

## Ultra-High Field Brainstem and Cervical Spinal Cord Imaging

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The cervical spinal cord, together with supraspinal brainstem circuits, conveys important sensorimotor information between the cortex and body. However, delineation of the brainstem nuclei and cervical spinal cord grey matter, let alone examination of their functional roles, has been challenging at conventional field strength due to their small sizes. Recently, we have designed and constructed a two-panel (anterior-posterior) ultra-high field (7T) radiofrequency (RF) coil with 4 transceive (Tx/Rx) and 18 receive (Rx) elements that overcomes the limitations of existing 7T cervical spinal cord coils, allows the peak RF transmit power ( $B_1+$ ) to be localized near the spinal cord and brainstem, and achieves excellent receive sensitivity and large superior-inferior coverage.

To demonstrate the performance of this coil for 7T brainstem and cervical spinal cord imaging, axial GRE images with  $0.30 \times 0.30 \times 3.00$  mm resolution were acquired at multiple locations spanning from the midbrain to the distal medulla (Fig. 1) and C1 to C7 spinal cord segments (Fig. 2) with exquisite anatomical detail. A sagittal GRE image of the brainstem and cervical spinal cord was also acquired with a  $300 \times 197$  mm field of view (FOV) at  $0.78 \times 0.78 \times 3.00$  mm resolution.  $B_1+$  efficiency was mapped using the double-angle method. Additionally, our two-sided 22 channel coil allows focusing of peak  $B_1+$  to adapt to the depth of the subject's cervical spinal cord beneath the body surface.

This coil array enables high-resolution structural and functional MRI covering both the brainstem and spinal cord at 7T.

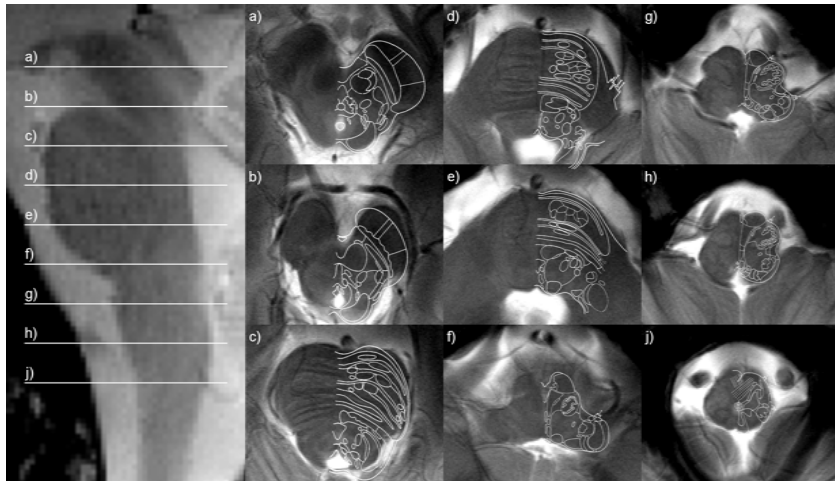


Figure 1: Sagittal GRE image of the brainstem (left) with high-resolution axial GRE images at several levels (right), overlaid with atlases from "Duvernoy's Atlas of the Human Brain Stem and Cerebellum."

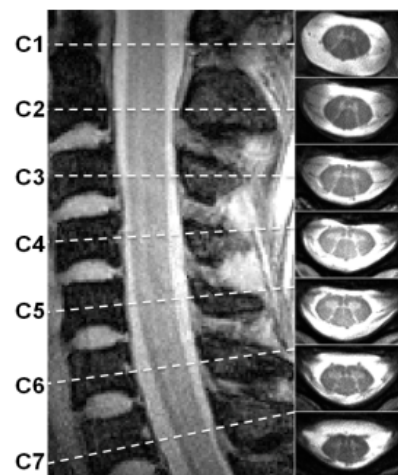


Figure 2: Sagittal GRE image of the cervical spinal cord (left) with high-resolution axial GRE images from C1 to C7 (right).