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Original Article

Percutaneous US-Guided Renal Biopsy in Children: A Single Center Experience

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ABSTRACT

Background: Renal biopsy plays a fundamental role in clinical practice to establish morphological diagnosis, prognosis as well as in developing the appropriate therapy plain.

Objectives: The aim of this study was to assess the safety and efficacy of the real time US guided renal biopsy in children and to determine the optimal period of observation after renal biopsy as well as to evaluate the indications and histology of renal biopsies in our **center.**

Methods: PRB performed at the Pediatric Department, Tanta University Hospital between January 2007 to January 2011 with the real time US guidance were retrospectively **analyzed. Post procedure** complications that required surgical intervention or **blood transfusion** were considered "Major".

Results: A total of 8S renal biopsies were performed on 80 patients from native kidneys. Forty three patients **were males (53.75%) with age range 6 month —** l2 years and 37 female (46.25%) with age range I 15 year. **Two cores from each patient were taken. A mean of 10 glomeruli were present** in each specimen. The two cores were insufficient for diagnosis in 2 patients (2.35%) and at least one core was effective for diagnosis in **97.65% of procedures. Local pain (required analgesi) at site of biopsy was the most common minor complication seen post biopsy (70.58%). Transient grosshematuria was seen in 8** patients (9.4%) without urine retention. Major complications that required surgical intervention or blood transfusion did not occur. All complications were observed within 24 hours of biopsy. There was no difference in the rate of detection of patients with complications after 24 hrs. and 1 week. The main indication of renal biopsy was nephrotic syndrome and mesangioproliferative GN was the most common finding in light microscopic examination regardless the indication of biopsy while in children with nephrotic syndrome minimal change disease was the commonest finding.

Conclusion: PIlB using real time US guidance is a safe and effective procedure in children and can be done as one day case with 24 hrs. observation.

INTRODUCTION

Renal biopsy plays a fundamental role in clinical practice to establish morphological diagnosis, prognosis as well as in developing the appropriate therapy plain. Knowledge of renal histology has been reported to influence the management of the disease state in as many as 42% of cases undergoing the procedures). Although a renal biopsy can be performed by an open surgical procedure, the percutaneous method is the preferred manner. Percutaneous renal biopsy (PRB) is a routine procedure, like every invasive procedure, is fraught with potential complications. However the introduction of real time U/S guidance

dramatically reduced the risk of complications and further improved its successt Q

AIM OF THE WORK

The aim of this study was to assess the safety and efficacy of the real time US guided renal biopsy in children and to determine the optimal period of observation after renal biopsy as well as to evaluate the indications and histology of renal biopsies in our center.

PATIENTS AND METHOD

This study is retrospective. Eighty five **PRB** were performed at the pediatric Department, Tanta University Hospital between January 2007 to January 2011 with the real time US guidance. An informed consent was taken from all patients.

Biopsy procedure:

A coagulation profile including PT, APTT, INR and platelet count were done in all the patients before the procedure. Patients with an INR > 1.5 or platelet count < 100.000/m^2 were not biopsied.

The patients. were positioned in a prone position with a bellow under • the abdomen to support the lion. The kidneys were scanned to determine the optimal biopsy site. The preferred site was the lateral aspect of the lower pole of the right kidney. US machine (Siemens Sono-Line G60F. Germany) with a convex any transducer 3.5 MH was used. All patents received local anesthesia and sedation prior to **the** procedure. Biopsy was performed by semi-automated gun **with 18** gauge needle. The gun needle was inserted under U/S guidance into the abdominal wall through a small **skin** incision. The needle was then advanced until the tip was seen within the outer cortex. The gun was fired to take the core specimen. The number of insertions was estimated depending on the adequacy of specimen based on visual inspection of each core. A renal pathologist was not available at the site and hence none of the core specimens could be examined immediately for adequate glomerular yield. At least two adequate specimens are obtained. All patents were kept on strict bed rest for б hours post-procedure. A post procedure scan was performed (1) immediately after the procedure (2) after 24 hours of biopsy (3) after 1 week.

Post procedure complications that required surgical intervention or blood transfusion were considered "Major". "Minor" complications such as local pain were managed symptomatically. The patients were followed up by urine examination for 2 weeks post biopsy.

Glomerular yield: is defined as the total number of glomeruli presented in the specimen as observed and reported by trained renal pathologist.

RESULTS

A total of 85 renal biopsies were performed on 80 patients from native kidneys. Forty three patients were males (53.75%) with age range б month **1 2** years and 37 female (46.25%) with age range 1 . 15 years. Five patients performed follow up renal biopsy. Two cores from each patient were sent. A mean of 10 glomeruli were present in each specimen. Seven cores (4.1%) were reported as inadequate for diagnosis due to absence of glomeruli. JI glomerular yield of less than

five glomeruli was seen in 8 cores (4.7%). The two cores were insufficient for diagnosis in 2 patients (2.35%) and at least one core was effective for diagnosis in 97.65%.

