

Table 2: Proposed Update to the Bosniak Classification of Cystic Renal Masses

Class	CT: Proposed Bosniak Classification, Version 2019*	MRI: Proposed Bosniak Classification, Version 2019*
I	Well-defined, <i>thin</i> (≤ 2 mm) smooth wall; homogeneous simple fluid (-9 to 20 HU); no septa or calcifications; <i>the wall may enhance</i>	Well-defined, <i>thin</i> (≤ 2 mm) smooth wall; homogeneous simple fluid (<i>signal intensity similar to CSF</i>); no septa or calcifications; <i>the wall may enhance</i>
II	Six types, <i>all well-defined with thin</i> (≤ 2 mm) smooth walls: <ol style="list-style-type: none"> 1. Cystic masses with thin (≤ 2 mm) and few (1–3) septa; septa and wall <i>may enhance</i>; may have <i>calcification of any type</i>[†] 2. <i>Homogeneous hyperattenuating</i> (≥ 70 HU) masses at noncontrast CT 3. Homogeneous nonenhancing masses > 20 HU at renal mass protocol CT (73), may have <i>calcification of any type</i>[†] 4. <i>Homogeneous masses</i> -9 to 20 HU at noncontrast CT 5. <i>Homogeneous masses</i> 21 to 30 HU at portal venous phase CT 6. <i>Homogeneous low-attenuation masses that are too small to characterize</i> 	Three types, <i>all well-defined with thin</i> (≤ 2 mm) smooth walls: <ol style="list-style-type: none"> 1. Cystic masses with thin (≤ 2 mm) and few (1–3) <i>enhancing</i> septa; <i>any nonenhancing septa</i>; may have <i>calcification of any type</i>[†] 2. <i>Homogeneous masses markedly hyperintense at T2-weighted imaging (similar to CSF) at noncontrast MRI</i> 3. <i>Homogeneous masses markedly hyperintense at T1-weighted imaging (approximately $\times 2.5$ normal parenchymal signal intensity) at noncontrast MRI</i>
IIF	Cystic masses with a smooth minimally thickened (3 mm) enhancing wall, or smooth minimal thickening (3 mm) of one or more enhancing septa, or <i>many</i> (≥ 4) smooth thin (≤ 2 mm) <i>enhancing</i> septa	Two types: <ol style="list-style-type: none"> 1. Cystic masses with a smooth minimally thickened (3 mm) enhancing wall, or smooth minimal thickening (3 mm) of one or more enhancing septa, or <i>many</i> (≥ 4) smooth thin (≤ 2 mm) <i>enhancing</i> septa 2. <i>Cystic masses that are heterogeneously hyperintense at unenhanced fat-saturated T1-weighted imaging</i>
III	One or more enhancing thick (≥ 4 mm width) or enhancing irregular (<i>displaying</i> ≤ 3 -mm <i>obtusely margined convex protrusion[s]</i>) walls or septa	One or more enhancing thick (≥ 4 mm width) or enhancing irregular (<i>displaying</i> ≤ 3 -mm <i>obtusely margined convex protrusion[s]</i>) walls or septa
IV	One or more <i>enhancing nodule(s)</i> (≥ 4 -mm <i>convex protrusion with obtuse margins, or a convex protrusion of any size that has acute margins</i>)	One or more <i>enhancing nodule(s)</i> (≥ 4 -mm <i>convex protrusion with obtuse margins, or a convex protrusion of any size that has acute margins</i>)

Note.—Italicized elements emphasize changes from the current Bosniak classification (10) (Table 1). For detailed definitions of terms, see Table 3. CSF = cerebrospinal fluid.

* The Bosniak classification is intended for cystic renal masses after infectious, inflammatory, or vascular etiologies and necrotic solid masses are excluded. If a cystic mass has features described in more than one Bosniak class, the highest Bosniak class is assigned. In rare cases, a mass may have an unusual combination of features (undefined, not fitting a specific Bosniak class) that may warrant inclusion into Bosniak IIF. Other than for the diagnosis of Bosniak I simple cysts, the role of US with or without contrast material in assigning a Bosniak class is uncertain.

† Renal masses that at CT have abundant thick or nodular calcifications; are hyperattenuating, homogeneous, nonenhancing, and larger than 3 cm; or are heterogeneous (including but not limited to many [four or more] nonenhancing septa or 3 -mm or larger nonenhancing septa or wall) might best be visualized at MRI prior to the assignment of a Bosniak class to determine if there are occult enhancing elements that might affect classification.

