EARLY PROGNOSIS OF STROKE OUTCOME BY MEANS OF KATZ INDEX OF ACTIVITIES OF DAILY LIVING

K. Hulter Åsberg and I. Nydevik

From the Departments of Internal Medicine, Enköping Hospital, Enköping and University Hospital, Uppsala; Departments of Geriatric Medicine, Södertälje Hospital, Södertälje, and Huddinge University Hospital, Stockholm, Sweden

ABSTRACT. The predictive validity of Katz' Index of ADL (Activities of Daily Living) regarding length of hospital stay, discharge to own home or death within one month, and its reproducibility in clinical practice was studied prospectively in Södertälje and in Enköping, Sweden. The Södertälje study included 124 consecutive patients, who were all assessed on days 5–7 after stroke by an occupational therapist. The Enköping study included 106 consecutive patients, who were assessed similarly by trained nurses. Ninety-six and 94%, respectively, of patients in grades A–C on days 5–7 after stroke were discharged to their own homes within one month. Ninety-six and 92%, respectively, of patients in grades D–G stayed in hospital longer than one month or died. Sixty-two and 68%, respectively, of patients in grade G died within one month. The instrument is now used as a valid tool for early prognosis of stroke outcome in order to facilitate the planning of care and rehabilitation in clinical practice.

Key words: activities of daily living, disability, nursing practice, prediction, outcome, rehabilitation, stroke.

In Sweden, most stroke patients are acutely admitted to departments of internal medicine. To inform the patients and their relatives, and to utilize the rehabilitation resources effectively, it is of importance to identify at an early stage those individuals who can be expected to be discharged to their own homes and those who will need a longer hospital stay or who may even die.

Functional admission score after stroke is a well-known strong predictor of discharge functional status, but Jongbloed (11) has demonstrated that comparisons between studies are hindered by differences in patient samples, timing of assessments, criteria by which outcome is measured, and measuring instruments used.

Katz' Index of ADL (Activities of Daily Living) is a well-known instrument for assessing ADL-performance, and its reliability and validity in acute medical care have been studied earlier at the general county hospital of Enköping, Sweden (8). In a prospective study on stroke patients at a similar hospital in Södertälje, Sweden (7), this instrument seemed to have a remarkable predictive value with regard to length of hospital stay, type of discharge, and survival or death during the first few months after stroke.

In this study, the Södertälje data have been compared to a consecutive number of stroke patients in Enköping. Trained licensed practical nurses have assessed the patients at the same time intervals by means of the same assessment instrument and with the same outcome criteria as in Södertälje.

MATERIAL

The two studies were carried out in the departments of internal medicine at Södertälje Hospital and at Enköping Hospital, Sweden, during the years of 1986 and 1987, respectively. Both hospitals are general county hospitals responsible for the short-term and long-term medical care in their health service districts. The catchment area of Södertälje Hospital included 92000 inhabitants and that of Enköping Hospital 48000 inhabitants. The proportion of persons 65 years of age and older was 11.7% in Södertälje and 13.6% in Enköping on the 1st of January, 1987.

Since the 1st of January, 1986, all types of stroke in the Enköping area have been recorded in a stroke register according to principles suggested by the WHO (16) but including all ages. Eighty-seven percent of all stroke incidents that took place in the health service district were admitted to the Department of Internal Medicine at Enköping Hospital during the year 1987.

All patients admitted to hospital with acute CVD-symptoms, which did not disappear within 24 hours, from the 1st of January to the 31st of December in 1986 and 1987, respectively, were included in the studies. In Södertälje, 137 persons were admitted and in Enköping 113 persons. Thirteen patients (9 percent) in Södertälje and seven patients (6%) in Enköping were either not ADL-assessed or followed up due to different circumstances, like acute referrals to the neurosurgical department, and were excluded.

