ORIGINAL ARTICLE

ULTRASOUND GUIDED NATIVE RENAL BIOPSY: USING A CAUDAL ANGULATED NEEDLE PATH TO YIELD ADEQUATE CORTICAL SAMPLE

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ABSTRACT

PURPOSE: To describe the caudal angulation technique for ultrasound guided native kidney biopsy and to compare complication rate with that available in literature. **MATERIAL & METHODS:** Retrospective study of 60 consecutive patients who underwent ultrasound guided renal biopsies between January 1, 2011 to December 31, 2011 was carried out at a tertiary care center. The number of core biopsy samples and glomeruli per core were recorded, along with any ensuing complications. **RESULTS:** Minimum of 2 biopsy core samples per case were taken by three consultant radiologists using caudal angulation technique. In all patients (success rate,100%) sufficient material was obtained for histopathology. Biopsy results showed mean of 24.5 ± 8 glomeruli per specimen. Three patients (5%) experienced minor self-limiting perinephric hematoma complication. **CONCLUSION:** The caudal angulation needle approach under real time ultrasound guidance in obtaining cortical tissue from the lower pole of the native kidney is an effective technique with very few complications. The success rate is higher without increase in complication rate even when more than two core specimen are taken.

Key words: Renal biopsy, Ultrasound guidance, complications.

Introduction

Percutaneous renal biopsy is mandatory for establishing the specific diagnosis of diffuse renal disease and helping to ascertain the degree of active (potentially reversible) and chronic (irreversible) changes. The degree of active or chronic changes helps determine prognosis and likelihood of response to treatment. The routine evaluation of renal biopsy involves examination of tissue under light, immunoflurocent and electron microscopy.[1,2]

Complications were significantly reduced after introduction of ultrasound guided renal biopsies and using automated spring loaded devices.[3,4,5,6]

Lower pole of native kidney is ideal site for biopsy because of relatively less vascularity at this site and easy approach.[7,8]

The path of the needle to lower pole of the native kidney is not established in literature. Most author's state that under real time ultrasound guidance tip of biopsy needle is advanced up to renal capsule and during a breath hold, spring loaded device is activated for biopsy.[5,9,10]

The quality of renal biopsy depends on the size of core and number of glomeruli. It is generally agreed that 10 to 15 glomeruli are adequate for diagnosis. For the diagnosis of severity of focal glomerular lesion, a small biopsy sample with low number (less than 6 glomeruli) will lead to considerable misclassification of disease severity making it difficult to exclude focal disease.[11]

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Before era of ultrasound guided biopsies only approximately 88% of core biopsy provided adequate tissue.[12] With the use of ultrasound guidance getting tissues from kidney significantly improved from 88% to 93%-98% for histopathology with more than 9 glomeruli per specimen.[12,13,14,15]

Aim of this study is to improve the sampling of renal cortical tissues for histopathology while minimizing complications using ultrasound guidance caudal angulations of the biopsy needle for native renal biopies. We will also compare complication rate with that available in literature.

Material & Methods

The institutional review board granted us an exemption for this retrospective study. Informed consent was not required for this retrospective analysis. The study was conducted at the radiology department of tertiary care center from January 1, 2011- to December 31, 2011. A total of 60 patients (age range 15- 65 years) of both genders presenting with various indications for renal biopsies were included in this study. Percutaneous biopsy was performed to establish the diagnosis of type of renal disease.

A complete blood count, prothrombin time, and partial thromboplastin time, INR and platelets were checked before the procedure. Renal biopsy was not performed if there were any abnormalities in coagulation tests that could not be explained by reversible causes.

To reduce the risk of post biopsy bleeding patients on aspirin were asked to stop aspirin for at least a week before biopsy. Biopsy was performed only in those patients who had normal range blood pressure at the time of biopsy.

Biopsies were not performed if native kidney size was smaller than 9cm or cortical thickness less than 1 cm, which are generally indicative of chronic irreversible disease.

An informed consent was taken from all patients. All biopsies were performed in ultrasound interventional room by one of the three consultant radiologists. (All radiologists having more than 8 years of postresidency experience and were members of ultrasound section) Previous imaging and laboratory results were verified. Intravenous access was established with 22G cannula. The patient was placed in a prone position. Noninvasive blood pressure monitoring and pulse oximetery were instituted.

