

Exploring the Protective Mechanisms of Hypoxia Preconditioning in Cardiac Tissue

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Abstract

Hypoxia preconditioning (HPC) is a promising strategy to mitigate the detrimental effects of ischemia in cardiac tissue. This study aimed to investigate the protective mechanisms of HPC by examining its effects on cellular metabolism, gene expression, and antioxidant response. We employed a murine model of cardiac ischemia and subjected half of the animals to a brief period of hypoxia before inducing ischemia. Our results demonstrated that HPC significantly reduced infarct size and improved cardiac function post-ischemia. Mechanistically, HPC upregulated the expression of hypoxia-inducible factors (HIFs), which in turn activated genes involved in angiogenesis and metabolic adaptation. Additionally, HPC enhanced the cellular antioxidant capacity by increasing the expression of superoxide dismutase and catalase. These findings suggest that HPC induces a protective cellular response by modulating metabolic pathways and antioxidant defenses, thereby providing a potential therapeutic approach for ischemic heart disease. The study's limitations include the need for further investigation into the long-term effects of HPC and its applicability in human cardiac conditions.

Keywords

Hypoxia Preconditioning, Cardiac Ischemia, HIFs, Metabolic Adaptation, Antioxidant Defense