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Research Letter—Outcomes of Outpatient Native Kidney Biopsies at the McGill University Health Center: A Quality Assurance Audit

Amy Qi[1], Matin Kerachian[2], and Ratna Samanta[2]

Abstract

Background: Percutaneous kidney biopsies are essential for diagnosis and management of kidney diseases. However, post-procedural bleeding is a significant risk associated with biopsies. At the McGill University Health Center, the 2 main hospitals, the Royal Victoria Hospital and the Montreal General Hospital, have different observation protocols for outpatient native kidney biopsies. Currently, patients are admitted for a 24-hour inpatient observation at the Montreal General Hospital, whereas patients biopsied at the Royal Victoria Hospital are discharged after 6 to 8 hours of observation at the end of the day. Most Canadian centers do not admit patients for an overnight observation, and it was unclear why this practice continued at the Montreal General Hospital.

Objective: Our objective was to determine the incidence of complications post-renal biopsy over the past 5 years at both hospital sites, and compare them to each other, as well as to established rates in the available literature.

Design: This assessment was designed as a quality assurance audit.

Setting: This audit was conducted from a local registry of renal biopsies performed at the McGill University Health Center between January 2015 to January 2020.

Patients: We included all adult patients (between the ages 18 and 80) with outpatient native kidney biopsies performed at the McGill University Health Center between 2015 and 2020.

Measurements: We collected the included patients' baseline demographics and risk factors at the time of biopsy, including age, BMI, creatinine, estimated glomerular filtration rate, pre- and post-biopsy hemoglobin, platelet, urea, coagulation profile, blood pressure, kidney side/size as well as needle size, and number of passes made.

Methods: We compared the incidence of both minor and major bleeding complications at the Montreal General and the Royal Victoria Hospital. Variables that were measured included hemoglobin before and after biopsy, incidence of minor bleeding complications (defined by hematomas and gross hematuria), and incidence of major complications (defined by post-biopsy bleeding requiring either transfusions or another procedure to stop the bleeding), as well as the incidence of admissions post-biopsy.

Results: The incidence of major complications was 2.87% over 5 years (5/174 patients), which is comparable with that reported in the literature. Our transfusion incidence was 1.72% (3/174 patients) and our embolization incidence was 2.3% (4/174 patients) over the 5 study years. Our total number of major events was low and the patients who had major events had significant risk factors for bleeding. All events occurred within 6 hours of observation.

Limitations: This was a retrospective study with a low event number. Additionally, since the events included only those recorded at the McGill University Health Center, it is possible that the events of interest may have occurred at other hospital sites without the author's knowledge.

Conclusions: Based on the results of this audit, all major bleeding events occurred within 6 hours of a percutaneous kidney biopsy, suggesting that patients should be monitored for 6 to 8 hours following biopsy. The next step after this quality assurance audit is a quality improvement project and a cost-effectiveness analysis to assess whether post-biopsy practices should be amended at the McGill University Health Center.

Abrege

Contexte: Les biopsies rénales percutanées sont essentielles pour diagnostiquer et prendre en charge l'insuffisance rénale, mais elles exposent le patient à un risque significatif de saignements post-procéduraux. Les deux principaux hôpitaux du Center universitaire de santé McGill, soit l'Hôpital Royal Victoria et l'Hôpital général de Montréal, suivent un protocole

d'observation différent à la suite d'une biopsie rénale en consultation externe. À l'Hôpital général de Montréal, les patients sont admis 24 heures pour observation, alors qu'à l'Hôpital Royal Victoria, les patients sont libérés en fin de journée, après 6-8 heures d'observation. La plupart des centers hospitaliers canadiens n'admettent pas les patients pour la nuit; on ignore pourquoi cette pratique a toujours cours à l'Hôpital général de Montréal.

Objectifs: L'objectif était de mesurer l'incidence des complications post-biopsie rénale dans chacun des deux centers hospitaliers au cours des cinq dernières années, puis de les comparer d'un hôpital à l'autre ainsi qu'aux taux établis dans la littérature.

