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RESEARCH

Influence of preoperative indwelling urinary catheter on outcomes of high-power holmium laser enucleation for very large prostate (≥ 200 mL)

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Abstract

Purpose to evaluate the impact of Indwelling Urinary Catheters (IUC) on perioperative and functional outcomes, as well as the safety profile, of High-Power HoLEP for the treatment of prostate gland volumes exceeding 200 cc.

Methods A retrospective analysis was conducted on 237 patients with prostate volumes > 200 cc who underwent HoLEP between January 2016 and December 2022. Patients were included based on specific criteria, such as an International Prostate Symptom Score (IPSS) > 7 and a maximum urinary flow rate (Qmax) < 15 mL/s. Patients were categorized into two groups: Group 1 included those with IUC prior to surgery, while Group 2 comprised patients without it.

Results A total of 237 patients with prostate volumes exceeding 200 cc underwent HoLEP, and were categorized into Group 1 ($n = 63$) and Group 2 ($n = 174$), with Group 1 exhibiting higher Charlson Comorbidity Index and BMI. Postoperative outcomes indicated a higher incidence of urinary tract infections in Group 1, as well as worse IPSS, Qmax, and PVR at 3 months; however, by the 1-year follow-up, both groups demonstrated comparable results. Longitudinal analysis revealed that both groups experienced significant functional and symptomatic improvements over time, with Group 2 showing rapid early gains that stabilized, whereas Group 1 exhibited continuous improvement from 3 months to 1 year.

Conclusion HoLEP is an effective treatment for very large prostate volumes in patients with IUC. Although these patients are at a higher risk for UTI and initial lower Qmax, these outcomes improve by one year.

Keywords BPH · High-power holep · Indwelling urinary catheter · Very large prostate

Introduction

Very large prostate volumes, though not uniformly defined in the literature, present a significant challenge in surgical management of benign prostatic hyperplasia (BPH), with an increasing prevalence among referred patients [1]. Additionally, these patients often present with more severe symptoms, a heightened risk of BPH-related complications, and an increasing incidence of adverse outcomes associated with advanced BPH [2]. In particular, there is an increased risk of acute urinary retention (AUR), which may necessitate the placement of an indwelling urinary catheter (IUC), thereby leading to a higher risk of psychological distress, urinary tract infections (UTIs), and mortality [3]. This highlights the critical need for effective, tailored treatment strategies for these men.

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Historically, open simple prostatectomy (OSP) has been the preferred surgical option for large prostatic volumes. Despite its excellent functional outcomes, OSP is associated with significant morbidity, longer recovery times, and a higher incidence of complications [4]. As a result, there is an increasing shift toward minimally invasive techniques, with holmium laser enucleation of the prostate (HoLEP) emerging as a widely recognized and preferred endoscopic treatment for BPH, particularly in patients with prostate volumes exceeding 80 mL, offering comparable efficacy with fewer adverse effects [5]. Even in patients with a history of AUR, HoLEP remains a highly effective and durable therapeutic intervention, ensuring favorable clinical outcomes and providing immediate improvements in quality of life and voiding parameters [6]. Furthermore, HoLEP is an effective treatment for patients with an IUC, achieving high catheter removal success rates and excellent functional outcomes, with no adverse impact on functional outcomes compared to patients with LUTS alone [7].

Although evidence supporting this technique is growing, its role in treating very large prostates remains an area of ongoing research, with limited high-level data on surgical outcomes for prostates larger than 200 cc [8]. Thus, this study aims to assess the perioperative and functional outcomes, as well as the safety profile, of High-Power HoLEP in the treatment of prostate gland volumes exceeding 200 cc, evaluating the impact of a preoperative indwelling bladder catheter.

