Orientation in the Acute and Chronic Stroke Patient: Impact on ADL and Social Activities. The Copenhagen Stroke Study

Palle M. Pedersen, MA, Henrik S. Jørgensen, MD, Hirofumi Nakayama, MD, Hans O. Raaschou, MD, Tom S. Olsen, MD, PhD

ABSTRACT. Pedersen PM, Jørgensen HS, Nakayama H, Raaschou HO, Olsen TS. Orientation in the acute and chronic stroke patient: impact on ADL and social activities. The Copenhagen Stroke Study. Arch Phys Med Rehabil 1996;77:336-9.

Objectives: To determine the influence of initially lowered orientation on rehabilitation outcome in stroke patients, and how decreased orientation 6 months after stroke influences ADL and social activities.

Design: Prospective, consecutive, and community based.

Setting: A stroke unit receiving all acute stroke patients from a well-defined catchment area. All stages of rehabilitation were completed within the unit.

Patients: 524 patients with acute stroke.

Main Outcome Measures: Basic ADL assessed by the Barthel Index (BI) at discharge; discharge placement; higher level ADL and social functions assessed by the Frenchay Activity Index (FAI) at a 6-month follow-up.

Results: The independent influence of orientation in acute stroke on rehabilitation outcome was analyzed with multiple linear and logistic regression models, using initial stroke severity (Scandinavian Neurologic Stroke Scale), initial BI, age, sex, comorbidity, prior stroke, and marital status as covariates. A one-point decrease in orientation decreased BI with 9 points (coefficient b = 8.66, SE(b) = 1.02, $p < .0001$) and reduced the likelihood (1.49, 95% CI: 1.05 to 2.11) of discharge to independent living (b = .40, SE(b) = .18, $p = .026$). Follow-up examinations 6 month poststroke showed that decreased orientation at this point still exerted a marked, negative influence on ADL and social functions (BI: coefficient b = 12.06, SE(b) = 1.95, $p < .0001$; FAI: coefficient b = 6.28, SE(b) = 1.42, $p < .0001$).

Conclusion: The level of orientation influences basic ADL and higher level ADL and social activities in acute as well as chronic stroke. This finding suggests that rehabilitation of memory and attention might be relevant in stroke patients with impaired orientation.

From the Department of Neurology (Mr. Pedersen, Dr. Jørgensen, Dr. Nakayama, Dr. Olsen) and the Department of Radiology (Dr. Raaschou), Bispebjerg Hospital, Copenhagen, Denmark.

Submitted for publication June 1, 1995. Accepted in revised form September 11, 1995.

Supported by grants from the Danish Aphasia and Stroke Association (Hjernesagen), the Danish Health Foundation, the Danish Heart Foundation, Ebba Celinders Foundation, and the Gangsted Foundation.

No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit upon the authors or upon any organization with which the authors are associated.

Reprint requests to Palle M. Pedersen, Department of Neurology, Bispebjerg Hospital, 23 Bispebjerg Bakke, DK-2400 Copenhagen, Denmark.

0003-9993/96/7704-3540$3.00/0

STROKE CAN CAUSE several specific neuropsychological sequelae, such as aphasia and unilateral neglect, and also can bring about more general intellectual impairment. Such impairment may influence stroke outcome in terms of daily life activities and social activities.

Orientation for time, place, and person is a crude measure of general intellectual function, and has a bias toward memory and attention; however, it is easily assessed and, thus, useful in large samples. A number of studies have investigated the influence of cognitive function on different aspects of rehabilitation outcome in stroke patients,[1-5] but few studies have specifically looked at orientation. It has been reported that the level of orientation assessed 6 months after stroke was independently associated with activities of daily living (ADL) and quality of life[6]; however, two other studies[7,8] reported that orientation had no independent influence on recovery of ADL functions. The question of the relation between orientation and ADL has not been settled.

The goal of this study was twofold: (1) to evaluate the relation between orientation on admission and rehabilitation outcome in stroke, and (2) to evaluate the consequences of residual impairment of orientation for daily life activities and social activities after the conclusion of rehabilitation 6 months poststroke. The study was prospective and employed standardized and validated assessment procedures in a large, consecutive, and community-based sample who received acute care and rehabilitation on a stroke unit.

