The incidence of urethral stricture and bladder neck contracture with transurethral resection vs. holmium laser enucleation of prostate: A matched, dual-center study

Mohamed Elsaqa[1,2], Mohamed Serag[1], Navid Leelani[3], Moustafa Momtaz Elsawy[1,4], Mostafa Sakr[1], Tamer Abou Youssif[1], Hazem Rashad[1], Marawan M. El Tayeb[2]

[1]Alexandria University Faculty of Medicine, Alexandria, Egypt; [2]Division of Urology, Department of Surgery, Baylor Scott & White Health, Temple, TX, United States; [3]Alabama College of Osteopathic Medicine, Dothan, AL, United States; [4]Darent Valley Hospital, Dartford, Kent, United Kingdom

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Abstract

Introduction: Urethral strictures (US) and bladder neck contracture (BNC) are common, long-term complications of transurethral prostate surgery. We aimed to compare transurethral resection of the prostate (TURP) and holmium laser enucleation of the prostate (HoLEP) regarding incidence of US or BNC and identify possible risk factors.

Methods: A retrospective review of patients who underwent TURP and HoLEP with followup data of at least one year in two separate institutions was performed. The incidence of postoperative US or BNC in both groups was compared. Bivariate and multivariate analysis of risk factors in both cohorts with US or BNC were performed.

Results: The study included 208 patients: 101 and 107 patients in the TURP and HoLEP arms, respectively. The two groups were matched for age and prostate size. Eight (7.92%) and five (4.72%) patients in the TURP and HoLEP arms, respectively, developed US (p=0.3423), while two (1.87%) patients in the HoLEP arm had BNC (p=0.2634). Of the eight patients with the US in the TURP arm, six (9.8%) had bipolar TURP, while two (5%) had monopolar TURP. Multivariate analysis showed that larger prostate volume (hazard ratio [HR] 1.22, 95% confidence interval [CI] 1.05, 1.41, p=0.0066) and longer operative time (HR 1.84, 95% CI 1.76, 1.93, p=0.0015) were associated with risk of US/BNC.

Conclusions: There is no significant difference between TURP and HoLEP regarding incidence of US or BNC, although there is a tendency towards a higher rate of US associated with bipolar TURP. Increased prostate volume and operative time are possible risk factors.

KEY MESSAGES

- We compared TURP and HoLEP regarding their incidence of US or BNC with matching patients for age and prostate volume and identified possible risk factors.
- The US incidence was comparable, although the incidence within the TURP arm was higher with bipolar than monopolar TURP.
- The BNC incidence was 1.87% in the HoLEP arm, while none of the patients in the TURP arm developed BNC (statistically insignificant).
- Multivariate analysis showed that larger prostate volume and longer operative time were associated with higher risk of US/BNC.

Introduction

Urethral strictures (US) and bladder neck contracture (BNC) are unfortunate complications of transurethral prostate surgery. Transurethral surgery is considered the most common cause of iatrogenic US, accounting for about 41% of all causes.[1] The US incidence is still considered one of the leading long-term complications following transurethral resection of the prostate (TURP) despite the advancement of multiple minimally invasive techniques for managing enlarged prostate and bladder outlet obstruction. US occurs in 4.5–13% of patients post-TURP. The most common location for US post-TURP is the bulbo-membranous urethra, followed by the fossa navicularis and penile urethra. It is also reported that 0.3–9.7% of TURPs are complicated by BNC.[2-4]

The pathogenesis of US in transurethral surgeries is still unclear but supposed mechanisms include breach of mucosal integrity with repetitive "in and out" movement of the resectoscope, lack of adequate lubrication, electric current

leak from resectoscope in case of monopolar or bipolar diathermy TURP, or pressure ischemia to the fixed bulbomembranous junction.[5,6] Incidence of US is also postulated to be related to multiple factors, such as type of energy used through the resectoscope, size of adenoma, duration of the surgery, the diameter of the resectoscope, temperature of irrigation fluids, and postoperative infection.[7]

In this study, we aim to compare TURP, either monopolar or bipolar electrocautery, and holmium laser enucleation of prostate (HoLEP), regarding the incidence of US or BNC and to identify the risk factors for the development of US in both modalities.

Methods

We conducted a dual-center joint study. A retrospective chart review of a prospectively maintained database of patients who underwent TURP or HoLEP for bladder outlet obstruction within between July 2017 and June 2020 was performed in two separate institutions. TURP was performed at Alexandria University Hospital in Egypt, while HoLEP was performed at Baylor Scott and White Memorial Hospital in the U.S. The study included patients with at least one year of complete followup post-surgery. Patients in both groups were matched for age and preoperative prostate volume. Patients with a previous history of transurethral surgery or prospectively diagnosed prostate cancer were excluded. Also, patients with previous history of US or accidently discovered US during TURP or HoLEP were excluded.

Outcome measures

Preoperative, operative, and postoperative characteristics for both groups were collected. The incidence of postoperative US or BNC in both groups was compared. Data regarding the characteristics of US and management of the US and BNC patients were collected. Multivariate analysis of the risk factors in the group of patients with US or BNC was performed.

