Acute Stroke Management in the Local General Hospital

René Handschu, MD; Andreas Garling, MD; Peter Ulrich Heuschmann, MD; Peter L. Kolominsky-Rabas, MD; Frank Erbguth, MD, PhD; Bernhard Neundörfer, MD, PhD

Background and Purpose—The majority of stroke patients are treated in local general hospitals. Despite this fact, little is known about stroke care in these institutions. We sought to investigate the status quo of acute stroke management in nonspecialized facilities with limited equipment and resources.

Methods—Four general hospitals located in smaller cities of a rural area in Germany participated in this study. The 4 hospitals were similar in structure and technical equipment; none had a CT scanner in-house. We reviewed the medical records of every stroke patient hospitalized in 1 of the 4 hospitals within a period of 8 weeks within 1 year.

Results—We collected data of a total of 95 patients at all 4 hospitals. The frequency of diagnostic tests was low: at least 1 CT scan was obtained in only 36.8% of all cases, whereas diagnostic methods available in-house were used more frequently, such as Doppler ultrasound (49.0%), echocardiography (42.3%), and 24-hour ECG registration (48.4%). Each hospital had a different therapeutic approach. Main therapeutic options were the use of pentoxyfilline (0% to 90.5%), osmodiuretics (0% to 90%), piracetam (0% to 93.3%), and hydroxyethylstarch (4.8% to 30%). Medication for long-term secondary prevention was given to 69.8% of all patients.

Conclusions—This study provides one of the few data samples reflecting stroke care in smaller general hospitals. The findings demonstrate a partially suboptimal level of care in these institutions. To achieve future improvements, extended human and technical resources as well as research for stroke care should not be restricted to academic stroke centers.

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Key Words: diagnosis ■ Europe ■ quality of health care ■ stroke management

Stroke is the second leading cause of death and the most frequent cause of permanent disability in the world. In the last decade, various therapies have been proven effective,1–3 and the importance of specialized units for acute care and early rehabilitation has been demonstrated.4–6 Advances in new diagnostic techniques make early identification of ischemic tissue possible. On the basis of these recent developments, international guidelines for stroke management were established on a scientific basis7,8 and are now used in the clinical practice of stroke centers.

However, being a major health problem, acute stroke is managed not only by specialized academic medical centers; the majority of stroke patients are still seen by local general hospitals. Little is known about the standard of care and quality of diagnosis and therapy in these institutions concerning stroke management. Most research included major academic centers or a mixture of institutions with variable size, resources, and equipment.9–11 Only few studies were focused on smaller hospitals in rural12 or urban13 communities.

At the turning point in the “thrombolysis era,” we sought to investigate features of acute stroke care in smaller community hospitals with limited technical and human resources. We decided to use a retrospective design because we did not want to interfere with routine practice. A prospective study would have been recognized quickly by the staff at a small facility. This would then have influenced the treatment of stroke patients because they were now “study patients.” Our goal was to get an impression of the true status quo of diagnostic and therapeutic procedures of stroke patients by retrospective extraction of data from medical records. These data should provide information about existing or missing standards in smaller nonspecialist facilities at a point in time when acute stroke management was changing, while first results of thrombolysis trials were published,1,14 and plans for nationwide establishment of stroke units in Germany were on the way to realization.

Subjects and Methods

Four community hospitals in northern Bavaria participated in our study. All 4 were general primary care facilities located in smaller cities within a rural area serving a population of ~200 000 people altogether. They were ~20 to 40 km away from a metropolitan area with a university medical center and another tertiary care teaching hospital. The distance between the 4 hospitals was ~25 km, and their main features were similar: All stroke patients were treated by the departments of internal medicine, each covering 48 to 103 beds. None of the 4 hospitals had a CT or MRI scanner in-house or even nearby. Other diagnostic tools such as ECG recording, Doppler

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866
ultrasound, or echocardiography were available. All hospitals had an emergency department and an intensive care unit (3 to 6 beds) with some of the beds also prepared for mechanical ventilation if necessary. None of our hospitals had a stroke unit or a specific stroke team at the time the patients were treated.

To create a representative sample, we investigated 8 weeks within 1 year (1996 to early 1997) split into 4 blocks of 2 weeks, each block in a different quarter of the year to avoid seasonal variations. None of the 2-week blocks included any public holidays that could possibly alter access to diagnostic or therapeutic services or influence admission policy.

