Usefulness of contrast enhanced ultrasound guided biopsy in large renal and adrenal tumors: Preliminary experience

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Authors: Z. Sparchez, P. Radu, T. Zaharia, R. Badea, G. Kacso; Cluj-Napoca/RO
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• **Percutaneous biopsy (PB)** is a well established diagnostic method in renal and adrenal tumors with overall sensitivities and negative predictive values in diagnostic malignancy of 76-93% and 6-21% respectively [1,2]. The sensitivity and negative predictive value are lower for fine needle aspiration biopsy (64-85% and 8-36%). Core biopsy performed with larger needles has higher performances (80-100% overall sensitivity, 97.7% for malignancy) but it is itself influenced by several factors: small or very large tumors and cystic lesions [3]. In large lesions (> 6cm) the sensitivity and NPV are lower (87% and 44% respectively) due to the presence of necrosis, hemorrhage or cystic degeneration [4].

• In adrenal tumors the sensitivity of fine needle biopsy in diagnosis of malignancy varies between 88-94.5 % [5].

• **Contrast enhanced ultrasound** (CEUS) has been shown to accurately depict the vascularized, active parts in renal [6-8] and adrenal [9] tumors.
• CEUS performed before or during a percutaneous biopsy was shown to be a useful method to avoid fibrotic or necrotic areas in various tumors [10-12] and to increase the conspicuity of less defined liver lesions [13].
• Recent studies have shown that percutaneous biopsy may be performed under low MI CEUS guidance thus increasing the accuracy of biopsy in liver tumors [14,15].

• The objective of our study was to evaluate the feasibility and clinical value of CEUS guided percutaneous biopsy (PB) in large renal and adrenal tumors.
Methods and Materials

Patients

• 14 patients (11 males, 3 females, mean age 62.4 years) with renal tumors (mean diameter 9.5 cm, range 6.3-14 cm) and 2 with adrenal tumors (1 male, 1 female, mean diameter 8.9 cm, range 6.8-11 cm) detected by CT in oncological patients were referred to the ultrasound department for percutaneous biopsy.
• Five patients have inconclusive results after biopsies performed in another department.

Contrast enhanced ultrasound studies

• Before PB patients were evaluated with CEUS, low MI (0.1-0.2) (1.2-2.4 ml SonoVue, Bracco, Milan) using Logiq 7 and E9 systems (GE). The enhancement in arterial phase and venous phase was documented and also the extent of unenhanced areas (with significance of necrosis, fibrosis or hemorrhage).

CEUS guided percutaneous biopsy

• PB was performed with an 18G Bard needle coupled on Biopty Gun using the freehand technique. If the first specimen (sampled in the arterial phase) was judged to have excellent qualities (at least 12 mm length with no macroscopic signs of necrosis) the procedure was stopped. In the other cases a second specimen was sampled quickly after the first passage (in the early venous phase).
• **CEUS guidance** was used in all patients in arterial phase (0-30 sec after injection of 2.4 ml SonoVue), the needle being guided in the enhancing areas. Targeting the enhanced area was facilitated by the Logiq 7 & E9 equipment which displays both the CEUS image in one half screen and the fundamental US image in the other half screen.
Results

• 80% of renal tumors and all adrenal tumors have unenhanced, necrotic areas. The larger the tumor is the important the necrotic part. (Fig.1,2)
• Both adrenal tumors showed large unenhanced areas in arterial phase (Fig.3). In one adrenal tumor only the capsule and few septa were enhanced during the arterial phase (Fig.4)

Assessment of the feasibility of CEUS guided biopsy

• The use of CEUS guidance in renal or adrenal biopsy was technically feasible in all cases. Targeting the enhanced areas in arterial phase in large tumors needs some skills, gained after 2-3 attempts (Fig.5 Movie)
• The difficulties encountered during biopsies were related to: 1) the relatively poor visibility of the needle in the CEUS image which may cause mistargeting (Fig.6); or/and 2) the quite short time (30-40 sec) available to perform the biopsy
• A good enhancement persists in the early venous phase allowing a second passage if the first specimen is judged to be insufficient for histological diagnosis (Fig.7, Movie)

Performances of CEUS guided renal and adrenal biopsy

• In CEUS guided renal biopsy one passage was used in 3 cases and 2 passages in the remaining 11 cases.
• The specimens were longer (9.92 ± 2.49 mm) when sampled in the arterial phase in comparison with those in the early venous phase (9.09±2.25 mm) but without statistical significance (p>0.05). (Table 1)
The overall diagnostic sensitivity for malignancy of CEUS guided PB in renal tumors was 100% (71.4% being renal cell carcinoma, clear cell type). (Table 2)

