Sex Differences in Stroke Care and Outcome in the Swedish National Quality Register for Stroke Care

Marie Eriksson, PhD; Eva-Lotta Glader, PhD; Bo Norrving, PhD; Andreas Tere´nt, PhD; Birgitta Stegmayr, PhD

Background and Purpose—Previous reports concerning sex-related differences in stroke management and outcome are inconsistent and are sometimes difficult to interpret. We used data from a national stroke register to further explore possible differences between men and women in baseline characteristics, stroke treatment, and outcome.

Methods—This study included 24 633 stroke events registered in Riks-Stroke, the Swedish national quality register for stroke care, during 2006. Information on background variables and treatment was collected during the hospital stay. After 3 months, the patients’ living situation and outcome were assessed.

Results—Women were older than men when they had their stroke (mean age, 78.4 versus 73.6 years; P<0.001). On admission to the hospital, women were more often unconscious. Among conscious patients, there was no sex-related difference in the use of stroke unit care. Men and women had equal probability to receive thrombolysis and oral anticoagulants. Women were more likely to develop deep venous thromboses and fractures, whereas men were more likely to develop pneumonia during their hospital stay. Women had a lower 3-month survival, a difference that was associated with higher age and impaired level of consciousness on admission. Women were less often living at home at the 3-month follow-up. However, the difference in residency was not present in patients <85 years who were living at home without community support before the stroke.

Conclusions—Reported sex differences in stroke care and outcome were mainly explained by the women’s higher age and lower level of consciousness on admission. (Stroke. 2009;40:00-00.)

Key Words: outcome ■ registry ■ sex ■ stroke ■ stroke management

Previous studies have demonstrated differences between men and women regarding prestroke condition, initial stroke symptoms, management, severity, and outcome. Before stroke, women are more likely to live alone in their own homes or in institutions.1–2 They are more likely to be disabled before stroke4,5 and unconscious on admission.2–4 Previous studies have also shown that women have a less favorable functional outcome2,5,6 and are less often discharged to their own homes.7–9 It is not clear whether men and women have different chances to survive after a stroke beyond the age-related differences. Poorer survival for women has been reported in hospital and after 28 days,1 but there are also reports of better survival for women after 6 months4 and after 1 year.2 Other studies have not shown any significant differences in survival during the hospital stay,2 after 3 months,1,5 or after 6 months.8

Overall, results concerning sex differences related to stroke treatment and outcome are inconsistent and not easily interpreted. Additional studies are needed to evaluate possible sex differences and their underlying causes. The study performed by Glader et al on sex differences in Swedish stroke care used data from 2001.2 Since then, stroke care has been improved, eg, more patients have access to care in stroke units, thrombolytic therapy has been approved for acute stroke, and new guidelines on stroke care have been published by the Swedish National Board of Health and Welfare.10 To ensure good care for all patients with stroke, regardless of sex, it is important to further explore possible differences between men and women using recent data.

Our aim was to update results from a previous study that was carried out 5 years ago2 concerning sex-related differences in baseline characteristics, stroke management, and stroke outcome in Sweden. We also aimed to explore possible differences in thrombolytic therapy, secondary complications, secondary prevention, and patient satisfaction between men and women.

Methods

This study included stroke events registered during 2006 (January to December) in Riks-Stroke, the Swedish national quality register for stroke care.11 A total of 24 633 stroke events treated in the hospital were
variable Assessments and Definitions

Level of consciousness on admission to the hospital was recorded using 3 categories based on the Reaction Level Scale. Patients with Reaction Level Scale 1 were defined as alert, Reaction Level Scale 2 to 3 as drowsy but responding to stimulus, and Reaction Level Scale 4 to 8 as unconscious. Patients were defined as independent in activities of daily living if they were able to walk indoors without assistance from another person. According to a previously published algorithm, this corresponds to a score of 8 on the modified Rankin Scale. Depression was self-reported. Patients responding with any of the first 2 alternatives were considered to have self-reported depression, and patients who answered “do not know” were considered as missing. General state of health was assessed in a similar way. The patients were asked the following question: “How do you regard your general state of health?” with the alternatives: “very good,” “fairly good,” “moderately bad,” “very bad,” and “do not know.” Patients who answered “moderately bad” or “very bad” were defined as perceiving their health status as bad. The patients were asked the following question: “Are you satisfied with the care you received in the hospital?” and they were asked 6 additional questions concerning treatment by the staff, rehabilitation, dialogue with the physician and other staff, stroke information about affliction, and where to turn for support after hospitalization. Each question had 5 response alternatives: “very satisfied,” “satisfied,” “dissatisfied,” “very dissatisfied,” and “do not know.” Patients responding with any of the first 2 alternatives were considered to be satisfied.