Table 4: Suggested Terms and Phrases to Use When Reporting Cystic Renal Masses Using the Bosniak Classification, Version 2019

Classification	Suggested Terms and Phrases
Bosniak I	“Benign simple renal cyst requiring no follow-up.”
Bosniak II	(Option 1) “Benign Bosniak II renal cyst requiring no follow-up.”* (Option 2) “Likely benign Bosniak II renal mass requiring no follow-up.”†
Bosniak IIF	“Bosniak IIF cystic renal mass. The large majority of Bosniak IIF masses are benign. When malignant, nearly all are indolent. Generally, Bosniak IIF masses are followed by imaging at 6 months and 12 months, then annually for a total of 5 years to assess for morphologic change.”
Bosniak III	“Bosniak III cystic renal mass. Bosniak III masses have an intermediate probability of being malignant. If not already obtained, consider urology consultation.”
Bosniak IV	“Bosniak IV cystic renal mass. The large majority of Bosniak IV masses are malignant. If not already obtained, consider urology consultation.”

Note.—This content is intended for patients in the general population and not those with a renal cell carcinoma syndrome.

* This option is best used for Bosniak II masses that have been confirmed to be cysts (eg, cysts with few thin septa).

† The Bosniak II category includes some masses that, although they are reliably considered benign, have not been definitively characterized as cysts (eg, low-attenuation lesions that are too small to characterize).

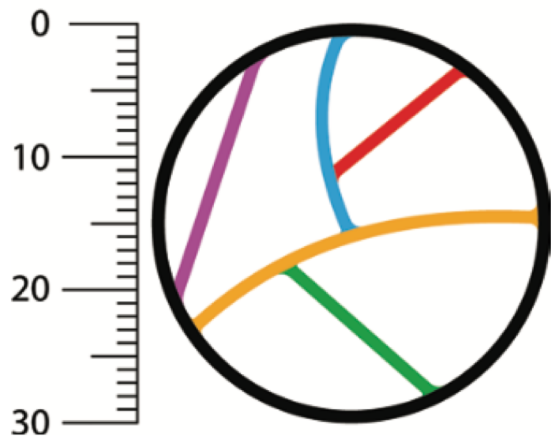
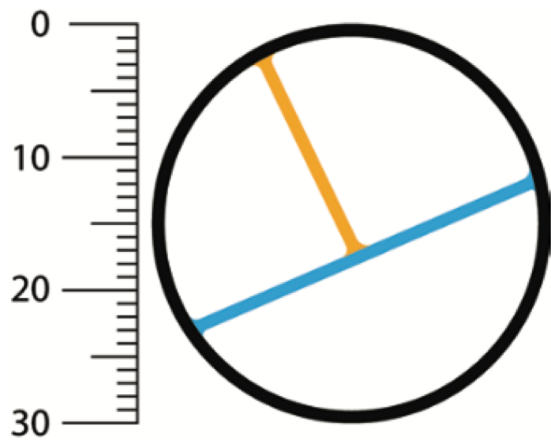


Figure 1: Determination of number of septa with the Bosniak classification of cystic renal masses, version 2019. Example of Bosniak II cyst (top) and IIF cystic mass (bottom) classified on the basis of the number of thin (≤ 2 mm) septa. A septum is defined as a linear or curvilinear structure that connects two surfaces. Each differently colored line indicates a unique septum (two on top, five on bottom).

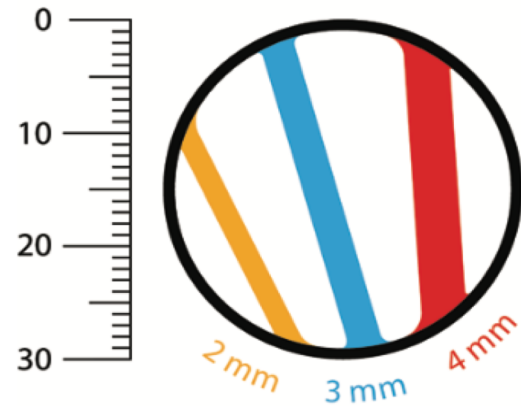
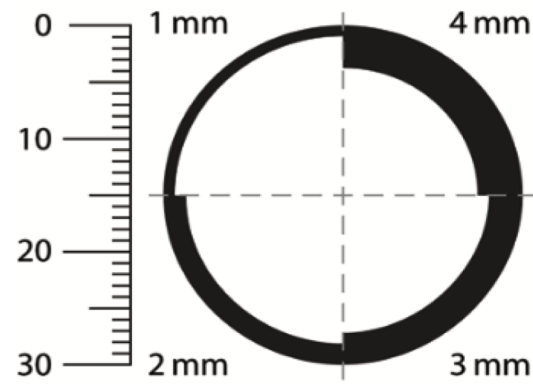


