The financial burden of prolonged urinary retention in patients awaiting holmium laser enucleation of the prostate in the Quebec healthcare system

A retrospective cohort study

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ABSTRACT

INTRODUCTION: With rising surgical wait times for benign prostatic hyperplasia (BPH)-related urinary retention (UR), we aimed to assess the healthcare costs of prolonged UR management in patients awaiting holmium laser enucleation of the prostate (HoLEP) and evaluate the impact of wait times on resource utilization and complications.

METHODS: We retrospectively analyzed 91 patients with BPH-related UR on the HoLEP waitlist (September 2021–2024). Wait times, urologic and emergency department (ED) visits, interventions, and costs were recorded. Total costs included institutional and physician-billed fees from our cost center. Continuous variables were reported as mean ± standard deviation or median (interquartile range).

RESULTS: Mean patient age was 71±8 years, with a mean prostate size of 123±54 g. Median wait time from retention to surgery was 220 days (149–300), with median total cost of $5315.95 (4343.85–7385.94). Longer wait times correlated with higher total costs ($r=0.374$, $p<0.001$) but inversely with cost per month ($r=-0.680$, $p<0.001$), suggesting cumulative burden over time. There were 685 urology clinic visits and 55 ED visits, nine (16%) resulting in hospital admissions. Complications occurred in 51 patients, including infections (63%), hematuria (47%), catheter issues (18%), and urosepsis (16%). Admissions were due to acute kidney injury (AKI) (n=3), urosepsis (n=2), pyelonephritis (n=2), and hematuria (n=2), with pyelonephritis, AKI, and urosepsis contributing the highest costs. Patients with complications required more visits and incurred higher costs (all $p<0.05$).

CONCLUSIONS: Prolonged UR management significantly increases healthcare costs. Prioritizing earlier surgical intervention may reduce complications, lessen economic strain, and improve patient outcomes.

INTRODUCTION

Urinary retention (UR) is the inability to voluntarily empty the bladder and is a common and often debilitating urologic condition, particularly in aging men.[1] One of the leading causes of UR is benign prostatic hyperplasia (BPH), a progressive enlargement of the prostate that leads to lower urinary tract symptoms and bladder outlet obstruction if left untreated.[2-4] While temporary management of UR typically begins with catheterization to relieve the obstruction, definitive treatment requires addressing the underlying prostatic obstruction, often through medical therapy or surgical intervention, such as transurethral resection of the prostate (TURP) or holmium laser enucleation of the prostate (HoLEP).[5-7]

HoLEP is an endoscopic procedure recognized as the size-independent gold standard for surgical management of BPH according to the latest guidelines.[8] HoLEP offers durable symptomatic relief, low complication rates, and is effective across a wide range of prostate sizes, making it an ideal option for men with significant UR.[9,10]

If left untreated, BPH and associated UR can lead to complications, including urinary tract infections (UTIs), hematuria, bladder stones, and upper urinary tract deterioration.[8] Prolonged UR, especially when managed with chronic catheterization, exposes patients to more risks,

KEY MESSAGES

- Prolonged urinary retention management in patients awaiting HoLEP surgery leads to significant healthcare costs, driven by repeated catheter care, complications, and hospital visits.
- Over half our patient cohort experienced complications, which significantly increased total costs and healthcare use.
- Longer surgical wait times were associated with higher overall costs, though not greater monthly intensity of care, suggesting a cumulative burden over time.
- Hospital admissions contributed the highest costs per patient.
- Prioritizing earlier surgical intervention may reduce complications, improve quality of life, and alleviate the strain on the healthcare system.

such as recurrent infections, catheter blockages, discomfort, and even life-threatening complications like urosepsis and acute kidney injury (AKI).[7,11-14] These adverse outcomes often necessitate frequent contact with the healthcare system through emergency department (ED) utilization and hospital admissions.[15,16]

In cases where surgical intervention is clearly indicated, such as persistent UR, recurrent infections, or failure of medical therapy, access to timely HoLEP is essential;[8] however, in publicly funded healthcare systems such as Quebec's, surgical wait times are often prolonged due to limited operating room (OR) availability, staffing shortages, and the ongoing impact of the COVID-19 pandemic.[17,18] Indeed, since the pandemic, wait times continue to increase for patients requiring surgical treatment.[19]

