiovascular disease [13–16]. In patients with CHF after myocardial infarction, vital exhaustion and type D personality both predicted mortality and cardiac events independent of other prognostic factors [17,18]. Vital exhaustion has been conceptualized as a state of extreme mental fatigue with a concomitant increase in irritability consequent to maladjustment to ongoing psychological stress [19]. Type D personality confers trait characteristics of experiencing negative affect which a person avoids to express in social interactions to prevent disapproval by others [20]. Psychosocial factors might exert part of their cardiac toll by virtue of an association with HRR; however, the literature to support this notion is currently scant given that to our

knowledge only two studies on this issue have been published so far. In patients with coronary artery disease elevated levels of depressed mood were associated with reduced HRR one [21] and respectively 2 [22] min after exercise cessation. However, depression, type D negative affectivity, and type D social inhibition reflect distinct constructs in patients with cardiac disease, including CHF [23]. Depression, vital exhaustion, and type D negative affectivity were also revealed as distinct psychological concepts in apparently healthy subjects [24]. These psychometric examinations merit an investigation on a relationship between HRR-1 and psychological factors above and beyond depression.

We hypothesized that higher levels of vital exhaustion and type D personality would be associated with decreased HRR-1 in patients with CHF. We further predicted that these associations would be independent of previous correlates of reduced HRR, namely female gender [25], increased age [25,26], impaired left ventricular ejection fraction (LVEF) [5,27], and reduced exercise capacity [26,28]. A number of epidemiological studies suggest both a gradual and categorical relationship between reduced HRR and increased cardiovascular risk [29]. Abnormal HRR-1 is usually defined as a heart rate that declines ≤ 18 bpm in the first minute after abrupt cessation of exercise [30]. Applying this cut-off, we additionally explored whether psychosocial factors would relate to HRR-1 gradually and categorically assuming a threshold association in case of the latter.

Materials and methods

Patients and recruitment

All patients provided written informed consent to the study protocol which was approved by the ethical committee of the State of Bern, Switzerland. The study participants were 56 consecutively enrolled patients with ischemic and non-ischemic CHF. All patients underwent a 12-week compre-

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