



Functional gain following rehabilitation of recurrent ischemic stroke in the elderly: Experience of a post-acute care rehabilitation setting



E.H. Mizrahi^{a,c,*}, Y. Fleissig^b, M. Arad^{b,c}, A. Adunsky^{b,c}

^a Department of Geriatric Medicine and Rehabilitation, Shmuel-Harofe Hospital, Beer-Yaakov 70300, Israel

^b Department of Geriatric Rehabilitation, Sheba Medical Center, Tel-Hashomer 52621, Israel

^c The Sackler School of Medicine, Tel Aviv University, Ramat Aviv, Tel Aviv 69978, Israel

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ABSTRACT

The aim of the study was to evaluate whether rehabilitation of patients with recurrent ischemic strokes is associated with functional gain. We studied a total of 919 consecutive post-acute ischemic stroke elderly patients admitted for rehabilitation. 22% out of the patients had recurrent stroke on index day. Functional outcomes of first-ever stroke patients and recurrent ischemic stroke patients were assessed by the Functional Independence Measurement scale (FIMTM) at admission and discharge. Data was analyzed by *t*-test, Chi-square test and by multiple linear regression analysis. There were 716 patients with first ever stroke and 203 patients with recurrent stroke. Total and motor FIM scores at admission and total, motor, gain and Montebello Rehabilitation Factor (RFG) FIM scores at discharge were similar in the two groups. A multiple linear regression analysis showed that age ($\beta = -0.13, p = 0.001$) length of stay ($\beta = 0.21, p < 0.001$), Mini-Mental State Examination score (MMSE) ($\beta = 0.1, p = 0.01$), and admission total FIM ($\beta = -0.12, p = 0.01$) emerged as the only independent predictors of higher gain FIM scores at discharge. The finding suggests that elderly patients with recurrent ischemic stroke admitted to rehabilitation ward, showed similar FIM gain scores at discharge, compared with first-ever stroke patients. It is concluded that recurrent stroke should not be considered as adversely affecting the short-term functional outcomes of patients in a post-acute rehabilitation setting.

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1. Introduction

Stroke remains a major cause of mortality all over the world (Murray & Lopez, 1997). The fastest growing segment of the elderly population is at highest risk of sustaining strokes (World Population Prospects, 2000). As a result, stroke will remain a major healthcare problem unless the incidence and disabling consequences of first-ever and recurrent strokes are reduced. Approximately 25% of patients with first-ever stroke will suffer a recurrent stroke over a period of five years, with one quarter of them being fatal within 28 days (Hardie, Jamrozik, Hankey, Broadhurst, & Anderson, 2005). The greatest risk of recurrence is throughout the first six months following a first stroke and compared with the general population of the same gender and age, over a 10-year period the risk of recurrent stroke is six times higher

than the risk of a first-ever stroke (Hardie, Hankey, Jamrozik, Broadhurst, & Anderson, 2004). Recurrent stroke increases significantly the probability of disability and institutionalization (Hankey, Jamrozik, Broadhurst, Forbes, & Anderson, 2002) with approximately half of the survivors remaining disabled and one-seventh remaining in need of institutional care (Hardie et al., 2004). The MATCH study (Management of Athero-thrombosis with Clopidogrel in High-Risk Patients) has provided not only data on the rate, degree and predictors of recovery from disability following ischemic stroke (Hankey, Spiessner, Hakimi, Carita, & Gabriel, 2007) but also on time frame and predictors of recovery from disability following recurrent ischemic stroke (Hankey, Spiesse, Hakimi, Bego, et al., 2007). However, it recorded the degree of disability by the Modified Rankin Score, rather than results of functional outcome following a post-acute care rehabilitation process. We could not find studies focusing on results of a post-acute care and degree of functional outcome after recurrent ischemic stroke.

Therefore, the present study aimed to evaluate whether, and to what extent, recurrent stroke is interrelated to overall functional outcome of a large group of elderly stroke patients.

* Corresponding author at: Department of Geriatric Medicine and Rehabilitation, Shmuel-Harofe Hospital, Beer-Yaakov 70300, Israel. Tel.: +972 8 9258770; fax: +972 8 9258657.

E-mail addresses: eli.mizrahi@grsh.health.gov.il, dmizrahi49@gmail.com (E.H. Mizrahi).

This would assist in evaluating rehabilitation potential and possibly avoid unrealistic expectations of medical staff and caregivers.

2. Patients and methods

This is a retrospective chart analysis study. The study design was approved by the local Institutional Review Board (non-exempt study). The basic hypothesis was that a diagnosis of recurrent stroke could adversely affect the short-term functional outcome of ischemic stroke patients, compared with first-ever ischemic stroke patients admitted to rehabilitation ward.

2.1. Setting

The Department of Geriatric Rehabilitation at our center is a 36-bed unit. This ward uses interdisciplinary team approach, in which medical personnel (physicians, nurses, physical, occupational and speech therapists, social workers, psychologists) meet twice a week to evaluate the status of each patient. During these meetings, treatment plans are established and monitored. Stroke patients typically undergo an average of five hours of physical therapy and five hours of occupational therapy a week.

