Functional Outcome After Stroke in Patients With Rheumatoid Arthritis and Systemic Lupus Erythematosus

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Objective. To compare outcomes following stroke rehabilitation among patients with rheumatoid arthritis (RA) or systemic lupus erythematosus (SLE) versus patients with neither RA nor SLE (non-RA/SLE).

Methods. We conducted a retrospective analysis using a national database of patients with stroke admitted to inpatient rehabilitation between 1994 and 2001. Primary outcomes were discharge disposition and functional status, rated by the Functional Independence Measure (FIM) Instrument, at discharge and at followup. The independent variable was RA or SLE. Covariates were age, sex, race/ethnicity, admission FIM ratings, additional comorbidities (none, 1–3, and >3), type of stroke, and length of stay.

Results. We studied 47,853 patients with stroke, 368 with RA, and 119 with SLE. Discharge dispositions were similar for patients with RA and non-RA/SLE (81% discharged home). At discharge, the average FIM rating for patients with RA was 85.8, compared with 87.8 for non-RA/SLE patients. At followup, the average FIM rating for patients with RA was 95.9, compared with 99.6 for non-RA/SLE patients. RA was associated with lower FIM ratings at discharge and followup in multivariate analyses. SLE was associated with younger age (17.5 years). However, patients with SLE had similar discharge dispositions and FIM ratings to non-RA/SLE patients.

Conclusion. RA was associated with lower functional status ratings at discharge and followup. Outpatient therapy for patients with RA may reduce long-term assistance. Patients with SLE were younger, but had similar functional outcomes to patients without RA/SLE, suggesting early morbidity from stroke among patients with SLE.

INTRODUCTION

Stroke is the leading cause of severe disability in the US (1). Among patients with stroke age ≥65 years, 50% report hemiparesis and 30% are unable to walk without assistance at 6 months after stroke. Approximately 1 in 4 stroke patients are subsequently institutionalized (1).

Medical rehabilitation following stroke significantly improves functional outcomes by limiting functional decline and restoring mobility and ambulation (2). Functional recovery after stroke can be delayed or reduced by conditions which cause joint pain and swelling in the extremities. For example, osteoarthritis (the most common arthritis) in patients with stroke is associated with lower functional recovery following inpatient rehabilitation (3). Other investigators have also identified self-reported arthritis as a comorbidity that reduces functionality (4). The effects of other diseases that cause joint pain and swelling of the extremities on functional outcomes after stroke are not known. Specifically, studies examining the impact of rheumatoid arthritis (RA) and systemic lupus erythemato-
sus (SLE) on functional outcomes after inpatient rehabilitation have not, to our knowledge, been performed. In patients with RA and SLE, swelling and pain of the upper and lower extremities often limit physical activity and may interfere with such rehabilitation activities as locomotion or transfer.

In this study, we hypothesized that stroke patients with RA or SLE would experience worse functional outcomes following inpatient rehabilitation. We examined the impact of RA and SLE on 1) discharge disposition (home versus not home) and 2) functional status at the time of discharge from inpatient rehabilitation and at followup (between 3 and 6 months) in persons receiving inpatient rehabilitation after a stroke.

**PATIENTS AND METHODS**

**Patients.** We conducted a retrospective cohort study using the Uniform Data System for Medical Rehabilitation (UDSMR), a national inpatient rehabilitation database. The UDSMR is the largest nongovernmental registry of standardized information on medical rehabilitation inpatients in the US (5,6). Detailed information about it has been published elsewhere (7) and is also available on the Web at www.udsmr.org.

From the UDSMR, we extracted data for patients admitted to inpatient rehabilitation facilities following a stroke from 1994 to 2001. Each patient had a primary diagnosis for admission and up to 7 secondary diagnoses. Using the primary and all secondary diagnoses, we identified subgroups of patients who received inpatient rehabilitation after a stroke with comorbid diseases of RA (International Classification of Diseases, Ninth Revision [ICD-9] codes 714.0–714.89) or SLE (ICD-9 code 710.0). Patients with missing data (age or Functional Independence Measure [FIM; Uniform Data System for Medical Rehabilitation, Buffalo, NY] Instrument ratings at time of admittance) were excluded from multivariate analyses.

**Variables derived from the UDSMR database.** Dependent variables. The primary outcomes for the study were discharge disposition and functional status rating at the time of discharge from inpatient rehabilitation and at followup (between 3 and 6 months postdischarge). Discharge disposition was dichotomized into the categories discharged home versus not home (not home included discharge to board and care, transitional living, intermediate care, skilled nursing facilities, acute hospital unit, chronic hospital, rehabilitation facilities, or alternative levels of care).

