

Transjugular Kidney Biopsy: Enabling Safe Tissue Diagnosis in High Risk Patients

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ABSTRACT: **Background:** Transjugular kidney biopsy (TJKB) was first described in 1990. Indications for TJKB include uncorrectable bleeding disorders and conditions precluding the prone position.

Objectives: To describe our initial experience with TJKB.

Methods: Between February 2008 and December 2009 all patients in whom percutaneous biopsy was contraindicated or unsuccessful underwent image-guided TJKB using a standard set with a 19 gauge core biopsy needle. Prospectively collected data included indication, number of needle passes, contrast dose, tissue yield, and complications.

Results: Twelve patients, age range 15–76 years (mean 55), underwent 14 TJKB procedures. Indications for the transjugular route included bleeding diathesis, dyspnea, ventral hernia, ascites, marked obesity, need for concomitant liver biopsy or concomitant insertion of tunneled dialysis catheter, discrepant kidney size, and failed percutaneous attempt. Thirteen biopsies were performed in 11 patients; in one patient TJKB was abandoned due to unfavorable renal vein anatomy. Four patients were premedicated with desmopressin and one with platelet transfusion due to prolonged bleeding time. Three to six passes (mean 3.8) were made per biopsy, with an overall yield of 9.6 ± 8.2 glomeruli, providing a definite diagnosis in nine patients and a probable diagnosis in two. In two patients the first biopsy attempt yielded insufficient tissue, necessitating a repeat procedure. There were two minor bleeding episodes not requiring intervention. Serum creatinine was unchanged after the procedure and hemoglobin levels asymptotically dropped by 0.3 ± 1.0 g/dl within 48 hours, requiring no treatment.

Conclusions: TJKB appears to safely allow adequate tissue diagnosis in patients at increased risk for complications from or contraindications to percutaneous renal biopsy.

IMAJ 2011; 13: 425–427

KEY WORDS: kidney, biopsy, transjugular, angiography, diagnosis

percutaneous kidney biopsy, however, is often profoundly influenced by issues of technical feasibility and safety. These include patient factors (ability to lie in the prone position, anatomic abnormalities, comorbidities, bleeding diathesis), operator experience (type of biopsy needle and guidance), and availability of ultrasound assistance (real-time guidance or ultrasound-guided localization only).

In 1990 Mal and colleagues [3] described a transjugular approach to perform kidney biopsies. The transjugular route was already in use for liver biopsy in high risk patients. They therefore postulated that the transjugular route in the supine position might be used safely to obtain renal tissue in patients either at increased risk for bleeding complications or in those who were unable to lie in the prone position for percutaneous access to the kidney. Current indications for the transjugular rather than the percutaneous route include uncorrectable bleeding disorders and conditions precluding the prone position, such as mechanical ventilation, dyspnea, morbid obesity and voluminous ascites. TJKB is a technically demanding procedure that has thus not gained widespread popularity since its inception nearly 20 years ago. We describe here our initial single-center experience with TJKB. Our primary objectives were to evaluate procedural safety and diagnostic yield.

PATIENTS AND METHODS

Between February 2008 and December 2009, TJKB was offered to 12 patients (4 men, 8 women) in whom renal histology was deemed necessary for clinical management but percutaneous biopsy was contraindicated or unsuccessful. Their mean age was 55 years (range 15–76). The procedure was performed in the interventional radiology suite by a team including one or two physicians (each with several years of experience), a nurse and a technician. We prospectively collected data, including indication for biopsy, volume of contrast media, number of biopsy passes, tissue yield, complications, and diagnosis.

THE BIOPSY PROCEDURE

Patients gave written informed consent for the procedure. Blood count and coagulation parameters were normal or cor-

TJKB = transjugular kidney biopsy

Renal biopsies are performed to obtain a diagnosis, to determine appropriate therapy, to decide when treatment is futile, and to ascertain the degree of potentially reversible pathological changes [1,2]. The decision to perform a

rected to a hematocrit of 25%, minimum platelet count of 50,000/mm³, and a maximal international normalized ratio of 1.5. Desmopressin was administered 1 hour before the procedure if the bleeding time was longer than 8 minutes.

The procedure was performed using local anesthesia with lidocaine HCl 1% buffered with sodium bicarbonate 4.6% and conscious intravenous sedation with midazolam, with continuous monitoring of vital signs and pulse oxymetry. Access was obtained via the right internal jugular vein, and the renal vein (right side in all but one) was catheterized. A small quantity of iso-osmolar contrast material (iopamidol 300) was injected to confirm positioning in a lower pole renal vein. TJKB was then performed using a standard transjugular biopsy set (Cook, Bloomington, IN, USA) with a 19 gauge true cut-core biopsy needle. Several passes were made per biopsy by advancing the needle under fluoroscopic guidance to the renal capsule, while avoiding traversing it. Adequate tissue retrieval was determined by visual inspection only. Post-procedure ultrasound was performed to check for hemorrhage in the region of the biopsy.