Methods

Patient selection

A retrospective analysis was performed on the medical records of all patients who underwent HoLEP at a single institution between January 2016 and December 2022. The procedure was performed by six experienced surgeons, each with prior experience of performing over 100 HoLEP procedures. The inclusion criteria comprised a prostate volume greater than 200 cc, a maximum urinary flow rate (Qmax) of less than 15 mL/s, and an International Prostate Symptom Score (IPSS) above 7. Patients with incomplete data, Qmax greater than 15 mL/s, an IPSS score below 7, and previous neurogenic etiology such as uncontrolled diabetes mellitus (HbA1c > 7), stroke (recent event or sequelae), parkinsonism, previous spinal surgery, or pelvic surgery were excluded.

We selected a threshold of 200 mL to define a very large prostate, as it represents the upper limit in the literature and has been utilized in several studies [4, 9, 10].

Collected data included demographic, functional, and pathological characteristics, such as age, total serum PSA level, prostate volume, IPSS, uroflowmetry parameters, presence of a preoperative indwelling bladder catheter, bladder stones, and any history of medical or surgical treatment for BPH. Preoperative prostate volume was measured through imaging techniques, including transrectal ultrasonography or magnetic resonance imaging (in cases where prostate cancer was suspected) (Fig. 1). Prostate volume calculations were performed using the ellipsoid formula (Height × Width × Length × 0.52), based on imaging conducted within six months prior to surgery. Prostate cancer was ruled out with a pre-HoLEP prostate biopsy in suspicious cases.

A preoperative assessment for the presence of a urinary tract infection is conducted in every patient through urine culture 7 days before surgery. In the case of a positive result, antibiotic treatment was administered based on the antibiogram. In case of negative urine culture, prolonged antibiotic prophylaxis was administered with either Amoxicillin and Clavulanic Acid (1 g, one tablet three times daily for six days) or Ciprofloxacin (500 mg, one tablet twice daily for five days).

Intraoperative and perioperative data were also collected, including overall operative time (OT) (defined as the duration from the initiation of cystoscopy to the insertion of the urinary catheter)., enucleation time (ET), length of hospital stay (LOS), time to catheter removal, and complications within 30 days post-surgery. Morcellation time was not gathered. Early complications (within 30 days) were classified according to the Clavien-Dindo (CD) grading system [11]. Urinary tract infection (UTI) was defined as an increase in body temperature of ≥38 °C requiring intravenous antibiotics with positive urine culture.

Follow-up assessments, including IPSS and micturition parameters, were scheduled at 3 months, 1 year, and annually thereafter. Urinary incontinence was also assessed and described as any reported instance of urine leakage, based on patient accounts, and categorized into three types: (i) urge incontinence, characterized by the involuntary loss of urine triggered by a sudden, strong need to urinate; (ii) stress incontinence, involving involuntary urine loss during physical effort, exertion, sneezing, or coughing; and (iii) mixed incontinence, which combines symptoms of both stress and urge urinary incontinence [12].

Patients were subsequently divided into two groups: Group 1 consisted of individuals who had an indwelling urinary catheter (IUC) prior to surgery, while Group 2 included those who did not. There was no patient on clean intermittent catheterization (CIC).

Formal ethics committee approval was deemed unnecessary for this type of study in our center because retrospective