Local **pain** (required analgesia) at site of biopsy was the most common minor **complication seen** post biopsy **(70.5i%) (Figure 1)** Transient gross hematuria was **seen in 8** patients (9.4%) without urine retention. Major complications that required surgical intervention or blood transfusion did not occur. Minor complication in the form of a small perinephric hematoma was noted in 2 patients (235%) and resolved spontaneously. All complications were observed within 24 hours of biopsy. There was no difference in the rate of detection of patients with complications after 24 hrs and 1 week.

The main indication of renal biopsy was nephrotic syndrome (Table 1) and mesangioproliferative (iN was the most common finding in light microscopic examination regardless the indication of biopsy while in children with nephrotic syndrome minimal change disease was the commonest finding (Table 2).

Table 1: Indications for renal biopsy.

Indication	Number (%)
Nephrotic syndrome	48 (56.47%)
Steroid dependent	20 (23.5%)
Steroid resistant	12 (14.12%)
Frequent relapse	8 (9.4%)
Congenital or familial	3 (3.5%)
Follow up biopsy	5 (5.88%)
Unexplained CRF	10 (11.76%)
Recurrent gross or persistent hematuria	10 (11.76%)
SLE	8 (9.4%)
Unexplained ARF	5 (5.88%)
Glomerulonephritis (unresolved or progressive)	4 (4.7%)

Table 2: Light microscopic findings in renal biopsies.

Indication	Finding in light microscopy	Number (%)
Nephrotic syndrome	Minimal lesion	18 (37.5%)
	Mesangioproliferative GN	15 (31.25%)
	Focal Segmental GS	7 (14.58%)
	Finish type NS	2 (4.17%)
	Inadequate sample	1 (2.08%)
	No cyclosporin vasculopathy	5 (10.42%)
SLE	WHO Stage IV	4 (50%)
	WHO Stage III	3 (37.5%)
	WHO Stage II	1 (12.5%)
Chronic renal failure	Tubular necrosis suggestive of pyelonephritis	3 (30%)
	Chronic interstitial nephritis	3 (30%)
	Nephronophthisis	2 (20%)
	SLE	2 (20%)
Acute renal failure	Crescent GN	3 (60%)
	Acute tubular necrosis	2 (40%)
Rapidly progressive GN	Crescent GN	2 (50%)
	Mesangioproliferative GN	2 (50%)
Persistent hematuria or recurrent gross hematuria	Mesangioproliferative GN	7 (70%)
	Normal finding	2 (20%)
	Inadequate sample	1 (10%)

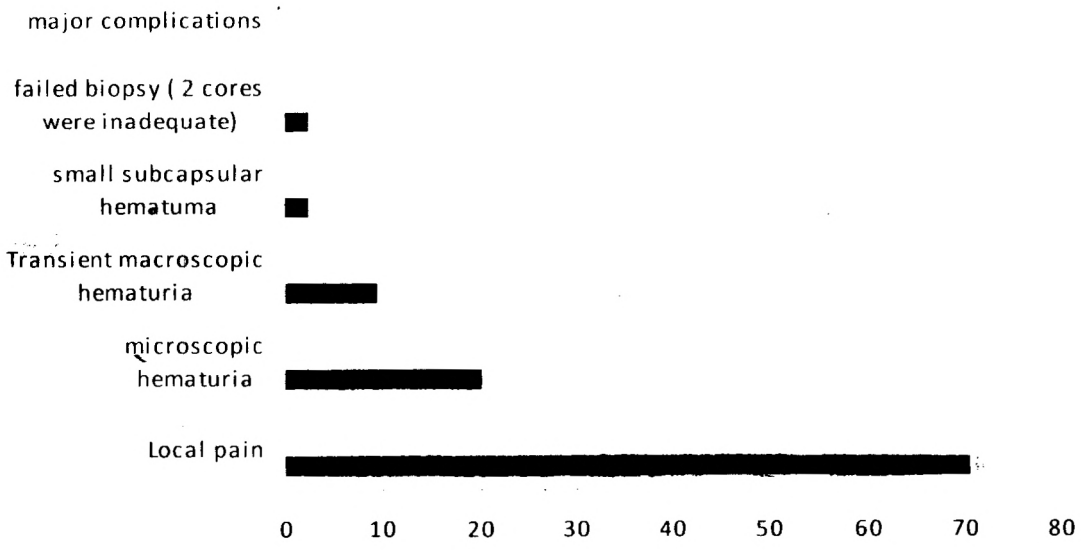

Fig. 1: Post-biopsy complications.

