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Post-Percutaneous Renal Biopsy Observation Time; Single Center Experience

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Abstract

Background: Percutaneous Renal Biopsy (PRB) should be performed to diagnose renal damage, to assess response to treatment and to predict prognosis.PRB is a safer procedure and mostly free of complications. Assessing optimal time duration post-PRB is important to predict Post-PRB complication and to reduce the cost of PRB.

Aim: To reduce the Post-PRB observation time for optimal outcome and patient's safety.

Methods: All PRBs were performed at the Nephrology Unit, Tripoli Central Hospital, Libya between May 2008 to December 2015. One hundred eighteen ultrasound-guided PRBs were done. After explaining the procedure and its possible complications, an informed consent was signed by patients. Coagulation profile PT, PTT, INR, BT, CT and CBC were done before PRB. Each biopsy was performed with an automated biopsy gun with a 16 -gauge needle under real-time US. Two biopsy specimens from lower pole of left kidney were taken from native kidneys. All patients were kept under close medical supervision and on bed rest for 2-hours. All patients had IV 500 ml normal saline and Lasix during the first 30 minutes, and asked to pass urine to check for macroscopic hematuria. US were done before the patient discharge Patients were followed by ultrasound and urine examination a week later.

Statistical analysis: Statistical analysis was done using statistical software IBM-SPSS 16.0 for post-PRB complications by multiple linear and multivariate logistic regression.

Results: A total of 118 PRB were performed; 73 patients were rheumatology patients, 10 kidney transplant recipients and 35 patients referred by general physician clinics. There were 50 males aged 15-60 years, and 68 females aged 16-52 years. Indications for renal biopsy were an elevation in serum creatinine (>2 mg/dL), proteinuria, hypertension, hematuria and for assessment of kidney involvement in rheumatologic diseases. A mean of 9 glomeruli were present in each specimen. A specimen yielded less than five glomeruli was seen in four biopsies. The core sample was reported as "inadequate for diagnoses" in two patients, and "normal" in two patients.

Post-PRB minor bleeding was higher in women and older patients with overall complication rate of 5.8%, small perinephric hematoma in two patients, arteriovenous fistula and large hematoma occurred in one patient causing graft loss. Severe bleeding caused patient death two days post-PRB in SLE female patient. Macroscopic hematuria was seen in two renal allograft patients, of which one developed urinary retention and required intervention urinary catheterization and bladder irrigation. All the three complications were observed within the first two hours after PRB. Pain at the site of PRB were seen more in elective native biopsies (P=0.02). There were not late complications reported by patients or detected by US a week after post-BRP.

Conclusion: Experienced operator using real-time US and automated 16-gauge automatic biopsy gun with certain safety precautions make PRB complications free procedure. Two hours post-PRB observation is optimal time to assess the safety of PRBs and prediction of late complications. This makes PRBs safe and more cost effective.

Keywords: PRB; Renal biopsy; Post-PRB observation time

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Introduction

Renal tissue biopsy is performed to have early exact diagnosis, treatment in kidney diseases and to establish prognosis to prompt early actions for disease prevention and progression to end stage renal disease.

Chronic kidney disease (CKD) has five stages that range from mild renal function impairment to end-stage renal disease according to GFR assessment and other parameters. Knowing the stage of CKD at presentation is essential to prevent or at least delay disease progression, and renal biopsy plays a key role in defining the processes involved [1].

PRB indications vary. There is no definite agreeable list of indications worldwide. Unexplained renal function deterioration is a vague usual indication term used, but certainly PRB is needed to help clinicians to assist and to clarify CKD stages epidemiology and to plan CKD patients' management. Furthermore, PRB aids researchers to discover the underlying pathobiology that help to discover new therapeutic strategies. In addition, PRB has useful role in pre-transplant work-up in kidney diseases as in IgA-nephropathy and ANCA- positive vasculitis recurrence and response to therapy [1].