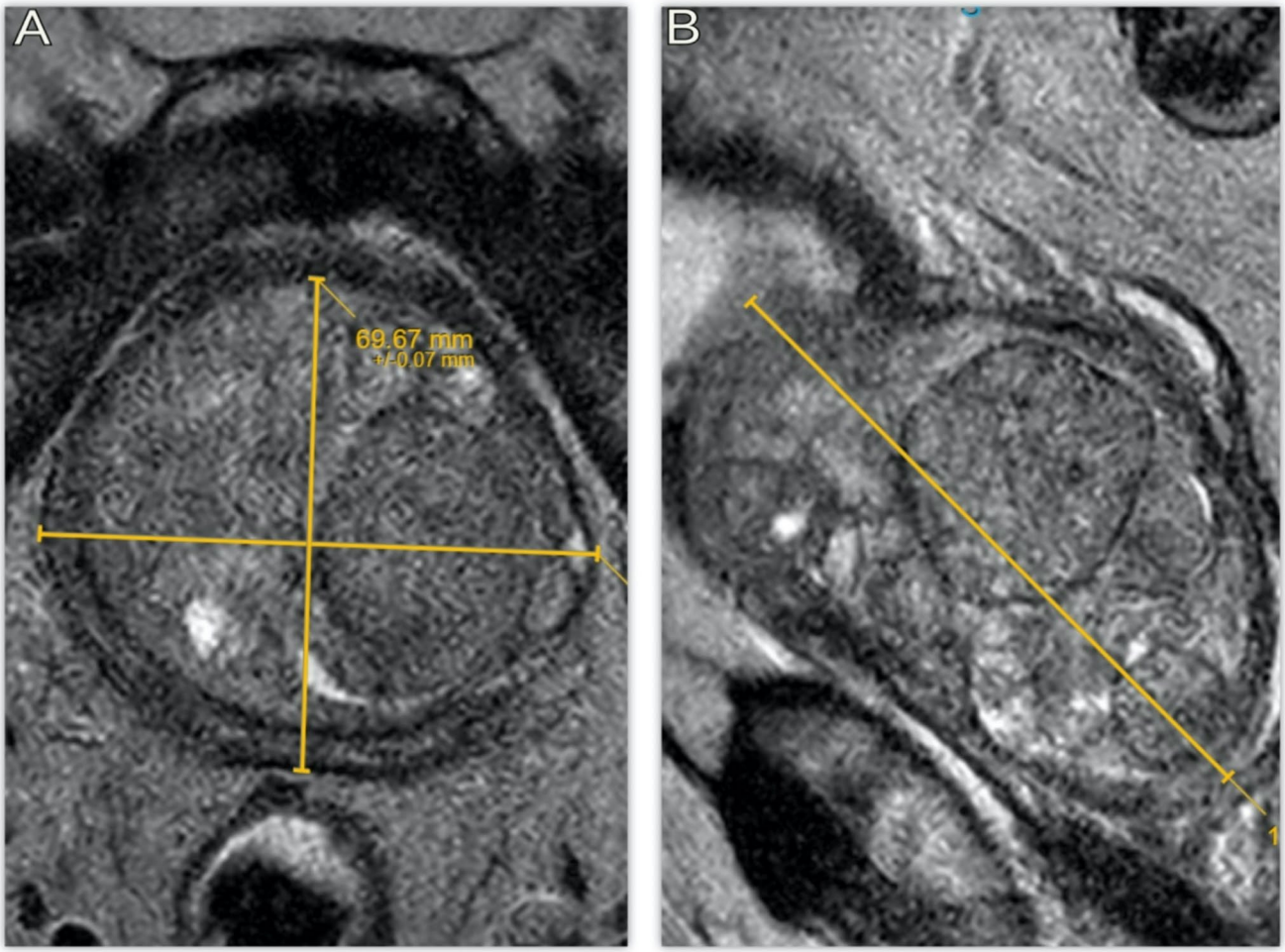

Fig. 1 Magnetic Resonance Imaging in the transverse (**A**) and sagittal (**B**) planes of a patient with a prostate volume exceeding 200 cc

data collection was obtained for clinical purposes, and all the procedures were performed as part of routine care. All patients provided written informed consent for the collection of their anonymized data.

All procedures adhered to the ethical standards of the institutional and national research committees, as well as the 1964 Helsinki Declaration and its subsequent amendments or equivalent ethical guidelines.

Surgical technique

All HoLEP procedures were performed following either the three-lobe enucleation technique described by Dr. P. J. Gilling and colleagues [10] or the two-lobe technique. The equipment utilized included a 120 W Holmium laser (Lumenis Inc®, Palo Alto, CA, USA) with a reusable 550-nm laser end-fire fiber, a 26-Fr continuous flow resectoscope (Storz®), a 27-Fr nephroscope with a 5-mm working channel, and a morcellator (Versacut, Lumenis® Inc). The laser settings were configured to 2 J and 50 Hz for enucleation and 1.5 J and 40 Hz for hemostasis.

