Combination of Core Biopsy and Fine-needle Aspiration Increases Diagnostic Rate for Small Solid Renal Tumors

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Abstract. Aim: Our aim was to evaluate the performance of combination of fine-needle aspiration (FNA) and core biopsy (CB) as a method for the diagnosis of small solid renal tumors. Patients and Methods: Ninety patients with a radiologically detected small solid renal tumor (≥4 cm) underwent a biopsy. Patient underwent FNA (FNA group, n=32) or CB (CB group, n=30) or combination of both FNA and CB (combination group, n=28). The diagnostic rate and accuracy of both techniques were assessed. Results: The diagnostic rate of the combination group (92.9%) was superior to that of the FNA group (62.5%) and CB group (76.7%) (p=0.006, and p=0.147, respectively). In the combination group, 11 CBs were diagnostic with 13 nondiagnostic FNAs, while 4 FNAs were diagnostic with 6 nondiagnostic CBs. For tumors ≤2 cm, the combination of FNA and CB significantly increased the diagnostic rate, compared with FNA alone (p=0.033) and CB alone (p=0.044). The accuracy for FNA, CB and the combination of FNA and CB was 88%, 100% and 100%, respectively. Conclusion: The combination of FNA and CB increased the diagnostic rate of renal biopsy for the small solid renal tumors.

The incidence of small renal tumors is rapidly increasing. About 20-30% of small renal tumors are benign (1). New treatment options such as ablative therapy are increasingly used for small tumors. Imaging alone is unable to predict the nature of renal tumors. For these reasons, the contemporary role of tissue diagnosis of small renal masses has been recently established (2). Fine-needle aspiration (FNA) cytology and core biopsy (CB) are two widely used and accepted methods for obtaining tissue material for diagnosis. In many tumors, FNA is an established technique, usually using 20-25 gauge needles, and generally provides a sample for cytological examination. Traditionally, FNA is preferred in obtaining the tissue of deeply placed lesions, tumors adjacent to major vessels or in cases in which the needle is to be passed through the bowel wall (3). Cytological samples can be immediately stained and examined, thereby providing a rapid diagnosis. The experience with the CB technique has improved considerably since the late 1990s. The tissue is usually obtained by using larger 14-18 gauge needles. The major advantage of CB includes the preservation of tissue architecture, which may be important in the assessment of subtyping of some tumors.

CB has been a recently renewed topic of study for small solid renal tumors (4, 5). Some groups have renewed the interest in the FNA technique (6, 7). In theory, each technique offers different advantages and limitations. FNA is minimally invasive and favored as the initial procedure for accessing renal masses. CB is very accurate for solid renal tumors, but about 20% of CBs fail (8). This percentage is expected to increase where very small tumors (<3 cm) are concerned (9). The combination of FNA and CB has been appreciated for breast, thyroid nodules, as well as in deep thoracic and abdominal lesions (3, 10, 11). Although it has been suggested that FNA and CB may be complementary in the assessment of renal tumors (12, 13), we have found no detailed study on the combination of FNA cytology and CB in the preoperative tissue sampling for small renal tumors. The purpose of this study was to evaluate the performance of the combination of FNA and CB as tissue sampling for the diagnosis of small solid renal tumors.

Patients and Methods

From January 2004 to December 2009, 90 patients underwent a biopsy of renal tumor in our Department. The patient selection was based on the presence of a solid tumor of ≥4 cm or suspicion of
benign tumor such as renal oncocytoma. There were 45 men and 35 women, with an age range of 27-88 years (mean, 64.8 years). Coagulation test was checked before biopsy in each case. All patients provided written informed consent for the biopsy. This research protocol was approved by the local Ethics Committee.

Patients underwent a FNA (FNA group), CB (CB group) or combination (combination group) of FNA plus CB for tissue diagnosis. Patient data is given in Table I. Biopsy was performed under guidance of imaging, usually with computed tomographic scanning. The biopsy was performed by a single experienced radiologist, whose objective was to obtain tumoral tissue under image guidance.

