

The prognostic impact of the stroke unit care versus conventional care in treatment of patients with transient ischemic attack: a prospective population-based German study

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Abstract

Background and purpose: The risk of a stroke after a transient ischemic attack (TIA) is high in the short time following a TIA. The German Stroke Society recommends an early hospitalization of patients with TIA preferably in a stroke unit (SU). This study aims to compare the impact of SU care with conventional care (CC) in patients with TIA.

Methods: In a prospective study, during a 36-month phase (starting November 2007), patients with TIA who were admitted to the hospital within 48 h of symptom onset were enrolled. Stroke rate during hospitalization and the 90-day rates of stroke and mortality were studied. Logistic regression analyses were used to estimate the odds ratio (OR).

Results: Of 2,200 patients (mean age, 17.6 ± 12 years, 49% female), 1,347 (61%) treated in a SU and 853 (39%) received CC at general departments. Patients treated in SU were significantly younger than those received a CC (69.9 vs. 71.7 years; $P = 0.001$). TIA patients treated on SU received more ultrasound investigations of the neck arteries (98 vs. 96%; $P = 0.003$) and of the brain arteries (97 vs. 82%; $P < 0.001$) than those of CC. The primary outcomes (stroke during hospitalization, stroke after 90 days, and mortality after 90 days) did not show a difference between the SU and CC groups. In patients of male sex, the 90-day stroke rate was significantly lower in the SU group than the CC group (1.8 vs. 4.5%; $P = 0.033$). Using the adjusted logistic regression analysis, treatment in a SU revealed a reduction of 90-day stroke rate in patients of male sex (OR 0.38; 95% CI 0.15–0.95; $P = 0.04$).

Conclusion: The impact of evaluation and treatment of patients with TIA in SU and CC appears to differ only among patients of male sex. Further randomized trials are necessary.

Keywords

TIA; prognosis; stroke; stroke unit; mortality; management; hospitalization

Introduction

Transient ischemic attack (TIA) is an unstable condition that is associated with higher stroke risk. The risk of stroke after TIA is highest during the early period after the index event [1,2]. Meta-analyses of patients with TIA have revealed that the short-term risk of stroke after TIA is approximately 3–5% over a period of 7 days [3,4]. Guidelines recommend that patients with TIA should be evaluated immediately, preferably in a stroke unit (SU) [5–7]. The ways of TIA management vary worldwide. Researches about the impact of early hospitalization in SU on patients with TIA are rare. The Ger-

man semi-intensive care SU concept combines closely monitoring of vital signs and neurological status with early treatment and evaluation for patients suffering from acute ischemic stroke. In addition to specialized staff, a neurologist with stroke experience is present 24 h a day in the SU. The German SU concept differs from SUs in other countries, which combine both acute care and rehabilitation.

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Table 1.

Baseline information's of stroke unit compared with conventional care group.

Baseline characteristic	SU group (n = 1347)	CC group (n = 853)	P value
Female, gender	49	50	0.9
Mean age, years (SD)	69.9 (13)	71.7 (12)	0.001
TIA symptoms			
Motor weakness	29	20	<0.001
Aphasia	17	11	<0.001
Dysarthria	16	13	0.02
Diabetes mellitus	20	16	0.015
Previous TIA/stroke	24	26	0.25
Hypertension	79	82	0.13
Atrial fibrillation	19	16	0.08
Hypercholesterolemia	56	55	0.7
Anti-platelet therapy before TIA	39	39	0.84
Mean hospitalization, days (SD)	6.7 (3)	5.9 (3)	<0.01

SU stroke unit, CC conventional care, SD standard deviation, TIA transient ischemic attack Values are percentages unless otherwise indicated

Table 2.

Diagnostic and therapeutic procedures and secondary prevention strategies.

Diagnostic and therapeutic procedures/secondary prevention strategies	Stroke unit (n = 1347)	Conventional care (n = 853)	P value
CCT	95	93	0.077
cMRI	59	55	0.075
Infarct's lesion detected by CCT/MRI	16	15	0.7
Extracranial vessel sonography	98	96	0.003
Transcranial vessel sonography	97	82	<0.001
AT with <48 h after onset	85	84	0.6
AT at discharge	84	83	0.6
OAC at discharge	19	20	0.5
CEA/stenting	3.4	2.5	0.24

SU stroke unit, CC conventional care, CCT cranial computed tomography, cMRI cranial magnet resonance imaging, AT anti-platelet therapy, CEA carotid endarterectomy

Values are percentage.

