The Value of 3D eTHRIVE in the Diagnosis of Early Rheumatoid Arthritis of the Hand at 3T

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Introduction: Early diagnosis is essential for improving clinical outcomes in patients with rheumatoid arthritis (RA). MR imaging (MRI) has demonstrated greater sensitivity for the detection of synovitis and bone erosions than clinical examination or conventional radiography. On the other hand, recent technical development of 3D GRE sequences (THRIVE, VIBE, or LAVA) enables high-resolution contrast-enhanced MRI of the liver and the breast with thin-slice thickness and excellent fat suppression. The purpose of this study was to evaluate the value of 3D eTHRIVE in the diagnosis of early RA of the hand at 3T.

Materials and Methods: Fifty-five patients who fulfilled the ACR criteria for RA were studied with a 3.0T Achieva X-series scanner (Philips Medical Systems, Best, The Netherlands).   Gadolinium–enhanced T1-weighted images with fat suppression were obtained with 3D eTHRIVE (TR/TE 4.2 ms/1.97 ms, resolution 0.8 x 0.8 x 0.5 mm3, 120 slices, 2 min 31 sec) and conventional 2D FSE sequences (TR/TE 554 ms/8 ms, resolution 0.8 x 0.8 x 2 mm3, 24 slices, 2 min 46 sec). For the qualitative comparison between two sequences, depiction of synovial enhancement and bone erosions, homogeneity of fat suppression and delineation of various fine anatomical structures adjacent to RA lesions (such as small vascular structures, nutrient foramina of the carpal bones, and intraosseous ligament insertions) were reviewed independently by two radiologists with a four-point scale (a score of 1 indicated poor and a score of 4, excellent).

Results :   Individual scores (mean±SD) were shown in Table 1. 3D eTHRIVE tended to depict RA lesions and fine anatomical structures more clearly than conventional 2D FSE . Homogeneity of fat suppression tended to be also superior with 3D eTHRIVE than with conventional 2D FSE (Fig.1 A, B).

	synovial enhancement	bone erosions	homogeneity of FS	anatomical structures
3D eTHRIVE	3.40±0.58	3.13±0.78	3.45±0.44	3.09±0.88
conv. 2D T1W-FSE	2.87±0.66	2.55±0.91	2.09±0.34	2.45±0.46

Tab.1 Grading Scores (mean±SD) of Image Quality in 3D eTHRIVE and conventional 2D T1W-FSE (n=55)

Note. - FS: fat suppression, conv. 2D T1W-FSE: conventional 2D T1-weighted fast spin-echo images
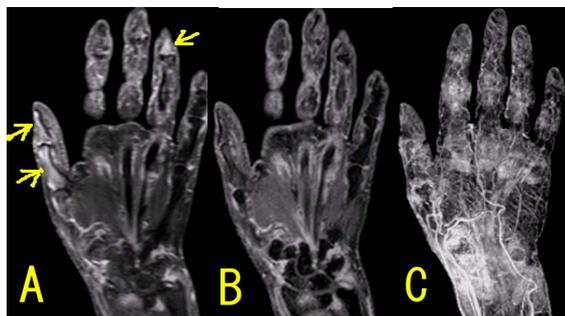

Fig.1   2D FSE and 3D eTHRIVE in the same patient with RA. 2D FSE (A) shows insufficient fat suppression in 1st proximal, distal phalanges and 4th distal phalanx (arrows). On the other hand, 3D eTHRIVE (B) shows homogenous fat suppression. MIP image of 3D eTHRIVE in the same patient (C) delineates the extent of widely spread synovial enhancement in interphalangeal, metacarpophalangeal and intercarpal joints clearly.

Discussion and Conclusion: Thin slice-thickness with 3D eTHRIVE can provide better delineation of subtle RA lesions and fine anatomical structures by eliminating partial volume effect. In addition, 3D eTHRIVE can yield maximum intensity projection (MIP) images, which can provide useful information in the determination of precise extent of synovial enhancement (Fig.1C). Furthermore, better fat suppression can be obtained with 3D eTHRIVE than with conventional 2D FSE especially at high static magnetic fields such as 3T. 3D eTHRIVE has a potential of playing important roles in the diagnosis of early RA of the hand.

References: 1.Sommer OJ, et al., RadioGraphics 25:381,2005   2.Ejbjerg B, et al., Arthritis Rheum 50:1097, 2004

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