In cases where lobulated adenoma tissue (referred to as "beach-balling") could not be adequately morcellated, monopolar resection was employed to fragment the remaining tissue. At the end of the procedure a 3-way bladder catheter with continuous irrigation was placed and left until became clear.

Statistical analysis

Quantitative variables were described using means and standard deviations. Categorical variables were presented as absolute numbers and percentages. Continuous variables with a normal distribution were compared using independent samples t-tests. Categorical variables were analyzed using chi-square tests to assess the independence of measures. Changes in functional outcomes and IPSS during follow-up were evaluated using the Wilcoxon test. A p-value less than 0.05 was considered statistically significant. Statistical

Table 1 Patients' baseline demographics and characteristics

Variable	*Group 1* *N = 63*	*Group 2* *N = 174*	*P value*
Age, *years*	67.7 (13.4)	69.6 (10.7)	0.29
Body Mass Index, *kg/m²*	27.9 (4.2)	25.9 (3.2)	**0.03**
ASA Score			
1	21 (33.3)	65 (37.4)	0.57
2	34 (54.0)	81 (46.6)	0.31
3	8 (12.7)	28 (16.1)	0.52
Charlson Comorbidity Index	4.2 (1.3)	3.8 (1.5)	**0.02**
Surgery with ongoing anticoagulant/antiplatelet, n (%)			0.11
Yes	18 (28.6)	33 (19.0)	
No	45 (71.4)	141 (81.0)	
Duration of preoperative indwelling catheter, *months*	3.2 (1.7)	-	-
Pre-operative positive urine culture, n (%)	30 (47.6)	64 (36.7)	0.13
Prostate volume, ml	260.5 (39.4)	251.0 (36.6)	0.09
Preoperative PSA, ng/ml	3.4 (1.5)	3.1 (1.4)	0.16
Preoperative IPSS	-	22.2 (4.3)	-
Preoperative Q max, ml/s	-	10.1 (2.6)	-
Preoperative PVR, ml	-	81.8 (24.5)	-

ASA: American Society of Anesthesiologists; IUC: Indwelling Urinary Catheterization; PSA: Prostate-specific antigen; IPSS: International Prostate Symptom Score; Q max: The maximum urinary flow rate; PVR: Post-void Residual.

Table 2 Perioperative characteristics and Follow-Up analysis of patient symptoms and micturition variables

Variable	*Group 1* *N = 63*	*Group 2* *N = 174*	*P value*
Operative time, minutes	94.2 (13.5)	91.9 (16.3)	0.31
Enucleation type, n (%)			0.57
3 lobes	25 (39.7)	62 (35.6)	
2 lobes	38 (60.3)	112 (64.4)	
Electrocautery after enucleation, n (%)	7 (11.1)	14 (8.1)	0.46
Enucleation time, minutes	69.2 (13.3)	68.5 (12.6)	0.72
Adenoma not amenable for morcellation, requiring monopolar resection, n (%)	3 (4.7)	4 (2.3)	0.32
Cystolithotomy for adenoma extraction, n (%)	1 (1.6)	1 (0.6)	0.45
Length of Hospital stay, days	2.5 (0.8)	2.3 (0.8)	0.23
Time To Urethral Catheter Removal, days	2.3 (0.9)	2.1 (0.7)	0.1
Histologic findings, n (%)			0.73
Incidental prostate cancer	4 (6.3)	9 (5.2)	
Benign prostatic tissue	59 (93.7)	165 (94.8)	
3 month-Postoperative IPSS *	11.3 (2.4)	10.5 (2.3)	**0.02**
3 month -Postoperative Q max *, ml/s	22.4 (4.4)	24.4 (5.3)	**0.01**
3 month - Postoperative PVR *, ml	23.8 (8.1)	19.6 (6.5)	**< 0.001**
1 year-Postoperative IPSS $^{\Delta}$	7.1 (3.2)	6.6 (1.9)	0.13
1 year-Postoperative Q max $^{\Delta}$, ml/s	24.7 (3.2)	25.2 (3.3)	0.33
1 year- Postoperative PVR $^{\Delta}$, ml	19.4 (6.6)	18.3 (6.7)	0.35

IPSS: International Prostate Symptom Score; Q max: The maximum urinary flow rate; PVR: Post-void Residual.

