This algorithm should be applied only to incidental renal masses in asymptomatic adult patients (18 years of age or older). This algorithm should not be applied to patients with medical conditions or genetic syndromes that predispose them to renal neoplasms or to those with a primary malignancy that has a reasonable possibility of metastasizing to the kidneys, such as lung cancer, lymphoma, or melanoma. The algorithm also does not apply to infiltrating renal processes; these have a broad differential diagnosis and should be managed separately.

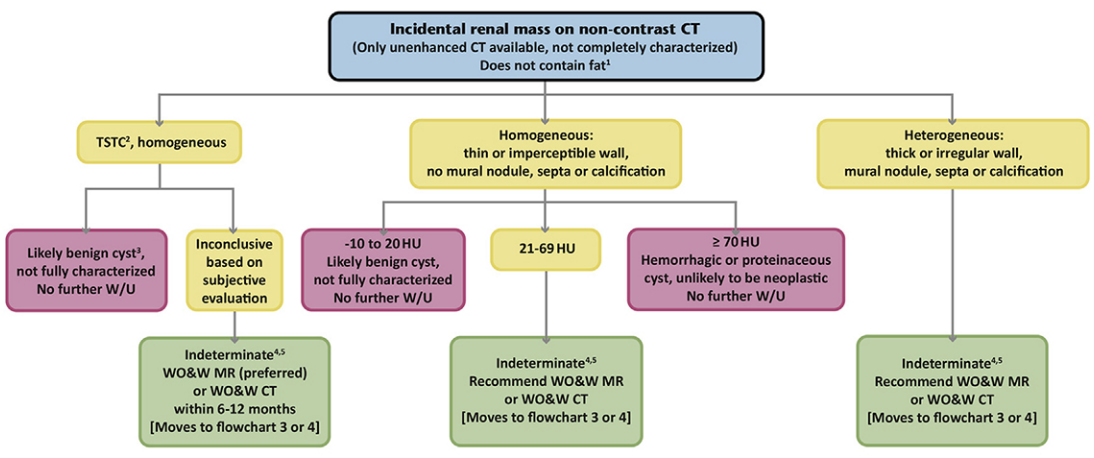

Fig 1. Flowchart for managing an incidental renal mass on noncontrast CT. [1]If the mass contains fat attenuation (a region of interest < −10 HU), refer to Figure 5. [2]Too small to characterize. [3]Well-circumscribed and homogeneous TSTC renal masses that are visually much lower or much higher than the unenhanced renal parenchyma are probably benign cystic lesions. [4]MRI is preferred for characterizing smaller masses (<1.5 cm) and for detecting enhancement in suspected hypovascular masses. Ultrasound may be able to characterize a homogeneous hyperattenuating renal mass as a hemorrhagic or proteinaceous cyst. [5]If old images are available, any renal mass that has been without change in imaging features *and* has had an average growth of ≤ 3 mm per year for at least 5 years is likely of no clinical significance and does not need further workup. HU = Hounsfield unit; TSTC = too small to characterize; WO&W = without and with; W/U = work-up.

