Comparison of outcomes in patients with and without neurologic diseases undergoing holmium laser enucleation of the prostate

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ABSTRACT

Introduction: We aimed to compare holmium laser enucleation of the prostate (HoLEP) outcomes in patients with and without neurologic diseases (ND).
Methods: A prospectively maintained database of patients undergoing HoLEP from January 2021 to April 2022 was reviewed. The following NDs were included: diabetes-related neuropathy/neurogenic bladder, Parkinson's disease, dementia, cerebrovascular accident, multiple sclerosis, traumatic brain injury, transient ischemic attack, brain/spinal tumors, myasthenia gravis, spinal cord injury, and other. Statistical analysis was performed using t-tests, Chi-squared, and binomial tests ($p<0.05$).
Results: A total of 118 ND patients were identified with 135 different neurologic diseases. ND patients were more likely to have indwelling catheters (57% vs. 39%, p=0.012) and urinary tract infections (UTIs) preoperatively (32% vs. 19%, p=0.002). Postoperatively, ND patients were

KEY MESSAGES

- Patients with neurologic diseases undergoing HoLEP are more likely to experience post-op urinary retention, urinary incontinence, and higher overall complication rates compared to non-neurologic disease patients .
- While UTI rates are higher in this cohort, HoLEP significantly reduced three-month UTI, M-ISI, IPSS, and catheterization rates in the neurologic disease cohort.
- When counselling patients within this cohort, it should be emphasized that recovery may be prolonged.

more likely to fail initial trial of void (20% vs. 8.1%, p<0.001) and experience an episode of acute urinary retention (16% vs. 8.5%, p=0.024). Within 90 days postoperative, the overall complication rate was higher in the ND group (26% vs. 13%, p=0.001). Within the ND group, 30/118 (25%) had ≥1 UTI within 90 days preoperative, which decreased to 10/118 (8.7%) 90 days postoperative (p<0.001). At last followup (mean 6.7 months [ND] vs. 5.4 months [non-ND], p=0.03), four patients (4.4%) in the ND group required persistent catheter/clean intermittent catheterization compared to none in the non-ND group (p=0.002).
Conclusions: Patients with ND undergoing HoLEP are more likely to experience postoperative retention and higher complication rates compared to non-ND patients. While UTI rates are higher in this population, HoLEP significantly reduced three-month UTI and catheterization rates.

INTRODUCTION

Male lower urinary tract symptoms (mLUTS) affect a large proportion of the aging population.[1] The etiology of mLUTS is often multi-factorial and is most often associated with an anatomical bladder outlet obstruction secondary to benign prostatic hyperplasia (BPH). Patients with BPH and concomitant neurologic diseases (ND) are often thought to have neurogenic-related reasons for developing mLUTS rather than obstruction.[2] ND patients are traditionally perceived to experience worse perioperative and functional outcomes after BPH surgery. As a result, these patients are generally excluded from routine treatment pathways presented within national surgical BPH treatment guidelines and may experience delays in their surgical BPH management.[2,3]

Amongst the surgical options available for treatment of non-neurogenic BPH, Holmium Laser Enucleation of the Prostate (HoLEP) has demonstrated numerous advantages to treatment alternatives, including shorter length of stay (LOS), shorter catheter duration, and the ability to treat patients irrespective of pre-operative prostate volume or anti-platelet/anti-coagulant status.[4–7] More recently, with new advancements in laser technology and surgical technique, HoLEP has evolved into a same-day procedure that has proven to be safe with excellent functional outcomes and low rates of complications. [8,9]

There have been several series of patients with NDs that have benefited from transurethral resection of the prostate (TURP) leading to improved voiding parameters, decreased urinary tract infections (UTI), and catheter dependence.[10–13] Within the HoLEP literature, a prospective case series investigating non-neurogenic men with urodynamic-proven detrusor hypocontractility or acontractility showed that HoLEP led to significant improvements in detrusor function and successful spontaneous voiding.[14] To our knowledge, no studies have investigated outcomes in patients with neurologic diseases undergoing HoLEP. The objective of

our study is to determine if HoLEP reduces UTI rates in the ND population and to compare outcomes in patients undergoing HoLEP with and without ND states. Furthermore, we aimed to assess whether catheter dependence and urinary incontinence (UI) rates after HoLEP in patients with and without ND. Herein, we performed the first study to date investigating HoLEP in ND states.

