The Influence of Language Discordance Between Patient and Physician on Time-to-Thrombolysis in Acute Ischemic Stroke

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Abstract

Background and purpose: Reducing door-to-imaging (DIT) time is a major focus of acute stroke quality improvement initiatives to promote rapid thrombolysis. However, recent data suggest that the imaging-to-needle (ITN) time is a greater source of treatment delay. We hypothesized that language discordance between physician and patient would contribute to prolonged ITN time, as rapidly taking a history and confirming last known well require facile communication between physician and patient. **Methods:** This is a retrospective analysis of all patients who received tissue plasminogen activator (tPA) in our emergency department between July 2011 and December 2014. Baseline characteristics and relevant time intervals were compared between encounters where the treating neurologist and patient spoke the same language (concordant cases) and where they did not (discordant cases). **Results:** A total of 279 patients received tPA during the study period. English was the primary language for 51%, Spanish for 46%, and other languages for 3%; 59% of cases were classified as language concordant and 41% as discordant. We found no differences in median DIT (24 vs 25, $P = .5$), ITN time (33 vs 30, $P = .3$), or door-to-needle time (DTN; 58 vs 55, $P = .1$) between concordant and discordant groups. Similarly, among patients with the fastest and slowest ITN times, there were no differences. **Conclusion:** In a high-volume stroke center with a large proportion of Spanish speakers, language discordance was not associated with changes in DIT, ITN time, or DTN time.

Keywords

stroke, quality, safety, thrombolysis

Introduction

Treatment of acute stroke is highly time sensitive.¹ Door-to-needle (DTN) time, the interval between emergency department (ED) arrival and tissue plasminogen activator (tPA) administration, is the most commonly tracked metric for speed of thrombolysis.² Since neuroimaging is essential for thrombolysis, the DTN interval consists of 2 distinct component times, door-to-imaging (DIT) time and imaging-to-needle (ITN) time.

National quality improvement efforts have led to decreases in thrombolysis times.³ Reducing the DIT component of DTN time is a key focus of these initiatives.^{4,5} Significant improvements in the DIT interval have been realized,⁶ especially via adoption of protocols such as bringing the patient directly to the computed tomography (CT) scanner from the ambulance.⁷ However, recent data suggest that the ITN time is more important than the DIT interval in driving treatment delays.⁸ The ITN time has not been directly targeted by quality improvement measures nor is it well understood. As DIT times

decrease, components of thrombolysis decision-making increasingly shift to the ITN interval.⁸ Targeting factors that contribute to prolonged decision-making may lead to improvements in the ITN interval and yield overall reductions in DTN time.

We hypothesized that language barriers between patients and treating neurologists would lead to delayed thrombolysis decision-making and would be demonstrated by longer ITN

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times. Obtaining a focused history, establishing last known well, and assessing tPA contraindications are critical components to determining thrombolysis eligibility that require facile communication between physician and patient or surrogate. While language barriers have been evaluated in primary care and inpatient settings,⁹⁻¹¹ the role of language in acute stroke treatment has not been explored.

Methods

The electronic medical record (EMR) was reviewed for all patients who received tPA in the ED at Columbia University Medical Center from July 1, 2011, through December 31, 2014. Demographic, clinical, and relevant times were abstracted by manual chart review. Stroke mimics were defined as any diagnosis other than acute ischemic stroke, aborted stroke, or transient ischemic attack as established by the treating vascular neurologist. The Columbia University Institutional Review Board approved this study (IRB# AAAN03110) and granted a waiver of informed consent.

Patients' primary language was determined by self-report, which was documented at the time of patient intake by nursing staff. Fluency in languages other than English of treating neurologists was self-reported via standardized questionnaire administered to all neurology residents who are the primary neurologists at all acute stroke codes. Cases where the treating neurology resident is fluent in the patient's primary language were categorized as concordant and those where the treating neurologist is not fluent as discordant. In our ED, in-person Spanish interpreters are available 24 hours a day; telephone translation services are available for other languages. Our official hospital policy is to provide interpreter services to all limited-English-proficiency patients and only use family members or other unofficial interpreters when hospital-provided translation services are refused. During the years of this study, no formal quality improvement projects to improve DTN were initiated.

