Transjugular renal biopsy. Update on hepato-renal needlework

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Introduction

In 1990, a poster presented at the American Society of Nephrology kindled curiosity [1]. The placard indicated that renal biopsy can be performed by puncturing the right kidney from inside, with a needle inserted along a catheter running from the jugular vein into the lower pole. Publications followed, from those who had broken new ground and thereafter from many members of the nephrological circles. Most confirmed the interest in the jugular route, others brought grist to the mill, yet others were definitely misleading regarding the technique, its indications and its complications. It is therefore time to review the issue of transjugular renal biopsy (TJRB) in the light of acquired experience and to formulate recommendations and caveats.

From liver to kidney: going astray to the right vein

Transjugular liver biopsy was described in 1964 [2]. Its rationale is simple: the hepatic veins open into the vena cava almost vertically. It is easy to introduce a catheter through the right jugular vein down to the hepatic veins and let it guide a long rigid needle to obtain a sample of liver tissue, under aspiration, according to the Menghini technique. As liver disease entails a risk of bleeding, and its capsule is far from the needle tip, the liver will bleed back into the circulation.

In 1989, Frédéric Mal who had carried out a transjugular liver biopsy received to his surprise a pathology report from Patrice Callard describing a sample of renal tissue. The catheter that missed the hepatic veins had entered the right renal vein, which is short and runs almost vertically to the hilum. The patient had an uneventful course. Mal and Callard undertook a study on cadavers which concluded with the feasibility of TJRB and led to designing a set comprising a needle shorter than that used for taking samples of liver tissue. This set has been used since then and we consider it as the most appropriate for that purpose [3–5].

Conduct of the procedure

The patient is mildly sedated 30 min before the procedure and placed in a supine position on the radiology table. The right internal jugular vein is localized by ultrasonography and punctured under local anaesthesia. A wire guide is inserted into the vena cava under radiological control and leads the catheter that is wedged into the lower pole of the right kidney. Its position is checked with 2 ml of contrast medium. The biopsy needle is filled with saline, inserted along the sheath and connected to a syringe filled with saline. The needle is briskly pushed and withdrawn under continuous vacuum aspiration. The renal tissue sample is flushed out of the needle, or the syringe, and occasionally the catheter.

The procedure can be repeated to obtain tissue for immunofluorescence. This second pass is also guided by phlebography with a small amount of contrast medium. As repeated passes into the same venous branch progressively drills a channel that gets closer to the renal capsule, it is advisable to change the orientation of the catheter and to avoid as much as possible more than three passes. When appropriate, the renal biopsy can be followed by a liver biopsy with the same material. Note that the amount of iodinated contrast medium required for the procedure (2–4 ml) is in the order of 3% of that used for an intravenous pyelography and that contrast medium toxicity is virtually excluded.

The biopsy set

The biopsy set designed in 1990 and manufactured by William Cook-Europe, Bjaeverskov, Denmark,
consists of a modification of the Colapinto liver biopsy set. The catheter is 62.5 cm long, gauge 9 F (2.97 mm), pre-curved at 45°. The needle length is 63.8 cm, gauge 15 G (1.84 mm) with a reverse bevel at 45°. Note that the needle throw length does not exceed 13 mm. Different material has been used by others. We see below that it is inadequate and may be dangerous.

Indications for the transjugular route

The transjugular route cannot be considered a routine procedure that may replace the conventional percutaneous approach, for reasons of personnel, time and cost. The procedure requires an experienced operator, vascular radiology equipment for ~30 min and the Mal-Renal biopsy set costs €140 + VAT (value added tax). Considering the poor background of the patients in whom TJRB is deemed advisable, a vascular radiologist should be available in case of severe haematuria and/or perirenal haematoma to perform embolization. We feel that discharging the patient 6 h after the procedure, and thus avoiding an overnight hospital stay for economic reasons [6], is somewhat reckless.

