血管內皮細胞在高磁場環境下之生物效應

許博翔

摘要

磁振造影以高磁場及射頻共振原理，在臨床上提供高解析度的醫學影像，相較於電腦斷層使用 x-ray 所產生之高輻射劑量，其不具輻射劑量，是目前放射影像技術中，可兼顧影像品質與輻射安全的方法。目前主流磁振造影儀器磁場強度 3 Tesla，為生活環境中地磁之六萬倍。高磁場強度對人體是否所造成影響，是未來儀器發展之重要規範。血管是人體養份及代謝物運輸的管道，而血管內皮細胞在相關分子交換過程扮演重要角色。因此，本研究主要探討高磁場環境下，對血管內皮細胞生長之影響。結果顯示，血管內皮細胞在 3 T 高磁場下之存活率、傷口癒合速率及細胞形態並無顯著差異。在以奈米螢光粒子作為追蹤標的監控血管內皮細胞對奈米螢光粒子攝取量之結果顯示，高濃度(250 μg/ml) 奈米螢光粒子在作用 6 小時後會影響細胞存活，而低濃度(25 μg/ml) 則對內皮細胞存活率無顯著影響。在 3 T 磁場環境下，血管內皮細胞對於奈米粒子，在 30、60、120 分鐘之攝取量有顯著增加。本研究探討高磁場環境對於細胞生理活性之影響，將有助於高磁場之安全規及藥物動力學上之應用。

關鍵詞：磁振造影、3 Tesla、血管內皮細胞、奈米螢光粒子

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The Bioeffects of Endothelial Cell in High magnetic Field

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Abstract

Magnetic resonance imaging (MRI) is a technology using high magnetic fields and radio frequency resonance. It provides high-resolution medical imaging in clinical practice without the involvement of radiation. The magnetic field strength of mainstream MRI instrument is 3 Tesla which is sixty thousand times higher than that of geomagnetic environment. The biologic effect associated with the exposure of high magnetic field therefore becomes and important issue for medical device. The endothelial cells are the inner layer of blood vessels which play an important role in nutrient and metabolite exchanged. High magnetic effects of endothelial cells were investigated in this study. The results of cell morphology observation, MTT cell viability and wound-healing assay show that no significant difference was observed between controls and cells under 3 Tesla magnetic fields exposure. Uptake of fluorescent nanoparticles by vascular endothelial cells was also investigated. Cell viability was reduced in the presence of 250 μg/ml nanoparticle, but no significant change was observed in 25 μg/ml nanoparticle. The exposure of 3 T magnetic environments also leads to the increase of nanoparticles uptake by vascular endothelial cells. The results presented in this study might refer to the practical applications of high magnetic field safety.

Keywords: magnetic resonance imaging, 3 tesla, endothelial cell, fluorescent nanoparticles