A Qualitative Assessment of Practices Associated With Shorter Door-to-Needle Time for Thrombolytic Therapy in Acute Ischemic Stroke

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ABSTRACT

Early treatment with intravenous (IV) recombinant tissue plasminogen activator/alteplase (tPA) is associated with improved outcomes for patients with an acute ischemic stroke. Thus, rapid triage and treatment of stroke patients are essential, with a goal of door-to-needle time of no more than 60 minutes. We sought to identify best practices associated with faster treatment among hospitals participating in Get With the Guidelines—Stroke. Qualitative telephone interviews were conducted to elicit strategies being used by these centers to assess, treat, and monitor stroke patients treated with IV tPA. We sequentially carried out these interviews until we no longer identified novel factors. Interviews were conducted with 13 personnel at 7 top-performing U.S. hospitals. With the use of a hermeneutic—phenomenological framework, 5 distinct domains associated with rapid IV tPA delivery were identified. These included (a) communication and teamwork, (b) process, (c) organizational culture, (d) performance monitoring and feedback, and (e) overcoming barriers.
because door-to-needle times among hospitals participating in the “Get With The Guidelines” database vary widely, understanding the various factors associated with optimal outcomes is critical.

Methods

This qualitative study was conducted using semi-structured interview questions and a hermeneutic–phenomenological framework. The population for this study was key stroke personnel from “top-performing” hospitals contributing data to the GWTG-Stroke registry. Top-performing sites were defined as those in the top 1% of all GWTG-Stroke contributing hospitals (n = 1,315) for achieving a DTN time of less than 60 minutes between April 2009 through March 2010. Hospitals administering tPA to fewer than 12 patients (average of less than one patient per month) were excluded (n = 960).

Key personnel at the top-performing sites were first sent an e-mail by the coordinating center (Duke University) and asked to respond via e-mail if they were willing to participate in a telephone interview. All of the hospitals selected for sampling agreed to participate (no refusals). A mutually agreed-upon time was coordinated, and the interviews were conducted with the primary investigator. Interviews were transcribed and reviewed immediately after the interview (within 4 hours). Thematic analysis of the transcribed interviews was completed within 24 hours of each interview.

Representatives at selected hospitals were interviewed via telephone. The interview team was composed of a cerebrovascular neurosurgeon engaged in stroke care, a neuroscience nurse researcher who provides direct care to stroke patients, a nurse working full time as the hospital stroke coordinator, and a project leader with experience in qualitative study design. This approach allowed for the interview team to utilize current knowledge for constructing questions around the problem and process of IV tPA administration and also to allow for prompting when, and if, a conversation began to stagnate. The semi-structured interview questions were developed from a problem-centered approach that allowed for the expression of subjective opinions about specific facts as well as opinions about process-driven experiences (Flick, 2009).

Thematic Analysis

This study was approved by the institutional review board to be exempt from consent. To protect anonymity,
no information was recorded to identify individuals or their hospitals and the audiotapes and transcripts were destroyed after the highlighting approach step of thematic analysis. Seven distinct interviews were completed with seven different institutions. Three interviews were completed one-on-one with a stroke coordinator; three interviews were completed with a stroke coordinator/stroke manager and one other person (one with a neurologist, one with a staff radiologist, and one with the ED nurse manager); and a seventh group interview was completed with a stroke coordinator, nurse manager, pharmacist, and physician. Interviews were completed with 13 key stroke personnel at seven distinct institutions.

Thematic analysis was completed for each interview and a new set of semistructured interview questions was developed prior to each subsequent interview. The use of thematic analysis is well established in qualitative research and requires the researcher to code sections of data (in this study, statements or phrases from transcribed interviews) into themes. In this study, thematic analysis was performed for each interview using a standardized approach (Buetow, 2010; Flick, 2009). Immediately after the telephone interview, each audiotaped interview was transcribed verbatim and reviewed by the primary investigator. A highlighting approach was used to analyze the data for themes. Significant statements were identified and abstracted from the interview by the primary investigator. Commonalities were identified and then organized into thematic groups that represented important aspects of achieving a DTN time of 60 minutes or less for IV tPA. The organized statements were then shared among members of the interview team (D.O., G.B., L.Z., M.C.), who verified the commonalities within each thematic group. The members of the interview team assessed for saturation and then jointly developed the next semistructured interview questions. This iterative process continued until all four members of the interview team agreed that saturation was reached and no new statements or themes were emerging.

We identified five distinct domains associated with the process of rapid DTN times for patients who arrive at the ED for evaluation and treatment of acute ischemic stroke and are eligible for IV tPA. These domains were (a) communication and teamwork, (b) process, (c) organizational culture, (d) performance monitoring/feedback, and (e) overcoming barriers (Table 1). Although each of the domains is described in the following as a singular entity, there are facets of each domain that inherently overlap. Components of these domains were consistently identified in each of the interviews.

