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[Advanced Search](#)

Feedback	Subscription	Archive	Search	TOC		
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Stroke

[electronic table of contents](#)
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Articles

Where and How Should Elderly Stroke Patients Be Treated?

A Randomized Trial

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Abstract

Background and Purpose Elderly stroke patients in particular are at risk of receiving less than optimal care. We studied the effects of the department care (medicine versus neurology) on the outcome of elderly stroke patients in a randomized controlled trial with 1-year follow-up.

Methods A total of 243 consecutive patients aged 65 years or older with acute stroke were randomized to receive care in the Departments of Medicine or the Department of Neurology of a university teaching hospital with a referral area of 1.1 million. The outcome was assessed by mortality, length of hospital stay, ability to live at home on discharge, Barthel Index, and Rankin grades at 1 year.

Results There were no differences in sex and age, severity or type of stroke, other diseases, or social factors between the two groups. One-year mortality was 21% in both patients treated by the Departments of Medicine and those treated by the Department of Neurology. Patients treated by the Department of Neurology were discharged an average of 16 days earlier (24 versus 40 days). The length of hospital stay of patients aged younger than 75 years differed significantly ($P=.02$). Patients randomized to neurological wards more often went directly home (75% versus 62%; $P=.03$), and their functional status was better as assessed with Barthel Index and Rankin grades at 1 year ($P=.02$ and $P=.03$, respectively). Independent predictors of a better functional outcome and shorter hospital stay by stepwise multivariate analysis included management by the Department of Neurology.

Conclusions Well-organized management of elderly stroke patients was associated with a better outcome. It was also the more economical alternative.

Key Words: activities of daily living • rehabilitation • aging • stroke outcome

- [Top](#)
- [Abstract](#)
- [Introduction](#)
- [Subjects and Methods](#)
- [Results](#)
- [Discussion](#)
- [References](#)

Introduction

Stroke is the third most common cause of death and a major cause of hospital resource consumption, not only in acute-care hospitals but also in institutional long-term care. In addition to its financial costs, stroke has many personal costs. Few other major illnesses are treated as inconsistently as stroke, and elderly stroke patients in particular are at risk of receiving suboptimal care.

Older stroke patients were generally admitted to medical wards and younger patients to neurological wards in our hospital, a university teaching hospital. This practice is not rare in most hospitals with a shortage of neurological beds. A working group of the Finnish National Board of Health recommended that all stroke patients irrespective of age who were previously independent in activities of daily living should be treated by neurologists.¹ In this study we assess whether this recommendation is appropriate for elderly stroke patients.

- [Top](#)
- [Abstract](#)
- [Introduction](#)
- [Subjects and Methods](#)
- [Results](#)
- [Discussion](#)
- [References](#)

Subjects and Methods

Meilahti Hospital, a part of the Helsinki University Central Hospital with 800 beds, serves a population of approximately 1.1 million inhabitants in the cities of Helsinki, Espoo, Kauniainen, and Vantaa and the surrounding area. The referral area of our hospital includes many smaller hospitals that also admit stroke patients. There are no general rules for admission, and the decision regarding in which hospital a stroke patient will be treated is relatively random, although elderly stroke patients often are admitted to smaller hospitals without neurological beds.

- [Top](#)
- [Abstract](#)
- [Introduction](#)
- [Subjects and Methods](#)
- [Results](#)
- [Discussion](#)
- [References](#)

Stroke Management in the Department of Neurology

The Department of Neurology has three wards, each with a stroke team and a weekly rehabilitation meeting. Each stroke patient is investigated in a standardized manner including neurological assessment, computed tomography of the brain, blood tests, electrocardiography, and chest radiograms. Angiography, cardiology consultations, and echocardiography are carried out selectively. The patients are carefully followed to detect signs of deterioration and secondary complications of the stroke. Progressing ischemic strokes are treated with anticoagulants. For patients with cardioembolic stroke, early anticoagulation is a standard treatment.

Members of the stroke team are the patient's own physician and nurse, social worker, physiotherapist, occupational therapist, speech therapist, neuropsychologist, the senior neurologist in charge of the ward, and the head nurse responsible for the ward. When a patient arrives, diagnostic and functional evaluations are performed immediately, and treatment and rehabilitation plans are made. A systematic program to enhance recovery is made soon after admission, and the spouse and other family members of the patient are included in the rehabilitation program. The stroke team meets weekly to follow the progress of the recovery and to tailor the rehabilitation program according to the patient's needs.

