Role of Computed Tomography Guided Percutaneous Biopsy in Assessment of Renal Tumors

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Abstract

Objective: To evaluate role of Computed Tomography (CT)-guided percutaneous biopsy in diagnosis of different renal tumors either benign or malignant masses.

Patients and Methods: Twenty patients were included in this study, these patients were presented with renal tumor of indeterminate diagnoses according to the imaging modalities (US, CT or MRI), CT-guided percutaneous biopsy was performed to evaluate the nature of this renal tumor after pre and post contrast CT examination.

Biopsy yield, complications and impact of patient’s management were analyzed.

Results: The diagnostic capability of CT-guided percutaneous biopsy was (90%), non representative biopsy was demonstrated in 2 patients (10%) who underwent 2nd trial of biopsy with incidence of minor complications (5%).

Conclusion: The CT guided percutaneous biopsy can help in accurate and specific diagnosis of renal tumors with subsequent impact on their clinical management.

Key Words: CT-guided percutaneous biopsy – Renal mass – Renal cell carcinoma.

Introduction

TODAY, biopsy plays a fundamental role in the care of patients with a renal mass. Biopsy results are used to confirm the diagnosis of renal cancers, metastases, and infections, and there is increasing evidence to suggest that biopsy can help subtype and grade many primary renal cancers [1].

The role of percutaneous renal mass biopsy has expanded considerably in the past 10 years. Percutaneous biopsy provides a minimally invasive method for discriminating benign from malignant renal masses, and portends the potential for stratifying malignant risk. With recent improvements in image-guided equipment and technique, percutaneous renal mass biopsy can be performed safely and effectively, with a low complication rate (<5%) and a high diagnostic yield (>90%) [2].

Use of percutaneous biopsy to identify which masses are benign, and in some patients which masses are more or less aggressive (for consideration of active surveillance), can permit better stratification of patient risk before treatment decisions [3-5].

There are many indications for percutaneous renal mass biopsy, either established indications, including solid renal mass and known extra renal primary malignancy, unresectable solid renal mass, solid renal mass with significant comorbidities, renal mass presumed secondary to infection and emerging indications, including patients with a small (<3cm) hyperattenuating homogeneously enhancing renal mass, patients with a renal mass considered for percutaneous ablation and patients with an indeterminate cystic renal mass [1,6].

CT is usually used to guide renal mass biopsy, and it can aid in diagnosis in 79%-97% of cases. However, US guidance offers numerous advantages over CT guidance for biopsy including lack of ionizing radiation, real-time visualization of the needle, and relatively lower cost, several studies reported the efficacy of US-guided renal mass biopsy, but because large renal masses and SRMs (small renal masses) were included in these studies,
it is still unclear whether US-guided biopsy is adequate for tissue diagnosis of SRM [7].

It is essential to identify tumor histology in the setting of metastatic disease, both to confirm that metastatic sites represent tumor spread (and not a second primary tumor) and to classify the histologic subtype as a guide to systemic therapy [8].

Before image-guided biopsy, a review of previous cross-sectional imaging studies is needed to determine the safest approach to the targeted lesion. As with all percutaneous procedures, the shortest distance to the lesion without crossing additional organs, large vessels, or vital structures is optimal [2].

CT guided biopsy has the advantage of better resolution and tissue contrast, is better able to localize the lesion and the needle tip and identify the surrounding critical structures (pleural space and bowel) [9].

In the last 10 years there were little number of published articles about role of percutaneous biopsy in renal masses, aim of our study: To evaluate the role of CT-guided percutaneous biopsy in diagnoses of different renal tumors either benign or malignant (primary or secondary) masses.

### Patients and Methods

This prospective study was approved by our institutional review board. It included 20 patients who were referred from outpatient clinic to Radiology Department, Urology and Nephrology Center, Mansoura University in a 2-year period (December, 2013 to December, 2015) for percutaneous biopsy from their indeterminate masses.

These patients were presented with renal masses of indeterminate diagnosis according to the imaging modality that was done for them. They underwent CT-guided percutaneous mass biopsy.

This study included 20 patients. 16 of them are males and 4 are females. Their ages ranging from 23 to 79 years mean ± SD (54.5 ± 13.1).

The size of different renal masses among 20 patients underwent CT-guided percutaneous biopsy ranged from 2 up to 12.7 cm, mean ± SD (6.7 ± 3.4).

Nineteen patients (95%) of 20 patients whom underwent CT-guided percutaneous biopsy presented with unilateral renal mass, one of them (5%) had unilateral multiple renal masses and other 18 case (90%) had single unilateral renal mass, one patient (5%) was presented with bilateral renal masses.