This present study aimed to compare the prognostic impact of the SU concept with that of conventional care (CC) on patients with TIA.

Methods

Study design

In our study, 15 hospitals in the German federal state of Schleswig-Holstein were included from the benchmarking project, Quality of Treatment of Stroke in Schleswig-Holstein "Qualitätsgemeinschaft Schlaganfallversorgung in Schleswig-Holstein" (QugSS2) [8]. The federal state of Schleswig-Holstein has approximately 2.8 million inhabitants and is located in the northernmost part of Germany. The local Ethics Committee at the University of Lübeck approved the study. All patients gave written informed consent to be included and evaluated in the study. The SU concept was used in 10 departments of neurology. CC management was performed in 5 departments of internal medicine. The TIA was diagnosed by at least one vascular neurologist in the SU group and by one external consulting neurologist in the CC group.

Data acquisition

All patients over the age of 18 years who were suffering from TIA were recruited at the participating hospitals during a period over 36 months (starting November 2007). To be included in the study, patients had to meet the following criteria: suffer a TIA that fulfills the definition put forth by the World Health Organization [9], have their main place of residence in Schleswig-Holstein, and be admitted to clinic within the first 48 h following symptom onset of TIA. The exclusion criterion was admitted to a hospital after 48 h following symptom onset. Follow-up was performed 3 months after the TIA. The patients were questioned by letter or telephone interview 3 months after discharge from the hospital. When patients were unavailable, 90-day mortality was evaluated by a request in the registration office. Baseline characteristics (Table 1)—gender, age, symptoms of TIA, vascular risk factors, and medical history—were recorded. In addition, diagnostic and therapeutic procedures and secondary prevention strategies were documented (Table 2) as well as primary outcomes (Table 3).

Treatment concepts

The SUs were located in two departments of neurology at university hospitals and in eight departments of neu-

Table 3.

Outcomes parameters.

Parameters	Stroke unit (n = 1347)	Conventional care (n = 853)	P
Stroke rate during hospitalization	0.9	1.2	0.58
Stroke rate at 90-day after discharge ^a			
In all patients	2.6	3.2	0.54
In patients of male sex	1.8	4.5	0.033
90-day mortality rate ^b	1.4	1.4	1.4

Values are in percentage.

^a90-day stroke rate recorded in 1,335 patients.^b90-day mortality recorded in 2,125 patients.

rology at general hospitals. The SU concept has been previously described in the German and European recommendations on stroke treatment [6,10]. The German interpretation of the SU concept is based on the provision of semi-intensive care and recommends that all patients with TIA should be transferred to a hospital as quickly as possible and that the evaluation of etiology must be performed immediately. The SU team consists of neurologists working in cooperation with neuroradiologists and internists. If necessary, a specialized medical and nursing team implements physiotherapy immediately as well as both logopedic therapy and ergotherapy as early as possible.

The five departments of internal medicine representing CC treatment were located in general hospitals. Cranial computed tomography (CCT) and magnetic resonance imaging (MRI) were not available on a 24-h basis in these hospitals. The possibility of systemic thrombolysis was limited. The provision of appropriate neurological or neurosurgical advice was guaranteed by external services but only during daytime working hours. The clinics without SUs were asked to agree to a uniform medical protocol so that data collection could be accurately evaluated.

Statistics

We analyzed the data with SPSS program (version, 20). We used mean, standard deviation, and percentage values to describe the data. We performed a χ^2 test to calculate the correlation between categorical variables, and a *t* test between continuous variables. Adjusted logistic regression analyses were performed to estimate the odds ratio (OR), and parameter with a $P < 0.1$ was entered in the logistic regression model. A significant correlation was set for $P < 0.05$.

