Thrombolytic Therapy Rates and Stroke Severity
An Analysis of Data From the Swedish Stroke Register (Riks-Stroke)
2007–2010

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Background and Purpose—We tested the hypothesis that higher proportions of patients with minor stroke being treated with thrombolysis contribute to increasing overall rates of thrombolysis.

Methods—We included 1743 ischemic stroke patients (age 18–80 years) treated with thrombolysis, recorded in the Swedish stroke register Riks-Stroke between 2007 and 2010. Minor stroke was defined as National Institutes of Health Stroke Scale score ≤5.

Results—The proportion with minor stroke among patients treated with thrombolysis increased from 22.1% in 2007 to 28.7% in 2010 (P = 0.021). The rate of increase did not differ significantly between men and women, age groups, or hospital types (university hospitals, other large hospitals, or community hospitals). Hospitals with high proportions of thrombolysis patients with minor stroke were more likely to have high thrombolysis frequencies (R = 0.55; P < 0.001).

Conclusions—In recent years, an increase in the proportion of patients with minor stroke treated with thrombolysis has contributed to rising overall thrombolysis rates in Sweden. At the hospital level, high rates of thrombolysis are associated with a high proportion of minor stroke being treated. (Stroke. 2012;43:536-538.)

Key Words: acute ischemic stroke ■ thrombolysis ■ rtPA ■ implementation ■ stroke severity

After many years of slow implementation rates there is now, in many countries, a thrust to enhance the rates of thrombolytic therapy for acute ischemic stroke. In Sweden, feedback to hospitals and decision-makers from the national quality register Riks-Stroke,1 public reporting with open comparisons between hospitals, and economic incentives have increased the pressure on hospitals to increase the rates of thrombolysis.

Increased use of thrombolysis is often attributed to improved logistics to reduce delays in prehospital and in-hospital management of acute stroke patients. In this study, we have tested the alternative hypothesis that an increasing rate of thrombolysis is partly caused by more patients with minor stroke being treated.

Methods
Riks-Stroke covers all 76 hospitals in Sweden that admit patients with acute stroke.1 Ethical approval was given by the Regional Ethical Board at Umeå University.

Hospitals were included in the study if National Institutes of Health Stroke Scale (NIHSS) scores (optional in Riks-Stroke since 2007) were available in at least 70% of thrombolysed ischemic stroke patients in each year from 2007 to 2010. Patient inclusion criteria were ischemic stroke (International Classification of Diseases code I63), recombinant tissue-type plasminogen activator (rtPA), reported NIHSS data, and age 18 to 80 years.

Minor stroke was defined as NIHSS 0 to 5.2,3 Included hospitals were categorized into university, large nonuniversity, and community hospitals. Patients who managed clothing, toileting, and walking without help from others were defined as being independent in activities of daily living.

Symptomatic intracranial bleeding was defined as a hemorrhage with a clinical NIHSS score deterioration of 4 points or more within 36 hours of the start of treatment.

The Pearson χ²-test was used for univariate comparisons of proportions with minor stroke in different patient groups. Significant differences were then analyzed using multiple logistic regression with 2-way interactions included in the initial model. Statistical analyses were performed using SPSS v.18.2 (SPSS Inc).

Results
Thirty-three hospitals fulfilled the hospital inclusion criteria (7/9 university hospitals, 12/20 larger nonuniversity hospitals, and 14/47 community hospitals). Of the 28 462 patients age 18 to 80 years with ischemic stroke recorded in Riks-Stroke from 2007 to 2010, 1908 patients (6.7%) received thrombolytic therapy. NIHSS scores were missing for 165 patients (8.6%). Thus, the study population included 1743 patients, of which 460 patients (26.4%) were classified as minor stroke on admission to hospital (Table).
Among patients treated with thrombolysis, the proportion with minor stroke increased from 22.1% in 2007 to 28.7% in 2010 (P=0.021; Figure 1). There was a slight decrease in median NIHSS scores (interquartile range); 11 (6–17) in 2007, 10 (6–16) in 2008, 10 (5–17) in 2009 and 9 (5–15) in 2010 (P=0.05, Kruskal-Wallis test). Hospital minor stroke proportions ranged from 3.2% to 42%.

A high proportion of patients with minor stroke receiving thrombolysis was associated with younger age (P=0.001), no blood pressure medication (P=0.004), and more specialized hospital type (P=0.001; Table). There was no significant association with sex, dependence in activities of daily living, institutional living, smoking, atrial fibrillation, previous stroke, previous transient ischemic attack, diabetes, acetylsalicylic acid treatment, and other antiplatelet agent treatment.

Multiple logistic regression confirmed the association between minor stroke and age, year of onset, and hospital type (Table). The increase over time in proportion with minor stroke was similar in men and women (P=0.567), in different age groups (P=0.561), and in different types of hospitals (P=0.104).

At a hospital level, there was a positive correlation between proportion of thrombolysis patients with minor stroke and overall proportion of patients receiving thrombolysis (Figure 2; R=0.549; P<0.001).

The frequency of symptomatic intracranial bleedings was 4.9% for NIHSS 0 to 5 and 6.2% for NIHSS ≥6 (P=0.295).

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**Table. Patients With Thrombolytic Therapy and Minor Stroke**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Thrombolytic Therapy N</th>
<th>Minor Stroke n</th>
<th>%</th>
<th>95% CI</th>
<th>Multiple Logistics Regression OR</th>
<th>95% CI</th>
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<tbody>
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<td>Age</td>
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<tr>
<td>18–64</td>
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<td>17.6</td>
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<td>Year of onset</td>
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<td>65</td>
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<td>17.6</td>
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<td>22.8</td>
<td>18.5</td>
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<td>29.7</td>
<td>25.6</td>
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<td>28.7</td>
<td>24.8</td>
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<td>Large non-university</td>
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</table>

Ref indicates reference category; CI, confidence interval; OR, odds ratio.

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**Figure 1.** Proportion (%) of patients in each National Institutes of Health Stroke Scale interval among patients receiving thrombolysis. Q indicates quarter.

**Figure 2.** Proportion (%) of minor stroke (National Institutes of Health Stroke Scale 0–5) among patients receiving thrombolysis vs overall rates of thrombolysis in patients with ischemic stroke.
Discussion

The median NIHSS scores among patients with thrombolysis reported here indicate that patients treated in routine clinical practice in Sweden have, on average, somewhat milder symptoms than do patient populations in clinical trials. Our data show that the proportion of patients with minor stroke is increasing among patients receiving thrombolytic therapy for acute ischemic stroke. Together with other factors, such as improved acute stroke management logistics, this has contributed to increasing proportions of patients being treated with thrombolysis. At the hospital level, a high proportion of patients with minor stroke receiving thrombolysis is associated with a high overall proportion treated with thrombolysis.

According to Riks-Stroke data, the proportion of acute ischemic stroke patients treated with mechanical thrombectomy was 1.4% during 2010 (unpublished). This proportion is insufficient to explain an increase in the proportion of minor stroke among patients receiving thrombolysis, even if patients with severe stroke were to be treated preferentially with thrombectomy rather than with thrombolysis.

The scientific evidence for treatment with thrombolysis is weaker for minor stroke than for moderate or severe stroke, and estimates are imprecise. The rtPA product label used in Sweden does not include a lower NIHSS threshold, but in absolute terms, the possible benefits of thrombolysis are considerably smaller in patients with minor stroke.

Sources of Funding

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Disclosures

None.

References

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