CT guided percutaneous renal biopsy versus ultrasound guided for obtaining adequate tissue

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Abstract

Objective: To study the diagnostic yield of specimen obtained by percutaneous renal biopsy (PRB) under CT guidance and Ultrasound (US) guidance.

Methods: This study was conducted at the department of Nephrology at Liaquat National Hospital and Dr. Ziauddin Hospital, Karachi. Renal biopsy specimens obtained between January 2007 and September 2009 were studied for number of glomeruli obtained. In addition data was collected of how many patients had to undergo renal biopsy again because of nonavailability of renal cortex (the area of the kidney that contains glomeruli necessary for diagnosing renal disease) by both methods.

Results: We analyzed 205 renal biopsy specimens. Fifty were obtained via CT and 155 under US guidance. All 50 specimens obtained by CT guidance had renal cortex, compared to 147/155 (94.8%) specimen obtained by US guidance. Mean number of glomeruli in US guided specimens was 10.28 ± 6.85, compared to CT guided specimen which was 23.34 ± 13.42 .Definitive diagnosis was made in 100% of CT guided biopsy compared to 94.8% ($p < 0.001$) in US guided specimens. None of the patients undergoing CT guided biopsy required re-biopsy.

Conclusion: PRB of native kidney under CT guidance is a more effective tool compared to ultrasound guidance in obtaining renal cortex that prevents patients from undergoing biopsy twice and provides sufficient number of glomeruli for definitive diagnosis of renal diseases especially when focal disease is suspected.

Keywords: Percutaneous renal biopsy, CT guided, Ultrasound guided, Diagnosis, adequacy. (JPMA 62: 880; 2012)

Introduction

Percutaneous renal biopsy (PRB) is usually performed to establish an exact diagnosis in cases of unexplained renal failure, renal parenchymal diseases and a variety of glomerulonephritis so that prompt action could be taken to prevent progression of the disease to end stage renal disease, or to establish prognosis.

With a newer technology, few investigators have reported that the use of real time ultrasound guidance and automated biopsy needle has improved the rate of successful diagnosis in over 95% of cases.[1] CT guided biopsy was primarily used to assist the diagnosis of malignant disease. However, the diagnosis of benign disease has become increasingly important. Many reports have documented the efficacy, techniques and results of CT -directed biopsy. Nowadays, automated spring loaded gun in real time ultrasonography, is the technique of choice in most centers.

The more the number of glomeruli obtained, the easier it becomes to make a diagnosis, and in cases like Focal Segmental Glomerulosclerosis (FSGS), in which diagnosis can be missed if corticomedullary junction is not obtained and other focal diseases, it is imperative that an adequate tissue is obtained. Recently a study published by Constantin et al compared different guage needles for obtaining more glomeruli.[2]

In east, "blind approach" is more prevalent, where surface of the kidney is marked over the skin, using ultrasound and then automatic gun is fired unaided to obtain a sample.[3]

We compared the blind approach with CT guided, percutaneous renal biopsy versus ultrasound guided with automated biopsy gun for obtaining adequate number of glomeruli.

Patients and Methods

Percutaneous renal biopsy specimens of native kidneys performed on patients aged between 16-65 years from January 1 2007 to September 30 2009 were analyzed.

Sample size was calculated using Open Epi version 2. The total population was 200000, expected frequency was taken 50 %. Sample size for 95% Confidence Level came out to be 196. Hence, 205 patients were incorporated in the study.

Our sample size was better than a previous studies[3] for adequacy of sample size by CT guidance. Comparative study was done by convenient sample technique. These biopsies were performed at Dr. Ziauddin Hospital and Liaquat National Hospital, Department of Nephrology in collaboration with Department of Radiology. Study was approved by ethical committees of Dr. Ziauddin University hospital and Liaquat National hospital and Medical College. Inclusion criteria for the study was the common indications of biopsy that included unexplained renal failure, nephrotic syndrome and systemic lupus erythematosus (SLE) with active urinary sediment. Patients were excluded or biopsy postponed if they had any of the following: deranged coagulation profile, Platelets less than 100,000, and uncontrolled hypertension. Once these were corrected renal biopsy was performed.

All biopsy specimens were obtained using spring loaded automated needle of 18 gauge. Patient were placed in prone position. Ultrasound was performed by a senior radiologist. After localization of kidney the skin surface was cleansed with 10% pyodine solution, sterile precautions were taken including covering the area and the ultrasound probe to avoid contamination. Local anaesthesia by 2% lignocaine was used along the needle insertion track to the lower pole of kidney. An 18 Gauge needle was passed and two samples were obtained. Similar technique was used in CT scan guided renal biopsies, except the lower pole of the kidney which after localisation by CT scan, the needle for local anesthesia was used as a guide for direction and accuracy, after which the biopsy samples were obtained.

All biopsies were performed by two experienced consultant nephrologists. Ultrasound was performed by a senior radiologist and CT guidance by an experienced technician. Help was taken by senior radiologist if needed.

Biopsies containing two cores of specimen were analyzed. Information was recorded regarding availability of cortex, and number of glomeruli obtained. Data was analyzed on SPSS. Number of glomeruli per biopsy on CT and Ultrasound was expressed in percentages. Mean and standard deviation were calculated and significance was determined by Mann - Whitney Test.. P<0.05 was considered as significant.