Ultrasound guidance was performed with a 4-MHz sector transducer (GE Logiq 9 Ultrasound Machine), and biopsy specimens were taken using 18- gauge autamatic biopsy-gun device. (Bard Max. Core Disposable Biopsy Instrument, needle length 16 cm, length of sample notch 1.8 cm, penetration depth 22 mm)

In most cases, the diagnostic sonogram was obtained immediately before and after the biopsy. After selection of the appropriate site, the area was cleansed with 10% pyodine solution. Area was covered with sterile drapes. Ultrasound probe was also draped to eliminate contamination. Local anesthesia by 2% Xylocaine was used along the needle insertion tract to lower pole of kidney. This was applied under ultrasound control. General sedation was not given to any patient. A small nick was made on skin for easy access for needle insertion. Free hand technique under real time ultrasound guidance was used. In each case, biopsy was performed by one individual, who held the transducer with one hand and manipulated the biopsy device with the other hand; a nurse assistant was also in the room to assist with machine set-up, biopsy tray setup, and image capture.

Kidney was visualized in longitudinal plane; lower pole of kidney was visualized with superior (upper) end of curvilinear ultrasound probe. Needle was inserted near to superior (upper) end of curvilinear ultrasound probe with possible short distance and caudal angle to target the lower pole of kidney. Needle was advanced making sure that the needle path was parallel to the outer capsule of the kidney with course of the needle through the cortex while tip of the needle directed away from renal hilum towards lower pole of the kidney. (Fig. 1) In case of altered orientation of the kidney the transducer was placed parallel to the long axis of the kidney while keeping the needle path parallel to the outer capsule as much as possible. Needle path was also checked in another plane to confirm the adequacy of cortical tissue obtained if needed. (Fig. 3)

All patients were asked to hold breath while biopsy was obtained after unlocking and firing the biopsy

device. After the removal of biopsy needle manual pressure was applied at punctured site for ten minutes followed by dressing. Patients were re evaluated after one hour with doppler ultrasound for presence of any transient arteriovenous fistula or perinephric hematoma. (Fig. 2) All patients were on strict bed rest for six hours in supine position and advised to bed rest for 24 hours. Post biopsy vitals signs including blood pressure, pulse, and respiration were monitored at every fifteen minutes for two hours, then every thirty minutes for next two hours, then hourly interval for next 24 hours after biopsy. Transient gross hematuria was watched for 24 hours. Next morning hemoglobin and hematocrit were measured.

All biopsies were performed with 18G biopsy needles. Minimum two passes were made in all patients. Samples were sent in formalin and normal saline for routine light microscopy and immunoflurocent studies. Specimen were not evaluated immediately in the biopsy room for adequacy by using light microscopy.

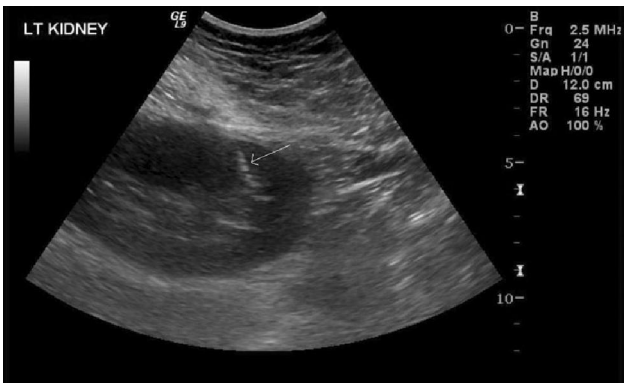

Figure 1: Sagittal sonogram obtained during renal biopsy of 35-year-old male shows needle path (arrows) through the cortex at lower pole with needle directed caudally.

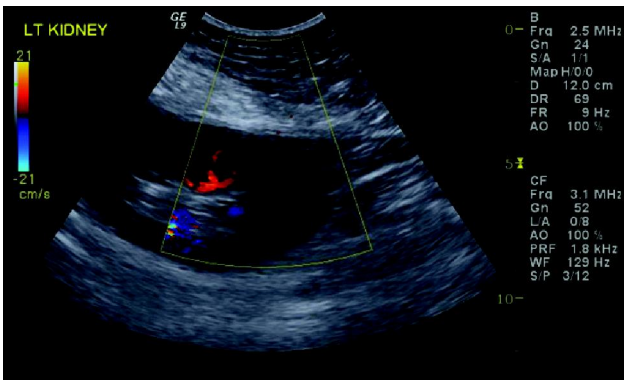

Figure 2: Same patient reevaluated with color doppler ultrasound after one hour for presence of any transient arteriovenous fistula or perinephric hematoma showing no complication.

