Telestroke Tips: How to Reduce Time to Treatment
Practical Advice for Minimizing Door-to-Needle and Door-to-Puncture Times

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Introduction

Medical professionals are quite familiar with the time-sensitivity of stroke and the need for streamlined, repeatable stroke evaluation and treatment protocols. The introduction and expansion of telestroke technology has created a need for adapting these protocols. This document examines telestroke-specific best practices for reducing time to treatment for tissue plasminogen activator (tPA) and endovascular therapy (EV).

Foundational Elements

Launching a telestroke program provides the opportunity to revisit and optimize existing stroke treatment protocols. With the adoption of a telestroke program, hospitals that previously did not treat stroke patients now find themselves on the front lines in the battle against stroke. For these facilities, it’s especially important to focus on minimizing time to treatment.

Overall Approach to Training

Minimizing the time it takes to treat a patient, either by IV tPA or EV, demands consistent adherence to a clear stroke protocol. Ideally, the entire interdisciplinary care team – including personnel from neurology, emergency medicine, radiology, nursing and emergency medical services – will be trained on the stroke triage and treatment protocol, including training on any telestroke technology they may need to use for their portion of the process.

Some common training challenges can arise. It can be very difficult, perhaps impossible, to train every single person who might use the telestroke technology due to the way scheduling/shifts work in the emergency department. Some members of the ED team may not use the telestroke technology frequently, depending on the volume of stroke patients and when they present to the ED. Employee turnover can also be problematic. Thus, it’s best if supervisors or other key personnel on every shift have been extensively trained on the telestroke system and stroke care protocol so they can train new employees or make sure each step of the process is properly executed. Initial training should include designated ‘Train the Trainer’ sessions, to ensure that sufficient personnel are available as resources.

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1 For guidance on implementing telestroke with minimal workflow disruptions, please see this two-part article in Becker’s Hospital Review: Part 1, Part 2.
For training to be most effective, it needs to be an ongoing process rather than an introductory exercise. Regular meetings at each of the hospitals in the telestroke network will help reinforce the training that has occurred and identify further areas for improvement. Daily ‘checks’ of technology used to perform consults reinforces training on the system and validates readiness of the system when a potential stroke patient is admitted. Regular meetings and mock telestroke consults also help ensure accountability throughout. The stroke care team must not only be trained on the stroke evaluation and treatment protocol, but on tPA inclusion criteria and contraindications.

Dedicated Leadership With Administrative Support

While telestroke networks function best when there is a dedicated telestroke coordinator responsible for the success of the program, every member of the stroke care team must be accountable for telestroke to function properly and consistently. That accountability must include administrative support for the telestroke program to be successful. Administrative support is vital to developing the ongoing vision and strategy for the telestroke network. Administrators can help negotiate transfer agreements and allocate budget. In cases of disagreement or stalemate, administrators can cast a tie-breaking vote or make key decisions. Administrators also have the ability to judiciously exert influence to make sure prior decisions are followed.

Measure, Analyze, Improve

In order to evaluate the effectiveness of the telestroke treatment protocol and identify best practices or areas for improvement, hospitals and health systems are advised to select telestroke solutions that capture performance metrics for providers, hospitals and the network as a whole. What is not being measured cannot be improved. Genentech, the manufacturer of tPA, advises hospitals to utilize an acute stroke tracking tool to capture all times, including time all diagnostics are completed, to help ensure prompt data monitoring and feedback.

The telestroke coordinator or other person who oversees the telestroke program should regularly examine key performance metrics pertinent to timely stroke evaluation and treatment. The objective is to examine each step in the process of stroke assessment and treatment to spot patterns and identify stages that occur expeditiously and those which can be improved. It is also very important that the quality improvement process be performed via multidisciplinary committee with representatives from all areas of the hospital involved in the stroke process. Suggested intervals to be measured include:

