

## Endoscopic ultrasound-guided fine-needle aspiration for the diagnosis of kidney lesions: A review

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**Author contributions:** Lopes RI and Moura RN wrote the article and performed review of the literature, independently; Artifon EL performed all the EUS-FNA procedures and critically revised the manuscript; final version was approved by all authors. **Conflict-of-interest:** The authors declare that they have no competing interests.

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Telephone: +55-11-26618080

Received: September 18, 2014

Peer-review started: September 18, 2014

First decision: December 1, 2014

Revised: November 9, 2014

Accepted: December 16, 2014

Article in press: December 17, 2014

Published online: March 16, 2015

summarize the recent advances in this field, providing recommendations for the practicing clinician. The use of EUS-FNA appears to be a safe and feasible means of confirming or excluding malignancy. EUS allows assessment and biopsy of masses or lesions within both kidneys and related complications are rare. The main advantages of EUS-FNA are that it can be done as an outpatient procedure, with good results, minimal morbidity and a short hospital stay. Nevertheless, EUS-FNA of renal masses should be indicated only in selected cases, in which there is potential to decrease unnecessary treatment of small renal masses and to best select tumors for active surveillance and minimally invasive ablative therapies. Additionally, some renal lesions may be ineligible for EUS-guided biopsy because of anatomical limitations. EUS-FNA renal biopsy will probably be best applied to central anterior renal masses, while tumors on the posterior aspect of the kidney, percutaneous access will probably be superior.

**Key words:** Kidney; Renal; Endoscopic ultrasound; Cancer; Puncture

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**Core tip:** Although controversy exists on the need of renal biopsy, endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) can be used in selected cases. In this review we discuss the rationale for EUS-FNA kidney and summarize the recent advances in this field, providing recommendations for the practicing clinician.

### Abstract

Traditionally, treatment of renal lesions is indicated based only on imaging features. Although controversy exists about tissue sampling from small renal masses, renal biopsy is indicated in some cases. In this review, we discuss the rationale for endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) and

Lopes RI, Moura RN, Artifon E. Endoscopic ultrasound-guided fine-needle aspiration for the diagnosis of kidney lesions: A review. *World J Gastrointest Endosc* 2015; 7(3): 253-257 Available from: URL: <http://www.wjgnet.com/1948-5190/full/v7/i3/253.htm> DOI: <http://dx.doi.org/10.4253/wjge.v7.i3.253>

## INTRODUCTION

Improvements on imaging technology and widespread use of imaging studies have not only increased the detection, but also allowed better characterization of incidental renal masses, which resulted in smaller lesions being depicted on such studies<sup>[1]</sup>. Up to 80% of renal cell carcinomas (RCC) are incidentally detected during radiological work-up, usually for non-urological indications. At time of nephrectomy, 70%-90% of solid renal lesions prove to be RCC<sup>[2,3]</sup>, accounting for 2% of all cancers and being the leading kidney malignancy<sup>[2,4,5]</sup>. Therefore, an enhancing renal neoplasm on computed tomography (CT) or magnetic resonance imaging (MRI) has been considered by most urologists to be a sufficient indication for surgery because about 80% of such lesions prove to be RCC.

Some recent studies demonstrated that up to 30% of detected renal lesions are benign at surgery, depending on renal lesion size<sup>[6,7]</sup>. Furthermore, current management of small renal tumors involves from surveillance strategies to alternative minimally invasive and nephron-sparing options, such as laparoscopic/robotic partial nephrectomy, cryotherapy and radiofrequency ablation. In this scenario, pre-therapeutic guided biopsy might be helpful to avoid unnecessary surgery and to choose the most appropriate management strategy. In almost 30% of selected patients, a surgical procedure became non-mandatory after renal biopsy results were obtained<sup>[8]</sup>. Therefore, if a renal biopsy might impact treatment decisions, the use of core biopsy and fine needle aspiration (FNA) for better characterization of suspicious renal masses preoperatively should be considered.

In most patients, treatment of renal lesions is indicated based on imaging features alone. Although controversy exists about tissue sampling from small renal masses (tumors with less than 4 cm, since they have up to 30% chance of being benign), renal biopsy is indicated to: (1) characterize radiographically indeterminate lesions; (2) confirm malignancy in patients, who either are not surgical candidates or plan primary treatment with minimally invasive ablative therapy; and (3) rule out non-renal cell primary tumors (metastasis and lymphoma) or benign conditions (abscess), which may not require surgery<sup>[9-11]</sup>.

Biopsy has also been used to confirm the diagnosis and the histological subtype of a renal primary lesion in patients with disseminated metastasis or unresectable retroperitoneal mass. In metastatic RCC, patients with clear cell subtype histology are most likely to benefit from adjuvant immunotherapy following cytoreductive nephrectomy. Additionally, new target therapies demonstrate variant response rates with distinctive RCC subtypes<sup>[2,8]</sup>.

