Stroke Management: From Acute to AI Future

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Introduction

This article offers a comprehensive overview of acute ischemic stroke, detailing current and emerging therapeutic strategies. It emphasizes the importance of timely diagnosis and intervention, discussing advancements in thrombectomy, thrombolysis, and neuroprotective agents. The authors highlight ongoing research aimed at improving outcomes and reducing disability post-stroke, particularly focusing on expanding the treatment window and personalizing care approaches [1].

These guidelines provide an updated framework for managing patients with acute ischemic stroke, offering evidence-based recommendations for prehospital care, emergency department evaluation, thrombolytic therapy, endovascular treatment, and post-treatment management. The update reflects the latest research findings, stressing the critical role of time-sensitive interventions and multidisciplinary team approaches to optimize patient outcomes [2].

This review delves into the long-term management strategies and outcomes for stroke survivors, highlighting the shift from acute care to comprehensive post-stroke support. It addresses secondary prevention, rehabilitation, and the management of complications, emphasizing the need for coordinated care to improve quality of life and functional independence over time. The discussion covers lifestyle modifications, medication adherence, and addressing comorbidities to prevent recurrence [3].

This scientific statement outlines critical recommendations for the secondary prevention of ischemic stroke, providing a robust guide for healthcare professionals. It covers various risk factors such as hypertension, dyslipidemia, diabetes, atrial fibrillation, and lifestyle choices, offering evidence-based strategies for their management to significantly reduce the risk of recurrent stroke. The statement underscores a personalized approach to prevention [4].

This JACC Council Perspective provides insights into the latest approaches for managing acute ischemic stroke, integrating clinical guidelines with real-world considerations. It reviews the utility of advanced imaging, optimal patient selection for reperfusion therapies, and the nuances of post-procedure care. The authors discuss the evolving landscape of stroke care, emphasizing improvements in patient access to specialized treatments and the impact of organized stroke systems [5].

This review focuses on reperfusion therapy, a cornerstone of acute ischemic stroke management, summarizing the most recent evidence and clinical implications. It covers the efficacy and safety of intravenous thrombolysis and mechanical thrombectomy, detailing patient selection criteria, procedural considerations, and the importance of a rapid workflow. The article also touches upon future directions, including extended time windows and advanced imaging techniques [6].

This article provides a thorough review of stroke rehabilitation, outlining current evidence-based practices and highlighting future perspectives. It covers motor, cognitive, and speech recovery interventions, emphasizing personalized approaches and the integration of technology, like robotics and virtual reality. The discussion underscores the critical role of intensive, multidisciplinary rehabilitation in improving long-term functional outcomes and quality of life for stroke survivors [7].

This comprehensive review examines the critical role of blood pressure management in acute ischemic stroke, providing guidance on optimal targets and treatment strategies. It synthesizes current evidence regarding blood pressure control before, during, and after reperfusion therapies, acknowledging the complexities and individualized considerations for different patient profiles. The authors emphasize balancing the risks of hypotension and hypertension to minimize secondary brain injury [8].

This statement from the American Heart Association/American Stroke Association provides crucial guidance for healthcare professionals on the management of intracerebral hemorrhage (ICH). It covers immediate diagnostic steps, surgical considerations, blood pressure management, reversal of anticoagulation, and strategies to prevent hematoma expansion. The recommendations aim to standardize care, reduce mortality, and improve functional outcomes for patients experiencing this severe form of stroke [9].

This article explores the rapidly advancing role of Artificial Intelligence (AI) in various facets of stroke management, from prevention and acute treatment to long-term rehabilitation. It discusses how AI can enhance diagnostic accuracy, personalize treatment decisions, optimize workflow in stroke units, and predict patient outcomes. The authors highlight the potential of AI to revolutionize stroke care by improving efficiency, precision, and accessibility of interventions [10].

Description

Acute ischemic stroke requires timely diagnosis and intervention, utilizing current and emerging therapeutic strategies like thrombectomy and thrombolysis. Research is continually working to expand treatment windows and personalize care for better outcomes and reduced disability [1]. Comprehensive guidelines offer an updated framework for managing patients from prehospital care through emergency department evaluation and post-treatment, stressing the importance of time-sensitive interventions and multidisciplinary team approaches [2]. Recent perspectives further integrate these clinical guidelines with practical considerations, looking at advanced imaging and optimizing patient selection for reperfusion therapies, alongside the impact of organized stroke systems on patient access to specialized treatments [5].

Reperfusion therapy is a central component of acute ischemic stroke care, detailing the efficacy and safety of intravenous thrombolysis and mechanical thrombectomy. Key aspects include patient selection, procedural considerations, and rapid workflow, with future directions exploring extended time windows and advanced imaging techniques [6]. Critical to this acute phase is precise blood pressure management, which guides optimal targets and strategies before, during, and after reperfusion therapies. Balancing hypotension and hypertension risks is vital to minimize secondary brain injury, acknowledging individualized patient profiles [8]. Beyond ischemic stroke, specific guidance addresses the management of intracerebral hemorrhage (ICH), covering immediate diagnostics, surgical options, blood pressure control, and reversal of anticoagulation to prevent hematoma expansion and improve outcomes [9].

