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MRI of Multilocular Cystic Nephroma

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Abstract. We report the magnetic resonance imaging (MRI) findings in 2 patients with multilocular cystic nephromas. Both underwent MRI immediately prior to resection. The images accurately reflected the morphology of the tumors: in each, the capsule was hypointense on all pulse sequences. Varied intensities of signal from the fluid in the visualized locules presumably represented differing concentrations of old hemorrhage and protein. In one case soft tissue elements became hyperintense on T2-weighted images. We speculate that MRI of multilocular cystic nephromas will produce imaging features that are highly suggestive, but not always pathognomonic, of the disease.

Key words: Nephroma, multilocular cystic — Magnetic resonance imaging, nephroma.

Multilocular cystic nephroma (MLCN) is a well known but rare lesion of the kidney. Its gross morphology and appearance in cross sectional imaging bear distinctive features. Although computed tomographic (CT) and ultrasound appearances are well reported, the MRI features have not been described before. We report the MRI appearance of such a case.

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Case 1

A 33-year-old gravida 4 para 2 Hispanic woman presented with a palpable right upper quadrant mass. She had passed a right renal calculus 11 years earlier, at which time an intravenous pyelogram (IVP) showed a renal mass. She decided against surgery at that time. Since then, urine cytologic studies had been negative for malignancy and several ultrasound studies consistently detected a complex cystic mass in the right kidney. At the current admission, physical examination revealed her to be normotensive and afebrile. A large, nontender, mobile right upper quadrant mass was palpated. All laboratory values were normal except for a finding of microscopic hematuria.

Intravenous urography and retrograde pyelography revealed a unilateral, extrapelvic mass arising from the right renal parenchyma. Precontrast CT images showed a sharply circumscribed, spherical cystic mass 10 cm in diameter with multiple thin septa. There was no evidence of calcification or acute hemorrhage. The septa showed moderate enhancement with intravenous contrast and normal opacification of both kidneys was demonstrated (Fig. 1).

The MRI was performed with a Philips Gyroscan device operating at 0.5 T. Slices 10 mm thick with 2 mm intervals were obtained in the axial and coronal planes utilizing T1- and T2-weighted spin echo pulse sequences (TR, 700 msec; TE, 30 msec; and TR, 2150 msec; TE, 50, 100 msec). These images showed an encapsulated mass arising from the right renal cortex (Fig. 2). There was considerable displacement and compression of the kidney without evidence of infiltration. The capsule maintained a hypointense signal on both T1- and T2-weighted images. Multiple thin septa divided the cystic mass into numerous compartments. The septa were hypointense on both pulse sequences but were best visualized when contrasted with the bright signal of cyst fluid on T2-weighted images. Several of the peripheral locules were irregular and exhibited bright signal on both T1- and T2-weighted images. The remaining cyst fluid was hypointense on T1-weighted images and converted to progressively brighter signal with increasing T2 weighting (Fig. 3). There were no soft tissue components seen on either T1- or T2-weighted images.

The patient underwent a radical nephrectomy. The gross specimen showed an encapsulated multilocular cystic mass. The locules varied in size and did not communicate with each other or the renal pelvis. Most of the cysts were filled with clear fluid, though some contained dark, turbid fluid thought to be old blood.

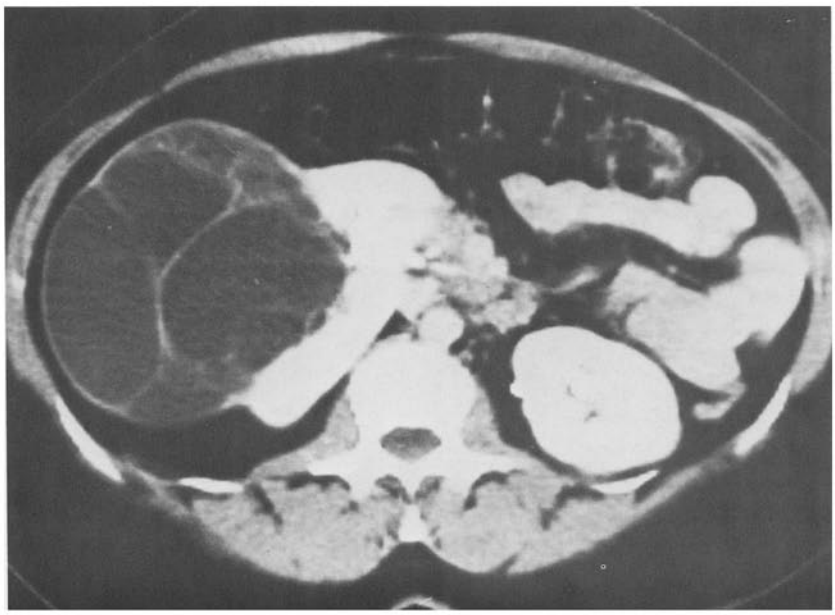

Fig. 1. *Case 1.* A large multilocular cystic mass of the renal parenchyma distorts the collecting system and alters the renal axis. There is septal enhancement on this postcontrast CT image.

