Renal leiomyoma is a rare benign tumor of the kidney and may develop from the renal capsule (37%), renal pelvis (17%), renal cortical vasculature (10%) or indeterminate areas (37%) (1). When renal leiomyoma originates from the capsule, exophytic renal cell carcinoma should be included in the differential diagnosis (2). In the literature, descriptions of magnetic resonance (MR) imaging findings of renal leiomyoma are rare (3, 4); to our knowledge, MR imaging findings of renal leiomyoma originating from the capsule have not been described. We report a case of renal capsular leiomyoma that showed low signal intensity on both T1- and T2-weighted MR images.

**Case report**

A 41-year-old man was referred for treatment of a right renal mass found incidentally on abdominal ultrasound. Physical examination on admission revealed no palpable mass, and the results of laboratory tests were within normal limits.

Excretory urography revealed a mass arising from the lower pole of the right kidney. Ultrasonography (ATL HDI 3000; Advanced Technology Laboratories, Bothell, WA, U.S.A.) showed a well defined hypoechogenic mass attached to the lower portion of the right kidney. Unenhanced computed tomographic (CT) scans of the kidney obtained using a Somatom Plus 4 (Siemens Medical Systems, Erlangen, Germany) revealed a well-circumscribed mass (4x3x2.5cm) arising from the right kidney. After bolus injection of contrast media, the mass showed heterogeneous enhancement (Fig. 1A). The renal outline was smooth, not distorted. MR imaging was performed with a 1.5-T superconducting system (Magnetom Vision; Siemens Medical Systems, Erlangen, Germany). T1-weighted fast low-angle shot GRE images (140/4.8 [repetition time msec / echo time msec]; flip angle, 75°) showed the mass to be hypointense (Fig. 1B). On breath-hold T2-weighted turbo SE images (3500/138; echo train length of 29), the mass presented heterogeneous low signal intensity (Fig. 1C). After diagnosis of a renal tumor originating from the capsule, a right partial nephrectomy was performed.

A gross specimen showed an ovoid rubbery mass (4x3x3cm) connected with the kidney by a short thin stalk, and about 0.4cm in diameter. The cut surface showed a homogenous yellowish tan and had a slightly whorled appearance (Fig. 1D). Microscopic sections showed interlacing bundles of smooth muscle fiber. On immunohistochemical staining, tumor cells were diffusely positive for desmin and actin.
Discussion

Renal leiomyomas arise in areas of the kidney that normally contain smooth muscles, such as the renal capsule, the renal pelvis, or renal cortical vasculature (1). In a recent review of the literature, the frequency of leiomyoma of the kidney found at autopsy was reported to be 4.2 to 5.2% (1). They are well encapsulated and sharply circumscribed, and occur most often among women (66%) and whites (70%). The tumor is found equally in both kidneys, and is common in the lower pole (74%) (1).

A diagnosis of renal capsular leiomyoma is clinically and radiologically difficult and should be considered in the differential diagnosis of exophytic renal cell carcinoma (2). The imaging features of renal capsular leiomyoma are nonspecific and the diagnosis is usually made

Fig. 1. 41-year-old man with renal capsular leiomyoma.
A. Contrast-enhanced CT scan shows heterogeneous enhancement of the mass (white arrow) at the lower pole of the right kidney. The renal outline is smooth, not distorted.
B. Oblique sagittal T1-weighted image shows low signal intensity of the mass in the lower pole (white arrow).
C. On oblique sagittal T2-weighted image, the mass shows heterogeneous low signal intensity (white arrow).
D. Cut section of the mass shows homogenous, yellowish tan with whorling appearance.
following nephrectomy. The CT findings of renal leiomyoma are entirely cystic, purely solid, or mixed cystic and solid tumors (1). Although there are a few key features of renal leiomyoma such as a well-circumscribed mass in capsular, subcapsular, or peripelvic location, without evidence of extrarenal invasion or metastasis, and the presence of a distinguishable plane between the tumor and kidney without significant parenchymal distortion, no constant features of a leiomyoma can be found for differential diagnosis from other renal tumors (1).

The first MR imaging findings of renal leiomyoma were reported by Selli et al. (3), who in 1992 described a case in which MR imaging revealed a hypointense lesion on both T1- and T2-weighted images. Although the MR imaging appearance of our patient was similar in this respect, T2-weighted images showed heterogeneous low signal intensity. Low signal intensity of a leiomyoma, as seen on T1- and T2-weighted images, is due to T1 and T2 relaxation times of smooth muscle. The signal intensity of a leiomyoma varies according to the degree of degeneration or cellular component. In our case, since necrosis, hemorrhage, or calcification were not found histologically, heterogeneity may be due to differences in the compactness of tumor cells. Low signal intensity on both T1- and T2-weighted MR images is not, however, a characteristic finding of renal leiomyoma; it can be seen in cases of fibroma, milk of calcium cysts, renal cell carcinoma secondary to iron within the tumor, and other calcified renal lesions (5, 6).

The differential diagnosis of renal capsular leiomyoma includes exophytic renal cell carcinoma and leiomyosarcoma. Renal cell carcinomas usually show a signal intensity intermediate between the renal cortex and the medulla on T1-weighted images, and are isointense or hyperintense relative to normal parenchyma on T2-weighted images (7). Although renal cell carcinomas may have a low signal intensity on both T1- and T2-weighted images (6), renal capsular leiomyoma should be considered when an exophytic renal mass has this appearance. The differential diagnosis between leiomyoma and leiomyosarcoma is not clear. Most renal leiomyomas are well encapsulated and sharply circumscribed, whereas invasion of adjacent structures and lack of encapsulation denote leiomyosarcoma (1). The only definitive method of distinguishing leiomyoma and leiomyosarcoma is, however, microscopic evaluation.

When an exophytic solid renal mass is found, the presence of a smooth renal outline without parenchymal distortion, and low signal intensity on both T1- and T2-weighted MR images, indicate that renal capsular leiomyoma should be included in the differential diagnosis. If the renal mass is thought to be capsular leiomyoma, simple excision or partial nephrectomy are possible treatment options.

References
4. Radvany MG, Shanley DJ, Gagliardi JA. Magnetric resonance imaging with computed tomography of a renal leiomyoma. Abdom Imaging 1994;19:67-69

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<th>MR Imaging Findings</th>
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MR findings indicate that T1 and T2 values differ, with T1 showing a contrast and T2 showing no contrast.