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4 For additional guidance on tPA administration and stroke treatment guidelines, please see: Golden Hour of Acute Ischemic Stroke. [https://www.activase.com/scstroke/golden-hour-acute-ischemic-stroke](https://www.activase.com/scstroke/golden-hour-acute-ischemic-stroke)
• Door-to-ED Doctor: The time between the patient’s arrival at the hospital and when the patient is seen by an ED physician
• Door-to-Stroke Team Activation: The time between the patient’s arrival at the hospital and code stroke activation
• Stroke Team Activation to Stroke Team Arrival: The time between code stroke activation and the arrival of the stroke team at the patient’s bedside
• ED Doctor to CT Order: The time between when the patient is seen by the ED physician and when the CT scan is ordered
• CT Order to Consultant Contacted: The time between when the CT scan has been ordered and when the consulting neurologist has been contacted for the telestroke consultation
• CT Order to CT Initiation: The time between when the CT is ordered and when the CT scan begins
• CT Completion to CT Read: The time between when the CT is completed and when the CT is read
• Consultant Contacted to Telestroke Initiated: The time between when the consulting neurologist is initially contacted and when the telestroke consult is launched
• Telestroke Initiated to Consultant Joined: The time between telestroke consult initiation and when the consulting neurologist joins the consult
• Consultant Joined to CT Read: The time between when the consultant joins the telestroke consult and when he or she reads the patient’s CT scan
• CT Read to tPA/EV Recommendation: The time between when the neurologist interprets the CT scan and when he or she recommends treatment for the patient
• tPA/EV Recommendation to Treatment: The time between the treatment recommendation and the treatment itself
• Door to Needle (DTN): The time between the patient’s arrival at the hospital and tPA infusion
• Door to Puncture (D2P): The time between the patient’s arrival at the hospital and groin puncture (access of the femoral artery) to initiate EV
• Time to revascularization (for EV): The time between a patient’s arrival at the Hub hospital and revascularization\(^5\)
• Symptom onset to revascularization (for EV): The time between the onset of a patient’s stroke symptoms and revascularization.

In some cases, not every interval will be appropriate. For instance, if EMS sends a pre-hospital alert and the suspected stroke patient is taken directly to the CT scanner, the Door-to-ED Doctor metric may

\(^5\) Recall that Comprehensive Stroke measure CSTK-07 examines median time to revascularization and defines it as the median time from hospital arrival to the start of an intra-arterial thrombolytic (tPA) infusion or the first pass/deployment of a mechanical reperfusion device to extract an arterial occlusive lesion and restore blood flow to brain tissue. For more information, please see The Joint Commission and American Heart Association/American Stroke Association Comprehensive Stroke Performance Measurement Implementation Guide from August 2015, available at: [http://www.jointcommission.org/assets/1/6/CSTKManual2015August.pdf](http://www.jointcommission.org/assets/1/6/CSTKManual2015August.pdf).
become irrelevant. The overall point is to accurately track each stage in the process to identify opportunities to reduce door to treatment time.

The metrics above relate primarily to assessing the outcomes of telestroke consults to focus on effective strategies, common sources of delay and opportunities for improvement. However, there are many measures relevant to designations such as Primary Stroke Center Certification or the Get with the Guidelines Stroke Comprehensive Measures. It is prudent to consider these reporting requirements when selecting telestroke technology, as systems vary in terms of the effectiveness and thoroughness of data collection and export.

Prehospital

The effort to reduce stroke treatment times requires community education and EMS training. The race against time begins at stroke symptom onset, before stroke patients ever present to the hospital.

Community Stroke Awareness

Rapid treatment of stroke depends upon a speedy determination that a stroke is occurring (or has occurred). It goes without saying that public awareness of stroke risk factors, symptoms (e.g., FAST), and time-sensitivity to accessing 911 (e.g., Dial Don’t Drive) are critical. But public education campaigns should also focus on the availability of telestroke programs and treatment methods at local hospitals. The public should be taught those relevant details that must be collected in order to make the best treatment decisions from available options. Time of Last Known Well and any current medications for anticoagulants such as Warfarin are both good examples, as they directly impact the possibility of using tPA.

The education campaigns should be directed toward at-risk populations as well as the general public, even schoolchildren – anyone who might encounter a person having a stroke. The public should be taught to communicate stroke symptoms and other relevant information to emergency medical services.

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8 See, for instance, St. Dominic’s Stroke Center video, available at: [https://www.youtube.com/watch?v=CRtzwVNLkvo](https://www.youtube.com/watch?v=CRtzwVNLkvo).

(EMS) and emergency department personnel. One key point to communicate to the public: stroke patients who use EMS transport tend to be more rapidly evaluated and treated.\textsuperscript{10}

### Telestroke Training for EMS

EMS must be made aware of any local hospitals that, because of new telestroke programs, can treat potential stroke patients – especially since County and Regional EMS Protocols may dictate where the stroke patients are transferred.