We compared baseline characteristics and relevant time intervals between the language concordant and discordant groups as well as between English- and Spanish-speaking patients regardless of treating physician language. Subgroup analyses between concordant and discordant groups for those patients with the fastest and slowest ITN and DTN times, as determined by quartile, were performed. Means (standard deviations) or medians (interquartile ranges) were reported for continuous variables. Fisher exact tests were used for binary variables; Mann-Whitney *U* test was used for all continuous variables aside from age, which was compared using a *t* test. We considered $P \leq .05$ to be statistically significant. Calculations were done using SPSS version 22.0 (Armonk, New York). Following our analysis, a post hoc power calculation revealed we had 80% power to detect a difference of 9.8 minutes in DTN time between groups using a 2-sample *t* test.

Table 1. Characteristics and Relevant Time Intervals of the Overall Population of Thrombolysed Patients With Stroke.^a

Age, years ^b	68.3 [16.6]
Men (%)	96 (30.4)
Initial NIHSS ^c	7 [4-16]
Primary language	
English (%)	142 (50.9)
Spanish (%)	128 (45.9)
Other (%)	9 (3.2)
Mode of arrival	
Ambulatory (%)	62 (22.2)
EMS/911 (%)	193 (69.2)
Other ^d (%)	22 (7.9)
Stroke mimic (%)	34 (12.2)
Relevant time intervals	
Onset-to-arrival, min ^c	69 [43-100]
Onset-to-needle, min ^c	137 [103-175]
Door-to-imaging, min ^{c,e}	24 [17-36]
Imaging-to-needle, min ^{c,e}	32 [20-44]
Door-to-needle, min ^c	57 [47-78]

Abbreviations: CT, computed tomography; EMS, emergency medical services.

^a(N = 279).

^bMean [standard deviation].

^cMedian [interquartile range].

^dPrivate ambulette or unknown.

^eTime of CT interpretation.

Results

A total of 279 patients received tPA during the study period. Most patients were either English speaking (51%) or Spanish speaking (46%), with other languages accounting for a small portion (3%). Overall, median DIT was 24 minutes, ITN time was 32 minutes, and DTN time was 57 minutes (Table 1).

Fifty-three neurology residents treated patients during the study period, of which 15 (28%) were fluent in Spanish. There were 166 (59%) cases classified as concordant and 113 (41%) as discordant. All concordant cases were either English-speaking or Spanish-speaking pairs except 1 who was Russian speaking. There were no differences in age, sex, and initial National Institutes of Health Stroke Scale (NIHSS) between concordant and discordant groups (Table 2). Similarly, there were no differences in age, sex, and initial NIHSS between English and Spanish speakers regardless of the treating physician fluency.

However, the proportion of stroke mimics was higher in the concordant group compared to the discordant group (16.3% vs 6.2%, $P = .02$). We found no differences in median DIT (25 vs 24, $P = .5$), ITN time (33 vs 30, $P = .3$), DTN time (58 vs 55, $P = .1$), or other relevant time intervals between concordant and discordant groups (Table 2). Similarly, there were no differences in any time intervals between English- and Spanish-speaking patients. Among patients with the fastest ITN times (≤ 20 minutes, fastest time quartile), there was no difference between concordant and discordant groups (25% vs 29%, $P = .4$). Similarly, among patients with the slowest ITN times (≥ 44 minutes, slowest time quartile), there was no

Table 2. Characteristics and Relevant Time Intervals by Language Grouping.

	Concordant (N = 166)	Discordant (N = 113)	P Value
Age, years ^a	67.2 [17.7]	70.0 [15.2]	.17
Men (%)	59 (35.5)	37 (32.7)	.70
Language			
Spanish (%)	23 (13.9)	105 (93.0)	
English (%)	142 (85.5)	0 (0.0)	
Other (%)	1 (0.6)	8 (7.0)	
Initial NIHSS ^b	7 [4-15]	6 [4-16]	.67
Stroke mimic (%)	27 (16.3)	7 (6.2)	.02
Relevant time intervals			
Onset-to-arrival, min ^b	70 [39-98]	66 [47-107]	.37
Onset-to-needle, min ^b	137 [102-173]	139 [105-179]	.90
Door-to-imaging, min ^{b,c}	25 [17-36]	24 [16-35]	.52
Imaging-to-needle, min ^{b,c}	33 [21-46]	30 [20-42]	.26
Door-to-needle, min ^b	58 [49-78]	55 [44-76]	.10
Patients with ITN ≤ 20 minutes (%)—fastest quartile of patients	41 (24.7)	33 (29.2)	.41
Patients with ITN ≥ 44 minutes (%)—slowest quartile of patients	49 (29.5)	27 (23.9)	.34
Patients with DTN ≤ 60 minutes (%)	90 (54.2)	67 (59.3)	.46

Abbreviations: CT, computed tomography; ITN, imaging-to-needle time; DTN, door-to-needle time; NIHSS, National Institutes of Health Stroke Scale.