A physician and a research associate from the university hospital retrospectively reviewed the medical records of all patients admitted to any of the 4 hospitals within the 8-week time period and discharged with a diagnosis of stroke (a diagnosis code of 430 to 438 according to ICD 9). Cases identified by this algorithm that were obviously not stroke cases, or in which stroke was not the main diagnosis, were not included for further analysis.

From the medical records of each case, we collected data about patient characteristics (age, sex, medical history, and medication before stroke), the onset of symptoms, prehospital therapy, means of transportation to the hospital, time and type of admission, time and type of diagnostic procedures, and in-hospital therapy. Furthermore, data about length of stay, discharge destination, and mortality were noted.

**Results**

One hundred three cases were identified. In 8 cases, stroke was not the main diagnosis or there was no stroke. Ninety-five patients were included in the study: 53 women and 42 men. Sixty-seven of the reviewed cases were a first occurrence of stroke or transient ischemic attack (TIA), and 28 were recurrent disease. Patient age was 54 to 94 years (median, 77 years). Patient characteristics on admission are shown in Table 1.

**Prehospital Management and Admission**

The majority of patients (58.1%) were referred by a general practitioner (GP), 28% of all patients were referred by a physician in the team of the emergency medical service, 3.2% were seen by paramedics only, and 7.6% came to the hospital without previous contact with any healthcare personnel (self-referral).

Transport to the hospital was done by ambulance in 73.3% of all cases; in 23.3%, patients were brought by relatives or friends, and 3 patients (3.3%) made their way in by themselves.

An exact time for the onset of symptoms was noted in the records of 86 cases, and we calculated admission delay only in those patients; 59.3% of these were admitted within 6 hours after the onset of symptoms, 22.1% within 24 hours, and another 15.1% after 2 to 7 days; 3.49% were admitted even longer than 7 days after onset of the first symptoms.

Prehospital therapy, which describes every therapy after onset of symptoms and before reaching the hospital, was only documented in ambulance-transported patients (n=71). Fourteen (21.2%; 14.7% of all patients in the study) received antihypertensive treatment and 23 (32.4%; 24.2% of all) received various other medication. Fifteen patients received oxygen by nasal cannula; 2 patients underwent endotracheal intubation on the scene.

**Diagnostic Procedures and Diagnoses**

Of all patients, 36.8% had at least 1 CT scan; a second scan was performed in 3.2%, and an MRI scan was obtained in 1 patient; 57% of all CT scans were obtained within the first 24 hours of admission. Delay to first CT scan is shown in Figure 1. Doppler ultrasound was done in 49.5% of all patients and echocardiography in 42.1% of all patients. Twenty-four–hour ECG recording was performed in 48.2% of all patients between day 4 and day 19 (median, day 9) after admission, and 24-hour blood pressure recording was performed in 23.2% of all patients between day 5 and day 17 (median, day 11).

Hospitals B and D had angiography available within the department, and 6.3% of all patients underwent cerebral angiography. Neurological consultation was obtained in 18.9% of all patients, mostly at the university hospital (usually together with a CT scan) but in some cases with a local neurologist. Table 2 shows the proportion of patients receiving specific procedures in each hospital. As discharge

![Figure 1. Delay to first brain imaging.](http://stroke.ahajournals.org/)
In-Hospital Therapy

Regarding therapy during the whole time of hospitalization, we only evaluated the 67 patients with a first occurrence of stroke or TIA.

Main therapeutic strategies observed were medication with pentoxifylline in 49.3% of all cases, hydroxyethylstarch for hemodilution in 16.3%, osmo- and diuretics (e.g., glycerol, mannitol) in 31.3%, and the administration of piracetam in 22.4% of all cases.

Some physiotherapy was given to 41.8% of all cases, mostly starting in the first week after admission, but only 14.9% had physiotherapy within the first 48 hours.

For secondary prevention of ischemic stroke, 74.6% of all patients received aspirin, 59.7% within the first 48 hours; 14.9% were receiving intravenous heparin for at least some days, mostly in hospital A after a CT scan and a neurology consultation. Subcutaneous heparin was given to 82.1% of all patients, mainly to prevent venous thromboembolism because patients were bedridden. Of all patients with a discharge diagnosis of stroke (excluding TIA and PRIND), 30.2% were given aspirin, 2.3% were given intravenous heparin, and 41.8% were given subcutaneous heparin without any form of brain imaging done.

