Training improves walking capacity and cardiovascular function in arteritis

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Patients with arteritis have a high risk of mortality from cardiovascular disorders. However, whether these patients benefit from an intervention involving exercise remains unclear. In this study, we assessed the effects of an unsupervised exercise program on walking capacity, quality of life, and cardiovascular parameters of a patient with arteritis. A 33-year-old man reporting symptoms of claudication during walking was studied. Imaging tests revealed severe atherosclerosis and arteritis was diagnosed. Five weekly sessions of walking for 16 weeks increased claudication distance and total walking distance, produced improvements in six out of the eight health-related quality-of-life domains, decreased systolic blood pressure, and changed cardiac autonomic modulation toward parasympathetic modulation. This case report showed that unsupervised exercise training improved walking capacity, quality of life, and cardiovascular parameters in a patient with arteritis. (J Vasc Nurs 2014;32:51-54)

Arteritis is an idiopathic autoimmune disease that is more frequent in young adults.[1] It affects 2.5 per 1 million people in the United States and 1.3 per 1 million in Europe.[2] Symptoms of claudication[3] are often reported in these patients, leading to impaired walking, which probably results in low levels of physical activity and reduced quality of life. Furthermore, patients with arteritis have a high risk of mortality from cardiovascular disorders, including stroke or myocardial infarction.[4]

Exercise training improves general health in people with various types of disease, however, the effects of exercise have been not investigated in patients with arteritis. Although there is a large body of evidence indicating that exercise training improves walking capacity,[5] quality of life,[5] and cardiovascular function[6] in patients with peripheral artery disease, the extrapolation of the results for patients with arteritis is limited to the various differences between patients with peripheral artery disease and arteritis. In fact, while the common profile of peripheral artery disease patients is a middle-aged or elderly subject with a history of an unhealthy lifestyle and with several comorbid conditions, patients with arteritis are commonly younger and usually do not have several comorbidities. Arteritis is also more aggressive, resulting in a less promising prognosis[7,8] compared with peripheral artery disease. Therefore, whether patients with arteritis also benefit from an intervention involving exercise remains unclear.

In this case report, we assessed the effects of 16 weeks of unsupervised exercise training on walking capacity, quality of life, and cardiovascular function in a young man with arteritis. In addition to performance and quality-of-life outcomes, we also assessed the heart rate variability, measured from short-term electrocardiogram recordings, which has been widely used as a noninvasive method to quantify the parasympathetic and sympathetic autonomic modulation of the heart in different populations (for more information see[9]).

METHODS

We studied a 33-year-old male farm worker, weighing 87.0 kg, 1.72 m tall, with a body mass index of 29.4 kg/m^2, nonsmoker, who had dyslipidemia, hypertension, and reported symptoms of claudication in the right leg during walking. Magnetic resonance angiogram revealed severe atherosclerosis in the right peripheral arteries and arteritis was diagnosed with no identifiable cause. Ankle-brachial index for both limbs were ≤0.40; however, surgical treatment was not indicated. The patient was taking simvastatin and cilostazol. The clinical characteristics of the patient are presented in Table 1. He was informed of the study and gave his written consent. This study was approved by the Institutional Review Board of the University of Pernambuco.

The patient underwent a 16-week, unsupervised exercise training program. The subject was instructed to walk at least 1 hour daily until the maximum claudication pain at least five times a week. The subject was free to determine walking speed. Weekly phone calls were made to monitor adherence to training. Before and after the training program, his walking capacity, quality of life, and cardiovascular parameters were evaluated.

Walking capacity was assessed using a progressive graded treadmill protocol[10] and 6-minute walk test.[11] In these tests,

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TABLE 1

BASELINE PATIENT CHARACTERISTICS

Characteristic	*Values*
Demographics data	
Age (y)	33
Weight (kg)	87.0
Height (m)	1.72
Body mass index (kg/m^2)	29.4
Ankle-brachial index	0.40
Cardiovascular risk factors	
Hypertension	Yes
Diabetes mellitus	No
Dyslipidemia	Yes
Current smoker	No

claudication distance with intraclass correlation coefficients (ICC) of 0.89[10] and 0.80,[11] respectively, was defined as the walking distance at which the patient first experienced pain, and the total walking distance with ICC of 0.93[10] and 0.94,[11] respectively, was defined as the walking distance at which ambulation could not continue owing to maximal pain, were recorded.