Extended wait times result in patients remaining catheter-dependent for weeks or even months, turning a potentially reversible condition into a chronic management problem.[20] This has significant consequences, not only for patient quality of life (QoL) but also for the healthcare system. The burden of managing prolonged UR through repeated procedures, infection treatment, and ED visits adds significant cost and resource strain.[21] Yet, there is a paucity of data evaluating the economic toll of delayed surgical treatment for UR.

Our study aimed to address this critical gap by assessing the financial and clinical impact of prolonged UR in patients awaiting HoLEP. By measuring healthcare use and associated costs, we aimed to highlight the broader implications of delayed access to definitive surgical care. Our findings will help inform policy changes to optimize surgical prioritization, improve access to care, and ultimately reduce the avoidable burden of prolonged UR management on patients and the healthcare system alike.

METHODS

Study design

We conducted a retrospective cohort study to evaluate the financial burden associated with prolonged UR management in patients with BPH awaiting HoLEP at a tertiary care center in Quebec (September 2021 to September 2024). During the study period, HoLEP was performed by three surgeons at our institution. The study was approved by the McGill University Health Centre (MUHC) Research Ethics Board (REB # 2025-10471). Patient confidentiality was ensured by de-identifying all extracted data, and the study is reported in line with the STROBE guidelines.[22]

Study population

Eligible patients were identified through the hospital's electronic medical records. The study included adult male patients (aged ≥18 years) with a diagnosis of BPH-related UR, confirmed by clinical assessment and cystoscopy, and who had been placed on the HoLEP surgical waitlist during the specified study period. Only patients with UR secondary to BPH were included. Exclusion criteria were history of prostate cancer and neurogenic bladder. Patients with prior prostate/bladder surgery were excluded due to potential anatomical or functional changes that could confound outcomes. Finally, patients with incomplete medical records were also excluded.

Data collection

Data were extracted using a standardized data abstraction form. Variables included patient demographics, such as age; and clinical parameters, including prostate size, medical therapy for UR, type of catheterization, onset of UR, date of consent for surgery, date of surgery, surgery details, number and type of urology visits, ED visits related to UR, and hospitalizations related to UR. The overall wait time was defined as the duration from UR onset to the date of surgery. We also

reported two subintervals: 1) from UR onset to consent for surgery; and 2) from consent for surgery to the operative date.

For the purpose of this study, the onset of retention was defined as the patient's initial presentation to our hospital for UR secondary to BPH, with the date recorded as the first documented instance of UR. This established a clear starting point for tracking management and associated costs. We collected information on healthcare use, including the number and type of urologic outpatient visits, telephone followups, ED visits, and hospital admissions. We also recorded complications associated with the prolonged management of UR, such as UTIs and catheter-related issues.

Cost data

Cost data were obtained in collaboration with our academic center's cost service. These data were generated under the *Coût Par Parcours de Séjours et Soins* methodology, a project initiated by Quebec's Ministry of Health to integrate clinical and financial information across the hospital network as a precursor to Activity-Based Financing. Cost information was generated using the Power Performance Manager (PPM) system, a tool employed internationally in healthcare cost calculations. Briefly, PPM extracts raw data (e.g., patient index, admissions, transfers, OR, imaging, pharmacy, and laboratory data) and combines it with manually calculated financial inputs for specific services (e.g., interventional cardiology and OR supplies). The system allocates both direct and indirect costs to individual patient trajectories using various weights based on service utilization (e.g., visit frequency, duration, and specific supply usage) and internal allocation statistics (e.g., worked hours and departmental expenses).

Furthermore, service fees for physicians, determined by billing codes associated with the interventions provided (Table 1), were incorporated into the overall cost analysis to capture professional fees, as well as institutional costs. All monetary values are reported in Canadian dollars (CAD). This integrated approach allowed for the detailed quantification of all cost components, including diagnostic, interventional, ward-based, procedural, and professional costs, thereby providing comprehensive financial estimates for the management of prolonged retention management for patients awaiting surgery.