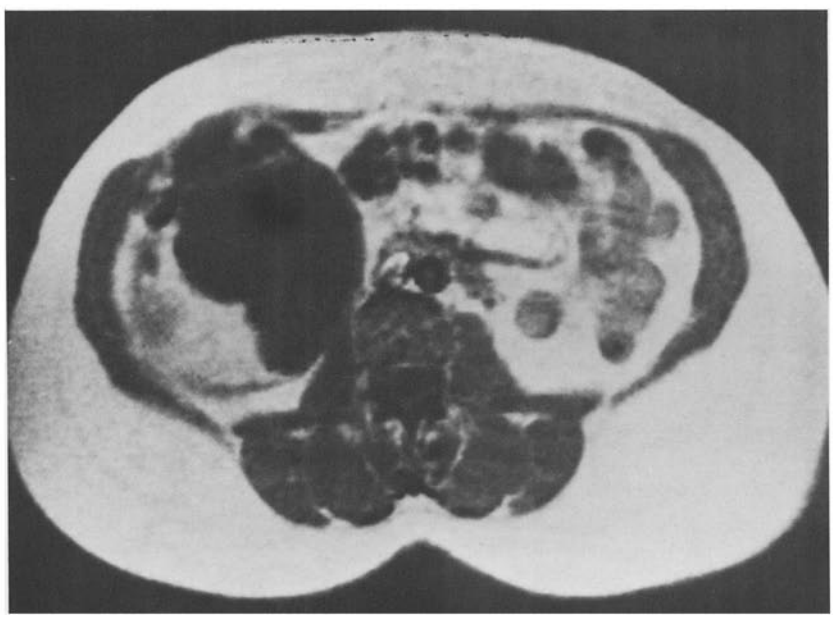

Fig. 2. *Case 1.* Transverse view with T1-weighted pulse sequence demonstrates serous (hypointense) and hemorrhagic (hyperintense) fluid within a complex cystic mass.

Histologically, the cysts were lined with flat cuboidal cells. The stroma was predominantly fibrous, populated by spindle cells resembling plump fibroblasts. Mitotic figures were not seen. Occasionally tubular structures lined by epithelial cells were seen in the dense regions of the stoma. The histologic diagnosis was multilocular cystic nephroma.

Case 2

A 72-year-old woman presented complaining of chronic fatigue and symptoms resembling upper respiratory infection. Her prior history included surgery for bronchiectasis 30 years earlier and a hysterectomy 20 years earlier. She had been on chronic digitalis therapy for a cardiac tachyarrythmia since young adulthood. No urologic symptoms or signs were present; she was normotensive. Abdominal examination revealed a palpable left upper quadrant mass. Her laboratory results were normal; she had no evidence of hematuria. She was referred for an abdominal ultrasound scan, which detected an 11 cm multilocular complex mass in the anterior aspect of the upper pole of the left kidney containing mostly cystic, but some solid, elements.

An MRI scan (Figs. 4, 5) was performed with a Philips Gyroscan, operating at 0.5 T. Ten mm slices were taken at 2 mm intervals. Coronal T1- and axial T1- and T2-weighted spin echo sequences were performed (TR700; TE 30 msec; and TR 2000;

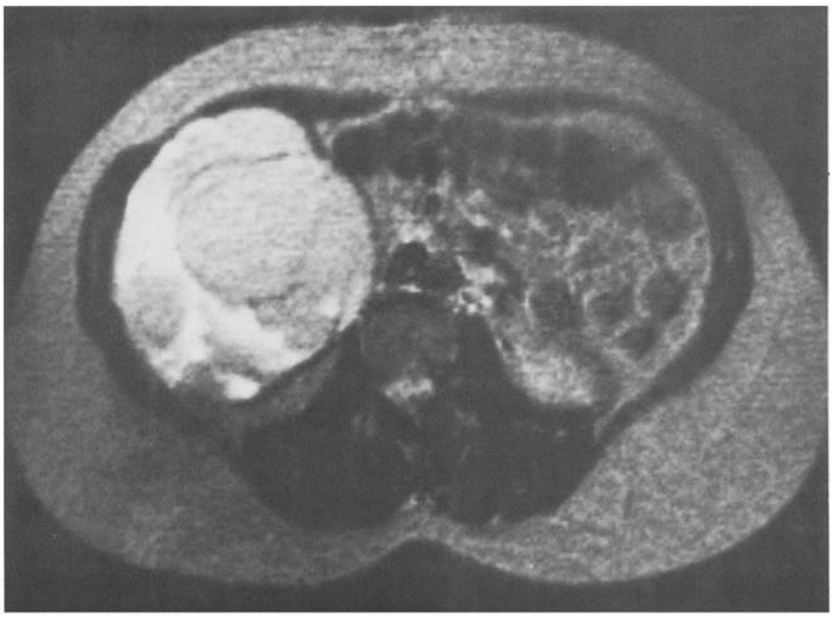

Fig. 3. *Case 1.* T2-weighted axial images show bright signal of serous fluid and brighter areas of subacute hemorrhage. Capsule and septa remain hyperintense.