** Data were available for 63 patients in Group 1 and 172 patients in Group 2*

$^{\Delta}$Data were available for 58 patients in Group 1 and 165 patients in Group 2

analyses were performed using the IBM SPSS software package version 26.0 (IBM Corp., Armonk, NY).

Results

A total of 237 patients were included in the final analysis. Of these, 63 patients were allocated to Group 1, and 174 to Group 2. Baseline demographics and characteristics associated with BPH are summarized in Table 1.

Group 1 exhibited significantly higher CCI (4.2 vs. 3.8, $p = 0.02$) and BMI (27.9 vs. 25.9, $p = 0.03$) compared to Group 2. In contrast, no significant differences were observed between the groups in preoperative prostate volume or preoperative PSA levels and mean age.

Operative characteristics are presented in Table 2. There was no significant differences between the groups in OT, ET, enucleation type, LOS, or time to urethral catheter removal. However, as shown in Table 3, there was a significant higher incidence of postoperative UTIs in Group 1 compared to Group 2 (12.7% vs. 4.3%, $p = 0.02$). The rates

Table 3 Postoperative complications and urinary incontinence in patients with prostate volume over 200 cc who underwent holmium laser enucleation of the prostate (HoLEP)

Variable	*Group 1* *N = 63*	*Group 2* *N = 174*	*P value*
Perioperative complications, *n* (%)			
Urinary tract infection (CD 2)	8 (12.7)	7 (4.3)	**0.02**
Acute urinary retention within 24 h (CD 2)	5 (7.9)	9 (5.2)	0.43
Blood transfusion (CD2)	4 (6.3)	9 (5.2)	0.72
Postoperative bleeding needing endoscopic re-surgery (CD 3)	1 (1.6)	4 (2.3)	0.74
Sepsis requiring Intensive Care Unit admission (CD 4)	1 (1.6)	1 (0.6)	0.45
3-Month Postoperative urinary incontinence			
Urge	3 (4.8)	5 (2.9)	0.47
Stress	5 (7.9)	16 (9.2)	0.76
Mixed	0 (0)	5 (2.9)	0.17
1-Year Postoperative urinary incontinence			
Urge	0 (0)	2 (1.2)	0.39
Stress	4 (6.3)	7 (4.0)	0.45
Mixed	0 (0)	1 (0.6)	0.55

CD: Clavien Dindo; ICU: Intensive Care Unit

of other complications were similar between the groups. Importantly, postoperative urinary incontinence rates at 3 months and 1 year did not differ significantly between the groups. After 1 year from surgery, no patient required CIC or IUC in both groups.

At the 3-month follow-up, Group 1 demonstrated higher PVR (23.8 mL vs. 19.6 mL, $p<0.001$) and IPSS (11.3 vs. 10.5, $p=0.02$) and lower Qmax (22.4 mL/s vs. 24.4 mL/s, $p=0.01$) compared to Group 2. However, by the 1-year follow-up, no significant differences were observed between the groups in all outcomes.

