


Impact of Patient Language on Emergency Medical Service Use and Prenotification for Acute Ischemic Stroke

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Abstract

Background and Purpose: Use of emergency medical services (EMS) is associated with decreased door-to-needle time in acute ischemic stroke (AIS). Whether patient language affects EMS utilization and prenotification in AIS has been understudied. We sought to characterize EMS use and prenotification by patient language among intravenous tissue plasminogen activator (IV-tPA) tissue plasminogen (IV-tPA) treated patients at a single center with a large Spanish-speaking patient population. **Methods:** We performed a retrospective analysis of all patients who received IV-tPA in our emergency department between July 2011 and June 2016. Baseline characteristics, EMS use, and prenotification were compared between English- and Spanish-speaking patients. Logistic regression was used to measure the association between patient language and EMS use. **Results:** Of 391 patients who received IV-tPA, 208 (53%) primarily spoke English and 174 (45%) primarily spoke Spanish. Demographic and clinical factors including National Institutes of Health Stroke Scale (NIHSS) did not differ between language groups. Emergency medical services use was higher among Spanish-speaking patients (82% vs 70%; $P < .01$). Prenotification did not differ by language (61% vs 63%; $P = .8$). In a multivariable model adjusted for age, sex, and NIHSS, Spanish speakers remained more likely to use EMS (odds ratio: 1.8, 95% confidence interval: 1.1-3.0). **Conclusion:** Emergency medical services usage was higher in Spanish speakers compared to English speakers among AIS patients treated with IV-tPA; however, prenotification rates did not differ. Future studies should evaluate differences in EMS utilization according to primary language and ethnicity.

Keywords

stroke, disparities, emergency medical services, prehospital care, thrombolysis

Introduction

Use of emergency medical services (EMS) and prenotification is associated with decreased door-to-needle (DTN) time in acute ischemic stroke (AIS).^{1,2} Although racial and ethnic disparities in EMS use for AIS are well known,^{1,3} the role of patient language has been understudied.⁴ As the limited English proficiency (LEP) population in the United States rises,⁵ it is particularly important to understand whether EMS use and hospital prenotification differ by patient language in order to develop targeted interventions to improve prehospital AIS care. Our objective was to characterize EMS use by patient language among intravenous tissue plasminogen activator (IV-tPA) treated patients at a single urban center with a large Spanish-speaking patient population. We hypothesized EMS use and prenotification would be lower in Spanish-speaking patients compared to English-speaking patients, based on prior research regarding health utilization

in Spanish-speaking patients⁶ and prehospital delays in the presence of language barriers.⁷

Methods

We reviewed our prospective stroke registry for all patients who received IV-tPA in the emergency department (ED) at Columbia University Medical Center from July 1, 2011,

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through June 30, 2016. Primary language was determined by patient self-report and indicated at the time of ED triage and was abstracted by manual chart review.

Use of EMS was the primary outcome in this study, and primary language spoken was the primary exposure variable. We compared baseline characteristics, including age, sex, and stroke severity as measured by the National Institutes of Health Stroke Scale (NIHSS), between English and Spanish speakers. Secondary outcomes included time intervals associated with ED stroke delivery of care and prenotification. Means (standard deviations) or medians (interquartile ranges) were reported for continuous variables. Categorical variables were compared with χ^2 , continuous with Student *t*, and medians with Mann-Whitney *U* tests. A multivariable model assessing the association between patient language and EMS use adjusting for demographics (age, sex) and stroke severity (NIHSS) was also conducted. SPSS version 23.0 (Armonk, New York) was used for statistical analyses. $P < .05$ was considered significant. This was a planned analysis only testing a single hypothesis. *P* values are provided for completeness, but no conclusions were drawn from them; so testing for multiple comparisons was not conducted. The Columbia University Medical Center Institutional Review Board approved this study (IRB# AAAN0310) and a waiver of informed consent was granted.

Results

Over the study period, 391 consecutive patients received IV-tPA. Of these, 208 (53%) primarily spoke English and 174 (45%) primarily spoke Spanish. Nine patients spoke other languages, and 2 patients had missing mode of arrival. These 11 patients were excluded, leaving for 380 patients for analysis. There were no differences in age, sex, initial NIHSS, and proportion of minor strokes (NIHSS ≤ 5) between Spanish- and English-speaking patients. Similarly, median onset-to-door (65 vs 70 minutes; $P = .9$) and DTN (54 vs 57 minutes; $P = .2$) did not differ by language (Table 1).

A total of 285 (75%) arrived by EMS and 95 (25%) arrived via private transportation or walked in. Compared to English-speaking patients, Spanish-speaking patients were more likely to use EMS (82% vs 70%; $P < .01$). Of the patients who arrived by EMS, the proportion that received prenotification did not differ by language (61% vs 63%; $P = .8$). Similarly, among patients with minor stroke (NIHSS ≤ 5), EMS use was higher in Spanish-speaking patients (68% vs 51%; $P = .03$) but prenotification did not differ (44% vs 46%; $P = .9$; Table 2). In a multivariable model adjusting for age, sex, and NIHSS, Spanish speakers remained more likely to use EMS than English speakers (odds ratio: 1.8, 95% confidence interval: 1.1-3.0).

Discussion

In a large cohort of IV-tPA-treated patients having stroke with an overall rate of EMS use similar to other IV-tPA treated

Table 1. Baseline Characteristics of Patients Treated With IV-tPA .