### Table (1): Complaints and radiological findings of 20 patients whom underwent percutaneous biopsy.

<table>
<thead>
<tr>
<th>Pt. complaints and radiological findings:</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loin pain and renal mass with abdominal LNS</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Loin pain and bilateral renal masses</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Loin pain and renal mass with abdominal + mediastinal LNS* with lung secondaries</td>
<td>3</td>
<td>15.0</td>
</tr>
<tr>
<td>Incidentally discovered renal mass</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>History of previous nephrectomy with develop local renal bed mass</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Previous history of CTH for NHL* and develop renal mass</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>History of TACE* for HCC*, develop renal mass</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Renal mass with huge suprarenal mass</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Loin pain and hematuria with renal mass shows central scar</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Loin pain and hematuria with renal mass, abdominal LNS + lung secondaries</td>
<td>2</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Total 20 100

*LNS* : Lymph Nodes.
*CTH* : Chemotherapy.
*NHL* : Non Hodgkin Lymphoma.
*HCC* : Hepatocellular Carcinoma.
*TACE* : Trans arterial Chemo Embolization.
Exclusion criteria:
- Patients with bleeding tendency e.g. uncorrected coagulopathy.
- Patients with acute illness e.g. septicemia.

Pre-procedure workup includes, medical history of the patients, medications, laboratory data (especially the coagulation profile) were reviewed before the procedure.

The percutaneous renal mass biopsy was guided by MSCT. Pre and post contrast MSCT was done first to localize the mass and to depict the most accessible route for needle insertion.

Procedure:
- Patient position was decided by the operator according to the location of the renal mass, most of the cases was done in prone position.
- CT images were taken to locate the perfect site of needle introduction as well as the desirable depth.
- Complete skin sterilization with betadine.
- Local anesthesia with 5-10ml of Xylociane (2%) at site of skin entry.
- Introduce the 18-G coaxial biopsy needle into the soft tissue component of the mass.
- Further CT images were taken to confirm accurate target of the lesion.
- Following this, from 2-3 cores were taken from the mass for histopathological evaluation.
- Post biopsy CT was obtained after removal of the needle to assess any possible complications.
- The adequacy of biopsied tissues was correlated with histo-pathological results.
- If there was indication for biopsy from renal tumor prior to Radiofrequency Ablation (RFA), it was done 15 days before RFA.

Statistical analysis:
All statistical calculations were done using SPSS (Statistical Package for the Social Science, Version 20).

For continuous variables, the mean and SD ratio (descriptive statistics) were calculated.

For categorical variables, frequencies with a p-values <0.05 indicated statistical significance.

Results

Table (2): Histopathological types of renal tumors underwent CT-guided percutaneous biopsy

<table>
<thead>
<tr>
<th>Result of biopsy</th>
<th>No. of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCC</td>
<td>11</td>
<td>55.0</td>
</tr>
<tr>
<td>Clear cell type</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Papillary cell type</td>
<td>3</td>
<td>15.0</td>
</tr>
<tr>
<td>Unclassified type</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Chromophobe type</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>3</td>
<td>15.0</td>
</tr>
<tr>
<td>Oncocytoma</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Squamous cell carcinoma</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Plasmacytoma</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Urothelial carcinoma</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Cystic nephroma</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Undifferentiated carcinoma</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

Table (3): Trials of biopsy of 20 patients underwent CT guided percutaneous biopsy.

<table>
<thead>
<tr>
<th>Trials of biopsy</th>
<th>No. of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single trial</td>
<td>18</td>
<td>90.0</td>
</tr>
<tr>
<td>1 core of tissues</td>
<td>8</td>
<td>40.0</td>
</tr>
<tr>
<td>2 core of tissues</td>
<td>7</td>
<td>35.0</td>
</tr>
<tr>
<td>3 core of tissues</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>4 core of tissues</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Two trial</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

Eighteen patients (90%) of 20 patients underwent single trial of CT-guided percutaneous biopsy, in 8 cases (40%) of them one core of tissue from the mass was taken, in 7 cases (35%) two cores of tissues were taken, in 2 cases (10%) three cores of tissues were taken, in one case (5%) 4 cores of tissues was taken and in two patients (10%) underwent two trials of CT-guided percutaneous biopsy as the first trial was non representative (Table 3).

Table (4): Failure rate and complications of percutaneous biopsy.

<table>
<thead>
<tr>
<th>Failure rate:</th>
<th>No. of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non representative biopsy</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Complications:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinephric hematoma</td>
<td>1</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Two cases (10%) of 20 patients who underwent CT guided percutaneous biopsy are non representative and underwent 2nd biopsy, 1 case (5%) of 20 patients who underwent CT-guided percutaneous biopsy was presented with post biopsy self liming peri-nephric hematoma, resolving spontaneous.
Fig. (1): 76-year-old male patient, presented by right loin pain and hematuria. (A,B,C): Axial and coronal CT images after iv contrast, show right renal middle zone enhanced soft tissue mass with central scar. (D,E): CT guided percutaneous biopsy in prone position, the histopathological diagnosis was oncocytoma.

Fig. (2): 49-year-old male patient, presented by left loin pain. (A,B,C): Axial and coronal CT images after iv contrast, shows left lumber enhancing soft tissue mass infiltrating upper pole of left kidney with enlarged peri lesional LNS. (D,E): CT guided percutaneous biopsy in prone position, the histopathological diagnosis was Non Hodgkin Lymphoma (NHL), diffuse large B cell type.
Fig. (2): 59-year-old male patient, have a history of liver cirrhosis, TACE for HCC and incidentally discovered right renal mass. (A): Abdominal US shows ill defined right renal post. Mid zone echogenic soft tissue mass lesion about 3.5 X 2cm, (B): Coronal non contrast CT image, show right renal posterior mid zone iso dense soft tissue mass lesion. (C,D): CT guided percutaneous biopsy in prone position, the histopathological diagnosis was RCC, clear cell type.

