Moderately T2-weighted MR urography using single shot fast spin echo technique: differentiation between benign and malignant urinary obstructions

Masao Date MD, Hideharu Sugimoto MD, Tarou Takahara MD, Takaki Hayashi MD, Kenji Takizawa MD
Minoru Honda MD
1 Dept. of Radiology, Showa Univ. Fukuoka Hospital, Yokohama, Kanagawa, Japan
2 Dept. of Radiology, Kyorin Univ., Mitaka, Tokyo, Japan

BACKGROUND
Recently, utility of breath-hold MR urography using ultrafast T2-weighted sequences, such as half-Fourier acquisition single-shot turbo spin echo (HASTE) technique and single shot fast spin echo (SSFSE) technique, were reported [10][11]. Although these ultrafast T2-weighted sequences accurately show the level and degree of ureteral obstruction, they rarely allow determination of the etiology of urinary tract dilatation. Since fat saturation pulse and/or long effective echo time were applied for complete signal suppression of surrounding soft tissues in these sequences, they cannot distinguish ureteral wall from surrounding soft tissues.

PURPOSE
Since moderately T2-weighted images without fat saturation make soft tissue contrast more prominent than heavily T2-weighted images, they suppose to distinguish ureteral wall from ureteral fluid and from periureteral fat. The purpose of this study was to evaluate the morphological change and signal intensity of the lesion at the level of obstruction, and then testify whether MRU technique using moderately T2-weighted images without fat saturation can distinguish between benign and malignant ureteral obstructions.

METHODS AND MECHANISM
SUBJECTS
Thirty-nine consecutive patients with urinary tract dilatation as diagnosed by US and/or excretory urography were examined. The study group consisted of 12 women and 27 men who were 16-83 years old (mean, 55.8 years old). Thirty-four patients had unilaterally dilated ureters and 5 patients had bilaterally dilated ureters. Diseases included urothelial carcinomas in 8 patients, bladder carcinomas in 5 patients (2 patients had bilaterally dilated ureters), metastatic ureteral infiltration in 2 patients, urinary stones in 7 patients, renal sinus lipoma in 1 patient, intraluminal hamatoma in 1 patient, non-malignant uretero-pelvic junction (UPJ) stricture in 16 patients (2 patients had stricture bilaterally).

IMAGING TECHNIQUE
All MR images were obtained using a 1.0-T super-conducting unit (Signa; GE Medical Systems, Milwaukee, WI), and a torso phased-array coil. Before moderately T2-weighted MR urography, heavily T2-weighted sequence using SSFSE was done for localizing the level of obstruction in the coronal plane. Modestely T2-weighted MR urography was done with a SSFSE sequence and was acquired both on the coronal and axial planes in the site of obstruction revealed by the heavily T2-weighted sequence. Multislice acquisition was used with a slice thickness of 4 mm, an effective TE of 92 msec and a 256x160 matrix, and without fat-suppression. The field of view varied between 30 and 35 cm providing pixel dimensions in the range of 1.9 - 2.2 mm. 10 to 15 sequential sections with 4 mm thickness were acquired and the acquisition time was 20 - 30 seconds.

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PROTOCOL
In multislice images, imaging findings of the level of obstruction were analyzed according to the morphological changes, and the alteration of signal intensity. The morphological changes were classified as wall thickening and no change.

RESULTS
There was statistically significant difference between benign and malignant group in both morphological change (p<0.0001) and signal intensity of the lesions at the level of obstruction (p<0.0001). Wall thickening and increased signal intensity as a predictor of malignant disease yielded a sensitivity of 88%, a specificity of 100%, a negative predictive value of 93%, and a positive predictive value of 100%. Absence of wall thickening and increased signal intensity as a predictor of benign disease yielded a sensitivity of 81%, a specificity of 88%, a negative predictive value of 75%, and a positive predictive value of 92%.

DISCUSSION
Heavily T2-weighted sequences cannot distinguish ureteral wall itself from surrounding soft tissues, and the causes of ureteric obstruction were revealed as filling defects that were non-specific finding [6]. Moderately T2-weighted sequence made the soft tissue contrast more prominent than the heavily T2-weighted images. Therefore this method was supposed to be a remarkable improvement for evaluation of the lesion at the level of obstruction.

According to our results, if the lesion at the obstruction shows the wall thickening with increased signal intensity, it should be diagnosed as a malignant process. If the lesion at the obstruction does not show any morphological change nor signal intensity change, it should be diagnosed as a benign process (Fig.).

REFERENCES
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3) Tang Y. et al. AJR 1996;167: 1497-502

Fig. Coronal Images in a 36-year-old man with UPJ stricture. (a) Heavily T2-weighted image shows urinary dilatation and the level of obstruction. (b) Moderately T2-weighted image does not show any morphological change nor signal intensity change (arrowheads).