

ORIGINAL ARTICLE

# Interdisciplinary Cardiovascular and Neurologic Outpatient Rehabilitation in Patients Surviving Transient Ischemic Attack or Stroke With Minor or No Residual Deficits



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## Abstract

**Objective:** To evaluate the feasibility and effectiveness of a comprehensive outpatient rehabilitation program combining secondary prevention and neurorehabilitation to improve vascular risk factors, neurologic functions, and health-related quality of life (HRQOL) in patients surviving a transient ischemic attack (TIA) or stroke with minor or no residual deficits.

**Design:** Prospective interventional single-center cohort study.

**Setting:** University hospital.

**Participants:** Consecutive consenting patients having sustained a TIA or stroke with 1 or more vascular risk factors (N=105) were included.

**Interventions:** Three-month hospital-based secondary prevention and neurorehabilitation outpatient program with therapeutic and educational sessions twice a week. Patients were evaluated at entry and program end.

**Main Outcome Measures:** Impact on vascular risk factors, neurological outcome, and HRQOL.

**Results:** A total of 105 patients entered the program and 95 patients completed it. Exercise capacity ( $P<.000$ ), smoking status ( $P=.001$ ), systolic ( $P=.001$ ) and diastolic ( $P=.008$ ) blood pressure, body mass index ( $P=.005$ ), low-density lipoprotein cholesterol ( $P=.03$ ), and triglycerides ( $P=.001$ ) improved significantly. Furthermore, the 9-Hole-Peg-Test ( $P<.000$ ), Six-minute Walking Test ( $P<.000$ ), and One Leg Stand Test ( $P<.011$ ) values as well as HRQOL improved significantly. The program could be easily integrated into an existing cardiovascular prevention and rehabilitation center and was feasible and highly accepted by patients.

**Conclusions:** Comprehensive combined cardiovascular and neurologic outpatient rehabilitation is feasible and effective to improve vascular risk factors, neurologic functions, and HRQOL in patients surviving TIA or stroke with minor or no residual deficits.

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Stroke represents one of the major health problems worldwide, particularly in countries with economy in transition and industrialized countries.<sup>1,2</sup> Patients after transient ischemic attack (TIA) or stroke are at an increased risk for recurrent stroke or

cardiovascular events.<sup>3</sup> Stroke prevention is complex and includes pharmacological and lifestyle interventions for risk factor reduction.<sup>4-7</sup> Using all proven measures, up to 90% of strokes could be prevented or would occur at an older age.<sup>8-10</sup>

Comprehensive cardiac rehabilitation (CCR) is an accepted treatment modality to improve secondary prevention in patients with cardiac disease.<sup>11-13</sup> Exercise programs are effective in reducing the cardiovascular risk. However, the combination of

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exercise therapy and risk factor intervention has proven to be superior and is recommended by actual guidelines.<sup>11-13</sup> In contrast, patients surviving TIA or stroke with minor or no residual deficits are usually discharged from acute care without subsequent rehabilitation or comprehensive risk factor intervention. In addition, secondary stroke prevention is often neglected in stroke rehabilitation programs despite being considered a formal component of such programs.<sup>4</sup> The necessity of secondary prevention and the integration of patients surviving TIA or stroke with minor or no residual deficits into an existing CCR has recently been reported.<sup>14</sup> However, these patients usually suffer from various psychosocial sequelae, and disabilities are often underestimated during acute hospitalization. Minor disabilities impair activities of daily living, and health-related quality of life (HRQOL) is reduced in the majority of patients with stroke even when residual deficits are not apparent.<sup>15</sup> Psychological and social factors such as poststroke depression, anxiety, poor social support, and poor coping strategies are consistent determinants of poor HRQOL and main factors limiting recovery and rehabilitation.<sup>16-18</sup> Patients, their families, and home-based caregivers are mostly unable to address the complexity of problems and therapeutic needs after stroke resulting in poor recovery, secondary prevention, and HRQOL.<sup>19,20</sup>

Patients with TIA and stroke share the same vascular risk factors as do patients with cardiac and other vascular diseases. In a survey, it was found that cardiac diseases were present in 52%, arteriosclerosis in 90%, and small vessel disease in 66% of patients with ischemic stroke and stroke risk is elevated in patients after myocardial infarction.<sup>21,22</sup> Considering this, rehabilitation programs should be integrative.<sup>23</sup> Although stationary neurorehabilitation programs for patients with stroke with severe neurological impairments exist, appropriate rehabilitation programs for patients after TIA or stroke with minor or no deficits that include secondary prevention interventions are lacking. Because of the patients' characteristics, these programs have to be ambulatory.