METHODS

Study design

After Institutional Review Board approval, we retrospectively reviewed a prospectively maintained HoLEP database. We identified patients with and without ND that underwent HoLEP at our institution from January 2021 to April 2022. Patients with a history of pelvic radiation, radical prostatectomy after HoLEP, intra-vesical BCG or chemotherapy were excluded from the control group. The following disease states were included: diabetes-related neuropathy or neurogenic bladder (DM-N), Parkinson's disease (PD), dementia (D), cerebrovascular accident (CVA), multiple sclerosis (MS), traumatic brain injury/hemorrhage (TBI), transient ischemic attack (TIA), brain/spinal tumors (BT), myasthenia gravis (MG), spinal cord injury (SCI), multiple system atrophy (MSA), cerebral palsy (CP), and other. Overall, a total of 118 patients with ND and 474 without ND were identified. Certain data points were not inclusive of our entire cohort due to missing data.

Intraoperative technique and post-operative follow-up

Our intra-operative surgical technique and institutional same-day HoLEP discharge pathway have been previously published.[8,9,15] All cases were performed by a single fellowship-trained endourologist using MOSES 2.0 holmium laser technology (Lumenis Ltd., Yoknaem, Israel) and the Wolf Piranha morcellator (Richard Wolf, Knittlingen, Germany). Post-operatively, our institutional pathway consists of a one-week post-procedure phone call with a urology nurse and a 3-month post-operative clinic visit. If the patient is continent and stable at the 3-month time interval, then the patient is released back to their primary MD, with follow up as needed. However, if a patient has additional concerns or complaints, then additional follow-up occurs at 3-month intervals until all concerns resolve.

Study variables

Variables were collected at four major timepoints: pre-operatively, intra-operatively, immediately post-operatively (up to 90 days post-HoLEP), and long-term post-operatively (beyond 90 days post-HoLEP). Time to continence (months) was calculated based on first known timepoint documented in which a patient was noted to be continent of urine. Continence was defined as usage of no pads or 1 security pad that remains dry of urine over a 24-hour period.

As a secondary analysis, diabetes mellitus (DM) patients were categorized based on evidence of neuropathy or neurogenic bladder, A1c category (less than 6.5, 6.5 to less than 9, greater than 9), and insulin dependence. The A1c thresholds were chosen based on the American Diabetes Association definition of 6.5% as "diabetic" and National Center for Quality Assurance Health Employer Data and Information Set's threshold of 9% as poorly-controlled diabetes.[16–18] Patients with a history of ND, pelvic radiation, radical prostatectomy after HoLEP, intra-vesical BCG or chemotherapy were excluded from the non-DM group. A total of 117 patients were identified as DM and 414 as non-DM. Study variables analyzed in this secondary analysis were the same as mentioned previously for the ND cohort. Sub-group analysis was further performed on DM patients based on A1c levels (< 6.5, 6.5 to 9, □ 9) and insulin dependence.

Statistical analysis

Statistical analysis was performed using SAS□, version 9.4 (SAS Institute Inc., Cary, NC, USA) and R, version 4.1.1 (R Foundation for Statistical Computing, Vienna, Austria). Paired t-tests, Chi-squared, McNemar's tests, Fisher's exact tests, and binomial tests were conducted with a p-value<0.05 as statistically significant. Kaplan Meier survival analysis was performed to calculate and display time to continence in each cohort.

RESULTS

A total of 118 patients were identified with 135 different neurological diseases: DM-N (30), PD (9), D (17), CVA (26), MS (2), TBI (8), TIA (16), BT (16), MG (4), other (7). There were no SCI, MSA, or CP patients.

