

Ambulatory percutaneous nephrolithotomy in Canada: A cost-reducing innovation

Tad Kroczak, MD, FRCSC¹; Kenneth T. Pace, MD, MSc, FRCSC¹; Sero Andonian, MD, MSc, FRCSC, FACS²; Darren Beiko, MD, MBA, FRCSC³

¹Division of Urology, Department of Surgery, University of Toronto, Toronto, ON, Canada; ²Division of Urology, Department of Surgery, McGill University, Montreal, QC, Canada; ³Department of Urology, Queen's University, Kingston, ON, Canada

Cite as: *Can Urol Assoc J* 2018;12(12):427-9. <http://dx.doi.org/10.5489/cuaj.5416>

Published online September 27, 2018

Globally, growth in healthcare expenditures is becoming unsustainable. In 2017, Canada's healthcare expenditure was estimated at \$242 billion (\$6604 per person) or 11.5% of gross domestic product.¹ In Canada, provinces spend on average 40% of their total budgets on healthcare, and hospitals accounted for the largest proportion (28.3%) of healthcare dollars.¹ Over the past few decades, there has been a major worldwide shift from inpatient to outpatient surgical care across different specialties.² Patient safety — specifically reducing the incidence of nosocomial infections — and cost containment have been significant drivers of this shift.

Among surgical specialties, urology has been one of the leaders in advancing ambulatory surgical care. Presently, most penoscrotal and endoscopic urological operations are routinely performed on an outpatient basis. Yet patients undergoing percutaneous nephrolithotomy (PCNL) continue to routinely require hospitalization despite the introduction of tubeless PCNL in 1997³ and an initial report of outpatient PCNL dating back to 1986.⁴ Over the past decade, ambulatory PCNL (aPCNL) has emerged as a safe and efficacious option for select patients according to previously published strict criteria in small case series.^{5,6} Since these case series, a few cohort studies have been completed, all of which confirm the safety and efficacy of aPCNL.⁷⁻⁹ Based on these studies, the recent Medicare Ambulatory Surgical Centre Fee Schedule increase in the U.S.¹⁰ and the Affordable Care Act's initiative to augment quality of care and patient satisfaction scores,¹¹ there has been a growing interest in performing PCNL on a completely outpatient basis in the U.S.

The Canadian Institute for Health Information (CIHI) is an independent, not-for-profit organization that provides essential information on Canadian healthcare systems.

According to CIHI's most recent 2016–2017 databases and reports, the average daily cost of a standard hospital bed is \$799.^{12,13} This is based on CIHI's calculated average cost of a standard hospital stay in Canada of \$5992¹² and CIHI's calculated average length of stay (LOS) in hospital of 7.5 days.¹³ CIHI does not report PCNL-specific data. Instead, PCNL data is captured within CIHI's larger category termed "Major Intervention on Upper Urinary Tract." The average acute LOS for PCNL and other major interventions on the upper urinary tract in adults is 4.19 days according to CIHI.¹⁴ Based on CIHI's 2016–2017 databases and provincial data, an estimated 1600 PCNL operations occur in adults annually in Canada.¹⁴

If we consider a few reasonable assumptions (first, PCNL patients are admitted to a standard [non-intensive care unit] bed postoperatively; and second, when comparing standard PCNL and aPCNL, equivalent or similar: anesthetic equipment and costs; surgical equipment and costs; physician cost/billings; operative times; perioperative imaging tests and costs; postoperative emergency room visits; postoperative readmissions to hospital; postoperative complication rates [and associated costs for all]), calculation of the cost of an average postoperative PCNL hospital stay will provide an estimate of the cost savings of aPCNL. According to CIHI, the overall estimated average cost of the PCNL surgery is \$9673.¹⁴ Given an average cost of a standard hospital bed of \$799 per day and an average LOS for PCNL of 4.19 days, the resulting average cost of the hospital stay portion of PCNL is calculated to be \$3348. When all the costs are considered, the per-procedure costs of aPCNL is calculated to be \$6325 (the overall PCNL cost of \$9673 minus the cost of the hospital stay of \$3348), a 34.6% cost reduction. If 10% of PCNL procedures can be performed on an outpatient basis, the total potential annual cost savings to Canadian healthcare systems is just over \$535 000 (1600 cases/year x 10% aPCNL rate x \$3348 savings/case).