Schwartz, et al. (1992) reported, exact diagnosis of interstitial and glomerular renal diseases; renal biopsy is the standard procedure [2]. Acute and chronic kidney diseases are either caused by insult to the kidney directly or as a manifestation to systemic diseases. Early renal biopsy in acute renal diseases is important to the underlying cause, and to assess the progression of renal injury and response to medical treatment [3,4].

PRB was introduced during the twenty's, description of its technique was published in the 1930s [5] while the detailed practical and efficient technique described clearly during 1950s [6]. The first PRB was reported in 1951 [7]. During 1954, Franklin modified Vim-Silverman needle was invented and used at prone position [8,9].

PRB biopsy needles had large bore-cutting needle, and they were not automatic. These types of PRB needles made PRB unpleasant, frightful, had more frequent and severe complications, [10-12]. Recently, ultrasound guided PRB with high speed automatic biopsy needle guns made the efficacy and safety of PRB procedure better, and has dramatic complications reduction. The improvement in PRB needle and technique has made the procedure safe and routine world-wide in nephrology centers, and it gives proper and adequate tissue for histological, biochemical examination by about 98% [13-15]. Factors as patient demographics character, clinical data, baseline liver and renal function results, and needle size had been claimed to have considerable predictive value in the risks of PRB complications. However, some reports claimed that gender, age and baseline PTT only had predictive value for the post-kidney biopsy complications while others had no significant role on the post-renal biopsy complications [16].

A single previous study conducted in Libya to assess safety of early discharge (within 6 hours) in 78 patients with PRB. The study concluded that patients' observation for six hours post-PRB is optimal to detect the early complications as bleeding and prediction of late complications [17].

Up to our knowledge, there is not any published study to assess earlier discharge i.e., before 6 hours post- PRB, therefore, this study planned to assess two hours post-PRB observation time for prediction and occurrence of complications.

Methods

This study was done as a prospective study during May 2008 to December 2015. All PRBs performed at the Nephrology Unite, Tripoli Central Hospital, Tripoli- Libya. All the PRBs were performed by the nephrologist in concordance with referring physicians and general physician and rheumatologist. A mandatory informed consent for PRB was filled and signed by all the patients after full detailed discussion of the procedure and possible complications. During these 7-years period, 118 ultrasound-guided PRBs were conducted. The biopsies were done on out-patient bases in most of patients. Coagulation profile including prothrombin time (PT), partial thromboplastin time (PTT) and International Normalized Ratio (INR), bleeding time, clotting time and complete blood picture for total platelet count were done in all patients. Patients with INR >1.3 or total platelet count <70×103/mL, or prolonged bleeding time and/or prolonged clotting were excluded. Each biopsy was performed with an automated biopsy gun (16 -gauge) needle (C Rose Bard Inc., Murray Hill, NJ, USA). An ATL HDI 5000 ultrasound machine (Philips Medical Systems, The Netherlands). Before doing the biopsy, all patients had abdominal ultrasound to exclude abdominal masses, local infection and as cites. In most of the patients, the left kidney lower pole was chosen for the biopsy, while the risk of liver injury is more with the right kidney. Biopsy from native kidney, patient lied on one or two pillows under his abdomen, and the kidney localized by ultrasound. After kidney localization and determining the optimum site of puncturing and the distance between the skin and kidney capsule, site sterilization, local anesthesia infiltration for the skin and subcutaneous tissues including the renal capsule were done. A biopsy needle introduced gently under ultrasound guide just outside the kidney capsule while the patient holding a deep inspiratory breath, biopsy gun fired to obtain the core specimen. All patients had two specimens taken for histological examination. Core biopsied tissues were kept in formalin-containing tube to be sent for microscopic examination in Pathology Department at the Central Hospital while a stereo microscope and a renal pathologist were not available at the site.

All patients were kept in strict bed rest for 10-hours post-procedure. During first two hours after-PRB, vital signs were assessed every ten minute for the first 60 minutes, then every 30 minutes if there was not any complaint. Abdominal and kidney ultrasound scan was done before the patient leaves the hospital. All patients had IV 500 ml normal saline and Lasix during the first 30 minutes, and asked to pass urine to check for macroscopic hematuria. The patients were followed up by ultrasound and urine examination, one week after leaving the hospital.