Statistical Methods

Age was summarized by mean values and categorical variables by proportions. Differences between men and women were tested using Student t test for age and length of hospital stay and Pearson χ² test for proportions. Because women were older at stroke presentation, age-adjusted analysis was conducted using multiple logistic regression, including sex and age as independent covariates. The results from the multiple regressions are presented as age-adjusted ORs with corresponding 95% CIs. Possible sex differences were further analyzed in more consistent subgroups of patients and by adjustment for additional confounding factors. CIs and probability values were not corrected for multiple testing. All statistical analyses were performed using SAS version 9.1.3.

Results

Baseline Characteristics

The age distribution differed between male and female patients with stroke. Below 75 years of age, there were more men (61.8%) than women, whereas >75 years of age, there were more women (56.9%) than men. On average, the women were
4.8 years older than the men when they had their stroke (mean age, 78.4 versus 73.6 years; \(P<0.001\); Table 1). Before their stroke, women were more often living alone (\(P<0.001\)), in an institution (\(P<0.001\)), or were dependent in activities of daily living (\(P<0.001\)) as compared with men. The women were also more likely to have atrial fibrillation (\(P<0.001\)) and treatment for high blood pressure (\(P<0.001\)). Women were less likely than men to smoke (\(P<0.001\)), have diabetes (\(P<0.001\)), or have had a previous stroke (\(P<0.001\); Table 1).

**Hospital Care**

Women were less often treated in a stroke unit (\(P<0.001\)), a difference that was not explained by women’s higher age alone (OR, 0.904; 95% CI, 0.846 to 0.966). More women than men had impaired consciousness on admission (\(P<0.001\)). The difference was consistent in all age groups (<65, 65 to 74, 75 to 84, and ≥85 years) and was not affected by adjustments for the baseline factors presented in Table 1 or type of stroke (OR, 1.449; 95% CI, 1.332 to 1.575). Unconscious patients were less often treated in a stroke unit (59.6% versus 83.1%, \(P<0.001\)). After adjustment for level of consciousness on admission, the estimated sex difference in stroke unit care was small and nonsignificant (OR, 0.942; 95% CI, 0.880 to 1.007). In patients ≥80 years with ischemic stroke, 3.4% received thrombolytic therapy. No difference between men and women was seen (Table 2).

### Table 2. During the Hospital Stay and on Discharge: Frequencies, Proportions, and Age-Adjusted ORs With Corresponding 95% CIs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sex</th>
<th>Valid Observations</th>
<th>n</th>
<th>Proportion (%)</th>
<th>Age-Adjusted OR 95% CI of OR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>On hospital admission</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drowsy/unconscious</td>
<td>Men</td>
<td>12 241</td>
<td>1846</td>
<td>15.1</td>
<td>1.394 (1.304–1.492)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>12 149</td>
<td>2645</td>
<td>21.8</td>
<td></td>
</tr>
<tr>
<td>Intracerebral hemorrhage</td>
<td>Men</td>
<td>12 350</td>
<td>1545</td>
<td>12.5</td>
<td>0.928 (0.857–1.005)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>12 283</td>
<td>1318</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>CT performed</td>
<td>Men</td>
<td>12 307</td>
<td>12 115</td>
<td>98.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>12 233</td>
<td>11 990</td>
<td>98.0</td>
<td>1.007 (0.828–1.225)</td>
</tr>
<tr>
<td><strong>Acute care</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke unit care</td>
<td>Men</td>
<td>12 350</td>
<td>10 245</td>
<td>83.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>12 283</td>
<td>9851</td>
<td>80.2</td>
<td>0.904 (0.846–0.966)</td>
</tr>
<tr>
<td>Thrombolytic therapy*</td>
<td>Men</td>
<td>6881</td>
<td>237</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>5059</td>
<td>166</td>
<td>3.3</td>
<td>0.989 (0.807–1.212)</td>
</tr>
<tr>
<td><strong>Complications during hospital stay</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep vein thromboses/pulmonary embolus</td>
<td>Men</td>
<td>12 179</td>
<td>89</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>12 088</td>
<td>141</td>
<td>1.2</td>
<td>1.558 (1.187–2.046)</td>
</tr>
<tr>
<td>Fracture</td>
<td>Men</td>
<td>12 179</td>
<td>60</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>12 102</td>
<td>96</td>
<td>0.8</td>
<td>1.394 (1.001–1.940)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>Men</td>
<td>12 141</td>
<td>545</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>12 071</td>
<td>443</td>
<td>3.7</td>
<td>0.712 (0.624–0.812)</td>
</tr>
<tr>
<td><strong>Secondary prevention on discharge from hospital</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment for hypertension</td>
<td>Men</td>
<td>10 918</td>
<td>8182</td>
<td>74.9</td>
<td>1.028 (0.964–1.096)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>10 480</td>
<td>8086</td>
<td>77.2</td>
<td></td>
</tr>
<tr>
<td>Lipid-lowering drugs</td>
<td>Men</td>
<td>10 896</td>
<td>4921</td>
<td>45.2</td>
<td>0.811 (0.769–0.860)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>10 465</td>
<td>3667</td>
<td>35.0</td>
<td></td>
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<tr>
<td>Antithrombotics†</td>
<td>Men</td>
<td>9354</td>
<td>7639</td>
<td>81.7</td>
<td>1.060 (0.982–1.144)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>9122</td>
<td>7528</td>
<td>82.5</td>
<td></td>
</tr>
<tr>
<td>Oral anticoagulants‡</td>
<td>Men</td>
<td>1277</td>
<td>646</td>
<td>50.6</td>
<td>0.994 (0.835–1.183)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>904</td>
<td>434</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>Discharge destination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To own home</td>
<td>Men</td>
<td>10 972</td>
<td>8098</td>
<td>73.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>10 523</td>
<td>6618</td>
<td>62.9</td>
<td>0.764 (0.719–0.812)</td>
</tr>
</tbody>
</table>