The initial Canadian experiences with aPCNL demonstrated that aPCNL is safe and effective in highly selected

patients.^{5,6} As experience was gained in Canada, more medically complicated patients with larger stone burdens and complex renal anatomy underwent aPCNL and the results were excellent; high stone-free rates, low complication rates, and readmission rates similar to standard PCNL showed that an ambulatory approach is feasible.⁷ Patient selection and technical precision with near-perfect needle puncture at the calyceal tip is critical to ensure success with this approach.¹⁵ Even when patient selection and surgical technique are optimal, the patient may still require admission. Bechis et al reviewed 60 patients undergoing outpatient PCNL and found that 28% of patients who were planned to be discharged after the procedure ended up being admitted overnight due to persistent pain symptoms or “social reasons.”¹⁶ No difference in 30-day overall complication rate and emergency department presentation was shown between both groups. Admitted PCNL patients were more likely to have a larger stone burden, multiple punctures, and supracostal puncture for access. Stone-free rate for the outpatient group, confirmed by computed tomography, was 67%. Fahmy et al reported their experience involving a larger cohort of outpatient PCNL patients.⁸ Overall, 146 of 162 patients (90.1%) were suitable for aPCNL and successfully discharged home the same day with an average of 8.97 hours post-PCNL, without any additional adverse outcomes.⁸ Taking it one step further, Abbott et al presented their growing experience with tubeless aPCNL performed on 219 patients in an ambulatory surgical centre (ASC) setting, and confirmed the safety and efficacy of aPCNL performed outside the hospital environment.⁹ The progression of PCNL from the hospital to ASCs is an innovative and natural progression for maximum cost savings. Further analysis and studies are required to determine the potential cost savings of aPCNL in ASCs.

In Canada alone, an estimated 1600 PCNLs are performed annually. Understandably, not all patients are suitable for same-day discharge following PCNL, and a shift from standard PCNL with nephrostomy tube drainage to tubeless PCNL is the natural first step in adopting aPCNL. A recent meta-analysis of 14 randomized controlled studies showed that tubeless PCNL is associated with a significantly shorter hospital stay, shorter time to return to normal activity, lower postoperative pain scores, less analgesia requirement, and reduced urine leakage when compared to standard PCNL.¹⁷

The potential cost savings of aPCNL are limited if emergency department (ED) visits, readmission rates, and complications are greater than those for standard PCNL. A retrospective review of 50 patients undergoing aPCNL from two Canadian institutions had a re-admission rate of 4%,⁷ favourably comparable to standard PCNL. Six patients (12%) presented to the ED within seven days. No major complications were identified and nine (18%) of patients had low-grade (I–II) Clavien complications.

There are several assumptions that our cost analysis depends on when comparing the surgical aspect of aPCNL to standard PCNL. These include: similar operative times between aPCNL and PCNL, no difference in surgical or anesthetic equipment, no difference in perioperative imaging and associated costs, as well as no difference in ED visits, readmission rates, or complication rates. Furthermore, one limitation of our cost analysis is the general difference in renal drainage post-PCNL; standard PCNL usually involves placement of a nephrostomy tube despite a slow trend toward tubeless PCNL among endourologists, whereas aPCNL usually involves placement of a ureteral stent. Despite these assumptions and limitations, one can readily comprehend aPCNL’s immediate cost savings by avoiding one or more days in hospital. A randomized trial with healthy patients and similar stone burdens would help elucidate and better quantify the precise cost-effectiveness of aPCNL in the “real world.” Surgical complexity and patient factors can also affect outcomes and complication rates after PCNL. Patient selection is critical to ensure the safety of aPCNL. A report by Bagrodia et al interestingly demonstrated that body mass index had no negative impact on efficacy, complication rate, or cost in patients undergoing PCNL.¹⁸

Ambulatory PCNL is but one example of how a new approach — one that challenges the surgical dogma that PCNL patients must be admitted postoperatively — can contribute to cost containment in healthcare systems across the globe. Shifting PCNL from an inpatient to an outpatient procedure results in a 35% reduction in costs, which translates to a cost savings of over \$3000 per PCNL in Canada. With the ongoing trend toward tubeless PCNL and ambulatory surgical care, along with the established safety and efficacy of aPCNL and these reported cost savings, aPCNL represents a timely advance and a new option for urologists to consider in the surgical management of nephrolithiasis. Endourologists around the world have started performing aPCNL, and we invite others to adopt a fiscally responsible approach and consider aPCNL in highly selected patients.

Competing interests: The authors report no competing personal or financial interests.

Acknowledgements: This work was supported in part by the Northeastern AUA Young Investigator Award and Montreal General Hospital Foundation Award to Sero Andonian and the Academic Health Sciences Centre (AHSC)-Alternate Funding Payment (AFP) Innovation Fund Research Grant to Darren Beiko.

This paper has been peer-reviewed.

