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FEATURES OF CEREBRAL HEMODYNAMICS IN ELDERLY PATIENTS WITH TRANSIENT ISCHEMIC ATTACKS

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ABSTRACT

Transient ischemic attacks (TIAs) are acute cerebrovascular events characterized by temporary neurological dysfunction resulting from focal cerebral ischemia. Elderly patients represent a particularly vulnerable population due to age-related changes in vascular structure and cerebral autoregulation. This article discusses the pathophysiological characteristics of cerebral hemodynamics in elderly individuals with TIAs, evaluates diagnostic approaches, and highlights the implications for early intervention and stroke prevention.

KEYWORDS: Transient ischemic attack, cerebral hemodynamics, elderly patients, cerebral blood flow, cerebrovascular reserve, aging brain, stroke prevention, autoregulation, transcranial Doppler, cerebral perfusion.

INTRODUCTION

Transient ischemic attacks (TIAs) are acute cerebrovascular events characterized by temporary neurological deficits resulting from focal cerebral ischemia without permanent tissue injury. In elderly individuals, TIAs are particularly significant due to the progressive decline in cerebrovascular integrity and autoregulatory function that accompanies aging. Understanding the hemodynamic characteristics specific to this population is crucial for early detection and prevention of full-blown ischemic stroke.

With age, the cerebral vasculature undergoes substantial changes. There is a reduction in arterial elasticity and a concurrent increase in vascular stiffness. Endothelial dysfunction becomes more pronounced, resulting in decreased nitric oxide bioavailability, while cerebral autoregulation—the brain's ability to maintain constant perfusion despite blood pressure fluctuations—is often impaired. These physiological alterations make the elderly more susceptible to transient episodes

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of cerebral hypoperfusion, especially in the presence of risk factors such as carotid atherosclerosis, atrial fibrillation, or systemic hypotension.

Hemodynamic analysis in elderly patients who experience TIAs reveals several distinct features. First, cerebral blood flow is often diminished, particularly in regions dependent on collateral circulation or in areas downstream from stenotic arteries. There is frequently a notable asymmetry in perfusion between the hemispheres, and compensatory vasodilation, a critical mechanism to maintain adequate perfusion during reduced flow states, is typically blunted or absent. Additionally, the cerebral vascular resistance is elevated due to chronic vessel remodeling and calcification. This combination of impaired autoregulation and diminished vascular reserve severely limits the brain's ability to respond to ischemic stress.

Assessment of cerebral hemodynamics in this patient group relies on non-invasive diagnostic modalities. Transcranial Doppler ultrasound is widely used to evaluate blood flow velocity in basal cerebral arteries and to detect microembolic signals. More detailed imaging through magnetic resonance angiography, CT angiography, and perfusion studies helps identify regions at risk and evaluate the adequacy of collateral circulation. In select cases, cerebrovascular reactivity tests using hypercapnic challenges or vasodilatory agents provide insight into the functional reserve of cerebral vessels.

The clinical significance of these hemodynamic disturbances is profound. Elderly patients with TIAs are at markedly increased risk for subsequent ischemic strokes. Therefore, early therapeutic intervention is imperative. Management strategies include antiplatelet or anticoagulant therapy depending on underlying pathology, optimal control of blood pressure without inducing hypotension, statin administration to stabilize atherosclerotic plaques, and lifestyle interventions to reduce modifiable risk factors. In cases of significant carotid stenosis, surgical or endovascular intervention may be warranted, guided by individual hemodynamic findings.

In conclusion, the study of cerebral hemodynamics in elderly patients with transient ischemic attacks reveals a pattern of compromised perfusion regulation, decreased vascular reserve, and increased stroke susceptibility. Recognition of these features through appropriate diagnostic techniques allows for timely and individualized treatment, thereby improving outcomes and reducing the incidence of disabling strokes in this vulnerable population.

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