For FNA, the samples were obtained following local anesthesia using a standard 18G needle attached to a 20 ml syringe. After localization, the needle was passed through the tumor and two to three passes were performed. Direct smears were prepared for each aspiration. After preparing smears, the needles were rinsed in Cytolyt® (Marlborough, MT, USA). Cells from aspiration collected in Cytolyt® were centrifuged and used for preparation of smears. CB was performed using an 18G automated cutting needle biopsy system (Cook, Bloomington, IN, USA). The quality of the specimens was judged visually and up to three separate core samples were obtained. The CBs were fixed in 10% neutral buffered formalin, processed routinely, and stained with hematoxylin and eosin. For the combination of FNA and CB, FNA was performed first. The cytological and histological examinations were separately performed by a cytopathologist and a pathologist, respectively.

The diagnosis was made into four classifications: malignant, suspicious, benign and non-diagnostic. Non-diagnostic specimens included only blood, fibrosis, necrotic debris, normal tissue and insufficient material (8). For the combination group, only the positive result was considered. The diagnosis of suspicions was considered as a positive result for the calculation of accuracy. The calculation of accuracy was based on the definitive pathological diagnosis after the surgical operation.

Pearson chi-square test was used to assess the difference between two groups. Fisher’s exact test was performed when the number of data was less than five. Significant differences were established when \( p<0.05 \).

### Results

Table I outlines the tumor size in each group. The performance of each technique or combination is summarized in Table II. The diagnostic yield for each group was 62.5%, 76.7% and 92.9% for FNA, CB and their combination, respectively.

In the combination group, both the FNA samples and the CBs were non-diagnostic in two patients. Subsequent pathological diagnosis showed that these two patients suffered from clear cell renal cell carcinoma. In the combination group, 11 CBs were diagnostic, with 13 nondiagnostic FNAs, while 4 FNAs were diagnostic with 6 nondiagnostic CBs. Combining the techniques increased the diagnostic rate to 92.9%.

<table>
<thead>
<tr>
<th>Number</th>
<th>Tumor size (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNA</td>
<td>32 2.80±0.18</td>
</tr>
<tr>
<td>CB</td>
<td>30 2.85±0.19</td>
</tr>
<tr>
<td>FNA+CB</td>
<td>28 2.83±0.16</td>
</tr>
</tbody>
</table>

FNA: Fine-needle aspiration; CB: core biopsy.

Table I. Tumor size in each group (mean±standard deviation).

57 patients underwent surgery. The final pathological diagnosis after surgery was compared with that of preoperative biopsy. The diagnostic accuracy for FNA, CB and their combination was 88%, 100% and 100%, respectively.

No serious complications were found. The combination of FNA and CB did not cause extra complications.

### Discussion

Tissue diagnosis is a challenging problem for radiologists, urologists and pathologists because more and more small renal masses are being discovered on imaging examinations. A successful tissue diagnosis depends on two factors: one is to obtain an appropriate tissue sample by a biopsy operator to increase the diagnostic rate, the other is the analysis of the tissue by a cytopathologist to make an accurate diagnosis. The decision to use FNA or CB as a sampling technique depends on many factors: the size and site of renal mass, the suspected diagnosis, experience of individual radiologists, risk of complications and the availability of cytopathologists. In the present study, we emphasize the problem of the diagnostic rate of renal biopsy for small renal tumors.

FNA was proven to be more sensitive than CB in tissue sampling for the diagnosis of abdominal lesions (3). For renal tumors, the nondiagnostic rate of FNA varied from 10% to 60% (14, 15). During the 1980s, the diagnostic yield of FNA was considered acceptable. In a series of 285 FNAs, Juul et al. reported 5% of FNAs as being nondiagnostic (16). These early reports included large or cystic renal tumors. Campbell et al. studied FNA of small solid tumors and found a 40% diagnostic rate (14). More recently, Andonian et al. suggested a cytotecnician in the examination room and non-diagnostic rate decreased to 16% (6). The diagnostic rate of FNA was 80.2% in the series of Heilbrun et al. (15). In the present study, we had a non-diagnostic rate of 37.5% for the FNA group.

