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Article

The Effects of Preoperative Bowel Function on Lower Urinary Tract Symptoms After Holmium Laser Enucleation of Prostate (HoLEP): A Prospective Study

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Abstract

Background/Objectives: Variations in urinary symptom improvement after benign prostatic hyperplasia (BPH) surgery remain incompletely characterized. Preoperative factors, including bowel dysfunction, may influence postoperative recovery. We evaluated the association between baseline bowel function and urinary outcomes after holmium laser enucleation of the prostate (HoLEP), hypothesizing that worse baseline constipation would be associated with poorer outcomes. **Methods:** A prospective cohort study of patients undergoing HoLEP by a single surgeon at a high-volume center (December 2023–September 2024) was performed. Patients with neurogenic bladders, bowel disorders, or diabetes mellitus were excluded. Baseline bowel function was assessed using the Constipation Scoring System (CSS) and Vaizey Incontinence Score (VIS). The primary outcomes were 3-month changes in International Prostate Symptom Score (IPSS) and Michigan Incontinence Severity Index (MISI). Associations were evaluated using Spearman correlation and multivariable linear regression. **Results:** Among 102 patients (median age of 71.6 years), 81 (79.4%) completed follow-up. The median prostate size was 90.5 cc, and 50% had prior urinary retention. The baseline CSS and VIS were low. IPSS, quality of life, and MISI bother improved postoperatively, while MISI severity showed minimal change. Higher CSS correlated with higher VIS ($p < 0.001$). Baseline CSS and VIS were not associated with changes in IPSS, quality-of-life (QoL), or MISI bother. Baseline VIS was associated with modest improvement in MISI severity (β −1.14, $p = 0.01$). **Conclusions:** Baseline bowel function was not associated with urinary symptom improvement after HoLEP. However, preoperative fecal incontinence was associated with improvement in urinary incontinence severity.

Keywords: holmium laser enucleation of the prostate; benign prostatic hyperplasia; lower urinary tract symptoms

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1. Introduction

Holmium laser enucleation of the prostate (HoLEP) has emerged as a durable and size-independent surgical option for symptomatic benign prostatic hyperplasia (BPH), offering excellent long-term functional outcomes for lower urinary tract symptoms (LUTS) [1].

Despite these advantages, postoperative recovery of urinary symptoms—particularly irritative symptoms and incontinence—varies substantially. Given the shared pelvic floor musculature and close innervation of the anal and urethral sphincters, preoperative bowel dysfunction may contribute to variation in postoperative urinary recovery. Rectal distention places direct pressure on the posterior bladder wall leading to detrusor overactivity or impaired bladder emptying. Moreover, there are similarities in voiding and elimination with regard to contraction and relaxation of the pelvic floor muscles. Few studies have investigated the association between preoperative bowel function and urinary symptom recovery after HoLEP. Our research group previously found in a retrospective analysis that patients with a diagnosis of Irritable Bowel Syndrome (IBS) required higher rates of anticholinergic medication use and had a higher frequency of provider interactions post-HoLEP, compared to men without IBS [2]. In this study, we prospectively evaluated the relationship between preoperative bowel function and urinary symptom profile after HoLEP in men without diagnoses of neurologic or gastrointestinal disorders. We hypothesized that patients with poor baseline bowel function, particularly those with more severe constipation, would have worse reported urinary outcomes compared to patients with better bowel function scores.

2. Materials and Methods

2.1. Study Design and Patient Population

This was a prospective study of patients undergoing HoLEP performed by a single high-volume surgeon at a tertiary academic medical center between December 2023 and September 2024. Patients were eligible for inclusion if they underwent HoLEP for symptomatic BPH and completed preoperative bowel and urinary questionnaires (Vaizey Incontinence Score (VIS) and Constipation Scoring System (CSS)). We enrolled males with BPH undergoing HoLEP who had the capacity to review and understand questionnaires and who consented to the study. The exclusion criteria included neurologic disease affecting bowel or bladder function, prior bowel surgery, concurrent urologic procedures at time of HoLEP including bladder botox, and patients with prior radiation or bladder cancer. Patients with indwelling catheters were included, as a considerable portion of patients interested in HoLEP at our institution are catheter-dependent.