Pre-operative characteristics are categorized in Table 1. ND patients were older (73.5 □ 8.4 years vs 69.7 □ 8.0 years, p<0.001) and more likely to have indwelling catheters (57% vs 39%, p=0.012) and UTIs pre-operatively (32% vs 19%, p=0.002) compared to non-ND patients. ND patients had a higher mean number of UTIs within 90 days pre-op (0.4 □ 0.9 vs 0.2 □ 0.5, p<0.001). There was no difference in body mass index or prostate size between both cohorts.

Intra-operative HoLEP characteristics are listed in Table 2. There was a significant difference in ASA score between non-ND and ND groups with higher percentages of ASA 3 or greater in the ND cohort (77.5% vs 49.2%, p<0.001). ND patients were more likely to be admitted for observation rather than discharged same-day (23% vs 9.4%, p<0.001). There were no significant differences in procedure, enucleation, or morcellation times between the ND and non-ND cohorts.

Table 3 shows the immediate and long-term post-operative characteristics. Post-op, ND patients were more likely to fail initial trial of void (TOV) (20% vs 8.1%, p<0.001) and experience an acute urinary retention episode (16% vs 8.5%, p=0.024). Within 90 days post-op, complication rates were higher in the ND group (26% vs 13%, p=0.001), and ND patients were more likely to visit the emergency department (25% vs 13%, p=0.002) compared to non-ND.

Furthermore, the proportion of patients with 1 post-operative UTI was significantly higher in the ND cohort (8.7% vs 3.4%, p=0.034) compared to non-ND.

ND patients had longer post-operative follow up (6.7 5.5 months) compared to non-ND patients (5.4 4.7 months, p=0.03). At last follow-up, 4 patients (4.4%) in the ND group were catheter dependent post-HoLEP compared to 0 in the non-ND group (p=0.002)—one patient with DM-N and TIA was performing continuous intermittent catheterization (CIC) twice daily, and three patients required an indwelling catheter (1 with TBI, 1 with D, 1 with CVA/DM-N). Overall continence rates were 94.3% for the non-ND group and 87% for the ND group (p=0.008). Of the 14 patients with ND that remained incontinent at last follow-up, the breakdown of ND states included 8 DM-N (57.1%), 3 CVA (21.4%), 1 D (7.1%), 1 TIA (7.1%), 1 BT (7.1%), 1 PD (7.1%), 1 MG (7.1%). Two patients had concomitant DM-N and CVA, and one had PD and D. **Figure 1** displays the time to continence Kaplan-Meier survival analysis. ND patients took significantly longer to regain continence compared to non-ND (p=0.048). However, median time to continence was 3 months for both groups. There were no significant differences in number of pads/diapers per day in either group (ND: 0.41 vs non-ND: 0.16, p=0.06). However, more ND patients required diapers than non-ND patients (14.89% vs 6.21%, p=0.0045). A significantly higher number of ND patients had stress UI (SUI) (7.4% vs 2.2%, p=0.006) compared to control patients but there were no differences in urge UI (UUI) (3.7% vs 2%, p=0.14) and mixed UI (MUI) rates (1.9% vs 0.9%, p=0.24). Change in pre-op to post-op International Prostate Symptom Scores (IPSS) and Michigan Incontinence Symptom Index (M-ISI) total severity and bother scores were similar amongst both groups.

On sub-analysis, ND patients exhibited significant improvements in pre- vs post-op IPSS Scores (24.5 vs 7.8, p<0.001) and M-ISI bother scores (1.7 vs 1.1, p=0.04). Within the ND group, 30/118 (25%) had ≥1 UTI within 90 days pre-op which decreased to 10/118 (8.7%) 90 days post-op (p<0.001). The number of ND patients requiring indwelling catheter/CIC pre vs post-HoLEP significantly decreased from 35/90 (38.9%) to 5/90 (5.6%, p<0.001).

