

## R E V I E W

## Imaging guided percutaneous renal biopsy: do it or not?

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**Summary.** Since its first reported application, renal biopsy became an important part of the diagnostic algorithm, considered advantages and risks, to better manage therapeutic options. The biopsy can be performed with different techniques (open, laparoscopic, transjugular, transurethral and percutaneous). Currently, the percutaneous approach is the modality of choice. Percutaneous biopsy can be performed under CT or US guidance, but critical benefits and disadvantages have to be considered. Core needle biopsy is usually preferred to fine-needle aspiration because of the sample quality, usually obtaining multiple cores, especially in heterogeneous tumors. Principal complications are hematuria (1-10%), perinephric hematoma (10-90%), pneumothorax (0,6%), clinically significant pain (1,2%). ([www.actabiomedica.it](http://www.actabiomedica.it))

**Keywords:** percutaneous renal biopsy, small renal mass, renal cell carcinoma, US-guided biopsy, CT-guided biopsy, coaxial technique.

### Introduction

Interventional radiology techniques have been developed and used widely, becoming critical both for the diagnosis and therapeutic management of many diseases (1-15). The first renal biopsy approach was surgical, performed by Gwyn (16). More recently, different methods (open, laparoscopic, transjugular, transurethral, and percutaneous) (17, 18) and improvements have been made (19). Nowadays, the percutaneous approach (Percutaneous Renal Biopsy or PRB) is considered the modality of choice, but in case of failure or major contraindication, other methods could be preferred. The transjugular approach, even in consideration of its disadvantages, allows multiorgan biopsies during the same procedure, and it can be recommended in case of failure of PRB and in patients with severe coagulopathies since it gives the possibility

to perform a selective embolization in case of bleeding. The transurethral biopsy may be considered in case of patients undergoing a cystoscopic examination and do not wish to undergo PRB separately, or when there is the suspected involvement of upper urinary tract.

### Indications

The main indications to perform a renal biopsy, following nephrologists recommendation, are cases of idiopathic nephritic and nephrotic syndromes and the diagnosis of unknown primary lesions (20). Renal biopsy could also be useful in detecting acute or chronic renal allograft rejection (in presence of increasing serum creatinine levels) or in order to evaluate the response to antirejection therapy.

Timing and utility of the biopsy are still debated even in presence of an unknown primary lesion,

though the consensus on the need of tissue sampling if the management could be conditioned. Different theories explain the poor adoption of renal tumor biopsy as a standard of care for small renal masses (SRMs, size <4 cm), but none is well-supported by studies reported over the past years (21, 22). Safety, discordance with diagnosis after surgery, low diagnostic rates, and lack of perceived impact on clinical management are reported as the leading causes for the low consensus between specialists for practicing renal tumor biopsy (RTB) (23). Despite these concerns, the number of renal biopsies is grown thanks to the fact that procedural risks, such as tumor seeding and bleeding, have been reduced through improving the experience of operators and perfecting those techniques (24) (**fig 1**). Moreover, an international panel has recommended RTB before any ablative treatment (25).

#### *Imaging methods*

Accurate preprocedural imaging study is crucial for a proper diagnosis, preoperative planning, and postoperative follow-up (26-28). Though the application of MRI is growing in the field of interventional radiology, most procedures are performed under fluoroscopic, ultrasound, and CT imaging guidance (19, 29-39). Percutaneous biopsy can be performed under CT or US guidance, but critical benefits and disadvantages have to be considered. Ultrasonography has the advantages to offer a real-time view during needle

placement, which allows to avoid vascular structures; furthermore, US is a low-cost technique and allows multiplanar imaging (40). However, US does not allow an accurate visualization of all renal mass, thus requiring contrast media administration (41).