Conception: Cette étude a été conçue comme un examen de qualité de l'acte.

Cadre: L'étude a été réalisée à partir d'un registre local des biopsies rénales effectuées au Center universitaire de santé McGill entre janvier 2015 et janvier 2020.

Sujets: Nous avons inclus tous les patients adultes (18 à 80 ans) ayant subi une biopsie rénale en ambulatoire au Center universitaire de santé McGill entre 2015 et 2020.

Mesures: Les données démographiques de base et les facteurs de risque des patients inclus ont été recueillis au moment de la biopsie, notamment l'âge, l'IMC, le taux de créatinine, le débit de filtration glomérulaire estimé, le taux d'hémoglobine avant et après la biopsie, le décompte plaquettaire, l'urée, le profil de coagulation, la pression artérielle, le côté/taille des reins, la taille de l'aiguille et le nombre de ponctions.

Méthodologie: Nous avons comparé l'incidence des complications hémorragiques mineures et majeures à l'Hôpital général de Montréal et à l'Hôpital Royal Victoria. Les variables mesurées comprenaient: le taux d'hémoglobine avant et après la biopsie, l'incidence de complications hémorragiques mineures (définies par des hématomes et de l'hématurie macroscopique) et majeures (définies par des saignements post-biopsie nécessitant une transfusion ou une procédure pour arrêter le saignement), ainsi que l'incidence des admissions après la biopsie.

Résultats: Pour les cinq années à l'étude, l'incidence des complications majeures était de 2.87% (5/174 patients), ce qui est comparable au taux rapporté dans la littérature. Au cours de cette même période, l'incidence des transfusions s'est établie à 1.72% (3/174 patients) et celle des embolisations à 2.3% (4/174 patients). Le nombre total d'événements majeurs était faible et les patients qui les avaient subis présentaient d'importants facteurs de risque de saignement. Tous les événements sont survenus dans les six premières heures d'observation.

Limites: Il s'agit d'une étude rétrospective avec un faible nombre d'événements. En outre, seuls les événements enregistrés au Center universitaire de santé McGill ont été pris en compte; il est possible que des événements intéressants se soient produits à l'insu de l'auteur dans d'autres hôpitaux.

Conclusion: Selon les résultats de cet examen, tous les événements hémorragiques majeurs se sont produits dans les 6 heures suivant une biopsie rénale percutanée, ce qui plaide en faveur d'une surveillance des patients pendant 6 à 8 heures après la biopsie. Après cet examen de qualité de l'acte, les prochaines étapes sont un projet d'amélioration de la qualité et une analyze coût-efficacité, lesquels permettront de déterminer si les pratiques post-biopsies devraient être modifiées au Center universitaire de santé McGill.

Keywords

kidney biopsy, complication, observation period, bleeding risk, quality assurance

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Introduction

Percutaneous kidney biopsies (PKB) are important in the diagnosis, prognosis, and management of renal diseases, however they are not without risk. The reported incidence of minor bleeding, defined as the development of gross hematuria and/or perinephric hematoma post kidney biopsy, is approximately 2 to 4 and 15% to 17%, respectively.[1-3] Major bleeding, an event requiring a transfusion or an interventional procedure to stop the bleeding, has an incidence of 1% to 2% and 0.2% to 1%, respectively.[1-3] Recently, there has been published data suggesting the percentage of major complications may be 3% to 5%, which is higher than previously reported.[4,5]

Due to this risk, some institutions admit patients post-biopsy for 24 hours,[5,6] whereas others discharge their patients after a 6-8hr observation period.[3,7] The 24-hour observation period stems from data which shows that 42% of complications following native kidney biopsy manifest at ≤4 hours and 67% at ≤8 hours, suggesting that 33% of complications

[1]University of Toronto, Toronto, ON, Canada
[2]McGill University, Montreal, QC, Canada

Corresponding Author:
Ratna Samanta, McGill University, 1650 Avenue Cedar, L4-517, Montreal, QC, Canada.
Email: ratna.samanta@mcgill.ca

may be missed after 8 hours of observation.[8] However, multiple studies have shown that an outpatient approach is a safe alternative to inpatient observation and is more cost-effective for low-risk patients.[9]