Analysis of longitudinal changes within the groups revealed that Group 1 demonstrated significant improvements in IPSS (11.3 vs. 7.1, $p<0.001$), Qmax (22.4 mL/s vs. 24.7 mL/s, $p<0.001$), and PVR (23.8 mL vs. 19.4 mL, $p<0.001$) from the 3-month to the 1-year follow-up. In Group 2, significant improvements were observed at 3 months for IPSS (22.2 vs. 10.5, $p<0.001$), Qmax (10.1 mL/s vs. 24.4 mL/s, $p<0.001$), and PVR (81.8 mL vs. 19.6 mL, $p<0.001$), with these values remaining stable through the 1-year follow-up, except for further reduction of IPSS (10.5 vs. 6.6, $p<0.001$) (Table 4). No patient required surgery for residual adenoma within 12 months of HoLEP.

Discussion

According to international guidelines, HoLEP is considered among first-line treatment for prostate volume larger than 80 cc, with no defined upper size limit, as the procedure is considered size-independent [8]. However, as prostate size exceeds 200 cc, surgical expertise and technique become critical determinants of perioperative and postoperative outcomes because endoscopic management of mega prostates presents significant challenges [13]. *In this analysis, high-power HoLEP demonstrated an overall adequate safety and efficacy profile but according to the literature, no significant differences have been observed between low-power and high-power HoLEP in terms of surgical time, surgical efficiency, and postoperative complications* [14]. *However, a recent randomized controlled trial reported that, despite similar perioperative outcomes, patients with large prostate glands experienced a significantly longer lasing time ($p<0.001$) and required a greater volume of irrigation fluid ($p<0.001$)* [15]. *Therefore, it is plausible that high-power settings may be more advantageous for very large prostates.*

An important consideration for patients with large prostates is the high prevalence of preoperative catheter dependence due to urinary retention. HoLEP has emerged as a valuable surgical intervention, effectively alleviating obstructive symptoms while also facilitating the removal of indwelling catheters, thus offering a potential pathway to restore micturition in nearly all cases [16]. A meta-analysis indicated that transurethral intervention should be offered to patients with urinary retention, although their recovery may initially be slower compared to those not requiring a catheter, although outcomes tend to equalize within 6 to 12 months [17]. This finding was in line with our study where patients in Group 1 significantly improved their Qmax at

Table 4 Variations in the international prostate symptom score (IPSS), maximum urinary flow rate (Qmax), and postvoid residual urine (PVR) at the 3-month (3MPO) and 1-year (1YPO) postoperative follow-up assessments

Variable	Baseline	3MPO	Baseline-3MPO *p* value	1YPO value	3MPO-1YPO p value
Group 1					
IPSS	-	11.3 (2.4)	-	7.1 (3.2)	**<0.001**
Qmax, *ml/s*	-	22.4 (4.4)	-	24.7 (3.2)	**<0.001**
PVR, *ml*	-	23.8 (8.1)	-	19.4 (6.6)	**<0.001**
Group 2					
IPSS	22.2 (4.3)	10.5 (2.3)	**<0.001**	6.6 (1.9)	**<0.001**
Qmax, *ml/s*	10.1 (2.6)	24.4 (5.3)	**<0.001**	25.2 (3.3)	0.08
PVR, *ml*	81.8 (24.5)	19.6 (6.5)	**<0.001**	18.3 (6.7)	0.07

1 year as compared to 3-month follow-up. Conversely, the improvement was not significant in Group 2 patients. This finding could also be explained with a longer time required to improve strengthens by the detrusor of patients on preoperative retention. Another reason behind this could be the delay in surgery for patients on retention. In fact, a study comparing two patient groups with differing rates of preoperative catheter dependence (72.1% vs. 44.6%) suggested that the higher proportion of catheter-dependent patients in the group with larger prostates may be attributed to delays in surgical consultations, likely stemming from a tendency to prolong medical therapy to avoid what is perceived as high-risk surgery [18]. Notably, despite these delays, catheter-free rates at three months for men previously reliant on catheters exceeded 98% in both groups. A prospective study of 500 patients demonstrated that HoLEP achieved catheter-free rates exceeding 98.5% at three months in AUR patients without preoperative urodynamic studies, while the initial trial without catheter was significantly more likely to fail in patients with non-neurogenic chronic urinary retention (NNCUR) compared to those with AUR [19]. Even at the one-year follow-up, patients with AUR exhibited a recatheterization rate of 0%, compared to 5.9% in those with NNCUR, with no significant differences observed relative to patients who underwent HoLEP for LUTS [7]. Similarly, in a retrospective bicentric study of patients undergoing endoscopic surgery, older individuals demonstrated catheter-free rates comparable to their younger counterparts (3% vs. 0%, $p=0.2$) [20]. In our cohort, all patients remained catheter-free one year after the procedure, further confirming the effectiveness of HoLEP in relieving bladder outlet obstruction, with no significant differences in functional outcomes compared to patients treated for LUTS at twelve months postoperatively. These findings underscore HoLEP as a highly effective treatment for restoring normal urinary function, even in men with a preoperative indwelling catheter.