The technique of CB has improved considerably since the late 1990s. In the era of small renal masses, the nondiagnostic rate of CB was about 20% (4, 12). Since a fine needle is now used in CB, CB has also become minimally invasive. The present study confirms that the diagnostic rate of CB is superior to that of FNA for solid renal tumors. We agree that CB may be the preferred sampling technique in patients with a small solid renal tumor (17).
One limitation for CB of small solid tumors is its association with nondiagnostic problems (4, 8, 18). The non-diagnostic rate can be as high as 37% when tumors <3 cm are sampled (9). Very recently, the benefits of combination of FNA and CB for renal tumors were discussed (19). Barwari et al. did an experiment using the combination of FNA and CB in extirpated tumors, but their results cannot be compared with in vivo biopsy (18). Parks et al. found that FNA was more likely to obtain diagnostic material whereas CB was more likely to provide a definitive diagnosis (19).

The present study demonstrated that cases in which it was difficult to obtain an adequate tissue for diagnosis with a CB were not the same as those in which it was difficult to obtain adequate tissue for diagnosis with an FNA. In some cases, the difficulty in obtaining adequate tissue materials may reside in the tumor itself, not necessarily with the skill of the operator. Trying a different technique, such as an FNA, seems to be a more effective strategy to obtain sample from a mass in which CB cannot be applied, rather than simply repeating a technique that simply may not be very effective in a particular case. Our results seem to suggest that the combination approach is effective for very small tumors (≤2 cm). Most of failures in CB occur for very small solid tumors. CB was unsatisfactory in these cases, in which FNA provided diagnostic material. This additional benefit by FNA is probably due to its flexibility in sampling the different areas of a tumor mass. Thus, FNA and CB may be complementary in individual cases, especially for very small masses. Adding FNA to CB produced no extra complications, so the combination approach is safe.

However, whether the combination is cost effective is difficult to comment on. FNA is inexpensive in terms of disposables, but does need time for the cytopathologist. Another advantage of FNA is that it can also easily be applied for molecular analysis (20). We hope that it may be possible to identify a subgroup of lesions which could benefit most from the combination approach. Nevertheless, larger studies are needed to confirm our results.

Although rare false-positive diagnoses may occur with FNA, some studies have confirmed that cytological examination is reliable for a malignant diagnosis of renal masses. In a recent experimental study, Kümmerlin et al. showed a high accuracy for FNA cytology for the diagnosis of renal tumors (7). In our study, the accuracy rate in the CB group was higher than that in the FNA group. The high accuracy for both FNA and CB indicates that both techniques may be useful for a malignant diagnosis of small solid tumors.

In conclusion, the combination of FNA and CB increased the diagnostic rate for small solid renal tumors. The combination of FNA and CB may be complementary in the tissue diagnosis of small solid renal masses. More studies are needed to confirm our results.

**Conflict of Interest**

There is no conflict of interest.

**Acknowledgements**

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**Table II. The diagnostic rate for each group.**

<table>
<thead>
<tr>
<th></th>
<th>Malignant</th>
<th>Suspicious</th>
<th>Benign</th>
<th>Non-diagnostic</th>
<th>Diagnostic</th>
<th>( p )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNA</td>
<td>16</td>
<td>3</td>
<td>1</td>
<td>12 (37.5%)</td>
<td>20 (62.5%)</td>
<td>vs. CB=0.227</td>
</tr>
<tr>
<td>CB</td>
<td>17</td>
<td>0</td>
<td>6</td>
<td>7 (23.3%)</td>
<td>23 (76.7%)</td>
<td>vs. FNA+CB=0.147</td>
</tr>
<tr>
<td>FNA+CB</td>
<td>25</td>
<td>0</td>
<td>1</td>
<td>2 (7.1%)</td>
<td>26 (92.9%)</td>
<td>vs. FNA=0.006</td>
</tr>
</tbody>
</table>

FNA: Fine-needle aspiration; CB: core biopsy.

**Table III. The diagnostic rate for tumors ≤2 cm.**

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Non-diagnostic</th>
<th>Diagnostic</th>
<th>( p )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNA</td>
<td>9</td>
<td>5</td>
<td>4 (44.4%)</td>
<td>vs. CB=0.586</td>
</tr>
<tr>
<td>CB</td>
<td>10</td>
<td>5</td>
<td>5 (50.0%)</td>
<td>vs. FNA+CB=0.044</td>
</tr>
<tr>
<td>FNA+CB</td>
<td>7</td>
<td>0</td>
<td>7 (100%)</td>
<td>vs. FNA=0.034</td>
</tr>
</tbody>
</table>

FNA: Fine-needle aspiration; CB: core biopsy.
References


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