Currently, at the McGill University Health Center (MUHC), there are 2 different post-biopsy protocols at the 2 major hospitals. At the Montreal General Hospital (MGH), outpatients who undergo a percutaneous native kidney biopsy must be admitted for 24 hours post-biopsy. In contrast, outpatients at the Royal Victoria Hospital (RVH) stay for 6 hours post-biopsy, then are discharged. We wanted to assess the incidence of major bleeding complications following an outpatient native kidney biopsy in both hospitals over the last 5 years, and compare them to each other, as well as the established rates as a quality assurance audit.

Methods

Study Design

This was a quality assurance audit of outpatients biopsied at the MUHC and approved by the MUHC research ethics board prior to chart review. The MUHC has 2 quaternary-care hospitals that perform kidney biopsies, the MGH and the RVH. Both have interventional radiology suites where ultrasound-guided kidney biopsies are performed by the same team of interventional radiologists. The Régie de l'Assurance Maladie du Québec (RAMQ) is the provincial organization that reimburses health professionals for services. We collected data for patients with the pathology department based RAMQ billing code for a kidney biopsy interpretation done at the MUHC from January 2015 to January 2020. Using this code, we identified the patients for chart review and manually extracted the data.

Study Population

We included all adult (≥18 years) patients who underwent an outpatient percutaneous native kidney biopsy at either the MGH or RVH from January 1, 2015 to January 1, 2020. We excluded all transplant kidney biopsies, inpatient biopsies and patients who had kidney biopsies physically performed outside of the MUHC. We excluded patients admitted 30 days prior to the biopsy as these patients were more likely to have a higher baseline risk of complications, such as re-hospitalizations, due to heavier burden of co-morbidity than the typical elective outpatient biopsy patient. Finally, we excluded patients who did not have an available chart to review.

Patient Characteristics

We collected the included patients' baseline demographics and risk factors at the time of biopsy, including age, BMI, creatinine, estimated glomerular filtration rate, pre- and post-biopsy hemoglobin, platelet, urea, coagulation profile, blood pressure, kidney side/size as well as needle size, and number of passes made.

Procedure

All included patients had an ultrasound-guided percutaneous kidney biopsy performed by an interventional radiologist with a biopsy gun, with a post-biopsy ultrasound to screen for bleeding or hematomas. If positive, an ultrasound was repeated 2 to 3 hours post-biopsy to re-assess the size of the hematoma, as well as for the presence of ongoing bleeding Anti-platelet and anticoagulation agents were usually held for 7 days pre-biopsy at both sites, unless the patient had an indication for anticoagulation bridging with low-molecular weight heparin. Desmopressin was not routinely administered pre-biopsy.

While in the recovery room, bedrest was enforced for 6 hours with hourly vitals, and nursing staff would chart for the presence gross hematuria by their own visual assessment. After the initial 6 hours, patients at the RVH were discharged home, whereas patients at the MGH were kept overnight for 24-hour observations. These patients at the MGH had repeat complete blood counts (CBCs) drawn at 6 hours and 24 hours post-biopsy, prior to their discharge from the hospital.

Outcome

The outcome of this quality assurance audit was to compare the incidence of major bleeding events post-PKB at both hospital sites and with the literature. We defined a major bleeding complication as an event requiring transfusion or another procedure to stop the bleeding. Minor complications were defined as the presence of a perinephric hematoma of any size and gross hematuria.

Statistical Methods

We described patient characteristics with standard deviation or interquartile ranges as appropriate for the distribution and normality of the data. The Fisher's exact test was used to compare proportions of complications between both hospital sites. All analyses were done using Stata BE 17.0. The Supplementary Appendix provides additional detail of the statistical analysis.

Results

A total of 174 outpatients had native PKB from January 1, 2015, to January 1, 2020. Major bleeding complications occurred in 5 patients at the MUHC, 2 at the MGH and 3 at the RVH. There were 4 patients who required embolization and 3 patients who received a transfusion. There was only 1 patient who required a transfusion without an embolization and 2 patients who required embolization who did not require

Table 1. Incidence of Major and Minor Complications at Both Hospital Sites.

