

Image-Guided Renal Interventions



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KEYWORDS

• Renal mass biopsy • Renal parenchymal biopsy • Renal mass ablation

KEY POINTS

- Renal mass and parenchymal biopsies are safe (<5% minor complication rate and <0.5% major complication rate) with high diagnostic rates.
- Final biopsy pathology results must be compared with preprocedural imaging; rebiopsy or definitive treatment is recommended for discordant or nondiagnostic results.
- The safety and efficacy of renal parenchymal biopsies is optimized by meticulous needle placement confined to the peripheral renal cortex.
- Cryoablation, microwave ablation, and radiofrequency ablation are the most commonly used methods for renal malignancies, each with specific advantages and disadvantages.
- Renal mass ablations are indicated for stage T1a (<4 cm) renal masses in poor surgical candidates; other indications are emerging.

RENAL MASS AND PARENCHYMAL BIOPSIES

Renal mass biopsies (RMB) and renal parenchymal biopsies (RPB) play an increasing role in clinical management. This article discusses the indications, techniques, and clinical considerations for RMB and RPB.

Renal Mass Biopsy Indications

Established indications

Historically, most renal masses were presumed malignant and surgically resected. Accepted indications for RMB were limited to confirmation of metastatic renal disease in patients with known primary malignancies, differentiation of malignancy from infection, evaluation of multiple solid renal masses, and evaluation of unresectable renal masses for prognostication and medical management.¹⁻⁴ These indications remain important in current practice (**Table 1**).

Emerging indications

The number of small (<3 cm) incidentally discovered renal lesions has increased dramatically, with a recent study finding 25% of those less than 3 cm and 44% of those less than 1 cm to be benign.⁵ Such data have led to a push for biopsies of small masses to decrease the number of unnecessary nephrectomies and preserve renal tissue, particularly when a metastatic, inflammatory, or infectious etiology is suspected.⁶

Reported malignancy rates in indeterminate cystic masses (Bosniak IIF and III) are widely variable, ranging from 31% to 100%.^{1,7,8} Therefore, there has been an increasing role of biopsy to characterize these lesions before definitive management.^{3,4}

Renal Parenchymal Biopsy Indications

RPB is used to establish a diagnosis for unexplained renal symptoms or to assess chronicity and reversibility of the disease process.

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Table 1
Common renal mass biopsy indications

Established Indications	Recent and Emerging Indications
Determine metastatic vs primary renal malignancy	Presurgical diagnosis of renal masses (especially <3 cm)
Differentiate infection vs malignancy	Diagnose indeterminate cystic masses (Bosniak IIF and III)
Prognostication/management in nonsurgical candidates	Confirm malignancy before renal mass ablation

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Nephrotic syndrome

In patients with nephrotic syndrome, RPB is commonly performed to evaluate idiopathic and systemic lupus erythematosus-related proteinuria, but is less clinically useful in chronically acquired diabetic proteinuria, in children younger than 6 years of age (>90% have minimal change disease), or in malignancy-related proteinuria.^{9,10}

Nephritic syndrome

RPB may be useful in the evaluation of acute nephritic syndrome to diagnose a systemic disease process (eg, microscopic polyangiitis, granulomatosis with polyangiitis, antglomerular basement membrane antibody disease). RPB is less likely to impact clinical management in patients with post-streptococcal glomerulonephritis or endocarditis-related nephritic syndrome.^{9,11}

Other indications

RPB is also used to evaluate acute unexplained renal failure, moderate to severe nonnephrotic proteinuria, and suspected renal transplant rejection.^{9,11} RPB is often not useful in patients with isolated microscopic hematuria in the absence of proteinuria or renal failure.^{9,12}

Differential Diagnosis of Renal Masses

Benign

Commonly biopsied benign entities include oncocytoma (70%), minimal fat angiomyolipoma (18%), and papillary adenoma (4%).^{2,5} Other less frequently encountered masses include metanephric adenoma, leiomyoma, and focal pyelonephritis. A mass referred for biopsy may occasionally have imaging characteristics that allow definitive diagnosis of a benign entity (eg, macroscopic fat in

angiomyolipoma) and recognition of such features can avoid unnecessary intervention.

Malignant

Renal cell carcinoma (RCC) can be further categorized by grade and subtype. The Fuhrman classification system offers prognostic and therapeutic implications.¹³ Common subtypes include clear cell (80%–90%), papillary (10%–15%), and chromophobe (4%–5%).¹⁴ Chromophobe subtypes share histologic features with oncocytoma with the potential for misdiagnosis.^{5,15} Sarcomatoid differentiation may occur with any subtype and portends a worse prognosis.^{16,17} Other common malignancies include transitional cell carcinoma and metastases (most commonly lymphoma, lung, and breast).¹⁸

Preprocedure Workup

Review history and imaging

Before biopsy, the patient's history, underlying disease, and indication for the procedure should be reviewed (**Box 1**). Relevant imaging should also be reviewed to confirm the appropriateness and feasibility of the biopsy.

Box 1

Renal intervention preprocedure checklist

- Confirm appropriate indication.
- Ensure no benign diagnostic features (eg, macroscopic fat in angiomyolipoma).
- Plan approach.
- Review history and physical; allergies.
- Assess pain control (eg, heavy opioid use, recent surgery).
- Assess ability to lie and breathe in desired position.
- Confirm NPO status.
- Anesthesiology consultation, if appropriate.
- Target blood pressure less than 140/90 mm Hg (optional).
- Manage anticoagulation: risk–benefit assessment.
- Review laboratory studies: prefer International Normalized Ratio of less than 1.5; platelets greater than 50,000.
- Check baseline hematocrit.

Abbreviation: NPO, nil per os.

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