Figure 2: Determination of wall and septa thickness by using the Bosniak classification of cystic renal masses, version 2019. Images show example thicknesses of the walls and septa within 30-mm cystic masses (measurements are to scale). A smooth, thin (≤ 2 -mm) wall is a feature of a Bosniak I cyst, a smooth and thin (≤ 2 -mm) wall and septa are features of a Bosniak II cyst, a smooth and minimally thickened (3-mm) wall or septa is a feature of a Bosniak IIF mass, and a thickened (≥ 4 -mm) enhancing wall or septa is a feature of a Bosniak III mass. The wall in the bottom image is 1 mm thick.

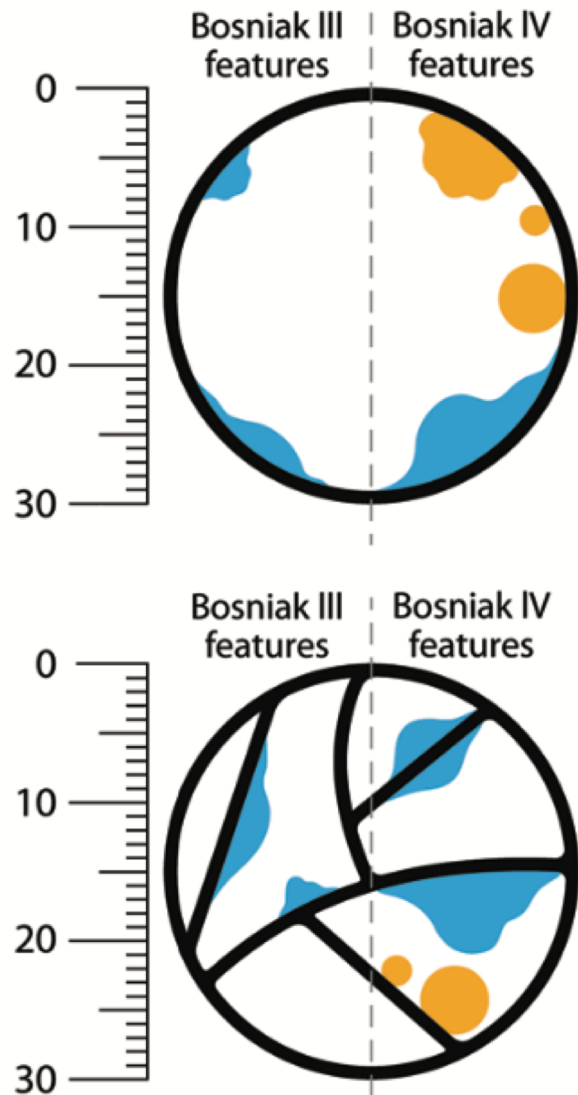


Figure 3: Distinguishing wall and septa irregularity from nodules by using the Bosniak classification of cystic renal masses, version 2019. Images show examples of convex protrusions within 30-mm Bosniak III and Bosniak IV cystic masses (measurements are to scale). Enhancing convex protrusions that arise from a wall or septa are either nodules (any size if they have acute margins with the walls or septa, or ≥ 4 mm if they have obtuse margins with the wall or septa [a feature of Bosniak IV]) or irregular thickening (≤ 3 mm if they have obtuse margins with wall or septa, a feature of Bosniak III). Size measurements are obtained perpendicular to the wall or septum of origin. If convex protrusion(s) are on both sides of a wall or septum, the cumulative perpendicular distance is used and excludes the thickness of the underlying wall or septum. Orange features have acute margins and blue features have obtuse margins. Bosniak III features are examples of focal irregular thickening. Bosniak IV features are examples of nodules.