2.2. Preoperative Assessment

Preoperative bowel function was assessed using two validated instruments: the CSS, to evaluate stool frequency, difficulty, duration, and need for assistance; and the VIS, to quantify the severity of fecal incontinence [3,4]. The Cleveland Clinic CSS grades constipation severity on a 0–30 (30 being severe constipation) scale, with a cutoff score of 15 suggesting clinically significant constipation [4]. Similarly, fecal incontinence severity can be measured using the validated St. Mark's VIS on a scale of 0–24, with 24 indicating complete fecal incontinence [3].

Urinary symptoms were assessed pre- and postoperatively using the International Prostate Symptom Score (IPSS), including the quality-of-life (QoL) question, and the Michigan Incontinence Severity Index (MISI). Patients were not specifically counseled on preoperative bowel regimen nor tracked as to whether they used a bowel regimen at home.

2.3. Outcomes

The primary outcomes were changes in the IPSS total score and MISI severity score at 3 months postoperatively. The secondary outcomes included changes in IPSS QoL and MISI bother scores.

2.4. Statistical Analysis

Continuous variables were summarized using medians and interquartile range (IQRs). Spearman correlation coefficients were used to assess associations between preoperative bowel function scores and postoperative changes in urinary outcomes. Multivariable linear regression models were constructed to evaluate the independent association between bowel function scores and urinary outcomes, controlling for age, body mass index (BMI), prostate size, history of urinary retention, stricture, and prostatitis, American Society of Anesthesia (ASA) score, and deep vein thrombosis/pulmonary embolism (DVT/PE). Statistical significance was defined as $p < 0.05$. Statistical analysis was performed with IBM SPSS for Windows version 29 (SPSS Inc., Chicago, IL, USA). This study was approved by the Institutional Review Board (Study number: STU00220105, 5 October 2023).

3. Results

3.1. Study Cohort

A total of 102 patients were enrolled, of whom 81 completed 3-month postoperative follow-up and were included in the final analysis. The median age was 71.6 (66.7–77.8) years, median preoperative prostate size was 90.5 cc (55.3–137.3) and 51 (50%) patients had history of prior urinary retention (Table 1). There were no significant differences in baseline characteristics between patients who completed the 3-month follow-up surveys and those who were lost to follow-up.

Table 1. Baseline characteristics.

Characteristic	Overall N = 102 [1]	No Follow-Up N = 21 [1]	Completed N = 81 [1]	*p*-Value [2]
Age, years	71.6 (66.7–77.8)	69.9 (62.9–79.2)	71.7 (67.5–77.3)	0.9
BMI, kg/m^2	26.0 (23.7–29.0)	25.5 (22.4–29.3)	26.3 (24.7–28.9)	0.3
Prostate size, cc	90.5 (55.0–139.0)	96.0 (70.0–117.6)	87.0 (54.0–141.0)	0.7
ASA score				0.083
1	1 (1.0%)	0 (0.0%)	1 (1.2%)	
2	57 (55.9%)	16 (76.2%)	41 (50.6%)	
3	44 (43.1%)	5 (23.8%)	39 (48.1%)	
History of urinary retention	51 (50.0%)	13 (61.9%)	38 (46.9%)	0.2
Foley-dependent	21 (20.6%)	5 (23.8%)	16 (19.8%)	0.8
History of UTI	23 (22.5%)	5 (23.8%)	18 (22.2%)	>0.9
History of prostatitis	5 (4.9%)	1 (4.8%)	4 (4.9%)	>0.9
History of urethral stricture	6 (5.9%)	1 (4.8%)	5 (6.2%)	>0.9
Preoperative IPSS total	18.0 (12.0–24.0)	14.0 (11.0–23.0)	20.0 (13.0–24.0)	0.2
Preoperative IPSS QoL				>0.9
2	4 (4.0%)	0 (0.0%)	4 (5.1%)	
3	14 (14.1%)	3 (14.3%)	11 (14.1%)	
4	38 (38.4%)	9 (42.9%)	29 (37.2%)	
5	30 (30.3%)	6 (28.6%)	24 (30.8%)	
6	13 (13.1%)	3 (14.3%)	10 (12.8%)	
Preoperative MISI severity	4.0 (2.0–8.0)	4.0 (3.0–8.0)	4.0 (1.0–8.0)	>0.9