In very large prostates the increased vascular density in large prostates can elevate the risk of intraoperative bleeding, complicating the distinction of the surgical capsule [21]. This heightened vascularity makes identifying true capsular planes during enucleation more challenging, requiring more extensive hand movements and greater surgical precision than with smaller prostates, where the tissue volume is more manageable. Additionally, enucleating large prostates may necessitate prolonged and intensified mechanical maneuvers, which heightens the risk of urethral mucosal trauma and subsequently increases the likelihood of complications [22]. Subsequently, blood transfusion considerations are critically important. The correlation between increased prostate volume and a higher number of bleeding vessels can be attributed to the greater surface area and vascular density necessary to support larger prostates [22]. Consequently, achieving hemostasis presents greater challenges in these patients, despite the inherent hemostatic capabilities of laser technology. However, Zell et al. reported a transfusion rate of 21.6% for patients with prostate volumes between 200 and 299 cc, compared to only 8.3% for those with prostate volumes exceeding 300 cc [9]. In our analysis, we observed a low blood transfusion rate of 6.3% in men with a preoperative indwelling catheter and 5.2% in those without. These findings are consistent with a retrospective analysis by Krambeck et al., which documented a transfusion rate of 3.5% among patients with prostate volumes greater than 175 cc [23]. Therefore, our findings show that in hands of experienced surgeons the procedure can be performed even in such very large prostate with minimal complications. In fact, our transfusion rate was low and in line with previous studies. Interestingly, we found no difference on transfusion rate between the groups highliting that the inflammation commonly found in patients having a preoperative catheter did not increase the transfusion rate.

While HoLEP demonstrates excellent outcomes in terms of postoperative recovery, it is associated with specific risks, particularly in patients with very large prostate glands. During the 30-day postoperative period, UTIs emerged as the most prevalent complication, occurring in 8% of cases. A prospective study indicated a 34.9% incidence rate of postoperative UTIs following transurethral prostate surgery, revealing an association with prolonged operation time and noting that neither the type nor the duration of prophylactic antibiotics affected the rate of infectious complications [24]. Our analysis showed a higher occurrence of postoperative UTIs in patients with IUC despite similar antibiotic prophylaxis for both groups. These findings are consistent with the understanding that biofilms, which are clusters of microorganisms encased in an extracellular matrix primarily composed of polysaccharides, form on both the internal and external surfaces of urinary catheters shortly after insertion [25]. Additionally, an analysis by Sopeña-Sutil et al. identified the presence of an IUC as a significant risk factor for UTIs following transurethral surgery, reporting an OR of 2.6 ($p<0.001$) [26]. Therefore, meticulous preoperative management, including urine culture and, when necessary, antibiotic therapy, is essential to minimizing the persistence of these infections in the postoperative period for patients at high risk of UTIs, such as diabetic patient, and those with a preoperative indwelling bladder catheter.