Outcome measures

The primary outcome measure of the study was the total financial cost associated with the prolonged UR management. Secondary outcomes included the frequency of complications related to UR management and the extent to which these complications were associated with increased healthcare utilization, such as ED visits and hospital admissions.

Table 1. Physician service fees for interventions in UR management secondary to BPH

Intervention/procedure	Fee ($)*
HoLEP	458.10
Morcellation	211.10
Cystoscopy	52.75
Interconsult†	115.35
New consult	69.00
Followup consult (6 months or more)	48.15
Followup consult (less than 6 months)	17.85

*Costs reported in CAD. †Interconsult is defined as a consult from one urologist to another working in different healthcare centres. Note: Telemedicine consultation fees are 10% lower than the in-person rates shown above. BPH: benign prostatic hyperplasia; HoLEP: holmium laser enucleation of the prostate; UR: urinary retention.

Statistical analyses

All statistical analyses were performed using SPSS version 29.0 (IBM Corp, Armonk, NY, U.S.). Continuous variables are presented as means ± standard deviations (SD) or as medians with interquartile ranges (IQR), depending on their distribution, while categorical variables are summarized as frequencies and percentages. Comparisons were made using the Mann-Whitney U test, as appropriate. Correlations among non-parametric data were assessed using Spearman's rho. A two-tailed p-value of ≤0.05 was considered statistically significant.

RESULTS

Patient demographic and clinical characteristics

A total of 91 patients were included. The mean age of the cohort was 71±8 years, and the mean prostate size was 123±54 g. Most patients (87%, 79/91) had an indwelling catheter, while 8% (7/91) used clean intermittent catheterization (CIC), and 5% (5/91) had no catheterization. The median interval from the onset of UR to surgery was 220 days (IQR 149–300). When broken down by interval, the median wait time from UR to consent was 35 days (IQR 0–116), while the

time from consent to surgery was longer at 153 days (IQR 93–230). Key characteristics of the patient cohort are summarized in Table 2.

Healthcare resource utilization and cost analysis

The patient cohort collectively accounted for 685 urologic outpatient visits and 55 ED visits. Notably, patients with complications had significantly higher healthcare utilization, with a median of eight outpatient visits (IQR 5–13) and one ED visit (IQR 0–2), compared to four outpatient visits (IQR 3–7) and zero ED visits (IQR 0–0) in those without complications (both p<0.001); however, patients with complications and patients without complications related to UR did not differ significantly in age, prostate size, catheterization type, and wait time from retention to surgery.

The median total cost per patient was $5315.95 (IQR 4343.85–7385.94), with costs being significantly higher among patients with complications ($6063.60, IQR 4743.75–7892) compared to those without ($4906.05, IQR 4061.49–5962.79) (p=0.011). When costs were normalized by wait duration (per month), the median cost was $799.29 (IQR 573.18–973.75), with no significant difference between groups (p=0.666). Complications due to retention from BPH contributed significantly to the overall financial burden, with substantial costs attributed to pyelonephritis (mean cost of $4861±3750.49), AKI ($3441±2197.25), and urosepsis ($4006.5±5893.37).

Table 2. Key characteristics of the patient cohort

Cohort	All patients (N=91)	With complications (n=51)	Without complications (n=40)	p
Age (years)	71±8	72±8	70±8	0.315
Prostate size (g)	123±54	126±59	118±46	0.490
Catheterization				0.758
Indwelling	79 (87)	45 (88)	34 (85)	
CIC	7 (8)	4 (8)	3 (7)	
None	5 (5)	2 (4)	3 (7)	
Wait time				
From retention to surgery	220 (149–300)	246 (196–316)	202 (132–276)	0.065
From retention to consent to surgery	35 (0–116)	64 (9–129)	23 (0–90)	0.040
From consent to surgery to surgery	153 (93–230)	181 (100–230)	147 (85–228)	0.525
ED visits				<0.001
Total*	55	51	4	
Per-patient	0 (0–1)	1 (0–2)	0 (0–0)	
Urologic outpatient visits				
Total*	685	455	230	<0.001
Per-patient	6 (4–11)	8 (5–13)	4 (3–7)	
Total visits per patient	6 (4–12)	8 (5–14)	4 (3-7)	<0.001
Total costs per patient ($)	5315.95 (4343.85–7385.94).	6,063.60 (4743.75–7892)	4906.05 (4061.49–5962.79)	0.011

*Total number of visits in the cohort, not per patient. Note: Data are presented as mean ± standard deviation, n (%), or median (interquartile range). CIC: clean intermittent catheterization; ED: emergency department.