2.2. Participants

The study included consecutive patients admitted to our ward during a six-year period with symptomatic acute ischemic stroke (Table 1). Primary inclusion criteria included stable medical status, enabling active rehabilitation treatment. Patients with a length of stay in the rehabilitation ward shorter than ten days (assuming that the extent of rehabilitation in such a short period is limited), residual brain damage due to infection, trauma or surgery and patients with space occupying lesions or hemorrhagic strokes were excluded.

Stroke was diagnosed on the basis of clinical presentation of acute onset of focal neurological signs. CT scans were performed in all cases to confirm the presence and nature of ischemic stroke. The presence of arterial hypertension, ischemic heart disease (manifested as stable or unstable anginal syndrome), atrial fibrillation, previous stroke, diabetes mellitus and hyperlipidemia were established by medical history, obtained by interview and a complete physical examination. The presence or absence of recurrent ischemic stroke was also established upon registry data positive for ischemic stroke in the past (ICD-9-CM code 434.91) and/or criteria adopted from previous studies on recurrent stroke (Hankey, Spiesser, Hakimi, Carita, et al., 2007; Hatano, 1976; Schmidt, Smirnov, & Ryabova, 1988). All patients were also assessed for their cognitive level by the Mini-Mental State Examination (MMSE) (Boban et al., 2012; Folstein, Folstein, & McHugh, 1975).

2.3. Functional assessment

To assess stroke outcome each patient was evaluated twice (upon admission and discharge) for level of functioning by the FIM instrument (Kidd et al., 1995; Linacre, Heinemann, Wright, Granger, & Hamilton, 1994). This tool is widely used to rate patients' performances on 13 motor and 5 cognitive domains (total FIM). Motor FIM is particularly sensitive in the detection of functional improvements (Dodds, Martin, Stolov, & Deyo, 1993) and score ranges between 13 (minimum) and 91 (maximum). We also used several relative measures of recovery, such as the respective FIM gains, obtained by subtracting admission from discharge scores, the Montebello Rehabilitation Factor Score (MRFS) efficacy equation (maximum possible FIM – admission FIM/discharge FIM) and the Montebello Rehabilitation Factor Score (MRFS) efficiency equation (MRFS efficacy/Length of stay) (Dru-bach, Kelly, & Taragano, 1994).

FIM scores were recorded by certified physiotherapists and geriatric nurses familiar with this scoring system.

2.4. Data analysis

Comparisons between the two groups of patients with recurrent stroke and first-ever stroke as defined above, regarding demographic and clinical characteristics, were performed using 2 tailed Student's *t*-test or Chi-square test (for continuous and categorical variables, respectively). To test association between total, motor and FIM gain at discharge, and possible predictive independent variables, a multiple linear regression analysis was applied respectively. Separate multiple regression analyses were performed as for total and motor discharge FIM scores, as well as for their corresponding gains. All variables were entered in single stage.

The statistical significance level was set to 0.05, and SPSS for Windows software, version 11.0, was used for these analyses.

3. Results

Data of 985 patients admitted with acute stroke was available. 42 patients were excluded due to non-ischemic nature of stroke and 24 due to space occupying lesions or other exclusion reasons. The data of remaining 919 consecutive patients with a recent acute ischemic stroke, 60 years and older (age range 60–96) and meeting the aforementioned inclusion criteria were included in the final analysis. The clinico-demographic characteristics of patients are shown in Table 1. Female gender ($p < 0.001$), diabetes mellitus ($p = 0.05$) and length of stay ($p = 0.002$) emerged as statistically significant parameters differing between those with recurrent or first-ever ischemic stroke patients. There were no statistically significant differences between recurrent ($n = 203$) and first-ever stroke patients ($n = 716$) by age, atrial fibrillation, hypertension, ischemic heart disease, Parkinson's disease and MMSE score.

Table 1
Patients' characteristics by occurrence of stroke at admission, mean \pm S.D., n (%).

Variable	All	First-ever	Recurrent	<i>p</i> *
Number	919	716	203	
Age (years)	75.70 \pm 7.94	75.79 \pm 7.96	75.40 \pm 7.88	0.53
Female gender	405 (44.1)	348 (48.6)	57 (28.1)	<0.001
Length of stay (days)	50.29 \pm 27.39	51.79 \pm 27.73	44.85 \pm 25.52	0.002
Diabetes mellitus	349 (38)	260 (36.3)	89 (43.8)	0.05
Atrial fibrillation	180 (19.6)	148 (20.7)	32 (15.8)	0.12
Hypertension	648 (70.5)	500 (69.8)	148 (72.9)	0.39
Ischemic heart disease	275 (29.9)	207 (28.9)	68 (33.5)	0.21
Parkinson's disease	36 (3.9)	29 (4.1)	7 (3.4)	0.69
MMSE score	22.20 \pm 5.42	22.38 \pm 5.38	21.60 \pm 5.50	0.13

* *p* calculated using χ^2 -test for categorical variables and Student's *t*-test for comparisons of continuous variables.

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