Cognitive Dysfunction and Physical Activity After Stroke: The Gothenburg Cognitive Stroke Study in the Elderly

Ulrika Påhlman, MSc,*† Marianne Sävborg, MSc,* and Elisabeth Tarkowski, MD, PhD*

This study explored the association between cognitive and executive dysfunction and level of physical activity 1 year after stroke. Cognition before stroke and cognitive and executive function in the acute phase and at 1 year after stroke were assessed in 74 subjects. Physical activity was assessed at 1 year after stroke. Factors that appeared to predict low level of physical activity at 1 year after stroke were impaired global cognition before stroke, visual neglect and impaired logical deductive ability in the acute phase, and impaired global cognition, executive function, and visual memory 1 year after stroke. Our findings underscore the importance of identifying stroke patients with impaired cognitive and executive function who are at risk for developing inactivity. **Key Words:** Cognition—executive—inactivity—cerebrovascular disease.

Stroke survivors are often predisposed to a sedentary lifestyle caused by disability.[1] Even survivors with only mild motor impairment may have a low level of physical activity.[2] Inactivity is a significant predictor of decline in mobility at 1 year after stroke.[3] Physical functioning gives the individual the capability to engage in physical activities, and physical activity helps maintain, and in some cases improve, physical functioning.[4] Physical activity is defined as any bodily movement produced by contraction of skeletal muscle that substantially increases energy expenditure; the intensity and duration can vary substantially.[5] According to the International Classification of Functioning, Disability and Health there are four health related domains; body functions, body structure, activity and participation. Physical activity sorts under the domain of activity, requiring an ability to carry out an action.[6]

Other factors, such as the presence of cognitive problems 1 year after stroke, are significant predictors of decline in mobility.[3] Cognitive impairment, defined as impairment of intellect (information handling) and execution or control (how behavior is expressed),[7] is common in stroke patients, particularly in elderly patients.[8,9]

Thus, physical inactivity as well as cognitive and executive dysfunctions commonly occur after stroke and are associated with poorer functional outcome. Physical activity may imply not only the capacity to move or execute routine activities, but also the participation in different types of more complex leisure activities. Thus, physical activity may engage different parts of cognition and execution, such as intentional functions, concentration, mental flexibility, fluid reasoning, and ability to carry out an action. However, it seems important to explore the relationship between global cognition and physical activity, and also to explore whether the different cognitive or executive functions are associated with different levels of physical activity after stroke. If such a relationship exists, it will be important to specifically support physical activity in patients with cognitive impairment after stroke. Furthermore, in previous studies we showed that not only cognition after stroke, but also cognition before stroke onset, are related to the recovery of activities of daily living[10] and the recovery of balance after stroke.[11] Thus, we may assume that prestroke cognitive status is associated with the physical activity level after stroke.

The aim of this prospective study, therefore, was to study the relationships between (1) prestroke cognitive impairment, (2) global and selective cognitive and

From the *Sahlgrenska Academy at the University of Gothenburg, Institute of Medicine, Gothenburg, Sweden; and †Department of Physiotherapy, Sahlgrenska University Hospital, Gothenburg, Sweden.

Received January 13, 2011; accepted February 19, 2011.

Address correspondence to Ulrika Påhlman, MSc, Sjukgymnastikavdelningen, Sahlgrenska Universitetssjukhuset, Vita Stråket 13, 413 45 Göteborg, Sweden. E-mail: ulrika.pahlman@vgregion.se.

1052-3057/$ - see front matter

doi:10.1016/j.jstrokecerebrovasdis.2011.02.012

executive impairment in the acute phase after stroke, (3) global and selective cognitive and executive impairment 1 year after stroke and physical activity level 1 year after stroke.

