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"Telestroke Evolution: from Maximization to Optimization"

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Telemedicine in the stroke arena has now progressed from its infancy to its young adulthood, with expected growing pains along the way. Its growth over the past 1-2 decades has been shockingly fast. Beyond the scope of this editorial is a detailed description of the progress in the field. Instead, this editorial will highlight an apparent change in focus from simply maximizing stroke therapies, to optimizing how and when these therapies are delivered. The accompanying manuscript,[1] and similar recent publications, focus our attention on the implementation of telestroke into the ambulance setting. This natural growth of telemedicine is highlighting this change in focus from telestroke maximization to optimization.

The authors of this manuscript describe a pilot trial assessing the use of telestroke in the pre-hospital setting. The aim was to assess feasibility and reliability of performing NIHSS evaluations in simulated ambulance runs. Real-time audio-video telemedicine devices were placed in 3 ambulances and NIHSS scoring was performed. Forty percent of the scenarios were feasible with weighted κ-values of 0.69 for real-time examiners. The manuscript has significance first because it notes early feasibility in ambulances. Second, it highlights a shift away from simply maximizing acute telestroke rt-PA and begins a shift towards optimization, specifically in how to improve stroke treatment times.

This paper's primary goal was to minimize hospital delays by placing telestroke systems in ambulances, and by providing immediate expertise to local hospitals though a network. The primary limitation was in the failure to perform all NIHSS examinations due to wireless inadequacies. The limitations of using trained actors and simulated ambulance runs is a necessary first step in moving telestroke uses forward and enabling continued growth.

Increasing population numbers, population aging, and relative paucity of stroke trained specialists makes telestroke an attractive technique of care. Adding in the low rt-PA rates further highlights the problem. Telemedicine for stroke is a natural extension of utilizing new tools for the underlying problem. Levine et al noted many years ago the power of telestroke to improve elements of stroke care including increasing rt-PA rates, consults, education, trial enrollments, mentoring and even data collection.[2] Many of these prognostications have robustly come to fruition.

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Prior telestroke work focused on first developing feasible and reliable telemedicine systems and then maximizing their use in rt-PA administrations. Clinical trial publications and case series have shown the feasibility and reliability of performing the NIHSS in the non- acute setting,[3, 4] and in the acute setting,[5, 6] with data available on feasibility and comparative reliability during actual stroke consultations as well [7-10]

In this manuscript, for the feasible examinations, Liman et al noted excellent reliability of performing the NIHSS via wireless telemedicine, with 60% of the items having excellent and 87% of the items having at least good kappa scores. This is consistent with the NIHSS reliability literature which ranges from 31%-100% of the scores being in the excellent kappa range.[3, 4, 6, 9, 11, 12] The authors show consistency in that the poorer reliability scores were in line with known poorly reliable items such as ataxia, inattention and sensory items.

Feasibility and reliability reports, by their very nature, tend to improve over time. Shafqat et al, in 1999, reported only 31% of NIHSS questions with excellent kappa reliability, using ISDN lines at 384 kbps and 2 pre-set camera angles.[3] Thirteen years later, robust Internet enabled camera systems have resulted in improved reliability, excellent Internet data transmission and robust pan/tilt/zoom camera capabilities.[4, 6, 9] A similar progression is expected in the pre-hospital wireless setting as well.

Evaluation of video transmission from an ambulance telemedicine system has been reported in only the mobile telemedicine for the Brain Attack Team (TeleBAT) project.[9, 13] TeleBAT ambulance use was shown to be reliable with 40-47% of elements showing excellent kappa reliability, though with a low image transfer rate. Increases in wireless data rates are continually improving and will likely improve this issue over time.

Sustainable telestroke networks are now being increasingly developed, and are helping to maximize rt-PA use for stroke.[7, 8, 14, 15] Over time, the growth of telestroke has begun to include the issue of optimization, though maximization has always been at the core of these attempts. STRokE DOC reported a high degree of telestroke decision-making efficacy.[16] Other studies have focused on optimizing long-term outcomes.[17, 18] Finally, how to optimize telestroke in a stroke systems of care model has also been addressed.[19]

The authors point out that both pre- and in-hospital time delays are major concerns in acute stroke management. They address this by facilitating neurologic assessments and some decision making in the ambulance, thus enabling the potential for decreased “door to needle” times and increased treatments. Since only 27% of IV rt-PA patients have “door to needle” times within the 60 minute goal,[20] and since telemedicine reports similarly poor “door to needle” times,[15, 16] efforts to creatively improve times such as this should continue to be pursued.

Even if not a single increased patient receives treatment, left-shifting these stroke times is a significant goal. Shaving off even 10 minutes will optimize care by minimizing the tens of millions of neurons lost due to a time delay such as this.[21] Currently, the majority of patients still require time once arriving to the hospital to obtain neuroimaging. This allows for stroke specialist examination at the treating facility, if one is present in person or via telemedicine. Future growth may change this requirement. Pre-hospital management is already changing by enabling ambulances to provide acute CT imaging,[22] by providing potential neuroprotective therapies,[23] or by initiating trial consent in the ambulance.[24] Creatively increasing data throughput and even prioritizing wireless data packets for medical use will all help with the telestroke evolution.

The authors correctly point out that these preliminary findings should simply encourage further studies to overcome technical problems with the background goal of providing patients with reliable and optimized access to specialty expertise. With the growth of telestroke, as highlighted by this manuscript, the field has continued to grow and our focus has evolved from one of maximization to one of optimization.

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