CT is frequently used, with a step-and-shoot approach or as CT-fluoroscopy, allowing a better and less operator-dependent target detection. CT approach is characterized by high spatial resolution and a large field of view, enabling multiplanar reconstruction (MPR) to obtain an adequate visualization of the path of the needle (19) (**fig 2**). The main disadvantages are related to the more difficult positioning of the needle due to the patient's respiratory movement, as well as the side effects related to ionizing radiation.

#### *The technique*

There are two primary modalities for performing a percutaneous biopsy: fine-needle aspiration biopsy (FNAB) and core needle biopsy (CNB) (42, 43).

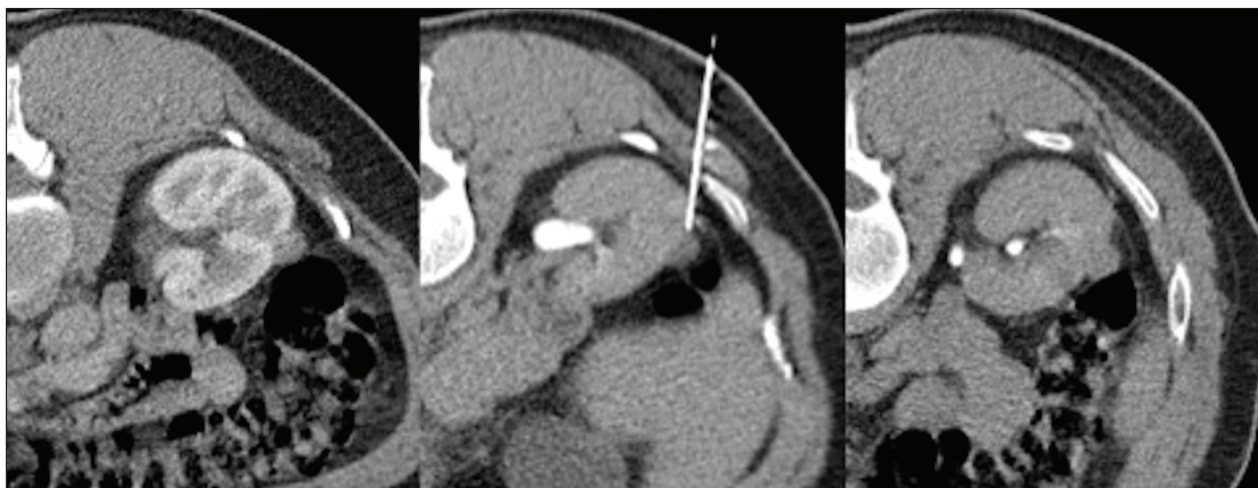
FNAB is a cytologic technique involving the use of a small needle (18-25G) equipped with an inner stylet. Once in the target, the stylet is removed, and a syringe is connected.

Individual cells for cytological evaluation could be obtained after creating a vacuum and moving gently and repeatedly back-and-forth the system.

CNB involves devices with larger needles (usually 16-18G) and different mechanisms to obtain the



