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Management of Acute Stroke in the Emergency Setting: From Thrombolysis to Endovascular Therapy

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Introduction

Stroke is one of the leading causes of death and long-term disability worldwide, and its acute management remains a cornerstone of modern emergency medicine. The vast majority of strokes are ischemic, resulting from an obstruction of cerebral blood flow, while a smaller proportion are hemorrhagic, caused by intracranial bleeding. The emergency department serves as the critical entry point for stroke patients, where rapid recognition and intervention can dramatically alter outcomes. Time is the most important determinant of prognosis in acute ischemic stroke; the concept of "time is brain" underscores the urgency of early intervention, as millions of neurons are lost every minute without reperfusion. Emergency physicians must therefore be equipped with knowledge of evolving management strategies, ranging from intravenous thrombolysis to advanced endovascular interventions, in order to deliver optimal care within stringent time windows [1].

Description

The initial evaluation of a suspected stroke patient in the ED involves rapid triage, stabilization, and diagnostic confirmation. Prehospital notification by emergency medical services can accelerate door-to-needle times by alerting the stroke team before arrival. Upon presentation, immediate assessment of airway, breathing, and circulation is essential, followed by a focused neurological examination using standardized tools such as the National Institutes of Health Stroke Scale (NIHSS). Neuroimaging, most commonly non-contrast computed tomography, is indispensable to differentiate ischemic from hemorrhagic stroke and exclude contraindications to thrombolysis. Advanced imaging modalities such as CT angiography and CT perfusion have further refined the selection process by identifying large vessel occlusions and salvageable brain tissue, guiding decisions about reperfusion therapies. The integration of imaging into streamlined ED workflows has become central to modern stroke management protocols. Early initiation of antiplatelet therapy, particularly aspirin, is recommended for ischemic stroke patients not receiving thrombolysis, while anticoagulation is indicated in selected cases such as cardioembolic stroke due to atrial fibrillation [2].

Intravenous thrombolysis with recombinant tissue plasminogen activator (tPA, alteplase) remains the gold standard for eligible patients presenting within the therapeutic window. Administered within 4.5 hours of symptom onset, tPA has been shown to significantly improve functional outcomes, though it carries a risk of symptomatic intracranial hemorrhage. Patient selection is critical, and contraindications such as recent surgery, active bleeding, or very high blood pressure must be carefully assessed. In recent years, tenecteplase, a genetically modified fibrinolytic agent with more favorable pharmacokinetics, has emerged as a promising alternative, offering easier administration and potentially improved efficacy. The success of thrombolysis in the ED hinges on minimizing door-to-needle times through standardized protocols, multidisciplinary coordination, and quality improvement initiatives. Despite its proven benefits, thrombolysis remains underutilized globally due to delays in recognition, patient arrival outside treatment windows, and limited access to specialized stroke centers [3].

Endovascular therapy has revolutionized the management of acute ischemic stroke caused by LVOs, expanding treatment options beyond intravenous thrombolysis. Landmark trials such as MR CLEAN, EXTEND-IA, and DAWN demonstrated the efficacy of mechanical thrombectomy in achieving rapid reperfusion and improving outcomes, even in patients presenting up to 16–24 hours after symptom onset, provided imaging confirms viable brain tissue. EVT is performed by interventional neuroradiologists using stent retrievers or aspiration catheters to physically remove the clot from large cerebral arteries. In many centers, EVT is now standard of care for eligible patients, often in combination with intravenous thrombolysis when feasible. For emergency physicians, rapid identification of LVO candidates and coordination of timely transfer to thrombectomy-capable centers are critical steps in ensuring access to this life-saving intervention. While thrombolysis and EVT dominate discussions of reperfusion therapy, the management of acute stroke in the ED encompasses a broader spectrum of supportive care measures. Blood pressure control, glucose management, and temperature regulation are all critical in optimizing neurological recovery. For hemorrhagic stroke, rapid reversal of anticoagulation, neurosurgical consultation, and aggressive blood pressure management are priorities [4,5].

Conclusion

The management of acute stroke in the emergency setting has undergone remarkable advances, shifting from a singular focus on intravenous thrombolysis to a comprehensive approach that includes endovascular therapy and advanced supportive care. Emergency physicians are at the forefront of this evolution, responsible for rapid recognition, diagnostic accuracy, and timely initiation of reperfusion strategies. Despite challenges related to time windows, resource limitations, and patient variability, streamlined protocols, prehospital coordination, and technological innovations have greatly improved outcomes for stroke patients. The future of acute stroke management lies in expanding access to thrombolysis and thrombectomy, refining patient selection with advanced imaging, and enhancing systems of care to ensure equitable treatment delivery. Ultimately, the success of stroke management in the ED depends on the integration of speed, precision, and multidisciplinary collaboration, offering the best chance for functional recovery and survival in this devastating condition.

Acknowledgement

None.

Conflict of Interest

None.

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