Table 1. *Cont.*

Characteristic	Overall N = 102 [1]	No Follow-Up N = 21 [1]	Completed N = 81 [1]	*p*-Value [2]
Preoperative MISI bother				>0.9
0	38 (37.3%)	7 (33.3%)	31 (38.3%)	
1	14 (13.7%)	3 (14.3%)	11 (13.6%)	
2	21 (20.6%)	6 (28.6%)	15 (18.5%)	
3	10 (9.8%)	2 (9.5%)	8 (9.9%)	
4	11 (10.8%)	3 (14.3%)	8 (9.9%)	
5	4 (3.9%)	0 (0.0%)	4 (4.9%)	
6	2 (2.0%)	0 (0.0%)	2 (2.5%)	
7	2 (2.0%)	0 (0.0%)	2 (2.5%)	
Preoperative CSS total	2.0 (1.0–4.0)	2.0 (1.0–4.0)	2.0 (1.0–4.0)	0.6
Preoperative VIS total				0.4
0	54 (52.9%)	13 (61.9%)	41 (50.6%)	
1	19 (18.6%)	3 (14.3%)	16 (19.8%)	
2	13 (12.7%)	1 (4.8%)	12 (14.8%)	
3	6 (5.9%)	3 (14.3%)	3 (3.7%)	
4	5 (4.9%)	1 (4.8%)	4 (4.9%)	
5	2 (2.0%)	0 (0.0%)	2 (2.5%)	
6	3 (2.9%)	0 (0.0%)	3 (3.7%)	

[1] Median (Q1–Q3); n (%). [2] Wilcoxon rank-sum test; Fisher's exact test; Pearson's Chi-squared test. BMI: body mass index; ASA: American Society of Anesthesiologists; UTI: urinary tract infection; IPSS: International Prostate Symptom Score; QoL: quality-of-life; MISI: Michigan Incontinence Severity Index; CSS: Constipation Scoring System; VIS: Vaizey Incontinence Score.

3.2. Baseline Bowel and Bladder Symptoms

Preoperative CSS and VIS were overall low, at 2 (1–4) and 0 (0–2), respectively. The IPSS total QoL scores were 18 (12–23.75) and 4 (4–5). The MISI severity and bother scores were 4 (2–8) and 1 (0–3). On unadjusted analysis, baseline CSS and VIS were correlated ($\rho = 0.35$, $p < 0.001$) (Table 2). Internal consistency was observed within MISI domains, with strong correlations between baseline MISI severity and bother ($\rho = 0.63$, $p < 0.001$) and between changes in MISI severity and bother ($\rho = 0.57$, $p < 0.001$).

Table 2. Unadjusted Spearman correlations between baseline bowel function scores and changes in urinary and incontinence outcomes after HoLEP.

	VIS Total	Total CSS	MISI Severity	MISI Bother	Change in IPSS Total	Change in IPSS QoL	Change in MISI Severity	Change in MISI Bother
CSS Total	**0.35 ($p \leq 0.001$)**		0.08 ($p = 0.446$)	0.1 ($p = 0.325$)	−0.05 ($p = 0.671$)	0.03 ($p = 0.791$)	0.02 ($p = 0.859$)	0.01 ($p = 0.965$)
VIS Total		**0.35 ($p \leq 0.001$)**	**0.23 ($p = 0.022$)**	0.06 ($p = 0.55$)	−0.07 ($p = 0.506$)	0.03 ($p = 0.815$)	**−0.25 ($p = 0.025$)**	−0.11 ($p = 0.346$)
MISI Severity	**0.23 ($p = 0.022$)**	0.08 ($p = 0.446$)		0.63 ($p \leq 0.001$)	0.04 ($p = 0.742$)	**0.29 ($p = 0.011$)**	**−0.56 ($p \leq 0.001$)**	**−0.46 ($p \leq 0.001$)**
MISI Bother	0.06 ($p = 0.55$)	0.1 ($p = 0.325$)	**0.63 ($p \leq 0.001$)**		0.04 ($p = 0.744$)	**0.28 ($p = 0.014$)**	**−0.34 ($p = 0.002$)**	**−0.78 ($p \leq 0.001$)**
Change in IPSS Total	−0.07 ($p = 0.506$)	−0.05 ($p = 0.671$)	0.04 ($p = 0.742$)	0.04 ($p = 0.744$)		**0.47 ($p \leq 0.001$)**	0.16 ($p = 0.162$)	0.16 ($p = 0.162$)