Functional status was rated by the FIM Instrument within 72 hours of discharge from inpatient rehabilitation and at followup between 3 and 6 months postdischarge. The FIM Instrument includes 18 items in 2 domains (see Appendix A, available at the Arthritis Care & Research Web site at http://www.interscience.wiley.com/jpages/0004-3591/1/suppmat/index.html). Ratings of individual items measure the amount of assistance a person needs to complete the activity being evaluated, ranging from 1 = complete dependence to 7 = complete independence. Total FIM ratings can range from a minimum of 18, reflecting total dependence, to a maximum of 126, reflecting total independence. The interrater reliability and stability of the FIM information collected at discharge and followup ranges from 0.79 to 0.99 based on intraclass correlation (8–10).

**Independent variable.** The presence or absence of RA or SLE was the independent variable. For analysis, the cohort was divided into 3 groups: patients with RA, patients with SLE, and patients with neither RA nor SLE (non-RA/SLE). Comparisons were performed between RA versus non-RA/SLE patients with stroke and between SLE versus non-RA/SLE patients with stroke.

**Covariates.** Covariates were age, sex, race/ethnicity (non-Hispanic white versus nonwhite), admission FIM Instrument rating (administered within 72 hours of admission to the inpatient rehabilitation unit), number of other comorbidities (none, 1–3, or >3), types of stroke (left side, right side, both sides, or other), and length of stay. Length of stay equaled the total number of days spent in inpatient rehabilitation. If a patient was transferred from inpatient rehabilitation to an acute care hospital and then returned to the initial rehabilitation service within 30 days, length of stay equaled only the days spent in rehabilitation.

**Statistical analyses.** Descriptive and summary statistics were performed for demographic characteristics and outcomes. Wilcoxon’s signed rank tests were used to compare age as well as FIM Instrument ratings at admission, at discharge, and at followup between patients with RA or SLE versus non-RA/SLE patients. Ordinary least squares regressions were performed to examine associations between RA and FIM Instrument ratings as well as SLE and FIM Instrument ratings, adjusted for appropriate covariates. Chi-square tests were used to compare discharge dispositions among patients with RA versus non-RA/SLE patients as well as patients with SLE versus non-RA/SLE patients (interaction was performed for SLE and age). Logistic regressions were performed to examine associations between RA or SLE and discharge disposition, adjusted for appropriate covariates. All analyses were performed using SAS software version 9.1.2 (SAS Inc., Cary, NC).

**RESULTS**

We studied 47,853 patients receiving inpatient rehabilitation services after a stroke between 1994 and 2001. The mean and median ages upon admission were 69.8 years and 72 years, respectively. The average FIM Instrument rating at admission was 63.2, and the average FIM Instrument rating at discharge was 87.7. The average FIM Instrument ratings were 93.5 for patients who were discharged home versus not home (not home included discharge to board and care, transitional living, intermediate care, skilled nursing facilities, acute hospital unit, chronic hospital, rehabilitation facilities, or alternative levels of care).

Patients with RA were older, more likely to be female, and more likely to be white (Table 1). On admission to inpatient rehabilitation, patients with RA had FIM Instrument ratings similar to non-RA/SLE patients. At discharge, patients with RA had average FIM Instrument ratings of
85.8, compared with 87.8 in non-RA/SLE patients. The average discharged FIM Instrument ratings were not statistically different for patients with RA versus non-RA/SLE patients (Table 2, model 1). However, after adjusting for FIM Instrument rating at admission, RA was associated with lower FIM Instrument ratings at discharge (−2.0) compared with non-RA/SLE patients (Table 2, model 2). When multivariate analyses were performed to adjust for additional covariates (age [continuous variable], sex, race/ethnicity, type of stroke, other comorbidities, and length of hospital stay), RA was still associated with lower FIM Instrument ratings (Table 2, model 3).

When we examined discharge dispositions, patients with RA were discharged home at similar rates to non-RA/SLE patients (81% in both groups). Logistic regression confirmed no association between RA and discharge disposition. At followup, patients with RA continued to have lower FIM Instrument ratings, averaging 95.9 as compared with 99.6 for non-RA/SLE patients (Figure 1).

Among patients with stroke, 119 had SLE. Baseline characteristics of patients in the study are shown in Table 1. Patients with SLE were younger. The difference in average ages between patients with SLE and non-RA/SLE was 17.5 years. Patients with SLE were also more likely to be female. Bivariate analysis showed that patients with SLE did not have lower FIM Instrument ratings at admission than non-RA/SLE patients.

Figure 1 presents the FIM ratings of 5 age groups (16–44 years, 45–54 years, 55–64 years, 65–74 years, and 75–87 years), stratified by SLE, RA, and non-RA/SLE. On admission, the average FIM Instrument ratings for SLE patients in the youngest (age 16–44 years) and oldest (age 64–87 years) groups were above the average ratings for non-RA/SLE patients. However, among the age 45–64 years group, the average FIM Instrument rating at admission for patients with SLE was below the average for non-RA/SLE patients.

