CLINICAL STUDY

Combined Fluoroscopy and Ultrasound-Guided Transjugular Kidney Biopsy in Cirrhotic Patients

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ABSTRACT

Purpose: To evaluate the safety and diagnostic yield of combined fluoroscopy and ultrasound-guided transjugular kidney biopsy (TJKB) in cirrhotic patients with suspected renal parenchymal disease.

Materials and Methods: A retrospective review was made of 27 patients (21 men; overall mean age 44.7 y) who underwent TJKB from June 2013 to June 2016; 21 patients had coagulopathy and/or thrombocytopenia, 4 underwent simultaneous TJKB with transjugular liver biopsy, and 1 patient each had severe obesity and gross ascites. All procedures were performed with the use of fluoroscopy and simultaneous transabdominal ultrasound guidance. The data were analyzed for number of passes taken, number of glomeruli in the tissue cores, adequacy of tissue core for histopathologic diagnosis, and incidence and severity of complications.

Results: The average number of passes per case was 3.6 (range 2–6). The total length of tissue cores ranged from 0.4 cm to 2.5 cm. The mean numbers of glomeruli per procedure on light microscopy were 6.7 (range 0–17). Diagnostic biopsy specimens were obtained in 23 out of 27 patients (85%). Eleven patients had minor complications. One patient had major complication in the form of hemoglobin drop of 2.1 mg/dL which required embolization and blood transfusion.

Conclusions: Combined use of fluoroscopy and ultrasound guidance for TJKB yielded adequate tissue samples with fewer passes and a low rate of complications in high-risk patients with cirrhosis.

ABBREVIATIONS

PKB = percutaneous kidney biopsy, TJKB = transjugular kidney biopsy

Kidney biopsy is often crucial for determining the etiology and severity of kidney disease and thus helps in making therapeutic decisions. Percutaneous kidney biopsy (PKB) remains the preferred method for obtaining kidney tissue since its inception in 1952 (1). However, despite improvements in technique and use of ultrasound (US) guidance, PKB is still not a risk-free procedure. The incidence of all bleeding complications (gross hematuria, arteriovenous fistula, and hematoma) after performing PKB is ~34.1%, with major complications requiring interventions seen in 1.2% patients (2). As such, PKB is generally contraindicated in patients with deranged coagulation parameters, thrombocytopenia, a single functioning kidney, or small kidneys. Also, PKB can be technically very challenging in very obese patients or patients who are unable to lie prone. In this subgroup of patients, the transjugular kidney biopsy (TJKB), which is basically a modification of transjugular liver biopsy (TJLB), provides an alternate method of tissue acquisition. In TJKB, the biopsy is taken with the use of endovascular technique, and in theory any hemorrhage will return into the vein unless significant capsular perforation or collecting system puncture occurs. Current indications for TJKB rather than PKB include uncorrectable hemorrhagic disorders and conditions precluding the prone position, such as mechanical ventilation, severe dyspnea, morbid obesity, and voluminous ascites (3). TJKB is performed also in

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patients undergoing TJLB as part of evaluation for liver and kidney disease, where simultaneous liver and kidney transplantation are contemplated (4). In the future, prevalence of hemorrhagic diatheses may further increase owing to wider use of anticoagulation for thrombotic disorders and dysrythmias, and as such patients undergoing TJKB are expected to increase (5).

Compared with PKB, TJKB is more demanding and requires an appropriately trained interventionist and ancillary staff. TJKB can be performed either by means of aspiration technique or with the use of core biopsy needle. There are limited published data on both the aspiration (6–9) and the core biopsy (10–15) techniques. Described here are the technical details and single-center experience of combined fluoroscopic and real-time transabdominal ultrasonographic guidance for TJKB with retrospective analysis of the needle passes taken, the sample adequacy, and the complications of TJKB in 27 patients.

