Technical Note

Safety of ultrasound-guided percutaneous renal biopsy-retrospective analysis of 1090 consecutive cases

Olaf Hergesell¹, Helmut Felten², Konrad Andrassy¹, Karlwilhelm Kühn² and Eberhard Ritz¹

¹Department of Nephrology, University of Heidelberg, and ²Renal Unit, Municipal-Hospital Karlsruhe, Germany

Abstract

Background. Ultrasound-guided renal biopsy with an automated spring-loaded biopsy device has become the standard method for kidney biopsy. Information on the success rate and safety of the routine use of this procedure from large series is not available. Such information is of interest for cost benefit considerations and for medicolegal purposes. We performed an audit of this procedure.

Subjects and methods. From January 1993 to June 1997, 1090 percutaneous renal biopsies were performed in the renal units of Heidelberg (n = 557) and Karlsruhe (n = 533) using a spring-loaded biopsy device (Biopty®; Radiplast AB, Uppsala, Sweden). After intensive local disinfection, biopsies were performed under local anaesthesia and direct visualization by ultrasound (Sonolayer SSH-140 A, Toshiba Inc., Japan). A puncturing adaptor was used (model UAGV 009 A, Toshiba, Japan). Of the 1090 biopsies 114 (10.4%) were performed on renal allografts and 976 (89.6%) on orthotopic kidneys.

Biopsies were performed only if patients were strictly normotensive (<140/90 mmHg) and had normal coagulation parameters (PT, PTT, factor VIII, thrombocyte count, and bleeding time). All patients had been advised not to take aspirin or non-steroidal anti-inflammatory agents for at least 5 days prior biopsy. We analysed (1) yield of diagnostically useful material, and (2) frequency of postbiopsy complications (e.g. macrohaematuria, haematoma, infections, and AV fistula).

Results. Except for one case requiring interventional radiology because of persisting blood loss and three cases requiring blood transfusions, no serious complications were seen in the 1090 percutaneous renal biopsies, e.g. death, loss of kidney, life-threatening haemorrhage, or persisting haemodynamically relevant AV fistulae.

The frequency of minor haematoma with an extension >2×2 cm, but no significant decrease of haemoglobin, was 2.2% (25/1090). Self-limited mild macrohaematuria occurred in 0.8% (9/1090). The incidence of small, haemodynamically irrelevant AV fistulae detected by Doppler ultrasound was 9% (48/533).

Sufficient tissue for reliable histopathological diagnosis was obtained in almost all cases (1077/1090 = 98.8%). The median number of glomeruli per biopsy sample was 9 (range 1–37).

Conclusion. If contraindications, especially high blood pressure and abnormal haemostasis, are respected, ultrasound-guided percutaneous renal biopsy with an automated biopsy device is safe. Skilled operators obtain satisfactory amounts of kidney tissue in almost all cases.

Key words: automated biopsy device; complications; efficacy; percutaneous renal biopsy

Introduction

Renal biopsy is the diagnostic procedure of choice in many patients in whom renal disease is suspected. Like every invasive procedure, renal biopsy is fraught with potential complications.

With the introduction of the ultrasound-guided biopsy renal biopsy has become easier and safer [1,2] compared to the presonography era, and a further step forward was the introduction of an automated spring-loaded biopsy device [3,4].

Although compared to the Tru-Cut or Vim–Silvermann device the needle used with the Biopty® technique is narrower (18 gauge = 1.2 mm) so that less tissue is obtained, the number of glomeruli per biopsy specimen is apparently still sufficient for histopathological diagnosis in most cases.

Information on the efficacy and safety of renal biopsy with the spring-loaded Biopty® device is of interest for cost benefit calculations regarding the indication of renal biopsy [5], for medicolegal purposes, and for other reasons. To obtain such information, we analysed retrospectively 1090 consecutive biopsies in two German renal units.
Biopsy was performed in prone position with patients lying with the abdomen on a firm pillow. The lower pole of the kidney was located by ultrasound and the site of insertion of the biopsy needle was marked with ink. The most appropriate needle–skin angle was selected by adjusting the puncturing adaptor (usually 65°).

After disinfection of the skin (Frekaderm®, Fresenius, Bad Homburg, Germany) lignocaine (1%) was applied locally under ultrasound control along the needle insertion tract. To facilitate introduction of the biopsy needle a small incision of the skin was made. Under visualization by ultrasound the needle was advanced at an angle of 65° until the capsule of the lower kidney pole had been reached. The patient was asked to hold his or her breath, the biopsy device was unlocked and tissue obtained. The sampling time was <1 s.

The length of the obtained biopsy specimens was usually 18–20 mm in orthotopic kidney biopsies and 10–12 mm in transplant biopsies. In the renal unit of Heidelberg at least two biopsies were taken.

After biopsy the patient was instructed to remain in bed for 24 h. Local pressure on the biopsy site was exerted with a pillow. Blood pressure and pulse were monitored at hourly intervals after biopsy. Four to six hours after the biopsy haematocrit and haemoglobin were measured.

On the next morning patients were mobilized after ultrasound examination had ruled out major haematoma.