The patients either remain on the ward until they are able to return home, are transferred to a rehabilitation hospital, or go to a long-term care facility. After discharge patients may undergo outpatient rehabilitation. The outpatient rehabilitation clinic also has a stroke team, which is similarly structured, although with a larger number of rehabilitation specialists than the three neurological wards.

Stroke Care in the Departments of Medicine

In our hospital there are three Departments of Medicine, each with three or four wards. Medical wards do not have stroke teams or extra resources for rehabilitation of stroke patients. There is no standard program for diagnostic evaluation, therapy, and rehabilitation for stroke patients. Physiotherapy is given when the physician on the ward prescribes it. Speech therapy, neuropsychological rehabilitation, and occupational therapy are given if a neurologist is consulted and he/she recommends them. The Departments of Medicine can send stroke patients to a rehabilitation hospital or the outpatient rehabilitation clinic of the Department of Neurology, as appropriate.

Transfer to Long-term Hospitals

All patients who are candidates for long-term hospital care are seen by a single geriatric specialist. The main selection criteria for long-term hospital care are mental impairment, severity of stroke, and inability to function at home. There is a waiting list for admission to the long-term hospitals.

Allocation of Stroke Patients

Patients aged 65 years or older admitted to our hospital because of acute stroke between May 1, 1987, and September 30, 1989, were screened for inclusion in the study. A total of 298 patients were screened. Fifty-five patients were not randomized because of diagnostic or therapeutic reasons: 33 of them were admitted to the Department of Medicine, mostly for medical reasons such as brittle diabetes or severe cardiac problems, and 22 were admitted to the Department of Neurology, largely because the diagnosis of stroke was in question. All remaining patients were randomized. Eleven patients were excluded because the final diagnosis on discharge was not an acute stroke: 3 had a brain tumor, 2 intoxication, and 1 each had brain contusion, subdural hematoma, Bell's facial paralysis, Todd's paralysis, anemia combined with hypotension, and vertigo. This left 232 randomized patients for analysis. No stroke patient admitted to our hospital was excluded from randomization for any reason, including such prognostic reasons as unconsciousness, dementia, severity of stroke, earlier strokes, or living in a nursing home before the present stroke.

All patients were evaluated by the authors, who collected the information about social and medical characteristics of patients on admission, made the final diagnosis of stroke according to the classification of the National Institute of Neurological and Communicative Disorders and Stroke,² and followed up the patients for up to 1 year with the help of a study nurse. The severity of stroke was assessed by Scandinavian Stroke Score³ on admission and at 3 and 12 months, and mental status was assessed by the Mini-Mental State⁴ also at 3 and 12 months. The Barthel Index was used to assess the patient's ability to perform the activities of daily living,⁵ and the Rankin Scale⁶ was used to evaluate the overall outcome of the patients. The patient's assessment of his/her life satisfaction before the stroke and 3 and 12 months after the stroke was evaluated according to Viitanen et al⁷ by the study nurse who also made the Barthel Index assessment. Life satisfaction and Barthel Index were assessed together with the Rankin Scale at 1 and 6 weeks and 3 and 12 months. In addition, we counted the duration of hospitalization, including days of later admissions because of a recurrent cerebrovascular accident within 1 year.

Statistical Analysis

Randomization was carried out in blocks of 10,⁸ with use of numbered sealed envelopes. Tests used included the two-sample *t* test, Fisher's exact test, [{chi}](#)² with Yates' correction when indicated, Mann-Whitney test, life-table analyses with log-rank test, and multiple stepwise logistic regression analyses.⁹

The results of 232 randomized patients were analyzed after excluding the 11 patients who did not have stroke. Inclusion of these 11 patients in the intention-to-treat analyses favored the Department of Neurology because more patients with good outcome among those 11 patients were randomized to the Department of Neurology than to the Department of Medicine.

The physicians of the departments knew that the trial was in progress. The routine procedures of the departments continued unchanged during the course of the study because the study itself did not call for changes in management routines, and the investigators kept a low profile so that the clinical routines of wards would not be disturbed. The Ethics Committee of our hospital accepted the study before it was started on May 1, 1987.

Results

Demographic characteristics did not differ between 119 patients randomized to the Departments of Medicine and 113 randomized to the Department of Neurology (Table 1[□]). There were no differences in medical characteristics on admission except cardiac disorders, which were more common among the patients randomized to neurological wards (Table 1[□]). The severity of stroke on admission was equal in both groups (Table 1[□]).

