Faster MRI imaging of perianal fistulas through a limited sequence protocol based on high-resolution free-breathing post-contrast imaging, with comparison to standard care

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Target Audience: Clinicians who utilize MRI in the evaluation of perianal fistulas. Researchers interested in free-breathing post-contrast imaging in the pelvis.

Purpose: Standard recommendations for MRI of perianal fistulas include 2-3 planes of T2, a plane of T2 with fat saturation (FS), and 1-2 planes of pre and post-contrast T1 [1]. In our experience, the T2 imaging alone requires >20 minutes of scan time, with an average study taking 30-40 minutes. We investigated whether imaging of perianal fistulas could be accomplished utilizing a stream-lined sub 15-minute protocol consisting of a single plane of T2 with fat saturation, plus a single high-resolution free-breathing post-contrast 3D SPGR sequence.

Methods: With IRB approval we retrospectively identified 10 consecutive patients referred for MRI evaluation of perianal fistulas over a 6-month period with the required imaging components: axial FSE T2 FS (TE 100 ms, 416x224), sagittal/axial oblique/coronal oblique FSE T2 small field of view (sFOV) (TE 120 ms, 512x256, slice spacing 4-mm), axial SPGR pre and post-contrast with two-point DIXON water/fat phase separation (LAVA-flex, 320x224, slice spacing 3-mm, ARC 4), and a high-resolution free-breathing post-contrast 3D SPGR sequence with intermittent fat suppression. Studies were performed at 3 Tesla, and field of view was adjusted to patient anatomy except for the sFOV sequences where it was set to 22-cm.

The 3D SPGR sequence was modified to acquire Cartesian k-space data with a radial ordering to disperse respiratory artifacts [2], and utilizes an intermittent spectrally-selective inversion recovery fat suppression. This sequence was acquired axially during free-breathing with a matrix of 416x416, slice spacing of 0.6-mm, without acceleration, and a scan time of 4-5 min.

Each exam was divided into two bundles. The first "conventional" bundle consisted off all T2 sequences, plus pre/post-contrast LAVA-Flex sequences. The second "fast" bundle consisted only of the axial T2 FS and the 3D SPGR sequences. For the "fast" bundle, axial/coronal/sagittal oblique reformats generated from the 3D SPGR sequence were provided. Two readers were utilized who were assigned either the conventional bundle or the fast bundle from each patient in an alternating manner. Readers were asked to determine the course of each fistula including the relation to the levators/Parks classification [3], and the presence of Setons, pockets of undrained fluid, and coccygeal involvement. Readers assigned a confidence measure from 1 (poor) to 4 (high) for each finding. In the case of a discrepancy between the two reads, the official read (utilizing all sequences) and operative reports were utilized to determine the base truth. For the purposes of calculation, incorrect findings were rescored as a "1" on the confidence scale. The null hypothesis of no significant difference was assessed with a Wilcoxon signed rank test, with two-tailed $p<0.05$ considered significant.

Results/Discussion: Examples of image quality are shown in Fig 1 and Fig 2. There were no significant differences between the two protocols for any of the assessed parameters, although a trend favored the fast protocol (Fig 3). Seven discrepancies in reads between the two protocols were present, all due to errors from the conventional protocol. Two were incorrectly identifying the presence or absence of a Seton, 2 were incorrectly identifying or missing infectious/inflammatory changes of the coccyx, 2 were missing secondary exit points, and 1 was incorrectly locating the fistula entry site.

Fig 1: Representative axial sequences showing a fistula anterior to the anus. Only the 3D SPGR sequence visualized the anterior entry site of the fistula, on other sequences its presence could only be inferred due to the adjacent fistula tract.

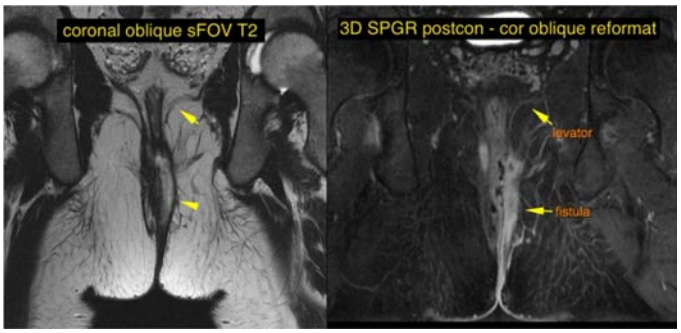

Fig 2: Representative coronal sequences show the levator ani, and a fistula taking a course parallel to the anus.

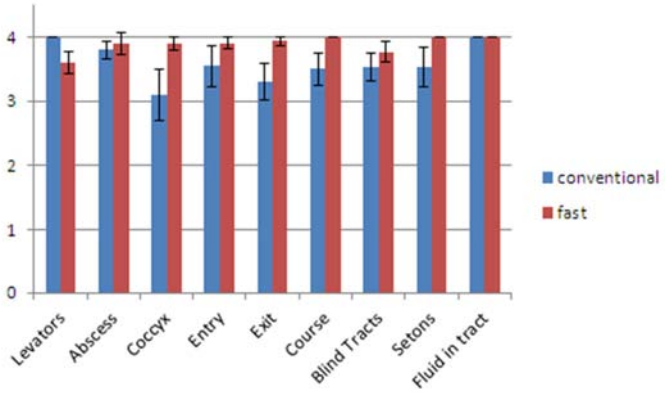

Fig 3: Confidence scores for the conventional and fast protocols for the following findings: location of the levators, presence of abscesses, infection/inflammation of the coccyx, fistula entry/exit/course, blind fistula tracts, Setons, and fluid in fistula tracts.

Conclusion: A potential limitation to this study is that due to practice patterns at our institution most of the patients referred for MRI evaluation are already postoperative, with MRI performed for evaluation of treatment failure rather than as initial evaluation. Nonetheless, the use of a fast protocol utilizing a high-resolution free-breathing post-contrast sequence was equivalent to a conventional protocol in the evaluation of perianal fistulas. This greatly reduces total scan time from 30-40 min to less than 15 min, and may in fact improve diagnostic accuracy.

References:

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