DISCUSSION

PRB can be fraught with severe complications that may result in loss of the kidney and rarely, even death'". Selection of patients plays a crucial role in avoiding complications. Prior to the procedure, it is imperative to evaluate the patient for a history of a bleeding diathesis. hypertension control. recent pyelonephritis, or skin infections near biopsy site. Pre-biopsy laboratory tests should include C IBC and PT/INR, but bleeding time is optional as studies have shown it to have no correlation to surgical bleeding. Stiles et al. [4] reported complications in 112 renal biopsies and concluded that the use of bleeding time does not significantly alter the major complication rates. Once a biopsy is scheduled, careful technique and selection of instrumentation contribute to a successful procedure. Since 1990. a safe and reliable renal biopsy technique uses real time US guidance with a semi-automated spring loaded needle". For patients with difficult landmarks and poor visualization on US. alternative methods include CT-guidance, laparoscopic and open kidney biopsies.

Kersnik Levart et al. performed 88 biopsies by gun using real time US guidance in children without major complications. This is consistent with our results. Piotto et a1." used the same maneuver in 30.5 renal biopsies in children and found minor complications in 8.6%. Feneberg et al.'[s] evaluated the effect of technological advances by using automated biopsy devices and real time US guidance on the adequacy and safety of renal biopsies from children in their center. The new technique was independently associated with fewer passes required to obtain adequate tissue and more glomeruli per specimen. however the occurrence of macroscopic hematuria (9.6%) in the native kidney biopsies was not

affected by the puncture or localization technique applied. In Indian study, 250 nephrotic children were biopsied and mild (16%) and gross (16.8%) hematuria and subcapsular hematoma (6%) were the common complications. The high incidence of complications in later study may be explained by the maneuver of renal biopsy in this ceder as they used blind technique in early stages lithe study and US guidance in later stages.

In adult studies. Mendelssobtn and Cole' found an overall complication rate of 5.3%i _ in 544 PRR. Transient gross hematuria occurred in 4.4% of their patients as opposed to 9.4% in the present series. This difference may be explained by the difficulty of renal, biopsy from children especially of young age and biopsies from renal allografts are easier than from native kidneys. In addition. our data suggest that native kidney biopsies are more likely to be associated with pain requiring analgesia especially in children because of low pain threshold compared to adults. In recent study[1`5], renal biopsy by automated gun and real time US guidance was effective in 97.6%, with a 2.24% rate of major complications, this high rate of major complication may be explained by the high prevalence of systemic lupus crythematosus diagnosis in those patients. Manna et al_[`21] prospectively evaluated the predictive value of demographics, clinical data, baseline chemistry and needle size for the risk of post-renal biopsy complications in 471 patients. They concluded that only gender, age and base line APPT show a significant predictive value and the other variables investigated do not have any predictive value.

The high success rate of biops (97.65%) in this study and the absence of major complications denote the efficacy and safety of the procedure even in young children. In similar studies on children the number of glomeruli per puncture was 5 in more than 96% of biopsies[t6] .

Light microscopic examination oT renal tissue alone may not he helpful for reaehinf final diagnosis. The most common light microscopic finding in our series regardle ss of the indication for renal biopsy was mesangial proliferation which could be the light microscopic picture in S1 .L. l.\ nephropathy, Ilcnoch-Schonlein purpu a and idiopathic NS. Igпiпнofluoreseei xe and if possible electron microscopic examination should be considered to differentiate the etiolo,y. In this study five patient u:H cyciosporine A therapy did 10110" up, renal biopsy for detection of cyelosporine ' a:ens.. lopathy, none of the patients had c;.:: losporin toxicity. This may he explained by the regimen of cyclosporine used in unr center. We target a trough serum level of 100 150 ng/m1 of cyclosporinc in the I" months of therapy and after that we accept trough levels between 50 100 ng-n1l as long as the patient is in remission. (ye-losporine trough level was found to be an independent and significaiit risk factor fur the development of cyelosporine uephru-. toxicity in children with nephrotic syndrom e receiving moderate-dose of c:yclospori ›ie At› 3)

The present study provides suf iciein evidence to perform renal biopsies as a day - case procedure. We have shown that there would have been no difference in the rate of detection of patients witlh

complications if they have been observed for 24 hours post-biopsy. Chan et aL[14] performed PRB on 25 native kidneys and 70 allografts under real time US guidance. They concluded that real time US guidance is a safe and accurate method for performing PRB in the hands of radiologists. Marwah et al.t[15] performed PRB in 394 native kidneys and concluded that observation of patients for 24 hrs. is optimal and that observation for 8 hrs. or less, risks missing at least 20% of complications. Our study has shown that observation period of 24 hours is optimal and that did not encounter any missed late complications after one weeks of follow up. Iiergesell et al.[t1 wt] retrospectively analyzed the results of 1090 PRBs and found that an i.US guided PRB is a safe procedure, and skilled operators obtain satisfactory amounts of kidney tissue in almost all cases. In our study, we had an adequate glomerular yield in 97.65% of patients, despite the fact that we did not have the renal pathologist at the site to check for sample adequacy. The major limitation of the study was the small sample size.

Conclusion: PRB using real time US guidance is a safe and effective procedure in children and can be done as one day case with 24 hrs. observation.

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