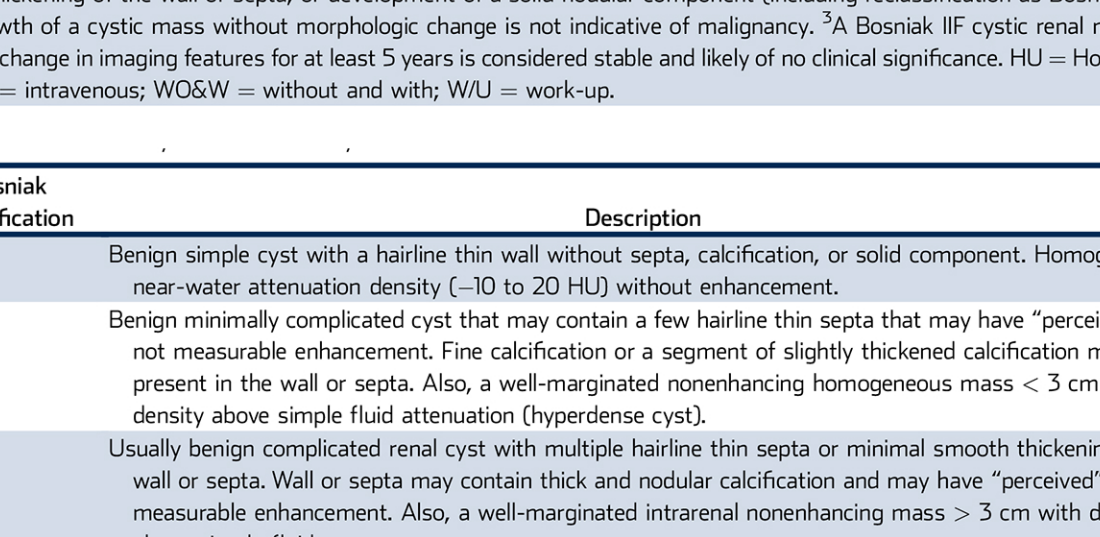

Fig 2. Flowchart for managing an incidental renal mass on contrast-enhanced CT. [1]If the mass contains fat attenuation (a region of interest < −10 HU), refer to Figure 5. [2]Too small to characterize. [3]Well-circumscribed and homogeneous TSTC renal masses that are visually much lower than the enhanced renal parenchyma are probably benign cystic lesions. [4]MRI is preferred for characterizing smaller masses (<1.5 cm) and for detecting enhancement in suspected hypovascular masses. Ultrasound may be able to characterize a homogeneous renal mass as a hemorrhagic or proteinaceous cyst. [5]If old images are available, any renal mass that has been without change in imaging features *and* has had an average growth of ≤3 mm per year for at least 5 years is likely of no clinical significance and does not need further workup. HU = Hounsfield unit; TSTC = too small to characterize; WO&W = without and with; W/U = work-up.

Table 3. CT and MRI criteria for defining enhancement in a renal mass

CT Criteria: Increase in Attenuation After Contrast	
≥20 HU	Definite for enhancement
>10 to < 20 HU	Equivocal for enhancement; consider factors related to beam hardening, intra-renal location*
≤10 HU	No enhancement
MRI criteria for enhancement	
≥15% increase in signal intensity after contrast	Enhancing lesion
Alternative method	Visible signal intensity on subtraction images

HU = Hounsfield units.
*Stricter criteria (15 HU) should be used as a cutoff for enhancement of exophytic or larger lesions not prone to these factors.