Statistical analysis

For descriptive statistics, continuous variables were presented as mean (standard deviation [SD]) or median (interquartile range [IQR]) according to normality, while categorical variables were given as absolute numbers and percentages. Two-sample t-tests were used for univariate analysis of most quantitative variables, where equal and unequal variance assumptions were checked; Wilcoxon rank sums tests were used for variables that did not appear to attain normality. Chi-squared tests or Fisher's exact tests were used for categorical variables according to the expected cell counts. The significance level was set at a $p<0.05$.

Results

Data of total 1160 patients were reviewed, there were 160 and 900 patients in TURP and HoLEP groups, respectively. This matched study included only 208 patients with followup of at least one year. In the TURP arm, 101 patients fit our criteria. In the HoLEP arm, 107 age- and prostate size-matched patients were included. Within the TURP arm, 61 and 40 patients had bipolar (plasma-kinetic) and monopolar electrocautery, respectively.

The two groups were comparable for the baseline characteristics of age, prostate size, history of previous catheterization, associated bladder stone, and history of diabetes mellitus, while the HoLEP group had statistically higher prostate-specific antigen (PSA) and postvoid residual (PVR) volume compared to the TURP group (Table1).

All the TURP cases were performed using 26 Fr continuous flow sheath, whereas HoLEP was performed with 26 Fr and 28 Fr sheath in 66 and 41 patients, respectively. The TURP group had statistically significant longer operative and catheterization times (p=0.0067 and p=0.01, respectively). HoLEP was associated with incidentally discovered prostate cancer on histopathological examination in 14 patients compared to none of the patients in TURP group (p=0.0002) (Table 2). Among the patients with accidental prostate cancer, 12 and two patients had Gleason grade group (GG) 1 and GG 2, respectively; all the patients were subsequently managed by active surveillance.

Eight (7.92%) and five (4.72%) patients in the TURP and HoLEP arms, respectively, developed US (p=0.3423), while two (1.87%) patients in the HoLEP arm had BNC (p=0.2634). Of the eight patients with US in the TURP arm, six (9.8%) had bipolar TURP, while two (5%) had monopolar TURP. In the HoLEP group, of five patients with US, 26 Fr and 28 Fr sheath were used in one and four patients, respectively. The US was bulbar, bulbo-membranous junction, and penile in nine, two, and two patients, respectively. US/BNC was diagnosed with cystoscopy and retrograde urethrogram usually

Table 1. Baseline characteristics of both groups

Variable	TURP (n=101)	HoLEP (n=107)	p
Age, years, median (IQR)	66 (62–80)	66 (61–69)	0.9668
Prostate size, g, median (IQR)	62 (49–83)	68 (53–80)	0.7112
PSA, ng/ml, median (IQR)	2.3 (1.3–4.1)	4.7 (2.4–7.4)	**<0.0001**
Hx of urine retention, n (%)	33 (32.6%)	43(42%)	0.15
DM, n (%)	28 (27.7%)	29(27.1%)	0.92
PVR, ml, mean (SD)	43.63 (70)	127 (146)	**<0.0001**
Bladder stone, n (%)	9 (8.9%)	7 (6.6%)	0.21

Bolded values represent statistical significance. DM: diabetes mellitus; HoLEP: holmium laser enucleation of prostate; Hx: history; IQR: interquartile range; PSA: prostate-specific antigen; PVR: postvoid residual; SD: standard deviation; TURP: transurethral resection of prostate.

Table 2. Perioperative and outcome data

	TURP (n=101)	HoLEP (n=107)	p
Operative time, min, median (IQR)	88 (71–92)	71.1 (58–84)	**0.0067**
Catheterization time, days, mean (SD)	2.12 (0.64)	1.81 (2.28)	**0.01**
Incidental PCa pathology, no (%)	0	14 (13.8)	**0.0002**
Urethral stricture, no (%)	8 (7.92)	5 (4.72)	0.3423
BN contracture, no (%)	0	2 (1.87)	0.2634
Stricture onset, months, median (IQR)	8 (6–8)	7 (3–14)	1.0

Bolded values represent statistical significance. BN: bladder neck; HoLEP: holmium laser enucleation of prostate; IQR: interquartile range; PCa: prostate cancer; SD: standard deviation; TURP: transurethral resection of prostate.

following lack of improvement or worsening lower urinary tract symptoms post-surgery. US/BNC was diagnosed at a range of 1.5–24 months post-TURP or HoLEP.

With bivariate analysis, the patients with US/BNC had no statistically significant difference regarding their age (p=0.6484), prostate volume (p=0.1423), history of previous catheterization (p=0.93), serum PSA(p=0.3967), operative time (p=0.9542), catheterization time (p=0.9557), history of diabetes mellitus (p=0.31), or incidental prostate cancer pathology (p=0.15). The multivariate regression analysis model with multiple factors showed that larger prostate volume (hazard ratio [HR] 1.222, 95% confidence interval [CI] 1.057, 1.411, p=0.0066) and longer operative time (HR 1.845, 95% CI 1.762, 1.937, p=0.0015) were associated with statistically significant risk of US/BNC (Table 3).

