

## EDITORIAL

## Neurology

# Strengthening the stroke chain of survival in community emergency departments

In this issue of *JACEP Open*, Zachrisson et al<sup>1</sup> of the American College of Emergency Physicians Emergency Quality Network, an educational and quality improvement collaborative of emergency departments (EDs) across the United States, describe the diagnostic and treatment capabilities of community EDs for acute stroke. The study population in Zachrisson et al primarily consisted of community EDs without a stroke center certification, and care processes varied widely at the study sites. Most, but not all, had reliable access to computed tomography (CT) imaging and real-time stroke specialist consultation, but only two-thirds of EDs surveyed had written protocols for the care of patients with acute stroke. Most were able to administer thrombolytics, and patients requiring endovascular therapy (EVT) were typically transferred, commonly to the first accepting comprehensive stroke center (CSC) or thrombectomy-capable stroke center (TSC) rather than through an established network of care. Although derived from a self-selected convenience sample, their data are an important contribution to a limited existing evidence base about community hospital ED stroke capabilities.

Community hospital EDs are essential to providing high-quality acute stroke care for much of the US population, and their role in acute stroke care cannot be understated.<sup>2,3</sup> Particularly, when a community acute stroke ready hospital (ASRH) or primary stroke center (PSC) is the only hospital capable of facilitating a stroke diagnosis and subsequent thrombolysis in a given geographic area, ensuring efficient high-quality stroke care is of utmost importance. However, Zachrisson et al identified important gaps in acute stroke care processes that exist in community hospital EDs. In addition, because survey participants were self-selected and likely highly motivated and engaged community hospital EDs, the reported data may actually represent a high-water mark of how community hospitals approach acute stroke care. Therefore, what does this study reveal about the opportunities to improve acute stroke care in community EDs?

Particularly in geographic areas with limited access to stroke centers, the community ED can be conceptualized as the anchor of the larger community's stroke chain of survival. The stroke chain of survival conceptual model has helped frame systems of care improvements in EDs and recently in the prehospital setting to facilitate timely reperfusion.<sup>4</sup> To easily conceptualize the critical action steps that occur

between stroke onset and appropriate disposition of acute stroke patients receiving thrombolysis, the "stroke chain of survival" identifies 8 key steps of acute stroke recognition, diagnosis, and treatment.<sup>4</sup> Each link in the chain is critical to facilitating timely reperfusion—starting with layperson recognition of stroke and calling 9-1-1, continued with on-scene evaluation and transport decisions by emergency medical services (EMS) practitioners, efficient diagnosis and reperfusion in the ED, and admission to an inpatient unit capable of caring for acute stroke.<sup>5</sup> A delay at any step leads to overall treatment delays and may even result in the patient not being eligible for certain reperfusion therapies. Therefore, strengthening the stroke chain of survival in a community is inseparable from improving a community hospital ED's provision of efficient and highly reliable acute stroke care.

First, patients with stroke commonly access emergency care via EMS when they or their family recognize symptoms of stroke and call 9-1-1.<sup>6</sup> Identification of stroke by EMS and subsequent prearrival notification of the receiving stroke center expedites time to thrombolysis.<sup>7</sup> Therefore, leveraging advances in prehospital stroke identification during the 9-1-1 call, for example by educating laypersons and emergency medical dispatchers about words and communication elements used when describing acute stroke, can be seen as an opportunity to initiate coordinated stroke care even before EMS arrival.<sup>8</sup>

Next, once EMS practitioners arrive on scene, prehospital stroke severity screening is an opportunity to identify certain patients who may benefit from direct transport to a TSC or CSC for immediate EVT.<sup>9-12</sup> Although the American Heart Association provides guidance that EMS systems can consider when developing transport protocols in the context of severe stroke screening, in many areas of the United States, the closest TSC or CSC may be prohibitively distant, hence defaulting the transportation destination to the community ASRH or PSC.<sup>2,3,13</sup> In addition, because severe stroke screening is not diagnostic, some patients with large vessel occlusion (LVO) will be transported by EMS to PSCs, further highlighting the importance of efficient ED processes of care at ASRHs and PSCs.<sup>14,15</sup>

Therefore, even in a high-functioning prehospital stroke system of care, optimizing the evaluation and treatment of stroke patients in community EDs is requisite for strengthening the overall stroke chain of survival. To facilitate timely diagnosis and treatment of acute stroke, EDs that care for patients with acute stroke should acquire immediate CT imaging to differentiate hemorrhagic from ischemic stroke,