EMS professionals should be trained to use one of the available stroke assessment tools, such as the Cincinnati Prehospital Stroke Scale or Modified Los Angeles Pre Hospital Stroke Scale (mLAPSS). Advanced Stroke Life Support (ASLS) is a practical and worthwhile training option. Developed by stroke experts, it is continuously updated to reflect the latest findings in stroke research. It offers a unique neurologic assessment tool – the MEND exam.

EMS should also collect baseline patient vitals and blood glucose to rule out changes in consciousness. EMS should make every effort possible to identify the patient’s Last Known Well time as accurately as possible. One way to accomplish this is to contact the person who called 911(if possible) and question that person regarding the time of the patient’s Last Known Well. The focus should be on a specific time (e.g., 2:36PM) rather than elapsed time (e.g., 20 minutes ago). If the call to 911 was placed on a cell phone, the time of that call will be recorded. To facilitate the collection of this information, some hospitals offer EMS a pre-printed form with the pertinent metrics for suspected stroke patients; this form can easily be attached to the triage paperwork. There are also pre-hospital EMRs with embedded stroke data fields.

When the specific time of Last Known Well is unknown, EMS may wish to jog the 9-1-1 caller’s or patient’s memory about the things that were occurring at the same time – for instance, a television show – that can help pinpoint the time.

Correct use of pre-hospital stroke alerts by EMS can save valuable time. As stated by Binning et al.:

> Trained EMS responders are able to correctly identify patients who are experiencing neurological/neurosurgical emergencies and deliver patients to our comprehensive stroke center in a timely fashion after pre-notification. The prehospital stroke alert protocol bypasses the ED, allowing the patient to be met in CT by the neurological ED

http://circoutcomes.ahajournals.org/content/early/2013/04/29/CIRCOUTCOMES.113.000089
Once the hospital is aware of a stroke patient en route, they should use a single call activation system to activate an internal “code stroke.”

Depending on EMS and hospital protocols, it may be possible to leverage EMS professionals to draw blood samples from the suspected stroke patient then deliver the vials to ED personnel.

A hospital that owns its own fleet of ambulances may have the greatest ability to train and effect timesaving strategies with its EMS professionals. Other tactics that can help reach local EMS include EMS-specific lunch-and-learns and simplified pocket guides that EMS professionals can carry on duty. Hospitals in competitive geographies with telestroke programs may also wish to offer EMS professionals food or coffee after they deliver stroke patients – this simple gesture can help reinforce the relationship.

One of the biggest ways to improve EMS engagement is to provide feedback on the outcomes of those stroke patients brought to their ED. This not only provides an opportunity to pat EMS staff on the back for a job well done, but for reiterating any information that should be collected on future EMS Stroke calls.

Recently there have been promising developments in technologies that facilitate pre-hospital stroke alerts and the transmission of useful data such as patient vitals and Last Known Well. Some telestroke platforms allow EMS to carry mobile devices within ambulances to directly interface with the telestroke software at the receiving hospital. There are also third-party mobile applications that can capture and transmit at least some of the pertinent patient information to the receiving hospital.

Additional stroke training resources for EMS professionals are available from groups such as EMS4Stroke.¹²

CT/Triage

After EMS arrives with a suspected stroke patient, the receiving hospital must quickly collect all the information that will be needed by the remote neurologist.


Stroke Team Notification

The ideal form of notification is a single call activation system,\(^{13}\) which alerts the entire stroke team. Several key members of the stroke team should be notified:

- the CT technician (to make sure the scanner is ready to go and the stroke patient has priority)
- the critical care nurse(s)
- the stroke coordinator
- the lab/EKG technician (to draw any necessary labs)
- the pharmacy technician or whoever is responsible for mixing tPA
- the critical care transport team (e.g., helicopter pilot).

Traditionally, the neurologist would be part of the single call activation system. However, this is not always advisable in the context of telestroke, as a remote neurologist may be providing coverage for multiple hospitals or compensated based upon the number of consults he or she performs. Or the telemedicine network might use a particular approach, such as OhioHealth’s eICU,\(^{14}\) where the neurologist is not contacted until after tele-triage has occurred. Suffice it to say, that the neurologist should be contacted as quickly as possible; at the latest when a suspected stroke patient is sent to receive a CT scan. The speed of the neurologist’s response is at least partially dictated by the telestroke technology in use.

