Novel MRI Sequence on 3T Accurately Depicts the Osseous Segments of Cranial Nerves VII-VIII: A Pilot Study

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INTRODUCTION

3D FSE Cube is a multi-echo FSE sequence using long echo trains with variable flip angles to maintain high signal at a relatively long TE. We seek to report our initial experience using a novel developed 3D FSE Cube sequence incorporated with FLAIR and fat saturation for imaging of the cranial nerves VII-VIII and its comparison with conventional 3D CISS sequence.

METHOD AND MATERIALS

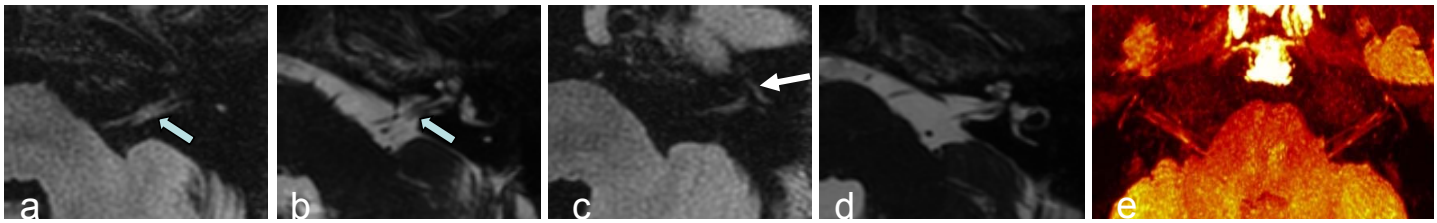
6 healthy volunteers (24-49 y) with institutional review board approval and informed consent underwent imaging of the cranial nerves (VII-VIII) with a 3.0-T MRI (Signa, GE Healthcare). A novel 3D FSE Cube incorporated with FLAIR and fat saturation was performed as well as the conventional 3D CISS sequence. Axial 3D FSE Cube FLAIR was performed with TR=5000 ms; TE=101.6 ms; TI= 1676 ms; matrix =320x320; FOV=22cm; slice thickness=0.7 mm; 140 slices/slab; scan time 15:00. 3D CISS was performed with exactly the same parameters as 3D CUBE except for the TR 5ms; TE 2.4ms and scan time 5:20. Source images and reformatted axial (2mm), Sagittal (2mm) and Coronal (4mm) images of 3D FSE Cube FLAIR and 3D CISS were evaluated by 2 experienced neuroradiologists independently, for depiction of cranial nerve segments in the CSF cistern, IAC and petrous bone, using a 5 grade scale: 1: invisible; 2: partially visible; 3: entire course visible; 4: partially clearly visible; 5: entire course clearly visible.

RESULTS

Compared with 3D CISS, 3D FSE-Cube FLAIR images were rated higher (4.2 vs 2.35, FSE-Cube FLAIR vs 3D CISS, respectively) for depiction of the osseous petrous segments of both the cranial nerves VII and VIII. There was equal depiction of the cisternal (4.6 vs 4.57) and IAC (4.4 vs 4.3) segments. Reformatted axial, sagittal and coronal 3D FSE-Cube FLAIR further significantly enhanced the visualization of these cranial nerves compared to 3D CISS.

CONCLUSION

3D FSE-Cube FLAIR sequence demonstrates clear superior ability to demonstrate the osseous petrous segments of the cranial nerves VII-VIII. These cranial nerves in their osseous petrous segments were visualized more clearly and over a longer course. Furthermore, reformatted images significantly enhance the ability to delineate the above nerves. This is both clinically significant and meaningful as until now the osseous portions of cranial nerves VII-VIII are unable to be accurately evaluated on MRI due to inability to adequately visualize these. The ability to see these on a FLAIR sequences allows for not only clearer depiction of its course but more importantly detection of subtle cranial nerve pathology. Until now, CT has been used to evaluate osseous segments based on changes in size; this sequence will allow for detection of changes in intensity affording earlier detection of pathological involvement.



With suppression of the signals from water and fat, the cranial nerves become bright and are more clearly visualized on 3D CUBE FLAIR images (a, c) than on corresponding 3D CISS images (b, d). The IAC segment of the VII and VIII nerves (arrow in a and b) are better delineated on axial reformatted 3D CUBE FLAIR image (a) than on axial reformatted 3D CISS image (b). The geniculate ganglion of the VII nerve can be clearly visualized on 3D CUBE FLAIR image (arrow in c), but not well visualized on 3D CISS image (d). Thick slab reformatted image (e) display the the VII and VIII nerve in the CP angle and intrapetrous portion.