Treatment of Acute Ischemic Stroke

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KEYWORDS

• Acute ischemic stroke • Reperfusion • Intravenous thrombolysis
• Endovascular therapy • Tissue plasminogen activator

KEY POINTS

- The treatment of acute ischemic stroke is aimed at reperfusing ischemic tissue, halting progression of infarction, and preventing recurrence.
- Brain parenchyma is sensitive to brief periods of oligemia and hypoperfusion, and the success of reperfusion therapies are highly time dependent.
- Intravenous thrombolysis may benefit patients experiencing an acute ischemic stroke up to 4.5 hours from symptom onset.
- Emergency medicine systems of care should focus on the availability and speed of access to reperfusion therapies to maximize the benefit for as many patients as possible.
- Extended time window reperfusion, neuroprotection, and adjunctive therapies remain exciting areas of acute ischemic stroke research.

INTRODUCTION

The treatment of acute ischemic stroke (AIS) shares similarities with other vascular emergencies, in that reperfusion of ischemic tissue, halt in propagation of infarction, and prevention of recurrence are the 3 primary early goals of care. Even more than myocardial and other tissue, however, brain parenchyma is exquisitely sensitive to short periods of oligemia and hypoperfusion. In fact, radiographically proven acute cerebral infarction has been reported in patients with as little as 10 seconds of symptoms.[1] The term "time is brain" has been popularized to emphasize the rapidity by which neurons are irretrievably lost during an ischemic stroke.[2] Although dependent on several factors, including degree of ischemic preconditioning, site of occlusion, perfusion of collateral vessels, blood pressure, and glucose and oxygen delivery, on average 1.9 million neurons are destroyed with each passing minute that a stroke evolves.[2] When translated into patient lifetime benefits from expeditious thrombolysis, each minute saved in stroke onset to treatment led to an average of 1.8 days of additional healthy life (95% prediction interval, 0.9–2.7).[3]

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Although stroke recently declined from the third to the fifth most common cause of death in the United States, the annual incidence and overall prevalence continue to increase and it remains a leading cause of long-term disability.[4] Since the available US Food and Drug Administration (FDA)–approved treatment options are time dependent, improving stroke care in the early moments may have more of a public health impact than any other phase of care. Timely and efficient stroke treatment should be a priority for emergency department (ED) and prehospital providers. This article discusses the currently available and emerging treatment options in AIS focusing on the preservation of salvageable brain tissue, minimizing complications, and secondary prevention.

PATIENT EVALUATION OVERVIEW

The initial evaluation of AIS should be focused on the efficient detection of functionally disabling neurologic deficits to optimize eligibility for time-dependent treatment options. A detailed discussion of AIS diagnosis is discussed elsewhere in this issue (See Lauren M. Nentwich's article, "Diagnosis of Acute Ischemic Stroke," in this issue). In short, an expedited neurologic examination should be performed including, but not limited to the National Institutes of Health Stroke Scale (NIHSS). Documentation of a NIHSS before stroke treatment and at the time of initial evaluation is a quality metric per The Joint Commission for Primary and Comprehensive Stroke Centers, which becomes the responsibility of the emergency medicine provider, unless neurologic expertise is available in house or via remote video telestroke services. Although formal NIHSS training and certification is not currently required per The Joint Commission, it is encouraged and freely available (https://secure.trainingcampus.net/uas/modules/trees/windex.aspx?rx=nihss-english.trainingcampus.net). Perhaps more important than a full NIHSS, at least initially, is to perform a brief stroke detection and severity screen, which can be performed in the ambulance or while being triaged in the ED. Prehospital stroke detection screens such as FAST (Facial drooping, Arm weakness, Speech difficulties and Time), CPSS (Cincinnati Prehospital Stroke Scale), LAPSS (Los Angeles Prehospital Stroke Screen), MASS (Massachusetts Stroke Scale), Med-PACS (Medic Prehospital Assessment for Code Stroke), OPSS (Ontario Prehospital Stroke Screening Tool), and ROSIER (Recognition of Stroke in the Emergency Room) have been linked with improved thrombolytic treatment rates and door-to-needle times.[5] Severity scales such as the LAMS (Los Angeles Motor Scale), KPSS (Kurashiki Prehospital Stroke Scale), sNIHSS (Short NIHSS), CPSSS (Cincinnati Prehospital Stroke Severity Scale), VAN (vision, aphasia, neglect), and RACE (Rapid Arterial oCclusion Evaluation) have proven reasonably sensitive and specific tools to detect patients with emergent large vessel occlusion (ELVO) and may be used to trigger neurointerventional team activation, prehospital diversion, or interfacility transfer to a comprehensive stroke center.[6–10]

Emphasis should be given to establishing the time the patient was "last known well," that is, without symptoms, which is distinct from the time symptoms were first noted. The time last known well should be used in all cases as the equivalent of symptom onset unless the patient or witness is clearly able to recall the time symptoms began. This is important to ensure that symptom duration is not underestimated, resulting in treatment of the patient with thrombolytics beyond the approved treatment window.

It is also important to gain a sense of the patient's premorbid functional status immediately before the stroke onset. This becomes important when weighing and discussing the risks and benefits of treatment options for reperfusion. This