Thrombolysis in Right versus Left Hemispheric Stroke

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Background: Recent evidence has suggested that patients with right hemispheric stroke (RHS) present later to an emergency department, have a lower chance to receive intravenous (IV) recombinant tissue plasminogen activator (t-PA), and have poorer clinical outcomes than do patients with left hemispheric stroke (LHS). *Methods:* We analyzed the rate of IV t-PA administration with respect to the side of the affected hemisphere in a large community population, to determine whether a difference exists. The study population was a large prospective cohort of patients with acute stroke treated with IV t-PA at our hospital's stroke center (October 2000 to October 2006). *Results:* Of 2932 patients presenting with ischemic stroke, 953 met criteria for study inclusion. In all, 151 patients received IV t-PA. Between groups, there was no significant difference in presentation within 3 hours after acute stroke ($P = .180$). There was no difference in the use of IV t-PA between patients with RHS and LHS ($P = .237$). *Conclusions:* There was no difference with respect to affected hemisphere in time to presentation to the emergency department. Furthermore, there was no difference in the rate of IV t-PA administration for patients with RHS versus LHS. This finding is in contrast to previous research on IV t-PA use in hemispheric stroke and may reflect improved recognition of right hemispheric syndromes. **Key Words:** Stroke—hemisphere—functional laterality—tissue plasminogen activator.

Intravenous (IV) recombinant tissue plasminogen activator (t-PA) is a potentially life-saving medication used in the treatment of acute ischemic stroke.[1,2] General indications for IV t-PA include presentation to an emergency department within 3 hours of onset of an acute stroke and a National Institutes of Health Stroke Scale (NIHSS) score of 4 to 19. Because of differences in NIHSS scoring, patients with right hemispheric stroke (RHS) may be at risk for not receiving IV t-PA compared to patients with left hemispheric stroke (LHS).[3-7] Other clinical factors between RHS and LHS may also affect the decision to use IV t-PA. Recent literature has demonstrated that a difference exists in rates of thrombolysis in LHS versus RHS,[8-10] with patients with RHS being 45% less likely to receive t-PA than patients with LHS symptoms.[8] However, with the increasing prevalence of specialized stroke centers, this previously detected difference may no longer exist.[11] This study examines the rate of IV t-PA administration in patients with RHS versus LHS presenting to a stroke center in New England, as well as outcome data for those who receive IV t-PA.

Methods

This study is a secondary statistical analysis of existing data in the Stroke Center at Hartford Hospital Database, Hartford, CT, and was approved by the hospital's institutional review board. Data of patients presenting to the hospital emergency department with an acute ischemic

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stroke between October 1, 2000 and October 1, 2006 were collected prospectively (n = 2932). On arrival, demographics, stroke risk factors, blood pressure, biochemistry, hematology, noncontrast head computed tomography (CT), and NIHSS score were collected. The stroke onset to emergency department arrival time (onset-to-arrival time) was recorded. Patients were excluded if they received t-PA at an outside hospital before being transferred to Hartford Hospital, or if they had a stroke while currently admitted to Hartford Hospital for another reason. Administration of IV t-PA followed the National Institute of Neurological Disorders and Stroke protocol.[1] Noncontrast head CT scan was obtained in all patients before IV t-PA, and head magnetic resonance imaging scan and/or CT scan was obtained when appropriate after IV t-PA administration. Intracerebral hemorrhage (ICH), when it occurred, was diagnosed by radiographic findings.

Stroke classification was based on review of the medical records and vascular territory was determined from clinical and imaging information. Analysis was further restricted to those patients with CT or magnetic resonance imaging data localizing the stroke to a cerebral hemisphere. Patients were excluded if they were found to have bilateral, brainstem, or cerebellar infarction; no onset-to-arrival time documented; or incomplete data. Patients were also excluded if they had died before arrival at Hartford Hospital.

With the side of the acute stroke syndrome as the independent variable, differences in the following parameters were evaluated: age, sex, history of vascular risk factors, current medication use, stroke of an MCA (middle cerebral artery) onset-to-arrival time, NIHSS score on admission, discharge location, and discharge mortality. Analysis was carried out using software (SPSS, Version 16.0, SPSS Inc, Chicago, IL). Statistical tests included Ci-square tests to compare categorical variables and independent sample *t* tests to compare categorical and continuous variables.

Logistic regression analysis was performed predicting t-PA receipt with sex, handedness, age, glucose, and NIHSS score at admission as covariates.

Results were considered significant at P less than .05, and all reported P values are 2-sided.

Results

A total of 953 patients met initial criteria for inclusion in the study. Of them, 444 (46.6%) had a RHS and 509 (53.4%) had a LHS (Table 1). Patients with LHS had a higher NIHSS score at arrival (7.87 for LHS v 7.00 for RHS, $P = .049$). Furthermore, patients with LHS were less likely to present with an NIHSS score of 4 to 19, a recommended criteria for IV t-PA administration, but were more likely to have an NIHSS score of 20 or greater, indicating a severe stroke, which is often thought to be a contraindication to IV t-PA use ($P < .001$) (Table 2). There was no significant difference in the median onset-to-arrival time between groups (119 minutes for LHS v 102 minutes for RHS, $P = .312$). There were no other significant differences between the two groups, including sex, mean age or age older than 60 years, history of vascular risk factors, and previous medication use.

In the study population, 575 (60.3%) patients presented to the emergency department within 3 hours of stroke onset and were eligible for IV t-PA (Table 3). Between groups, there was no significant difference in presentation

Table 1. *Demographic and clinical characteristics of study population*

	RHS	LHS	*P*
Male, n (%)	199 (44.8)	250 (49.1)	.185
Mean age, y (±SD)	72.5 (14.3)	74.0 (13.6)	.111
Age ≥ 60 y, n (%)	358 (80.6)	431 (84.7)	.099
Right handedness, n (%)	341 (94.7)	375 (92.1)	.152
Mean NIHSS score at arrival (±SD)	7.00 (6.1)	7.87 (7.3)	.049*
Mean glucose at arrival, mg/dL (±SD)	137 (63.7)	138 (55.1)	.956
Median onset-to-arrival time, min	102.0	119.0	.312
History of vascular risk factors, n (%)			
Hypertension	295 (66.4)	352 (69.2)	.371
Diabetes	105 (23.6)	131 (25.7)	.456
Hypercholesterolemia	109 (24.5)	137 (26.9)	.405
Atrial fibrillation	109 (24.5)	121 (23.8)	.780
Stroke	106 (23.9)	103 (20.2)	.176
Previous medications, n (%)			
Aspirin	154 (34.7)	183 (36.0)	.683
Warfarin	62 (14.0)	64 (12.6)	.527
MCA stroke, n (%)	321 (72.3)	364 (71.5)	.788

Abbreviation: LHS, left hemispheric stroke; n, number of patients; MCA, middle cerebral artery; NIHSS, National Institutes of Health Stroke Scale; RHS, right hemispheric stroke.

Percentage is of a total of 444 patients with RHS and 509 with LHS.

*Significant value.

Table 2. *Study population National Institutes of Health Stroke Scale score*

NIHSS score	RHS, n (%)	LHS, n (%)	*P*
0-3	187 (42.1)	220 (43.2)	.001
4-19	239 (53.8)	228 (44.8)	.001
20-32	18 (4.1)	61 (12.0)	.001

Abbreviation: LHS, left hemispheric stroke; n, number of patients; NIHSS, National Institutes of Health Stroke Scale; RHS, right hemispheric stroke.

Percent is of a total of 444 patients with RHS and 509 with LHS.