Complications and hospital admissions

Complications associated with prolonged retention were noted in 56% (51/91) of the cohort. The most frequently encountered complications were UTIs (63%, 32/51), hematuria (47%, 24/51), catheter-related issues (18%, 9/51), and urosepsis (16%, 8/51) (Figure 1). Complications that resulted in hospital admissions had the highest associated costs. Among the nine hospital admissions, the primary reasons were AKI (n=3), urosepsis (n=2), pyelonephritis (n=2), and hematuria (n=2). The mean costs for all complications due to retention experienced by the patient cohort are summarized in Table 3. Due to small subgroup sizes and high variability, costs for specific complications are reported as mean ± SD to better reflect the distribution of values.

Additional analyses

A statistically significant positive correlation was found between longer wait times and increased healthcare costs (Spearman's rho=0.359, p<0.001); however, when costs were normalized by wait duration (cost per month), a significant negative correlation emerged (Spearman's rho=-0.680, p<0.001), indicating that the increase in total cost was primarily driven by longer exposure time rather than greater intensity of care. Furthermore, patients with complications incurred significantly higher healthcare costs and required more frequent healthcare visits, including urologic outpatient visits and ED visits, compared to those without complications (all p<0.05) (Figure 2).

DISCUSSION

Study findings and healthcare system constraints

Our study revealed that prolonged UR management in patients with BPH awaiting HoLEP is associated with significant healthcare utilization, higher rates of complications, and significant costs. The median wait time from the onset of retention to surgery exceeded 200 days, during which patients frequently required catheterization,

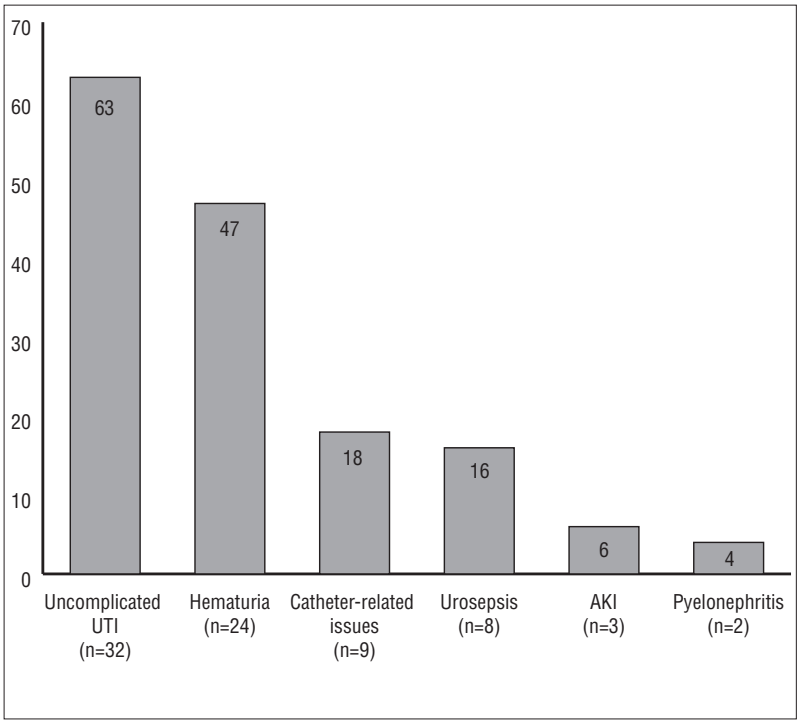

Figure 1. Types of complications experienced by benign prostatic hyperplasia (BPH)-related urinary retention patients. More than half the patient cohort (56%, 51/91) encountered complications due to retention from BPH. Some patients experienced multiple complications. AKI: acute kidney injury; UTI: urinary tract infection.

