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ACUTE ISCHEMIC STROKE: RISK FACTORS, DIAGNOSIS, TREATMENT, AND REHABILITATION

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Abstract: Acute ischemic stroke (AIS) is one of the leading causes of mortality and long-term disability worldwide. It occurs when blood flow to a region of the brain is interrupted due to arterial occlusion, resulting in ischemia and neuronal injury. Rapid diagnosis and timely intervention are essential for minimizing brain damage and improving clinical outcomes. Despite significant advances in stroke management, acute ischemic stroke remains a major public health concern because of its high incidence, severe complications, and substantial socioeconomic burden. This article reviews the major risk factors associated with acute ischemic stroke, discusses current diagnostic approaches, examines modern treatment strategies, and highlights the importance of rehabilitation in promoting functional recovery.

Keywords: Acute ischemic stroke; cerebral ischemia; risk factors; thrombolysis; mechanical thrombectomy; neuroimaging; rehabilitation; cerebrovascular disease.

Introduction

Stroke is a medical emergency characterized by the sudden onset of neurological deficits resulting from disturbances in cerebral blood circulation. Among all stroke types, acute ischemic stroke accounts for approximately 80–85% of cases and represents a significant cause of death and disability worldwide.

The burden of ischemic stroke continues to increase due to population aging, the growing prevalence of cardiovascular risk factors, and lifestyle changes. Survivors frequently experience long-term physical, cognitive, and psychological impairments that substantially affect quality of life. Therefore, understanding the risk factors, diagnostic principles, treatment options, and rehabilitation strategies associated with acute ischemic stroke is essential for improving patient outcomes.

Pathophysiology of Acute Ischemic Stroke

Acute ischemic stroke occurs when cerebral blood flow is interrupted by an arterial occlusion, leading to insufficient oxygen and nutrient delivery to brain tissue. The most common causes include thrombosis, embolism, and small-vessel occlusive disease.

Reduced blood flow initiates a cascade of pathological events involving energy failure, excitotoxicity, oxidative stress, inflammation, and neuronal death. The central region of severe ischemia, known as the infarct core, undergoes irreversible injury. Surrounding this area is the ischemic penumbra, a region of potentially salvageable tissue that can recover if reperfusion is achieved promptly.

The concept of the ischemic penumbra forms the basis for modern stroke therapy, emphasizing the importance of rapid diagnosis and timely treatment.

Risk Factors for Acute Ischemic Stroke

Multiple factors contribute to the development of acute ischemic stroke. Some risk factors are non-modifiable, while others can be effectively controlled through preventive interventions.

Age is one of the strongest risk factors, with incidence increasing significantly in older populations. Genetic predisposition, sex, and family history may also influence stroke susceptibility.

Among modifiable risk factors, hypertension remains the most important contributor to ischemic stroke. Persistent elevation of blood pressure damages blood vessels and promotes atherosclerosis. Diabetes mellitus, dyslipidemia, obesity, smoking, and physical inactivity further increase stroke risk by accelerating vascular disease.

Cardiac disorders, particularly atrial fibrillation, are major sources of cerebral emboli. Other contributing factors include excessive alcohol consumption, chronic kidney disease, and certain inflammatory conditions.

The identification and management of modifiable risk factors are fundamental components of stroke prevention strategies.

Clinical Presentation

The clinical manifestations of acute ischemic stroke depend on the location and extent of cerebral injury. Symptoms typically develop suddenly and require immediate medical attention.

Common neurological deficits include unilateral weakness or paralysis, facial asymmetry, speech disturbances, sensory impairment, visual deficits, dizziness, and loss of coordination. Cognitive dysfunction and altered consciousness may occur in severe cases.

Rapid recognition of stroke symptoms is critical because treatment effectiveness is highly time-dependent. Public awareness campaigns often emphasize the importance of recognizing early warning signs and seeking urgent medical care.

Diagnosis of Acute Ischemic Stroke

Accurate and timely diagnosis is essential for determining eligibility for reperfusion therapy and preventing complications.

Clinical evaluation begins with a detailed neurological examination aimed at identifying focal deficits and assessing stroke severity. Standardized assessment tools facilitate objective evaluation and monitoring.

Neuroimaging plays a central role in diagnosis. Non-contrast brain imaging is commonly used to differentiate ischemic stroke from intracranial hemorrhage. Advanced imaging techniques can provide additional information regarding vascular occlusion, tissue viability, and the extent of ischemic injury.

Laboratory investigations assist in identifying underlying causes and evaluating risk factors. Assessment of blood glucose, coagulation parameters, lipid profiles, and cardiac function contributes to comprehensive patient evaluation.

Rapid diagnostic protocols are essential because treatment delays are associated with poorer outcomes.

Treatment Strategies

The primary goal of acute ischemic stroke treatment is to restore cerebral blood flow as quickly as possible while minimizing secondary brain injury.

Intravenous thrombolytic therapy remains a cornerstone of treatment for eligible patients presenting within the appropriate therapeutic window. Early administration can improve neurological outcomes by dissolving thrombi and restoring perfusion.

Mechanical thrombectomy has revolutionized the management of large-vessel occlusions. This minimally invasive procedure allows direct removal of occlusive thrombi and has demonstrated substantial benefits in carefully selected patients.

Supportive care is equally important and includes optimization of oxygenation, blood pressure management, glucose control, and prevention of complications such as aspiration pneumonia and deep vein thrombosis.

Secondary prevention strategies are initiated following the acute phase to reduce the risk of recurrent stroke. These measures include antiplatelet therapy, anticoagulation when indicated, lipid-lowering treatment, and aggressive management of cardiovascular risk factors.

Rehabilitation and Recovery

Rehabilitation is a critical component of stroke management and begins as early as possible after stabilization. The primary objective is to maximize functional independence and improve quality of life.

Recovery following ischemic stroke varies considerably among individuals and depends on factors such as lesion size, location, age, and comorbidities. Neuroplasticity, the brain's ability to reorganize and adapt after injury, forms the biological basis of rehabilitation.

Physical therapy helps restore motor function, strength, balance, and mobility. Occupational therapy focuses on improving activities of daily living and promoting independence. Speech and language therapy addresses communication difficulties and swallowing disorders.

Psychological support is also essential because depression, anxiety, and cognitive impairment are common among stroke survivors. Comprehensive multidisciplinary rehabilitation programs provide the greatest opportunity for successful recovery.

Future Perspectives

Recent advances in stroke research continue to improve diagnosis, treatment, and rehabilitation. Artificial intelligence-assisted imaging analysis, telemedicine-based stroke care, and personalized treatment approaches are increasingly being integrated into clinical practice.

Research into neuroprotective therapies, stem cell treatment, and advanced rehabilitation technologies offers promising opportunities for enhancing recovery and reducing disability. Continued investment in prevention programs and public education remains essential for decreasing the global burden of stroke.

Conclusion

Acute ischemic stroke is a major cause of death and long-term disability worldwide. The disease results from interruption of cerebral blood flow, leading to rapid neuronal injury and neurological dysfunction. Numerous modifiable and non-modifiable risk factors contribute to stroke development, emphasizing the importance of prevention and early intervention.

Advances in neuroimaging, thrombolytic therapy, and mechanical thrombectomy have transformed acute stroke management and significantly improved patient outcomes. Nevertheless, rehabilitation remains indispensable for maximizing functional recovery and quality of life. Continued research and innovation are expected to further improve the prevention, diagnosis, treatment, and rehabilitation of acute ischemic stroke in the future.

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