# T2-weighted MR Imaging of the Pelvis at 3.0 Tesla: Optimum routine Fast Spin-echo Sequences

**M. Hori[1], T. Kim[1], H. Onishi[1], K. Tomoda[1], H. Nakamura[1], and T. Murakami[2]**

[1]Dept. of Radiology, Osaka University, Suita, Osaka, Japan, [2]Dept. of Radiology, Kinki University, Osakasayama, Osaka, Japan

**INTRODUCTION**:

MR scanners at 3.0 T for the body have been introduced in clinical settings recently. Because of the differences in T1 and T2 relaxation times between 3.0T and 1.5 T, optimal parameters for MR imaging should be different between those [1]. The purpose of the study was to establish parameters for routine clinical T2-weighted fast spin-echo (FSE) MR sequences for the pelvis at 3.0 T.

**METHODS:**

T2-weighted MR images obtained with FSE sequences with three sets of imaging parameters in 25 patients (15 women and 10 men) were analyzed. The mean age of women was 51 years (age range, 28-68 years), and the mean age of men was 71 years (61-82 years). All patients underwent imaging with a whole-body 3.0-T MR scanner (Signa Excite 3.0T HD, GE Healthcare) equipped with an 8 channel coils. The three sets of parameters were as follows: (a) TR(ms)/TE(ms)/ETL=8000/80/20, (b) 6000/80/16, and (c) 4000/80/12. These sets were selected in consideration of various T2 contrast without significant differences in imaging times. A matrix of 512 x 256 - 512 x 320 pixels was used, with a field of view of 24 cm, section thickness of 4-6 mm, and NEX of 2. Imaging times were approximately 3-5 min. Image blurring was evaluated visually by a radiologist with a four-point scale (1=poor, 2=fair, 3=good, 4=excellent). Contrast-to-noise ratios between (a) the myometrium and the junctional zone of the uterus, and (b) the endometrium and the skeletal muscle were calculated for each woman, and that between (c) the skeletal muscle and the peripheral zone of the prostate was calculated for each man.

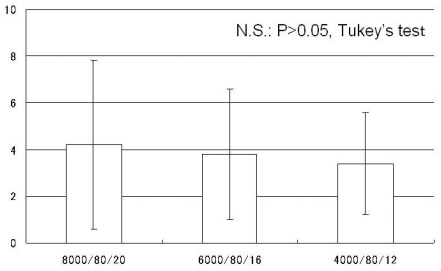


Fig 1. CNR between myometrium and junctional zone

**RESULTS:**

There were no significant differences in image blurring among three sequences (median=3 for all sequences, P>0.05). Contrast-to-noise ratios (mean ± SD) between the myometrium and the junctional zone were 4.2 ± 3.6 (TR/TE/ETL=8000/80/20), 3.8 ± 2.8 (6000/80/16), and 3.4 ± 2.2 (4000/80/12) (Fig 1). There were no significant differences among the three sequences (P>0.05, Tukey's test). FSE images with TR of 8000 (19.2 ± 9.1, P=0.001) and with TR of 6000 (19.4 ± 8.4, P=0.001) showed higher contrast-to-noise ratios between the endometrium and the skeletal muscle than images with TR of 4000 (16.0 ± 7.1), though there was no significant differences between images with TR of 8000 and 6000 (P=0.98) (Fig 2). FSE images with TR of 8000 (18.0 ± 5.0) showed higher contrast-to-noise ratio between the skeletal muscle and the peripheral zone of the prostate than images with TR of 6000 (16.4 ± 4.1, P=0.04) and with TR of 4000 (14.0 ± 3.3, P<0.001) (Fig 3). Also, the difference between the images with TR of 6000 and those with TR of 4000 was statistically significant (P=0.003).

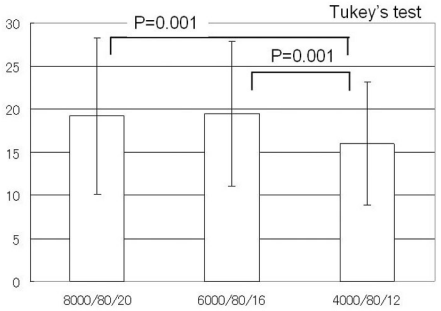


Fig 2. CNR between endometrium and the skeletal muscle

**DISCUSSION:**

T2-weighted MR imaging plays an important role in diagnosing malignant tumors in the uterus or the prostate. Thus, obtaining good T2 contrast is crucial for practical 3.0T MR imaging of the pelvis. Although optimal parameters for MR imaging might be different between 3.0T and 1.5T, many radiologists use the same TR and TE at 3.0T as at 1.5T [2]. The MR signal intensity (*S*) for spin-echo sequence is generally given by the following equation:

$$S \propto M\left[1-\exp\left(\frac{-TR}{T1}\right)\right]\exp\left(\frac{-TE}{T2}\right)$$

Longer TR would be desirable for obtaining good T2-weighted images. However, imaging times would be also longer with such situation without adjusting echo train length (ETL). If we increase ETL to maintain practical imaging times, the degree of image blurring might be significant, and it might lead to inferior diagnostic quality. Our results showed that there were no significant differences in terms of image blurring among the three sequences we examined.

In conclusion, T2-weighted FSE images with TR(ms)/TE(ms)/ETL=8000/80/20 or 6000/80/16 showed better contrast-to-noise ratio than images with 4000/80/12 without significant increase in image blurring at 3.0 T for female pelvis. TR/TE/ETL=8000/80/20 was the best among the three sets of imaging parameters for male pelvis.

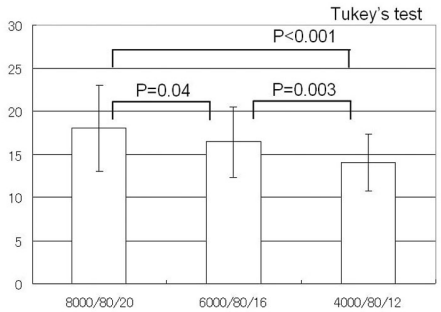


Fig 3. CNR between skeletal muscle and the peripheral zone

**REFERENCES:**

1. de Bazelaire CM, et al. MR imaging relaxation times of abdominal and pelvic tissues measured in vivo at 3.0 T: preliminary results. *Radiology* **230**:652-659, 2004.
2. Morakkabati-Spitz N, et al. 3.0-T high-field magnetic resonance imaging of the female pelvis: preliminary experiences. *Eur Radiol.* **15**:639-644. 2005.