Risk of Bleeding after Native Renal Biopsy as a Function of Preprocedural Systolic and Diastolic Blood Pressure

J. Scott Kriegshauser, MD, Maitray D. Patel, MD, Scott W. Young, MD, Frederick Chen, MD, William G. Eversman, MD, and Yu-Hui H. Chang, PhD

ABSTRACT

Purpose: To determine the risk of bleeding complications after native renal biopsy as a function of preprocedural blood pressure (BP).

Materials and Methods: A total of 293 patients (163 men; mean age, 59.1 y) who underwent ultrasound-guided native kidney biopsy at a single institution over a 10-year period were retrospectively identified. Demographic and clinical data were collected, including systolic BP (SBP) and diastolic BP (DBP) at the time of the biopsy and presence and severity of complications. Differences in clinical and demographic data among patients with and without complications were analyzed.

Results: Of 293 patients, nine (3.1%) experienced major complications (required transfusion or intervention) and 10 (3.4%) experienced minor complications (pain, hematoma, or hematuria). Patients with SBP greater than 140 mm Hg or DBP greater than 90 mm Hg were 10 times more likely to experience major complications ($P < .02$) than patients without high BP (odds ratio [OR], 10.6; 95% confidence interval [CI], 1.3–86.0). The odds of complications were particularly increased in patients with SBP greater than 170 mm Hg (OR, 23.3; 95% CI, 2.3–234.4) and were modestly increased in patients with SBP between 141 and 170 mm Hg (OR, 7.11; 95% CI, 0.8–61.7). For DBP, the odds of complications increased with DBP greater than 90 mm Hg (OR, 7.2; 95% CI, 1.9–27.9).

Conclusions: Patients undergoing native renal biopsy who have an SBP greater than 140 mm Hg or DBP greater than 90 mm Hg are at higher risk for bleeding complications. Further research is needed to determine whether medically lowering these patients' BP before kidney biopsy decreases complications.

ABBREVIATIONS

BP = blood pressure, CI = confidence interval, DBP = diastolic blood pressure, INR = International Normalized Ratio, OR = odds ratio, SBP = systolic blood pressure

Renal biopsy can be an invaluable tool in the management of suspected renal pathologic conditions. Since native renal biopsy was first described in 1951, technical and procedural advances have been made with improvements in ultrasound (US) imaging, the application of real-time sonographic guidance, the use of automated spring-loaded biopsy devices, and cortex-targeting biopsy techniques (1,2). Despite these technical and procedural improvements, native renal biopsy confers a potentially serious risk of bleeding that can lead to pain, loss of the kidney, and death, and can require hospitalization, analgesia, blood transfusion, and image-guided or surgical intervention (2).

The effects of high blood pressure (BP) on the risk of bleeding related to native renal biopsy is a topic of interest, especially in the setting of these technical and procedural improvements (3–7). The evidence for an effect of increased BP on bleeding complications after native renal biopsy has not been consistently demonstrated. A recent metaanalysis (3) found a slightly increased rate of transfusion after renal biopsy in studies in which the mean systolic BP of patients exceeded 130 mm Hg, but this observation did not reach statistical significance

From the Department of Radiology (J.S.K., M.D.P., S.W.Y, F.C., W.G.E.), Mayo Clinic Hospital, 5777 E. Mayo Blvd., Phoenix, AZ 85054; and Department of Biostatistics (Y.-H.H.C.), Mayo Clinic, Scottsdale, Arizona. Received May 27, 2014; final revision received August 6, 2014; accepted October 22, 2014. **Address correspondence to** J.S.K.; E-mail: skriegshauser@mayo.edu

From the SIR 2014 Annual Meeting.

None of the authors have identified a conflict of interest.

J Vasc Interv Radiol 2015; 26:206–212

http://dx.doi.org/10.1016/j.jvir.2014.10.020

($P = .09$), and the vast majority of the 34 studies used in that metaanalysis were not conducted with the latest technical and procedural methods (3). In addition, many of these studies excluded patients with increased BP from having renal biopsy (8–13).