Secondary analysis of peri-operative characteristics in all diabetic patients undergoing HoLEP is displayed in Supplementary Table 1. Post-operatively, patients were more likely to be admitted rather than discharged same-day (21% vs 8.5%, p<0.001) and fail initial TOV (15% vs 7.8%, p=0.026). DM patients had higher rates of complications of any kind (24% vs 12%, p=0.003), higher rates of UTIs (12% vs 2.8%, p<0.001), and were more likely to require foley/CIC at last follow-up (3.2% vs 0%, p=0.01) compared to non-DM patients. Although not statistically significant, HoLEP decreased the proportion of DM patients with at least 1 UTI pre vs post-op (21% to 12%, p=0.05). When stratified based on A1c levels and insulin dependence, no correlation was noted between increased A1c or insulin use and post-op UTIs, complication rates, or catheter dependence (p>0.05). Supplementary Table 1 illustrates the time to continence survival analysis comparing DM and non-DM patients. DM patients took significantly longer to achieve continence compared to the control cohort (p=0.0024).

DISCUSSION

Patients with ND were often excluded in BPH literature due to a perceived higher likelihood of complications and worse peri-operative outcomes. As a result, there has been a paucity of research examining mLUTS, UTI rates, incontinence rates, and long-term outcomes in patients with ND states undergoing BPH surgery. Furthermore, the American Urological Association and European Association of Urology guidelines on BPH/LUTS pertains only to a non-neurogenic cause of LUTS.[2,3] We present a novel study comparing the peri-operative outcomes in patients undergoing HoLEP with and without ND states. Our results demonstrate that ND patients undergoing HoLEP are more likely to experience post-op retention, temporary UI, and higher overall complication rates compared to non-ND patients. Within this complex heterogeneous cohort, HoLEP significantly reduced 3-month UTI and catheterization rates pre- vs post-op. Based on these results, HoLEP appears to be beneficial for ND patients in retention or with history of UTIs.

Although there are presently no studies investigating HoLEP in ND, there have been several case series describing patients undergoing TURP with various ND states. Hou et al.[10] performed a retrospective analysis using the Taiwan National Health Insurance Research Database comparing TURP outcomes in 577 stroke patients and 6048 patients without stroke. The authors found that stroke patients were older and had higher rates of post-operative UTIs and retention compared to control patients. Although not statistically significant, within the stroke cohort, TURP was able to reduce the UTI rate from 34.7% at 1-year pre-op to 29.8% 1-year post-op and decrease 1-year urinary retention rates from 55.5% to 22.5%. Prior comparisons between HoLEP and TURP have shown that HoLEP removes a greater amount of tissue and has lower re-operative rates, which may explain the more significant reduction in UTIs and retention rates seen in our study.[7]

Parkinson's disease has historically been considered a relative contraindication to undergoing BPH outlet procedures due to the risk of UI. A historic study from Staskin and colleagues[19] showed the risk of incontinence increased from 17% pre-TURP to 28% post-TURP. The high rate of UI in the prior study was attributed to the mis-diagnosis of multiple system atrophy as PD. More recently, a retrospective analysis by Roth et al.[11] of 23 PD patients undergoing TURP, selected with caution to avoid patients with MSA, found a de novo incontinence rate of 0%. In the present study, we were able to identify a small subset of 9 patients with PD and no patients with MSA. Of the 9 patients with PD, we identified one patient with incontinence for a UI rate of 11.1%, conveying that HoLEP is a safe modality for PD patients.

Diabetes mellitus has been shown to be a risk factor for development of stress UI post-HoLEP.[20,21] We found that patients with DM-N were most likely out of all ND patients to develop UI. In TURP patients, a retrospective study using Taiwanese claims data comparing 831 DM patients to 4056 non-DM patients revealed that DM patients had higher post-op retention rates and usage of anti-muscarinics.[13] Interestingly, DM patients had lower rates of UTI in this

study, which the authors explain may be due to their strict definition of UTI as any ED or clinic visit with a formal diagnosis of UTI which likely under-estimated the UTI rates. We similarly noted that DM patients were more likely to fail same-day TOV and had slightly higher rates of post-op acute urinary retention. We also found that DM patients were significantly more likely to be prescribed anti-cholinergics or beta-3 agonists post-surgery and have higher rates of 90-day UTIs post-operatively. No prior studies in the literature have solely focused on HoLEP outcomes in DM-N or performed sub-analyses based on insulin dependence and A1c. While uncontrolled A1c has been thought to be a predictor of poor surgical healing and worse post-operative outcomes, we found that post-HoLEP UTI and complication rates were similar regardless of A1c level or insulin dependence, suggesting that HoLEP is safe and effective in DM patients regardless of these factors.[22]