The major indication for TJRB is represented by the renal patient with a bleeding disorder, or treated with anticoagulants, in whom renal histology is mandatory for diagnosis and treatment options [4,5]. In liver disease, the technique has the advantage of allowing simultaneous renal and liver tissue sampling [5]. The patient treated in an intensive care unit, with respiratory assistance and/or the necessity for artificial kidney procedures under heparinization can only be biopsied by the transjugular route. Voluminous ascites also precludes the prone position. Uncontrolled hypertension is a third possibility. Morbid obesity may require a biopsy of the right kidney via the renal vein. Fine et al. [6] carried out TJRB in 37 patients with morbid obesity. In six, the left kidney was biopsied because of technical difficulties regarding the right side approach. Despite the fact that the needle throw length was 20 mm, there was only one major retroperitoneal bleed requiring transfusion, seven instances of gross haematuria and five extra-capsular extravasations.

The rationale for performing renal biopsy in cirrhotic patients, especially when liver transplantation is considered, is based on the various aetiologies of renal insufficiency which may result from the hepatorenal syndrome [7], moderate renal lesions, such as IgA deposits or developing lesions, an example of which is post-infectious glomerulonephritis (GN) [8]. The biopsy may also disclose some form of end-stage renal disease (ESRD). Renal histopathology is essential when deciding between liver transplantation, liver + kidney transplantation or no transplantation.

Jouet et al. [5] investigated by TJRB 70 patients with alcoholic and non-alcoholic cirrhosis and clotting disorders. The renal results influenced the strategy regarding transplantation as follows: carry out liver transplantation in eight, combined renal and hepatic transplantation in five, refuse transplantation in two and modify the medical treatment in six.

The complications of the biopsy procedure were tolerably limited to persistent haematuria in four, requiring transfusions in one, and four perirenal haematomas, requiring transfusion in two.

Complications of the transjugular approach

In our first 200 cases [4], six minor perirenal haematomas were detected by systematic ultrasonography. Fourteen patients had a macroscopic haematuria. Transfusions were necessary in four cases of perirenal haematoma and one of abundant haematuria. This rate of significant bleeding (2.5%) is small, comparable with that of the conventional percutaneous approach, which according to series and material used may represent 4% (for a review, see [9]). The rate of complications in the last 200 biopsies carried out at Jean Verdier Hospital (where TJRB was first described) was virtually nil.

In 2000, Cluzel et al. [9] compared the effectiveness and safety of 400 TJRB procedures using the Cook Mal-Renal biopsy set with those of 400 percutaneous renal biopsies using the Bard ‘biopsy gun’ (Table 1). The patients in the transjugular subset were mostly selected (303 out of 400, 75.8%) according to a bleeding disorder. The yield of renal tissue and the incidence of major complications were the same in both groups (Table 1).

Experience from other investigators

The publications of Mal et al. [1,3,4] were followed by a few reports dealing with isolated cases or ‘preliminary experience’. A current Medline search yields few large series, save for the foregoing cited above and for Rychlik et al. [10], who published a valuable contribution on 67 cases. However, some recent papers seem to rediscover the transjugular route of renal biopsy and must be considered with more than reservation.

A short American case series [11] reported 10 procedures in nine ‘high risk patients’, including an 88-year-old male with myeloma and AL amyloidosis who died of sepsis following the procedure. In a diabetic patient with nephrotic syndrome, eight passes yielded eight glomeruli at the expense of capsular perforation and gross haematuria. All patients but one suffered capsular perforation requiring Gelfoam pledget haemostasis. Gross haematuria occurred in six out of 10 biopsies. The material used was a side-cut QuickCore needle with a 20 mm throw length.

Another report from the UK presented the results of TJRB using a side-cut needle in 25 cases [12]. The procedure yielded renal tissue in 23 out of 25 cases, with 0–32 glomeruli for light microscopy.
There were 17 out of 23 capsular perforations, requiring embolization in six.