MATERIALS AND METHODS

This retrospective study was approved by the Institutional Ethical Committee. Patients who had chronic liver disease (CLD) with associated kidney dysfunction and underwent TJKB from June 2013 to June 2016 were identified by means of querying the radiologic database. Ethanol (n = 8) was the most common cause of CLD, followed by hepatitis B (n = 7), hepatitis C (n = 5), nonalcoholic steatohepatitis (n = 4), and other causes (n = 3). The study group included 21 male and 6 female patients ranging in age from 23 to 76 years (mean 44.7 years). The patient characteristics and indications for TJKB are summarized in **Table 1**. In all of these patients, histologic diagnosis was deemed to be necessary for clinical management by the referring nephrologists but percutaneous biopsy was contraindicated.

The hemoglobin (Hb) level, international normalized ratio (INR), and platelet count were obtained in all patients. Coagulopathy was defined as an INR >1.5 and thrombocytopenia as a platelet count $<150 \times 10^9$/L. An attempt was made to correct the patients' INR to <1.6 and platelet count to $>50 \times 10^9$/L by administration of fresh frozen plasma (2–4 units) or random donor platelet concentrate (1–4 units), respectively. Hb was monitored on day 1, day 2, and 1 week following the procedure to estimate the blood loss related to the biopsy. Post-procedure US of kidneys was done in all patients in the morning of the next day to look for any perinephric hematoma. Repeated US was done at 2 days, 1 week, and 1 month in those patients who had documented hematoma on post-procedure US. Complications were classified according to the Society of Interventional Radiology guidelines as class A through F (16).

Table 1. Patient Characteristics and Contraindications for PKB/Indications for TJKB

Characteristic	Measure
Sample size	27
Male:female	21:6
Age	23–76 years (mean 44.7)
Hemoglobin	5.9–12 gm/dL (mean 8.6)
Platelet count	23–397 $\times 10^9$/L (mean 105.2)
INR	1.02–2.31 (mean 1.5)
Contraindication for PKB or indication for TJKB	
Increased INR and thrombocytopenia and need for simultaneous TJKB and TJLB	1 patient
Increased INR and thrombocytopenia	12 patients
Increased INR	1 patient
Thrombocytopenia	8 patients
Simultaneous TJKB and TJLB	3 patients
Severe obesity	1 patient
Gross ascites	1 patient

INR = international normalized ratio; TJLB = transjugular liver biopsy.

Transjugular Kidney Biopsy: Technique

All of the procedures were performed in the interventional radiology suite by interventional radiologists (A.M. and S.B.). Right internal jugular vein access was established, and a 7-F access sheath (Cordis, Miami Lakes, Forida) was advanced into the superior vena cava. A 5-F Multipurpose A catheter (Cook, Bloomington, Indiana) and 0.035″ hydrophilic J-tipped guidewire (Radifocus; Terumo, Tokyo, Japan) were used to engage the main right kidney vein. The right kidney vein was chosen owing to the more favorable angle and shorter course from the inferior vena cava. The guidewire was advanced as distally as possible in a subcortical vein, followed by the catheter. The guidewire was removed and iso-osmolar contrast material (Iodixanol, 320 mg/mL) injected via the catheter to assess the venous anatomy and to confirm positioning in a lower pole kidney vein (**Fig 1**). The position was judged to be satisfactory when a wedge of cortical parenchyma was opacified by the contrast. A 0.035″ Amplatz wire was introduced through the catheter. The catheter and access sheath was then exchanged for a long transjugular cannula from a standard transjugular renal access and biopsy set (RABS; Cook). This set is composed of 4 components: a 5-F 90-cm-long multipurpose catheter, a 14-gauge 60.5-cm-long transjugular sheath, a 14-gauge 60.5-cm-long transjugular cannula, and a 19-gauge 70-cm-long Quick-Core blunt-tipped biopsy needle (**Fig 2**). Next, the wire was removed and the 70-cm-long 19-gauge Quick-Core biopsy needle with a 2-cm specimen notch was inserted into the cannula. The needle was pushed slightly to expose the tip beyond the cannula, and samples were taken with the aid of the spring-loaded gun. Real-time transabdominal US guidance was used in all cases to confirm the position of the tip of the long sheath and the biopsy needle in the lower pole of kidney. For this, a second radiologist would stand by the right side of the couch and focus the lower pole of right kidney by placing a 3.5-MHz convex probe in the right lumbar region. Besides helping in the localization