In our study, we noted overall UI rates of 13% in the ND cohort, which is significantly higher than the 6% incontinence observed in non-ND patients. It is important, however, to consider that 25% of ND and 23% of the non-ND cohort had pre-existing incontinence. Previously reported rates of incontinence range anywhere from 16% to 44% depending on time of follow-up.[23–26] Montorsi et al.[23] found that 44% of HoLEP patients had UUI at 1-months' follow-up, and 1.7% had SUI at 6 and 12-month follow-up. At 3-months' post-op, Nam and colleagues[24] noted an overall UI rate of 16.6% with 4.1% SUI and 7.4% UUI. Das et al.[26] of 589 HoLEP patients demonstrated transient SUI rates of 8.8% with 1.5% developing long-term SUI beyond 6 months. These rates correlate similarly to our total (non-ND+ND) UI rate of 7%, SUI rate of 3.2% and UUI rate of 2.3%. Furthermore, our follow-up for both cohorts was relatively short, 6.7 and 5.4 months, respectively, and we would anticipate these incontinence rates to continue to improve over the first year after surgery. Despite these limitations, we did note that ND patients require higher diaper usage than control patients though there were no statistically significant differences in overall pad and diaper usage in either cohort, and using a secondary incontinence scoring system, the Michigan Incontinence Symptom Index, we found that patients in both groups had decreases in the M-ISI bother score pre- vs post-HoLEP.

Two studies in the non-ND BPH population have shown evidence of successful spontaneous voiding and improved urodynamic (UDS) findings post-HoLEP in patients with detrusor hypocontractility or acontractility.[14,27] Mitchell et al.[14] conducted a prospective series of 5 men with detrusor hypocontractility and 19 with acontractility undergoing HoLEP and found that 5/5 with hypocontractility and 18/19 with acontractility were able to demonstrate successful spontaneous voiding post-HoLEP. Similarly, Lomas et al.[27] performed a retrospective review of 9 patients with detrusor underactivity (DUA) and 8 with acontractility undergoing HoLEP. Post-operatively, 8/9 men with DUA and 5/8 men with acontractility were able to spontaneously void catheter-free. Due to these findings demonstrating significant return of detrusor contractility, our current practice pattern does not typically include routine UDS prior to HoLEP. However, we acknowledge that the effect of ND on bladder storage and emptying mechanics is highly variable

and evidence of neurogenic bladder can only be truly determined using UDS. Therefore, one of the major limitations of our study is the lack of urodynamic studies conducted prior to HoLEP.

Other inherent limitations to our study include its retrospective nature. Because of our institutional follow-up protocol at 1-week and 3-months' post-op time intervals, there could be recall bias as it is difficult to ascertain the exact time when a patient regained continence. This could potentially lead to artificial prolongation of the reported time to continence. Pad/diaper usage, which we assessed during follow-up appointments, is also a highly subjective measurement of continence and varies based on the individual. Furthermore, loss of follow-up is a prevalent issue likely due to two main reasons. First, many patients at our institution come from far distances and follow-up afterwards with their local urologist. Second, patients with positive outcomes after surgery often choose not to attend follow-up appointments, which limits our ability to collect data on the same patient pre- vs post-op. As a result, this decreased the amount of paired data pre- and post-op that was able to be collected. Given the heterogeneity of patients included, it is difficult to draw definitive conclusions as to which patient characteristics predispose to worse outcomes. Finally, this study was conducted out of a tertiary institution with experienced urology staff using a streamlined same-day discharge pathway, so results may be difficult to generalize to other facilities.

CONCLUSIONS

Patients with ND undergoing HoLEP are more likely to experience post-op urinary retention, UI, and higher overall complication rates compared to non-ND patients. While UTI rates are higher in this complex heterogeneous cohort, HoLEP significantly reduced 3-month UTI, M-ISI, IPSS, and catheterization rates in the ND cohort. When counseling patients within this cohort, it should be emphasized that recovery may be prolonged. Future studies investigating individual ND in HoLEP will also be informative in further understanding the implications of each disease state.