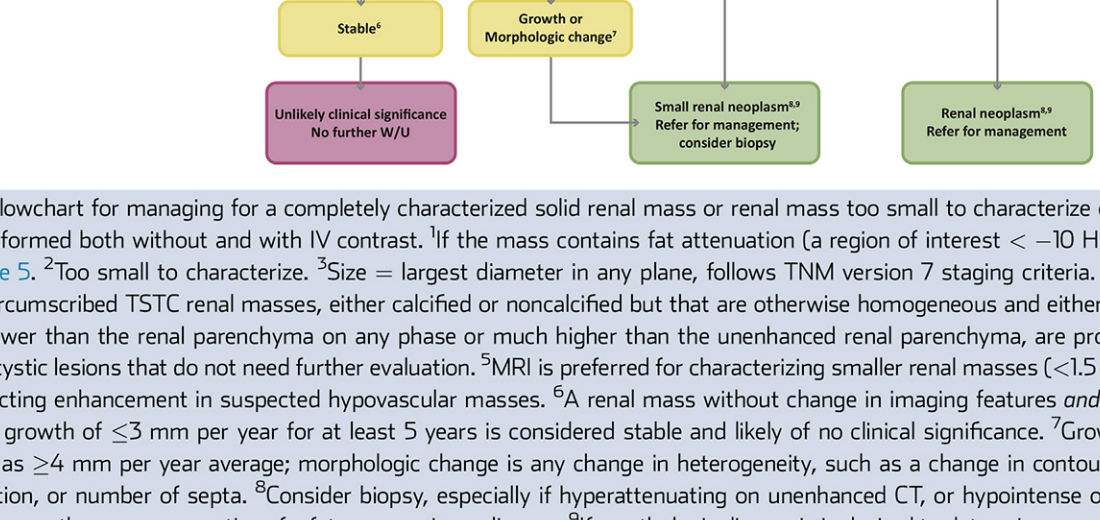

Fig 3. Flowchart for managing a cystic renal mass on CT or MRI performed both without and with IV contrast. [1]If the mass contains fat attenuation (a region of interest < −10 HU), refer to Figure 5. [2]Morphologic change includes increasing number of septa, thickening of the wall or septa, or development of a solid nodular component (including reclassification as Bosniak III or IV). Growth of a cystic mass without morphologic change is not indicative of malignancy. [3]A Bosniak IIF cystic renal mass without change in imaging features for at least 5 years is considered stable and likely of no clinical significance. HU = Hounsfield unit; IV = intravenous; WO&W = without and with; W/U = work-up.

Bosniak Classification	Description
I	Benign simple cyst with a hairline thin wall without septa, calcification, or solid component. Homogeneous near-water attenuation density (−10 to 20 HU) without enhancement.
II	Benign minimally complicated cyst that may contain a few hairline thin septa that may have "perceived" but not measurable enhancement. Fine calcification or a segment of slightly thickened calcification may be present in the wall or septa. Also, a well-marginated nonenhancing homogeneous mass < 3 cm with density above simple fluid attenuation (hyperdense cyst).
IIF	Usually benign complicated renal cyst with multiple hairline thin septa or minimal smooth thickening of the wall or septa. Wall or septa may contain thick and nodular calcification and may have "perceived" but not measurable enhancement. Also, a well-marginated intrarenal nonenhancing mass > 3 cm with density above simple fluid.
III	Indeterminate complicated cystic renal mass with thickened irregular walls or septa that have measurable enhancement.
IV	Malignant cystic renal mass with enhancing soft tissue components (cystic renal cell carcinoma).

Fig 4. Flowchart for managing for a completely characterized solid renal mass or renal mass too small to characterize on CT or MRI performed both without and with IV contrast. [1]If the mass contains fat attenuation (a region of interest < −10 HU), refer to Figure 5. [2]Too small to characterize. [3]Size = largest diameter in any plane, follows TNM version 7 staging criteria. [4]Well-circumscribed TSTC renal masses, either calcified or noncalcified but that are otherwise homogeneous and either visually much lower than the renal parenchyma on any phase or much higher than the unenhanced renal parenchyma, are probably benign cystic lesions that do not need further evaluation. [5]MRI is preferred for characterizing smaller renal masses (<1.5 cm) and for detecting enhancement in suspected hypovascular masses. [6]A renal mass without change in imaging features *and* with an average growth of ≤3 mm per year for at least 5 years is considered stable and likely of no clinical significance. [7]Growth is defined as ≥4 mm per year average; morphologic change is any change in heterogeneity, such as a change in contour, attenuation, or number of septa. [8]Consider biopsy, especially if hyperattenuating on unenhanced CT, or hypointense on T2WI MRI, because these are suggestive of a fat-poor angiomyolipoma. [9]If a pathologic diagnosis is desired to determine management but biopsy is technically challenging, or there is another relative contraindication to biopsy, consider MRI to assess the signal intensity on T2WI. Fat-poor angiomyolipoma and papillary renal cell carcinoma may be hypointense on T2WI in contrast to clear cell renal cell carcinoma, which is typically heterogeneous and mildly hyperintense on T2WI. HU = Hounsfield unit; IV = intravenous; T2WI = T2-weighted imaging; WO&W = without and with; W/U = work-up.

Fig 5. Flowchart for managing an incidental renal mass with a region of interest measuring fat attenuation (less than −10 HU). [1]Incidental sporadic AML (ie, no hematuria, flank pain, or perilesional hemorrhage.) [2]Many urologists will follow patients with small AMLs that are rapidly growing and some patients with multiple AMLs may benefit from an evaluation for tuberous sclerosis complex. [3]If only an unenhanced CT has been performed, consider CT or MR without and with IV contrast. [4]Patients with symptomatic AMLs (hematuria, flank pain, spontaneous bleeding) should be referred to urology regardless of size. [5]AML ≥ 4 cm or those with aneurysms greater than 0.5 cm should be referred for prophylactic treatment. AML = angiomyolipoma; HU = Hounsfield unit; IV = intravenous; WO&W = without and with; W/U = work-up.