Results

Only 1.2% of specimens showed no glomeruli (0.7%) or even no renal tissue (0.5%). In all other cases sufficient material could be detected. The median number of glomeruli was 9 (range 1–37) per specimen. A histological analysis, including conventional light and immunofluorescence microscopy, could be made by the pathologist in 99.1% of the successful biopsies.

The complications of renal biopsy are listed in Table 2.

Discussion

With the ultrasound-guided renal biopsy technique using an automatic spring-loaded biopsy device, renal biopsy has become safe and reliable. Burstein et al. [3] reported on 91 patients, who were biopsied with this device. They found complications in 14.3% of patients. Of these 6.6% were minor (macrohaematuria not requiring transfusion) and 7.7% were major (bleeding requiring blood transfusion). There was no significant difference in complication rate compared to the use of a standard biopsy needle (Tru-cut). The high incidence of minor and major complications despite using the Biopry® device compared to our findings may be due to the fact that they used a 14-gauge needle, whereas we used a smaller 18-gauge needle. In two other smaller series, using an automated spring-loaded biopsy device [6,7], 22 kidney biopsies were performed in each series. No major complications occurred. In one patient of each series macrohaematuria was observed (4.8%).

| Table 1. Demographic data and diagnostic categories in 1033 renal biopsy patients in two German renal units |
|---------------------------------|-----------------|-----------------|
| Patients (n)                   | Heidelberg      | Karlsruhe       |
|                                 | 538             | 495             |
| Biopsies (n)                   | 557             | 533             |
| Gender (m/f)                   | 350/207         | 334/199         |
| Median age (years) (range) 1997 | 44.3 (16–79)    | 49.2            |
| Patients presenting with ARF   | 31 (5.7%)       | 66 (13.3%)      |
| Patients with CRF              | 34 (6.3%)       | 52 (10.5%)      |
| (s-creatinine > 5 mg/dl)       |                 |                 |
Mendelssohn and Cole [8] found an overall complication rate of 5.3% in 544 consecutive percutaneous kidney biopsies (482 biopsies were performed with an automated core biopsy system). Transient gross haematuria occurred in 4.4% of their patients as opposed to 0.8% in the present series. It should be noted that the authors did not consistently biopsy with real time ultrasound control.

The results of our audit document that the risk of serious biopsy-induced complications is extremely low. Direct real time ultrasound control allows the correction of the needle position at any moment during the biopsy procedure [9]. As the automated device sample time is rather short (<1 s) and the diameter of the needle only 1.2 mm (18 gauge) the bleeding risk is minimized compared to Tru-Cut or Vim-Silverman device.

The yield of material obtained by the biopsy procedure is almost always sufficient for an adequate histopathological analysis. This finding is in line with the data of Burstein et al. [3] and Doyle et al. [4], who found no significant differences of diagnostic yield for material obtained with an automatic core biopsy system compared to their standard method (Tru-Cut).

We emphasize that in order to minimize risks it is not only important to adopt an adequate biopsy technique, but it is also imperative to exclude high-risk patients. Patients at high risk should be excluded from renal biopsy, particularly those with coagulation disorders, uncontrolled blood pressure, difficult anatomy and those unable or unwilling to co-operate. We feel that the almost total absence of severe complications in our patients results from the very strict inclusion criteria, but we acknowledge that in acute patients one may occasionally be forced to relax such strict coagulation and blood pressure criteria (fortunately this was not the case in our series). For acute lowering of blood pressure before biopsy it is currently uncertain whether dihydropyridine type channel blockers increase the risk of bleeding due to vasodilatation and inhibited platelet aggregation [10,11].

Finally we emphasize that the procedure should be carried out by experienced operators under supervision by senior nephrologists. In our team renal biopsy is not restricted to one or two persons, but a very strict learning protocol has been established to guarantee that junior colleagues are thoroughly familiar with the technique once they begin to carry out biopsies, and biopsies are never performed without supervision of a senior nephrologist.

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References


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Table 2. Breakdown of complications in 1090 kidney biopsies

<table>
<thead>
<tr>
<th></th>
<th>Heidelberg (n = 557)</th>
<th>Karlsruhe (n = 533)</th>
<th>Total number of biopsies (n = 1090)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macrahematuria</td>
<td>3</td>
<td>6</td>
<td>9 (0.8%)</td>
</tr>
<tr>
<td>Blood transfusion for macrahematuria or haematoma</td>
<td>0</td>
<td>3</td>
<td>4 (0.36%)</td>
</tr>
<tr>
<td>Renal haematoma (&gt; 2 × 2 cm, but no decrease of haemoglobin &gt; 2 g/dl)</td>
<td>14</td>
<td>11</td>
<td>25 (2.2%)</td>
</tr>
<tr>
<td>Arteriovenous aneurysm by colour</td>
<td>Not systematically looked for</td>
<td>48</td>
<td>—</td>
</tr>
<tr>
<td>Doppler sonography</td>
<td>Not systematically looked for</td>
<td>48</td>
<td>—</td>
</tr>
<tr>
<td>Loss of kidney</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Infection due to renal biopsy</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
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