The international POTS registry: Evaluating the efficacy of an exercise training intervention in a community setting

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BACKGROUND Postural orthostatic tachycardia syndrome (POTS) affects primarily young women and impairs quality of life. We found that in a research setting, exercise training along with lifestyle intervention is effective as a nondrug therapy for POTS.

OBJECTIVE To evaluate the efficacy of our exercise training/lifestyle intervention in POTS patients in a community environment.

METHODS We established a POTS registry and enrolled 251 patients (86% women, aged 26 ± 11 [SD] years) through their physicians. A 3-month program involving mild- to moderate-intensity endurance training (progressing from semirecumbent to upright, 3–5 times/wk, 30–45 min/session) plus strength training was implemented along with increasing salt/water intake. The program was delivered to the physicians, who oversaw training in their patients. A 10-minute stand test was performed at the physician's office and patient quality of life was assessed using the 36-Item Short Form Health Survey.

RESULTS One hundred and three patients completed the program. Of those that completed, 71% no longer qualified for POTS and were thus in remission. The increase in heart rate from supine to 10-minute stand was markedly lower (23 ± 14 vs 46 ± 17 beats/min before intervention; $P < .001$), while patient quality of life was improved dramatically after intervention ($P < .001$). Of those who were followed for 6–12 months ($n = 31$), the effect was persistent.

CONCLUSIONS A training/lifestyle intervention program can be implemented in a community setting with physician supervision and is effective in the treatment of POTS. It remains to be determined whether exercise can be an effective long-term treatment strategy for this condition, though patients are encouraged to maintain an active lifestyle indefinitely.

KEYWORDS Orthostatic intolerance; Tachycardia; Quality of life; Exercise training; Lifestyle intervention

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Introduction

Postural orthostatic tachycardia syndrome (POTS) affects approximately 500,000 people, primarily premenopausal women, in the United States alone.[1,2] The clinical hallmark is the inability to stand or remain upright for periods of time owing to excessive heart rate increases, intolerable palpitations, lightheadedness, dizziness, fatigue, nausea, or near syncope.[3,4] Severely affected patients are unable to work, go to school, or participate in recreational activities, resulting in substantial morbidity and poor quality of life.

The underlying mechanisms are not well understood, but research from our group and others suggests that physical deconditioning (ie, cardiac atrophy and hypovolemia) and reduced standing stroke volume may be important to the pathophysiology of POTS.[5–10] This notion is supported by studies showing that in a research setting, physical reconditioning with short-term exercise training significantly increased peak oxygen uptake (an indicator of physical fitness), enlarged heart size and mass, expanded blood and plasma volume, improved POTS or orthostatic intolerance symptoms, and in most cases allowed these patients to be symptom free.[5,6,10,11] Furthermore, this unique exercise training program improved the quality of life in virtually all patients as measured by a reliable and valid questionnaire: the 36-Item Short Form Health Survey (SF-36, QualityMetric Incorporated and Medical Outcomes Trust).[5,6] These results demonstrate that this lifestyle intervention program is highly effective as a nondrug therapy for patients with POTS. These findings are innovative because so far there are no effective pharmacologic therapies for POTS and many patients have disabling side effects with standard drug treatments. As such, the 2015 Heart Rhythm Society Scientific Statement on Dysautonomia has advocated the use of an exercise training regimen in the management of POTS.[12]

Translating research findings from the laboratory into a community environment or clinical practice is essential to

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improve patient care in real life. To accomplish this objective, it is critical to create a link among researchers, primary physicians, and patients. Indeed, the National Institutes of Health have identified practice-based research networks as fundamentally necessary to support the translation of research into clinical practice.[13] To this end, we established a POTS registry that connected us (researchers) with POTS patients through their primary physicians.