**Back to basics**

*The biopsy material: long needles are dangerous*

The renal cortex is thinner than the liver mass. Ultrasonography provides useful information on the cortical thickness and occasionally discloses a solitary kidney, or a small atrophic kidney. Figure 1 shows the distribution of the renal vessels and the cortical thickness in a normal kidney. It is clear that two passes using a needle with a 20 mm throw length will perforate the capsule, irrespective of the orientation of the catheter wedged in a small peripheral renal venule. This is why the needle tip should not exceed 13 mm, and the reason for the high rate of complications found in the foregoing reports. Let us recall that repeating passes in the same site drills a channel that gets increasingly close to the capsule.

*The biopsy technique: stick to Menghini*

The original Menghini technique for liver biopsy is based on continuous vacuum aspiration during the whole procedure. The tissue fragments are often small but the yield is high and the risk is low. Conversely, it appears that side-cut needles are not appropriate for vacuum-based sampling.

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**Table 1.** Comparative results of the percutaneous and transjugular routes for renal histopathology (from Cluzel et al. [9])

<table>
<thead>
<tr>
<th>Approach</th>
<th>Percutaneous (n = 400)</th>
<th>Transjugular (n = 400)</th>
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<tbody>
<tr>
<td>Yield of renal tissue</td>
<td>382 (95.5%)</td>
<td>383 (95.8%)</td>
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<tr>
<td>Glomeruli for light microscopy</td>
<td>11.2 ± 7.7</td>
<td>9.8 ± 7.6</td>
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<tr>
<td>Glomeruli for immunofluorescence</td>
<td>6.4 ± 5.3</td>
<td>4.6 ± 4.6</td>
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<tr>
<td>Tissue core adequate for histopathological diagnosis</td>
<td>98.2%</td>
<td>98.2%</td>
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<td>Severe complications</td>
<td>Spleen puncture leading to splenectomy (1); AV fistulae requiring embolization (2)</td>
<td>Cervical haematoma (2); Major perirenal haematoma (3)</td>
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Capsular perforation and bleeding:
puncturing wrong ideas

A number of investigators base the safety of TJRB on the idea that capsular perforation is rare. They also consider that the blood extravasation returns to the patient’s own circulation.

Finally, they contend that in the case of perirenal haematoma or of significant haematuria, a pledget plugged by means of the catheter will stop the bleeding. These contentions are wrong.

First, and even when the needle throw length is short and the operator able, capsular perforation is not uncommon, as shown by systematic ultrasound examination. The ensuing haematoma, however, is usually small. The reason is that perirenal fat contains the bleeding. This is especially true in obese patients, whose perirenal fat thickness may exceed 2 cm. Fine et al. [6] observed very few cases of haematomas in their patients with morbid obesity, despite the fact that their needle throw length was 20 mm. Conversely, renal capsule perforation from outside allows extravasation through the channel drilled by the biopsy needle.

Secondly, the notion that bleeding can be stopped by a plug flushed into the venule where the catheter had been wedged is false. Significant bleeding does not originate from a vein, in which the hydraulic pressure is in the order of 3 mmHg, but from a renal artery, in which the blood pressure is in the order of 120 mmHg [13]. In the case of serious perirenal haematoma and/or haematuria, the only recourse is to undertake selective arteriography and plug an artery, not a vein.

Conclusion

To this day, >1800 procedures have been carried out in Paris and hundreds elsewhere. Both the right and the left kidney allow this mode of renal tissue sampling in high risk patients. With expanding experience, the rate of complications does not exceed that of the percutaneous approach. However, these encouraging results imply that the operator must heed simple but essential principles regarding the procedure he follows and the material he uses.

Acknowledgements. The invaluable assistance of Dr Frédéric Mal who first described TJRB and has now an experience of over 800 procedures is deeply appreciated.

Conflict of interest statement. None declared.

References