Table I shows the distribution of the included patients in Södertälje and in Enköping by age, sex, and type of stroke

Table I. *Distribution of patients in Södertälje and Enköping by age, sex, and type of stroke*

	Södertälje N=124	Enköping N=106
Age (years)		
Median (range)	75 (31–96)	78 (45–93)
Sex		
Men	62	51
Women	62	55
Diagnosis		
Unspecified stroke	75 (60%)	50 (47%)
CT-verified infarction	44 (36%)	50 (47%)
CT-verified hemorrhage	5 (4%)	6 (6%)

(unspecified CVD, infarction, or hemorrhage verified by computer tomography). The radiologic investigations were performed at the University Hospitals of Huddinge and Uppsala, respectively; they were carried out either within the first 24 hours after admission or within the first few weeks after hospital admission. Usually, they were not repeated.

The Enköping patients had a higher median age (78 compared to 75 years) and were examined by computer tomography more frequently than the Södertälje patients (53 compared to 40%).

METHODS

Katz' Index of ADL (12, 14) summarizes an individual's dependence on or independence of another person in performing six primary activities, namely, feeding, continence, transferring, going to the toilet, dressing, and bathing. The activities are ordered into a cumulative scale, which reflects a patient's improvement or deterioration in functional ability.

The performance is summarized in grades A, B, C, D, E, F, and G, where A is the most independent and G the most dependent. Each item is well-defined, and dependence on assistance is defined as active personal assistance, directive assistance, or supervision. The index has been used for prognosis of stroke in research studies since the beginning of the 1960s (13). It has been shown to vary with the subjective well-being and quality of life among stroke patients (1). The Swedish version of Katz' Index of ADL (8) has been shown to be reliable and valid in hospital and in home-care with licensed practical nurses as observers (2, 9).

The ADL-assessments were performed on days 5–7 and on days 10–12 among patients who stayed in the hospital by an occupational therapist in Södertälje and by trained licensed practical nurses in Enköping. These intervals were chosen to avoid the most acute phase with possible brain edema and to follow up changes over time. The Enköping results were verified by a registered nurse specialized in stroke nursing and by an occupational therapist at the department of internal medicine. The duration of hospital stay was recorded together with data on survival or death and type of discharge (to own home or to the department of geriatric rehabilitation, which also included wards for long-term care).

The predictive values for dichotomized ADL-grades (A–C versus D–G and A–F versus G) regarding length of hospital stay and type of discharge were computed, and the sensitivity and specificity of the predictions in the two hospitals were compared. These dichotomizations were chosen on empirical grounds: A–C-patients do need assistance only once or twice a day, while D–G-patients do need assistance day and night. G-patients have been found to have a higher mortality than A–F-patients irrespective of the medical diagnosis (2).

RESULTS

Table II shows the number of patients in Södertälje and in Enköping and their median age by ADL-grade on days 5–7 after stroke. As expected, the median years of age increased by decreasing level of ADL, although the age range within each ADL-grade was wide. The proportions of grade-A patients were the same in both hospitals, but there was a higher proportion of more disabled patients in Enköping, probably due to the patients' higher median age. This was also verified by the higher lethality rate in Enköping than in Södertälje, 27 and 19% within 1 month. Six months later the mortality rates were 30 and 24%, respectively.

Table III gives the number of patients by type of outcome and by ADL-grade. The patients were distributed in all grades, but there were rather few in grades C and D. About 60% of the patients were discharged directly to their own homes within six months, and they belonged to grades A to F. Thirty-five percent in Södertälje and 24% in Enköping were referred to the geriatric department for long-term rehabilitation or nursing-home care. Almost all of them belonged to grades D to G. Patients with a very long hospital stay (six months and over) belonged to grades F and G, and so did all who died.

