Redefining MRI:
From Image to Insight

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기능자기공명영상 (Functional MRI)

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7T Human fMRI Applications

SoHyun Han

Korea Basic Science Institute (KBSI), Korea

High spatial resolution functional MRI (fMRI) allows the investigation of mesoscopic cortical functional units, such as columns and laminae. Since the size of these small structures is at a range of submillimeter, both signal-to-noise ratio (SNR) and spatial specificity of fMRI-signals becomes critical. Generally, gradient-echo (GE) blood oxygenation level-dependent (BOLD) signal is the most popular method due to its high SNR and ease of implementation. However, the GE-BOLD signal is highest at the surface of the cortex due to the high density of draining veins, which is distal to neuronal activation. For this reason, GE-BOLD may not be optimal for mapping submillimeter functional structures. On the other hand, the spin-echo (SE)-BOLD signal is expected to be localized within gray matter with higher spatial accuracy. However, the SE-BOLD-signal suffers from lower sensitivity compared to GE-BOLD-signal, especially at high spatial resolution. In this presentation, I introduce new methodologies to improve sensitivity of SE-type BOLD fMRI signal and its applications for laminar and columnar fMRI. Several applications using those sequences will be shown and developed new methodologies provided enhanced laminar specificity and sensitivity in the gray matter region, making it an efficient tool for high spatial resolution fMRI studies to resolve mesoscopic functional units.

Keywords: *Laminar fMRI, Spin-echo, High-resolution*