Patients and Methods

A total of 74 patients (38 women and 36 men aged 65-97 years; mean age, 78 ± 8 years) were consecutively included into this study. All patients had been admitted to a geriatric stroke unit at Sahlgrenska University Hospital in Sweden after a stroke, defined in accordance with the stroke criteria of the World Health Organization.[12] The patients were referred directly from the emergency department or from a medical ward between 0 and 38 days after stroke onset (mean, 10.4 ± 9 days). On admission to the emergency department, each patient was assessed by medical and neurologic examination and brain computed tomography scan. An additional medical and neurologic examination was performed on the patient's admission to the geriatric department, and patients with stroke were consecutively included into this study. Patients with low level of consciousness, a severe medical condition, severe aphasia, severe dementia, or difficulty understanding Swedish were excluded from the study. Neurologic deficits were measured using the National Institutes of Health Stroke Scale.[13] The patients with stroke were stratified into minor stroke and major stroke groups according to the criteria of Hachinski.[14] The definition of minor stroke requires that the patient be discharged and sent home, can walk without assistance, and can cope unaided with self-care activities, such as eating, dressing, and toileting, within 1 month after stroke onset. In contrast, major stroke patients have a stable and usually severe neurologic deficit.

The level of disability and functional outcome before stroke onset, on admission to and discharge from the ward, and at 1-year follow-up were assessed using the modified Rankin Scale (MRS), with scores ranging from 0 (no symptoms) to 6 (death).[15,16] Following Sulter et al,[17] cutoff mRS scores were ≤2 (independent) and >2 (dependent). Of the 74 patients, 41 (55%) lived alone and 33 (45%) lived with a spouse. Some 80% of the patients had a comprehensive school education (9 years), 13% graduated high school (12 years), and 7% had attended college or university.

At the 1-year follow-up, 53 patients remained in the study. Seven patients had died, and 14 had left the study for various reasons, including inability to perform the tests due to recurrent disease (n = 6), unwillingness to participate (n = 7), and lack of time on the part of staff related to heavy workload (n = 1). The 53 patients who remained in the study were reassessed by medical and neurologic examination.

All participants provided written informed consent to participate, and the University of Gothenburg's Ethics Committee approved the study.

Physical Activity

Physical activity was assessed via patient interview using the Frändin and Grimby scale.[18,19] This scale records various physical activities, ranging from those involving relatively low levels of activity, such as walking, to more complex activities. The level of physical activity was estimated by a physiotherapist based on the patient's responses to questions about physical activity and household activity during the preceding 6 months. As shown in Table 1, the Frändin and Grimby scale has 6 levels, ranging from level 1 (hardly any physical activity) to level 6 (hard or very hard regular exercise several times a week). For comparison, the patients were divided into 2 groups with a cutoff between level 3 and level 4. The low level includes levels 1-3, encompassing hardly any to light physical activity, and the high level includes levels 4-6, ranging from moderate to hard or very hard physical activity (Table 1). To help patients record their activities as completely and objectively as possible, the questions were carefully worded; nonetheless, the potentially subjective recording of activities is a limitation of this method, and hence our study. Another approach to testing physical activity is to use an accelerometer, which is related to hip movements. But although this method provides a more objective measurement of physical activity, it does not explore all types of physical activities, such as household activities, which demand less walking.

Table 1. *Physical activity scale according to Frändin and Grimby*[23]

1	Hardly any physical activity.
2	Mostly sitting, sometimes takes a walk, light gardening or similar tasks, sometimes light household activities such as heating up food, dusting, or clearing away.
3	Light physical exercise around 2-4 hours a week, such as walks, fishing, dancing, and ordinary gardening, including walks to and from shops. Main responsibility for light domestic work, such as cooking, dusting, clearing away, and making beds. Performs or takes part in weekly cleaning.
4	Moderate exercise 1-2 hours a week, such as jogging, swimming, gymnastics, heavy gardening, doing home repairs or light physical activities more than 4 hours a week. Responsible for all domestic activities, light as well as heavy. Weekly cleaning with vacuum cleaner, washing floors, and window cleaning.
5	Moderate exercise at least 3 hours a week, such as tennis, swimming, jogging, and the like.
6	Hard or very hard exercise regularly and several times a week with great physical exertion, such as jogging.