METHODS

This study is part of the Copenhagen Stroke Study described in detail elsewhere.[9] This setting is community-based and includes all admitted stroke patients from a well-defined catchment area, regardless of the age of the patient, the severity of the stroke, and the condition of the patient before the stroke. In this area of Copenhagen 88% of all stroke patients are hospitalized.[10] All patients were admitted to the same stroke unit, in which all stages of acute care, workup, and rehabilitation took place. Rehabilitation based on the Bobath technique was given daily to all patients by the nursing staff, physiotherapists, and occupational therapists within the neurological wards. Patients were discharged when no further in-hospital improvement could be expected.

A total of 896 patients with stroke was admitted during the study period, April 1, 1992, to September 30, 1993. Their mean age was 74.6 years (SD 10.7); 398 (44%) were men and 498 (56%) were women. Patients admitted to hospital later than 7 days after stroke (N = 66), unconscious on admission (N = 47), with moderate or severe aphasia on admission (N = 201), and 58 who died during hospital stay were excluded. The 524 patients included were younger (mean age 73.1 years, SD 11.3) than the 371 patients excluded (mean age 76.6 years, SD 9.6; $t = 4.9, p < .001$) and the percentage of men was higher among the included (48%) than among the excluded (40%) ($\chi^2 = 5.1$, $p = .02$).

Table 1: Basic Characteristics and Univariate Analyses of Rehabilitation Outcome

	No Disorientation	Mild Disorientation	Moderate Disorientation	Severe Disorientation	Statistics
N	425	41	27	30	
Age, years (SD)	71.9 (11.4)	78.0 (9.1)	78.6 (9.4)	80.0 (7.7)	$r = -.23$, $p < .001$
Sex, % men	50%	44%	41%	20%	$t = -3.27$, $p = .001$
Marital status, % married	43%	29%	37%	28%	$t = -2.04$, $p = .041$
Prior stroke, %	19%	28%	15%	46%	$t = 2.22$, $p = .028$
Comorbidity, %	15%	35%	42%	22%	$t = 2.90$, $p = .004$
Initial SSS score (SD)	31.9 (8.5)	26.5 (11.6)	26.1 (12.1)	21.7 (11.7)	$r = .29$, $p < .001$
Initial BI score (SD)	73.7 (32.3)	44.8 (39.5)	32.7 (33.9)	29.5 (34.1)	$r = .39$, $p < .001$
BI score at discharge (SD)	88.6 (23.1)	56.9 (37.5)	49.2 (37.9)	37.3 (37.3)	$r = .50$, $p < .001$
Discharge to independent living, %	91%	71%	56%	43%	$t = -6.18$, $p < .001$

At the 6-month follow-up, 262 of the 896 admitted patients had died, 163 patients were noncompliant, and 26 had moderate or severe aphasia. No difference was found between the patients included and excluded in this part of the study in age (73.4 years, SD 10.5; and 72.6 years, SD 12.8; $t = -0.79$; $p = .43$), sex (44% and 51% men; $\chi^2 = 2.2$, $p = .13$), or marital status (42% and 41% married; $\chi^2 = .01$, $p = .91$).

Stroke was defined according to World Health Organization criteria[11]: rapidly developed clinical signs of focal disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin. Subaracnoidal bleeding was not included.

Stroke severity was assessed at the acute admission and at the 6-month follow-up with the Scandinavian Stroke Scale (SSS).[12,13] The SSS evaluates level of consciousness, eye movement, power in arm, hand, and leg, orientation, aphasia, facial paresis, and gait. The total score ranges from 0 to 58 (normal) points. The subscores for aphasia and orientation were subtracted from the total score, resulting in a total SSS score from 0 to 42 (normal) points.

Orientation was assessed using the orientation scale in the SSS: No disorientation: the patient was aware of time (month), place, and day of birth; mild disorientation: two of these were correct; moderate disorientation: one of these was correct; severe disorientation: none of these was correct.

Aphasia was graded as severe, moderate, mild, and no aphasia, using the aphasia scale in the SSS.

Information concerning comorbidity was obtained on admission and included former stroke and other disabling disease (amputation, multiple sclerosis, severe dementia, heart failure, latent or persistent respiratory insufficiency, parkinsonism, etc). Comorbidity was scored as present or absent.

ADL was assessed by the Barthel Index[14] and the Frenchai Activity Index (FAI).[15] The BI was done during the first week of admission, at discharge, and at follow-up. It evaluates 10 different basic abilities and ranges in total score from 0 to 100 points. The FAI was done at the follow-up. It comprises 15 activities, each rated from 1 to 4 points, and total score ranges from 15 to 60 points. The index evaluates domestic chores, leisure activities, work activities, and outdoor activities. The discharge rate to independent living in the patients own home (with any support necessary) and to nursing home were recorded.