Adequate tissue was defined as a renal biopsy specimen containing 10-15 glomeruli and inadequate specimen as one containing < 6 glomeruli per specimen.[4]

Results

We analyzed 205 percutaneous renal biopsy specimens. Out of them 50 specimens were obtained through CT guidance and 155 specimens through ultrasound guidance (Figure). In addition, subgroup analysis of the two groups revealed that 8/155 (5.2%) specimens obtained through

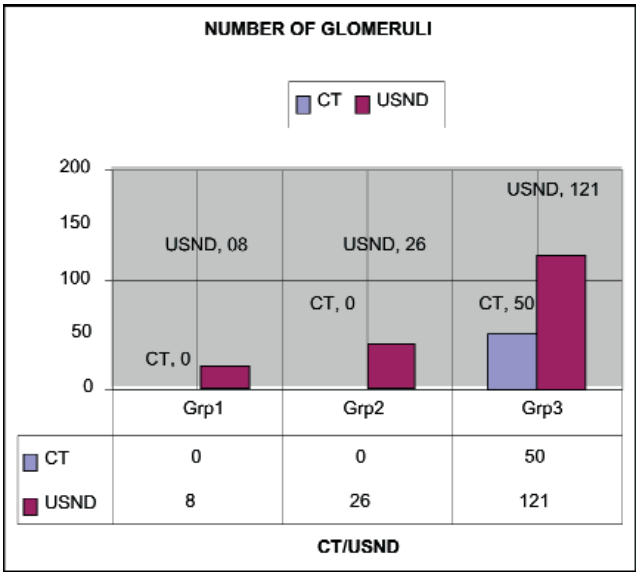

Figure: Where group 1 = glomeruli 0, group 2= glomeruli 1 to 5 and group 3 = >5 glomeruli.
Comparision of number of glomeruli obtained by CTguided versus Ultrasound guided renal biopsy showing number of biopsy specimen that contains 0, <5, or >5 glomeruli.

ultrasound had no glomeruli. Also, 26/155(16.8%) of patients in the ultrasound group had < 5 glomeruli, while all specimens obtained through CT guidance contained glomeruli. None of the patients in CT group fell in category of no glomeruli obtained or < 5 (P< 0.001) (Figure).

The mean numbers of glomeruli obtained through CT guidance were 23.34±13.42 and through ultrasound guidance were 10.28±6.85, which was statistically significant. Diagnosis was possible in all specimen undergoing CT guided biopsy while 5.2% patients who underwent ultrasound guided biopsy had to undergo re-biopsy.

Discussion

We report adequate tissue in all patients that underwent CT guided biopsy and significantly increased number of glomeruli compared to ultrasound guided specimens. Several studies have been conducted to identify as to how many glomeruli per biopsy sample are adequate. In a transplanted kidney this data is clear, however in a native renal biopsy it is generally agreed that 10-15 glomeruli are considered optimal and with 6-10 glomeruli a diagnosis can be made, however focal diseases can be missed, <5 glomeruli in a sample are generally considered inadequate, unless membranous nephropathy is the diagnosis.[5] Our results are similar to that published by Bruce T. Kudryk[6] in which they reported mean number of glomeruli per biopsy by CT 81 guidance as 19.8. In addition every biopsy sample in their study contained renal cortex. Ultrasound guided samples in

comparison, although have reported adequacy in 95%-97%, but in these studies usually 3 cores are obtained and average number of glomeruli was 14.5.[7]

In certain cases of nephrotic syndrome where the disease is focal, it is very important that tissue with more number of glomeruli be obtained to correctly establish the diagnosis so that appropriate therapy is instituted. Cases like focal segmental glomerulosclerosis (FSGS), and SLE with focal involvement,[8] crescentic Glomerulonephritis are few examples where need for tissue with more glomeruli cannot be stressed further, as the staging and diagnosis may change if not enough glomeruli are examined. In a discussion on renal biopsy Madaio MP et al[9] explained this concept by giving example of FSGS. The probability that FSGS is not present in a patient with idiopathic nephrotic syndrome depends both on the actual fraction of abnormal glomeruli and on the number of glomeruli obtained in the biopsy specimen. If 5 glomeruli are present in the biopsy specimen, and the actual glomerular involvement is 20%, there is a 35% chance that all glomeruli in the biopsy specimen will be normal. By contrast, if the actual glomerular involvement is 20% and 10 glomeruli are obtained, the chance of finding all normal glomeruli is only 10%.

Because of these reasons in vast majority of centers in the west, where both pathologist and nephrologist are readily available, biopsy cores are immediately examined to determine specimen adequacy during the procedure and further passes can then be made if necessary.[10] However, in our country, where most biopsies are done with blind technique multiple reports have reported a failure rate of 2-3%,[7] in which either inadequate or non cortical tissue was obtained, and required rebiopsy. A more recent study done in Libya by Mishra et al, also documented similar results, in which 4/86 (4.6%) of their samples had less than 5 glomeruli.[11]

Ultrasound guided biopsy requires an experienced radiologist for accurate localization of the lower pole of the kidney while in CT guided biopsy this is not the issue. In addition, if a bleeding complication occurs it can immediately be visualized and appropriate action can be taken early, rather than waiting for a few hours for patients to show signs or dropping their haemoglobin.

The present study has limitations, that the ultrasound technician was not the same in two centers which can affect localization of the lower pole of the kidney, and can affect specimen yield. Also, in our statistical analysis, we calculated sample size based on 7% confidence limit, which is more than the standard practice as few patients did not undergo renal biopsy due to various reasons. Hence, a bigger study in a larger population in future may be helpful. Although CT guided biopsy is an expensive technique, considering its advantage it may be considered in obese patients, high risk patients, patients with solitary kidney or a difficult patient and patients in whom focal disease is suspected.

Conclusion

CT guided PRB, is an effective method in obtaining renal cortex, with increased number of glomeruli that helps in diagnosing renal disease more accurately, less chances of missing renal tissue and hence, less need for the patients to undergo rebiopsy.

Acknowledgement

We are grateful to Dr Anila Jalil and Dr Safia Ahmed who helped with the data analysis.

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