^aMean [standard deviation].

^bMedian [interquartile range].

^cTime of CT interpretation.

difference between concordant and discordant groups (30% vs 24%, $P = .3$; Table 2).

Discussion

We did not observe an association between language discordance and DIT, ITN time, or DTN time. Comparing patients with the fastest ITN times and those with the slowest ITN times, we also found no differences between language groups. Few studies have examined the reasons for delays after neuroimaging in acute stroke treatment, yet this time interval presents a unique opportunity for improving stroke care. In our study, we hypothesized that history taking where physician and patient are language discordant could be a major barrier to rapid thrombolysis, but our results did not demonstrate this.

There are several possible explanations for our finding of a lack of difference between discordant and concordant groups: (1) discordant pairs communicate well because they are helped by professional translators, (2) discordant pairs communicate well due to overlap in languages or presence of English-proficient family members, or (3) discordant pairs are treated with less information and more rushed explanations than their concordant counterparts.

We are unable to accurately distinguish between the first and the second explanations for our negative findings. Our EMR does not capture when professional interpreters are used nor when sufficient language overlap exists within discordant pairs. However, there is widespread, round-the-clock access to professional in-person Spanish interpreters in our ED. Additionally, since our hospital policy prohibits the use of unofficial interpreters and family members unless official interpreter

services have been refused, it seems unlikely that family members facilitate the majority of discordant interactions. In-person professional translators likely facilitate the majority of language discordant, favoring the first explanation for our results.

The third explanation for our finding of a lack of difference between discordant and concordant groups seems least likely. We found no difference in the ITN interval between concordant and discordant pairs. Because this interval is when the majority of decision-making and patient discussion takes place, it is unlikely that discordant patients are treated with more rushed explanations. Furthermore, the stroke mimic (SM) rate was lower in the discordant group compared to the concordant group. Because SMs may represent rushed decision-making,¹² the lower SM rate makes it unlikely that discordant pairs are treated with more rushed explanations.

To our knowledge, this is the first dedicated study of language barriers and thrombolysis in acute stroke. In a recent Canadian study, DTN time did not significantly differ between those with and without language barriers, however, no adjustment was made for fluency of the treating physician nor were subsets of DTN time evaluated.¹¹ Our study is limited by its small size and retrospective design. Since we only included patients treated with tPA, we do not know how language discordance affects tPA-eligible patients who are not treated. Additionally, we cannot definitively determine important aspects of communication in discordant pairs. Despite these limitations, our finding of no difference in treatment times adds substantially to the extant literature on language discordance in acute stroke.

A major strength of this study is our unique location in northern Manhattan, which is considered a Dominican ethnic enclave by social scientists,¹³ with many primary Spanish

speakers. This setting, where the majority of Spanish-speaking patients have limited English proficiency,¹⁴ allows us to study language discordance in a way that other diverse urban centers, where multiple languages are spoken or acculturation rates are higher, cannot. As urban populations shift to include more non-English speakers, the effect of language barriers on acute medical care and physician decision-making may become more widespread. Additionally, methods such as direct-to-CT and administration of tPA while in the CT scanner that have been shown to expedite treatment in ethnically and linguistically homogenous regions^{4,15} may not be generalizable to more diverse urban settings. The time-sensitive nature of tPA administration and need for focused medical history taking makes the acute stroke setting an area where language barriers are particularly relevant.

Conclusion

Language discordance between physician and patient was not associated with delays in DIT, ITN time, or DTN time at our center where 24-hour in-person interpreter services are available. Focusing on the ITN interval, as well as careful observation of how language discordant pairs communicate in time sensitive settings, may allow for a better understanding of how to further expedite tPA administration. Future studies are needed where communication within discordant pairs is more robustly assessed.

Declaration of Conflicting Interests

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