Health-related quality of life was assessed using the Medical Outcomes Study Short-Form 36 General Health Survey, which provides information on the following eight domains: physical function, role limitations owing to physical problems, general health, bodily pain, social function, role limitations owing to emotional problems, mental health, and vitality. For each subscale, item scores were standardized on a scale from 0 to 100, with better states of health resulting in higher scores. For all eight subscales, internal consistency measured by Cronbach's alpha >0.7.[12]

Systolic blood pressure, diastolic blood pressure, heart rate, and rate–pressure product were measured after 10 minutes of resting in the sitting position. Blood pressure was measured using an automatic blood pressure monitor (OHMROM - USA). This device has good reproducibility for both blood pressures with ICC of 0.88 and 0.79,[13] respectively.

Electrocardiogram (EMGSystem, São José dos Campos, Brazil) and respiratory activity (Pneumotrace II, UFI, Morro Bay, CA, USA) were recorded for 10 minutes with a sample frequency of 500 Hz per channel. An autoregressive spectral analysis of RR variability was performed. The components were assigned based on their central frequency as low-frequency (LF; 0.04–0.15 Hz) and high-frequency (HF; 0.15–0.5 Hz) components. HF and LF components, with ICC of 0.48 and 0.77,[14] respectively, were reported in normalized units, which represent the relative value of each power component in proportion to the total power minus the very LF component (0–0.04 Hz). Normalized LF and HF components were accepted, respectively, as markers of sympathetic and parasympathetic cardiac modulations.[9]

RESULTS

The patient completed successfully the proposed exercise program, as observed in this logbook. Figure 1 shows the effects of unsupervised training on walking capacity. After training there were increases in claudication distance (109% and 191%) and total walking distance (49% and 19%) in the graded treadmill protocol and 6-minute walk test, respectively.

The effects of unsupervised training on quality of life and cardiovascular parameters are presented in Table 2. After training there were improvements in functional capacity (71.4%), physical function (75.0%), body pain (23.3%), vitality (15.4%), and in the social (50.0%) and emotional (33.0%) domains. After training, there was a decrease in systolic blood pressure (−3.4%), diastolic blood pressure (−3.4%), and rate–pressure product (−2.3%). Unsupervised training also decreased the LF/HF ratio (−88.2%).

DISCUSSION

Arteritis leads to impairment of walking capacity, with reduction of total walking distance. In fact, baseline results of our case was lower than observed in healthy individuals for the 6-minute walk test[15,16] and similar to patients with peripheral artery disease and symptoms of claudication in the graded treadmill test.[17] Interestingly, the improvements in performance on the progressive treadmill protocol and 6-minute walk test are greater than those observed after supervised training in patients with claudication. The greater effects observed in the present study might be related to the greater frequency of training and duration of exercise session. In fact, throughout the study, the patient achieved the recommendation of walking 1 hour daily at least 5 times a week. One possible explanation for this was that weekly phone calls were made to monitor patient adherence to training.

Unsupervised exercise training improved six out of the eight health-related quality-of-life domains. These effects might be the result of increased walking capacity that has been related to physical function domains in patients with claudication.[18] Moreover, improvements in social and psychological functioning were also observed, which is different from previous studies in patients with peripheral artery disease.[18,19] These psychosocial effects may also be related to the improvements in walking capacity that led to greater independence on the part of the patient.

The patient in the present study was hypertensive and presented a cardiac autonomic modulation in the direction of sympathetic modulation (LF/HF ratio, 1.7), differently from healthy individuals that presents lower LF/HF ratio.[20,21] Both of these conditions are known to be important risk factors for cardiovascular events.[22] In fact, risk of cardiovascular mortality increases 32% for each 10 mmHg increase in blood pressure in individuals with claudication.[23] However, the current study showed that exercise training reduced systolic and diastolic blood pressure in 5 and 3 mmHg, respectively. This reduction was probably mediated by changes in cardiac autonomic control, with decrease of sympathetic modulation. These results suggest that unsupervised exercise may play an important role in the reduction of cardiovascular events in such patients.