Bivariate analyses revealed that SLE was not associated with a lower FIM Instrument rating at discharge. Regression analyses showed no association between SLE and discharge FIM Instrument rating, after adjustment for age group, sex, race, type of stroke, or number of comorbidities (data not shown). No significant interaction between age group and SLE was detected. Discharge dispositions were not different between patients with SLE and non-RA/SLE patients. At followup, patients with SLE did not have significantly lower FIM Instrument ratings compared with non-RA/SLE patients.

### Table 1. Baseline characteristics and outcomes of subgroups of patients with RA or SLE compared with non-RA/SLE controls*

<table>
<thead>
<tr>
<th></th>
<th>Non-RA/SLE (n = 47,365)</th>
<th>SLE (n = 119)</th>
<th>RA (n = 369)</th>
<th>Total cohort (n = 47,853)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>69.9 ± 12.7 (72.0)</td>
<td>54.2 ± 16.7 (56.0)†</td>
<td>71.7 ± 10.0 (73.0)†</td>
<td>69.8 ± 12.7 (72.0)</td>
</tr>
<tr>
<td>Female, %</td>
<td>51.9</td>
<td>86.7†</td>
<td>69.6†</td>
<td>52.1</td>
</tr>
<tr>
<td>Non-Hispanic white, %</td>
<td>77.0</td>
<td>71.7</td>
<td>83.7†</td>
<td>77.0</td>
</tr>
<tr>
<td>Admitting FIM</td>
<td>63.2 ± 20.5 (65.0)</td>
<td>65.8 ± 20.6 (65.0)</td>
<td>63.6 ± 19.7 (63)</td>
<td>63.2 ± 20.5 (65.0)</td>
</tr>
<tr>
<td>Discharge FIM</td>
<td>87.8 ± 22.9 (92.0)</td>
<td>91.0 ± 22.6 (95.0)</td>
<td>85.8 ± 22.4 (88.0)</td>
<td>87.8 ± 22.9 (92.0)</td>
</tr>
<tr>
<td>Length of stay</td>
<td>21.8 ± 13.8 (19.0)</td>
<td>24.4 ± 36.0 (20.0)</td>
<td>22.6 ± 22.8 (19.0)</td>
<td>21.8 ± 13.9 (19.0)</td>
</tr>
<tr>
<td>Going home, %</td>
<td>81.1</td>
<td>83.1</td>
<td>81.0</td>
<td>81.1</td>
</tr>
<tr>
<td>Followup FIM, mean ± SD</td>
<td>99.6 ± 24.9</td>
<td>103.8 ± 24.2</td>
<td>95.9 ± 24.8†</td>
<td>99.5 ± 24.9</td>
</tr>
</tbody>
</table>

* Values are the mean ± SD (median) unless otherwise indicated. RA = rheumatoid arthritis; SLE = systemic lupus erythematosus; FIM = Functional Independence Measure.
† Indicates significant difference between patients with RA or SLE compared with non-RA/SLE patients (P < 0.05).

### Table 2. Bivariate and multivariate analyses for FIM Instrument ratings at discharge among patients with RA versus patients without RA/SLE*

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
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<tbody>
<tr>
<td>RA†</td>
<td>−2.0 (−4.8, 0.9)</td>
<td>−2.3 (−4.0, −0.7)</td>
<td>−2.1 (−3.4, −0.8)</td>
</tr>
<tr>
<td>Age, continuous variable</td>
<td>–</td>
<td>–</td>
<td>−0.2 (−0.3, −0.1)</td>
</tr>
<tr>
<td>Men versus women</td>
<td>–</td>
<td>–</td>
<td>0.3 (0.0, 0.6)</td>
</tr>
<tr>
<td>Nonwhite versus white</td>
<td>–</td>
<td>–</td>
<td>−1.1 (−0.8, −1.5)</td>
</tr>
<tr>
<td>Admitting FIM, each unit</td>
<td>–</td>
<td>0.9 (0.8, 1.0)</td>
<td>1.0 (0.9, 1.1)</td>
</tr>
<tr>
<td>Type of stroke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left side versus both</td>
<td>–</td>
<td>–</td>
<td>2.1 (1.0, 3.2)</td>
</tr>
<tr>
<td>Right side versus both</td>
<td>–</td>
<td>–</td>
<td>3.4 (2.3, 4.5)</td>
</tr>
<tr>
<td>Other comorbidity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–3 versus 0</td>
<td>–</td>
<td>–</td>
<td>−0.1 (−1.0, 0.8)</td>
</tr>
<tr>
<td>&gt;3 versus 0</td>
<td>–</td>
<td>–</td>
<td>−0.5 (−1.4, 0.4)</td>
</tr>
<tr>
<td>Length of stay, days</td>
<td>–</td>
<td>–</td>
<td>0.3 (0.2, 0.4)</td>
</tr>
</tbody>
</table>