Table 2. *Cont.*

	VIS Total	Total CSS	MISI Severity	MISI Bother	Change in IPSS Total	Change in IPSS QoL	Change in MISI Severity	Change in MISI Bother
Change in IPSS QoL	0.03 ($p = 0.815$)	0.03 ($p = 0.791$)	**0.29 ($p = 0.011$)**	**0.28 ($p = 0.014$)**	**0.47 ($p \leq 0.001$)**		0.14 ($p = 0.224$)	0.1 ($p = 0.374$)
Change in MISI Severity	**−0.25 ($p = 0.025$)**	0.02 ($p = 0.859$)	**−0.56 ($p \leq 0.001$)**	**−0.34 ($p = 0.002$)**	0.16 ($p = 0.162$)	0.14 ($p = 0.224$)		**0.57 ($p \leq 0.001$)**
Change in MISI Bother	−0.11 ($p = 0.346$)	0.01 ($p = 0.965$)	**−0.46 ($p \leq 0.001$)**	**−0.78 ($p \leq 0.001$)**	0.16 ($p = 0.162$)	0.1 ($p = 0.374$)	**0.57 ($p \leq 0.001$)**	

IPSS: International Prostate Symptom Score; QoL: quality-of-life; MISI: Michigan Incontinence Severity Index; CSS: Constipation Scoring System; VIS: Vaizey Incontinence Score; HoLEP: holmium laser enucleation of the prostate. Significant correlations are in bold.

3.3. Postoperative Urinary Symptoms

At 3 months post-HoLEP, urinary symptoms improved substantially: the median reductions in IPSS total and QoL scores were 13 (IQR 8–18) and 3 (IQR 2–4), respectively. MISI bother decreased by a median of 0.6 (IQR 0.2–1.0), while MISI severity showed minimal change, with a median increase of 0.04 (IQR −0.5–0.3).

On unadjusted analysis, CSSs and VISs were not significantly correlated with changes in IPSS total, IPSS quality of life, or MISI bother scores (Table 2). Baseline VIS modestly correlated with improvement in MISI severity ($\rho = -0.25$, $p = 0.025$), while CSS did not ($\rho = 0.02$, $p = 0.9$).

On multivariable linear regression analysis, only baseline VIS demonstrated a significant association, with a one-point increase in preoperative VIS associated with a one-point improvement in MISI severity ($\beta = -1.14$, $p = 0.01$) (Table 3).

Table 3. Multivariable analysis of bowel function and changes in urinary symptom scores.

Baseline Measure	Outcome Measure (Delta)	Beta	SE	*p*
CSS Total	**IPSS Total**	−0.62	0.4	0.12
VIS Total	**IPSS Total**	−0.8	0.65	0.22
CSS Total	**IPSS QoL**	0.02	0.08	0.75
VIS Total	**IPSS QoL**	0.01	0.12	0.95
CSS Total	**MISI Severity**	−0.08	0.3	0.79
VIS Total	**MISI Severity**	−1.14	0.45	0.01
CSS Total	**MISI Bother**	0.07	0.11	0.48
VIS Total	**MISI Bother**	−0.04	0.17	0.8

IPSS: International Prostate Symptom Score; QoL: quality-of-life; MISI: Michigan Incontinence Severity Index; CSS: Constipation Scoring System; VIS: Vaizey Incontinence Score; SE: standard error.

4. Discussion

The present study is the first prospective cohort study to evaluate how preoperative baseline bowel function mediates urinary symptoms after HoLEP. Contrary to our hypothesis, preoperative bowel function was overall not associated with post-HoLEP urinary symptom improvement. However, fecal incontinence was associated with a modest improvement in postoperative urinary continence as measured by the MISI. While overall improvements in IPSSs were observed after HoLEP, as expected, these improvements were not significantly different based on preoperative bowel function.

