Tracking Cardiovascular Responses To Anticipation Of An Exercise Test In Cardiac Rehabilitation: A Preliminary Test

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Abstract

Cardiovascular reactivity (CVR) refers to relatively high heart rate (HR) and blood pressure (BP) increases in the face of a mental stressor. CVR may be a concern for heart patients since it may precede ischemic events and CVR may be an indicator of relatively poor prognosis. Anticipation of an exercise tolerance test (ETT) results in rapid increases in HR and BP and has been used as a stressor in heart patient to study CVR. However, it is not clear how CVR changes associated with an ETT change after a course of cardiac rehabilitation (CR). **PURPOSE:** To examine CVR, specifically HR and systolic (SBP) and diastolic blood pressure (DBP) responses, to anticipation of an exercise tolerance test before and after a course of CR. **METHODS:** CVR was recorded for 76 patients at baseline and for a subsample of 23 patients who completed 6 weeks of CR. Identical procedures were used for baseline and post-CR data collection. Resting HR and BP were measured 3 times, 1 minute apart, by an automated oscillometric BP monitor after the patient had been seated quietly and alone for 5 minutes. The patient was then prepped for an ETT and met in the exercise stress testing lab by the researcher. Standing HR and BP measures were taken by the same automated BP device after 1 and 3 minutes of standing on the treadmill immediately prior to beginning exercise. The mean of the 3 seated measures was considered the resting BP and HR. Peak BP and HR standing were used to calculate the cardiovascular response to anticipation of exercise. CVR was defined as peak BP and HR minus resting BP and HR, respectively. **RESULTS**: Anticipation of exercise resulted in significant increases (all p's < .002) in CV parameters with an average CVR at baseline for HR, SBP and DBP of 4.0 bpm, 16.6 mmHg, and 13.5 mmHg, respectively. CVR after a course of CR for HR, SBP and DBP were 4.3 bmp, 15.9 mmHg, and 9.2 mmHg (ps < .001). Differences between baseline and post-CR CVR was significant only for the change in DBP (p = .05). **CONCLUSION:** Patients responded with a predictable increase in HR and BP in anticipation of an ETT before and after a course of CR. After CR, DBP increases in anticipation of an ETT were lower in magnitude than before CR. Future research should investigate specific components of CR that may help reduce CVR.

Introduction

Strike and Steptoe (2003) concluded that "one third to one half of patients with CAD" (p. 12) experienced silent myocardial ischemia as a result of mental stress, regardless of the severity of the patient's CAD (cf. Krantz et al., 1996). Further, the mental stressors reviewed by Strike and Steptoe mimicked stressors that one could expect to encounter in a typical day. Cardiovascular responses to mental stress is known as cardiovascular reactivity (CVR) and these responses are thought to precede ischemic events. Yet little CVR research has been conducted with patients entering cardiac rehabilitation and it is not known how these cardiovascular responses change as a patient goes through the course of CR.

Hypotheses

- CVR (changes in HR and BP) should increase from rest to anticipation of an ETT at baseline and following a course of CR
- The magnitude of CVR (changes in HR and BP) in response to anticipation of an ETT should decrease from baseline to post-CR.

Methods

Participants:

- Participants were 76 men (mean age = 60, SD = 10.4) and women (mean age = 61.4, SD = 10.9) at baseline and 23 men and women at follow-up.

Procedures:

Exercise tolerance test procedures
When the patient arrived for their ETT they were met in the waiting room and taken to an exam room for resting HR and BP measurements. Measures were taken by an automated cuff after the participant had been seated alone quietly for 5 minutes. The patient was then readied for an ETT and met in the exercise stress testing lab. Standing HR and BP measures were remotely taken after 1 and 3 minutes of standing on the treadmill immediately prior to beginning exercise.