Table 3. Complications experienced by BPH-related UR patients and their associated costs

Complication	Cost ($)*
Pyelonephritis†	4861±3750.49
Urosepsis†	4006.5±5893.37
AKI†	3441±2197.25
Hematuria†	586.83±432.83
Infection	379.6±303.35
Catheter-related issues	232.5±64.09

*Costs reported in CAD. †Led to hospital admission (n=9) at our tertiary care centre (n=2 for hematuria; n=2 for urosepsis, n=3 for AKI; n=2 for pyelonephritis). Note: Values are reported as mean ± standard deviation. AKI: acute kidney injury; BPH: benign prostatic hyperplasia; UR: urinary retention; UTI: urinary tract infection.

outpatient followup, ED visits, and hospital admissions. This duration far surpasses the nationally recommended maximum clinically acceptable wait time of eight weeks for surgical intervention in cases of UR, as established by the Canadian Urological Association in 2024.[23]

A study conducted in Ibadan, Nigeria, reported similarly prolonged delays for patients with BPH, with catheterization durations ranging from 1–13 months and catheter-associated complications occurring in 37.5% of patients.[24] Although specific cost metrics were not reported, the study highlighted the clinical consequences of delayed surgical care, including high complication rates, such as catheter encrustation, blockage, and infection. In our study, we found that complications such as UTIs, hematuria, and catheter-related issues were common, with 56% of patients experiencing at least one complication. Patients with complications incurred significantly greater costs, highlighting the impact of delayed surgical intervention. Notably, complications like pyelonephritis, AKI, and urosepsis accounted for the highest costs, as they frequently led to hospitalization.

Healthcare system constraints, including OR and staffing shortages, particularly exacerbated by the COVID-19 pandemic, have contributed to extended surgical wait times.[25] At the pandemic's peak, it was estimated that approximately 28.4 million operations were cancelled or postponed globally over a 12-week period, with over 90% of these cancellations involving procedures for benign conditions.[26] Despite a 20% increase in surgical volume following the initial COVID-19 disruption, clearing the resulting backlog of elective procedures was projected to take approximately 45 weeks.[26]

In publicly funded healthcare systems like Quebec's, such extensive surgical backlogs have led to increased reliance on conservative — and temporary — management strategies, such as prolonged catheterization, despite their well-documented risks. Median total cost per patient exceeded $5000, reflecting the cumulative burden of repeated catheterizations, followup visits, emergency care, and hospital admissions.

Chronic catheterization is a known healthcare burden. In a large, one-year, prospective study of 1540 nursing home residents, Kunin et al found that catheterized patients were hospitalized three times more often, spent three times longer in hospital, and received three times more antibiotics than matched non-catheterized controls. Mortality was also significantly higher, particularly among those catheterized for the majority of the year, who had nearly triple the odds of dying compared to non-catheterized patients.[16]

Our findings align with this evidence: nearly all of our patients were catheterized (95%, 86/91) and over half developed complications, including infections, hematuria, and catheter-related issues. Further, those with complications incurred significantly higher healthcare costs and more frequent outpatient and ED visits.

Interestingly, while longer wait times were associated with higher total costs, a significant negative correlation

was observed between wait time and cost per month. This suggests that patients who waited longer did not necessarily require more intensive care on a month-to-month basis. Rather, higher total costs were largely a function of cumulative exposure over extended time periods. Indeed, catheter changes, which cost approximately $70 each at our institution, became a major driver of monthly costs in patients awaiting surgery. As such, the long-term financial burden associated with prolonged UR appears to stem not only from acute complications but also from the accumulation of potentially avoidable, maintenance-based interventions.