RESULTS

Indications for biopsy were rapidly progressive renal failure (four patients), nephritic and/or nephrotic syndrome (six patients), kidney dysfunction with proteinuria (one patient) and kidney dysfunction with hypercalcemia (one patient). Indications for the transjugular route were bleeding diathesis (n=5), dyspnea (n=2), ventral hernia (n=1), ascites (n=3), obesity (n=3), need for concomitant liver biopsy (n=2), discrepant kidney size (n=1), need for concomitant placement of a tunneled dialysis catheter (n=2) and failed percutaneous attempt (n=1). In the latter patient, who previously failed and bled after a percutaneous biopsy attempt, TJKB was abandoned due to unfavorable renal vein anatomy that prevented stable positioning of the biopsy needle and sheath within the

Figure 1. [A] Right renal venogram confirms appropriate position of the biopsy guide within the lower pole renal vein. [B] The 19 gauge core biopsy needle is advanced as far as the estimated location of the renal capsule (arrow) for performance of the biopsy.

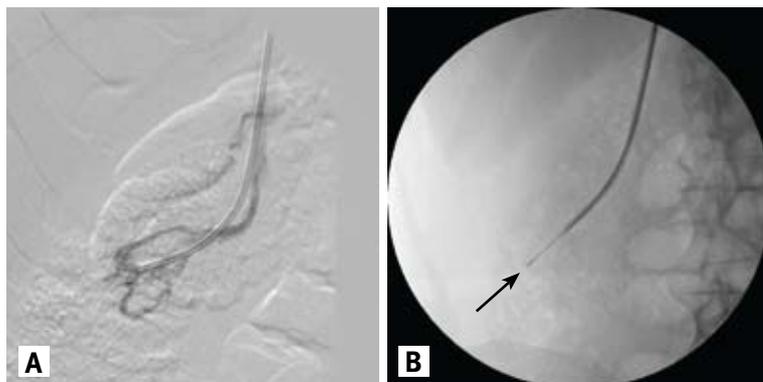
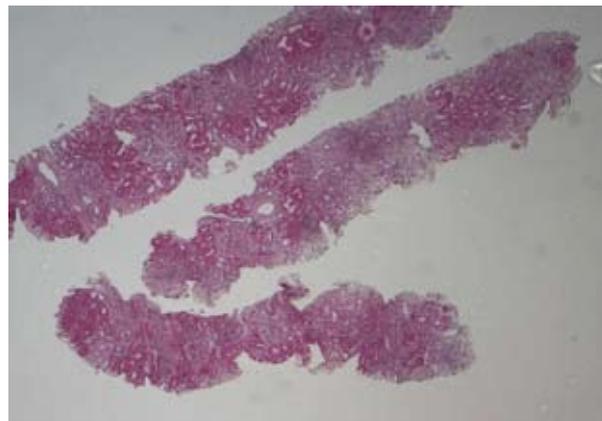


Figure 2. A low power magnification of a TJKB yield stained with hematoxylin & eosin, showing cores obtained by three needle passes.



renal vein (and the procedure was concluded by placement of a tunneled dialysis catheter). A subsequent laparoscopic biopsy revealed end-stage changes due to pauci-immune crescentic glomerulonephritis.

In the remaining 11 patients a mean of 3.8 needle passes were performed per biopsy (range 3–6) [Figures 1 and 2]. In two patients the first biopsy attempt yielded insufficient tissue, necessitating a repeat procedure. In one of these patients the first biopsy attempt was concluded with placement of a tunneled dialysis catheter, requiring a repeat procedure through the left internal jugular vein.

The overall yield was 9.6 ± 8.2 glomeruli per biopsy, 5.9 ± 5.4 glomeruli for light microscopy, 3.3 ± 3.9 glomeruli for immunofluorescence and 0.9 ± 0.6 glomeruli for electron microscopy. A definite diagnosis was made in 9 patients (75%) and a highly likely diagnosis in another 2 patients (17%) with a total diagnostic success rate of ~90%. Diagnoses were graft versus host disease-associated membranous glomerulopathy, pauci-immune glomerulonephritis (in a patient with diabetes, pulmonary capillaritis and hypocomplementemia), collapsing glomerulosclerosis (in a patient with breast cancer treated with pamidronate), acute tubular injury, mesangiocapillary glomerulonephritis (in a patient with hepatitis C virus cirrhosis, a survivor of promyelocytic leukemia), focal glomerulosclerosis (in a patient with lupus), granulomatous (non-caseating) interstitial nephritis (in a patient with renal failure and hypercalcemia), diffuse lupus nephritis class IV [Figure 3], immunoglobulin A nephropathy, and Henoch-Schonlein purpura and nodular diabetic glomerulosclerosis (the latter in a patient with HCV-related cryoglobulinemia, in whom the procedure also included a liver biopsy, revealing minimally active hepatitis with fibrosis).

