Building the Ideal Stroke Network With Telemedicine

Telemedicine is the glue that holds stroke networks together.

BY JEFFREY C. WAGNER, MD

Stroke is an unpredictable disease that usually occurs without warning. Stroke networks, which consist of a comprehensive stroke center (hub) and noncomprehensive facilities (spokes) connected by telemedicine, must be able to deliver proven therapies for all eligible stroke patients entering any part of the network.

Intravenous (IV) tissue plasminogen activator (tPA) (Genentech, Inc./Roche) is effective when administered to appropriate patients with ischemic stroke, with earlier treatment conferring a higher probability of recovery.[1] At our center, faster treatment has also resulted in a reduced rate of symptomatic intracerebral hemorrhage (ICH), which is the most devastating complication of IV tPA administration.

It is conservative to estimate that more than 10% of ischemic strokes are due to large vessel occlusion (LVO), and many of these strokes will not be effectively treated with IV tPA alone.[2] Fortunately, intra-arterial (IA) therapy has been shown unequivocally to be effective in such patients when performed by skilled operators at experienced, high-volume centers; the success of IA therapy is also time-dependent.

Given the time-sensitive nature of stroke treatments, spoke hospitals must be able to quickly obtain CT imaging to exclude a hemorrhage and efficiently prepare and administer IV tPA. When necessary, transfer to a hub hospital must be rapid for IA and other advanced therapies.

Telemedicine connects hub hospitals with spoke hospitals and is critical to ensuring that every patient receives evaluation by a stroke specialist and consideration for acute treatment. Telemedicine increases the use of IV tPA treatment and shortens hospital arrival-to-treatment time.[3] Recognizing and quickly transferring patients at high risk for LVO should be facilitated by rapid evaluation from a stroke specialist and early mobilization of the air transport team. Conversely, video assessment by a stroke specialist can increase confidence that a patient is able to avoid unnecessary transfer.[4]

A hub facility should be able to routinely handle every subtype of stroke. A certified hub hospital is required to have year-round, 24/7 availability of a stroke specialist, a neurointerventional surgeon, and necessary hospital support staff. A continuous effort toward process improvement using data collection to identify areas of inefficiency is essential.

This article describes a system consisting of a hub (Swedish Medical Center [SMC] in Englewood, Colorado) and many spoke hospitals connected by the Collaborative Digital Online Consultant (CO-DOC) Telemedicine Program.

FUNCTIONS OF THE COMPREHENSIVE STROKE CENTER (THE HUB)

Rapid response and emotional investment of stroke specialists, usually neurologists, are the single most important factors that drive performance of a stroke system of care. This is most critical at the hub.

At SMC, stroke specialists work closely with four, full-time neurointerventional surgeons to quickly identify candidates for IV tPA and IA therapy. Table 1 details some key quality metrics we track to measure our performance. Each of the listed metrics has improved annually over the past 5 years, and many other metrics are evaluated, which has allowed us to identify areas of inefficiency.

Close cooperation with emergency medical services, including prenotification of the emergency department, was required to achieve the door-to-stroke specialist time. Immediate stroke specialist presence, obtaining a CT scan and preparing IV tPA before admitting the patient to a room, and close collaboration with

pharmacy and laboratory services have each led to significant improvements. To achieve the metrics for IA therapy, neurointerventional surgeons have to respond immediately when called, even before the patient's arrival, in case of transfer from a spoke facility.

Administrative support has been critically important. SMC provides advance practice nurses who are critical to the efficient function of the stroke network. They perform daily rounds on stroke patients, ensure education is provided and core measures are met, and collect and track data that are used to determine areas for process improvement. Financial support for outreach to partner facilities and to help us engage emergency medical services has been very helpful to the growth of the system.

SPOKE FACILITIES

In our network, spoke facilities consist of telemedicine and nontelemedicine partners. In 2014, 136 facilities transferred stroke patients to SMC, and 50 of these facilities are telemedicine partners. Resources at these facilities range from extremely limited to nearly comprehensive. The ability to share protocols and data and review cases has been key in maximizing the benefit of cooperation between hub and spoke hospitals. When lack of telemedicine was felt to be a reason for suboptimal care, stroke specialists attempt to follow up with nontelemedicine spoke partners to identify ways to improve care, ideally by becoming a telemedicine partner.

TELEMEDICINE STRUCTURE AND FUNCTION

It is the opinion of the author that telemedicine is required for a stroke network to function optimally. Unlike telemedicine technologies used for less time-sensitive conditions, equipment for stroke telemedicine must be high quality, reliable, and include 24/7, year-round technical support. Our telemedicine technology provider is InTouch Health; however, there are many competing technologies that could meet these criteria. Also, on the facility side, sufficient bandwidth must be available to support uninterrupted use of the endpoint (ie, camera). State licenses and credentialing at each facility must be obtained for each provider, and malpractice coverage is required in each state.

As mentioned previously, stroke telemedicine providers must respond quickly in order to drive the evaluation and treatment process, because earlier treatment provides greater benefit and carries less risk. A failure of the technology or the provider can create a negative perception that is difficult to counter. It is my experience that physicians who either have not used telemedicine for stroke or have had suboptimal performance of a telemedicine service are resistant to considering telemedicine as a part of their system in the future. Ideally, stroke specialists at the hub hospital will assist spoke hospitals with telemedicine support. Continuity of care can be maximized in this situation, and stroke specialists can build trust with referring facility physicians over time.

