Editorial

Initial experience with arterial spin-labeling MR imaging to assess histology of renal masses

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Abstract: It is standard practice to presume that solid renal tumors are malignant and perform a nephrectomy without a biopsy. In many clinical situations, renal biopsies lack sufficient diagnostic accuracy to justify altering management. Lanzman and colleagues propose the use of arterial spin-labeling magnetic resonance imaging to assess renal histology and grade. They used histopathologic data as the reference standard, and reported a statistically significant difference in measured tumor perfusion between papillary renal tumor, oncocytomas, and all other histologic subtypes examined. If confirmed in larger studies, this imaging modality may play a role in triaging patients with solid renal masses for surgery or renal biopsy.

Key Words: Renal tumors; nephrectomy; renal biopsies; arterial spin-labeling magnetic resonance imaging

Submitted May 25, 2013. Accepted for publication Jun 25, 2013.
doi: 10.3978/j.issn.2223-4292.2013.06.05
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Each year over 60,000 cases of renal malignancies are diagnosed, representing 3.8% of all newly diagnosed cancers. Renal malignancies result in over 13,000 deaths each year, which account for 2.3% of all cancer deaths (1). Since the 1970s, the incidence of renal tumors has been increasing by approximately 3% each year. This trend is in part explained by the widespread increase in use of ultrasounds and CT scans, resulting in the incidental detection of early renal cell carcinoma (RCC). However, the mortality rate for RCC has also increased, which suggests that other unidentified factors account for this trend. Approximately one third of patients will have metastatic disease at the time of diagnosis, and after treatment for localized RCC, 25-50% of patients will suffer recurrence (2-5). The prognosis associated with recurrent and metastatic RCC is poor; historical 3-year survival is less than 5% and virtually all patients eventually die of their disease (6). Of all urologic malignancies, RCC has the highest ratio of disease-related deaths to incidence.

The standard-of-care for the management of solid renal tumors is surgical intervention such as radical nephrectomy, partial nephrectomy or ablative therapy. Unlike most other solid tumors where biopsy is an important part of the workup and management, renal tumors are often treated without a biopsy and presumed to be malignant. There are several reasons why biopsy is not routinely performed. (I) 10-15% of biopsies are indeterminate (7) and renal tumors are often treated despite lack of proof of malignancy on biopsy; (II) Although the risk of tumor spillage is not clinically significant for solid renal tumors, concern remains that renal lesions with cystic components can rupture and spill tumor cells into the retroperitoneum. The consequence of definitively managing solid renal lesions without a confirmed histologic diagnosis is that 10-20% of patients with benign lesions undergo surgery simply because we lack more effective diagnostic strategies.

A percutaneous biopsy is minimally invasive and it can identify the histologic subtype in approximately 90% of cases (8). However, it is less reliable for determining tumor grade and has been shown to underestimate grade in the majority of cases. Therefore, many expert pathologists simply choose not to report grade from a biopsy sample. Improved imaging technology holds out the promising of noninvasively delivering information traditionally obtained

used a microscope. Lanzman and colleagues explore the use of arterial spin-labeling magnetic resonance imaging (ASL MRI) to assess renal histology and tumor grade. ASL MRI is a completely noninvasive imaging technique for assessing perfusion without the need for injection of contrast agent (9). To accomplish this, water in endogenous blood is magnetized to "label" the blood. The difference in images acquired with and without labeling allows tissue perfusion to be quantified (10).

Lanzman and collegues performed ASL MRI as well as standard dynamic contrast enhanced (DCE) MRI on 42 patients and asked whether differences in the perfusion of renal tumors can provide information on histologic subtype and grade (9). Their final analysis included 34 patients for whom histopathologic data was available for use as the reference standard. The study included patients with low grade clear cell RCC (n=8), high grade clear cell RCC (n=7), chromophobe RCC (n=4), papillary RCC (n=5), unclassified RCC (n=4), and oncocytoma (n=4); one patient with urothelial carcinoma and one patient with tubulocystic RCC were excluded due to the low frequency of the histologic subtypes in their series. Renal tumor perfusion as measured by ASL or DCE produced statistically significant differences between histologic subtypes. Papillary renal tumors had the lowest perfusion, and oncocytomas had the highest perfusion. ASL-MRI was not useful for differentiating between low and high-grade clear cell RCC or between pT1 and pT3 tumors. However, there was a statistically significant correlation between peak tumor perfusion and size of clear cell RCC.

Based on these results the authors suggested that ASL MRI may be useful for identifying oncocytomas, which is a benign lesion. If oncocytomas can be identified with complete confidence, surgery can be avoided. However, as the authors point out, this is a small study that needs to be confirmed. Importantly, even in this small study that only contained 4 oncocytomas, there was overlap in the mean and peak ASL perfusion levels between oncocytomas and the other malignant RCC subtypes. Therefore, a larger study may provide clinicians with a measurement of sensitivity and specificity for diagnosing oncocytomas; however, it is unlikely that ASL MRI in its current form will provide the diagnostic accuracy available after nephrectomy. However, it is possible to envision a combination of ASL MRI and percutaneous biopsy to increase diagnostic accuracy. Additional diagnostic information may be available by characterizing small renal tumors with serial ASL MRI studies to provide information about tumor changes over time.

Cite this article as: Masarapu V, Kim HL. Initial experience with arterial spin-labeling MR imaging to assess histology of renal masses. Quant Imaging Med Surg 2013;3(3):130-131. doi: 10.3978/j.issn.2223-4292.2013.06.05

Acknowledgements

Disclosure: The authors declare no conflict of interest.

References

1. Jemal A, Bray F, Center MM, et al. Global cancer statistics. CA Cancer J Clin 2011;61:69-90.
2. deKernion JB. Treatment of advanced renal cell carcinoma--traditional methods and innovative approaches. J Urol 1983;130:2-7.
3. Hock LM, Lynch J, Balaji KC. Increasing incidence of all stages of kidney cancer in the last 2 decades in the United States: an analysis of surveillance, epidemiology and end results program data. J Urol 2002;167:57-60.
4. Rabinovitch RA, Zelefsky MJ, Gaynor JJ, et al. Patterns of failure following surgical resection of renal cell carcinoma: implications for adjuvant local and systemic therapy. J Clin Oncol 1994;12:206-12.
5. Skinner DG, Colvin RB, Vermillion CD, et al. Diagnosis and management of renal cell carcinoma. A clinical and pathologic study of 309 cases. Cancer 1971;28:1165-77.
6. Figlin RA. Renal cell carcinoma: management of advanced disease. J Urol 1999;161:381-6; discussion 386-7.
7. Mally AD, Gayed B, Averch T, et al. The current role of percutaneous biopsy of renal masses. Can J Urol 2012;19:6243-9.
8. Blumenfeld AJ, Guru K, Fuchs GJ, et al. Percutaneous biopsy of renal cell carcinoma underestimates nuclear grade. Urology 2010;76:610-3.
9. Lanzman RS, Robson PM, Sun MR, et al. Arterial spin-labeling MR imaging of renal masses: correlation with histopathologic findings. Radiology 2012;265:799-808.
10. Detre JA, Rao H, Wang DJ, et al. Applications of arterial spin labeled MRI in the brain. J Magn Reson Imaging 2012;35:1026-37.