Long-term stroke management moves beyond acute care to comprehensive post-stroke support. This includes secondary prevention, rehabilitation, and managing complications, all aimed at enhancing quality of life and functional independence. Strategies involve lifestyle modifications, medication adherence, and addressing comorbidities to prevent recurrence [3]. Specific scientific statements outline essential recommendations for the secondary prevention of ischemic stroke, providing guidance on managing risk factors such as hypertension, dyslipidemia, diabetes, and atrial fibrillation. These evidence-based strategies are crucial for significantly reducing the risk of recurrent stroke and call for a personalized approach to prevention [4].

Stroke rehabilitation is a vital area, with current evidence-based practices focusing on motor, cognitive, and speech recovery. Personalized approaches and technology integration, such as robotics and virtual reality, are emphasized for improving long-term functional outcomes and overall quality of life for stroke survivors through intensive, multidisciplinary rehabilitation [7]. Looking to the future, Artificial Intelligence (AI) is rapidly advancing its role across all facets of stroke management—from prevention and acute treatment to long-term rehabilitation. AI's potential lies in enhancing diagnostic accuracy, personalizing treatment decisions, optimizing stroke unit workflows, and predicting patient outcomes, ultimately aiming to revolutionize stroke care by improving efficiency, precision, and accessibility of interventions [10].

Conclusion

Acute ischemic stroke management focuses on timely diagnosis and advanced therapeutic strategies, including thrombectomy and thrombolysis, with ongoing research aiming to expand treatment windows and personalize care [1]. Guidelines provide updated frameworks for prehospital care, emergency department evaluation, and post-treatment management, emphasizing time-sensitive interventions and multidisciplinary approaches [2]. Long-term management shifts towards comprehensive post-stroke support, secondary prevention, and rehabilitation to improve quality of life and functional independence [3]. Secondary prevention highlights managing risk factors such as hypertension, dyslipidemia, diabetes, and atrial fibrillation, advocating for personalized strategies to reduce recurrence [4].

Current approaches integrate clinical guidelines with real-world considerations, reviewing advanced imaging and optimal patient selection for reperfusion therapies, while emphasizing organized stroke systems [5]. Reperfusion therapy remains a cornerstone, with detailed criteria for intravenous thrombolysis and mechanical thrombectomy, exploring extended time windows and advanced imaging [6]. Stroke rehabilitation focuses on evidence-based practices covering motor, cognitive, and speech recovery, utilizing technology and intensive multidisciplinary efforts for long-term outcomes [7]. Blood pressure management in acute ischemic stroke is critical, guiding optimal targets before, during, and after reperfusion therapies to minimize secondary brain injury [8].

Guidance also covers intracerebral hemorrhage management, including diagnostic steps, surgical considerations, blood pressure control, and anticoagulation reversal to standardize care and improve outcomes [9]. Looking ahead, Artificial Intelligence (AI) is transforming stroke management, from prevention to rehabilitation, by enhancing diagnostic accuracy, personalizing treatment, and optimizing workflow, promising improved efficiency and accessibility [10].

Acknowledgement

Conflict of Interest

References

1. Gregory W. Albers, Max P. Marks, Steven Kemp. "Acute Ischemic Stroke: A Review of Current and Emerging Therapies." *JAMA* 322 (2019):1395-1406.

2. William J. Powers, Alejandro A. Rabinstein, Teresa N. Telegrafer. "2019 Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association." *Stroke* 50 (2019):e344-e418.

3. Gregg C. Fonarow, Weihong Pan, Eric E. Smith. "Long-Term Stroke Management and Outcomes." *J Am Coll Cardiol* 76 (2020):1093-1107.

4. Dawn O. Kleindorfer, Askiel Towfighi, Lisa A. McClure. "Secondary Prevention of Ischemic Stroke: An American Heart Association/American Stroke Association Scientific Statement." *Stroke* 52 (2021):e364-e467.

5. Dileep R. Yavagal, Andrei V. Alexandrov, Robert L. Sacco. "Management of Acute Ischemic Stroke: JACC Council Perspectives." *J Am Coll Cardiol* 79 (2022):206-218.

6. Bruce C.V. Campbell, Henry Ma, Susan Coote. "Reperfusion Therapy for Acute Ischemic Stroke: JACC Review Topic of the Week." *J Am Coll Cardiol* 81 (2023):192-202.

7. Carolee J. Winstein, Gabriel F. Wittenberg, Steven C. Cramer. "Stroke Rehabilitation: Current Evidence and Future Perspectives." *Neurology* 100 (2023):1160-1171.

8. Paul K. Whelton, Robert M. Carey, Wilbert S. Aronow. "Blood Pressure Management in Acute Ischemic Stroke." *Hypertension* 80 (2023):1676-1689.

9. J. Claude Hemphill III, Steven M. Greenberg, Craig S. Anderson. "Management of Intracerebral Hemorrhage: A Statement for Healthcare Professionals From the American Heart Association/American Stroke Association." *Stroke* 54 (2023):e185-e221.

10. Shu-Ping Gao, Ming Liu, Dan Zheng. "Artificial intelligence in stroke management: from prevention to rehabilitation." *Stroke Vasc Neurol* 9 (2024):e002621.

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