Tissue sampling of renal lesions is traditionally performed by using percutaneous sonographic or CT guidance. The use of endoscopic ultrasound-guided

fine needle aspiration (EUS-FNA) is infrequently performed for the evaluation for RCC and there are few reported studies addressing the safety and feasibility of this technique<sup>[2,8,11-14]</sup>, as shown in Table 1.

The objective of this review is to: (1) outline the rationale for EUS-FNA kidney; (2) detail the procedural technique; (3) evaluate the clinical outcomes and limitations of the method; and (4) provide recommendations for the practicing clinician.

## RATIONALE FOR EUS-FNA OF KIDNEY LESIONS

Since EUS initial report in the 1980s, it rapidly crawled from a pure imaging modality used mainly for diagnostic purposes, especially for lesions of digestive tract, to a more interventional and therapeutic application<sup>[15]</sup>. With the subsequent advent of FNA, this technique has become the gold-standard procedure for the assessment of benign and malignant diseases of the gastrointestinal tract and of adjacent organs<sup>[16,17]</sup>. EUS-FNA is highly accurate, sensitive and specific with estimates reaching 80%, 90% and 100%, respectively for cytological diagnosis<sup>[18-20]</sup>.

As discussed above, percutaneous renal mass biopsy must not be performed for renal lesions less than 40 mm but it should be indicated for incompletely accurate renal imaging diagnosis after a full imaging evaluation. As well, EUS-FNA cannot currently be recommended as routine for cytologic diagnosis of renal masses, however, it might be useful in the aforementioned clinical situations when a renal biopsy should have an impact on clinical decision, especially for central and anterior renal masses. The advantages of a EUS-FNA in these cases is the potential to decrease unnecessary treatment of small renal masses and to best select renal tumors for active surveillance and minimally invasive ablative therapies<sup>[12,21]</sup>. EUS-FNA appears to be a safe and cost-effective way of confirming or excluding malignancy and may hinder the need for CT-guided exams<sup>[2]</sup>.

## PROCEDURAL TECHNIQUE

Anatomic approximation to both kidneys allows access for tissue sampling with the echoendoscope positioned in the upper gastrointestinal (GI) tract. Translating the probe within the duodenum or stomach, with the extension of 12.5 cm for 7.5 MHz probe, is sufficient to visualize both kidneys. The right kidney can be readily imaged by locating the transducer in the second portion of the duodenum (green area Figure 1) and rotating laterally, and the left kidney can be visualized when the transducer is facing posterolaterally into the body of the stomach (grey area Figure 1A)<sup>[12]</sup>. Color doppler ultrasound can verify the presence of major trespassing vascular structures, which should be identified and avoided during FNA.

**Table 1** Reported endoscopic ultrasound-guided fine needle aspiration case series

Ref.	Design	Location	Mean size	Approach	No. of EUS-FNA	Technical success	Complications
Farrell <i>et al</i> <sup>[2]</sup>	Case report	Right kidney	9 cm	Duodenum 22 G needle 2 passes	1	100%	No
Eloubeidi <i>et al</i> <sup>[13]</sup>	Prospective study	N/A	N/A	N/A 22 G needle up to 5 passes	1	N/A	N/A
Artifon <i>et al</i> <sup>[12]</sup>	Case report	Left kidney	1.3 cm	Gastric body 22 G needle 3 passes	1	100%	No
DeWitt <i>et al</i> <sup>[11]</sup>	Case series	Right kidney ( <i>n</i> = 5) Left kidney ( <i>n</i> = 10)	3.2 cm (1.1-6 cm)	Duodenum for right kidney and gastric body for left kidney 22 G needle 2 - 4 passes	15	80% (12/15)	No
Lakhtakia <i>et al</i> <sup>[14]</sup>	Case report	Right kidney	1.5 cm	Duodenum 22 G needle N/A passes	1	100	Transient hematuria
Moura <i>et al</i> <sup>[8]</sup>	Case series	Right kidney ( <i>n</i> = 4) Left kidney ( <i>n</i> = 4) Bilateral ( <i>n</i> = 1)	6 cm (1.3-16 cm)	Duodenum for right kidney and gastric body for left kidney 22 G needle 3 passes	10	90% (9/10)	No

EUS-FNA: Echoendoscopic ultrasonographic fine needle aspiration; N/A: Non available.

EUS-FNA is performed (Figure 1B) using curvilinear array echoendoscopes that are produced by three leading manufacturers: Olympus (Olympus Medical Systems Inc., Tokyo, Japan), Pentax (Pentax, Tokyo, Japan) and Fujinon (Fujifilm Corp., Tokyo, Japan). The working channel must be at least of 2.8 mm to accept the FNA needle and the echoendoscopes present at an elevator located on the side of the scope at the tip portion, that is able to make changes in the exit angle of the FNA needle to facilitate the targeting process<sup>[15]</sup>.

