Evaluation of Intraneural Ganglion Cysts Using 3D FSE-Cube

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Purpose: It is often difficult to definitively diagnose intraneural ganglion cysts with conventional MR imaging and to identify the origin of the cyst in a joint via what may often be a subtle connection [1]. Identification of the joint connection has important clinical implications if it is not addressed surgically, such as: cyst recurrence, incomplete patient recovery, and suboptimal operative outcomes [2-4]. The ideal acquisition for imaging these cysts would be a 3D acquisition with isotropic spatial resolution that would achieve optimum reformatting in all areas within a reasonable scan time. A recently developed technique of a fast-recovery 3D FSE with an extended echo-train acquisition (Cube) overcomes many of the previous imaging shortcomings and meets the above criteria [5]. It is the purpose of this study to demonstrate the clinical utility of 3D FSE-Cube in the evaluation of intraneural ganglion cysts and the important joint connection.

Methods: Conventional T2-weighted MRI with fat suppression was compared with 3D FSE-Cube techniques in six individuals with intraneural ganglion cysts about the knee. Five patients had primary peroneal intraneural ganglion cysts and one had an atypical recurrent intraneural ganglion cyst combined with an adventitial portion involving the posterior tibial vein.
Cube is a single-slab 3D-FSE imaging sequence that applies modulated refocusing flip angles that enables very long echo trains to generate T2-weighted images with reduced blurring and low SAR. Conventional FSE uses relatively short echo trains, which would require prohibitively long scan times if isotropic resolution were to be pursued. By modulating the flip angle of the refocusing pulses, the Cube sequence reshapes the signal decay curve and thus many more echoes can be used for efficient image formation without resulting in blurring.
Cube images were acquired in the axial and coronal planes with TR/TE 2500/18ms, matrix 256 x 256, NEX 0.5, field of view 240cm, bandwidth 41.7 kHz, and slice thickness 1.4mm - resulting in near isotropic resolution. Partial Fourier acquisition and ARC parallel imaging techniques were employed. Images were reconstructed using maximum intensity projection (MIP) and rotating views.

Results: Both 3 Tesla T2-weighted MRI with fat suppression and 3D FSE-Cube demonstrated the intraneural ganglion cyst involving the common peroneal nerve in all six cases. Visual evidence of the cyst's connection to a joint was demonstrated on one of the T2-weighted studies and in all of six of the Cube studies. The diagnosis was confirmed and treated surgically in all cases.

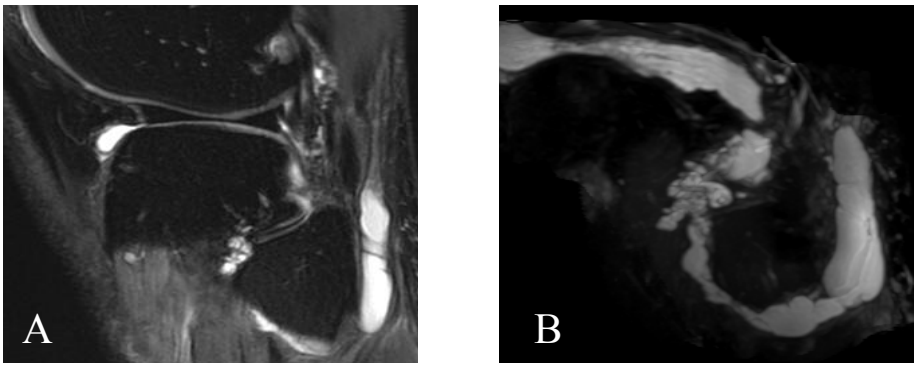

Figure A. Oblique sagittal T2-weighted (TR 3716ms, TE 65ms) FSE MR image with fat suppression shows a multiloculated cyst involving the common peroneal nerve at the level of the fibular head. Cystic involvement of the superior tibiofibular joint can be seen, but the connection is not visualized in this plane or any other in the series. **Figure B.** 3D FSE-Cube (parameters above) MIP at the same level demonstrates the full extent of the cyst (U-sign) including the communication to the superior tibiofibular joint.

Discussion: Results from the comparison of conventional T2-weighted MRI and Cube clearly show the superiority of the 3D rendering technique. In all cases, the anatomical extent of the intraneural ganglia could be better appreciated using Cube. This technique also provided direct visualization of the cyst's connection with the superior tibiofibular joint in all cases. Given the relatively short scan times and ease of image reformatting, this technique is feasible in the clinical setting. The improved anatomical illustration over conventional imaging would suggest that, in addition to intraneural ganglion cysts, this technique can be applied to other subtle clinicopathological entities.

References: [1] K. Amrami, et al. 2007, JMRI, 26: 768-772. [2] R. Spinner, et al., J Neurosurgery 2003, 33: 187-209. [3] R. Spinner, et al., J Neurosurgery 2006, 59:157-166. [4] R. Spinner, et al., Neurosurgical Focus 2007, 22(6): E16. [5] G. Gold, et al., AJR 2007, 188(5): 1287-93