In addition to the financial and clinical burden associated with prolonged UR management, the impact on patient QoL must also be considered. A study conducted in Nigeria evaluating the burden of prolonged catheter use in patients with UR awaiting surgery found that extended wait times had a significant negative impact on patient-reported QoL. Complications such as pain, bleeding, inability to work, and sexual dysfunction were common, with 85.5% of patients reporting dissatisfaction with their QoL, and many citing inability to have sex and partner abandonment as major concerns.[27]

Similarly, a U.K. qualitative study revealed that catheter users described profound effects on sexual self-esteem, body image, and intimate relationships.[28] In a recent Egyptian study, over 90% of patients reported lifestyle disruption, with common concerns including bladder spasms, infections, and sexual limitations; notably, 92.2% stated that their catheter prevented sexual activity altogether.[29]

While HoLEP has been shown to be a cost-effective surgical treatment for BPH independent of prostate size, increasing evidence supports the use of minimally invasive surgical therapies (MISTs), such as Rezūm and UroLift, as earlier interventions to allow durable symptom relief for patients with smaller prostates (<80 cc).[30-32] While these therapies are not intended for larger prostates, as per CUA guidelines, integrating MISTs into treatment pathways for selected patients may help preserve OR capacity for those requiring HoLEP, improve patient outcomes, and ultimately reduce the burden of prolonged catheter-based management.[33] Similarly, upfront surgical approaches have been shown to be more cost-effective than delayed surgery after failed pharmacotherapy.[34,35]

Optimized scheduling, increased resource allocation, and alternative surgical prioritization strategies may help mitigate the adverse effects of prolonged retention management.[24,36] In our cohort, we found that the median wait time from initial consultation for retention to consent for surgery was 35 days, compared to 153 days for the wait time from consent to the operative date. The relative delay seems to stem primarily from operative booking rather than access to consultation, highlighting the need for system-level strategies to expand surgical capacity and streamline booking processes.

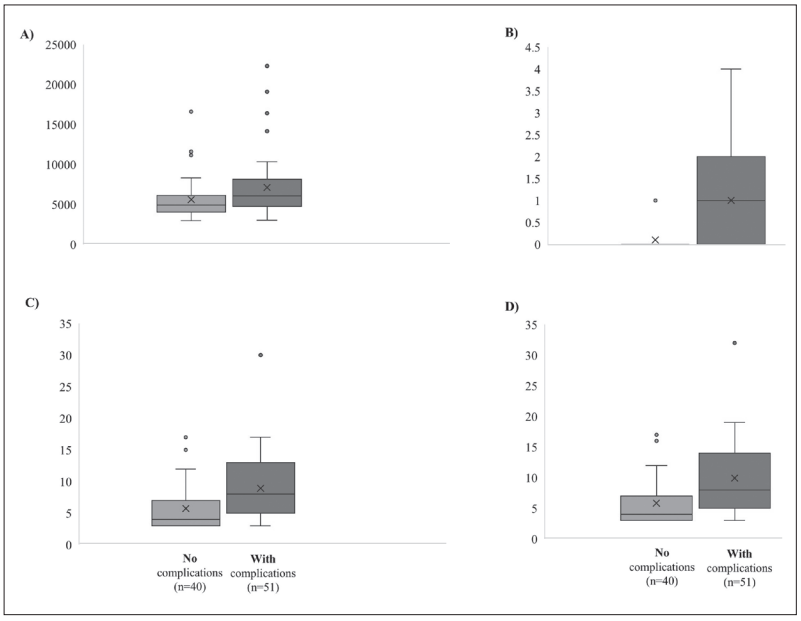

Figure 2. Patients with complications from benign prostatic hyperplasia (BPH)-related urinary retention incurred higher costs and utilized more healthcare services compared with those without complications. (A) Per-patient costs; (B) emergency department visits; (C) urologic outpatient visits; and (D) total healthcare visits. Box plots display the 25th, 50th (median), and 75th percentiles, along with the full range (maximum-minimum) for each variable. *Two-sided Mann-Whitney U test, $p<0.05$.

