Renal Masses Measuring Under 2 cm: What is the Utility of MRI Features in Distinguishing Benign and Malignant Cases?

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Target Audience: Radiologists and Urologists involved in the management of incidentally detected small renal masses.

Purpose: To explore the potential role of MRI features in distinguishing benign and malignant renal masses measuring up to 20 mm.

Methods: In this IRB-approved retrospective study, we performed a database search to identify renal masses measuring up to 20 mm that underwent MRI prior to resection or biopsy between 1/2003 and 6/2012. Two radiologists (R1 and R2, with 5 and 1 years of experience in body MRI, respectively) independently characterized each mass for the presence of a spectrum of MRI features. Fisher's exact test was used to assess for differences in the frequency of each MRI finding, as well as patient gender, between benign and malignant masses; unpaired t-test was used to assess for differences in patient age or lesion size (determined as average size measured by R1 and R2) between these two categories.

Table 1: Comparison of qualitative MRI features between benign and malignant renal masses measuring ≤20 mm						
MRI Feature	Reader 1			Reader 2		
	Benign	Malignant	p	Benign	Malignant	p
Microscopic lipid	4%	3%	1.0	13%	10%	0.717
Hemorrhage	8%	19%	0.338	13%	24%	0.380
T2 Hyperintensity	75%	69%	0.795	63%	62%	1.0
T2 Homogeneity	75%	56%	0.144	54%	41%	0.341
Cystic/necrotic areas	17%	25%	0.573	17%	25%	0.573
Hypervascularity	63%	49%	0.342	67%	51%	0.237
Enhancement Homogeneity	54%	56%	1.0	29%	24%	0.592
Circumscribed Margins	96%	93%	1.0	75%	74%	1.0
Predominantly exophytic	38%	49%	0.475	42%	49%	0.638

Results: 92 masses in 86 patients were included. At histopathology, 74% (68/92) were malignant (31 clear-cell RCC, 24 papillary RCC, 9 chromophobe RCC, 1 cystic RCC of undetermined subtype, 3 mixed clear-cell/papillary RCC), and 26% (24/92) were benign (8 AML, 13 oncocytoma, 3 benign cysts). No MRI feature showed a statistically significant difference between benign and malignant masses for either reader (p 0.144-1.0, **Table 1**). There was also no significant difference between benign and malignant masses in terms of size (15.5±3.5 mm vs. 14.2±3.5 mm, respectively, p=0.117), age (64.0±11.7 years vs. 60.5±13.2 years, respectively, p=0.251), or gender (benign: 58% male, 42% female; malignant: 53% male, 47%, female; p=0.812). Agreement between the two readers for the binary features ranged from 67.4% to 93.5%; inter-reader correlation for lesion size was excellent (r=0.803, p<0.001).

Figure 1 (top): 64 year-old female with benign 14 mm renal angiomyolipoma (solid arrow).
Figure 2 (bottom): 41 year-old with malignant 16 mm papillary renal cell carcinoma (dashed arrow).
Both masses show similar MRI features: circumscribed; predominantly endophytic; non-cystic; homogeneous decreased T2 signal; homogeneous low-level enhancement.

Discussion: Previous studies in the Urologic literature have reported increased frequency of benignity in small renal masses[1,2]. Indeed, our observed rate of benignity of 26% for masses measuring up to 20 mm is similar to the frequency of 30.0% for masses within the same size threshold reported by Frank et al[2]. Moreover, the importance of this category of lesions is highlighted by Radiology literature designating a distinct category of "very small" renal masses[3] that warrant a unique management strategy (serial follow-up rather than biopsy or resection) given the greater rate of benignity. The ability to reliably categorize such lesions at time of detection could impact clinical management by facilitating earlier intervention for malignant lesions and decreasing unnecessary intervention or follow-up imaging intervals for benign cases. While studies have shown the role of MRI features in reliably predicting histology of renal masses in general, we were surprised to observe that none of the features we assessed showed significant differences between benign and malignant pathologies when only including smaller lesions. We speculate that this may relate to difficulty of assessing some of the MRI features, such as homogeneity, among smaller lesions, as well as the possibility that very small renal masses show these features in different frequencies than have been reported in past studies that selected larger lesions.

Conclusion: While 26% of lesions within our cohort of 92 renal masses measuring up to 20 mm were benign, no demographic or MRI feature showed a significant difference in frequency between benign and malignant cases. Further studies are warranted to identify clinical features that may assist in their differentiation.

References: [1] Thompson RH, Kurta JM, Kaag M, et al. *J Urol.* 2009;181(5):2033-6. [2] Frank I, Blute ML, Cheville JC, Lohse CM, Weaver AL, Zincke H. *J Urol.* 2003;170:2217-20. [3] Silverman SG, Israel GM, Herts BR, Richie JP. *Radiology.* 2008;249: 16-31.