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enable real-time consultation with stroke specialists, have the capability to quickly administer thrombolytics, and establish mechanisms to facilitate timely access to EVT for patients with LVO.<sup>16</sup> One important innovation that continues to gain widespread use is “telestroke” consultation, wherein a stroke specialist can evaluate a patient remotely via an audiovisual connection, discuss with the patient and family in real time about potential treatment options, and use that evaluation to provide recommendations to the emergency physician or practitioner.<sup>3</sup> Telestroke systems have been demonstrated to provide high-fidelity patient interactions and have led to increased rates of thrombolysis at community hospitals.<sup>17</sup> An important complement to telestroke is remote neuroradiology, which facilitates specialized radiology review of acute stroke imaging. However, when remote neuroradiology is not available, especially during off hours, processes to support general radiologists to make critical CT interpretations is critical to efficient stroke diagnosis and treatment.<sup>18,19</sup>

Once the diagnosis and treatment plan are confirmed, transfer to a TSC or CSC is often considered. For ASRH EDs, transfer of all stroke patients is commonplace, and for PSCs, transfer of patients eligible or potentially eligible for EVT is typical.<sup>20</sup> Although a patient with an LVO is best served at a regional TSC or CSC, a patient with a mild stroke may be best served at the community PSC. Leveraging hospital networks of care, or “hub-and-spoke” collaborative care models between institutions, can lead to efficient regionalization of resources, facilitating patients being treated at the level of stroke center that is most appropriate for their type of stroke.<sup>21</sup> For patients requiring transfer to higher levels of stroke care for acute therapy, time is a premium, and current processes for reducing door-in-door-out times of interfacility transfers are typically prolonged.<sup>22,23</sup> These delays can be minimized through collaborative processes within networks with established transfer protocols.<sup>24</sup> Future innovations in times of high inpatient census at CSCs may even look to models where patients receive advanced hyperacute therapies, such as EVT, but complete the remainder of their inpatient hospitalization at a PSC in the patient’s local community. However, implementing such models require seamless coordination within a network of care.

An intriguing intersection of prehospital and hospital care is the mobile stroke unit (MSU). MSUs are specialized ambulances equipped with a CT scanner, staffed with trained nurses and paramedics, stocked with thrombolytics and often other medications to treat acute neurological emergencies, and linked with real-time access to stroke specialists via telestroke.<sup>25</sup> In some respects, the MSU can be conceptualized an “ASRH on wheels,” facilitating the diagnosis and treatment of acute stroke, and thrombolysis administered in MSUs is associated with improved clinical outcomes.<sup>26,27</sup> In areas with limited stroke center capabilities and a high prevalence of acute ischemic stroke, MSUs offer the potential for addressing critical gaps in acute stroke care.

Ultimately, strengthening acute stroke care in community hospital EDs means strengthening the stroke system of care in which the community ED exists, from prehospital through specialty center networks. Educating and empowering EMS practitioners to screen for severe stroke may help efforts to direct the patient to a higher level of stroke care when available, and when not, give the receiving community ED

important prearrival information. Similarly, community EDs can look to CSCs to support community hospital partners through initiatives to facilitate efficient diagnosis and treatment with thrombolysis and EVT. This includes expanded reliable access to telestroke, support of system improvements that promote quicker door-to-needle times, initiatives to improve interfacility transfer processes, and implementation of best practices through networked care.

Therefore, an overarching concept in approaching stroke systems of care is the importance of stroke center certification, which Zachrison et al report is commonly lacking at community hospitals. External stroke center certification of community hospitals formalizes, validates, and ensures the components of a stroke system of care intersecting at the community ED. Certification gives clarity about the reliable capabilities of receiving EDs when caring for patients with suspected stroke, ensuring that diagnostics and therapeutics are reliably available and mechanisms are in place to facilitate timely transfer. Pursuing formal certification is a critical pathway to expanding access to high-quality stroke care and advancing the science around improved processes of care improvements in underresourced communities.

Zachrison et al offer important insights into current emergency stroke care for a large geographic area of the United States. Innovation and improvement of the entire stroke chain of survival around community EDs hold promise for ensuring high-quality care for all patients with acute stroke.

#### CONFLICT OF INTEREST

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