Characteristic	English Speaking, N = 207	Spanish Speaking, N = 173	<i>P</i> Value
Age, mean (SD)	66.0 (18.4)	69.3 (15.5)	.07
Male (%)	87 (42.0)	57 (32.9)	.07
NIHSS, median (IQR)	7 (3-13)	6 (4-17)	.14
Minor stroke (NIHSS ≤ 5)	87 (42.0)	71 (41.0)	.85
Mode of arrival			
EMS-911 (%)	144 (69.6)	141 (81.5)	<.01
Ambulatory (%)	63 (30.4)	32 (18.5)	
Prenotification (%) ^a	91 (63.2)	86 (61.0)	.79
Median times intervals, min			
Onset-to-door (IQR)	70 (41-100)	65 (46-102)	.85
Door-to-CT (IQR)	21 (15-34)	23 (15-34)	.72
Door-to-needle (IQR)	57 (45-79)	54 (43-76)	.24

Abbreviations: EMS, emergency medical services; IQR, interquartile range; NIHSS, National Institutes of Health Stroke Scale; SD, standard deviation.
^aOf those who arrived via EMS.

Table 2. Predictors of EMS Utilization Among Patients Treated With intravenous tissue plasminogen activator (IV-tPA).

Adjusted ^a association between patient language and EMS use			
	OR	95% CI	<i>P</i> Value
Sex (male ref)	1.1	0.62-1.78	.85
NIHSS	1.2	1.12-1.27	<.01
Age	1.0	1.00-1.04	.02
Language (English ref)	1.8	1.05-3.01	.03
EMS use among minor stroke (NIHSS ≤ 5) patients			
	English, N = 87	Spanish, N = 71	<i>P</i> Value
EMS-911 (%)	44 (50.6)	48 (67.6)	.03
Prenotification (%) ^b	20 (45.5)	21 (43.8)	.87

Abbreviations: CI, confidence interval; EMS, emergency medical services; NIHSS, National Institutes of Health Stroke Scale; OR, odds ratio.

^aFor age, sex, and NIHSS.

^bOf those who arrived via EMS.

cohorts,⁸ we found that Spanish-speaking patients were more likely to arrive via EMS than English-speaking patients. Among those patients who arrived by EMS, there was no difference in the rate of stroke prenotification between English- and Spanish-speaking patients. These relationships held in a subgroup analysis of minor stroke patients. Our results suggest that in a catchment area with a large Spanish-speaking population,⁹ Spanish-speaking patients with acute stroke used EMS more frequently than English speakers.

Despite nationwide growth in the LEP population,⁵ data on language barriers and acute stroke treatment are limited. The Brain Attack Surveillance in Corpus Christi (BASIS) study

found that primary language was not associated with EMS use among Mexican Americans in Corpus Christi, a population with many second- and third-generation Mexicans.⁴ A single-center analysis of language preference and thrombolysis showed no difference in EMS use between English and non-English preference groups.¹⁰ Our results confirm these prior studies by showing no disparity in EMS use in the presence of language barriers among patients treated with IV-tPA and build on prior work by including EMS prenotification, a key prehospital factor in facilitating timely thrombolytic treatment for AIS. That our results held among patients with minor stroke demonstrates the robustness of our findings, as this group has known lower rates of EMS use.^{1,11} The lack of disparity in EMS use we found is also in keeping with prior work that demonstrated no difference in intent to call 9-1-1, despite decreased stroke symptom recognition among non-English-speaking Hispanics.¹² Finally, our finding of similar DTN times between groups despite higher use of EMS by Spanish speakers may suggest that hospital factors lead to relative DTN delays in this group and requires future systematic study.¹³ Alternatively, the lack of difference in prenotification despite higher rates of EMS use in Spanish speakers might explain the similar in-hospital treatment times, as we have previously shown that prenotification more so than EMS use affects DTN.¹⁴

There are several limitations to our study. Most critically, we did not track whether Spanish-speaking patients arrived alone; thus, we cannot exclude that English-speaking friends or family accompanied the majority of Spanish speakers. Similarly, we do not know how many of the Spanish-speaking patients had some degree of English fluency. However, our hospital's catchment area in Northern Manhattan is considered a "Dominican ethnic enclave,"¹⁵ with many primary Spanish speakers who have LEP. We do not know the language fluency of the EMS prehospital treatment team, which would be important to more robustly understand our prenotification findings. However, approximately 10% of our hospital's Emergency Medical Technicians are fluent in Spanish. It is possible that differences in vehicular ownership between English and Spanish speakers may partially explain our findings, but these data were not available. We also did not capture patient education level or race/ethnicity, which are both associated with EMS use,^{3,16} because unlike primary language these data are not reliably recorded in our medical record. By only including tPA-treated patients with stroke, there is inherent selection bias in our study. However, at our center, we have previously shown that tPA treatment among eligible patients did not differ between English and Spanish speakers.¹⁷ Additionally, the generalizability of our findings to other geographic areas may be limited.

Conclusion

In a catchment area with a large Spanish-speaking population, neither EMS use nor prenotification of stroke was less

frequent among Spanish speakers compared to English speakers with AIS who received thrombolysis. Our findings provide reassurance that current prehospital processes work similarly in English- and Spanish-speaking patients with acute stroke who receive thrombolysis; whether a similar lack of language disparities are present in non-tPA-treated patients with stroke requires additional study. Further work is also needed to reconcile these findings with known race/ethnic disparities in EMS use for AIS to improve prehospital care.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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