

ORIGINAL RESEARCH

Patient Characteristics That Influence Enrollment and Attendance in Aerobic Exercise Early After Stroke



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Abstract

Objective: To identify patient characteristics that influence physiotherapist's decisions on enrollment and attendance in a structured aerobic exercise program early after stroke.

Design: Retrospective chart review.

Setting: Rehabilitation hospital.

Participants: Consecutive sample of people (N=345) admitted to inpatient stroke rehabilitation over a 2-year period.

Interventions: Not applicable.

Main Outcome Measures: Patient demographic characteristics, preexisting medical conditions, and poststroke outcome variables (neurological deficit, physical impairment, balance control, and functional mobility and independence) were compared between individuals enrolled and not enrolled in a structured aerobic exercise program. The rate of attendance was calculated for the enrolled group.

Results: One hundred twenty-nine patients (38%) were enrolled in the structured aerobic exercise program. Patients who were older ($P=.0093$) and had cardiac disease ($P=.012$), cardioembolic sources ($P=.0094$), and arthritis ($P=.031$) were less likely to be enrolled in the structured aerobic exercise program. Poststroke outcome variables were not associated with enrollment. Among those enrolled, the rate of attendance was positively correlated with the FIM cognitive rating ($r=.27$; $P=.0031$).

Conclusions: Enrollment in structured aerobic exercise programs during inpatient stroke rehabilitation can be limited by safety concerns related to patients' cardiovascular and musculoskeletal status. Barriers associated with the perception of cardiovascular risk factors should be confronted because they do not preclude participation in cardiac rehabilitation. In addition, poststroke deficits do not limit participation in adapted aerobic exercise early after stroke. It is likely that the characteristics of the structured aerobic exercise program were integral to accommodate the breadth of poststroke deficits encountered in this study. Future research investigating physiotherapist and practice environment factors that influence the decision to prescribe and implement aerobic exercise is warranted.

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People recovering from stroke often have reduced cardiorespiratory fitness^{1,2} that persists over many years^{3,4} and is negatively reinforced by activity limitations.⁵ Systematic reviews

examining aerobic exercise interventions after stroke have shown improvements in aerobic capacity, walking endurance, walking speed, and quality of life.⁶⁻⁸ Accordingly, aerobic exercise is recognized as part of best practice guidelines for stroke rehabilitation,⁹ is recommended in clinical guidelines,^{10,11} and has been advocated for secondary stroke prevention.¹² However, participation in aerobic exercise to improve cardiovascular fitness is complicated by the presence of coronary heart disease (in up to 75% of individuals) and numerous comorbid conditions.¹³⁻¹⁵

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Structured aerobic exercise programs are an important part of comprehensive cardiac rehabilitation and have been shown to positively affect cardiovascular risk factors, improve quality of life, reduce depressive symptoms, and reduce morbidity and mortality.^{16,17} In contrast to cardiac rehabilitation, inpatient stroke rehabilitation programs do not routinely include structured aerobic exercise, despite evidence of the feasibility and effectiveness of symptom-limited exercise testing^{18,19} and aerobic training²⁰⁻²⁵ early after stroke. Although therapeutic interventions can improve the balance, endurance, and mobility of patients early after stroke,²⁶ the intensity of these interventions is often not sufficient to induce an aerobic training benefit.^{27,28} The early introduction to aerobic exercise may be particularly important to improve the outcome of rehabilitation and promote physical activity both in hospital and after discharge.

The absence of structured aerobic exercise programs during inpatient stroke rehabilitation may reflect barriers that involve the patient, health care providers, and practice environment. The patient's preexisting medical conditions and poststroke deficits are important considerations that may influence the safety or ability to participate. Therefore, the present study aimed to identify patient characteristics that influence physiotherapist's decisions on enrollment and attendance in a structured aerobic exercise program that is routinely provided as part of standard inpatient stroke rehabilitation. We hypothesized that patients who were enrolled and had high rates of attendance would have a lower prevalence of cardiovascular risk factors as well as lower levels of cognitive and physical impairments.