**Communication and Teamwork**

The first domain to emerge most clearly is communication and teamwork. This domain covers the team as a functional unit from prehospital through transition out of the ED to the stroke unit. Evidence of this domain is a system that supports teamwork and collaborations not only when staff are actively engaged but also before and after direct patient care. For the team to be maximally beneficial, there needs to be

<table>
<thead>
<tr>
<th>Domain</th>
<th>Lower End Anchor</th>
<th>Upper End Anchor</th>
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<tbody>
<tr>
<td>Communication and teamwork</td>
<td>The focus of care is on the individual; staff complain that there is little or no communication and no sense of team</td>
<td>Staff identify themselves as part of a team; communication extends beyond the immediate event</td>
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<tr>
<td>Process</td>
<td>The process of assessing for and administering IV tPA is different for each patient; there is no set pattern</td>
<td>There is a predetermined explicit and written pattern of care (e.g., policy or procedure) that is adhered to by all team members</td>
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<tr>
<td>Organizational culture</td>
<td>Staff verbalize a lack of support from management; there is a sense of “everyone is out for themselves”</td>
<td>Staff are fully supported by—and supportive of—the administration. Early IV tPA is a goal at the organizational level</td>
</tr>
<tr>
<td>Performance monitoring and feedback</td>
<td>There are no performance monitoring activities (e.g., quality improvement) in place</td>
<td>There are multiple performance monitoring activities that involve staff at all levels. There are explicit methods of providing regular constructive feedback on performance</td>
</tr>
<tr>
<td>Overcoming barriers</td>
<td>Staff are unable to provide examples of successful strategies that have been used in the past</td>
<td>There is an explicit process for identifying a barrier and for removing or resolving that barrier</td>
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Note. IV = intravenous; tPA = tissue plasminogen activator/alteplase.
specific evidence that the team is developed in advance of the situation.

EMS contacts us right away. At that point, we issue a stroke alert…which will clear the CT table, give a heads up to pharmacy, and get all the departments around…. We are ready when the patient arrives in the department.

In this example, the nurse describes an ongoing relationship between multiple entities that provide care to stroke patients. The nurse frequently uses the more global term we instead of I. The emphasis is on team member roles and not named individuals. The nurse identifies team relationships with departments (radiology and pharmacy) and agencies (the emergency medical services team) as functionally important. Communication within the team, as well as communication between the team and outside agents, is discussed in the context of team success.

**Process**

The process domain is exemplified by staff members discussing a predetermined pattern of care of patients who may ultimately receive IV tPA. Staff may often interrupt themselves when discussing key components of the process domain. The interruptions represent opportunities for staff to reveal details that are required to ensure that the process occurs unimpeded.

All of our stroke patients…go to the stroke bay, which is a mini ICU in the ER…... They are immediately seen by an ER physician [and]…nurse who draws the blood. Our blood work [is completed]...by using POC INR testing or is hand walked to the lab or sent using a tube system…after we put a sticker on the vial marked “Stroke Code”…then we call the lab to alert them that they are receiving samples for a stroke patient.

The use of jargon is commonplace and likely unit specific. “POC INR” is jargon for point-of-care (POC) testing equipment to perform laboratory analysis of International Normalized Ratio (INR). The INR is a serum sample determination of bleeding time and is a required test prior to the administration of IV tPA. The optimal evidence of the process domain includes corroboration that each individual understands her/his contribution to stroke care and also understands the roles of other team members. Thus, if a member is unable to complete his/her part in the process, other members, aware of the process steps, can help to complete a task. In the following exemplar, a physician describes how other team members help to regulate the process of care.

…the stroke coordinator assists in flow by helping transport the stroke patient back and forth and keeping up on neuro-assessments and prevents deviation from the protocol. Each room has necessary supplies for an acute stroke admission, like materials for NIHSS [administration] and paperwork/education for the patient/family.

Having members of the team who are able to quickly transport a patient to CT scan and back while other members are evaluating inclusion criteria for IV tPA and other team members are preparing the drug (tPA) for delivery is a complicated process that requires a coordinated team effort. The organization of facilities to assess and treat patients helps to improve efficiency. Respondents described the placement of order set, beds, and paperwork as enhancing the process of reducing DTN times.

**Organizational Culture**

Although there is some overlap between the organizational culture domain and the teamwork domain, here, it helps to explore the anchors for this domain. On one end are staff who specify that hospital administration is not supportive of efforts to reduce DTN time or staff who describe a culture whereby each individual who provides stroke care does so only insofar as it benefits that individual staff member. A culture where “…everyone is out for themselves…” would be the low anchor of the organizational culture domain. On the opposite end, a positive organizational culture is an environment in which staff identify management as contributing to successfully reducing DTN time and staff specifically describe a culture in which the hospital administration is seen to provide support for staff initiatives to reduce DTN time. A variety of statements from staff indicate that the culture within an organization is a driving force in reducing DTN times for IV tPA and the support from hospital administration was a vital component in determining organizational culture. Staff convey a sense of a shared mission and purpose that is supported by the organization.