Discussion

In this study twenty patients with renal masses underwent CT guided percutaneous biopsy to guide subsequent management decisions for reduction the number of patients who receive unnecessary surgery especially for small renal tumors.

The role of percutaneous biopsy in our study is to differentiate benign from malignant renal masses, primary from secondary renal masses and parenchymal from urothelial renal masses, to exclude possibility of lymphoma, and to assist the nature of renal mass in presence of other neoplasm in the same patient.

The size of renal masses in our study underwent percutaneous CT guided biopsy ranged from 2 up to 12.7cm, 19 patients had unilateral renal mass (18 had unilateral single renal mass and 1 had unilateral multiple renal masses) and 1 patient had bilateral renal masses.

RCC (55%) was the most common type of renal tumors among the 20 patients in our study whom underwent percutaneous CT guided biopsy, lymphoma was (15%), oncocytoma (5%), squamous cell carcinoma (5%), plasmacytoma (5%), urothelial carcinoma (5%), cystic nephroma (5%), and undifferentiated carcinoma (5%).

We agree with Caoili and Davenport, [2], as regards the high diagnostic yield of percutaneous renal mass biopsy >90%. The failure rate (non representative biopsy) among the 20 patients underwent CT guided percutaneous biopsy was 10% (in 2 cases) and underwent 2 nd trial of biopsy.

Our results are in agreement with study done by Silverman et al., [1], as regard the technical success rate of percutaneous biopsy is excellent for solid renal masses, the data are not as robust for complex cystic masses, specifically Bosniak III cystic masses.

Rybicki et al., [10], in a single-center retrospective study reported that the choice of imaging modality used (CT or US) when performing renal mass biopsies did not affect the sensitivity or the negative predictive value for identifying malignancy.

All patients with renal masses in our study were underwent CT guided percutaneous biopsy for accurate performance and the core tissues obtained from renal masses were sufficient and adequate for diagnosis. We agree with Lechevallier, 2007 [11], as the percutaneous biopsy for renal masses also was done under CT guidance and the diagnostic value >80%. The biopsy did not provide any diagnosis in 20% of cases, 15% biopsy reveal fibrosis,
inflammation and 5% were normal renal parenchyma.

Recent literature has focused on the success rates of percutaneous biopsy for small (<4cm) solid renal masses. The probability of malignancy within a small solid renal mass has been found to be inversely related to renal tumor size, with up to 22% of such masses measuring 1 to 4cm proving benign [2].

Our study agree with Halverson et al., [3], retrospectively evaluated 151 small renal masses that underwent both percutaneous renal mass biopsy and subsequent partial or radical nephrectomy. For diagnosing malignancy, there was complete concordance between the histology rendered from core biopsy and that rendered by surgery, histologic concordance was 94%.

Limitations: Our study was done on few number of renal masses were underwent CT-guided percutaneous biopsy for proper diagnosis, we recommend the CT-guided percutaneous biopsy of renal masses according to their radiological findings for accurate diagnosis and proper treatment.

Conclusion:

The CT-guided percutaneous biopsy helps in accurate and specific diagnosis of renal masses and their clinical treatment.

References


دور أخذ العينة من آورام الكلوي عن طريق الجلد

بمساءله الأشعة المقطعيه لتشخيص الأورام الكلوي

الهدف: تقييم دور أخذ العينة من آورام الكلوي عن طريق الجلد بمساءله الأشعة المقطعيه في تشخيص الأورام الكلوي المختلفة إما حميدة أو خبيثة.

المريض والطريق: شملت هذه الدراسة عشرون مريض، هؤلاء المرضى مصابون من ورم كلاوي غير محدد التشخيص وفقاً لطرق التصوير المختلفة (الأشعة المقطعيه، الأشعة السينوغرافيا والمغناطيسي) ثم أخذ العينة من هذه الأورام عن طريق الجلد بمساءله الأشعة المقطعيه لتقديم طبيعة هذا الأورام الكلوي بعد عمل شعاع مقطعية بالسبب كلوي.

وقد تم تحضير العينة من أخذ العينات والمصابات المحتفظة وتأثير هذه العينات في علاج المريض.

نتائج: كانت القدرة التشخيصية للعينات عن طريق الجلد بمساءله الأشعة المقطعيه 70%، وعينة غير تشخيصية في 2 من المرضى (10%)، الذين خضعوا لأخذ عينة أخرى من الورم ونسبة حدوث مضاعفات طفيفة (5%).

الخلاصة: أخذ العينات عن طريق الجلد بمساءله الأشعة المقطعيه يمكن أن يساعد في التشخيص الدقيق والمحدد للأورام الكلوي مع تأثير هذه العينات في علاج هذه الأورام.