At the time of discharge, 68.7% of all patients were taking aspirin, and 1 patient took oral anticoagulation (phenprocoumon) at the time of discharge, with the recommendation for continuation at home. None of the 9 patients with documented atrial fibrillation received long-term oral anticoagulation.

For treatment of hypertension, oral medication was administered in 65.7% of all patients at some time during their hospitalization and in 46.3% of patients within the first 48 hours. Elevated blood glucose was treated with insulin in 10.4% of all patients and with oral antidiabetics in 25.4%.

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TABLE 2. Frequency of Diagnostic Procedures

<table>
<thead>
<tr>
<th>Diagnostic Procedure</th>
<th>% of Patients</th>
<th>Range for Single Hospitals (Minimum–Maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT scan (first)</td>
<td>36.8</td>
<td>25–54.5</td>
</tr>
<tr>
<td>CT scan (control)</td>
<td>3.2</td>
<td>0–12.5</td>
</tr>
<tr>
<td>Angiography</td>
<td>6.3</td>
<td>0–13</td>
</tr>
<tr>
<td>MRI scan</td>
<td>1.1</td>
<td>4.3 (Hospital D)</td>
</tr>
<tr>
<td>ECG</td>
<td>97.9</td>
<td>95.7–100</td>
</tr>
<tr>
<td>Doppler ultrasound</td>
<td>49.5</td>
<td>31.3–73.9</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>42.1</td>
<td>18.8–52.2</td>
</tr>
<tr>
<td>24-h ECG recording</td>
<td>48.2</td>
<td>25–60.9</td>
</tr>
<tr>
<td>24-h blood pressure recording</td>
<td>23.2</td>
<td>0–43.5</td>
</tr>
<tr>
<td>Neurology consult</td>
<td>18.9</td>
<td>0–45.5</td>
</tr>
</tbody>
</table>

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Figure 2. Discharge diagnosis and brain imaging (all patients). Posterior row shows percentage of all patients with one specific discharge diagnosis; anterior row shows part of patients within this diagnosis group receiving at least 1 CT scan or other form of brain imaging.
As shown in Table 3, therapeutic approaches differed between the 4 hospitals, especially regarding the use of specific therapeutic options and secondary prevention.

### Case-Fatality and Type of Discharge

Twelve patients (12.6%) died during hospitalization. According to the medical records, in 1 of the 12 patients, pulmonary embolism was the cause of death. In the remaining 11 cases, the cause of death was thought to be directly related to their stroke as the level of consciousness decreased or new neurological deficits occurred.

Six patients were transferred to a another acute care hospital: 2 patients with intracerebral hemorrhage went to the Department of Neurosurgery at the University Hospital, and 2 patients were admitted to the Department of Neurology after consultation. The other 2 patients insisted on their transfer to another hospital because they had friends and relatives there.

Fifty-seven patients (60.0%) were discharged home and 16 patients (16.8%) were transferred to a nursing home, but at least some of the patients discharged home probably received some form of nursing care at home. Five patients went to a rehabilitation facility directly after acute hospital care and 13 after a short period at home. Thus, 18.75% of all patients received inpatient rehabilitation. Taking into account that 30.5% had a TIA or PRIND and left the hospital without any form of rehabilitation received inpatient rehabilitation. The average length of hospital stay was 19.5 days (median, 17.0 days), ranging from 1 to 49 days.

Ten patients (10.5%) were treated and monitored in the intensive care unit for 6 hours up to 15 days, with 3 patients ventilated for part of the time.

### Discussion

There are few data on the treatment of stroke patients in smaller community hospitals. Only few studies focus on stroke care in such facilities, and some recent national and international surveys included smaller hospitals. We conducted a retrospective study in 4 small general hospitals located in relatively rural communities.

The retrospective design of our work is tainted with all the methodological disadvantages of reviewing medical records in 4 different institutions. The quality of our data depends mainly on the quality of documentation in the participating hospitals. On the other hand, the retrospective technique provided insights into the status quo of “everyday” stroke management, avoiding the influence of an ongoing study itself. A retrospective design has already been used in other evaluations of stroke care.

A surprisingly large group of patients in our study reached the hospital within 6 hours of symptom onset. This proportion was even larger than that of an urban population from a Danish study. For estimation of admission delay, we only took patients with an exact onset time noted. The value of these data is nevertheless partially limited because there are cases in which it was unclear whether the onset time noted was really the true beginning of symptoms, or, for example, the patients were awakening with symptoms at that time.