Table II. *Number of patients and their median age in Södertälje and in Enköping by ADL-grade on days 5–7*

ADL-grade	Södertälje		Enköping	
	N=124	Median age (range)	N=106	Median age (range)
A	29	66 (48–84)	26	71 (45–83)
B	14		4	
C	5	73 (47–86)	2	76 (55–86)
D	7		1	
E	11	75 (56–83)	8	77 (70–82)
F	21	77 (61–86)	28	79 (60–92)
G	37	79 (31–96)	37	81 (48–93)

Table III. *Number of patients by type of outcome and ADL-grade in Södertälje and Enköping*

| ADL-grade | No. of patients | Type of outcome | | | | |
		Home < 1 mo	To home < 1–6 mo	Hospital care > 6 mo	Dead < 1 mo	Dead 1–6 mo
A						
Södertälje	29	29	–	–	–	–
Enköping	26	25	1	–	–	–
B						
Södertälje	14	13	1	–	–	–
Enköping	4	4	–	–	–	–
C						
Södertälje	5	4	1	–	–	–
Enköping	2	1	1	–	–	–
D						
Södertälje	7	1	4	2	–	–
Enköping	1	1	–	–	–	–
E						
Södertälje	11	1	8	2	–	–
Enköping	8	2	6	–	–	–
F						
Södertälje	21	1	11	8	1	–
Enköping	28	11	8	6	1	2
G						
Södertälje	37	–	1	7	23	6
Enköping	37	–	5	3	28	1
Total						
Södertälje	124	49	26	19	24	6
Enköping	106	44	21	9	29	3

Table IV shows the predictive values, the sensitivity, and the specificity of the dichotomized ADL-grades as concerned the observed outcome in the two hospitals. The dichotomization is based on the hypothesis that patients in grades A, B, C on days 5–7 after stroke would be discharged to their own homes within a month, and that patients in grades D, E, F, G would either die or remain in the hospital after one month.

The predictive values were high, and the Enköping data were similar to the Södertälje results. The sensitivity was also high, although somewhat lower in Enköping compared with Södertälje. The specificity was high in both hospitals.

Table V shows the results, presuming that patients in grades A–F were going to survive the first month. There was a high positive predictive value in both hospitals, which means that almost all patients in grades A–F did survive. The lower negative predictive value means that 68 and 62%, respectively, of patients in grade G actually died within one month. Eighty-four and 86%, respectively, of those who survived belonged to grades A–F, and 86 and 96%, respectively, of those who died within one month belonged to grade G.

DISCUSSION

Assessments of ADL-performance have been shown in a number of studies to have predictive validity regarding functional outcome after stroke. Many other variables, like specific physical, psychological, and social factors, have also been shown to predict good or bad outcome after stroke, see for example Henley et al. (6). Still, there is a need in clinical practice for a more global, rapid, stable, prognostic instrument with proven reliability and validity for early planning of care and rehabilitation. It is an advantage if a measure of need for care also can be a measure of outcome.

This study has shown that Katz' Index of ADL had a high predictive validity regarding early outcome in terms of length of hospital stay and survival or death within the first month after an acute stroke. This

Table IV. *Predictive values, sensitivity, and specificity of dichotomized ADL-grades and observed outcome (at home vs. at hospital at one month after stroke or dead) in Enköping*

The results from Södertälje within parentheses

ADL-grade	At home at 1 month	At hospital at 1 month or dead	Total
No. of patients			
ABC	30 (46)	2 (2)	32 (48)
DEFG	6 (3)	68 (73)	74 (76)
Total	36 (49)	70 (75)	106 (124)
Pos. pred. value	94 (96)		
Neg. pred. value	92 (96)		
Sensitivity	83 (94)		
Specificity	97 (97)		

predictive validity has been shown to be reproducible in two different general county hospitals.

The inclusion of patients was similar in the two hospitals, and the period of time between the onset of stroke and the assessment was the same. The higher incidence rate in Enköping was partly due to the strict stroke registration, which implied frequent computer tomographies and a high autopsy rate, and partly due to a greater proportion of old people in the health service district.

The stroke patients were also older in Enköping than in Södertälje, which will explain the higher number of very disabled patients and the higher lethality rate in Enköping.

In Södertälje, one occupational therapist made the assessments. In the Department of Internal Medicine at Enköping Hospital, Katz' Index of ADL in a Swedish version has been used for the last ten years, and trained licensed practical nurses have been found to be reliable as observers there (2).

The patients were distributed in all ADL-grades, and there was a moderate correlation to age, although the range within each ADL-grade was wide. The predictive values, the sensitivity, and the specificity of the dichotomized ADL-grades were high.

