

CT GUIDED RENAL BIOPSY: SAFETY AND EFFICACY, A STUDY IN PAKISTAN

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PJR July - September 2012; 22(3):73-77

ABSTRACT

BACKGROUND: Percutaneous renal biopsy (PRB) of native kidney with automated spring loaded device is performed with various techniques to improve efficacy and safety. This study was performed to evaluate¹ the safety and efficacy of PRB performed under CT guidance² time to develop complications to see whether this procedure can be performed as outpatient,³ diagnostic yield of the specimen. **MATERIALS AND METHODS:** The study was conducted at the Department of Nephrology of Dr. Ziauddin Hospital, on all patients admitted for renal biopsy between 1st January 2009 to 31st December 2011. PRB was performed on native kidneys by experienced nephrologist under CT guidance with a 18 gauge automated spring loaded biopsy gun. Patients were included if they fulfilled the inclusion criteria. All patients were observed for 24 hours post biopsy for major complications like gross hematuria, drop in hemoglobin requiring transfusion, or requiring surgical or radiological intervention and minor complications like transient hematuria, spontaneously resolving perinephric hematoma and their timing of development. In addition, information was gathered regarding diagnostic yield of the specimen. **RESULTS:** 100 consecutive biopsies were performed. There were no major complications in 98% of the biopsies. 2% patients developed gross hematuria and significant hematoma with a drop in hemoglobin that required blood transfusion. 2% of patients developed minor complications. 100 % of the specimen had adequate tissue for making the diagnosis. All major complications developed within 12 hours of procedure. The minor complication occurred at 18 hrs. **CONCLUSION:** PRB under CT guidance is a safe and effective procedure, however recommendations can not be made to perform it on outpatient basis.

Key words: CT, Percutaneous Renal biopsy, safety, complications.

Introduction

Percutaneous renal biopsy (PRB) is frequently performed to diagnose and manage various renal diseases. It is an essential tool in the field of Nephrology. Since its original description in 1951 by Iversen and Brun,¹ advances have been made to make the pro-

cedure safer and to improve success rates in obtaining adequate tissue for diagnosis. The basis of current techniques were developed in 1954 by Kark and Muehrcke,² who placed the patient in a prone position and localized the kidney with a needle before inserting biopsy instrument and demonstrated higher chance of obtaining adequate tissue. Over time, more safer

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techniques were used to localize the kidney. Some of these techniques include Ultrasound (US) guided,³ real time ultrasound guided,⁴ Computed Tomography (CT) guided⁵ and Fluoroscopic guided techniques.⁶ With newer technology, different studies have reported high success rates in diagnosis (upto 95% in one study)⁷ and minimal complications. Haaga et al published a report, where he postulated the idea of better visualization of kidney with computed tomography (CT).⁸ Many reports have documented the efficacy, techniques and results of CT-directed biopsy.

Renal biopsy in a native kidney is performed for proteinuria, with or without hematuria, renal manifestations of systemic illness and unexplained renal failure. Patients that have bleeding diathesis, uncontrolled severe hypertension or are uncooperative are generally considered to have absolute contra-indication to percutaneous approach. In addition, obese patients are considered to have higher risk for percutaneous approach, if size or weight restricts them to receive CT guidance.

In Pakistan, most of the PRB performed are US guided. Several studies have looked into the safety and efficacy of this procedure.⁹ We looked into the safety of PRB performed with CT guidance and frequency and timing of complications which has not been reported so far from Pakistan. We also looked at the specimen for adequacy and diagnostic yield.

Material and Method

CT scan guided renal biopsies were performed at Dr. Ziauddin Medical University Hospital from 1st January 2009 to 31st December 2011. The study was approved by the ethical committee of the hospital. Informed consent was taken from all subjects. Inclusion Criteria include all patients between the ages of 18-70 years who required renal biopsy as advised by a nephrologist. Exclusion criteria include patients with deranged coagulation profile, uncontrolled HTN as defined by SBP > 160 or DBP > 100, active urinary tract infection and pregnancy. Informed consent was taken and patients were admitted for 24 hours for the procedure. Baseline Hemoglobin (Hb), Prothrombin Time (PT)/ International Normalized Ratio (INR), Activated Partial Thromboplastin Time (APTT) were recorded.