In the absence of consistent evidence in the literature of an effect of increased BP on hemorrhagic complications from native renal biopsy, our practice has not used increased BP as an exclusion criterion for performing these biopsies and has not pursued BP reduction strategies for patients with increased BP before biopsy. Our practice has also used the technical and procedural advances (real-time sonographic guidance, automated biopsy devices, and cortex-targeting techniques) that have not been used in most previous studies of native renal biopsy. In this context, we report our institution's 10-year experience performing native renal biopsies, regardless of the patient's BP, to determine the risk of bleeding complications as a function of preprocedural systolic BP (SBP) and diastolic BP (DBP), especially to help determine thresholds of SBP and DBP that confer modest and marked increases in risk.

MATERIALS AND METHODS

This study was compliant with the Health Insurance Portability and Accountability Act and was approved by the institutional review board and deemed to be of minimal risk. Retrospective review of the electronic medical record at one institution identified all adult patients (N = 293; 163 men; mean age, 59.1 y) who underwent US-guided native kidney biopsy from October 1, 2002, to December 31, 2012. Demographic information and clinical data were collected for all included patients. The images and radiologic report from the biopsy were reviewed to determine procedural data. Distance to kidney was measured from the edge of the transducer along the shortest point to the renal cortex. The electronic medical record was reviewed to at least 1 week after the biopsy to identify complications. Bleeding complications were deemed major if the patient required transfusion or further intervention (including bladder irrigation or arterial embolization). Complications considered minor were hematuria, hematoma, pain, and other symptoms not requiring transfusion or further intervention. Complications were classified according to the Society of Interventional Radiology guidelines as class A through F (14). The need for transfusion or intervention was determined on a case-by-case basis by the primary service, often in consultation with other services, including interventional radiology.

Inpatients and outpatients were included. Outpatients were observed for a minimum of 2 hours before dismissal. A board-certified radiologist with at least 5 years' experience (range, 5–25 y) who controlled the US probe and biopsy device performed all biopsies under direct US guidance, with the exception of one procedure (without complication) performed by a radiology fellow (American Board of Radiology–certified) under the direct supervision of an experienced radiologist. Biopsies were performed "freehand" or with a biopsy guide attached to the probe, determined solely by the operator. Number of passes and needle size varied and were part of the analysis.

A nurse interviewed all patients before the procedure to exclude recent use of antithrombogenic medications or abnormal laboratory coagulation factors. Partial thromboplastin time, International Normalized Ratio (INR), and platelet levels were routinely measured within 30 days. Any deviations from reference values were reviewed with the radiologist, who decided whether to proceed, often in consultation with the clinical service. SBP, DBP, heart rate, and respiratory rate were recorded immediately before and during the biopsy, and at 15–30-minute intervals for at least 2 hours afterward. Unless the patient refused or was allergic, minimal procedural sedation was administered, consisting of intravenous midazolam and fentanyl. The nurse maintained a detailed record of each procedure in the electronic medical record.

Statistical Analysis

Patient characteristics were summarized as means and standard deviations or as frequencies and percentages. Characteristics were compared between groups by using the Wilcoxon rank-sum test for continuous variables and χ^2 test (or Fisher exact test, if applicable) for nominal variables. High BP was defined as SBP greater than 140 mm Hg and/or DBP greater than 90 mm Hg. The association between BP and complication was quantified by the odds ratio (OR) and 95% confidence interval (CI). All tests were two-sided, and a P value lower than .05 was considered statistically significant. All analyses were conducted with SAS software (version 9.2; SAS Institute, Cary, North Carolina). Study data were collected and managed by using REDCap electronic data capture tools hosted by our institution (15).

RESULTS

Of the 293 patients, nine (3.1%) had major complications (five class C, four class D) and 10 (3.4%) had minor complications (five class A, five class B). There were no deaths.

Patients were grouped by the presence or absence of major complications (**Table 1**) and by the presence or absence of any complication (major and minor; **Table 2**). Patients with major complications had significantly higher mean SBP ($P = .02$), and the group of patients with major complications included a higher percentage of patients with high BP in general ($P < .01$), compared with patients with no or minor complications (**Table 1**). Although the mean INR was significantly higher ($P = .01$) for patients with major complications (1.2; range,