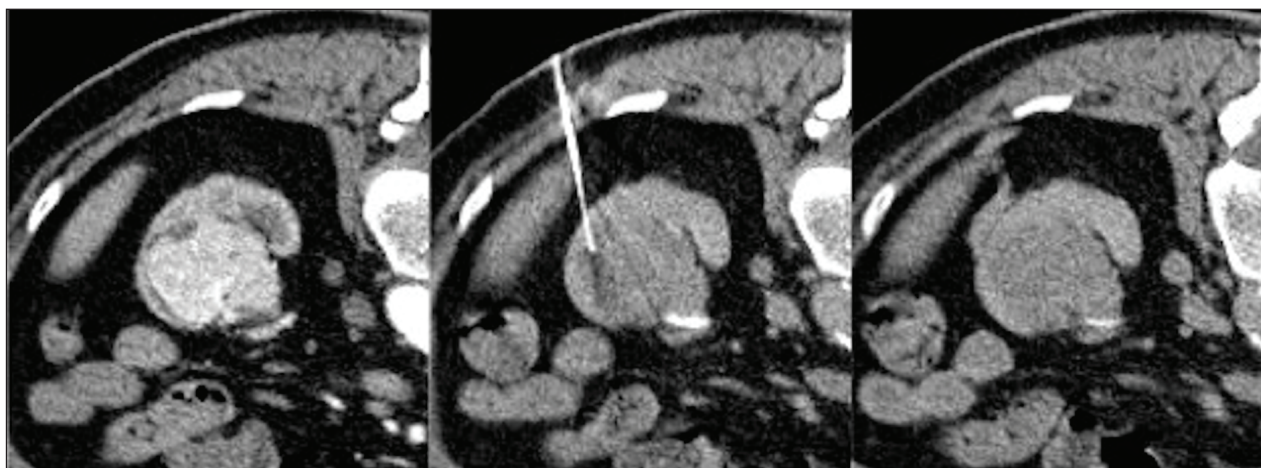
**Figure 1.** A core needle biopsy is performed on a single lesion in the para-hilar region of the right kidney. The lesion is in the proximity of important vascular and urinary system structures. The choice of a correct approach prevents post procedural complications such as bleeding and urinary tract lesions.



**Figure 2.** A single, small lesion at the middle third of the right kidney in the nearby of the ascending colon. Choosing the best approach, thanks to the large field of view and multiplanarity offered by CT, a fine needle aspiration biopsy is performed without any post-procedural complication.

specimen (manually or automatically cutting systems) (44). CNB is usually preferred to fine-needle aspiration (FNA) due to sample quality. Coaxial needle technique is a safe and proven technique consisting in the use of a guide needle (9-19G), previously advanced towards the target, in which the biopsy needle could be inserted to retrieve multiple specimens in a single puncture. Multiple cores allow a better assessment of tissue architecture and histologic subtype (22). Moreover, CNB does not increase the recurrence of complications and could decrease the tumor cells seeding risk along the needle path (45, 46). The sensitivity (97,5% - 99,7%) and spec-

ificity (96,2% - 99,1%), as reported in two large meta-analyses, are very high, allowing to consider RTB a highly accurate test in the detection of malignancy (47). When performing a percutaneous biopsy in nephritic or nephrotic syndrome, the target is usually the lower pole of the kidney. In lesions suspected for malignancy, the location should be chosen on the basis of the tumor size: in large tumors (>4cm), necrotic phenomena can occur, especially into the center of the lesion, making that site inappropriate for the sample quality (fig 3). In such lesions, to improve sensitivity and accuracy, a multi-quadrant technique is useful: obtaining multiple



**Fig 3.** A large, hyperenhancing focal lesion at the lower third of the left kidney in the first scan (on the left). CT guided fine needle aspiration biopsy is performed with the patient in prone position. In such large lesions a peripheral approach is preferred in order to avoid the center of the lesion which could be necrotic and not useful for histologic characterization



cores from different areas within the tumor has proven to better detect aggressive pathologic features as sarcomatoid dedifferentiation (48). In that cases, occurring usually in metastatic RCC with a poor life expectancy in the long-term (49-51), the biopsy has shown to have an important role in avoiding cytoreductive nephrectomy in patients who are unlikely to benefit and selecting different strategies as systemic therapy.

In large lesions, despite only 6,3% of masses higher than 7cm are not RCC-tumors, the biopsy could be essential in directing the appropriate treatment. E.g., lymphoma requires chemotherapeutical treatment instead of surgery (52), as large sarcomas need presurgical radiation (53). Although the benefit of retroperitoneal lymph node dissection (RPLND) for RCC is debatable (54), several studies reported high-risk features for lymph node metastases (55-57), pointing out the utility of RTB in the selection of patients with not-clinically-evident metastases who may benefit from aggressive surgery with RPLND.