Strong within-domain correlations were observed among MISI and IPSS measures, supporting the internal validity of urinary and incontinence symptom scores. That our

results showed a relationship with fecal incontinence but not with constipation, as measured by CSS, is not entirely surprising. Constipation is much more common than fecal incontinence with myriad etiologies (diet, medication, slow transit, etc.), not all of which are necessarily linked to pelvic floor dyssynergia. In contrast, fecal incontinence shares more biological underpinnings with urinary incontinence such as pelvic floor dysfunction and poor sphincter control [5]. Although chronic constipation may result in pelvic floor dyssynergia, impaired relaxation, and altered afferent signaling, this was not specifically studied here. It is possible that impaired pelvic floor function developed over time, with chronic constipation limiting continence recovery despite adequate anatomic decompression.

While prior studies have demonstrated that constipation is associated with LUTS and urinary incontinence, and that treatment of bowel dysfunction can improve urinary symptoms, many of these are in women or children [6]. In contrast, whether improvement in bowel elimination disorders can improve LUTS in the adult population has not been as widely studied. In one prospective study of men under the age of 40 years with defecatory disorders and LUTS, over half had experienced a reduction in LUTS severity after bowel-directed pelvic floor physical therapy (PFPT) [7]. In an analysis of the 2005–2008 National Health and Nutrition Examination Surveys (NHANESs), among men over 40 years, constipation was associated with nocturia, incomplete bladder emptying, and urinary hesitancy [8]. In a separate analysis of the 2009–2010 NHANES study, both diarrhea and constipation were associated with urinary incontinence [9].

Our findings extend this literature into the surgical BPH population. While HoLEP reliably relieves bladder outlet obstruction, postoperative irritative symptoms and urinary incontinence may persist, particularly in older patients [10,11]. It has been historically unclear which HoLEP patients may have persistence of irritative LUTS or incontinence postoperatively [12]. For example, higher preoperative anxiety has been associated with worsened LUTS post-HoLEP [13]. Our results suggest that in men without neurogenic comorbidities, baseline constipation does not substantially contribute to variation in postoperative urinary recovery, while baseline fecal incontinence may serve as a harbinger of urinary incontinence.

Our study has several limitations. The baseline cohort had overall minimal baseline bowel dysfunction. We were unable to include data for patients who were lost to follow-up despite multiple attempts to complete post-HoLEP surveys. This was a single-center study with an overall modest cohort with overall mild baseline bowel dysfunction. Whether patients used any bowel regimens at home was not assessed nor tracked. Our findings cannot be extrapolated to neurogenic patients or patients with diabetes. Finally, the Vaizey Incontinence Scale was validated in 21 females and while it may not be directly applicable in our patient population, it has been studied in men as well [14]. Although follow-up time was modest at three months, this represents a clinically meaningful time-point in our practice. Additionally, we did not evaluate postoperative bowel function scores, which given the aforementioned association between bowel–bladder function, represent a potential opportunity for further study. Future research on fecal incontinence and urinary incontinence after HoLEP may help validate our results.

5. Conclusions

In a general population of BPH patients without neurogenic bowel dysfunction, baseline preoperative constipation was not associated with postoperative urinary symptom improvement after HoLEP. However, patients with fecal incontinence at baseline may benefit additionally in terms of urinary incontinence improvement, compared to patients without baseline fecal incontinence.

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Data Availability Statement: The data is available on reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

ASA	American Society of Anesthesiologists
BMI	Body Mass Index
BPH	Benign Prostatic Hyperplasia
CSS	Constipation Scoring System
DVT/PE	Deep Vein Thrombosis/Pulmonary Embolism
HoLEP	Holmium Laser Enucleation of the Prostate
IBS	Irritable Bowel Syndrome
IPSS	International Prostate Symptom Score
IQR	Interquartile Range
LUTSs	Lower Urinary Tract Symptoms
MISI	Michigan Incontinence Severity Index
NHANES	National Health and Nutrition Examination Survey
PFPT	Pelvic Floor Physical Therapy
SE	Standard Error
QoL	Quality of Life
UTI	Urinary Tract Infection
VIS	Vaizey Incontinence Score

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