

# Fast Protocol for Treating Acute Ischemic Stroke by Emergency Physicians: What Took So Long?



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0196-0644/\$-see front matter

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<https://doi.org/10.1016/j.annemergmed.2018.09.017>

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[Ann Emerg Med. 2019;73:113-115.]

In June 1996, the Food and Drug Administration approval of alteplase transformed the emergency assessment and treatment of patients with acute ischemic stroke. Before this first acute treatment for stroke, health care efforts were focused on prevention and recovery. The adoption of thrombolysis was initially limited to larger, more resourced centers. The advent of stroke center certification, coupled with the development of stroke systems of care and telestroke, have led to a steady increase in alteplase use. The armamentarium for stroke expanded again in 2015 with the reporting of several successful trials of endovascular therapies for patients up to 6 to 12 hours from symptom onset.<sup>1</sup> Most recently, the DWI or CTP Assessment with Clinical Mismatch in the Triage of Wake-Up and Late Presenting Strokes Undergoing Neurointervention with Trevo (DAWN) and Endovascular Therapy Following Imaging Evaluation for Ischemic Stroke (DEFUSE-3) trials extended eligibility of endovascular therapy to 24 hours in selected patients with favorable penumbra.<sup>2,3</sup> These advances share an important fundamental principle: decreasing the time from symptom onset to reperfusion increases the likelihood of a better functional outcome.<sup>4,5</sup> This temporal reality is well quantified by Saver,<sup>6</sup> who estimated that in a typical middle cerebral artery occlusion, “20 million additional neurons die every 10 min[utes] if reperfusion is not achieved.”

From the outset, many emergency physicians hesitated to administer alteplase because of the belief that only highly trained vascular neurologists can administer it safely and effectively. However, beginning with the original National Institute of Neurological Disorders and Stroke (NINDS) trials through the more recent community-based third international stroke trial (IST-3) trial, a broad range of physicians in community hospitals have clearly

demonstrated the ability to diagnose and treat acute ischemic stroke patients with alteplase.<sup>7-9</sup> Currently, most acute stroke teams center on physicians with formal neurology training who provide consultation either in person or by telemedicine. However, limitations in access to emergency neurologic expertise remain a challenge worldwide. Expanding the number of physicians at the bedside who can assess and treat acute ischemic stroke patients is critical for minimizing treatment delays and maximizing patient outcomes.

In this issue of *Annals*, Heikkilä et al<sup>10</sup> report the results of the fast protocol for treating acute ischemic stroke by emergency physicians at their center. The goal of their project was to train emergency physicians in the assessment and treatment of patients with possible acute ischemic stroke. The training was necessitated by the absence of neurologic expertise in off hours of the day and on weekends.

In this pre- and postintervention analysis, the authors capitalized on the 2013 creation of an emergency medicine specialty in Finland that incorporated stroke education into the training program. Just before the implementation of the intervention period, experienced emergency physicians were clinically trained on the hospital stroke unit, received didactic and hands-on training in diagnosing and treating acute ischemic stroke patients, shadowed experienced neurologists in the management of acute neurologic emergencies, and managed patients under the supervision of neurologists in the emergency department (ED). The emergency physician also received focused training on the interpretation of brain computed tomography (CT) imaging. In the preintervention (group 1) period, acute ischemic stroke patients in the ED were managed by on-call stroke physicians, either a neurologist (or resident) or an internal medicine resident supported by telestroke resources. In the postintervention period (group 2), patients with acute ischemic stroke were almost exclusively managed by the stroke-educated emergency physicians, with the availability of a neurologist by telephone as needed.

The results are stunning not only in the rates of thrombolysis use and clinical outcomes but also in treatment (door-to-needle) times. Compared with the 3-year group 1 period, the proportion of patients with acute ischemic stroke treated with thrombolysis in group 2 increased significantly, from 7.8% to 14.4%. Similarly, the median door-to-needle time decreased from 54 minutes in group 1 to 20 minutes in group 2, an estimated difference of 32 minutes. Just a 15-minute improvement in door-to-needle times is associated with reduced in-hospital mortality, reduced symptomatic intracranial hemorrhage, increased achievement of independent ambulation at discharge, and increased discharge home.<sup>11</sup> The authors noted a similar association of decreased in-hospital mortality (3.7% versus 0%) and increased discharge to home (57.9% versus 63%) between group 1 and group 2, respectively. Data on 3-month outcomes were not available for group 1; in group 2, 70% of treated patients achieved a good outcome (modified Rankin Scale score 0 to 2), exceeding the 50% good outcomes in the original NINDS trials.<sup>12</sup> The findings from this single center highlight the effect of training and using emergency physicians in optimized stroke processes for rapidly assessing and treating acute ischemic stroke patients with alteplase, with outcomes consistent with those of traditional stroke teams.