TABLE 1. QUALITY METRICS USED BY SMC TO MEASURE AND TRACK PERFORMANCE

Metric	Median Time (min)
Patient arrival to presence of stroke specialist	0
Patient arrival to initiation of IV tPA	24
Patient arrival to groin puncture for IA therapy	38
Groin puncture to target vessel recanalization	37
	Rate (%)
Symptomatic ICH due to IV tPA	3.5 (2 of 57 patients; 23 additional patients who received IV tPA also received IA therapy)

When the demands of the telemedicine network cannot be met by stroke specialists at the hub, an alternative arrangement is for coverage to be provided or supplemented by third-party telemedicine providers (Figure 1). In this situation, a mechanism is required for communication between the telemedicine provider and the accepting physician at the hub hospital if the patient is transferred or with the admitting provider at the spoke facility.

SMC Experience

In the CO-DOC Telemedicine Program, there are 12 stroke specialists who collaborate to provide continuous coverage. One phone number connects the requesting facility to the transfer center, and then all telemedicine providers are paged with the location and nature of the consultation. The on-call provider responds within 5 minutes on average by phone or camera, performs an evaluation, and makes treatment recommendations. A formal consultation is completed for the medical record.

In 2015, more than 1,500 telemedicine consultations were performed, 185 patients received IV tPA and were subsequently transferred to SMC, and > 150 additional patients received IV tPA and stayed at a spoke hospital. Fewer than 1% (1/110) of patients who were treated with IV tPA and IA therapy suffered symptomatic ICH. We also have provided coverage as a third-party provider to assist other networks.

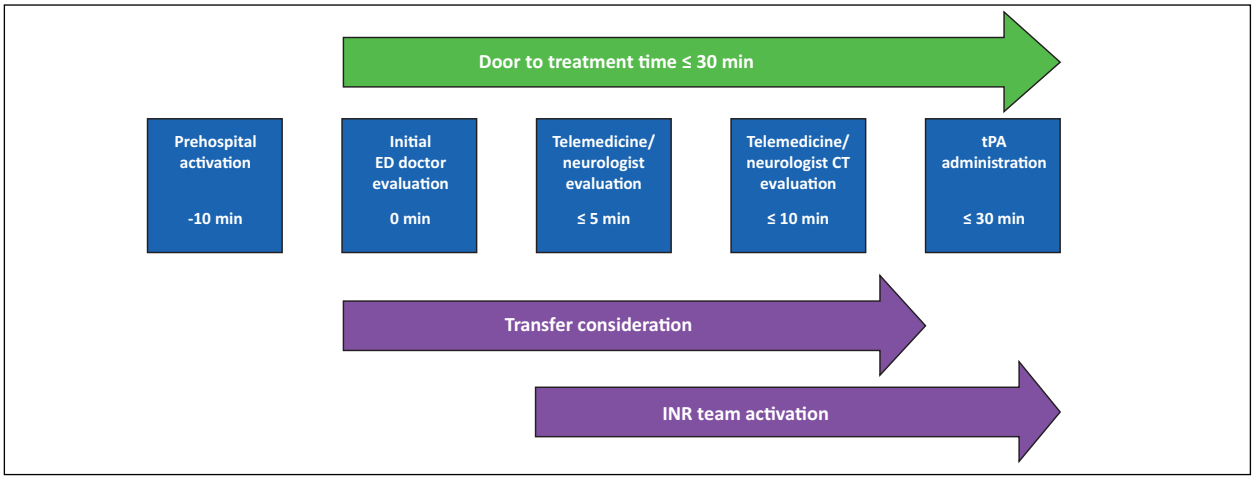

Figure 1. Third-party consult model.

BENEFITS RESULTING FROM NETWORK DEVELOPMENT

Other than improved delivery of therapies for acute stroke, there are other benefits of telemedicine for both spoke and hub facilities. Increased IV tPA delivery at spoke hospitals results in increased reimbursement to the spoke hospital. A decreased transfer rate from spoke to hub hospitals results in less revenue lost by spoke hospitals. Another expected effect of telemedicine implementation is improved stroke quality metrics, which are likely to factor into hospital reimbursement for services rendered in the future.

From the perspective of a hub hospital, the patients deemed safe to stay at spoke hospitals are less medically complex, and therefore, the rate of reimbursement is lower than the rate for patients who are more medically complex. As a result, a higher percentage of patients with higher reimbursement rates are transferred to the hub hospital, which generally has a limited number of beds, ideally maximizing reimbursement per patient.

With telemedicine, use liability is shared as though the stroke specialist is physically present in the emergency department of the spoke hospital. Our malpractice insurance provider is increasingly recommending stroke telemedicine coverage when in-person stroke specialist coverage is not available due to reduced liability exposure.

Finally, from a public health perspective, reducing unnecessary transfers, many of which involve an emergent critical care air ambulance, confers significant savings to the health care system as a whole. Medicare-funded studies are ongoing to determine the cost-effectiveness of telemedicine in neurology and neurosurgery as compared to availability of specialists by phone.

SUMMARY

Centralization of resources and experienced providers and support staff were required to produce the positive results seen in recent interventional stroke trials. The financial benefit of attracting LVO patients could result in centers racing to become comprehensive at the potential cost of the quality of care delivered. From a public health perspective, comprehensive stroke centers should be strategically located to optimize access to as many stroke patients as possible, ideally resulting in access to high-quality care regardless of where an individual is located when a stroke occurs.

Every spoke hospital must have a close working relationship with a comprehensive stroke center to ensure access of all stroke patients to the highest level of care. Telemedicine is integral to stroke network performance and should result in improved financial performance of spoke hospitals, hub hospitals, and the health care system as a whole. ■

Jeffrey C. Wagner, MD, is Medical Director at the Swedish Comprehensive Stroke Center and CODOC Telemedicine Program, and is affiliated with Blue Sky Neurology in Englewood, Colorado. He has disclosed that he is on the speakers bureau for Genentech. Dr. Wagner may be reached at wagnerj13@gmail.com.

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