We therefore developed a combined interdisciplinary hospital-based outpatient secondary prevention and neurorehabilitation program for patients surviving TIA or stroke with minor or no residual deficits with the goal to improve neurologic functions and HRQOL in addition to vascular risk factors. The program was incorporated into an already existing cardiovascular rehabilitation center with a 12-week hospital-based outpatient CCR provided by a multidisciplinary team including exercise therapists, nutrition counseling specialists, smoking cessation counseling specialists, psychologists, and cardiologists.<sup>24</sup> This program was adjusted to stroke-specific problems. In this article, we describe the combined secondary prevention and neurorehabilitation program and its impact on vascular risk factors, neurologic functions, and HRQOL.

#### **List of abbreviations:**

<b>BMI</b>	<b>body mass index</b>
<b>CCR</b>	<b>comprehensive cardiac rehabilitation</b>
<b>HADS</b>	<b>Hospital Anxiety and Depression Scale</b>
<b>HRQOL</b>	<b>health-related quality of life</b>
<b>9-HPT</b>	<b>9-Hole Peg Test</b>
<b>OLS</b>	<b>One Leg Stand</b>
<b>6MWT</b>	<b>Six-minute Walking Test</b>
<b>TIA</b>	<b>transient ischemic attack</b>

## **Methods**

### **Subjects**

Consecutive patients with TIA or stroke were selected from the stroke unit, the outpatient clinic, and rarely after stationary neurorehabilitation that usually lasted 2 to 3 months by a designated neurology fellow and started as soon as possible in the upcoming treatment groups. Minor deficits were defined as marginal physical or cognitive dysfunction that do not seem to handicap patients or strongly interfere with activities of daily living.

In all patients, ancillary investigations such as brain imaging using magnetic resonance imaging or computed tomography, neurovascular ultrasound or computed tomography-angiography or magnetic resonance imaging-angiography of the intracranial and extracranial vessels, standard and long-term electrocardiography, echocardiography, and blood analyses were performed as deemed necessary to determine stroke etiology.

### **Inclusion criteria**

Patients with TIA or stroke, age between 18 and 80 years, were eligible if their physical and cognitive functions had recovered well enough to attend the outpatient exercise and teaching program on the discretion of the recruiting neurologist using the available clinical information and interviewing the patients. In addition, patients had to have at least 1 of the following risk factors: hypertension (on antihypertensive medications, or systolic/diastolic blood pressure  $\geq 140/90$  mmHg), diabetes mellitus (use of oral antidiabetics or insulin or abnormal glucose values), dyslipidemia (on lipid-lowering drugs, or low-density lipoprotein  $\geq 2.5$  mmol/L), ischemic heart disease (angina pectoris, myocardial infarction, or coronary angioplasty within the previous year), acknowledged cigarette smoking within the previous year, or body mass index (BMI) of 30 kg/m<sup>2</sup> or more.

### **Exclusion criteria**

Patients with intracranial hemorrhage, disabling stroke, or other conditions such as clinically significant heart, lung, renal or malignant diseases, musculoskeletal problems, or psychiatric disorders that compromise the participation and proper performance of the program were ineligible to participate in the study.

### **Study design**

This was a prospective single-center interventional cohort study. All patients gave informed consent, and the ethical committee of the Canton of Bern approved the study. This hospital-based outpatient program is embedded in the Cardiovascular Prevention and Rehabilitation Center of the University Hospital Bern that offers similar programs to patients with various vascular diseases, and is managed both by cardiologists and by neurologists specialized in neurorehabilitation. The program components are reimbursed by the Swiss health insurance for patients after TIA or stroke having cardiovascular risk factors.

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