#### *Contraindications and complications*

Reported absolute contraindications are severe uncontrolled hypertension, poor patient compliance to undergo the procedure, solitary kidney, and uncontrollable bleeding diathesis. Relative contraindications are renal morphologic abnormalities, urinary tract infections, severe azotemia, and coagulation disorders (58).

Principal complications include bleeding diathesis, consisting in hematuria (1-10%), perinephric he-

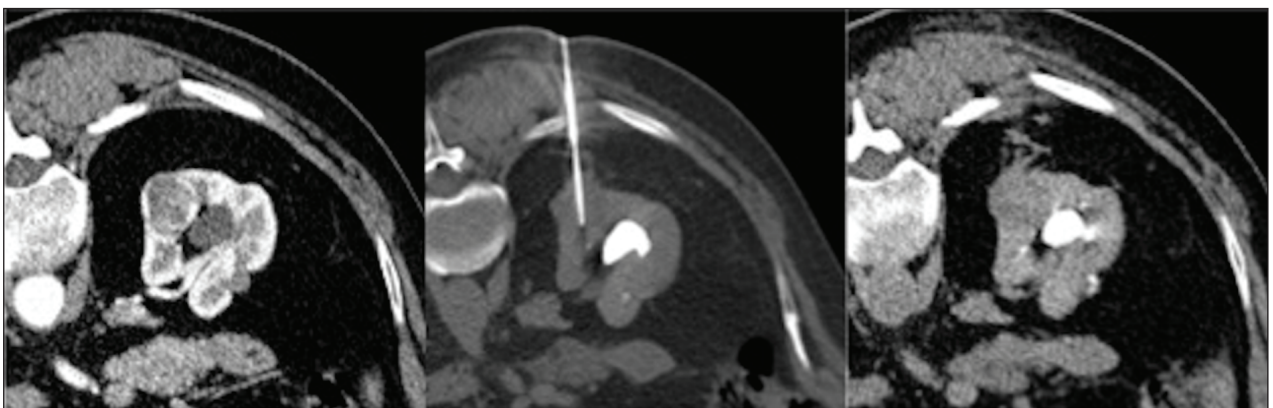
matoma (10-90%) to major bleeding requiring transfusion (0,3% - 7,4%) and nephrectomy (0,1%-0,5%) (fig 4). The risk is higher in cases of clotting disorders, thrombocytopenia, pharmacological treatment with anticoagulants or antiplatelets. According to the SIR-guidelines, renal biopsy is considered a high bleeding risk technique and appropriate preprocedural coagulation tests should be obtained (suggested laboratory value thresholds: correct INR to within range of 1.5-1.8 or less and consider platelet transfusion if platelet count is  $< 50 \times 10^9/L$ ) (59).

Other, less frequent complications are pneumothorax (0,6%), clinically significant pain (1,2%), infection and arteriovenous fistula. Tumor seeding is considered a fearsome complication but is very rare and reported only in a few cases (24,43,60-65),

#### **Conclusions**

Renal biopsy is a safe and effective technique in the majority of patients, useful in the diagnosis and management of certain medical conditions. Renal biopsy has a pivotal role in the algorithm of small renal masses (SMRs), avoiding unnecessary surgeries for benign disease and selecting appropriate candidates for focal ablation or active surveillance.

The biopsy is very useful for choosing the best management strategy, especially for SRMs, that is still based on the clinical setting of the patient and on histological characteristic of the lesion, selecting between



**Fig 4.** A core needle biopsy is performed on an exophytic lesion at the lower third of the right kidney; in the post-procedural scan (on the right) a minimal haematic suffusion of the pararenal tissue, along the needle path.

active surveillance, focal ablation, and surgical options. In tumors greater than 4cm and metastatic disease, the biopsy has a critical role in identifying patients that are unlikely to benefit from surgical operation or who may benefit from pre-nephrectomy systemic therapy, investigating the molecular and genetic information, and lymph node involvement in order to plan a different surgical approach, as the lymph node dissection.

**Conflict of interest:** Authors declare that they have no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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