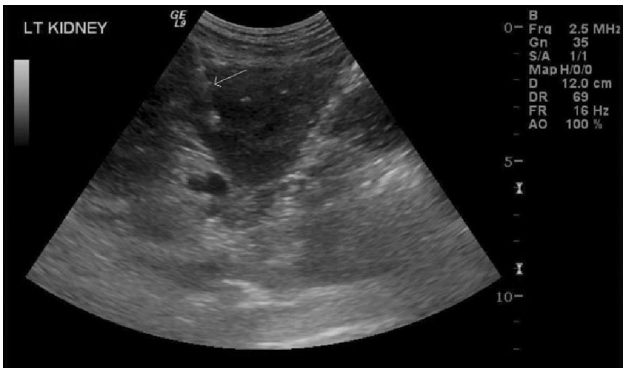

Figure 3: Transverse sonogram shows needle path (arrows) though the anterolateral cortex at lower pole of the left kidney seen in another 40-year- old patient with slightly altered orientation of the kidney.

Results

In all patients (100%) adequate material was obtained for histopathology. The mean number of glomeruli (24.5 ± 8 glomeruli) obtained with this technique far exceed the numbers reported in literature. (10 glomeruli was the minimum, while 31 glomeruli was maximum obtained in one biopsy core specimen) In six patients three core biopsy samples were taken. In no case more than three core biopsy samples taken.

Transient gross hematuria was not observed in any patient. After one hour of biopsy minimal perinephric hematoma was seen in three (5%) patients, however none of these patients showed drop in hemoglobin which remained unchanged from pre procedure value. No immediate post procedural arteriovenous fistula was observed in any patient on doppler ultrasound evaluation.

Our data indicate excellent success rates for acquisition of adequate cortical tissue during ultrasound guided renal biopsy without need of immediate specimen review.

Discussion

The renal biopsy plays a very important role in diagnosis of renal disease. Recent development of imaging guided techniques has significantly reduced complications while improving diagnostic yield.[6]

The automated biopsy needles have provided more glomeruli per core and per biopsy when compared to the manual needle of the same gauge.[16,17]

There is no difference in complication rate between a manual needle and an automatic needle of the same gauge.[16,17] A higher complication rate with a manual 14 gauge compared to smaller automated needles has been reported.[3,18]

Preda et al[19] found an overall complication rate of 12.2% in 515 ultrasound guided renal biopsies. Major complications occurred in 2.7% of the cases, minor complications in native kidneys were 17.1%. Burstein et al[16] reported overall complications in 14.3% of patients who underwent ultrasound guided renal biopsies. Of 14.3%, 6.6% were minor complications and 7.7% were major complication for which patients required blood transfusion.

Cozen NJ[5] had adequate tissue specimen of kidney for histopathology in 93% of patients. Most authors claim 95% to 98% of optimal tissue from lower pole of native kidney for diagnostic histopathology. Maya et al[6] reported 100% adequate tissue with 0% complications using ultrasound guided renal biopsies.

Native renal biopsy with ultrasound guidance has been described previously, but very few studies have provided any detail on the needle trajectory used. Aim of our study was to get optimal cortical tissue in terms of glomeruli number for adequete diagnosis of renal disease while reducing hemorrhagic complications using the new tailored technique.

Our initial results with caudal angulation technique, using real time ultrasound guidance for core biopsy from lower pole of native kidney are encouraging as adequate cortical tissue was obtained in all cases. The mean number of glomeruli obtained with this technique far exceed the numbers reported in literature.

We believe that others can duplicte these results if they are skilled in ultrsound guided procedures. In our initial experience there was no major complication, which may be because of small number of cases. Major complication rate documented, which required hospital stay and blood transfusion, is approximately 3%. Due to short number of cases we cannot speak of short- or long-term complications that are expected when more than two core samples are taken. We could not find any evidence from previous studies that supported this assertation.

In conclusion, we advocate the caudal angulation biopsy technique by using 18-gauge automated biopsy device when performing ultrasound guided native renal biopsy. The success rate (100%) of this technique and outcome in terms of mean number of glomeruli obtained far exceed the number reported in studies. Moreover this technique had very few complications with results supporting the fact that there was no immediate need for pathological review for specimen adequacy.

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