低酸素および再酸素化における心筋ミトコンドリア酸化的リン酸化活性の不可逆的変化

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Irreversible changes in oxidative phosphorylation activity of the mitochondrial membrane from hearts subjected to hypoxia and reoxygenation

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ABSTRACT: The present study was designed to elucidate irreversible biochemical changes in the mitochondrial membrane of hearts subjected to hypoxia and subsequent reoxygenation in a rabbit heart Langendorff preparation. Significant changes in the mitochondrial calcium uptake, ATPase, and oxidative phosphorylation activities were seen in the heart receiving 30 to 60 min of hypoxic perfusion. These changes were accompanied by deleterious alterations in contractile function. Among hypoxia-induced changes in biochemical activites of isolated mitochondria, only oxidative phosphorylation activity was found to be irreversible upon reoxygenation. This is compatible with the findings of reoxygenation-induced incomplete recovery of tissue ATP level, once decreased by hypoxic perfusion. In the electron microscopic study, the heart receiving 60 min of hypoxic perfusion showed contracted sarcomeres, vacuolization and electron lucency of the mitochondria which were not restored by the subsequent reoxygenation. The results suggest that an inability of the mitochondrial membrane to produce high-energy phosphate primarily induces lack of ATP required for cardiac mechanical activity and membrane integrity, which in turn leads to the impairment of myocardial cell funtion.

抄録　低酸素負荷および、その後の再酸素化時における心筋ミトコンドリア膜の生化学的変化を検討した。低酸素負荷を30-60分間行なうとミトコンドリアのカルシウム uptake 能、ATPase, 酸化的リン酸化能の著しい変化が見られ、それに伴う現象として心収縮力低下、高エネルギーリン酸合物の減少が起こった。その後、再酸素化を行なっても酸化的リン酸化能、高エネルギーリン酸化合物量の回復は望めなかった。この不可逆性は組織電子顕微鏡的検索においても確認された。以上の結果は低酸素状態におかれた心筋細胞におけるミトコン

ドリア膜の障害が心筋エネルギー代謝を悪化させ、心機能を低下させることを示唆した。

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