In the context of the pandemic, several studies have proposed frameworks to optimize resource distribution and surgical scheduling. Prachand et al proposed a scoring system to help prioritize time-sensitive procedures, offering a structured way to manage surgical backlogs and improve patient outcomes.[25] Similarly, the COVIDSurg Collaborative highlighted the critical need to expand surgical capacity and revise scheduling protocols in response to the widespread cancellations that occurred during the pandemic.[26]

Implications for healthcare policy and practice

Our study has several implications for healthcare policy and practice. First, our findings emphasize the importance of prioritizing surgical access for patients with BPH-related UR to prevent avoidable complications and reduce costs. Improving surgical wait times is an important step in advocating for patients with urologic conditions.[23]

Second, given the strong correlation between wait times and healthcare costs, targeting interventions

aimed at reducing delays, such as expanding surgical capacity or implementing alternative treatment pathways, could yield substantial benefits. With the global burden of BPH projected to rise significantly over the next decade, addressing surgical delays will become increasingly important. A recent study estimated that the incidence and prevalence of BPH will continue to grow due to aging populations, placing additional strain on healthcare systems.[36] Proactively optimizing resource allocation and access to timely treatment will be essential in mitigating the long-term impact of this trend. Operational research has demonstrated that implementing refined scheduling algorithms and strategic resource allocation can significantly reduce surgical delays and improve OR utilization, thereby mitigating the impacts of extended wait times for surgery.[37]

Third, improved patient education on the risks of prolonged catheterization and earlier referral for definitive surgical management may help reduce complications and associated healthcare utilization.[36]

Limitations

Our study has several limitations.

First, this was a retrospective, observational study with a modest sample size, limiting causal inference; however, despite the limited sample size, the study offers a snapshot of the important cost burden that UR places on our healthcare systems and may underestimate the overall impact of this condition. Comparisons with other surgical approaches for retention at our center could further contextualize these findings.

Second, reliance on electronic medical records may introduce selection or incomplete data capture. This is because certain clinical events or encounters, such as catheterizations performed outside the hospital, patient-reported complications, or informal care, may not be fully documented in structured fields or captured at all. Variations in documentation practices between providers can affect the consistency and completeness of the data. Nonetheless, standardized abstraction methods were applied to ensure consistency across cases.

Third, our cost analysis primarily reflects direct healthcare expenditures, such as ED visits, hospital admissions, imaging, laboratory tests, catheter supplies, and professional fees. While comprehensive in capturing institutional costs, this approach does not fully account for indirect economic impacts, such as lost productivity, out-of-pocket expenses, or diminished QoL. The true cost burden is likely greater than reported, reinforcing the urgency of addressing delayed care.

Fourth, the study was conducted at a single tertiary care center, which may affect the generalizability of our findings to other healthcare settings with different resource availability and wait time policies; however, our center is one of the few tertiary centers in Canada currently performing HoLEP, with all surgeons who regularly manage BPH being HoLEP-trained and actively performing the procedure. As such, differences in wait times were not driven by surgeon availability but rather by system-level factors, such as OR access and institutional resources. Given that most centers in Ontario and Quebec do not offer HoLEP as a treatment option, our data provide important insight into the Canadian context and remain valuable for informing both institutional planning and future multicentre evaluations.

Finally, we did not have data on the number of patients without UR who underwent HoLEP during the study period, limiting our ability to compare the experiences of UR and non-UR patients. This may provide additional context for interpreting our findings.

Future multicenter, prospective studies are warranted to assess the cost-effectiveness of earlier intervention and to include patient-centered outcomes to help guide strategies to improve the efficiency of care delivery in this population.

CONCLUSIONS

Extended wait times for HoLEP surgery result in significant healthcare costs and complications for BPH-related UR patients. Our study highlights opportunities to reduce delays through system-level strategies, such as expanding surgical capacity, optimizing scheduling, and incorporating MISTs for appropriately selected patients. Improving patient education and ensuring earlier referral for definitive management may also mitigate complications associated with prolonged catheterization. Our findings thus highlight the need to improve access to timely surgical care and adapt treatment pathways to the growing burden of BPH.

COMPETING INTERESTS: Dr. Aubé-Peterkin has received honoraria from AMT Surgical and Laborie. The remaining authors have no competing personal or financial interests to disclose.

This paper has been peer-reviewed.

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