

Severity of Spatial Neglect During Acute Inpatient Rehabilitation Predicts Community Mobility After Stroke

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Objective: To examine whether stroke survivors with more severe spatial neglect during their acute inpatient rehabilitation had poorer mobility after returning to their communities.

Design: A prospective observational study.

Setting: Acute inpatient rehabilitation and follow-up in the community.

Participants: Thirty-one consecutive stroke survivors with right-brain damage (women, $n = 15$ [48.4%]), with the mean (standard deviation) age of 60 ± 11.5 years, were included in the study if they demonstrated spatial neglect within 2 months after stroke.

Methods: Spatial neglect was assessed with the Behavioral Inattention Test (BIT) (range, 0-146 [a lower score indicates more severity]) and the Catherine Bergego Scale (range, 0-30 [a higher score indicates more severity]). A score of the Behavioral Inattention Test < 129 or of the Catherine Bergego Scale > 0 defined the presence of spatial neglect.

Main Outcome Measurements: The outcome measure is community mobility, defined by the extent and frequency of traveling within the home and in the community, and is assessed with the University of Alabama at Birmingham Study of Aging Life-Space Assessment (range, 0-120 [a lower score indicates less mobile]). This measure was assessed after participants returned home ≥ 6 months after stroke. The covariates were age, gender, functional independence at baseline; follow-up interval; and depressed mood, which may affect the relationship between spatial neglect and community mobility.

Results: A lower Behavioral Inattention Test score was a significant predictor of a lower Life-Space Assessment score after controlling for all the covariates ($\beta = 0.009$ [95% confidence interval, 0.008-0.017]); $P = .020$). The proportion of participants unable to travel independently beyond their homes was 0%, 27.3%, and 72.7% for those with mild, moderate, and severe acute neglect, respectively (Catherine Bergego Scale range, 1-10, 11-20, and 21-30, respectively).

Conclusions: Our result indicates that acute spatial neglect has a negative impact on regaining of functional mobility in the community. Specific screening and treatment of spatial neglect during acute stroke care may be necessary to improve long-term mobility recovery.

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INTRODUCTION

Regaining mobility at the community level is a fundamental component of successful rehabilitation among stroke survivors [1]. Being able to move around in the community is multidimensional capability, reflecting not only physical function but also cognitive function, social integration, and community participation. However, current research on poststroke mobility has focused primarily on visible physical attributes, for example, gait performance [2]. The role of cognitive function has been largely overlooked, especially the domain of spatial cognition.

Spatial neglect is a cognitive disorder that affects perception and/or motor execution, and that predominantly occurs after a right hemispheric stroke [3-5]. It is a disorder of spatial attention or intention, demonstrated by a failure to attend to stimuli presented in the opposite side of space from the damaged cerebral hemisphere or a failure to act on contralesional stimuli despite preserved motor strength [4]. Stroke patients with spatial neglect

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usually have poor functional outcomes and prolonged hospitalizations [6-8], and impose increased burden on caregivers after discharge [9]. Spatial neglect also significantly influences mobility performance. During walking, a person computes the space around his or her body to reach a desired location. Stroke survivors with spatial neglect make errors in spatial perception of a target location and have a tendency to veer when walking [10]. Patients with spatial neglect showed 3 times more collisions during walking through doorways, although their gait velocity was similar to those of patients without neglect [11]. During wheelchair navigation, stroke patients with neglect had difficulty avoiding objects (furniture or a wall), especially on the left side, compared with those without neglect [12,13]. In addition, spatial neglect has been identified as a predictor of poor fitness to drive among stroke survivors, which affects travel in the community [14].

Despite this evidence that spatial neglect is linked to eventual functional disability, efforts to assess or treat neglect in acute care have been questioned, which may be due to the knowledge gap between research and clinical practice of spatial neglect's prevalence, severity, and clinical significance. For example, in 1987, Sunderland et al [15] reported that spatial neglect was rarely observed by 6 months after stroke, which may be a common concept among physicians and therapists based on our communication with these clinicians. However, a recent longitudinal cohort study showed that approximately 40% of stroke patients with neglect at the acute stage showed a persistent spatial deficit more than 1 year after stroke [16]. According to the earlier view of neglect being transient [15], a consistent relationship between acute spatial neglect and poor recovery in motor functional performance at inpatient rehabilitation discharge [7] and even 3 years after stroke [17] may result from an association of spatial neglect with more severe stroke. However, this view does not consider all the skills needed for successful community mobility beyond motor performance in the clinic (eg, gait velocity) [18]. It has been reported that, despite good performance of mobility in the clinic setting, nearly one-third of stroke survivors do not get out into the community [19]. Currently, several measures are used to project and estimate community mobility among stroke survivors, including gait speed or distance, functional mobility scale (eg, Functional Independence Measure [Uniform Data System for Medical Rehabilitation, Amherst, NY], and the Barthel Index), and self-reported surveys of how much a person travels [2,19]. With increasing global acknowledgment of the environmental factors important to functioning and the relationship between environment and participation [20], self reports of mobility that extend from home to a more challenging environment may be considered the most useful stroke outcome for current clinical use [2].

One of the self-reported measures is an estimation of the spatial extent of an individual's whole-body movement within his or her own environment [21,22]. This construct, life space, is quantified by a self report of how far and how

frequently a person travels in the community setting and takes into account the amount of help needed [21]. Life space differs from conventional assessments of mobility, which is often focused on the perceived ability to move around in the environment (ie, what one thinks that he or she is capable of achieving); rather, life space assesses the spatial extent of mobility (ie, where one has been) in daily life [21]. It has emerged as an alternative and complementary approach to traditional measures of physical function and mobility (eg, gait velocity) among older adults and individuals with various illnesses [21,23,24], because life space is a report of an individual's actual whereabouts, which suggests functional mobility and the level of social participation. The measure of life space has most often been used, as shown in the gerontology and geriatric literature, by behavioral psychologists, movement scientists, and gerontologists [21-23,25]. However, when considering that life space is a multidimensional construct that not only reflects motor skill but also cognitive and psychological well-being, resources available for the patient, and social integration [21], it may be a valuable outcome measure among stroke survivors. A small life space has been reported to be associated with increased risk of mortality [25,26] and cognitive decline [27] among older adults, even after taking into account traditional measures of motor function (eg, gait) and disability. Because of the evidence that life space may measure mobility beyond motor and gait impairment, assessing life-space recovery may allow more specific evaluation of the long-term impact of spatial neglect. Because spatial neglect affects stroke survivors' ability to navigate in their environment [28,29], the extent and frequency of travel in the community may be reduced by this disorder even with a preserved level of functional ability. Thus, in this study, we examined whether severity of spatial neglect during inpatient rehabilitation independently predicts mobility later, back in the community, among a group of stroke survivors with right-brain damage and with spatial neglect.

METHODS

Participants

Right-handed survivors of right-brain stroke were recruited based on referrals from clinicians in an acute inpatient rehabilitation hospital. Clinicians, including physicians, physical therapists, and occupational therapists, referred patients to the research team when patients met 3 pre-screening criteria: age between 18 and 100 years; having had a right-brain stroke within the past 2 months; and being able to give informed consent and having no serious brain conditions other than a stroke (eg, seizure disorder, dementia, or Parkinson disease), brain lesions that involve the left hemisphere, a history of psychiatric hospitalization, or being blind in 1 or both eyes. When following up with the referral, the research staff screened the patients for spatial neglect.

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