- [□ Top](#)
- [□ Abstract](#)
- [□ Introduction](#)
- [□ Subjects and Methods](#)
- [□ Results](#)
- [□ Discussion](#)
- [□ References](#)

View this table: **Table 1.** Characteristics of Elderly Stroke Patients Randomized to Receive Care by the Departments of Medicine or the Department of Neurology
[\[in this window\]](#)
[\[in a new window\]](#)

Distribution of the type of stroke was the same in the two groups. Eighty percent of strokes were ischemic cerebral infarctions, of which 40% were progressing. Six percent of patients had transient ischemic attacks, 9% had intracerebral hemorrhages, and 4% had subarachnoid hemorrhages. The localization of brain infarction was hemispheric in 60 patients in both groups and was vertebrobasilar in 29 patients treated on medical wards and in 22 treated on neurological wards. In 15 patients (7 on medical and 8 on neurological wards)

both territories were involved. Twenty-seven percent of brain infarctions and transient ischemic attacks were classified as cardiogenic.

Computed tomography of the brain was performed on 77 patients (64.7%) on medical and 99 (87.6%) on neurological wards. Nuclear magnetic resonance imaging of the brain was performed on 2 patients (1.7%) on medical and 5 (4.4%) on neurological wards. Single-photon emission computed tomography was performed on 9 patients (7.6%) on medical and 8 patients (7.1%) on neurological wards. Aortic arch angiography was performed on 5 patients (4.2%) on medical and 5 patients (4.4%) on neurological wards, and 1 patient (0.9%) on a neurological ward had carotid angiography. Altogether 84 patients (70.6%) on medical and 102 (90.3%) on neurological wards had one of the aforementioned neuroradiological tests carried out ($P=.001$; χ^2 test).

Cerebrospinal fluid was analyzed in 11 patients (9.2%) on medical and in 8 (7.1%) on neurological wards. Brain stem auditory evoked potentials were registered in 10 patients (8.8%) on neurological wards and in none on medical wards ($P=.01$; χ^2 test). A cardiologist was consulted for 7 patients (5.9%) on medical and for 18 (15.9%) on neurological wards ($P=.02$; χ^2 test), and echocardiography was performed on 5 patients (4.2%) on medical and 11 (9.7%) on neurological wards.

The mean duration (range) of hospital stay of patients was 40.4 days (median, 14; SD, 71.3; range, 1 to 365 days) for the Departments of Medicine and 24.1 days (median, 13; SD, 40.0; range, 2 to 365 days) for the Department of Neurology on the first admission. The mean total hospital stay at our hospital (including later admissions because of recurrent cerebrovascular accident within 1 year) was 41.7 days (median, 15; SD, 71.9; range, 1 to 365 days) for the Department of Medicine and 25.4 days (median, 14; SD, 40.3; range, 2 to 365 days) for the Department of Neurology.

The incidence of pulmonary and other infections or deep venous thrombosis did not differ between the groups. No patients suffered decubitus ulcers during the hospital stay.

There were no significant differences in hospital stay on the first admission between the groups in life-table analyses. When only patients between 65 and 75 years of age were analyzed, the patients randomized to neurological wards were able to leave the hospital significantly earlier than patients randomized to medical wards ($P=.02$; log-rank test; Fig 1 \square). Patients randomized to neurological wards were more often ($P=.03$; χ^2 test) able to go directly home on discharge (85 of 113; 75%) than those randomized to medical wards (74 of 119; 62%).

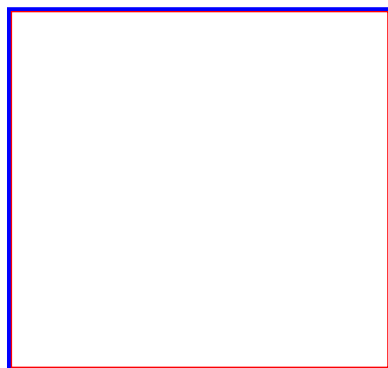


Figure 1. Line graph shows life-table analysis of length of hospital stay of stroke patients aged younger than 75 years randomized to receive care in the Departments of Medicine or the Department of Neurology.

View larger version (19K):

[\[in this window\]](#)

[\[in a new window\]](#)

There was no difference in the incidence of recurrent stroke during the 1-year follow-up. Seventeen patients randomized to medical and 18 of those randomized to neurological wards suffered a recurrent stroke during the follow-up year. There was no difference in case-fatality rate in the hospitals or during the 1-year follow-up. Twenty-one percent of patients in the two groups died during the follow-up (Table 2 \square).