Measures:

- *HR and BP* were measured with a calibrated automated oscillometric cuff (Piezometer MK-1).
- Resting HR and BP was defined as the average of three readings.
- CVR was defined as the peak of two readings taken after 1 and 3 minutes of the patient standing on the treadmill minus the average resting values (cf. Fraser et al., 2008). For example, SBP reactivity = SBP_{peak} - SBP_{mean}

Figure 1. Baseline changes in HR, SBP, and DBP from resting to anticipation

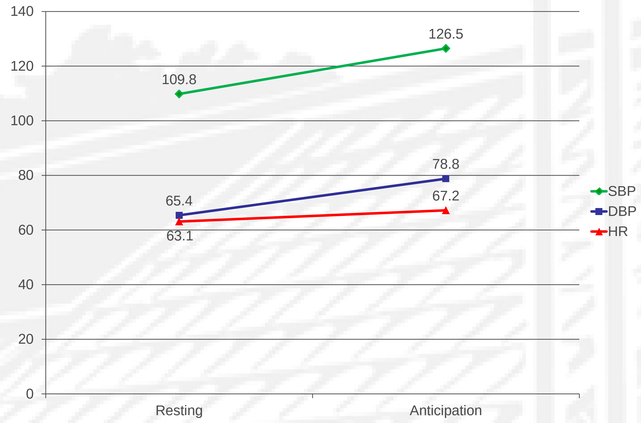


Figure 2. Post-CR changes in HR, SBP, and DBP from resting to anticipation

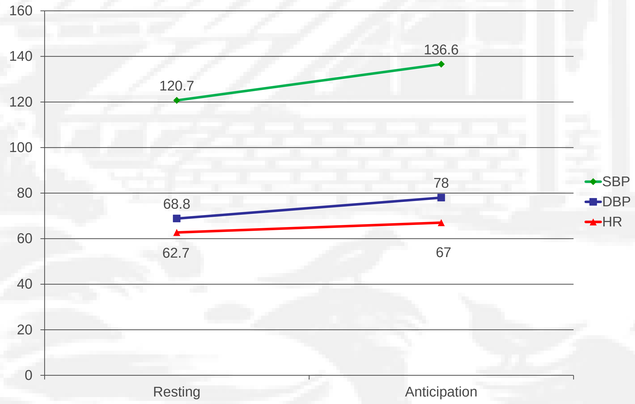
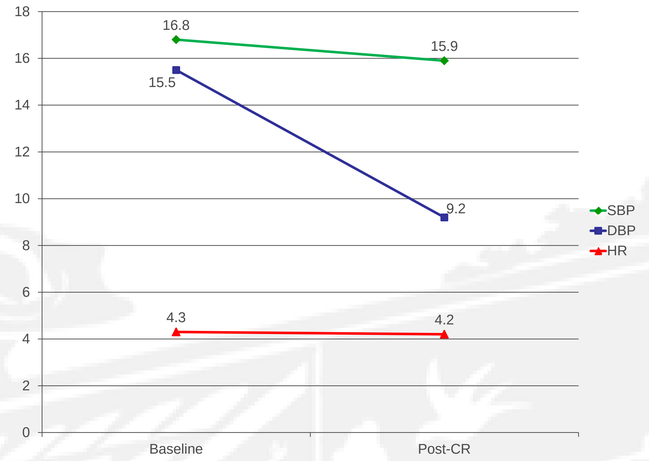


Figure 3. Changes in CVR from baseline to post-CR



Results

- Figures 1 and 2 show how HR, SBP, and DBP changed from resting to anticipation of the ETT.
- Anticipation of exercise resulted in significant increases (all p's < .002) in CV parameters with an average CVR at baseline for HR, SBP and DBP of 4.0 bpm, 16.6 mmHg, and 13.5 mmHg, respectively (see Figure 1).
- CVR after a course of CR for HR, SBP and DBP were 4.3 bmp, 15.9 mmHg, and 9.2 mmHg (ps < .001) (see Figure 2).
- Differences between baseline and post-CR CVR was significant only for the change in DBP (p = .05) which decreased from 15.5 mmHg to 9.2 mmHg (see Figure 3).

Conclusion

- Patients responded with a predictable increase in HR and BP in anticipation of an ETT before and after a course of CR. After CR, DBP increases in anticipation of an ETT were lower in magnitude than before CR.
- Future research should investigate specific components of CR that may help reduce CVR.
- Limits include a relatively small follow-up sample. In this field study we could not account for medication use, sex of the attending physician, and other environmental influences.
- Future research should examine whether or not the changes observed here are primarily centrally (e.g., increased cardiac output) or peripherally mediated (e.g., changes in peripheral vascular resistance).

References

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