Results

A total of 2,200 patients with TIA (mean age, 70 ± 12 years; 44.3% women) were included in this study, with 1,347 patients (61%) being treated in SUs and 853

patients (39%) undergoing CC. The mean hospitalization for patients treated in the SU was 6.7 days longer compared with 5.9 days for patients treated with CC ($P < 0.001$). The patients in the SU group were significantly younger than those in the CC group (69.9 vs. 71.7 years, respectively; $P < 0.001$).

The TIA symptoms, motor weakness, aphasia, and dysarthria were more frequent in patients who were being treated in SU (Table 1). Significantly higher rate for patients in the SU group than for those in the CC group was found for the risk factor of diabetes mellitus (20 vs. 16%, respectively; $P = 0.015$). Other vascular risk factors such as atrial fibrillation, hypercholesterolemia, arterial hypertension, and previous stroke showed no significant differences between the groups (Table 1).

As shown in Table 2, patients in the SU group, compared with those in the CC group, underwent extra- and transcranial ultrasound investigations significantly more often. The secondary prevention strategies showed no differences between the SU and CC groups.

The stroke rate during hospitalization (0.9 vs. 1.2%; $P = 0.5$), the stroke rate at 90-day (2.6 vs. 3.2%; $P = 0.54$), and the mortality rate at 90-days (1.4 vs. 1.4; $P = 0.8$) did not differ between the SU and CC groups (Table 3). After splitting the cohort according to gender, we found that patients of the male sex who were treated in SU have a lower rate of stroke at 90 days (1.8 vs. 4.5%, respectively, $P = 0.033$) than men in CC. Using the logistic regression analysis, SU revealed a reduction in the 90-day stroke rate in men (OR 0.38; 95% CI 0.15–0.95; $P = 0.04$).

Discussion

In the present study, we found that SU reduce the stroke at 3 months following TIA in patients of male sex (OR 0.38). This is a remarkable effect because neurological focal symptoms and diabetes mellitus were more frequent in the SU group compared to CC.

Similar to a previous study [10], we found no difference in the rates of stroke during hospitalization and of 90-day mortality in the SU group compared to the CC group in the complete cohort. The lack of difference between the SU and CC may be explained by the national guidelines that propose a standardized evaluation and treatment of patients with TIA. Another reason could be the small size of patient's groups who were suffered from stroke or died following a TIA.

Stroke unit group stayed at hospital longer than the CC group. Reasons for the longer mean hospitalization of patients in the SU group may result from the discovery of pathological findings after undergoing transesophageal echocardiography, performing 24-h Holter electrocardiography, and the ultrasound investigation. Patients with TIA stayed at the hospital until they received sufficient treatment with an oral anti-coagulant or underwent thrombendarterectomy/stenting of the carotid stenosis.

Several international studies have shown that patients with ischemic stroke benefit from a treatment in SU [10–13]. In all these studies, there is, however, no evidence that SU management and treatment are beneficial for patients with TIA. In our study, the risk of stroke in the SU and CC groups is comparable with that demonstrated in another study which investigated the risk of stroke in patients with TIA who were admitted to a SU [14]. The low-stroke rates may be attributed to a rapid and complete evaluation of TIA etiology (e.g., investigation of the brain by CCT and MRI, sonography of the brain and neck arteries, long-term ECG, and monitoring of vital parameter).

Furthermore, the rate of 90-day mortality in the present study was low and may be attributed to the early admission of patients and the rapid assessment of the TIA. The efficacy of early initiation of TIA evaluation has been shown in other studies [15,16] even though the patients were not hospitalized. The decision to provide those patients with outpatient care may have been influenced by the low cost of this type of care and patients' preference. In contrast, the patients included in the present study underwent hospitalization and received more in-depth diagnostic evaluation and cardiac monitoring than the one that is performed in an outpatient setting.

Our study has several limitations: The study was not a randomized trial. The diagnostic findings of long-term (24 h) Holter ECG and echocardiography were not evaluated. Despite these limitations, our investigation shows that the hospitalization in SU is correlated with low risk for stroke at 90 days in patients with TIA who are of a male sex. No differences in stroke rates during hospitali-

zation and in 90-day mortality were found. Further randomized studies are necessary to study the impact of SU in comparison to CC and outpatient setting.

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Disclosures

The authors do not have any conflicts of interest.

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