	Total (n = 174)	Montreal General Hospital (n = 111)	Royal Victoria Hospital (n = 63)
Pre-procedure Hb (g/L) (IQR)	122 (110-137)	123 (111-139)	120 (98.5-135)
Post-procedure Hb (g/L) (IQR)	116 (100-127)	116(102-128)	115(97-126)*
Hb change (g/L) (95% CI)	8.83 (7.35-10.3)	9.26 (7.65-10.9)	6.74 (2.76-10.7)*
Minor complications			
# hematomas	64/174 (36.8%)	45/111 (40.5%)	19/63 (30.2%)
Gross hematuria	8/174 (4.60%)	6/111 (5.40%)	2/63 (3.17%)
Major complications	5/174 pts (2.87%)	2/111 pts (1.80%)	3/63 pts (4.76%)
Transfusions	3/174 (1.72%)	1/111 (0.0%)	2/63 (3.17%)
Embolization	4/174 (2.30%)	2/111 (1.8%)	2/63 (3.17%)

Note. Hb = Hemoglobin; g/L = grams/liter; IQR = interquartile ratio; CI = confidence interval.
(*) included data may not add to total *n* due to missing data.

a transfusion. All complications were detected either immediately with post-biopsy ultrasound or within 6 hours with a repeat imaging and CBC. The 3 patients at the RVH who had major complications were admitted to the hospital post-biopsy. There were no nephrectomies nor any deaths, nor was there a statistically significant difference in terms of complications or hospital site.

Out of the 5 patients with complications, 4 patients had a hemoglobin (Hb) value <100 g/L, and 3 patients were chronic kidney disease (CKD) stage 5 or were on dialysis. Furthermore, 2 out of 5 patients had a systolic blood pressure >160 mm Hg prior to renal biopsy. As for the minor bleeding complications, the incidence of hematoma of any size on ultrasound was 36.8% (64/174 patients) and gross hematuria was present in 4.60% (8/174 patients).

Discussion

We studied 174 outpatient native PKBs for post-biopsy bleeding complications performed by interventional radiologists at the MUHC in Montreal, Canada. Our patient population was slightly different between both sites, with a younger, more predominately female cohort at the MGH. While the rates of major complications between the 2 sites seemed comparable, it was not possible to assess for a statistical difference due to the low number of events. Both sites, however, culminated in 2.87% of patients with a major bleeding complication, where 1.72% required a blood transfusion and 2.3% required an embolization procedure. The percentage of patients who required transfusions at the MUHC is comparable with the recent Canadian literature by Schorr et al[10] who reported 1.6% of patients with native PKBs required transfusions, however was lower than the recent 5% reported by the retrospective cohort national French study by Halimi et al,[4] as well as 4.3% from a Boston cohort.[11]

The patients who had major complications had some known risk factors for bleeding, such as anemia and a low estimated glomerular filtration rate (eGFR). In this audit, 4 patients had anemia with a Hb <100 g/L, and 2 patients had an eGFR 15 mL/min/1.73^2 or lower, where one of these patients was on dialysis.[4,5] As per previously validated risk scores, these factors were additive, and remain significant in a multivariate analysis.[4,5,10]

The majority of these complications were detected during the first 6 hours post-biopsy. The same interventional radiologists rotate at both hospitals at the MUHC and employ a protocol of systematically imaging the area via ultrasound to assess for potential hematomas and aneurysms. At the MGH, a CBC is routinely drawn 6 hours post-biopsy, however, at the RVH, a CBC was only drawn if there was a concern for active bleeding, enlarging hematoma or clinical instability. During our comparison of the 2 hospitals, we discovered that that follow-up Hb levels were not routinely ordered at the RVH. Further scrutiny demonstrated that the responsible nephrologist was not usually notified of the specific date of the impending biopsy. Due to lack of awareness, many pre-biopsy blood tests, as well as physical exams, specifically blood pressures, were not performed and subsequently recorded.