Needles for renal EUS-FNA are currently available in 3 sizes (19, 22 and 25 gauge). Thinner needles are used to gather cytological specimens, while thicker needle are better applied for acquisition of a tissue specimen for histological examination, that can be more useful to reach the definitive diagnosis. The choice of the needle depends on the type and site of the lesion to be sampled. In all the studies listed in Table 1, the kidney was punctured using a 22-gauge needle. More data is probably needed to characterize the correct needle size depending to the type and location of the lesion.

Whenever possible, EUS-FNA should be done under deep sedation with the assistance of an anesthesiologist. The main advantages of EUS-FNA are that it can be done as an outpatient procedure, and it appears to be safe with good results, minimal morbidity and a short hospital stay, as demonstrated in Table 1.

## PROCEDURAL LIMITATIONS

Some renal masses may be ineligible for EUS-guided biopsy because of anatomical limitations. EUS-FNA renal biopsy will probably be best applied to central

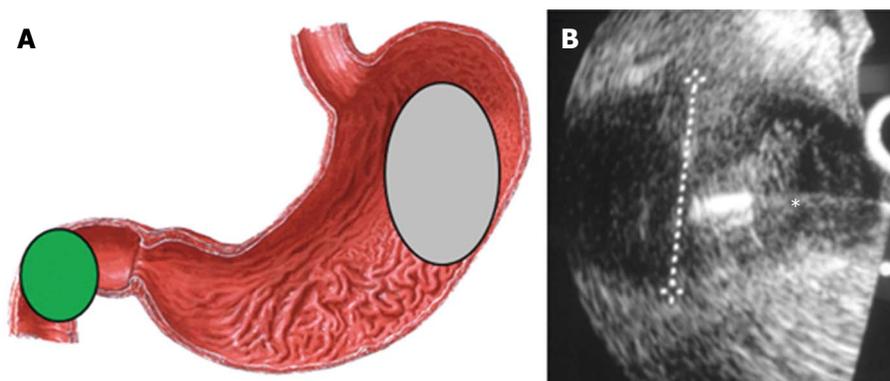
anterior renal masses, while tumors on the posterior aspect of the kidney, percutaneous access will probably be superior. Among other reasons, these limitations are likely to restrict widespread application of EUS for this indication<sup>[11]</sup>.

EUS-FNA related complications of kidney masses sampling are similar to those for aspiration of GI masses and include localized bleeding, infection, hematoma, hematuria, pneumothorax, and needle tract seeding<sup>[14]</sup>. The risk of complications associated with EUS-FNA spans from less than 1% to 6%. Tracheal suction (5%), vomiting (0.3%), aspiration (0.3%), esophageal perforation and death (less than 0.06%) are reported complications of EUS. In a relatively small group of patients, the frequency of bleeding as a result of fine-needle aspiration of the kidney was 0.5%, whereas that associated with fine-needle aspiration of GI lesions was 1.3%<sup>[2]</sup>.

Since the EUS needle has to transverse fewer tissue layers, the risk of needle seeding may be lower, with few cases reported. Overall, the prospect of needle track seeding is minor and it should be balanced against the benefit of a tissue diagnosis<sup>[12]</sup>. In a retrospective review of patients submitted to pancreatic mass FNA, either by EUS-FNA or percutaneous access, the incidence of peritoneal carcinomatosis was lower in the EUS-FNA group, which might suggest a lower risk of needle seeding<sup>[22]</sup>.

Higher accuracy rates are achieved with on-site cytopathology examination to assess specimen adequacy that, however, is not available in all centers and may increase the cost of the procedure<sup>[15]</sup>.

EUS-FNA is not done in situations when it is unlikely to alter the management of a cancer. In addition to the usual contraindications for any endoscopic



**Figure 1** The right kidney image. A: Endoscopic ultrasound positioning and access for tissue sampling; B: Fine needle aspiration of a renal lesion. The asterisk is over the needle to show the fine needle aspiration of the tumor.

procedure, including severe bleeding diathesis and thrombocytopenia, EUS-FNA is not advocated when good views of the lesion are not obtained or when a major vascular structure is present on the way to the target<sup>[15]</sup>.

## CONCLUSION

New techniques in EUS are emerging and will likely have a niche in aiding the diagnosis of undeterminate lesions. EUS allows visualization and sampling renal masses. This technique is evolving and will possibly have a role in diagnostic EUS in the future, as it appears to be a safe and feasible procedure with good results, minimal morbidity and a short hospital stay in the cases reported on the literature<sup>[2,8,11-13]</sup>.

We recommend that EUS-FNA of renal masses should be indicated only in selected cases, in which the procedure may alter clinical management by avoiding unnecessary treatment and helping to select patients for active surveillance and minimally invasive ablative therapies. Further research should evaluate the benefits of preoperative renal biopsy use and randomization of percutaneous, laparoscopic and echoendoscopic approach should be compared.

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**P- Reviewer:** Hu H, Sofi A, Tepes B **S- Editor:** Tian YL  
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