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Exercise therapy improves quality of life in patients with postural orthostatic tachycardia syndrome (POTS)

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ABSTRACT A clinical decision report using:

George SA, Bivens TB, Howden EJ, et al. The international POTS registry: Evaluating the efficacy of an exercise training intervention in a community setting. *Heart Rhythm*. 2016;13(4):943-950. <https://doi.org/10.1016/j.hrthm.2015.12.012>

for exercise efficacy in patients with POTS.

Keywords: POTS, treatment, exercise, training, adults

Clinical-Social Context

Melissa Thomas [pseudonym] is a 60-year-old white woman with a past medical history of diabetes mellitus (DM), gastroesophageal reflux disease (GERD), and postural orthostatic tachycardia syndrome (POTS) who presented to the clinic for further evaluation and a second opinion on the management and treatment of her POTS syndrome. She has been experiencing fainting episodes since the first grade and was clinically diagnosed with neurocardiogenic syncope before being formally diagnosed with POTS by tilt table testing. Her diagnosis has affected her socially by forcing her to become more aware of her surroundings; it has not impacted her education or career goals as she has been used to managing her symptoms for so long. She is also socially supported by her husband and daughter who are well-educated on the syndrome and take good care of her when needed.

Mrs. Thomas has been experiencing some fatigue and listlessness for the past couple of months, but her symptoms have improved with an increased dose of escitalopram. She can afford her medications, has insurance, and has easy access to both her primary care doctor and pharmacy. She complains of atypical, intermittent chest pain as well as intermittent palpitations. She frequently feels “too hot” and cannot withstand going outside in the summer due to pre-syncope and syncope episodes. She experiences brain fog and some cognitive dysfunction as a side effect of her syndrome. These symptoms are not attributed to her post-menopausal age, however, because she has been experiencing them for many years prior to menopause.

She had a Holter monitor in 2009 that revealed no arrhythmias and a prior CT-angiogram in 2015 that revealed no significant coronary artery disease. Although imaging showed no acute abnormalities, Mrs. Thomas was still concerned about the severity of her symptoms and whether her current treatment regimen was optimized. She previously saw a POTS specialist who prescribed her a beta blocker and a selective serotonin reuptake inhibitor

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(SSRI) and educated her on the importance of a salt-loading diet regimen in addition to fluid hydration. Although she was compliant with her recommended treatment, she was curious about how exercise would affect her symptoms. She is able to afford a gym membership, but stated that she was too scared to try intensive training. Given the fact that she lives in a neighborhood conducive to exercising outside, she rides her bike and goes on long walks instead, which occasionally improve her symptoms. Our team was curious to know if Mrs. Thomas, in addition to her current management, would benefit from an exercise program and if it would improve her quality of life.

Clinical Question

Is exercise training sufficient to positively impact and/or improve the quality of life in patients with postural orthostatic tachycardia syndrome (POTS)?

Research Article

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Description of Related Literature

Searching PubMed with the terms “POTS” AND “treatment” yielded 1,520 results. Narrowing the search criteria by filtering for clinical trials yielded 67 results, or by adding “exercise” to the query yielded 65 results without the clinical trials filter and 6 with; most of the results discussed pediatric obsessive-compulsive treatment studies, which were unrelated to the topic at hand. Revisions were made to the search and the terms “postural orthostatic tachycardia syndrome”, “treatment”, AND “adults” were used which resulted 200 studies. The clinical trial filter was applied, and the results were narrowed to 27 papers. The term “therapy” was then added with no change in number of results. Finally, “postural orthostatic tachycardia syndrome”, “treatment”, “adults”, AND “exercise” with the clinical trial filter were used and showed four results, which contained the chosen article.

Shibata et al. studied how physical reconditioning with exercise training improves exercise performance in patients with POTS.² Although the two groups studied were matched for age, sex, and body mass index (BMI), percentage of body fat was greater in those with POTS compared to healthy subjects. The biggest limitation was also that the healthy control group did not undergo a similar exercise training program as the treatment group, which limited the ability to generalize the data.