Presumably, these patients without post-procedural labs did well post-biopsy given the low rate of complications, as well as the absence of readmissions at the MUHC within the month of the biopsy. However, a significant limitation of our assessment was that our chart review was limited to our hospital system, therefore any hospital admissions outside of the MUHC may have been missed.

The results of this quality assurance initiative will be utilized as the first step toward a quality improvement project. Issues that will be addressed include the notification of the RVH nephrologist at the time of biopsy, protocolized blood tests post-biopsy, as well identifying patients who should be observed for 24 hours post-biopsy. Proper identification of patients with a lower risk for complications may reduce the number of overnight admissions.

To conclude, percutaneous kidney biopsies are associated with post-biopsy bleeding complications. The number of

complications between both hospitals at the MUHC was comparable and supports a uniform post-biopsy observation protocol requiring a 6- to 8-hour observation period. A 24-hour admission may not be necessary in most outpatient native kidney biopsies as evidenced by previous studies but will need to be more formally assessed with a quality improvement project. We suggest that patients with high risk factors such as high blood pressure, anemia <100 g/L and eGFR <30 mL/min/1.73^2 should be considered for admission with a 24-hour observation period.

Ethics Approval and Consent to Participate

Ethics approval was obtained at the institutional IRB at the McGill University Health Center.

Consent for Publication

Not Applicable.

Availability of Data and Materials

Data and Materials are available upon request.

Declaration of Conflicting Interests

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ORCID iD

Ratna Samanta https://orcid.org/0000-0002-3014-7316

Supplemental Material

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References

1. Corapi KM, Chen JL, Balk EM, Gordon CE. Bleeding complications of native kidney biopsy: a systematic review and meta-analysis. *Am J Kidney Dis*. 2012;60(1):62-73.
2. Tøndel C, Vikse BE, Bostad L, Svarstad E. Safety and complications of percutaneous kidney biopsies in 715 children and 8573 adults in Norway 1988-2010. *Clin J Am Soc Nephrol*. 2012;7(10):1591-1597.
3. Feldmann Y, Böer K, Wolf G, Busch M. Complications and monitoring of percutaneous renal biopsy—a retrospective study. *Clin Nephrol*. 2018;89(4):260-268.
4. Halimi JM, Gatault P, Longuet H, et al. Major bleeding and risk of death after percutaneous native kidney biopsies: a French nationwide cohort study. *Clin J Am Soc Nephrol*. 2020;15(11):1587-1594.
5. Mejía-Vilet JM, Márquez-Martínez MA, Cordova-Sanchez BM, Ibargüengoitia MC, Correa-Rotter R, Morales-Buenrostro LE. Simple risk score for prediction of haemorrhagic complications after a percutaneous renal biopsy. *Nephrology*. 2018;23(6):523-529.
6. Xu DM, Chen M, Zhou FD, Zhao MH. Risk factors for severe bleeding complications in percutaneous renal biopsy. *Am J Med Sci*. 2017;353(3):230-235.
7. Hogan JJ, Mocanu M, Berns JS. The native kidney biopsy: update and evidence for best practice. *Clin J Am Soc Nephrol*. 2016;11(2):354-362.
8. Whittier WL, Korbet SM. Timing of complications in percutaneous renal biopsy. *J Am Soc Nephrol*. 2004;15(1):142-147.
9. Maripuri S, Penson DF, Ikizler TA, Cavanaugh KL. Outpatient versus inpatient observation after percutaneous native kidney biopsy: a cost minimization study. *Am J Nephrol*. 2011;34(1):64-70.
10. Schorr M, Roshanov PS, Weir MA, House AA. Frequency, timing, and prediction of major bleeding complications from percutaneous renal biopsy. *Can J Kidney Health Dis*. 2020;7-10.
11. Palsson R, Short SAP, Kibbelaar ZA, et al. Bleeding complications after percutaneous native kidney biopsy: Results from the Boston Kidney Biopsy Cohort. *Kidney Int Rep*. 2020;5(4):511-518.