References

1. Canadian Institute for Health Information. National Health Expenditure Trends, 1975–2017. Available at: <https://www.cihi.ca/sites/default/files/document/nhex2017-trends-report-en.pdf>. Accessed March 16, 2018.
2. Davis JE. Ambulatory surgery ... how far can we go? *Med Clin North Am* 1993;77:365-75. [https://doi.org/10.1016/S0025-7125\(16\)30257-7](https://doi.org/10.1016/S0025-7125(16)30257-7)
3. Bellman GC, Davidoff R, Candela J, et al. Tubeless percutaneous renal surgery. *J Urol* 1997;157:1578-82. [https://doi.org/10.1016/S0022-5347\(01\)64799-2](https://doi.org/10.1016/S0022-5347(01)64799-2)
4. Preminger GM, Clayman RV, Curry T, et al. Outpatient percutaneous nephrolithotomy. *J Urol* 1986;136:355-7. [https://doi.org/10.1016/S0022-5347\(17\)44867-1](https://doi.org/10.1016/S0022-5347(17)44867-1)
5. Shahrour W, Andonian S. Ambulatory percutaneous nephrolithotomy: Initial series. *Urology* 2010;76:1288-92. <https://doi.org/10.1016/j.urol.2010.08.001>
6. Beiko D, Lee L. Outpatient tubeless percutaneous nephrolithotomy: The initial case series. *Can Urol Assoc J* 2010;4:E86-90. <https://doi.org/10.5489/auaj.886>
7. Beiko D, Elkoushy MA, Kokorovic A, et al. Ambulatory percutaneous nephrolithotomy: What is the rate of readmission? *J Endourol* 2015; 29:410-4. <https://doi.org/10.1089/end.2014.0584>
8. Fahmy A, Rhashad H, Algebaly O, et al. Can percutaneous nephrolithotomy be performed as an outpatient procedure? *Arab J Urol* 2017;15:1-6. <https://doi.org/10.1016/j.aju.2016.11.006>
9. Abbott JE, Silva MV, Davalos JG. Ambulatory percutaneous nephrolithotomy performed in a free-standing surgery centre: Outcomes of the first 219 cases. *J Urol* 2018;199:e1206. <https://doi.org/10.1016/j.juro.2018.02.2942>
10. Centres for Medicare & Medicaid Services. Ambulatory Surgical Center (ASC) Payment. Available at: <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ASCPayment/index.html>. Accessed March 16, 2018.
11. Loehrer AP, Chang DC, Scott JW, et al. Association of the Affordable Care Act Medicaid Expansion with access to and quality of care for surgical conditions. *JAMA Surg* 2018;153:e175568. <https://doi.org/10.1001/jamasurg.2017.5568>
12. Canadian Institute for Health Information. Cost of a standard hospital stay. Available at: <https://yourhealthsystem.cihi.ca/hsp/inbrief?lang=en#/indicators/015/cost-of-a-standard-hospital-stay;/mapC1;mapLevel2;/>. Accessed July 31, 2018.
13. Canadian Institute for Health Information. Quick stats. Available at: https://apps.cihi.ca/mstrapp/asp/Main.aspx?Server=apmstxtprd_i&project=Quick%20Stats&uid=pce_pub_en&pwd=&evt=2048001&visualizationMode=0&documentID=C6F8B4144B03958E3AE3CAB5DD440EA7. Accessed July 31, 2018.
14. Canadian Institute for Health Information. Patient cost estimator. Available at: <https://www.cihi.ca/en/patient-cost-estimator>. Accessed July 31, 2018.
15. Beiko D, Andonian S. Getting started with ambulatory PCNL: A CanMEDS perspective. *Can Urol Assoc J* 2015;9:E223-5. <https://doi.org/10.5489/auaj.3198>
16. Bechis SK, Han D, Abbott J, et al. Outpatient PCNL: The UC San Diego Health experience. *J Endourol* 2018;32:394-401. <https://doi.org/10.1089/end.2018.0056>
17. Xun Y, Wang Q, Hu H, et al. Tubeless vs. standard percutaneous nephrolithotomy: An update meta-analysis. *BMC Urol* 2017;17:102. <https://doi.org/10.1186/s12894-017-0295-2>
18. Bagrodia A, Gupta A, Raman JD, et al. Impact of body mass index on cost and clinical outcomes after percutaneous nephrolithotomy. *Urology* 2008;72:756-60. <https://doi.org/10.1016/j.urol.2008.06.054>

Correspondence: Dr. Darren Beiko, Department of Urology, Queen's University, Kingston, ON, Canada; beiko@queensu.ca

A prestigious honour

for former CUA president, Dr. Curtis Nickel

We are proud to report that the inaugural Mostafa M. Elhilali award has been granted to former Canadian Urological Association president, Dr. Curtis J. Nickel. The award, established by the Société Internationale d'Urologie in honour of the late Dr. Elhilali, is granted to a researcher of excellent scientific and ethical standing who has made very important contributions to the field of urology and to its development.

Dr. Nickel, a member of the Department of Urology at Queen's University since 1984, has focused his tremendous research efforts in the fields of inflammatory diseases of the urinary tract and benign diseases of the prostate gland. His work in chronic pelvic pain led to new awareness of this condition, updated definitions and classifications, validated outcome parameters, and new diagnostic standards. He has led several clinical trials in BPH, prostatitis, and interstitial cystitis that have helped shape medical therapy for these conditions. As an educator, he has influenced the careers of hundreds of urologists in Canada and beyond.

Dr. Elhilali, for whom the award is named, was also a former CUA president, a world-renowned urologist, and specialist in prostatic diseases. His entire career was devoted to improving urological patient care through surgical innovation and improvements in surgical training.

