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Novel Imaging of the Intervertebral Disk and Pain

Abstract

T-1-rho (T1ρ) magnetic resonance imaging (MRI) and disc height ratio (DHR) are potential biomarkers of degenerative disk disease (DDD) related to biochemical composition and morphology of the intervertebral disk (IVD), respectively. To objectively detect DDD at an early stage, the hypothesis was tested that the average T1ρ relaxation time of the nucleus pulposus (NP) correlates with the disk height of degenerate IVDs, measured by MRI. Studies were performed on a 3-T Siemens Tim Trio clinical MRI scanner (Siemens Healthcare, Malvern, Pennsylvania, United States) on patients being treated for low back pain whose disks were categorized into (1) painful and (2) nonpainful subgroups based on provocative diskography and (3) age-matched healthy controls. Painful disks presented both low DHR and T1ρ values, nonpainful disks measured the highest DHR and extended to a higher range of T1ρ, and control disks presented a midrange DHR with the highest T1ρ values. T1ρ MRI evaluated in the NP of IVDs may be useful to establish a threshold (120 milliseconds here) above which indicates a healthy disk, and disks measuring low NP T1ρ (50 to 120 milliseconds here) would require disk height analysis to further categorize the disk. Combining T1ρ MRI and disk height analysis may hold promise in predicting painful disks without provocative diskography, and predictive models should be developed.

疼痛椎間盤的新型成像

T-1-RHO（T1 ρ ）磁力共振成像（MRI）和椎間盤高度比例（DHR）是退變性椎間盤疾病（DDD）的生物標誌，分別與椎間盤（IVD）的生化組成物和形態有關。要客觀地檢測早期階段的 DDD，的平均的 T1 ρ 髓核（NP）鬆弛時間與退變性 IVD 高度關聯的假設已利用 MRI 作測試。 研究使用 3-T Siemens Tim Trio clinical 磁力共振掃瞄機（西門子醫療，馬爾文，賓夕法尼亞州，美國）於正在接受治療腰痛的退變性 IVD 患者，他們分類為（1）痛楚;（2）根據椎間盤造影的無痛楚分組和（3）年齡配合的健康對照。痛楚的椎間盤呈現低 DHR 和 T1ρ 值，無痛楚椎間盤呈現最高的 DHR 和擴展至較高範圍的 T1ρ，對照的椎間盤呈現中檔 DHR 和最高的 T1ρ 值。NP 和 IVDs 的 T1ρ MRI 鑑定對建立一個閾可能是有用的（這裡是 120 毫秒）高於此表示健康的椎間盤，而椎間盤量度到低的 NP T1ρ（這裡是 50～120 毫秒），需要進行椎間盤的高度分析，以進一步分類的椎間盤。結合 T1ρ MRI 和椎間盤高度分析可能更準確預測痛楚的椎間盤而不需進行椎間盤造影，而且應預建立測模型。