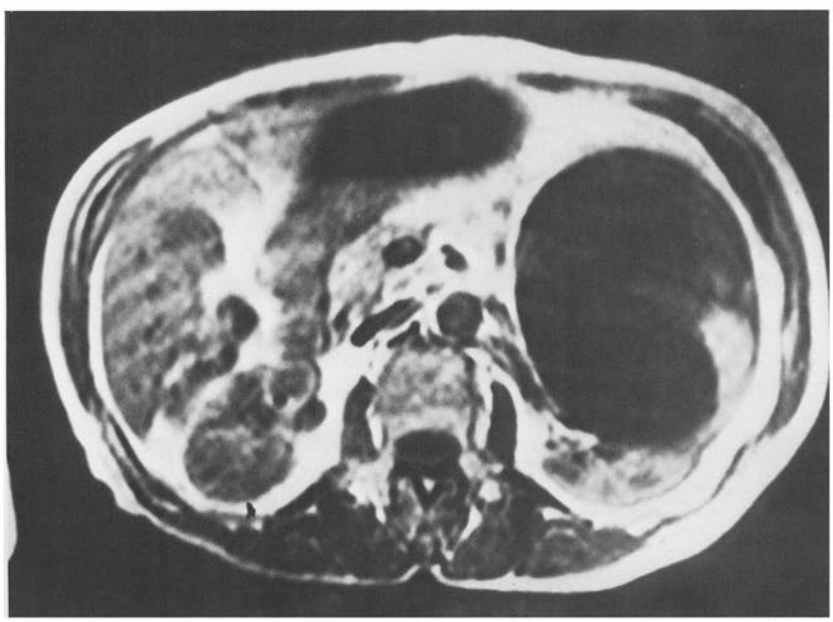

Fig. 4. *Case 2.* Transverse T1-weighted MRI shows spherical anterior left renal mass primarily filled with low-signal fluid; a locular higher-signal fluid is seen laterally.

TE 50, 100 msec). A well-defined, encapsulated mass was seen arising from the anterior aspect of the left kidney without evidence of infiltration of surrounding tissues. The renal artery and vein were clearly identified, stretched by the mass but patent. The capsule of the mass demonstrated low signal on both spin echo sequences with a chemical shift artifact present on axial scans. Numerous septa were present, with solid tissue elements that exhibited medium signal on T1-weighted images and high signal on T2 images. Most of the locules of fluid were of low intensity on T1 images and became increasingly bright with increased T2 weighting. One peripheral locule had high signal on both spin echo sequences.

The patient underwent a partial left nephrectomy. The resected specimen showed numerous noncommunicating cysts filled with serous fluid. No papillary excrescenses were seen, nor evidence of intracystic hemorrhage. Although an exact histopathologic description of the stroma was not available, the microscopic examination revealed no evidence of mitotic figures. The final diagnosis was multilocular cystic nephroma.

Discussion

MLCN is a rare, nonfamilial, benign cystic renal lesion. It is considered by most authors to be a neo-