Univariate statistical analyses were carried out with Studenta's nonpaired t test and the Pearson correlation quotient r. The relative importance of multiple influences on outcome was evaluated with multiple linear regression. The amount of variance explained by the resulting equation was determined by the adjusted R^2 statistic. Backward stepwise linear regression was followed by forward stepwise regression for all covariates with a probability of < 0.2. Independent variables were removed when the probability of F was $>.10$ and entered when the probability of F was $<.05$. The required two-tailed significance level for all statistical tests was set to $p < .05$, except for Pearson correlations coefficients where a one-tailed significance level was set to $p < .001$ because of multiple concurrent significance tests. All analyses were performed with the SPSS for Windows 6.0 statistical package.[16]

The study was approved by the Ethics Committee of Copenhagen, approval number V.100.2263/91.

RESULTS

Table 1 shows the univariate relations between basic patient characteristics and the level of orientation at admission. Orientation score is related to all patient characteristics. Table 1 also shows that BI at discharge and discharge to independent living is related to orientation score on admission. At the 6-month follow-up examination, severe disorientation was found in 1 patient (0.2%), moderate disorientation in 4 (1%), mild disorientation in 21 (5%), and no disorientation in 414 patients (94%). There was a negative relation between age and orientation score at follow-up ($r = -.13$, $p = .002$) and a positive relation between orientation and SSS score ($r = .17$, $p < .001$). There was a marginal difference with marital status (mean orientation score 2.90, SD .37 for singles; 2.97, SD .21 for married patients; $t = -2.46$, $p = .014$) and with prior stroke (mean orientation 2.92, SD .34 with no prior stroke; 2.98, SD .15 with prior stroke; $t = -2.46$, $p = .014$), but no difference in level of orientation between men and women or between patients with and without comorbidity.

BI at discharge was univariately correlated to age, sex, comorbidity, initial SSS score, initial BI score, and orientation on admission, but not to prior stroke (table 2). A multiple linear regression analysis was done with BI at discharge as the dependent variable and age, sex, prior stroke, comorbidity, initial stroke severity (SSS on admission), initial BI, and orientation on admission as the independent variables. The resulting equation explained 69% of the variance in the dependent variable ($F = 360.0$, $p < .0001$) and included orientation on admission (coefficent b = 8.66, SE(b) = 1.02, $p < .0001$): 13.93 [constant] + .56 · BI + 8.66 · orientation + .24 · SSS. One point of increase in orientation score on admission independently increased discharge BI by 9 points.

Discharge placements (independent living versus nursing home) was analyzed with a multiple logistic regression analysis including the following independent variables: age, sex, marital status, prior stroke, comorbidity, initial BI, initial SSS, and orientation on admission. The resulting equation correctly classified 92% of the discharge placements and included orientation score (coefficient b = .40, SE(b) = .18, $p = .026$): −2.61 [constant] + .07·BI + 1.50·marital status [married] + .40·orientation. A 1-point increase in orientation score thus raised the odds ratio for discharge to independent living by 1.49 (95% CI: 1.05 to 2.11).

Table 2: Univariate Correlations of Potential Predictors on Admission With ADL Function (Barthel Index) at Discharge

	BI at Discharge
Age, years	$r = -.24$*
Sex (% men)	$r = .16$*
Prior stroke, %	$r = -.08$
Comorbidity, %	$r = -.16$*
Initial SSS score	$r = .58$*
Initial BI score	$r = -.80$*
Orientation score	$r = .51$*

* $p < .001$, one-tailed.

Six months after stroke, the BI score was significantly correlated with comorbidity, SSS, and orientation, but not with age, sex, or marital status (table 3). A multiple linear regression analysis was done with BI score at follow-up as the dependent variable and age, sex, marital status, prior stroke, comorbidity, SSS at follow-up, and orientation at follow-up as the independent variables. Orientation score (coefficient b = 12.06, SE(b) = 1.95, $p < .0001$) was included in the resulting equation: -30.60 [constant] + 2.73 · SSS + 12.06 · orientation score − .28 · age − 3.60 · comorbidity (adjusted $R^2 = .74$; $F = 302, 5$; $p < .0001$). A 1-point decrease in orientation score decreased the BI score by 12 points.

