Radiological Appearance of Renal Leiomyoma: two cases report and review of the literature

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ABSTRACT

Renal leiomyomas are benign tumors originating from the smooth muscle cells of various renal structures, and are found in approximately 5% of the population based on autopsy series. However, their clinical incidence is much lower. Renal leiomyomas are usually small and discovered incidentally during imaging studies performed for various other reasons. Here we report 2 cases of incidentally found renal leiomyoma in 2 middle-aged women. The characteristic computed tomography findings are described and relevant literature is reviewed.

CASE REPORT

Case 1

A 46-year-old female with a history of breast cancer and a status of post-modified radical mastectomy, chemotherapy, and radiotherapy underwent an abdominal computed tomography (CT) examination for suspicious liver mass. A renal tumor was incidentally found during the abdominal CT, which presented as a well-defined renal mass measuring 2.5 × 2.4 cm in the renal parenchyma at the middle of the left kidney. The mass was relatively hypodense to the renal cortex in pre-contrast images, with slightly heterogeneous enhancement, and was relatively hypodense to the renal cortex after contrast medium injection (Fig. 1). The mean densities of the renal mass before and after contrast medium injection were 48 and 89 in Hounsfield Unit (HU) respectively (Fig. 1). A renal echography revealed a small, well-defined, hypoechoic solid mass in the left renal cortex, which was slightly lower in echogenicity.
than the adjacent renal cortex. Selective renal angiography showed an iso- to hypo-vascular space-occupying renal tumor in the lateral aspect at the middle of the left kidney, resulting in stretching and bowing of the adjacent renal arterial branches. To rule out the possibility of renal cell carcinoma, the patient underwent CT-guided biopsy.

Pathological examination of the specimen showed round to spindle-shaped cells arranged in a solid pattern with moderate nuclei pleomorphism and without abnormal mitotic figures. Immunohistochemical analysis demonstrated positive staining for smooth muscle actin and negative staining for cytokeratin and vimentin, indicating

Figure 1. A 46-year-old female with underlying breast cancer and an incidentally found left renal tumor. Abdominal CT with and without contrast showed: a. Pre-contrast axial view. The renal mass was well defined and slightly hyperdense to the renal cortex. b. Post-contrast axial view. The renal mass enhanced slightly heterogeneously, appeared relatively hypodense to the renal cortex.

Figure 2. A 57-year-old female with urinary tract infection and an incidentally found left renal tumor. Abdominal CT with and without contrast showed: a. Pre-contrast axial view. The renal mass was well-defined and slightly hyperdense to the renal cortex. b. Post-contrast axial view. The renal mass enhanced slightly heterogeneously and appeared relatively hypodense to the renal cortex.
a smooth muscular nature. Therefore the pathologic diagnosis was a smooth muscle tumor. The convalescence of the patient was unremarkable. The tumor has remained stationary during follow-up for 10 years.

**Case 2**

A 57-year-old female presented with abdominal fullness and left lower quadrant abdominal pain. She came to our colorectal outpatient department and findings from a physical examination were unremarkable. Initial laboratory data including a hemogram and biochemical analysis revealed leukocytosis and increase in C-reactive protein. Under the suspicion of colonic diverticulitis, an abdominal CT was arranged on the same day.

A small well-defined renal mass measuring $3.2 \times 2.2 \times 1.3$ cm and originating from the lateral aspect of the left kidney was incidentally found in abdominal CT. In addition, CT images suggested an inflammatory process of the left kidney. The mass appeared slightly hyperdense to the renal cortex before contrast medium injection, with slightly heterogeneous enhancement, and it was relatively hypodense to the renal cortex after contrast medium injection (Fig. 2). The mean densities of the renal mass before and after contrast medium injection were 43 HU and 66 HU, respectively. Further evaluation via renal echography showed a small, well-defined, hypoechoic, solid mass in the periphery of the left kidney, which was lower in echogenicity compared than the adjacent renal cortex (Fig. 3). To eliminate the possibility of renal cell carcinoma, the patient underwent left partial nephrectomy.

The resected left renal tumor measured $3.4 \times 2.5 \times 2.2$ cm. On a cut section, the gray-white tumor was solid, lobulated, and firm in consistency without areas of hemorrhage or necrosis. Microscopically, the tumor was located within the renal capsule and the superficial cortex and consisted of bundles of spindle smooth muscle cells without abnormal mitotic figures (Fig. 4). Immunohistochemical studies demonstrated strong positive staining for smooth muscle actin, focal positive staining for desmin and MyoD1, and negative staining for HMB-45 and S-100 protein. Thus, a diagnosis of renal leiomyoma was confirmed. The possibility of PEComa (perivascular epithelioid cell tumor) was eliminated by the absence of HMB-45 positivity. The convalescence of the patient was unremarkable.

**DISCUSSION**

Renal leiomyomas are benign tumors originating from smooth muscle cells of various renal structures, such as renal capsule (37%), renal pelvis and calyces (17%), renal cortical vasculature (10%) and indeterminate areas (37%) [1]. They have been found equally in both kidneys with lower pole involved in 74% of the specimens [1]. The tumors may be subcapsular (53%), capsular (37%), or in the renal pelvis (10%), and may be extremely exophytic or attached to the cortex by only a small stalk [1, 4]. Renal leiomyosarcomas also originate in the same area as renal leiomyomas. In general, renal leiomyomas are considered impossible to clinically differentiate from their malignant counterpart (renal leiomyosarcomas), if there is no evidence of malignant behavior via imaging or postoperative microscopic examinations.