We have two stroke champions who take stroke call, and they work very well with the ED physicians. We formed a team that meets every month and has someone from each department.... We also have a “stroke fair” every year; we educate to their level, be it a doctor, nurse or housekeeper…
This exemplar describes the culture of the ED. There is a sense of team and belonging. The role of administration is evidenced in the statement “...has someone from each department...” as being supportive of an inclusive culture. This support often includes having one or more stroke champions, agreed-upon shared goals, and a support system for team members and adequate staffing and coaching. Effective management is reflected in staff feeling comfortable with their tasks and in the low turnover rate that successful sites cite as a factor in effective interaction.

**Performance Monitoring/Feedback**

This domain includes formal and informal monitoring of ED stroke care. Formal monitoring includes participation in national QI initiatives such as GWTG-Stroke and TARGET: Stroke (AHA, Dallas, TX); hospital-level QI activities such as Six Sigma, Total Quality Management, or other PI packages; and informal monitoring such as staff message boards and problem resolution processes. Explicit goals and expectations allow for measurement and identification of gaps in processes. In part, this domain overlaps with the organizational culture domain: a culture in which the focus is not on finding blame but rather there is a focus on how the group can look for improvements together. These were components of successful process improvement at the sites we interviewed. Staff at these hospitals gave examples of their process for analyzing their performance, making improvements, and encouraging other team members, while describing how seriously they take performance by saying,

We wrote down the exact time frames they needed to hit. When giving them feedback, we lead them through the whole thing to find out what was missing and pumped them up for the next time; this seemed to provide a level of comfort for them.

Once we run all of our reports...we take the nursing and the core measure issues to either stroke council for review and discussion or the monthly core measure meeting with the CEO where we have to defend when we missed something.

Optimally, the ability of staff to verbalize and discuss multiple past and ongoing QI/PI activities would be evidence of the upper anchor of this domain.

**Overcoming Barriers**

The respondents voiced that although barriers exist within any system and in every hospital, it is the process of identifying and overcoming the barriers that results in reducing the DTN time. Thus, the “overcoming barriers” domain describes a problem-solving mentality that parallels the scientific approach but does not mandate the rigor associated with the approach used in the “performance monitoring/feedback” domain. Although each respondent identified different barriers that delay thrombolytic therapy, delay related to laboratory findings was common and provides a useful referent with the following exemplar:

Our lab is still our weak point for the most part, when compared to the other times that we have. We have to wait for the CBC, PT/coag, and the BNP. We’ve always had trouble just getting STAT labs and was always a hold up, waiting for the INR, and sometimes giving tPA without it just because of the delay in labs...

The interviewee then went on to describe various efforts that were tried at their institution. Important to this domain, the different solutions could be either discarded or modified before ultimately changing the process or paradigm for stroke treatment.

...now we put a sticker on the labs and it is green so that they know it’s for a stroke code so it’s faster.

To further illustrate this domain and provide distinction between overcoming barriers and performance monitoring/feedback, it is useful to explore an additional exemplar. The process of drug (tPA) delivery was frequently cited as a multifaceted barrier. The following exemplar provides evidence of the barrier as well as the iterative process of overcoming the barrier. This exemplar is abstracted from a longer response to the interview asking, “What sort of barriers has this hospital, in particular, overcome that help you ultimately reduce your door-to-needle time?”

One thing that slows us down is that when the decision to treat with tPA is made, the nurse waits for the handwritten order, then double checks the math, and then goes to get the tPA.

The pharmacy was a holdup for a while..., so we went back and forth about where to mix the tPA.

We have actually modified the orders many, many times.

**Discussion**

Efforts to reduce DTN time are well founded. Fonarow et al. (2011) provide multivariable analyses demonstrating that a reduction in DTN time...
by 15 minutes is associated with a 5% lower odds of in-hospital death. This study describes five domains associated with early use of IV tPA. Each of the five domains that emerged from staff interviews at hospitals that have achieved higher-than-average percentages of IV tPA administration within 60 minutes of patient arrival provides insight for hospitals seeking to improve their process of thrombolytic therapy for acute ischemic stroke.