Methods

Consent was provided and study procedures were approved by the Toronto Rehabilitation Institute (University Health Network) Research Ethics Board.

Sample

A retrospective chart review was conducted on individuals diagnosed with stroke and admitted to the Toronto Rehabilitation Institute (University Health Network) inpatient Stroke Rehabilitation Service over a 2-year period. Diagnosis was confirmed by the indication of acute stroke in electronic patient records from diagnostic imaging (ie, computed tomographic scan, magnetic resonance imaging, carotid ultrasound, cerebral angiogram, and/or echocardiogram). Physiotherapists and trained research personnel extracted de-identified data from charts of all individuals admitted between October 2010 and September 2012. There were no other inclusion/exclusion criteria.

Standard inpatient stroke rehabilitation

Patients received multidisciplinary rehabilitation including physiotherapy, occupational therapy, and speech or language services (as needed) 5 d/wk for the duration of their stay. In addition, structured aerobic exercise was routinely scheduled as part of standard care.²⁰ Patients were referred to the aerobic exercise program as soon as they were: (1) medically stable according to

American College of Sports Medicine guidelines²⁹; (2) able to understand and follow instructions (eg, to maintain cadence); and (3) able to report concerns (eg, pain or discomfort); supportive strategies were used for patients with aphasia).

Patients performed a graded submaximal exercise test using a semi-recumbent stepping machine^a to screen for contraindications to exercise and to inform the initial aerobic exercise prescription. Exercise testing was terminated when the patient (1) reached 70% (60% for individuals taking β -blockers or those who were diabetic with comorbid conditions) of the age-predicted maximum heart rate (defined as $208 - [0.7 \times \text{age}]^{30}$); (2) reported a "strong" rating of perceived exertion (RPE) (5 of 10 on the Borg 10-point category ratio scale); (3) was unable to maintain stepping cadence (decrease of 10 steps/min); or (4) requested the session to end. Heart rate, RPE, stepping rate, workload, and 5-lead electrocardiography^b output were monitored minute to minute.

A physiotherapist and trained assistants supervised aerobic exercise that was delivered in a group format 3 times/wk using semi-recumbent stepping machines^{a,c} (2 had optional leg stabilizer attachments). In each session, the patient's heart rate was monitored to ensure that the planned intensity was met and to safeguard against adverse events. Details of each aerobic exercise session were recorded in a patient log (eg, the frequency, intensity, and duration of exercise; heart rate from a heart rate monitor^d; RPE at rest and at 5-minute intervals; blood pressure from an automated system^e at rest, immediately after exercise, and during exercise if recommended by the primary treating physiotherapist).

The aerobic exercise prescription was progressed according to the individual. Across sessions, the target was to increase the duration of aerobic exercise to at least 20 minutes before increasing workload. Typical exercise sessions started with 2 to 5 minutes warm-up, up to 30 minutes of aerobic training, and 2 minutes cool-down (ie, low-intensity exercise).

Enrollment status and rate of attendance evaluation criteria

For the purposes of this study, patients were considered enrolled in the aerobic exercise program if they completed graded submaximal exercise testing and attended ≥ 1 aerobic exercise session. The rate of attendance was used to standardize the frequency that patients attended the aerobic exercise sessions prescribed; rate of attendance = (total number of sessions attended/total number of sessions prescribed) \times 100. Enrollment status and the rate of attendance were obtained from hospital charts.

Measures

Demographic variables

Patients were characterized according to sex, age, body mass index, type and location of stroke, affected side, and time poststroke.

Preexisting medical conditions

Preexisting medical conditions were categorized into 4 domains: cardiovascular factors, musculoskeletal factors, other comorbid conditions, and prescribed medications. Cardiovascular factors included the presence of hypertension, previous transient ischemic attack, previous cerebrovascular accident, cardiac

List of abbreviations:

CMSA	Chedoke-McMaster Stroke Assessment
ICC	intraclass correlation coefficient
NIHSS	National Institutes of Health Stroke Scale
RPE	rating of perceived exertion

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