Statistical analysis

Statistical analysis was done compiling all the data and results using statistical software IBM-SPSS 16.0 (SPSS Inc., Chicago, IL, USA). Predictors of post-biopsy bleeding were assessed by multiple linear and multivariate logistic regression analysis.

Table 1: Patients gender, mean age±sem, INR, CT, BT, Blood pressure, Hb and platelets (mean±sem).

Gender	Female (69 patients)	Male (49 patients)	F (58.5%), M (41.5%)
	Mean±sem	Minimum	maximum
Patient age (years)	34±1.75	14	56
Serum urea (mg/dl)	95±1.01	62	189
Serum creatinine (mg/dl)	2.63±1.5	1.2	4.5
INR	1.11± 0.01	1.0	1.3
Bleeding time (min.)	5±1.21	3	7
Clotting time (min)	11.4±2.10	10	15
Systolic blood pressure	125±1.24	95 (mmHg)	140 (mmHg)
Diastolic blood pressure	79±2.31	60 (mmHg)	85 (mmHg)
Hemoglobin (g/dl)	11.37±0.13	9.4	11.5
Platelets ($x10^3$)	173±0.13	119	301

Results

A total of 118 renal biopsies were performed; 73 patients were referred from rheumatology department, 10 patients were kidney transplant recipients and 35 patients from medical department Tripoli central hospital (TCH), and other major city hospital as Tripoli Children Hospital, Zawia, Musrata and Sert hospitals. There were 50 males with age ranging from 15 to 60 years, and 68 females with age ranging from 16 to 52 years. Two biopsy punctures were done in all the native kidney biopsies, while only one biopsy specimen in renal allograft.

A mean of 9 glomeruli were present in each specimen. A glomerular yield of less than five glomeruli was seen in four biopsies. The core sample was reported as "inadequate for diagnoses" in two patients and "normal" in two patients. Class I lupus nephritis (LN) was seen in three patients, class II LN in fifteen patients, class III LN in 15 patients and class IV LN in 29 patients. Other diagnoses including focal mesangial proliferation, focal sclerosing glomerulosclerosis, chronic glomerulonephritis, mesangio-capillary glomerulonephritis were reported in 42 patients. The ten renal allografts were diagnosed as acute tubular necrosis.

Post-biopsy minor bleeding was higher in women and older patients. The bleeding risk in those two categories of patient might be due to weakness of blood vessels wall and/or hormonal effect. The overall complication rate was 5.08%. Minor complications in the form of small perinephric hematoma were noted in two patients. Major complication as arteriovenuous fistula and large hematoma occurred in one patient, leading to loss of renal allograft. One SLE female patient had persistent bleeding for more than 4 hours, then ceased spontaneously in medical intensive care unit at TCH. Macroscopic hematuria was seen in two renal allografts of which one developed urinary retention and required interventional urinary catheterization and bladder irrigation, while the others was self-limiting. All three complications were observed within the first two hours after PRB. These complications including pain at the site of PRB were seen more in elective native biopsies (P=0.02). No late complications were seen in any of the patients except one patient who had prolonged bleeding that stopped spontaneously.

Discussion

Reducing early and late complications of PRB is important concern to patients and physician. Some complications as severe bleeding, puncturing other organs as liver or great vessels can lead to severe damage and mostly need surgical intervention, and it may even cause death. These complications make PRB frightful and make patients panic from PRB leading to PRB refusal by patients [11,12].

These frightful complications had led to a conclusion that careful patients' selection is essential after well comprehensive explanation and discussion is crucial to prevent or at least minimize them. Good medical history is important, especially previous history of prolonged bleeding, heavy menses, bleeding after circumcision, bleeding from nose and family history of bleeding diathesis etc. Even if there is no history of bleeding disorder, platelets count, bleeding time, clotting time, prothrombin time and INR were done before taking PRB in this study, although Peterson, et al. (1998) reported that bleeding time before PRB clinic had not a predictive value benefit for bleeding after PRB [18]. Same conclusion was reported by Stiles, et al. (2001) in 112 renal biopsies [19]. Recent use of non-steriodal anti-inflammatory drug, uncontrolled high blood pressure, recent pyelonephritis, skin infection at or near biopsy site and the inability of the patient to comply with the operator instructions during biopsy are important factors for the PRBs safety and they have to be assessed fully and carefully before performing PRB [20,21].