*Ischemic strokes, ≤80 years.
†Ischemic strokes.
‡Ischemic strokes, patients with atrial fibrillation, ≤80 years.
The mean length of stay in the hospital, including in-hospital rehabilitation, was 17.5 days (median, 11 days) for women and 17.2 days (median, 10 days) for men (P=0.199). Men were more likely than women to be discharged to home (Table 2). The difference in discharge destination was smaller in patients ≥85 years who were living at home without community support, with a spouse, before their stroke (OR, 0.894; 95% CI, 0.793 to 1.007). Compared with men, women were more likely to experience deep venous thromboses or pulmonary embolism and fractures (Table 2) during their hospital stay. The differences were significant both after age adjustments and in the subgroup of patients who were independent in activities of daily living before stroke (OR, 1.592; 95% CI, 1.182 to 2.143 for deep venous thromboses/pulmonary embolism and OR, 1.490; 95% CI, 1.048 to 2.119 for fractures). Women were less likely to experience pneumonia during the hospital care (P=0.001), and this difference was not affected by age (Table 2) or smoking (OR, 0.740; 95% CI, 0.633 to 0.865 for nonsmokers).

### Secondary Prevention

At discharge from the hospital, women were less likely to receive lipid-lowering drugs (P<0.001). After adjustments for age, there were no differences between men and women with respect to antihypertensive treatment or antithrombotic therapy (Table 2). In the group of patients ≤80 years of age with ischemic stroke and atrial fibrillation, the proportions of patients receiving oral anticoagulants were similar for men and women (P=0.235).

### Outcome 3 Months After Stroke

Three months after stroke, 20.2% of the women and 15.2% of the men had died (P<0.001). The women’s higher fatality rate, to a large extent, was explained by their higher age and impaired consciousness (Table 3). In contrast, a comparison of men and women with the same level of consciousness on admission showed that the women had a better 3-month survival than the men (OR, 0.899; 95% CI, 0.831 to 0.974).
Among patients who were independent before stroke, women were more likely to be dependent after 3 months (P<0.001), but the estimated sex difference decreased and was no longer significant after adjustment for age (OR, 1.079; 95% CI, 0.995 to 1.170).

At the 3-month follow-up, a total of 13 267 (79.4%) of the 16 714 stroke survivors with information on residency were living at home. Of the 15 734 stroke survivors who were living at home before their stroke, 13 097 (83.2%) were still living at home 3 months after their stroke. In patients living at home without community support before stroke, more women than men were living in an institution at follow-up (P<0.001). The difference was not significant in patients <85 years of age or in older patients who were living alone. In older patients, ≥85 years, who were living with a spouse before stroke, women were more likely than men to be institutionalized (P=0.034; Figure).

Three months poststroke, more women than men reported depression and bad health status (P<0.001). Those differences were independent of age and level of consciousness. There was no sex-related difference in perceived speech difficulties (Table 3).