Arnold et al. conducted a randomized controlled trial comparing the effect of low-dose propranolol to a placebo on exercise capacity in those with POTS.³ Although healthy subjects were used in a randomized, double-blinded study, eliminating the effect of any bias, sample size for both treatment group (11 patients) and control group (7 patients) was very small. In addition, the study looked at only one medication on peak oxygen consumption (VO₂ max), which was too specific for the question being asked. While this may have been a relevant next step to explore, the focus was not to evaluate for certain medications on exercise capacity, but to look at exercise’s impact on POTS in general.

Similarly, Fu et. al studied propranolol, but compared the medication to exercise training rather than to a placebo in patients with POTS.⁴ Although subjects were age-matched and completed a double-blind drug trial, there were proportionally more females than males in both treatment and control groups. In addition, the study focused primarily on adrenal function, specifically the renin-angiotensin-aldosterone system (RAAS), during orthostatic vital sign assessment by measuring patients’ heart rates after a 2-hour standing test. The study did not generalize to overall quality of life and day-to-day functioning. It also lacked assessment on whether or not the results were effective in a community environment outside of the constraints of a controlled clinical trial, which was an advantage of the chosen study.

The chosen study by George et al. evaluated the efficacy of exercise training and lifestyle intervention in POTS patients in a community environment, which was directly applicable to Mrs. Thomas’s concerns.¹ The study enrolled 251 patients, which was a much larger sample size than the other three studies with an average of about 20 subjects each. A 3-month program involving



intensity endurance training and strength training with increased salt/water intake was delivered under physician supervision and showed remission in POTS and improvement in quality of life. The body of evidence discussed above produced a Strength of Recommendation B-level according to the Strength of Recommendation Taxonomy.⁵

Critical Appraisal

The selected publication describes a randomized controlled trial that fits under SORT level 2, based on a single cohort, observational trial.⁵ The purpose of the study was to determine if exercise training and lifestyle modifications in the community setting outside of a controlled clinical trial were efficient to decrease or reduce orthostatic tachycardia and improve quality of life in POTS patients.

A POTS registry of 251 participants (216 female, 35 male), including people from 36 different states in the United States and seven different countries, was established. No direct advertising of the study was done. In fact, both patients and physicians contacted the laboratory to be enrolled in the study. Patients ranged from ages 26 ± 11 with the vast majority being white (234/251). The inclusion of so many white female patients is not abnormal for POTS, which overwhelmingly affects young white women, leading to frequent delayed and misdiagnosis in men and non-white patients.⁶ All patients included at least 6 months of orthostatic symptoms and had a heart rate rise of >30 beats/min or a rate that exceeded 120 beats/min that occurred after 10 minutes of standing. In addition, most patients had already been treated with standard medications such as beta blockers. Mrs. Thomas fit most of the inclusion criteria for this study, which made the data easily applicable to her case. She differed notably from the study population only in age.

To begin, patients had to stop medications that could affect the autonomic nervous system (ANS) at least 24 hours before screening and testing, which consisted of a 10-minute stand test and a SF-36 questionnaire with physician oversight. The training program consisted of 3 months of daily schedules with 3 training zones (recovery, base pace, or maximal steady state). Initially, participants were asked to exercise 3-4 times a week for about 30-40 minutes per session by rowing, swimming, or bicycling. This was crucial in the beginning for patients to avoid upright posture that would elicit their symptoms. As patients became accustomed to the program, workout modalities, duration, frequency, and intensity were increased. Resistance training was also included in addition to the endurance training, and patients were recommended to increase their water and salt intake. They were also encouraged to elevate the bed while sleeping at night so that they would remain in an upright position as much as possible.

The 10-minute stand tests and SF-36 questionnaire were reassessed at about 3 months after completion of the training program. Objective quantification of change in heart rate with the stand test and subjective evaluation with the questionnaire were used to evaluate the efficacy of exercise training/lifestyle modification.

Among all participants enrolled, 103 (41% of participants) completed the 3-month training program. Full data sets, providing both the stand test and questionnaire, were achieved in 78 of the 103 patients. Most physicians were able to wean their patients off medications prior to beginning the program; however, the decision was ultimately left to the primary physician.

The dropout rate was 59% (148/251 participants). Of the 148 participants, 35 did not finish due to other medical problems, 23 stopped for personal reasons, 59 stopped because they considered the training to be too difficult, and 31 were lost to follow-up.

Out of the 78 patients who had the full data set, it was determined that short-term exercise markedly reduced standing heart rate. 71% no longer qualified for POTS criteria and were said to be in remission. A subset of patients continued the training program after the study was over and showed no evidence of decay in the efficacy of the intervention over time (6-12 months).