The amount of contrast material used to verify location before biopsy was 9.8 ± 6.0 ml. On average, the serum crea-

HCV = hepatitis C virus

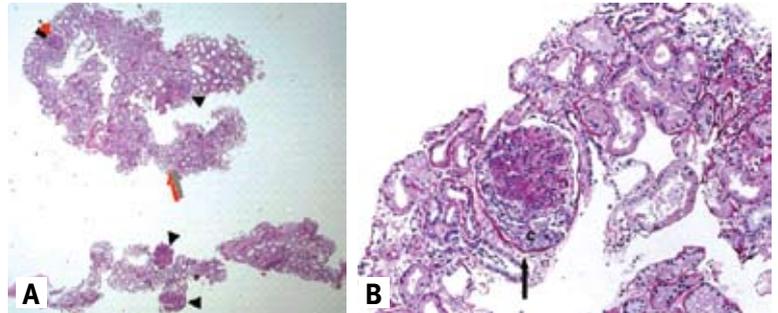
tinine levels *decreased* by $1.31 \pm 11.99\%$ after the procedure. There were two minor, self-limited bleeding episodes (macrohematuria and a small hematoma seen on ultrasound), with no need for a blood transfusion or further intervention. Mean hemoglobin levels dropped by 0.3 ± 1.0 g/dl within 48 hours, but required no specific treatment.

DISCUSSION

Kidney biopsy is an important procedure in the diagnosis and treatment of renal disease. In fact, the emergence of nephrology as a medical specialty was closely related to the technical feasibility of kidney biopsy in the 1960s. Yet, in some patients a percutaneous biopsy is either hazardous or not feasible. Before the development of TJKB such patients required an open biopsy, which carries surgical and anesthetic risks and contraindications. The option of performing a TJKB opened new possibilities for the management of this subgroup of patients. TJKB is performed in several centers around the world. As of 2005, over 1800 procedures had been performed, most of them in France [7]. In a large series published by Cluzel et al. [8], 400 TJKBs were compared to 400 percutaneous kidney biopsies. There was no difference in the diagnostic yield or in complication rates. Major complications occurred in ~1% when using both routes. The number of glomeruli per biopsy was smaller using the TJKB route (11.2 vs. 9.8). This reduction in yield probably resulted from the smaller needle size used for TJKB. In a recent report of TJKB in 63 patients, the authors reported a major complication rate of 2.6%, a minor complication (hematoma) rate of 52%, with contrast nephropathy occurring in 7.8% [4]. Our initial experience with TJKB is similar or better than in prior reports with regard to both diagnostic yield and complication rates [8]. This difference may be related to the small sample size. Compared with percutaneous biopsy, TJKB is more demanding since it requires angiography capability and an appropriately trained interventional radiologist and ancillary staff.

Although both percutaneous and open kidney biopsy have a better diagnostic yield, they may not be feasible for high risk patients. Had TJKB not been available, several of the patients in our series might have either not undergone biopsy at all or would have been considered for a laparoscopic biopsy with general anesthesia, despite its inherent risks.

Figure 3. [A] At scanning magnification there are cores of cortical renal tissue containing four glomeruli (black arrows) with diffusely increased mesangial cell and matrix, lobular accentuation and cellular crescent (red arrow) and slightly edematous interstitium with focus of interstitial fibrosis and atrophic tubules (grey arrow). **[B]** Note one glomerulus (arrow) with cellular crescent (C)



In conclusion, our initial experience with TJKB confirms that it may be safely used to obtain diagnostic renal tissue. Due to its technical complexity and the smaller amount of glomeruli retrieved when compared to percutaneous biopsy, it should be reserved for high risk patients.

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“A society grows great when old men plant trees whose shade they know they shall never sit in”

Greek proverb

“If people knew how hard I worked to get my mastery, it wouldn't seem so wonderful after all”

Michelangelo (1475-1564), Italian Renaissance painter, sculptor, architect, poet and engineer. His versatility in the disciplines earned him the title Renaissance man, along with fellow Italian Leonardo da Vinci. His most famous sculptures are the *Pietà* and *David*, and his paintings are the fresco on the ceiling and *The Last Judgment* on the altar wall of the Sistine Chapel in Rome