STATISTICAL ANALYSIS:

Data was entered on SPSS version 14. Frequencies

were calculated for gender, indications of renal biopsy, post biopsy complications and number of passes. Mean and standard deviation was calculated for age, urea and creatinine levels.

One way Anova was used for comparing variables between complicated and non complicated groups, while paired t- test was used for comparison between pre and post procedure Hb levels. P value of <0.05 was considered significant.

TECHNIQUE:

The patient was placed in prone position. 3 mm axial CT sections were taken through the kidney and the lower pole was localized for biopsy. The distance from the midline and the depth to the renal cortex was measured. After skin preparation, draping, an infiltration with 1 % xylocaine solution in a 22 gauge needle was used to deliver local anesthetic to renal and peri-renal and subcutaneous tissue down to the renal capsule. The needle was left in place and a CT image was taken to see the direction of the needle. Then an 18 gauge automated spring loaded biopsy gun was placed at the same point and in the same direction, and on reaching the previously measured depth, the gun was fired to obtain the tissue. The biopsy needle provides the core upto 1.7 cm long, 2-3 passes were made to obtain adequate tissue for light microscopy (LM) and Immunofluorescence (IMF). All patients underwent limited CT examination immediately post biopsy to identify hematoma. Patients were put on strict bed rest for 6 hours and were monitored very closely for vital signs including pulse and blood pressure every 15 minutes for 1st hour, every 30 minutes for 2 hours, every hour for 2 hours, every 2 hours for 4 hours then every 4 hours till discharge. They were also observed for gross hematuria or development of pain. In addition Hemoglobin was monitored at 0, 6 and 14 hours post biopsy and patients were planned for discharge at 24 hours.

Results

We performed CT guided renal biopsies on 100 consecutive patients. Baseline demographics of the patients undergoing biopsy are summarized in (Tab.1). Renal biopsy was performed to obtain atleast 2 cores of renal tissue to be reviewed for Light Microscopy (LM)

| Demographic Characteristics of the Study Population | |
|---|---------------|
| Age (in yrs) | 43.05 ± 16.62 |
| Gender | |
| Male | 53 % |
| Female | 47 % |
| Proteinuria | 33 % |
| History of DM | 9 % |
| History of HTN | 20 % |
| Unexplained renal failure | 25 % |
| Vasculitis | 13 % |
| Urea | 106.75 ± 54.5 |
| Creatinine | 3.8 ± 2 |

Table 1

and Immunofluorescence (IMF). Number of passes required in the patients is listed in (Tab.2). Majority of

| Details of Biopsy Procedure | |
|-----------------------------|-------|
| Number of Passes | N=100 |
| • 2 passes | 82 % |
| • 3 passes | 17 % |
| • 4 passes | 1 % |
| Needle gauge | 18 g |
| Renal tissue obtained | 100% |

Table 2

patients (82%) required only 2 passes, manifesting the ease of procedure. Renal tissue adequate to make a diagnosis was yielded in 100% of the cases. None of the patient required rebiopsy.

Post biopsy complications occurred only in 4 patients, 2 of whom developed major complication i.e. bleeding requiring transfusion while 2 developed minor complications including gross hematuria, not resulting in a drop in Hb (1 patient) and self limiting hematoma (1 patient). The patient who developed hematoma was diagnosed 18 hours after the procedure when he developed pain at biopsy site. None of the patients required Surgical or radiological intervention (Tab. 3).

| Post Biopsy Complications | |
|---------------------------|-----|
| Bleeding | 4% |
| Gross Hematuria | 3% |
| Infections | Nil |
| Intervention | Nil |
| Transfusion | 2% |
| Hematoma | 3% |

