

Fat-signal fraction quantification of paravertebral muscle using T2*-corrected multi-echo Dixon technique

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- **TARGET AUDIENCE:** Radiologists, spine-related clinicians, physicists developing fat-quantification sequences.
- **PURPOSE:** To compare accuracy of fat-signal fraction mapping sequences by comparing lumbar muscle fat-signal fractions derived from dual echo Dixon, T2*-corrected three point Dixon and T2*-corrected multi-echo Dixon magnetic resonance (MR) imaging with that from single-voxel MR spectroscopy as reference standard in lumbar spine.
- **METHODS:** Sixty-one patients (39 women and 22 men; 54.3 years \pm 19.1, age range of 20-92 years) with low back pain underwent MR imaging at a 1.5-T scanner. Additionally, automatically obtained fat-signal fraction mapping images using T2*-corrected Dixon VIBE (volume interpolated breath-hold GRE) sequence with two (non-T2*-corrected), three, and six echoes were obtained at the L4 through L5 levels for image-based quantification of fat-signal fraction. Fat-signal fraction from MR spectroscopy was automatically obtained at lumbar multifidus or erector spinae muscles of L4 through L5 levels from HISTO (High speed T2-corrected multiple echo 1H-MRS –Fat and R2 Quantification) sequence, which is single-voxel MR spectroscopy. The voxel size was fixed at 15 x 15 x 15 mm. Fat-signal fractions were measured directly by drawing region of interest at the automatically obtained fat-signal fraction mapping images from the three sequences. ROIs were drawn at the 3 consecutive slices of mapping images at the same location of the spectroscopic voxel by two musculoskeletal radiologists in consensus and the average values were obtained. The Student t test and Bland-Altman plots were used to quantify agreement between the values obtained from mapping images and those from spectroscopy. P-values <0.05 were considered to be statistically significant.
- **RESULTS:** A total of 120 spectroscopic measurements were performed bilaterally (59 of 61) or unilaterally (2 of 61). Mean spectroscopic fat-signal fraction percentage was 14.0 \pm 11.8 (range, 2.9–63.6). Correlation between spectroscopic and all imaging-based fat-signal fractions was statistically significant (R2 = 0.92[two-echo], 0.91 [three-echo], and 0.96 [six-echo], all P < .001). Fat-signal fractions obtained from six-echo T2* corrected Dixon VIBE sequence best correlated among all imaging-based fat-signal fractions with statistical significance (P < .001)
- **DISCUSSION:** Fat-signal fraction has been quantified for phantom and variable tissues using variable sequences based on Dixon technique (1-4). Recently, fat fraction mapping using multi-echo Dixon techniques have been developed for further improvement of accuracy. However, there has been no consensus whether T2*-corrected multi-echo Dixon technique can more accurately measure fat-signal fraction in skeletal muscle as compared with the 2-echo and 3-echo techniques (1).
- **CONCLUSION**
T2*-corrected six-echo Dixon sequence best correlates with spectroscopic fat-signal fractions as compared with dual-echo and T2*-corrected three-echo sequences, thus being expected to be used as an accurate quantification tool for measurement of muscle fat quantification in lumbar spine MR imaging.
- **REFERENCES**
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