View this table: **Table 2.** Outcome According to Management by Departments of Medicine Versus Department of Neurology
[\[in this window\]](#)
[\[in a new window\]](#)

The functional status graded according to the Barthel Index (Table 2[□]) was better in patients randomized to neurological wards compared with those randomized to medical wards at 1-year follow-up ($P=.02$; Mann-Whitney test) The same was true for Rankin groups at 1-year follow-up ($P=.03$; Mann-Whitney test; Fig 2[□]). Fifty-nine percent of patients treated on medical wards and 76 % of patients treated on neurological wards were independent in their daily life at 1-year follow-up ($P=.01$; χ^2 test; Table 2[□]).



Figure 2. Bar graph shows outcome of elderly stroke patients randomized to receive care in the Departments of Medicine or the Department of Neurology as assessed by Rankin grades at 1 year. Patients in grades 1 and 2 are independent, those in grades 3 and 4 need help but are able to walk, and patients in grade 5 are bedridden.⁶

View larger version (32K):

[\[in this window\]](#)
[\[in a new window\]](#)

Patients randomized to neurological wards were more satisfied with the quality of life as assessed by the scale of Viitanen et al⁷ 3 months from the onset of stroke compared with those randomized to medical wards ($P=.01$; Mann-Whitney test), although there had been no difference in their life satisfaction before stroke. The difference leveled off at 1-year follow-up (Table 2[□]).

By multiple stepwise logistic regression analysis, severe stroke on admission (odds ratio [OR], 9.5; 95% confidence interval [CI], 2.5 to 36.2) and management by the Departments of Medicine (OR, 5.2; 95% CI, 1.4 to 20.2) were independent predictors of the length of hospital stay over 90 days. Independent factors for the likelihood of not being discharged to home were severe stroke (OR, 13.6; 95% CI, 6.1 to 31.7), management by the Department of Medicine (OR, 2.3; 95% CI, 1.1 to 5.1), living in nursing home or need for help in activities of daily living before the present stroke (OR, 2.9; 95% CI, 1.1 to 7.2), and intermittent claudication (OR, 2.4; 95% CI, 1.0 to 5.7). Independent factors for unfavorable functional outcome were severe stroke on admission (OR, 2.5; 95% CI, 1.2 to 5.1), management by the Departments of Medicine (OR, 2.3; 95% CI, 1.2 to 4.6), and male sex (OR, 2.4; 95% CI, 1.2 to 5.0). The other factors tested for were age, living alone, previous stroke, aphasia, hypertension, heart disease, diabetes, and malignancy.

□ Discussion

Elderly stroke patients randomized to receive care in the Department of Neurology were able to leave the hospital earlier, more often went directly home on discharge, and were more independent in activities of daily living at 1 year than those randomized to receive care in the Departments of Medicine. What might explain these differences? There is no indication that the differences were due to patient differences, as randomization produced two groups with comparable social prognostic variables. Nor were there any differences in medical characteristics on admission, including previous strokes, myocardial infarction, angina pectoris, intermittent claudication, heart failure, atrial fibrillation, hypertension, diabetes, hyperlipidemia, or malignancy. The severity of stroke on admission was equal in both groups. The different outcomes are likely due to the systematic stroke management by the Department of Neurology, ie, organized diagnosis, acute treatment, and early systematic rehabilitation of stroke patients by the stroke team.

- [Top](#)
- [Abstract](#)
- [Introduction](#)
- [Subjects and Methods](#)
- [Results](#)
- [Discussion](#)
- [References](#)

Although randomization resulted in two comparable groups, there were more identified cardiac diseases in patients randomized to neurological wards. This likely resulted from a more determined search for a possible source of embolism in patients treated on neurological wards, supported by the fact that a cardiologist was consulted more often and more echocardiograms were performed on patients randomized to neurological wards. These findings are similar to the results of earlier comparable trials.¹⁰ A more active approach in diagnostic workup is also apparent in the number of patients undergoing neuroradiological tests. Ninety percent of stroke patients on neurological wards had neuroradiological tests performed, whereas only 71% of patients on medical wards had a neuroradiological evaluation.

Some of the patients treated on neurological wards were also included in a randomized double-blind trial of nimodipine in acute ischemic hemispheric stroke. The results of that trial do not show a benefit of nimodipine,¹¹ so this does not explain the differences in outcome.

