Feasibility and Effects of Cardiac Rehabilitation for Individuals after Transient Ischemic Attack

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Background and Objective: Cardiac rehabilitation programs (CRPs) are common for cardiac patients; however, most individuals post transient ischemic attack (TIA) receive no rehabilitation despite similar pathologies. The objective of this study is to determine effects of cardiac rehabilitation (CR) on cardiovascular fitness (peak oxygen uptake [VO_{2peak}]) and 6-minute walk distance (6MWD) post TIA. Secondary outcomes included other clinical and process indicators. *Methods:* Eighty-five people post TIA (mean age 67.5 ± 10.7, 47% female) were referred to CR (2006-2014). The retro-TIA cohort included 65 consecutively enrolled individuals who were evaluated retrospectively. To collect additional measures, the pro-TIA cohort included 20 participants who were followed prospectively with a 3-month non-intervention period followed by 6-months of CR with 6MWD, cognition, depression score, and anthropometrics measured at each time point. Baseline, 6-month cardiopulmonary exercise test results, depression score, and anthropometrics were examined separately for both cohorts. *Results:* Among all participants, 62% completed CR with $72.8 \pm 17.7\%$ attendance to prescheduled classes. CR resulted in improvements in VO_{2peak} for both cohorts (both, $P < .02$). In the retro-TIA cohort, there were improvements in resting heart rate and body mass index, with reductions in the proportion of people with obesity and abdominal obesity (all, $P < .04$). In the pro-TIA cohort, compared to the stable baseline period there was a significant improvement with the CR intervention in the depression score ($\Delta 1.1 \pm 4.3$ and $\Delta -3.3 \pm 3.9$, respectively; $P = .04$) but not in 6MWD ($\Delta 4.8 \pm 42$ m and $\Delta 61.0 \pm 73.5$ m, respectively; $P = .06$). For all participants, regression analysis revealed a higher depression score ($\beta = 1.10$, $P = .02$), male sex ($\beta = 4.932$, $P = .02$), and less social support ($\beta = 4.085$, $P = .04$) as predictors of dropout. *Conclusions:* A CRP is feasible and effective for improving cardiovascular health. Strategies to promote adherence in men, in those with depressive symptoms, and in those with less social support require investigation. **Key Words:** Exercise—TIA—comprehensive cardiac rehabilitation—cardiovascular fitness.

Introduction

Stroke is associated with a loss of sensorimotor function, cognitive function, vision, or speech as a result of injury to brain cells due to bleeding or insufficient blood supply to the brain.[1] A threatened stroke, called transient ischemic attack (TIA), is traditionally defined as an episode of neurological dysfunction caused by focal brain ischemia lasting less than 24 hours,[2] although recent definitions reserve the term for clinical symptoms lasting less than 1 hour.[3,4] Individuals who suffer a TIA are at a greater risk of subsequent cardiovascular event,[5] with 22% experiencing stroke, myocardial infarction, or death by 1 year.[6] Physical activity has been shown to reduce the risk of premature death and cardiovascular disease including stroke.[7] Thus, once an individual has suffered a TIA, preventative measures can be taken to target modifiable risk factors, one of which is physical inactivity. Stroke rehabilitation is generally limited to the few weeks post stroke and rarely extends beyond a 3- to 4-month period. Most individuals post TIA receive no rehabilitation at all. In contrast, cardiac rehabilitation programs (CRPs) are common for cardiac patients, often extending for 3-6 months after an event and are part of the routine management. The current study examines the use of an established and common model of care (cardiac rehabilitation [CR]) and applies it to those who have suffered a TIA to maximize cardiovascular fitness and minimize risk of future cardiovascular events.

Studies have demonstrated the value of exercise programs in cohorts that include minor stroke and TIA[8-12] but not TIA alone. We set out to examine if the addition of formal CR to standard care results in improvements in directly measured cardiovascular fitness (VO_{2peak}) and functional mobility measured by 6-minute walk distance (6MWD) on individuals after TIA. These measures are important factors linked to stroke risk and quality of life reflecting the most direct evidence of the potential impact of the CRP. Unlike other measures of recovery linked to stroke risk (e.g., blood pressure, lipid profile, and glucose tolerance), maximal exercise capacity and walking capacity after TIA are not as likely to be impacted by concurrent treatments focused on other risk factors. As a result, they are ideal candidates to explore the potential benefits of the program. In addition to the primary objectives, we were also interested in CR process indicators (both completion rate and attendance to prescheduled classes) and the potential benefit of the CR model on improving depressive symptoms, cognition, and anthropometric measures in view of the potential effect on mortality and metabolic and psychosocial health.[13-18] There were 2 cohorts in the present study; the first was a retrospective examination of the effects of the CR intervention alone on standard of care measures (retro-TIA), and the second was a prospective study (pro-TIA) that allowed for a greater number of metrics and included a baseline observation period to allow comparison between outcomes associated with a CRP and possible spontaneous change.

Materials and Methods

The present study was an analysis of 85 people following TIA enrolled in a single CRP in Toronto, Canada. The study included 2 cohorts. Figure 1 provides an overview of the design and assessments.

Retro-TIA: This cohort included all of the 65 consecutively enrolled individuals who participated in CR alone and were followed retrospectively. Participants were referred from stroke prevention clinics, neurologists, and primary care physicians from January 2006 to October 2012. Pre- and post-CR assessments were conducted and included cardiopulmonary assessments, anthropometric measures, depression score, and adherence indicators. Data were extracted from the institution's database. The study was approved by the institution's Research Ethics Board.

Pro-TIA: This cohort included 20 participants who were followed prospectively using a repeated measures design with a 3-month monitoring period without intervention (−3 to 0 months) followed by 6 months of CR, recruited from January 2010 to October 2014. Participants were recruited for the study through the Stroke Prevention Clinic at Sunnybrook Health Sciences Centre. As shown in Figure 1, assessments conducted at all 3 time points included 6MWD testing, cognition, depression score, and anthropometric measures. Assessments conducted only pre- and post CR included cardiopulmonary assessment and adherence indicators. The study was approved by the institutions' Research Ethics Board and all participants provided written informed consent.

CR Intervention

The program was led by an interprofessional team of physicians, physiotherapists, nurses, kinesiologists, psychologists, and dietitians. Participants post TIA from both cohorts of the study were integrated into the CR stream and received the same program delivery model as cardiac participants. The participants attended 90-minute exercise classes once per week for 6 months, and were offered baseline and 6-month cardiopulmonary exercise tests. Exercise classes included aerobic training, education sessions, as well as psychosocial and dietary counseling. Each patient was assigned to a case manager, and all patients were required to complete 5 aerobic and 2-3 resistance training sessions per week, which were tracked via an exercise diary. One exercise session was conducted in the facility, with the balance of the exercise being completed in the home or community. The initial walking prescription was set at a distance of approximately 1.6 km/day and an intensity equivalent to the ventilatory anaerobic threshold (VAT) and/or 60%-80% of peak oxygen uptake (VO_{2peak}). Prescriptions progressed every 2 weeks,