Patients with normal orientation had a higher FAI score than patients with disorientation ($F = 11.1$, $p < .0001$). FAI score was significantly correlated with age, prior stroke, comorbidity, SSS score, and orientation score, but not with sex or marital status (table 3). A high intercorrelation was found between BI score and FAI score ($r = .60$, $p < .001$). A multiple linear regression analysis was done with FAI score as the dependent variable and age, sex, marital status, prior stroke, comorbidity, SSS, and orientation score as the independent variables. Orientation score (coefficient b = 6.28, SE(b) = 1.42, $p < .0001$) was included in the resulting equation: 10.67 [constant] + .77 · SSS − 0.33 · age − 5.20 · prior stroke + 6.28 · orientation score − 2.94 · [male] sex − 4.11 · comorbidity (adjusted $R^2 = .43$, $F = 49.96$, $p < .0001$). An additional regression analysis including BI score in addition to the covariates in the previous analysis was also performed. The resulting equation included orientation (coefficient b = 4.42, SE(b) = 1.44, $p = .003$): 15.55 [constant] + .18 · BI − .28 · age + .29 · SSS − 4.79 · prior stroke − 2.91 · [male] sex + 4.24 · orientation score − 3.33 · comorbidity (adjusted $R^2 = .46$, $F = 49.1$, $p < .0001$). A 1-point decrease in orientation score independently reduced the FAI score by 4 points.

DISCUSSION

Orientation assessed on acute admission had a clinically relevant independent influence on rehabilitation outcome in terms of discharge ADL and discharge placements (independent living versus nursing home). Impaired orientation thus diminished the benefit of the rehabilitation activities. One previous study reported an influence of orientation on BI score,[6] whereas two other studies did not.[7,8] These different findings may be explained by differences in sample selection, the scales used for assessing orientation, the number of covariates included in the analyses, and the statistical methods employed.

It is important to the planning of rehabilitation to know why impaired orientation interferes with rehabilitation. Likely explanations are that the patient with impaired orientation is not attending well to the instructions or that the patient forgets the instructions because of impaired memory. The first possibility finds some support in a study that reported attention to be one of three important predictors of functional improvement,[3] and the second possibility finds support in studies that have reported an association of impaired memory with lower ADL scores[1,2] and lower FAI score.[17]

We chose BI at discharge as one of the outcome measures to predict. We have previously reported that predicting outcome at discharge is more relevant than predicting outcome at a fixed time after stroke.[18] Although this might not generally be the case, it is so in our department, where all stages of rehabilitation take place and where patients are not discharged until they are believed to have realized their full rehabilitation potential. This belief was confirmed by the finding that there was no significant change in BI score from discharge to the 6-month follow-up. Moreover, at this time the patients are reliably evaluated by nursing and training staff with detailed knowledge of the patients.

It is remarkable that a simple assessment of orientation performed acutely on admission contributed significantly and independently to the prediction of the benefit from rehabilitation. Thus, we recommend that such an assessment be included in the admission evaluation of all stroke patients.

Only 6% of the patients had impaired orientation at the time of the 6-month poststroke follow-up. Impaired orientation at this time point nevertheless significantly lowered the level of ADL as assessed by both BI score and FAI score. The influence of orientation per se on ADL was a considerable 12-point reduction in BI per point decrease in orientation score. A large part of the variance in the BI score—74%—was explained by the multiple linear regression equation including only four covariates: neurological severity (SSS score excluding aphasia and orientation score), age, comorbidity, and orientation score.

This part of the study evaluated the direct influence of level of orientation on ADL function. It can be concluded that not only does impaired orientation in the acute stage of stroke impede outcome of rehabilitation, but residual orientation impairment in rehabilitated patients continues to exert a negative influence on ADL function. The finding is in agreement with a previous finding in a selected sample.[6]

We found orientation to influence both the ADL activities measured with the BI, and the activities at a somewhat higher level measured with the FAI. More covariates were included in the equation for the FAI score than was the case for the BI score, but in spite of this, less variation was explained: 43%. This size of the explanatory power of the multiple linear regression equation for the FAI score, however, is by no means unsatisfactory. It is furthermore quite logical that less variation can be explained for higher level activities than for lower level ADL.

