MR Diffusion Tensor Imaging Applied to the Spinal Cord of Patients with Neuropathic Pain Secondary to Herpes Zoster Infection

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Abstract

The study explores the utility of diffusion tensor imaging (DTI) in elucidating microstructural spinal cord alterations associated with postherpetic neuralgia (PHN), a condition traditionally attributed to peripheral nerve and root damage but increasingly recognized for its central nervous system involvement. By quantitatively assessing fractional anisotropy (FA) and apparent diffusion coefficient (ADC) metrics in the spinal cords of fifteen subjects—ten with PHN and five with herpes zoster (HZ) absent of chronic pain—the research delineates significant microstructural disparities correlating with neuropathic pain manifestation. The cohort comprised predominantly females, with PHN patients averaging 72.2 years and the HZ-only group 60.8 years. Findings revealed elevated ADC values at spinal levels C5, T8, and T9, indicating increased diffusivity likely reflective of disrupted white matter integrity in PHN patients. Concurrently, FA values were diminished at T7, T8, and T9 levels, signifying a loss of anisotropic water diffusion consistent with microstructural compromise. Notably, receiver operating characteristic (ROC) curve analyses identified the T8 spinal level as a robust discriminator for PHN presence, with ADC demonstrating an area under the curve (AUC) of 0.960 and FA an AUC of 0.920, both statistically significant. Optimal cutoff thresholds for ADC (2455.08) and FA (395.05) yielded high sensitivity and specificity, underscoring their diagnostic potential. These results imply that DTI-derived parameters are sensitive biomarkers for detecting spinal cord microarchitectural alterations in PHN, providing a non-invasive window into central neuropathic mechanisms. The study advocates for expanded investigations with larger cohorts to substantiate these preliminary findings.

Keywords

Diffusion Tensor Imaging; Fractional Anisotropy; Herpes Zoster; Postherpetic Neuralgia; Spinal Cord.