Managing Distance

Many factors can impact the length of time required for stroke treatment and evaluation, and a major one is distance. The physical distance between the ED and the CT scanner also impacts the door-to-treatment time – transporting the patient between the two rooms or areas can consume valuable minutes. For instance, Riverside Methodist Hospital in the OhioHealth telestroke network dramatically shortened this distance from a quarter-mile to a short elevator ride in its new Neuroscience Center.\(^{15}\)

In the best case scenario, EMS has identified a likely stroke patient and notified the receiving hospital so the patient may be transported directly to the radiology department for a CT scan. To save time, a telestroke endpoint (cart, tablet, etc.) can be moved or kept close to the CT table, perhaps in an

\(^{13}\) Target: Stroke Phase II 11 Key Best Practice Strategies. American Heart Association/American Stroke Association. October 2014. Available at: [http://www.strokeassociation.org/STROKEORG/Professionals/TargetStroke/Clinical-Resources-and-Tools_UCM_432411_Article.jsp - VmDR0M6SaIQ](http://www.strokeassociation.org/STROKEORG/Professionals/TargetStroke/Clinical-Resources-and-Tools_UCM_432411_Article.jsp - VmDR0M6SaIQ).


antechamber. An ER or critical care nurse can likewise report to the CT table to draw the labs. If the patient has already been identified as a candidate for tPA, the bolus dose can be mixed and brought with the infusion equipment to the CT table while the neurologist is completing the remote evaluation. This strategy can be especially useful for patients who are nearing the applicable 3 or 4.5 hour “time from Last known Well” treatment window for administering tPA. But successful execution of this strategy will depend on meticulous training, planning and practice.

Patients who are eligible for EV will often receive advanced imaging, such as CTA scans. Facilities (usually spoke hospitals) that cannot perform EV are advised against performing advanced imaging. Rather, only the facilities that actually offer EV should perform these advanced imaging techniques. Since the comprehensive stroke center (usually the hub) will want to conduct its own advanced imaging, an earlier CTA scan is redundant and consumes valuable time. Also, in facilities who do these infrequently, time to treatment could actually be prolonged.

In situations where patients go directly to the radiology department, an ED physician will often meet the EMS at the ambulance to assess patient stability and accompany the patient as appropriate.

Teleconsult

The telestroke technology in use, including the endpoint and applicable software, can play a significant role in saving time during the remote stroke consult. The presence of a video feed will generally speed the consult, as the neurologist will be able to make his or her own observations. The telestroke technology may facilitate a guided neurology consult by including clinical tools such as the NIH Stroke Scale. Of high value is an automatic tPA weight-dose calculator.

Ideally, both the ED clinician and the remote neurologist can enter/record their observations, patient data, criteria that factor into the treatment decision, and any other data relevant to the consult. This contemporaneous documentation is especially important as a precaution against potential future medical malpractice liability.

While the teleconsult is occurring, it’s important that the bedside clinician and the remote neurologist talk to the patient and his/her family rather than ‘around’ them – as if they aren’t there or their

16 Genentech, which manufactures Activase® (the brand name for tPA) will replace at no charge vials of tPA that are mixed but not used. For additional information, please review the Product Return and Replacement information, available at: https://www.activase.com/reimbursement/product-return-and-replacement.

opinions/reactions don’t matter. Building this rapport will facilitate informed consent for treatment when necessary.

Treatment

Whenever tPA may be administered, there should always be a documented discussion about the risks and benefits of treating with tPA. It is wise to pre-emptively consider how to address any potential objections to treatment that may arise from discussing potential risks of tPA. Some hospitals prepare materials for just this purpose, which include visual representations of the odds of different outcomes following tPA. UCLA provides some sample patient education materials, included with the Get With the Guidelines® Stroke Clinical Tools.¹⁸

When tPA is the treatment option selected and can be administered within three hours of ischemic stroke onset, a signed informed consent document is not a pre-requisite to tPA administration.¹⁹ That’s because intravenous tPA is the only FDA approved treatment for acute ischemic stroke and is recognized as the standard of care. Note that local practices or hospital policy may still require informed consent prior to administration of the medication. In situations where a signed informed consent document is not required, hospitals may opt to begin tPA administration without informed consent to save time.²⁰ Similarly, if the patient lacks capacity and no proxy decision maker can be found, tPA administration may proceed based on the principle of implied consent for emergency treatment.

If tPA or EV is the treatment modality chosen, time is of the essence. Depending on staffing, the location of the hospital’s pharmacy, and other factors, the fastest option is to keep tPA in the ED or near CT scanner so that it can be quickly mixed at the patient’s bedside. Keep in mind that tPA also requires an infusion pump and often critical paperwork – all of these components should be kept in the same place.

