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PATHOPHYSIOLOGICAL AND NEUROLOGICAL ASPECTS OF CHRONIC CEREBRAL ISCHEMIA

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Abstract: Chronic cerebral ischemia is one of the most common neurological disorders associated with long-term insufficiency of cerebral blood circulation. The disease develops gradually and leads to structural and functional damage of brain tissue, resulting in cognitive impairment, emotional instability, vestibular disorders, and decreased quality of life. Modern clinical studies indicate that chronic cerebral ischemia is closely related to arterial hypertension, atherosclerosis, diabetes mellitus, and age-related vascular changes. The pathophysiological mechanisms of chronic cerebral ischemia include prolonged hypoxia, endothelial dysfunction, impaired microcirculation, oxidative stress, and neuronal degeneration. These pathological processes contribute to progressive neurological deficits and chronic impairment of brain function. Early diagnosis and timely therapeutic intervention are essential for preventing severe complications such as vascular dementia and ischemic stroke.

Keywords: Chronic cerebral ischemia, neurological disorders, cerebral hypoxia, cognitive impairment, vascular pathology, endothelial dysfunction, chronic brain ischemia, neurodegeneration, cerebral circulation, ischemic stroke prevention

Chronic cerebral ischemia is a multifactorial neurological disorder characterized by progressive impairment of cerebral blood circulation and gradual deterioration of brain function. The condition develops as a result of long-term vascular insufficiency, which reduces oxygen and nutrient delivery to neural tissues. Persistent hypoperfusion causes metabolic imbalance, neuronal damage, and structural alterations within the brain. The disease is commonly associated with arterial hypertension, cerebral atherosclerosis, diabetes mellitus, cardiac pathology, and age-related vascular degeneration. These

factors negatively affect cerebral hemodynamics and contribute to chronic ischemic changes in brain tissue. One of the main pathophysiological mechanisms of chronic cerebral ischemia is endothelial dysfunction. The vascular endothelium plays an important role in maintaining normal cerebral blood flow and vascular tone. Damage to endothelial cells leads to impaired vasodilation, increased vascular permeability, and activation of inflammatory processes. As a result, cerebral microcirculation becomes insufficient, and neuronal tissues experience prolonged hypoxia. Chronic oxygen deficiency disrupts mitochondrial energy metabolism and stimulates excessive production of reactive oxygen species, leading to oxidative stress and cellular injury. Another important mechanism is cerebral atherosclerosis, which causes narrowing and hardening of cerebral arteries. Atherosclerotic plaques reduce vascular elasticity and obstruct blood flow to the brain. In addition, hypertension contributes to pathological remodeling of cerebral vessels and impairs autoregulation of cerebral circulation. Under these conditions, neurons become highly vulnerable to ischemic injury, particularly in white matter structures and deep subcortical regions of the brain. Gradual destruction of neural pathways leads to cognitive dysfunction and neurological deficits. Neurologically, chronic cerebral ischemia presents with a wide spectrum of clinical manifestations. In the early stages, patients often complain of recurrent headaches, dizziness, fatigue, irritability, sleep disturbances, and decreased working capacity. Mild cognitive impairment is also common and includes reduced attention, memory problems, slower information processing, and impaired concentration. Because these symptoms progress gradually, many patients initially underestimate their severity. As the disease advances, neurological symptoms become more pronounced. Patients may develop gait instability, impaired coordination, tremor, muscle weakness, and vestibular disorders. Emotional disturbances such as anxiety, depression, apathy, and emotional lability are frequently observed. Chronic ischemic damage to frontal-subcortical pathways contributes significantly to behavioral and cognitive deterioration. In severe stages, patients may experience vascular dementia characterized by substantial decline in intellectual abilities, memory loss, impaired social adaptation, and reduced independence in daily activities. Neuroimaging studies play an important role in the diagnosis of chronic cerebral ischemia. Magnetic resonance imaging often reveals diffuse white matter lesions, lacunar infarctions, cortical atrophy, and chronic ischemic changes in subcortical structures. Doppler ultrasonography is useful for evaluating cerebral blood flow and detecting vascular stenosis. Neuropsychological assessment also helps determine the degree of cognitive impairment and neurological dysfunction. Early diagnosis is essential for preventing

progression of irreversible brain damage. Management of chronic cerebral ischemia requires a comprehensive therapeutic approach.

Conclusion

Chronic cerebral ischemia is a progressive neurological disorder caused by long-term impairment of cerebral blood circulation and chronic oxygen deficiency in brain tissues. The disease develops gradually and is closely associated with vascular risk factors such as arterial hypertension, atherosclerosis, diabetes mellitus, and age-related vascular changes. Pathophysiological mechanisms including endothelial dysfunction, oxidative stress, impaired microcirculation, and neuronal degeneration play a major role in the progression of cerebral ischemic damage. Clinical manifestations of chronic cerebral ischemia include cognitive impairment, headaches, dizziness, emotional instability, sleep disorders, gait disturbances, and decreased neurological function. In advanced stages, the disease may lead to severe cognitive decline, vascular dementia, and increased risk of ischemic stroke. Because the pathological process progresses slowly, early diagnosis remains difficult but extremely important for preventing irreversible brain injury. Modern neuroimaging methods and neurological assessment techniques provide valuable opportunities for early detection and monitoring of chronic cerebral ischemia.

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