As significant as these findings are, several observations are necessary. Concurrent with the training of the emergency physicians, the hospital began to provide stroke education to the ED nurses in 2012, 1 year before the intervention period began. Similarly, the hospital created a new acute stroke protocol using many of the Target: Stroke interventions, including out-of-hospital notification, single-call activation, ED point-of-care testing, placement of a CT machine in the ED, and initiation of thrombolysis while the patient is in the CT scanner.<sup>13</sup> In aggregate, the education, resourcing, and motivation of this new ED-based team collectively led to the significant reductions in door-to-needle time and increased rates of thrombolysis administration.

Emergency physicians have a history of incorporation into the early evaluation and treatment of patients with suspected acute ischemic stroke. In the 1980s, at the University of Cincinnati the Greater Cincinnati/Northern Kentucky Stroke Team was created, deliberately partnering an emergency physician, William Barsan, MD, with stroke neurologists Thomas Brott, MD, and Charles Olinger, MD. This team recognized the likely development of time-dependent therapies for acute ischemic stroke and the benefit of involving front-line emergency physicians. This team grew during the next several decades and has trained numerous emergency physicians in the treatment of acute ischemic stroke through the University of Cincinnati

residency program, as well as their stroke and neurocritical fellowships.

Regrettably, dedicated neurologic training in emergency medicine residency programs remains sparse worldwide. Stettler et al<sup>14</sup> conducted a survey of emergency medicine residency training programs in regard to the use of dedicated or elective neurologic rotations and found that less than 18% had a required clinical neuroscience rotation. A similar Canadian survey found that few programs had mandatory neurology or stroke rotations, and only 1 of 20 had emergency medicine residents act as stroke team leaders.<sup>15</sup> With increasing time pressures on trainees, even fewer emergency medicine residency programs dedicate clinical time to neurologic emergency and stroke training despite the frequency of ED presentations. With the paucity of dedicated clinical neurology training during residency, it is not surprising that many emergency physicians have trepidation about making treatment decisions surrounding thrombolysis use without formal neurology consultation.<sup>16</sup>

Postresidency training of emergency physicians may be an alternative in some settings. Greenberg et al<sup>17</sup> reported on the benefit of creating a “neuro-ED” staffed with emergency physicians who had undergone 80 hours of direct stroke education. Patients treated for acute ischemic stroke in the neuro-ED had a mean door-to-needle time of 35 minutes compared with 83 minutes when treated in the main ED. Again, other factors may have contributed to this reduction; regardless, patients clinically benefited. It may not be feasible to create and implement a similar 2-week training program in all ED settings, but alternatives exist.

A multidisciplinary team at Washington University in St. Louis used value stream analysis to restructure the ED acute ischemic stroke treatment processes.<sup>18</sup> As did Heikkilä et al,<sup>10</sup> the team redesigned their ED-based stroke processes to incorporate best practices, including many of the Target: Stroke interventions. The new protocol deliberately integrated the emergency physicians into the stroke team, whereas before, the emergency assessment was performed largely by the neurology resident. The overall effect was significant. Median door-to-needle time decreased from 60 to 39 minutes after the new process implementation. This study and others demonstrate the benefit of a team-based approach to acute stroke care.

With the limited number of neurologists, not all hospitals have the benefit of on-site neurologic expertise. A quality improvement initiative was conducted in 5 rural hospitals within the “stroke belt” that were not primary stroke centers and relied on an emergency physician–led stroke team to evaluate acute ischemic stroke patients and administer thrombolytics when indicated.<sup>19</sup> The program

consisted of grand round sessions for ED team members and repeated audit and feedback cycles related to team performance. With this relatively simple approach, more patients were treated within the desired 60-minute door-to-needle time than before the intervention, 1.9% versus 5.2%, respectively. Regional primary and comprehensive stroke centers and their stroke champions should partner with their more rural, less resourced hospitals and provide similar education and feedback to the ED teams to improve the level of stroke care throughout their catchment areas.

In summary, Heikkilä et al<sup>10</sup> demonstrated that the engagement of emergency physicians in the assessment and treatment of patients with acute ischemic stroke is not only feasible but also is associated with clinically significant time savings. Given the relative paucity of neurologists and the larger number of emergency physicians available for patients with acute ischemic stroke, it is incumbent on local stroke systems of care to incorporate their emergency medicine community into the hospital stroke team to the fullest extent possible to maximize the benefits of their involvement and expertise. In the end, all stroke patients will benefit.

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*Supervising editor:* William J. Meurer, MD, MS. Specific detailed information about possible conflict of interest for individual editors is available at <https://www.annemergmed.com/editors>.

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*Authorship:* All authors attest to meeting the four [ICMJE.org](http://www.icmje.org) authorship criteria: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND (2) Drafting the work or revising it critically for important intellectual content; AND (3) Final approval of the version to be published; AND (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

*Funding and support:* By *Annals* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see [www.icmje.org](http://www.icmje.org)). The authors have stated that no such relationships exist.

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