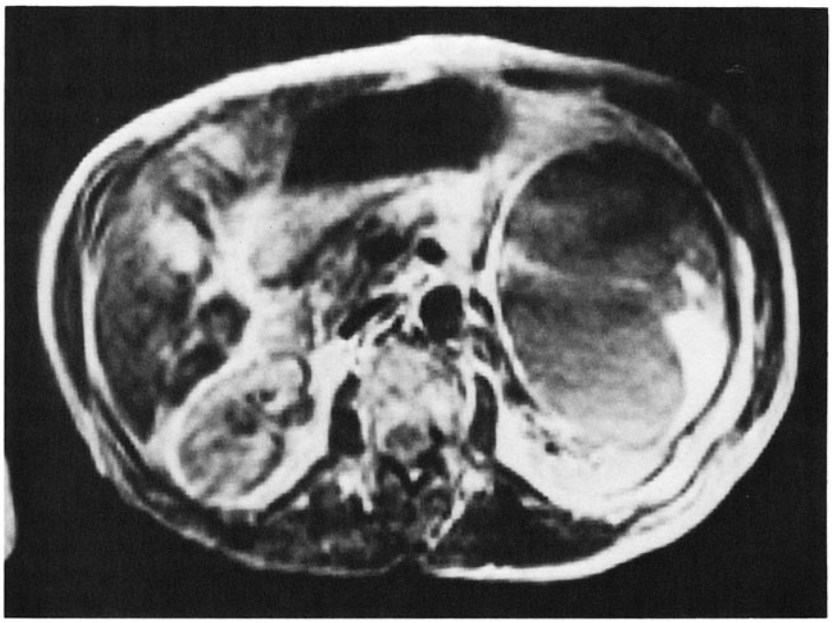

Fig. 5. *Case 2.* Transverse T2-weighted MRI shows relative increase in the signal from all fluid compartments.

plasm [1], although it has been suggested that the lesion represents a cystic dysplasia of the kidney. In early childhood, there is a male predilection, while in adulthood, a 2:1 female predominance is seen [2]. Half of the cases are in children, among whom it makes up 2.4% of primary renal neoplasms [3]. In children it presents as a painless, progressively enlarging abdominal mass whereas in the adult the presentation is frequently with pain, hematuria, and, rarely, hypertension and infection. Renal function is unimpaired. Hematuria is associated with herniation of tumor into the renal pelvis [4, 5]. It originates from the renal parenchyma and involves 1 segment with a tendency to occur in the lower pole. Surgical resection is considered curative.

The gross appearance is of a rounded mass (average 10 cm) divided by thick gray–white septa into multiple locules containing clear fluid. Occasionally, thick gel-like myxomatous material will fill the cysts. Hemorrhage and necrosis are rare. Typically, a thick, fibrous capsule surrounds the tumor forming a sharp interface with adjacent normal renal parenchyma [6]. The cysts characteristically do not communicate with each other or the renal pelvis. Microscopically, the cysts have an epithelial lining. Typically, there is an embryonic mesenchymal stroma of varying cellularity with islands of small tubules and metanephric blastema [7, 8].

Ultrasound, IVP, and CT reflect the characteristic morphology of the tumor and can strongly suggest the preoperative diagnosis [3, 9]. Radiologic differentiation from multilocular renal cell carcinoma may not always be possible. Peripheral, curvilinear calcification is sometimes seen in the older patient [10] but this can occur in renal carcinomas as well. Although these tumors are usually angiographically hypovascular, the septa show contrast enhancement on CT. The cyst fluid is generally slightly denser than water on CT without evidence of intracystic contrast accumulation.

Cystic disease of the kidneys can be effectively evaluated by MRI, which is able to differentiate between simple and hemorrhagic cysts [11]. Both signal and morphologic characteristics may allow recognition of inflammatory or neoplastic cysts, although the distinction between these is not always possible. An MRI study can accurately assess vascular involvement.

Most of the locules in our case of MLCN demonstrated the characteristics of "bulk phase" water with prolonged T1 and T2 values. Conditions that decrease the T1 value of cyst fluid include subacute hemorrhage and high protein or lipid concentrations. These conditions may arise in inflammatory masses or necrotic tumors. In subacute hemorrhage, T1 shortening is due to the paramagnetic effect of methemoglobin production. In the case of proteinaceous fluid, the "hydration phase" water around the hydrophilic protein moieties increases the efficiency of T1 relaxation [12].

In the first case the locules demonstrating high intensity on T1- and T2-weighted images contained

old blood. The higher signal of the septa in the second case probably represents a less fibrous, more cellular stroma. Unfortunately, exact histopathologic correlation is not available. The short T2 values of the capsule in both cases and the septa in the first case correlate with the predominantly fibrous elements seen on histologic examination. In the second case, the peripheral locule with high intensity on T1 and T2 contains clear fluid, not blood, which presumably had a high protein content.

There is increasing experience with MRI of renal tumors [13–16]. The nonnecrotic and noncalcified solid renal neoplasms have shown variable T1 values depending on the tissue type; for example, the fatty elements of angiomyolipoma emit a very bright signal on the SE images that is similar in intensity to the retroperitoneal fat. Renal cell carcinoma most commonly demonstrates a signal intermediate between the renal cortex and the medulla on T1-weighted images and hyperintense on T2-weighted images [13]. Metastases to kidneys, in contrast to renal cell carcinoma, have been reported with prolonged T1 values [14]. The highly suggestive morphologic characteristics of MLCN can be accurately demonstrated by MRI with the added advantages of identifying hemorrhage at various stages, evaluating vascular involvement, providing improved tissue contrast, and adding multiple imaging planes. If an MLCN is diagnosed by CT, it is probably not necessary to add MRI to the work-up. If the lesion is first encountered on an MRI examination, its features will probably be sufficiently characteristic to obviate the need for further imaging.

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