Urinary incontinence remains a significant clinical concern following HoLEP for treating very large prostates, with reported incidence rates ranging from 3.4 to 33.3% in patients with prostate volumes exceeding 200 ml [27]. This variability in UI rates across studies may partly stem from inconsistent reporting of preoperative continence status,

alongside variations in surgical techniques and surgeon experience. A retrospective analysis using binary logistic regression on preoperative multiparametric MRI identified posterior wall thickness of the membranous urethral sphincter, as well as overlap between the prostatic apex and membranous urethra, as independent risk factors for stress urinary incontinence [28]. Additionally, Fan et al. reported that prolonged operative time is associated with an increased risk of stress urinary incontinence, though no correlation was observed with prostate or enucleated adenoma volume, indicating that HoLEP can be a safe procedure even for very large glands [28]. Nevertheless, it is also crucial to differentiate between persistent and transient urinary incontinence: while the incidence of persistent incontinence following AEEP remains relatively low (1–5%), transient incontinence—predominantly stress-related—appears more common than with TURP and may be linked to factors such as patient age, Qmax, preoperative PVR, and OT [29]. In our analysis, urinary incontinence was observed in 14.3% of patients at one month, with a marked predominance of the stress variant (10%). Follow-up data indicated a gradual decline to 4.2% by twelve months, suggesting that HoLEP may present a risk of transient urinary incontinence that typically improves over time.

The Wilcoxon test demonstrated significant improvements in both IPSS and Qmax during follow-up in both groups, while similar values were observed at the 1-year mark. Likewise, a reduction in PVR was noted, further highlighting the efficacy of HoLEP in enhancing bladder emptying. While robotic-assisted simple prostatectomy (RASP) has gained recognition as an effective treatment for large prostates unresponsive to medical therapy, comparisons between RASP and HoLEP reveal that, despite both procedures achieving similar prostate specimen weights, HoLEP consistently demonstrates superior outcomes in terms of shorter operative times, reduced transfusions, and shorter hospital stays and catheterization durations [30]. A multicenter study by Fuschi et al. confirmed that while HoLEP and RASP yield comparable functional outcomes for prostates measuring ≥ 120 ml, HoLEP is associated with quicker recovery and shorter hospitalizations [31]. Furthermore, Zhang et al.'s comparative analysis highlighted HoLEP's advantages across multiple postoperative metrics, such as operative time and hospitalization duration, which align with earlier research underscoring its benefits in recovery and complication rates [32]. Although RASP remains a viable alternative, HoLEP consistently proves to be the more efficient option for postoperative recovery.

This study is not without limitations. Firstly, the retrospective design of this investigation imposes inherent limitations on establishing causal relationships and controlling for potential confounding factors and missing data, particularly those associated with urodynamic studies. However, preoperative and postoperative patient management was standardize potentially limiting the same. Secondly, a potential limitation of this study is that patients with an IUC had higher CCI and BMI, which may introduce selection bias and influence the observed outcomes. Moreover, the findings may be constrained by the experience of a single center, and the study may be subject to selection bias. Nevertheless, it is noteworthy that the procedures were conducted by multiple operators who, despite proficient in HoLEP, had with varying levels of expertise, potentially introducing additional variability. Finally, the study lacks data on prostate cancer follow-up.

Conclusion

This study demonstrates that HoLEP is a safe and effective procedure for patients with and without an IUC and prostate volumes exceeding 200 cc. However, urologists should exercise caution when performing enucleation in patients with IUC and very large prostates due to an increased risk of postoperative UTIs. Additionally, the presence of an IUC is associated with longer recovery of micturition and symptoms, although these effects are not sustained at the one-year follow-up.

Author contributions MT: manuscript writing, Data collection, CG: project development, manuscript writing, and analysis. AP: Data collection and analysis. FM: Data collection. RO: Data collection. SDP: Data Analysis. CI: Manuscript editing. DC: Data analysis and Manuscript Editing. TH: Manuscript editing. VG: Manuscript editing. AC: Project development and manuscript editing.

Data availability The dataset used in this study is available upon request from the corresponding author.

Declarations

Competing interests The authors declare no competing interests.

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