The main purpose of this study was to evaluate the efficacy of an intervention program involving exercise training and lifestyle modification (primarily increasing intake of salt and water) in the community setting outside the constraints of a controlled clinical trial. Specifically, we determined whether the intervention program, if implemented and supervised by primary care physicians, could eliminate or reduce orthostatic tachycardia and improve quality of life in POTS patients.

Methods

Study population

We screened 304 patients and enrolled 251 of them (216 female, 35 male) in the POTS registry between 2010 and 2012. Patients were from 36 different states in the United States and 7 different countries around the world, including countries in North America and Europe, and Australia. No direct advertising of our registry or solicitation was used. The initial POTS exercise training studies[5,6,10] generated enough publicity that both patients and their physicians contacted our laboratory to become enrolled in the registry. All patients enrolled in the registry met the inclusion criteria for POTS, including at least 6 months of orthostatic symptoms,[14] and had a heart rate rise >30 beats/min or a rate that exceeded 120 beats/min that occurred after 10 minutes of standing without any evidence of orthostatic hypotension.[15] Fifty-one percent of the patients enrolled met both criteria, 45% had an orthostatic tachycardia >30 beats/min with a standing heart rate ≤120 beats/min, and 4% of the patients were enrolled because of the 120 beats/min criteria without an orthostatic tachycardia >30 beats/min. Approximately 37% of them had mild POTS (ie, an increase in heart rate ≤35 beats/min), whereas 63% had moderate to severe POTS (ie, an increase in heart rate >35 beats/min). Most patients had been treated at some point with standard medications such as β-blockers, volume expanders, and/or α_1-adrenergic agonists.

All patients were informed of the purpose of and procedures used in the study and gave their written informed consent to a protocol approved by the Institutional Review Boards of the University of Texas Southwestern Medical Center and Texas Health Presbyterian Hospital Dallas. Table 1 depicts patients' characteristics.

Table 1 Patient characteristics

Variables	All participants (n = 251)
Age (y)	26 ± 11
Sex (male/female)	35/216
Height (cm)	168 ± 10
Weight (kg)	64 ± 16
Body mass index (kg/m^2)	23 ± 5
Heart rate (beats/min)	
Supine	78 ± 15
10-minute stand	120 ± 21
Change (Δ) from supine to 10-minute stand	43 ± 17
Blood pressure (mm Hg), systolic/diastolic	
Supine	115 ± 14/69 ± 9
10-minute stand	111 ± 19/72 ± 14
Race (n)	
White	234
African American	2
American Indian	1
Hispanic	4
Indian	1
Asian	2
Unknown	7

Data are expressed as mean ± standard deviation.

Study design

Patients stopped taking medications that could affect the autonomic nervous system at least 24 h before screening and testing (both before and after training). After a qualifying stand test with measurements of heart rate and blood pressure was received from a physician along with a completed SF-36 questionnaire and signed informed consent, an introductory letter was sent to the patient and the physician with recommendations for participation in our study. After that, we distributed a packet directly to the overseeing physician. This packet included an introduction to our study, global training guidelines, a month-by-month calendar of the exercise protocol, and heart rate goals to help guide the exercise program. The direct communication with the physician provided the initial level of oversight to ensure that the diagnosis was secure and that the patient was medically appropriate to participate in the intervention.

To test the feasibility of administering our program in the community setting, it was stated that we (the research team in Dallas) were not available to help in implementation of the program. Regular appointments with the primary physician were recommended to follow the patients' progress and their response to the interventions. Decisions about medications, especially psychiatric medications, were left up to the patients and their physicians. If the primary physician chose to maintain β-blockers during the training program, perceived exertion was used as a guide to exercise intensity prescription.

Exercise training and lifestyle intervention

The training program consisted of 3 months of daily schedules, outlined in Table 2. Based on the predicted maximal heart rate and resting heart rate, 3 training zones were determined (ie, recovery, base pace, and maximal steady state or "threshold").[16] Most of the training sessions, particularly during the early stages, were prescribed as base training, with the target heart rate equivalent to