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Conflicts of interest: *Dr. Lee is a consultant for Lumenis. Dr. Krambeck is a consultant for Ambu, Boston Scientific, Lumenis, Sonomotion, and Virtuoso Surgical; and is a board member of Sonomotion and Uriprene.*

FIGURES AND TABLES

Figure 1. Time to continence in neurologic disease patients vs. non-neurologic patients.

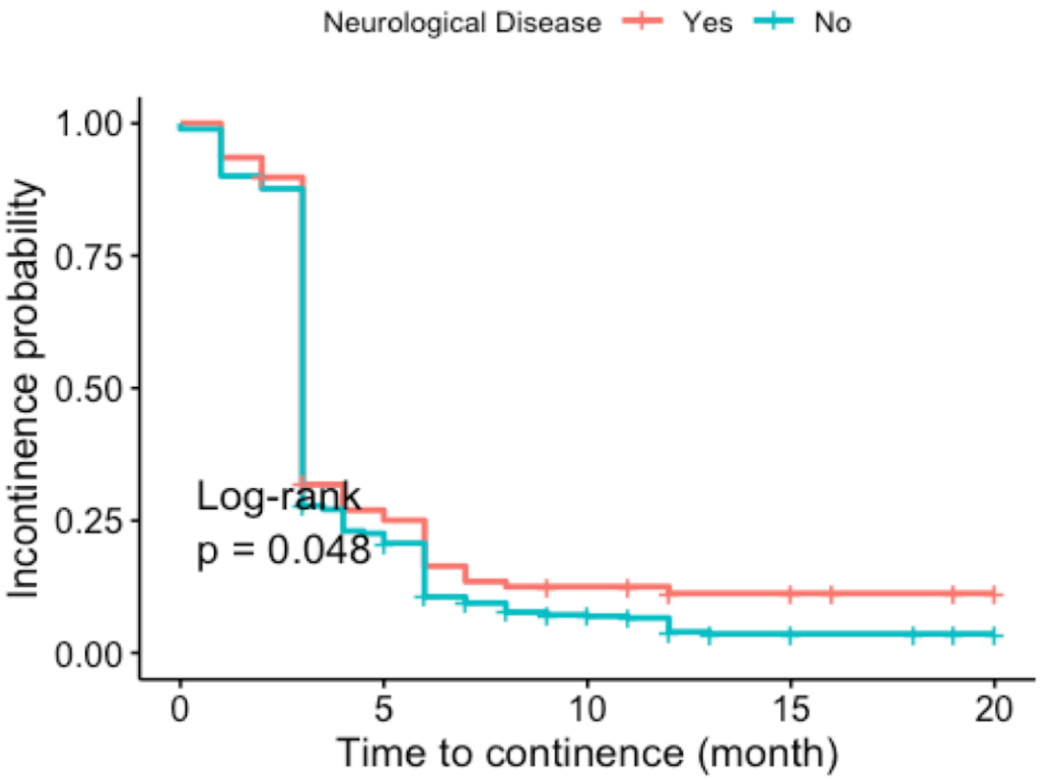

Table 1. Preoperative characteristics based on neurologic disease status

Preoperative characteristic	**N (n=592)**	**Non-ND (n=474)**	**ND (n=118)**	**p**
Urinary retention	589	259 (55)	65 (55)	>0.9
Indwelling urinary catheter	324	101 (39)	39 (57)	0.012*
Clean intermittent catheterization	201	52 (32)	10 (24)	0.4
Any history of Retention	520	190 (47)	54 (47)	>0.9
Incontinence	366	59 (23)	28 (25)	>0.9
History of UTI	590	89 (19)	38 (32)	0.002*
Total number of UTIs within 90 days pre-op	592	0.2 (0.5)	0.4 (0.9)	<0.001*

Proportion of patients with ≥1 UTI within 90 days pre-op	592	59 (12)	30 (25)	<0.001*
Age (years)	592	69.7 (8.0)	74.8 (8.4)	<0.001*
BMI	585	27.8 (5.0)	27.4 (4.9)	0.4
Prostate size (grams)	539	125.6 (66.2)	114.2 (72.9)	0.13

*Statistically significant. BMI: body mass index; ND: neurologic disease; UTI: urinary tract infection.