To evaluate the influence of higher level social activities independently of the level of basic ADL function, an additional analysis of FAI was done with BI as a covariate. In this analysis orientation still had a significant and clinically relevant influence on the FAI: the FAI was found to decrease more than 4 points with a 1-point decrease in orientation score. Thus, it can

Table 3: Univariate Correlations of Potential Covariates With ADL Function (Barthel Index) and Social Activities (Frenchay Activities Index) 6 Months After Stroke

	Barthel Index	Frenchay Activities Index
Age, years	$r = -.16$	$r = -.30$*
Sex (% men)	$r = .07$	$r = -.03$
Marital status (% married)	$r = .15$	$r = .05$
Prior stroke, %	$r = -.11$	$r = -.25$*
Comorbidity, %	$r = -.16$*	$r = -.18$*
SSS score	$r = .83$*	$r = .51$*
Orientation score	$r = .29$*	$r = .16$*

* $p < 0.001$ one-tailed.

be concluded that orientation influences both basic ADL and higher level ADL and social activities.

Techniques for retraining memory and attention are prominent in research on head trauma rehabilitation.[19] The results of the present study suggest that rehabilitation of memory and attention should be emphasized in stroke patients as well.

References

1. Novack TA, Haban G, Graham K, Satterfield WT. Prediction of stroke rehabilitation outcome from psychologic screening. Arch Phys Med Rehabil 1987;68:729-34.
2. Lincoln NB, Blackburn M, Ellis S, Jackson J, Edmans JA, Nouri FM, et al. An investigation of factors affecting progress of patients on a stroke unit. J Neurol Neurosurg Psychiatry 1989;52:493-6.
3. Mysiw WJ, Beegan JG, Gatens PF. Prospective cognitive assessment of stroke patients before inpatient rehabilitation. The relationship of the Neurobehavioral Cognitive Status Examination to functional improvement. Am J Phys Med Rehabil 1989;68:168-71.
4. Tatemichi TK, Desmond DW, Stern Y, Paik M, Sano M, Bagiella E. Cognitive impairment after stroke: frequency, patterns, and relationship to functional abilities. J Neurol Neurosurg Psychiatry 1994;57:202-7.
5. Galski T, Bruno RL, Zorowitz R, Walker J. Predicting length of stay, functional outcome, and aftercare in rehabilitation of stroke patients. The dominant role of higher-order cognition. Stroke 1993;24:1794-1800.
6. De Haan R, Horn J, Limburg M, Van Der Meulen J, Bossuyt P. A comparison of five stroke scales with measurements of disability, handicap, and quality of life. Stroke 1993;24:1178-81.
7. Wade DT, Skilbeck C, Hewer RL. Selected cognitive losses after stroke. Frequency, recovery and prognostic importance. Int Disabil Stud 1989;11:34-9.
8. Fullerton KJ, MacKenzie G, Stout RW. Prognostic indices in stroke. Q J Med 1988;250:147-62.
9. Jørgensen HS, Nakayama H, Raaschou HO, Olsen TS. Stroke in patients with diabetes. The Copenhagen Stroke Study. Stroke 1994;25:1977-84.
10. Jørgensen HS, Plesner A-M, Hübbe P, Larsen K. Marked increase of stroke incidence in men between 1972 and 1990 in Frederiksberg, Denmark. Stroke 1992;23:1701-4.
11. Report of the WHO task force on stroke and other cerebrovascular disorders: Stroke—1989. Recommendations on stroke prevention, diagnosis and therapy. Stroke 1989;20:1407-31.
12. Scandinavian Stroke Study Group. Multicenter trial of hemodilution in ischemic stroke. Background and study protocol. Stroke 1985;16:885-90.
13. Lindenstrøm E, Boysen G, Christiansen LW, a Rogvi Hansen B, Nielsen BW. Reliability of Scandinavian Neurologic Stroke Scale. Cerebrovasc Dis 1991;1:103-7.
14. Mahoney F, Barthel D. Functional evaluation: the Barthel Index. Md State Med J 1965;2:61-5.
15. Holbrook M, Skilbeck CE. An activities index for use with stroke patients. Age Ageing 1983;12:166-70.
16. SPSS for Windows 6.0 [computer software]. Chicago: SPSS Inc., 1993.
17. Cockburn J, Smith PT, Wade DT. Influence of cognitive function on social, domestic, and leisure activities of community-dwelling older people. Int Disabil Stud 1990;12:169-72.
18. Jørgensen HS, Nakayama H, Raaschou HO, Vive-Larsen J, Støier M, Olsen TS. Outcome and time course of recovery in stroke. Part I: Outcome. The Copenhagen Stroke Study. Arch Phys Med Rehabil 1995;76:399-405.
19. Mateer CA, Sohlberg MM, Youngman PK. The management of acquired attention and memory deficits. In: Wood RL, Fussey I, editors. Cognitive rehabilitation in perspective. London: Taylor & Francis, 1990:68-95.