Table 3

The patients with major complications developed them within 6 hours post biopsy. There was no statistical difference between patients with complication and

those without in relation to age, urea, creatinine or systolic or diastolic blood pressure (Tab. 4).

| Patient Characteristics | With complication | Without complication | P value |
|-------------------------|-------------------|----------------------|---------|
| Age(in yrs) | 55.6 ± 19.5 | 42.39 ± 16.3 | 0.083 |
| Creatinine | 4.1 ± 3.0 | 3.78 ± 2.07 | 0.73 |
| Urea | 105.00 ± 70.83 | 106.84 ± 54.07 | 0.94 |
| SBP(mmHg) | 135 ± 17 | 134 ± 19 | NS |
| DBP(mmHg) | 81 ± 9 | 78 ± 11 | NS |
| Pre-Hb (g/dl) | 10 ± 2 | 11 ± 2 | 0.01 |
| Post-Hb (g/dl) | 8 ± 2 | 10 ± 2 | <.0001 |

Table 4

Discussion

Renal biopsy is a frequently performed procedure to help diagnose unexplained renal failure, patients with heavy proteinuria, patients with rapidly declining renal function so that timely diagnosis and appropriate therapy can be instituted to save the kidney, or to decide if therapy is futile and sometimes to determine prognosis.¹⁰ Although it's a simple procedure, it is associated with complications that are major or minor. With newer techniques, safety precautions and close observation, incidence of complications have declined and major complications like bleeding requiring blood transfusion, embolization, need for surgical intervention or nephrectomy have been reported between 1-2%^{7,11} in PRB performed with US guidance and incidence of minor complications like self limiting gross hematuria, spontaneously resolving perinephric hematoma between 5-7%.^{12,13} Also studies have recommended observation timing of 24 hours post biopsy¹⁴ but recently it has been encouraged to discharge the patients 8 hours post biopsy^{15,16} so that it can be done as an outpatient procedure to be less costly.

We performed PRB under CT guidance as it accurately localizes the kidney and its lower pole and cortex is clearly visualized, hence obtaining adequate tissue is more easy.¹⁷ Incidence of major and minor complications have been reported to be lesser or equal to that performed under US guidance being 4.2-7.5%¹⁷ as bleeding and <1% requiring transfusion.¹⁸

We also observed very low complication rate in our CT guided procedures. None of the patients required surgical or radiological intervention. The incidence of minor complication was also comparable to data reported internationally. Factors contributing to complications include patients with renal insufficiency,

coagulopathy and patients with uncontrolled HTN.^{12,13} Renal insufficiency has been reported to be a significant risk factor with a six fold increase in risk in patients of major complications if GFR < 40 ml/min and two fold increase if the GFR is between 61-80 ml/min.¹⁹ This was consistent with our findings as both patients with major complication had GFR < 60ml/min. However, others did not develop. Hence, there is no definite way to predict which patients will develop a major complication.

Our low complication rate may be related to the needle gauge (G), as we used 18 G needle in all the procedures. Gauge size has been reported to be associated with complications with 16 or 18 G being associated with less complications as compared to 14 G.⁷

Hemoglobin drop of 1 gm after biopsy has been reported in about 50% of cases in different studies^{20,21} that may not be due to a significant hemorrhagic complication. In our study 17% of patients develop a drop in Hgb of about 1 gm but did not develop any major complication.


Regarding timing of complication, both our patients who developed major complication were diagnosed within 12 hours of biopsy. 1 patient who developed a small hematoma did so at 18 hours when he developed pain at biopsy site. Studies in the past have shown that discharging patients within 8 hours may miss 33% of complications¹⁴ Although our patients that developed major complications were picked within 12 hours, our sample size is not large enough to make a recommendation for early discharge.

Conclusion

We conclude that CT guided renal biopsy is a safe and effective tool with a good diagnostic yield. To perform this procedure as outpatient, cannot be recommended at this time and ideally patients should be observed for 24 hours. Larger studies are still needed if such an approach is to be practiced.

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