<table>
<thead>
<tr>
<th>Pts</th>
<th>Gender</th>
<th>Age</th>
<th>Tumor size (cm) (maximal diameter)</th>
<th>Specimen length (mm) arterial phase</th>
<th>Specimen length (mm) venous phase</th>
<th>Pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>M</td>
<td>65</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>RCC</td>
</tr>
<tr>
<td>2.</td>
<td>F</td>
<td>38</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>Malignant</td>
</tr>
<tr>
<td>3.</td>
<td>M</td>
<td>58</td>
<td>9</td>
<td>12</td>
<td>-</td>
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<tr>
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<td>8</td>
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<td>Metanephric adenoma</td>
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<tr>
<td>5.</td>
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<td>8</td>
<td>4</td>
<td>8</td>
<td>RCC</td>
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<tr>
<td>6.</td>
<td>M</td>
<td>62</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>Nontumoral (old haematoma)</td>
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<td>61</td>
<td>12</td>
<td>12</td>
<td>-</td>
<td>RCC</td>
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<tr>
<td>8.</td>
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<td>10</td>
<td>12</td>
<td>10</td>
<td>RCC</td>
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<tr>
<td>9.</td>
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<td>8</td>
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<td>M</td>
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<td>14</td>
<td>10</td>
<td>-</td>
<td>RCC</td>
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<tr>
<td>12.</td>
<td>F</td>
<td>42</td>
<td>7.9</td>
<td>10</td>
<td>6</td>
<td>Metastasis (mesenchymal tumor)</td>
</tr>
<tr>
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<td>12</td>
<td>12</td>
<td>10</td>
<td>RCC</td>
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<tr>
<td>14.</td>
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<td>60</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>RCC</td>
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</tbody>
</table>

**ADRENAL TUMORS**

<table>
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<tr>
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<th>Gender</th>
<th>Age</th>
<th>Tumor size (cm) (maximal diameter)</th>
<th>Specimen length (mm) arterial phase</th>
<th>Specimen length (mm) venous phase</th>
<th>Pathology</th>
</tr>
</thead>
<tbody>
<tr>
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<td>11</td>
<td>10</td>
<td>-</td>
<td>Metastasis (small cell carcinoma)</td>
</tr>
<tr>
<td>4.</td>
<td>F</td>
<td>65</td>
<td>6.8</td>
<td>5 aspiration</td>
<td>Inflammation, tuberculosis</td>
<td></td>
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</table>
Fig.: Table 2.

References: Ultrasound, 3rd Medical Clinic - Cluj-Napoca/RO

- In both large adrenal tumors the final diagnosis could be established (metastatic carcinoma and tuberculosis), in the second one by means of an aspiration puncture, performed in venous phase.

Complications

- No major complications occurred.
Fig. 0: A. Large renal tumor at the lower pole of the right kidney

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**Fig. 0:** CEUS. 28 sec after injection no enhancement was seen in central part of the tumor

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**Fig. 0:** Large right adrenal metastasis from lung cancer. Only a small part of the tumor is enhancing in the arterial phase

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**Fig. 0:** Right adrenal involvement in tuberculosis. Note the enhancement in the capsule and some septa

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Fig. 2: CEUS guided PB performed in early arterial phase

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**Fig. 0:** Needle misplacement in arterial phase. Histology: necrosis

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**Fig. 1:** CEUS guided renal biopsy performed in early venous phase. Note the good enhancement in the tumor.

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Conclusion

- Contrast enhanced guided biopsy in renal and adrenal tumor is a feasible procedure with a high accuracy. It can be performed both in arterial or early venous phase to sample tissue from nonnecrotic part of the tumor.
- Percutaneous biopsy should be performed always with CEUS guidance in patients with large tumors or with cystic areas.
- The results of this preliminary study should be confirmed in larger studies comparing the accuracy and cost-effectiveness of CEUS and US guided biopsy in renal and adrenal tumors.
References


Personal Information

Assoc.Prof. Zeno Sparchez.
Department of Ultrasound
3rd Medical Clinic, University of Medicine and Pharmacy
Croitorilor Str.19-21
Cluj Napoca, Romania

Email: zsparchez@gmail.com