The vast majority of patients were first seen by their GP and then referred to the hospital. Contrary to findings in previous studies, this suggests that in our sample calling GPs instead of the Emergency Medical Service did not play a crucial role in delaying admission.

In prehospital treatment, the use of antihypertensive drugs was quite common, although there was not always an identifiable indication for this therapy.

The consensus statement by the Helsingborg Conference demands computerized tomography for all patients with symptoms suggestive of stroke. In German surveys, the frequency of CT studies in acute stroke varied from 85% to 89% and 95% to 98%, or 95% for a university town nearby.

In our sample, the frequency of brain imaging was much lower. Only about one third of all patients with stroke or TIA received some form of brain imaging during their entire hospital stay. A similar proportion of brain imaging was found for an English general hospital and in a rural Danish hospital. For our 4 hospitals, obtaining a CT scan required ambulance transportation for 30 to 60 minutes 1 way. Under such circumstances, a CT scan can increase patient risk and hospital costs.

Other diagnostic methods such as Doppler ultrasound or echocardiography were used more frequently. These tests are easily accessible because they are part of routine diagnostics of each department, whereas brain imaging had to be done outside of the hospital grounds. Accordingly, there was a relatively large proportion of patients who underwent Doppler or echocardiographic studies to determine the cause of a suspected ischemic stroke never proven by any form of brain imaging. We conclude that the use of diagnostic tools in our study was more dependent on their availability than on their appropriateness in a stepwise diagnostic process.

Concerning therapeutic approach, we found partial differences between hospitals; each one had a somewhat individual therapy scheme. We did not find a joint standard for acute therapy used by all of our hospitals, and none of the specific therapies used by each hospital was clearly recommended by international guidelines. The fact that therapeutic options without any proven benefit were used in the study hospitals as

<table>
<thead>
<tr>
<th>TABLE 3. Main Therapeutic Options in Each Hospital</th>
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</thead>
<tbody>
<tr>
<td>% of Patients Receiving Each Therapy</td>
</tr>
<tr>
<td>Therapy</td>
</tr>
<tr>
<td>All Patients</td>
</tr>
<tr>
<td>(Minimum–Maximum)</td>
</tr>
<tr>
<td>Penoxiphilnine</td>
</tr>
<tr>
<td>Hydroxyethylstarch</td>
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<tr>
<td>Osmodiuretics</td>
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<tr>
<td>Piracetam</td>
</tr>
<tr>
<td>Physiotherapy</td>
</tr>
<tr>
<td>Aspirin</td>
</tr>
<tr>
<td>Intravenous heparin</td>
</tr>
<tr>
<td>Subcutaneous heparin</td>
</tr>
<tr>
<td>Antihypertensive medication</td>
</tr>
<tr>
<td>Insulin</td>
</tr>
<tr>
<td>Antidiabetics</td>
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</tbody>
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well as in prehospital management may express the wish of the physicians involved “to do at least something” for their stroke patients.

Regarding secondary prevention, there was a proportion of patients who did not receive appropriate medication that was approximately 2 times larger than in a Dutch study. Other patients had antithrombotic treatment without a prior CT scan to exclude hemorrhage, increasing the risk for those patients. However, there are arguments coming up from recent publications that starting aspirin without a CT scan is not as deleterious as one might expect.

To summarize, our findings demonstrate that quality of care for stroke patients in small district hospitals is sometimes suboptimal, a fact that has also been found in studies from other European countries. There is a clear need to increase the use of diagnostic tools, especially concerning brain imaging. Considering that our 4 hospitals were not more than 40 km away from academic teaching hospitals, we may expect that in institutions even further away from specific diagnostic options, the frequency of, for example, brain imaging studies, could be even lower.

There is also a pressing need for more standardized therapeutic protocols that are based on widely accepted guidelines.

The lack of diagnostic tools and sometimes limited therapeutic possibilities are primarily due to the limited resources of each hospital, and the 4 institutions tried their best to provide good care for stroke patients. To optimize stroke management in primary care, technical equipment must be updated, and more staff and better training is probably needed.

Since the time of our data collection, stroke management in our 4 hospitals changed in many ways. These improvements are due to a growing public attention to the problem of stroke but also consequences of the study itself. Thus, retrospective file review could be a tool for detecting deviations from optimum and for maintaining a favorable level of care. This was already demonstrated for standardized audits.

A possible solution is offered through the creation of networks linking local hospitals to stroke centers. Here, the use of telemedicine could help to provide the same level of care to all stroke patients no matter where they are.

Acknowledgments

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