The exact pathophysiological characteristics of
Renal leiomyoma


Figure 4

Figure 4. Histopathology. Hematoxylin and Eosin staining (100 x) showed uniform, interlacing bundles of spindle smooth muscle cells. Immunohistochemical study with smooth muscle actin revealed strong positive stain (not shown).

leiomyoma development are unknown. Various factors have been investigated based on uterine leiomyomas, which growth hormone and insulin-like growth factor may play a role [4]. The association of Epstein-Barr virus (EBV) with smooth muscle tumors in immunocompromised patients has been recognized, in that EBV-associated smooth muscle tumors have been reported in immunocompromised patients with acquired immunodeficiency syndrome, organ transplants, severe congenital immunodeficiency, and ataxia telangiectasia [5]. One case of EBV-induced renal leiomyoma was reported in an HIV-positive adult patient [6].

Renal leiomyomas occur most often in women (66%) in the second to fifth decades of life (median age 42 years) [1], and are rare in patients younger than 20 years. Only 11 cases in children have been reported [1, 5]. Most renal leiomyomas are small and asymptomatic; however, when the tumors continue to grow, they may cause symptoms. Steiner et al. [1] reviewed the literature in 1990 and collected 30 cases of clinically diagnosed leiomyomas, in which symptomatic lesions usually presented with palpable mass (57%), abdomen and/or flank pain (53%), or combination of both (32%). Microscopic hematuria occurred in 20% of the patients and macroscopic hematuria has also been reported [1, 7-9].

On gross appearance, leiomyomas are typically well encapsulated, sharply circumscribed, and solid firm nodules. On cut sections, a whorled appearance with occasional calcifications, cystic changes, hemorrhage, and absence of necrosis is seen. The tumors may be cystic or mixed cystic and solid. A cystic leiomyoma is believed to result from cystic degeneration and is unrelated to sarcomatous transformation. Microscopically, leiomyomas consist predominantly of smooth muscle cells in intersecting fascicles without frequent mitotic figures, pleomorphism or nuclear atypia. Most are considered to be hamartomatous [2]. The fact that a large number of leiomyomas contain microscopic fat raises the possibility that these tumors exist on a continuum with angiomyolipomas and lipomas [2]. On immunohistochemical examination, the cells express smooth muscle actin, desmin and sometimes HMB45 (a typical marker for PEComa, presenting with angiomyolipoma in the kidney) [3].

In imaging studies, leiomyomas typically appear as well-circumscribed, homogenous, solid lesions, although entirely cystic or mixed cystic and solid tumors may be seen. Calcifications may be seen in a minority of the cases. They are often peripherally located, mostly in capsular or subcapsular regions. The presence of a distinguishable plane between the tumor and kidney is an especially helpful sign, indicating that the tumor has a capsule [1]. On ultrasonography, leiomyomas appear hypoechoic and a thin hyperechoic cleavage line between the mass and renal parenchyma may be seen [3]. On CT, they are slightly hyperdense to the kidney with a density similar to that of muscles before contrast injection and become hypodense compared to the renal cortex after contrast injection [3]. And a thin hypodense cleavage plane between the mass and renal parenchyma may be seen [3]. Fewer than 10 reports have used magnetic resonance imaging (MRI) as the evaluation modality and no reports had concluded the imaging characteristics of renal leiomyoma on MRI. One case reported by Tessler et al. [10] showed a renal leiomyoma was heterogeneous in signal intensity on T2-weighted fast spin-echo MR. Another case reported by Derchi et al. [3]
showed a renal leiomyoma, that was homogenous on a postcontrast CT study, had heterogeneous signal intensities on both T1- and T2-weighted MR images and internal areas of low signal intensity on T1-weighted MR images. Angiographically, renal leiomyomas can be hypo-, iso- or hypervascular.

In our 2 cases, both patients were middle-aged women and both renal leiomyomas were found incidentally. Both masses were well defined, appeared hypoechoic and solid and were slightly lower in echogenicity than the adjacent renal cortex in ultrasound study. In addition, both appeared slightly hyperdense compared to the kidney with a density similar to that of muscles before contrast injection and became hypodense compared to the renal cortex after contrast injection in CT study.

Renal leiomyomas are impossible to preoperatively differentiate from renal leiomyosarcomas and the more common entity, renal cell carcinomas. However, when encountering an incidentally found renal tumor in a middle-aged woman, which met the characteristic imaging findings of a renal leiomyoma, a renal leiomyoma should be put into the differential diagnosis and conservative nephron sparing surgery is preferred rather than conventional radical nephrectomy. In contrast, in the pediatric group, renal leiomyomas are impossible to clinically differentiate from Wilms tumors; hence, conservative nephron sparing surgery is not recommended unless the tumor is small and confined to the renal capsule [11]. The prognosis after resection of these benign tumors is excellent [1, 2].

REFERENCES