The concept and benefits to a communication and a team approach for stroke care have been previously identified (Alberts et al., 1998; Alberts & Easton, 2004; Gonzaga-Camfield, 1999; Nazir, Petre, & Dewey, 2009; Peberdy et al., 2007). The members of the stroke team identified in this study are also similar in nature and scope to those identified by Alberts et al. (1998) over a decade ago. Our study reiterates that the development and maintenance of a team approach to improving communication and flow remain a vital component of care and, furthermore, is important to decrease the DTN times. Communication can also be extended to include prehospital notification, and prehospital (EMS) notification may contribute to reduced DTN times. The need to include EMS services in the communication and teamwork domain is supported by Bae et al. (2010), who found that EMS prehospital notification of a stroke patient was associated with fewer intrahospital delays. The link between prehospital notification and thrombolytic therapy is most evident in the communication and teamwork domain.

The process of delivering the IV tPA safely and effectively and avoiding in-hospital delays in the administration of IV tPA are the result of a combination of system and institutional factors. Previously identified factors include lack of staff training, delays in providing or interpreting CT scans, and lack of treatment protocols or a designated stroke center director (Evenson, Foraker, Morris, & Rosamond, 2009; Moser et al., 2007; van Wijngaarden et al., 2009). Professional education and routine use of written protocols have been shown to be instrumental in the comprehensive management of acute stroke to include rapid triage and assessment (Batumian et al., 2007; Yvonne Chan et al., 2010). Centers that perform thrombolysis on greater numbers of eligible patients tend to have written IV tPA protocols using clear inclusion and exclusion criteria, implementation of a stroke team, and explicit goals such as length of time to some aspect of triage or assessment and provision of feedback on performance (van Wijngaarden et al., 2009). Our study confirms that the process is also important in obtaining the desired DTN times. The organizational culture domain spans the continuum from disengaged staff who respond out of fear or self-preservation to a culture rich in support. Because organizational culture extends beyond the physical properties and incorporates attitudes and belief patterns, there is widespread support that organizational culture can directly and indirectly influence patient outcomes (Bosch et al., 2011; Dodek, Cahill, & Heyland, 2010; Hartmann et al., 2009; Kaisi, Kralezewski, Dowd, & Heaton, 2007; van Wijngaarden et al., 2009; Williams, Manwell, Konrad, & Linzer, 2007). A cohort study of acute stroke patients recently linked organizational culture to increased rates of thrombolysis (van Wijngaarden et al., 2009). However, extending this link to reduced DTN times will require additional study.

Prior work in PI has established many key factors for success, including (a) accurate performance measures developed by a credible source, (b) a plan of action for change, (c) staff buy-in, and (d) institutional support (Auerbach, Landefeld, & Shojania, 2007; Baker, 2006; Naylor, 1998; Peterson, 2005; Zhang et al., 2005). Top-performing hospitals also share cultural characteristics such as visible management support, flexible implementation of standardized protocols, interdisciplinary teams, and an organizational culture of problem solving (Bradley et al., 2006, 2007). The willingness to share successes and failures across organizations is also a key component in improving care.

The overcoming barriers domain has significant parallels and overlaps with the performance monitoring and feedback domain. O’Toole, Slade, Brewer, and Gase (2011) found that identifying barriers and facilitators was a vital step in the process of improving stroke care; this helps to provide support for the overcoming barriers domain by identifying these actions as distinct from PI projects. It is important to remember that the domains are not mutually exclusive and exhaustive. Domains have overlapping themes. Domains only provide a framework of categorization that allows for further evaluation and study within those domains to better understand the strengths and weaknesses of each factor within the domains.

**Limitations**

There are several potential limitations to this qualitative study. First, the study included only interviews from staff at leading hospitals that were identified through the GWTG-Stroke database as top performers in providing IV tPA within a 60-minute time window. Although this introduces a potential selection bias, the goal of the study was to gain understanding of what drives success. There is a potential that top-performing hospitals not participating in the GWTG-Stroke program may have added insight in a domain not identified by these interviews. However, external
validity is enhanced in that interviews were conducted with nurses, physicians, pharmacists, and administrators. Ultimately, additional research into these domains should include greater hospital representation.

A second possible limitation is the threat of a historical bias. All of the interviews were conducted within a 2-month time frame to reduce this risk. However, during this 2-month period, hospitals around the country were enrolling in a new AHA initiative (TARGET: Stroke) that is designed to increase the percentage of patients who receive IV tPA within the 60-minute time frame. It is not known if subjects who participated in this study had enrolled in the TARGET: Stroke program.

Conclusion

The communication and teamwork, process, organizational culture, performance monitoring and feedback, and overcoming barriers domains can be used as a foundation for continued research that explores specific systems-level interventions aimed to increase early IV tPA administration. Understanding of each domain is also useful to individual hospitals or hospital systems that wish to systematically examine or improve their emergency treatment of ischemic stroke. Data from this study will be used to develop an instrument for assessing key variables associated with DTN times in thrombolytic treatment of acute ischemic stroke.

References


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