* Values are the regression coefficients (95% confidence intervals). FIM = Functional Independence Measure; RA = rheumatoid arthritis; SLE = systemic lupus erythematosus.
† Reference group = non-RA/SLE; patients with SLE were excluded from this analysis.
DISCUSSION

Patients with RA had lower functional status ratings at discharge and followup, suggesting lower levels of functional recovery from rehabilitation. Lower FIM Instrument ratings in patients with RA and stroke, compared with non-RA/SLE patients with stroke, are presumably associated with higher levels of required assistance, as supported by previous studies (11,12). Each incremental decrease in FIM Instrument rating correlates with 2–4 minutes of required personal assistance (11,12). Interventions such as outpatient therapy following discharge from inpatient rehabilitation may further promote functionality among patients with RA and stroke.

We found that stroke patients with SLE admitted to inpatient rehabilitation were much younger (age 17.5 years) than patients with neither RA nor SLE. Despite their younger age, they did not return home more often than older persons without RA/SLE, nor did they have better functionality at discharge or at followup between 3 and 6 months postdischarge, suggesting a similar trajectory of functional recovery after stroke for patients with SLE and older patients without SLE. Possible explanations may include overrepresentation of patients with neuropsychiatric SLE among this cohort (stroke is among the manifestations of neuropsychiatric SLE) and/or under-recognition of other neuropsychiatric manifestations of SLE. Specifically, patients with SLE in this study might have had other unrecognized neuropsychiatric manifestations besides stroke (prevalence of neuropsychiatric SLE can be as high as 70% among patients with SLE [13]) that could compound morbidity from stroke, accounting for the similar discharge home and functional independence measurement among these younger persons with SLE. Another potential issue is the possible presence of differential support systems (being married, having care-givers, children, etc.) among persons with SLE versus persons without SLE.

Another study (14) also suggests that stroke patients with SLE demonstrate a shorter-term functional recovery similar to those without SLE. In an analysis of all hospitalizations in California, Ward reported that stroke patients with SLE were ~7 years younger, but had similar rates of discharge to skilled nursing facilities as older stroke patients without SLE (14). If patients with SLE do have a similar trajectory, that would mean a 25% risk of being in an institution at 6 months after stroke (1); among our cohort with SLE, average age was 54.2 years.

In addition, patients with SLE are at higher risk of having a stroke: 1.5–9.0 times higher than controls of similar ages (15–17). Development of earlier and/or more aggressive primary preventions for cardiovascular diseases among patients with SLE are needed to reduce or delay stroke and its morbidity (17,18).

This study had some limitations. Our investigation utilized a national database representative of Medicare patients receiving rehabilitation services. The database provided a large sample of stroke patients with documented comorbidities (19). Adding to the strength of our analyses, the data and other patient characteristics allowed adjustment for confounding variables.

Our studies and others have used ICD-9 codes to ascertain diagnoses of RA and SLE. However, these codes do not provide information on disease severity, including previous joint deformities (14,20). Also, errors in coding and reporting errors are possible (6,8,10). These errors should be nondifferentially distributed, and can lead to underestimation of the differences between groups (21). We did not have access to information regarding the acute care period of hospitalization, and this limited our ability to account for the type of treatment or services patients received immediately following stroke. The UDSMR database includes limited information on cognitive function and no information on psychological status. We also had very limited information on social support networks and resources available to patients at discharge or followup.

Less than 1% of the sample had missing data on key variables such as age and FIM Instrument ratings. There were no statistically significant differences between subjects with and without missing data for demographic variables (age, sex, and race). Because of the low number of patients with other rheumatic diseases (such as sero-
negative inflammatory arthropathy and vasculitis) in the database, these patients were excluded from the multivariate analyses of this study.

Stroke is associated with severe disability. Our findings suggest that persons with RA are at higher risk for long-term disability after stroke. Outpatient therapy after discharge from inpatient rehabilitation may facilitate more functional recovery and reduce long-term functional disability. This is an important topic for future research. Persons with SLE may be at risk for premature institutionalization after stroke, and earlier or more aggressive preventive strategies may be warranted to delay and prevent stroke morbidity in this population.

AUTHOR CONTRIBUTIONS

Dr. Nguyen-Oghalai had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study design. Nguyen-Oghalai, Wu, Granger, Ottenbacher.

Acquisition of data. Granger.


REFERENCES


