

Diagnosis and Management of Acute Ischemic Stroke



Tasneem F. Hasan, MD, CPH; Alejandro A. Rabinstein, MD;
Erik H. Middlebrooks, MD; Neil Haranhalli, MD; Scott L. Silliman, MD;
James F. Meschia, MD; and Rabih G. Tawk, MD

CME Activity

Target Audience: The target audience for *Mayo Clinic Proceedings* is primarily internal medicine physicians and other clinicians who wish to advance their current knowledge of clinical medicine and who wish to stay abreast of advances in medical research.

Statement of Need: General internists and primary care physicians must maintain an extensive knowledge base on a wide variety of topics covering all body systems as well as common and uncommon disorders. *Mayo Clinic Proceedings* aims to leverage the expertise of its authors to help physicians understand best practices in diagnosis and management of conditions encountered in the clinical setting.

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Learning Objectives: On completion of this article, you should be able to (1) summarize the endovascular thrombectomy landmark trials that documented benefit in acute ischemic stroke within the anterior circulation, (2) differentiate between prehospital, outside hospital, and emergency department triage and evaluation for acute ischemic stroke, and (3)

recognize the steps in evaluating a patient with ischemic stroke after initial stabilization.

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From the Department of Neurologic Surgery (T.F.H., N.H., R.G.T.), Department of Radiology (E.H.M.), and Department of Neurology (J.F.M.), Mayo Clinic, Jacksonville, FL; Department of Neurology (A.A.R.), Mayo Clinic, Rochester, MN; and Department of Neurology, University of Florida Health Science Center, Jacksonville, FL (S.L.S.).

Abstract

Acute ischemic stroke (AIS) is among the leading causes of death and long-term disability. Intravenous tissue plasminogen activator has been the mainstay of acute therapy. Recently, several prospective randomized trials documented the value of endovascular revascularization in selected patients with large-vessel occlusion within the anterior circulation. This finding has led to a paradigm shift in the management of AIS, including wide adoption of noninvasive neuroimaging to assess vessel patency and tissue viability, with the supplemental and independent use of intravenous tissue plasminogen activator to improve clinical outcomes. In this article, we review the landmark studies on management of AIS and the current position on the diagnosis and management of AIS. The review also highlights the importance of early stabilization and prompt initiation of therapeutic interventions before, during, and after the diagnosis of AIS within and outside of the hospital.

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Acute ischemic stroke (AIS) is a medical emergency, affecting 795,000 people in the United States each year.¹ The global burden of AIS on society continues to rise with increasing incidence, in part due to increasing longevity. Since the 1990s, intravenous (IV) tissue plasminogen activator (IV tPA) has been the only evidence-based therapeutic option for improving outcomes for patients with AIS. Subsequently, intra-arterial thrombolysis (IAT) was tested in the Prolyse in Acute Cerebral Thromboembolism II (PROACT II) study, which found potential safety and efficacy of IAT for middle cerebral artery (MCA) occlusions treated within 6 hours.² Subsequently, the Interventional Management of Stroke (IMS) trial investigated the feasibility and safety of combined IV and intra-arterial therapy in AIS.³ The ensuing years witnessed the evolution of endovascular procedures, from forcefully injecting thrombolytic agents or saline into the thrombus to mechanically disrupting the clot by microwires and microcatheters, to the advent of energy-emitting endovascular devices and percutaneous angioplasty. These advances led to the development of simple snare devices followed by US Food and Drug Administration approval of the first device for the indication of opening cerebral vessels, the Merci Retrieval System (Concentric Medical, Inc), and subsequently by suction catheters, intracranial stents, and stent retrievers. In parallel to this evolution, the design of AIS trials advanced, and the value of endovascular revascularization was clearly shown after the application of rigorous patient selection criteria. This advancement resulted in the second paradigm shift in AIS care since the initial approval of IV tPA. This shift was attributable partly to the efficacy of stent retrievers in clot extraction but largely to the appropriate selection of patients with salvageable brain tissue based on multimodal imaging. In this review, we provide a comprehensive review of current advances in the management of AIS.

This review is not intended to substitute for existing comprehensive clinical practice guidelines for the management of AIS, which are readily available.^{4,5} Instead, we hope to provide physicians evaluating and treating patients with AIS with actionable and

evidence-based advice. The current review is focused on the first 48 hours after onset of stroke symptoms, particularly the first few hours, as this represents the time when reduction of final infarct volume is most likely to be achieved.

PREHOSPITAL EVALUATION AND TRIAGE

Educating the public to recognize the symptoms and signs of acute stroke and use of urgent triage and treatment are essential to improve outcomes. This effort requires public service campaigns, emergency medical services (EMS), and development of systems of care for rapid transfer of patients to nearby stroke centers.

Prehospital assessment scales have been developed to identify acute stroke and severity, including the Los Angeles Prehospital Stroke Screen,⁶ the Rapid Arterial Occlusion Evaluation scale,⁷ and the Cincinnati Stroke Triage Assessment Tool.⁸ None have shown to be superior to another in identifying large-vessel occlusion (LVO). The FAST acronym (face drooping, arm weakness, speech difficulty, time to call emergency services) has been endorsed by multiple professional organizations and has been the centerpiece of recent educational campaigns.⁹ Calling EMS (by dialing 9-1-1 in the United States) when stroke is suspected must be emphasized because use of EMS is associated with faster arrival to the emergency department (ED) and higher rates of treatment with reperfusion therapies.¹⁰ Training of dispatch personnel to recognize the urgency of stroke and the use of standardized stroke scales in the prehospital setting are also very important and may increase diagnostic accuracy.¹¹⁻¹³ Prearrival notification of the ED that a suspected stroke case is being transported has been shown to accelerate times to thrombolysis.¹⁴ As useful as the FAST acronym is, it has considerable limitations, particularly with regard to posterior circulation and right hemispheric stroke symptoms (eg, hemianopia, diplopia, and neglect). Richer conversations regarding signs of stroke are warranted for patients at high risk.

Although the role of primary stroke centers (PSCs) has focused on prompt administration of IV tPA, the emergence of recent endovascular trials and mobile stroke units

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