Table 2. Intraoperative characteristics based on neurologic disease status

Intra-operative characteristic	**N (n=592)**	**Non-ND (n=474)**	**ND (n=118)**	**p**
ASA score	566			<0.001*
I		4 (0.9)	0 (0)	
II		225 (50)	27 (23)	
III		218 (49)	88 (75)	
IV		1 (0.2)	2 (1.7)	
V		0 (0)	1 (0.8)	
Procedure time (minutes)	554	70.4 (31.3)	70.1 (37.7)	>0.9
Enucleation time (minutes)	557	35.5 (14.7)	34.3 (17.1)	0.5
Morcellation time (minutes)	555	10.5 (10.1)	9.6 (10.5)	0.4
Outpatient vs. admitted	565			<0.001*
Outpatient		405 (91)	91 (77)	
Admitted		42 (9.4)	27 (23)	

*Statistically significant. BMI: body mass index; ND: neurologic disease; UTI: urinary tract infection.

Table 3. Immediate postoperative characteristics (within 90 days post-HoLEP) and long-term postoperative characteristics (90 days and beyond post-HoLEP) based on neurologic disease status

Postoperative characteristic	N (n=592)	Non-ND (n=474)	ND (n=118)	p
Failed same-day voiding trial	535	34 (8.1)	23 (20)	<0.001*
Immediate postop ED/clinic/or readmission	500	46 (12)	28 (26)	<0.001*
Any episode of postop urinary retention	503	33 (8.5)	19 (16)	0.024*
Any 90 Day complications	499	49 (13)	30 (26)	0.001*
Clavien-Dindo classification of complications	499			0.8
I		26 (53)	16 (53)	
II		19 (39)	10 (33)	
IIIA		2 (4.1)	1 (3.3)	
IIIB		2 (4.1)	2 (6.7)	
V		0 (0)	1 (3.3)	
UTI within 90 days	498	13 (3.4)	10 (8.7)	0.034*
Anticholinergics or beta-3 agonists	440	85 (24)	18 (21)	0.6
90 days readmission	590	16 (3.4)	21 (18)	<0.001*
90 days emergency room visit	493	48 (13)	29 (25)	0.002*
Pelvic floor physical therapy	140	25 (22)	8 (31)	0.4
Time of last followup (months)	514	5.4 (4.7)	6.7 (5.5)	0.03*
Persistent need for indwelling catheter or CIC	447	0 (0)	4 (4.4)	0.002*
Continence rates at last followup (%)	561	94.3	87	0.008*
Diapers	513	26 (6.2)	14 (14.9)	0.005*
Pads	513	20 (3.9)	4 (4.3)	0.82
Average number of pads/diapers per day	513	0.16	0.41	0.06
Diaper/pad usage breakdown:	590			0.10
1 diaper daily		14 (3)	4 (3.4)	
2–3 diapers daily		10 (2.1)	9 (7.6)	

>3 diapers daily		2 (0.4)	1 (0.9)	
0–1 pads daily		9 (1.9)	3 (2.5)	
2-3 pads daily		3 (0.6)	0 (0)	
>3 pads daily		5 (1.1)	1 (0.9)	
Stress urinary incontinence	561	10 (2.2)	8 (7.4)	0.006
Urge urinary incontinence	561	9 (2)	4 (3.7)	0.14
Mixed urinary incontinence	561	4 (0.9)	2 (1.9)	0.24
Difference in IPSS score pre- vs post-op	337	-14.6 (10.8)	-16 (12.1)	0.4
Difference in M-ISI total severity score pre- vs post-op	120	0.4 (6.5)	-0.8 (5.6)	0.4
Difference in M-ISI total bother score pre- vs post-op	118	-0.4 (2.5)	-1.1 (2.1)	0.2

*Statistically significant. BMI: body mass index; CIC: clean intermittent catheterization; ED: emergency department; IPSS: International Prostate Symptom Scores; M-ISI: Michigan Incontinence Symptom Index; ND: neurologic disease; UTI: urinary tract infection.