OBJECTIVE MEASUREMENT OF MYELIN IN THE DORSAL COLUMNS AND SPINOthalamic TRACT: IMPLICATIONS FOR ASSESSING NEUROPATHIC PAIN AFTER SPINAL CORD INJURY

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INTRODUCTION / AIM

The dorsal columns and spinothalamic tracts convey light touch and noxious input from the periphery to the brain via myelinated A-beta and unmyelinated C-fibres, respectively. After spinal cord injury (SCI), sensory impairments specific to the pathways damaged emerge. Diffuse damage in the spinal cord may also lead to below-level neuropathic pain. However, the type of damage associated with neuropathic pain after SCI is poorly understood. Using non-invasive neuroimaging in humans, we examined differences in central nervous system microstructure of the dorsal columns and the spinothalamic tract. We hypothesized that myelin content would be higher in the dorsal columns compared to the spinothalamic tract.

METHODS

Healthy subjects (n=10) were scanned on a 3.0T MRI Philips system with a phased-array spine coil. MRI data included cervical cord myelin water imaging (3D 32-echo, TE/TR=10/1300ms, six 5mm axial slices, reconstructed resolution= 0.63x0.63x5.0mm3) and a high-resolution anatomical scan (multi-echo fast gradient echo (mFFE), TE/TR=6.6/814ms, reconstructed resolution=0.29x0.29x2.5mm). Regions of interest were obtained by registering the mFFE scan to the MNI-POLY-AMU spinal cord template from the Spinal Cord Toolbox.

RESULTS

Segmentation of the dorsal columns (fasiculus cuneatus and gracilis) and spinothalamic tract was performed successfully for all subjects. Myelin content was significantly higher in the dorsal columns (cuneatus=0.28+/- 0.02 and gracilis=0.26+/- 0.01) relative to the spinothalamic tract (0.24+/-0.02).

DISCUSSION / CONCLUSIONS

Myelin water imaging of the spinal cord can detect differences in the microstructure of discrete somatosensory spinal cord pathways. Coupled with neurophysiological techniques, our approach can examine patterns of damage in central afferent pathways associated with below level neuropathic pain after SCI.

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