Patients’ Satisfaction

On all measured aspects, independent of age, women were less satisfied with the care they received in the hospital than were men (Table 3). Excluding patients who reported that they often or always felt depressed at the follow-up did not affect the difference (data not shown). Patients who were independent in activities of daily living and were living at home together with a spouse before their stroke, in general, were more satisfied with the care they received in the hospital than other patients (94.5% versus 88.9%, P<0.001). The sex difference in that subgroup was also smaller but remained statistically significant for treatment by the staff (OR, 0.738; 95% CI, 0.592 to 0.919), dialogue with the physician (OR, 0.771; 95% CI, 0.687 to 0.866), dialogue with other staff (OR, 0.869; 95% CI, 0.772 to 0.979), and stroke information (OR, 0.849; 95% CI, 0.759 to 0.950).

Lost to Follow-Up

A total of 1403 (11.4%) men and 1416 (11.5%) women were lost to follow-up. Of the 21 545 men and women who were discharged from the hospital alive, patients lost to follow-up were more likely to live in an institution or alone before their stroke. They were also more likely to have had previous strokes.

Discussion

In this large nationwide study, women’s worse outcome regarding case fatality and functional ability 3 months after stroke appeared largely to be a function of their higher age and lower level of consciousness at admission to the hospital. Adjustment for those 2 factors suggests that women have a better chance than men to survive 3 months after stroke, and functional outcome is similar between men and women. Our result on functional ability supports the finding by Lai et al concerning basic activities of daily living.

Thromboembolism related to atrial fibrillation has been shown to be more common in women than in men. Cardioembolic strokes are more likely to be severe than other stroke subtypes and thus more likely to affect level of consciousness. This may explain women’s lower level of consciousness at hospital admission.

Women’s higher risk of being institutionalized 3 months after stroke in patients ≥85 years who were living with a spouse before stroke may have sociodemographic causes; women’s spouses are generally older, whereas men’s spouses are younger.

Men and women were managed alike in most aspects. They were treated similarly in the hospital with respect to stroke thrombolysis and stroke unit care. The sex-related difference in antithrombotic medication that was seen 5 years ago has now disappeared. Our observation on the use of antithrombotics is in line with other recent register studies from other populations. Although those studies reported sex differences in thrombolytic therapy, other previous studies match our results on this therapy. Women’s lower odds of receiving lipid-lowering drugs is in accordance with a study from Scotland. Several studies have shown that more men with stroke have a history of myocardial infarction, which may explain our finding of a sex difference.

Other studies have demonstrated that secondary complications are more common in women, but few studies have had the power to explore sex-related differences in specific secondary complications. Our observation, that men have a higher risk to experience pneumonia, supports the findings by Kapral et al. Gargano et al studied deep venous thromboses/pulmonary embolism and pneumonia but did not observe the same differences we did. Most poststroke fractures are caused by accidental falls. Women’s higher risk of fractures after stroke is compatible with women’s higher risk of fractures in the general Swedish population >60 years of age and their higher risk of osteoporotic fractures.

Self-reported depression has been previously studied in Riks-Stroke and women continue to be more depressed and also perceive their general health as worse than men do 3 months after stroke. Female patients were less satisfied with the care, rehabilitation, dialogue, and information they received during the hospital stay than were male patients. Our finding is in accordance with a survey of 5857 hospital-
admitted patients by Woods et al.27 A study on stroke care decision-making has suggested that women worry more about risks and want more information before they make decisions about their stroke care than do men.28 It may be that female patients with stroke need a different type of information or that the information should be presented in a different way than for men.

This study used data from a nationwide quality register that includes all Swedish hospitals that admitted patients with acute stroke. Riks-Stroke has high coverage and the effect of patient selection bias is likely to be small. Our work also has limitations that could potentially affect the interpretation of our results. There was no information on stroke severity, besides level of consciousness on admission, and the information about comorbid conditions was limited. Neither was there any information on lesion size or location from neuroimaging. Many outcome measures were also self-reported rather than assessed clinically. Patient satisfaction with hospital care was assessed 3 months after stroke and there is a risk of recall bias. Eleven percent was lost to follow-up. The proportions lost to follow-up were similar for men and women and it is hence unlikely to have had any substantial effect on differences related to sex.

We chose to present probability values and CIs without adjustments for multiple testing. This reduced the risk of a Type II error (failing to detect a true difference), but enhanced the risk of a Type I error (spurious significant difference). This study had high power, and the main results would still be valid using a significance level of 0.001, which would preserve the risk of an overall Type I error at a low level.

In conclusion, men and women are managed similarly in the hospital on most aspects. Differences related to sex in case fatality and activities of daily living dependency remain but-fatality and activities of daily living dependency remain but are associated with women’s higher age and lower level of consciousness on admission. Studies with more detailed information on, eg, stroke severity and comorbidities, are needed to further explore women’s lower level of consciousness at hospital admission and differences in secondary complications.

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Disclosures
None.

References
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