The results from Södertälje and Enköping have been reinforced by further experience and have helped us to form a policy as a part of a care program for stroke patients, based on the diagnosis of an acute stroke and the ADL-grade on days 5–7 and days 10–12, which can be formulated as follows:

(*a*) Early prognosis as concerns discharge to a des-

ignated rehabilitation department should not be made until days 5–7 after an acute stroke, since it is well known that the patient's status may change during the first few days; for example, to the worse due to a progressive stroke or to the better due to a reduced brain edema.

(*b*) Patients in grades A, B, C on days 5–7 or earlier can be expected to be discharged to their own homes within one month. Before discharge, it is necessary to assess intellectual, linguistic, perceptual, motor, sensory, and emotional functions with sensitive instruments in order to detect even small disturbances, which can be of importance later on. The rehabilitation process has to continue at home or at an outpatient center.

(*c*) Patients in grades D, E, F, G may improve during the second week, and if they are in grades A, B, C on days 10–12, they can also be expected to be discharged directly to their own homes within 4–6 weeks. For these categories, the teamwork has to involve the primary health care staff and the community staff early, and the rehabilitation must continue at home or at an out-patient center.

(*d*) Patients who are still in grades D, E, F on days 10–12 can be referred to a rehabilitation department working with the goal of discharging the patient to his own home. This department can be informed one week in advance about the patient and the probability of a rehabilitation period longer than 4–6 weeks.

(*e*) Patients who are unconscious all belong to grade G and can be expected to die soon. For these people it is necessary to arrange for good terminal care just as we do for other patients when we do not expect them to survive for long. But, patients in grade

Table V. *Predictive values, sensitivity, and specificity of dichotomized ADL-grades and observed outcome (survival vs. death within one month) in Enköping*

Results from Södertälje within parentheses

ADL-grade	Survival at 1 month	Death <1 month	Total
No. of patients			
ABCDEF	65 (86)	4 (1)	69 (87)
G	12 (14)	25 (23)	37 (37)
Total	77 (100)	29 (24)	106 (124)
Pos. pred. value	94 (99)		
Neg. pred. value	68 (62)		
Sensitivity	84 (86)		
Specificity	86 (96)		

G who are conscious may improve during the second or third week. It is important to give them a chance to rehabilitate before they are referred to a nursing home.

(*f*) *Individual patients may not follow this pattern.* Occasionally, there will be patients in grade A who will deteriorate due to a recurrent stroke or to other diseases like myocardial infarction, and there will be single patients in grade G who will improve and survive and be discharged to their own homes. The ADL-performance has to be followed up at certain time intervals in order to update the care-plan.

With a stated policy like the above cited, the therapeutic team will speak a common language, thereby helping the patient and his relatives to understand and to contribute to the goals of the health care and rehabilitation. This policy does not list other important predictive factors, like advanced age, poor cognitive function, perceptual-spatial deficits, motor and sensory dysfunction etc. (3). Yet, many of these factors are included in the definition of dependence in performing the activities of daily living. Dependence can be due to physical, psychological, and/or social factors and is thus a result of a more global assessment than, for example, the other predictive factors mentioned above.

This policy connects up with Gresham (5) who pointed out that much early functional improvement after stroke is a part of the natural history of the disease and cannot be attributable to any intervention. The policy is also concordant with the first four of the guidelines presented by Feigenson (4) for improving stroke outcome while simultaneously decreasing costs: "1. Beginning rehabilitation in the acute care hospital as soon as the patient is medically stable. 2. Initiating rapid referral to regional rehabilitation facilities, if available. 3. Establishing disability-oriented units in both acute care and rehabilitation facilities. 4. Basing treatment and duration of hospitalization on the functional and neurologic deficits rather than on diagnostic category."

It can be concluded from this study, that Katz' Index of ADL can serve as a reproducible and valid tool for early prognosis of stroke outcome, thereby facilitating the planning of care and rehabilitation both in hospital and in primary health care.

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Address for offprints:

Dr K. Hulter Åsberg
Dept of Internal Medicine
Enköping Hospital
S-199 25 Enköping
Sweden