70. Renal Masses

MRI is often used to distinguish between benign and malignant renal neoplasms. MR of the normal kidneys clearly differentiates between the cortex and medulla, the latter exhibiting fluid-like SI due to the presence of urine. Dynamic cortical enhancement occurs at 20-30 seconds following contrast injection with near uniform medullary and cortical enhancement at 80 seconds—the time at which masses are most sensitively detected. Simple renal cysts are the most common lesion in adults. A case of adult polycystic kidney disease illustrated in Fig. 70.1A,B. Cysts of varying complexity are present, but the lesion denoted by the black arrow appears simple with typical low and high SI on (A) T1 and (B) T2WI, respectively, and no clearly identifiable wall or septation. The lesion denoted by the asterisk demonstrates SI compatible with a hemorrhagic cyst—high SI on (A) T1 and low SI on (B) T2WI—specifically the SI characteristics of intracellular methemoglobin. Additionally, the vertebral body SI is abnormal as the sequences were not acquired with fat saturation. In this case, the low SI correlates with the patient’s diagnosis of hemosiderosis (see Chapter 67).

Simple cysts do not exhibit enhancement with contrast administration and are classified as Bosniak type 1 lesions. A Bosniak 2 cyst is illustrated in the axial (A) T2 and (B) parenchymal phase CE T1WI of Fig. 70.2A,B, respectively. The (A) T2WI demonstrates a single, thin low SI septation that enhances minimally on (B) CE images. Bosniak 2F cysts may have multiple, thin septae or smooth, minimal wall thickening. As malignancy cannot be ruled out with certainty these lesions require follow-up at 6 and 12 months intervals. The septum of the lesion in Fig. 70.2C,D—a Bosniak 3 lesion—is thickened and somewhat irregular on (C) pre-contrast T1WI, findings confirmed on (D) parenchymal phase CE T1WI. Irregularly thickened, enhancing walls also constitute Bosniak 3 lesions, which have a risk of malignancy of up to 50%, thus partial nephrectomy is usually the treatment of choice. Bosniak 4 lesions are considered to 100% malignant and usually are cystic renal
cell carcinomas. Such a lesion is illustrated in Fig. 70.2E,F, the cystic component appearing as low SI on (E) T1WI. (F) 3 minutes following contrast administration, the thickened irregular rim of this cyst avidly enhances along with a nodule in the adjacent kidney. A concomitant enhancing soft tissue mass or adjacent nodule is sufficient to categorize a cyst as Bosniak type 4. A solid renal cell carcinoma is illustrated in Fig. 70.3. Here, (A) a coronal T2WI illustrates dilatation of the superior renal collecting system by a moderate to low SI mass arising from the lower renal pole. The mass demonstrates heterogeneous enhancement on (B) 5 minute post-contrast FS T1WI. This particular lesion extended to invade the renal vein and inferior vena cava, establishing a Robson stage of 3A. Other stage 3 lesions may involve regional lymph nodes (3B) or both the aforementioned venous structures and lymph nodes (3C). Lesions not extending beyond the renal capsule or Gerota’s fascia are classified as Stage 1 and 2 lesions, respectively. Local visceral invasion (with the exception of ipsilateral adrenal invasion) or distant metastases constitute a Stage 4 lesion. The presence of a pseudcapsule, appearing as a hypointense linear band surrounding the tumor on both T1 and T2WI, signifies a lack of perinephric fat invasion. Besides a cystic appearance, renal cell carcinoma may have a rather heterogenous tumor matrix extending from homogenously and strong enhancing soft tissue components to necrosis, hemorrhage and coarse calcifications. Benign renal oncocytoma may be confused with renal cell carcinoma, and the two lesions...
are not readily distinguishable on imaging. Oncocytomas tend to be better defined and enhance more homogeneously often with a central nonenhancing stellate scar. If an oncocytooma is favored in the differential diagnosis, nephron-sparing surgery may be performed. Renal angiomyolipomas, illustrated in Fig. 70.4, are the most common benign solid renal masses. Most cases are sporadic with, however, 20% are associated with a phakomatosis such as tuberous sclerosis. (A) Coronal T2WI demonstrate a hyperintense mass near the inferior pole of the right kidney. Linear areas of low SI likely correlate with flow voids from vascular structures within the lesion. On (B) axial T1WI the lesion demonstrates SI similar to that of perinephric fat, with loss of SI on (C) axial FS T2WI. (D) FS CE T1WI obtained 5 minutes following contrast administration demonstrate the lesion to remain low SI, with only linear, likely vascular enhancement. Clear and papillary cell
renal carcinoma may also contain small amounts of fat, complicating the diagnosis. A renal angiomyolipoma with a small amount of fat may also be diagnosed on in- and out-of-phase GRE T1WI, although in predominantly fatty lesions, SI dropout with such lesions is not as readily seen for reasons described in Chapter 69. Angiomyolipomas usually do not require further treatment, yet, symptomatic or larger masses exceeding 4 cm in diameter should be resected or treated with transarterial embolization as they have an increased risk of retroperitoneal hemorrhage.

Although the majority of transitional cell carcinomas occur in the urinary bladder the second most frequent site is the collecting system and the renal pelvis, constituting up to 10% of solid renal masses. In distinction to renal cell carcinomas these tumors are typically less vascularized, thus presenting only faint enhancement on dynamic CE T1WI. Filling defects and dilatation of the collecting system or the renal pelvis proximal to an occlusive mass are typical presentations of transitional cell carcinomas of the kidneys appreciable on axial and coronal T2WI or 3D-T1WI GRE sequences acquired in the late urographic phase after contrast agent administration.