The SF-36 scores were significantly increased in virtually all patients, suggesting an improvement in overall well-being and quality of life. Furthermore, these results appeared to persist in patients who were able to continue training past the 3-month mark.

Some limitations of the study included the fact that it was observational and descriptive, with no control group for patients enrolled in the training program. Exercise itself can improve general well-being, so it may have been of benefit for the study to include patients who don't have POTS and see how the increase in their SF-36 scores compared to patients with POTS when participating in the study. The results of the study should be confirmed in a large randomized and controlled community-based clinical trial. Additionally, selection bias was a big issue in this study, as patients were allowed to self-refer to be included in the study. About 86% of the participants were female and the majority of the patients had the same ethnicity. While these features may have been



attributed to the prevalence of the condition, it caused poor extrapolation of the results to other subgroups of the population. Also, the results were reported only for patients who completed the 3-month training program and had a full data set. This suggested a high dropout rate, either due to withdrawal from the study or loss to follow-up. The study could also not rule out the fact that those who completed the program might have had a naturally more favorable history compared to those who dropped out or may not have had as much difficulty performing this type of training without a personal trainer. Lastly, there are many other interventions to lower heart rates than exercise training.

It is still to be determined whether exercise can be effective long-term treatment therapy for those with POTS, however, of those who completed the 3-month training program, quality of life was significantly improved and the results were found to be applicable in the community setting.

Clinical Application

Postural orthostatic tachycardia syndrome (POTS) is a condition characterized by increased heart rate and orthostatic intolerance, where too little blood returns to the heart when moving from a lying down to a standing position.²⁸ POTS can affect men and women of all ages, although it tends to primarily affect women between the ages of 15-50, which applies to Mrs. Thomas, as she has been dealing with this syndrome from a very young age.

Mrs. Thomas came to the clinic with specific inquiry towards the benefits and risks of exercise, specifically the amount of exercise she would need to perform and how often. She had tried all other interventions including a wide range of medications and diets, which seemed to help control her symptoms but not eradicate them. It was concluded that she would benefit from an exercise program as primary treatment due to the fact that it would limit the amount of medications she would be needing to take and allow her to become flexible in her exercises without having to spend an unreasonable amount of money. Indeed, preventing polypharmacy is a major benefit to treating this condition through exercise therapy. Compared to medications, exercise is relatively inexpensive and, unlike medications, the risk of adverse effects from exercise are low and are limited to injuries from overexertion, falls, etc. These do not present much of a significant risk to Mrs. Thomas above the risk inherent in her daily activities. It is also likely to benefit or prevent many comorbid conditions common in America. Although the amount of exercise needed varies between individuals, at least about 30 minutes three or more times a week would show significant improvement in her functionality and management of her condition.

Mrs. Thomas had concerns about overexerting herself during exercise and what detrimental effects that would have on her health, however, there are very few risks associated with implementing exercise into her lifestyle. Nevertheless, she may need to take it slow in order to adjust and find her preferred exercise regimen. It is likely that the exercise therapy will help her show clinical improvement in POTS, and exercise is likely to provide health benefits to Mrs. Thomas in many other ways as well.

New Knowledge Related to Clinical Decision Science

The underlying mechanisms of POTS are not well understood, and there are few effective therapies available; however, the study by George et al. gathered data on the efficacy of an exercise-based intervention in a community setting and concluded that patients have a good chance of remitting their postural orthostatic tachycardia without the requirement for a specialized center or specific equipment. The data is easily applicable to Mrs. Thomas as she fits inclusion criteria, is very open to trying new treatments, and has a very supportive family to guide her through the consequences of her diagnosis. Future efforts to engage exercise specialists, physical therapists, personal trainers, and other health care providers could improve access, adherence, and long-term lifestyle modifications for maximal improvements in patients suffering from POTS.

As with all clinical decisions, the risks of harm need to be balanced with the risk of benefit. Simply having an example of patients with similar symptoms successfully attempt exercise was reassuring and allowed the recommendation for exercise to proceed. The patient was familiar with balancing risks and the information we were able to provide allowed her to continue to learn to live with her condition.



Conflict Of Interest Statement

The authors declare no conflicts of interest.

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