Right instrument selection and careful technique contribute to a successful and safe PRB with no or less complications. Since 1990, PRB is done with semi-automated spring-loaded needle using real-time ultra-sound guidance [22]. Computed tomographic (CT)-guidance, transvenous, laparoscopic and open kidney biopsies were used in some patients who the nephrologist or radiologist have difficulties to visualize the targeted kidney well by ultrasonographic [23-25].

A comparative study reported that 14% of series of patients studied had post-PRB complications; about half of those patients had the complications as simple macroscopic hematuria and the other half of patients had severe hematuria that required blood transfusion and the appropriate intervention [26]. Other study conducted found the rate of complication was only 5.3% in 544 PRBs series, and only 4.4% of the series had transient hematuria [27]. In this study

frank hematuria was reported in only three patients, one had SLE and two transplanted patients. The SLE patient was female and her platelets count was relatively lower than the other patients. The two transplanted patients had frank hematuria, one had one unit of packed red blood transfusion and more IV fluid and urinary bladder irrigation for three days, while the other patient had only increased oral fluid intake and twice urinary bladder irrigation for one day.

Pain at the site of the needle entrance is a common complaint of patients after PRBs. In our series of patients, most of them felt pain, but it was not severe enough that required strong analgesia except in 10 patients (<1%) who required analgesia as NSAID tablet during the first 2 hours. The difference in pain tolerance and sex difference between patients might have affected the degree of pain threshold and the need for pain relieving drugs. On the other hand, severe pain following PRBs of transplanted kidney was not reported in our patients. Desensitization to pain in renal transplanted patient at site of PRB might be due to denervation of the transplanted kidney capsule and cutting of nerves by the multiple surgical incisions.

Ultrasound guided PRBs is a safe invasive procedure when all precautions are implemented. Chan, et al. 2000 reported in 25 native kidney and in 70 allografts performed PRBs by using a 16-gauge automated core biopsy device under real-time ultrasound guidance were safe and accurate enough for getting good tissue sample [28]. Manno, et al. (2004) evaluated value of demographics, baseline chemistry, clinical data, and needle size for the risk of post-renal biopsy complications, and concluded that only gender, age and baseline PTT showed a significant predictive value while the other studied variables had not any predictive value [16]. Observation time after PRBs was assessed before. Marwah, et al. (1996) concluded that observing patients after PRB for 24 hours is necessary to be sure that there will not be late fatal complications [29]. On the contrary, Mishra, et al. (2011) concluded that doing PRBs by automated 16-gauge core biopsy system using real-time sonographic guidance is safe and accurate and 6 hours observation after PRB procedure is optimal and no delayed complications i.e., after 24hours and after 2 weeks were observed [17]. Analysis for 1090 ultrasound guidance PRBs results revealed; PRB was safe and enough tissue can be obtain for histological and biochemical study when PRBs were done under ultrasound-guidance by skilled operators [30]. In this study, PRB yielded adequate glomeruli in 91% of biopsies, and only about 2% gave fibrous tissues and the rest had not yield enough number of glomeruli to be assessed (<5 glomeruli). This insufficient PRB- specimen was due to that the pathologist and stereo microscope were at the same place to check for sample adequacy.

Conclusion

PRB is a safe procedure when it is performed by experienced operator using real-time sonographic guidance and automated 16-gauge automatic biopsy gun after taking all safety precautions. Two hours observation after PRB procedure is optimal time to assess the safety of PRBs and prediction of late complications. Therefore, PRBs can be done on out-patient basis safely, and two hours observation post-PRB is optimal to make PRB safe and more cost effective.

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