While the decision to treat with tPA or EV previously was an either/or decision, recent clinical trials have indicated these treatment options may be considered in parallel. As Dr. Nirav Vora, a neurointerventionist at Riverside Medical Center, recently put it:


²⁰ While this approach results in faster treatment, it may raise other considerations – such as those related to potential legal liability – that are beyond the scope of this document. For additional information and considerations related to tPA liability, please see Acute Ischemic Stroke and tPA – Understanding and Mitigating the Legal Liabilities. Broadcast Nov. 5, 2015. http://reachhealth.com/resources/telemedicine-webinars/.
We advocate moving in parallel, not waiting to see if the IV tPA treatment is going to work. We initiate the treatment with IV tPA and then proceed immediately to angiography.\textsuperscript{21}

There are relatively straightforward inclusion and exclusion criteria for tPA, documented on the medication’s label. Some telestroke systems include these criteria as part of the software interface. When the telestroke technology does not include this information, it’s advisable to keep the tPA guidelines at the point of patient care.

Compared to the relatively clear contraindications of tPA, the criteria for EV are more flexible. Wherever possible, specify the criteria that will be used to qualify patients for EV (e.g., NIHSS score of 8-10 or higher, last-known well within 6 hours, etc.). Another important consideration is whether the patient is likely to have significant improvement in quality of life. This will be a patient-by-patient evaluation, but it’s important that ED personnel, remote neurologists, and neurointerventionists all be on the same page with regard to the rationale for treating – or not treating – a patient with EV. The ED team needs to be clear on the policies and procedures in order to keep the patient and family informed of the process. The neurologist needs to know this for the same reason, but also so he/she is familiar with the neurointerventionist’s approach to EV.

If the patient is a candidate for EV and thus will need advanced imaging such as a CTA scan, it is important to try to determine whether the patient has a dye allergy as early as possible. The ED staff should ask the patient and any family members if possible, and also check the patient’s medical history.

It’s best to avoid anesthesia for EV. Not only does it potentially interfere with the ability to assess the patient’s neurological functions – it consumes valuable time.\textsuperscript{22}

When Patients Are Transferred

While telestroke often reduces transfer rates,\textsuperscript{23} some patients will still require transfer – for instance, to a comprehensive stroke center to receive EV. In this case, several parties must be promptly notified, including the ambulance or helicopter that will handle the transfer and the receiving hospital. If tPA is to be infused during transport, a critical care transport or air ambulance is the preferred transport method. If not already involved, the transport team should be notified as early in the process as possible.


\textsuperscript{23} Penn State Hershey Medical Center’s Journey to State-of-the-Art Telemedicine. http://reachhealth.com/customer-success/case-studies/
Uniformity for In-House Stroke Response

When an inpatient stroke occurs, the hospital’s response should mirror the process used when a stroke patient presents to the ED. Hospitals should develop a comprehensive in-house stroke process and practice that uses mock codes. Floor nurses and all levels of in-patient staff should be trained to recognize stroke symptoms and activate a code stroke. It is important to collect all relevant quality improvement data for in-house code stroke events and perform a rigorous evaluation with feedback to staff. Telestroke consults for in-patient strokes are best facilitated when the telestroke endpoint (e.g., cart) is mobile and/or kept near the radiology department.

This topic of in-house stroke responses will be covered in depth in a subsequent white paper.

Conclusion

Reducing stroke treatment times has long been a goal of healthcare providers around the globe, and telestroke affords unprecedented opportunities to facilitate this important goal. The target treatment times will likely be reduced as providers uncover additional techniques for reducing and eliminating delays and bottlenecks in the treatment process.

About REACH Health

REACH Health is the leading enterprise telemedicine software company, providing solutions supporting multiple service lines and settings of care, all on one common software platform. These solutions combine realtime audio and video with vital patient data, clinical workflow and documentation to recreate the bedside experience for both the doctors and the patient. Clinical and performance data is utilized within reporting and analytics to monitor key telemedicine program metrics and enable continuous benchmarking and improvement. Combined, these advanced capabilities are proven to result in improved patient outcomes and more effective, sustainable telemedicine programs.

Many of the nation’s most powerful telemedicine programs run on the REACH Health solution. REACH Health pioneered one of the nation’s first telestroke programs and continues to be the innovation leader, providing the most advanced clinical solutions to improve patient access and drive measurable improvements in outcomes. Physicians and clinicians embrace the ease of use of a single, intuitive platform tailored to multiple specialties including neurology, telestroke, cardiology, ICU, psychiatry, pulmonology and others. For more information, visit www.reachhealth.com.