Forty percent of strokes were progressing, and 27% of brain infarctions and transient ischemic attacks were attributed to cardiogenic embolism. These patients were systematically anticoagulated on neurological wards, which was not the case on medical wards. Whether this contributes to the outcome differences is difficult to say because there are no objective data supporting the use of anticoagulation in these patients, although it was a common practice in many departments before the recent guidelines of the American Heart Association.¹²
[13](#)

Mortality was the same among patients randomized to neurological and medical wards, ie, the aforementioned therapies did not affect the case-fatality rate. This finding was similar to the findings of most other randomized trials in regard to stroke units.^{10 14 15} In one study that showed reduced mortality in patients treated in a stroke unit at 6 weeks, the difference disappeared during the follow-up year.¹⁶ However, overall reductions in early mortality (median, 3 weeks after stroke) of 28% and late mortality (median, 12 months after stroke) of 21% were identified in a recent meta-analysis of all available data of stroke units when a broad definition of stroke unit was used.¹⁷

Early and systematic rehabilitation by a stroke team and an individual rehabilitation program for each stroke patient are the foundations of stroke rehabilitation at our department. This finding was similar to those found by other successful stroke teams.^{10 16 18} Weekly meetings of the stroke team in which the progression of each patient is analyzed and the rehabilitation program is tailored according to changes in a patient's status is most likely one of the important factors contributing to the difference in outcome. Home visits by the patient and members of the stroke team and weekend leaves before discharge prepare the patient and the family for the discharge and help in the early discharge to home.

After hospital discharge, rehabilitation therapy is continued at our outpatient rehabilitation clinic when appropriate by a stroke team trained in outpatient stroke rehabilitation. Such an approach helps to discharge patients safely and earlier than otherwise. This makes it possible to modify the rehabilitation program according to the life situation after hospitalization and also helps to ensure that long-lasting rehabilitation results can be achieved and maintained.¹⁹ The benefits of successful intervention may be lost if such a follow-up program is not available.²⁰

It is also important to retain the investments of acute-stage management after hospital discharge from an economic point of view. Every patient who is able to go back home after the stroke and is fully independent in his/her daily life saves taxpayers' money, a fact equally important to developed and developing countries. The total economic burden of one Finnish stroke patient for 1 year in institutional care is approximately \$85 000 (US dollars), compared with approximately \$50 000 for care in a home for aged people and approximately \$25 000 for salaries of home helpers and outpatient care nurses for a stroke patient needing help to be able to stay at home.²¹ More important, however, is the impact of stroke management on the life of the stroke survivors and their loved ones.

An additional explanation for the good outcome achieved at the Department of Neurology is the fact that a stroke patient is an important patient in that department, just as coronary patients are important to internists and receive specialized care on medical wards. Although the value of coronary care units is no longer questioned, the value of stroke units is often underestimated.²²

The evaluation of functional outcome and life satisfaction was performed by a research nurse specially trained for functional outcome evaluations and hired by our hospital for the present trial. It was not possible to blind the information regarding on which ward a patient had been treated, but the nurse had no reason to assume that either department would be superior to the other in the care of elderly stroke patients.

Devoted interest and rational management by an experienced stroke team in a designated area (in the present trial at the Department of Neurology and in earlier Scandinavian trials at a stroke unit of the Department of Medicine^{10 16}) provide a better outcome for the elderly stroke patient. It is possible to achieve better results with this system than with an ambulatory team of stroke specialists who consult throughout the hospital but do not have their own ward and well-trained staff.²³ The specialty of physicians in a stroke team is not

important; physicians can be internists, as in the other Scandinavian trials,^{10 16} or neurologists, as in the present trial.

Use of the information presented here may improve not only mortality¹⁷ but also functional survival. With organized stroke management one can shorten the in-hospital time, reduce the number of elderly stroke patients needing institutional care, and increase the number of those fully independent in their daily life, as was the case in the present trial. This is of benefit in both human and economic terms.

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Top
Abstract
Introduction
Subjects and Methods
Results
Discussion
References

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Table 2. Outcome According to Management by Departments of Medicine Versus Department of Neurology

	Medicine (n=119)	Neurology (n=113)	P
Mortality on first admission (%)	20 (16)	16 (14)	...
Total hospital stay for all patients, d ¹	4808	2728	...
Total mortality (%)	25 (21)	24 (21)	...
Discharged to home (%)	74 (62)	85 (75)	.03 ³
1-Year follow-up			
Barthel Index (SD)	17.7 (4.6)	18.6 (3.6)	.02 ⁴
Independent in ADL ² (%)	54 (59)	67 (76)	.01 ³
Patient self-assessment score			
3 Months (SD)	29.9 (6.5)	33.8 (5.2)	.01 ⁴
1 Year (SD)	30.9 (5.6)	32.1 (5.2)	...

ADL indicates activities of daily living.

¹ First year.

² Rankin grades 1 and 2.

³ χ^2 test.

⁴ Mann-Whitney test.

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