Table 3. Bivariate analysis of urethral stricture patients vs. non-complicated patients

Variable	US/BNC (n=15)	No US/BNC (n=193)	p
Age, years, median (IQR)	65 (61–68)	66 (61–70)	0.6484
Prostate size, g, median (IQR)	80 (60–90)	63 (50–79)	0.1423
PSA, ng/ml, median (IQR)	4.6 (3.05–5.4)	3.4 (1.6–6.1)	0.3967
Preoperative urine retention, n (%)	4 (30%)	58 (29%)	0.93
DM, n (%)	5 (38%)	50 (26%)	0.311
PVR, ml, median (IQR)	80 (35–130)	37.5 (0–140)	0.1854
Operative time, min, median (IQR)	70 (64.2–75)	66 (55–80)	0.9542
Catheter time, days, median (IQR)	2 (1–2)	2 (1–2)	0.9557
PCa pathology, n (%)	2 (15%)	11(5.6%)	0.15

BNC: bladder neck contracture; DM: diabetes mellitus; IQR: interquartile range; PCa: prostate cancer; PSA: prostate-specific antigen; PVR: postvoid residual; US: urethral stricture. Bolded values represent statistical significance. DM: diabetes mellitus; HoLEP: holmium laser enucleation of prostate; Hx: history; IQR: interquartile range; PSA: prostate-specific antigen; PVR: postvoid residual; SD: standard deviation; TURP: transurethral resection of prostate.

Among the patients with US, urethral dilatation under local anesthesia was initially attempted in 10 patients. Dilatation under local anesthesia was sufficient in the management of US in four and three patients in the TURP and HoLEP arms, respectively, while internal endo-visual urethrotomy was needed for the management of three and two patients, respectively. One patient in the TURP arm had urethroplasty for management of recurrent US. Patients with BNC post-HoLEP were management with endoscopic bladder neck incision with a satisfying outcome. Followup duration post-diagnosis of US/BNC ranged from 5–18 months.

Discussion

The rate of US in TURP is estimated in the range of 1.7–11.7%. It is postulated in multiple reports that bipolar TURP may be associated with higher rates of US compared to monopolar TURP (6.1–8.3% vs. 1.9–4.2%, respectively),[4,5,8-10] while some studies have reported the incidence of US accompanying HoLEP as 1.4–4.4%.[11-13] Rates of BNC post-TURP have been reported in the range of 0.14–9.6%, whereas the incidence post-HoLEP BNC has been reported to be 0.6–5.4%.[5,14]

To the best of our knowledge, the current study is the first to directly compare TURP and HoLEP regarding the US and BNC complications. Our results showed statistically comparable incidence of US in both TURP and HoLEP groups (7.9% and 4.7%, respectively, p=0.34). Bipolar TURP was associated with a statistically insignificant higher rate of US compared to monopolar (9.8% vs. 5%, respectively, p= 0.37). In comparison, BNC occurred in 0% and 1.9% of TURP- and HoLEP-treated patients, respectively (p=0.26). Although fossa navicularis stricture is reported in multiple studies as the second most common site of US post-TURP,[2,4] none of the patients in either arm of our study had a stricture at the fossa navicularis.

In their retrospective study, Grechenkov et al illustrated that a larger endoscope diameter, increased prostate volume, repeated urethral catheterization, and previous history of chronic prostatitis were associated with the risk of developing urethral or bladder neck stricture post-TURP.[15] Tao et al reported in their TURP series that intraoperative urethral mucosa rupture, lower resection speed, and postoperative continuous infection were associated with a higher risk of US, while more severe storage phase symptom and smaller prostate size were associated with a higher risk of BNC after TURP.[7] Thai et al found the rate of US and BNC post-HoLEP was comparable using either a 26 Fr or 28 Fr resectoscope sheath.[12] In our results, multivariate analysis showed that longer operative time and larger prostate volume were associated with statistically significant risk of US. According to Ibrahim et al in their large HoLEP series, BNC developed only in patients with a small adenoma (<55 g), with 60%

of BNC patients having a history of previous TURP.[13] Lee et al have also shown that 96% of patients with BNC post-TURP had a prostate volume <50 g.[14] In our results, BNC developed in two (1.9%) patients in the HoLEP arm, with the prostate volumes of 45 g and 50 g.

Of note, our results, in contrast to previous studies, showed that HoLEP was associated with shorter operative time compared to TURP.[16] This may be attributed to longer time spent for hemostasis in TURP for large prostates that may compensate for time needed for morcellation during HoLEP.

The management of US post-TURP or HoLEP varies with the site and length of the stricture segment. Studies report variable success rates for endoscopic management of US post-TURP. Urethral dilatation under local anesthesia with a balloon, filiform, and followers, urethral sounds, or self-dilatation with catheters can be adequate in 50–71% of patients, especially those with previously untreated strictures and soft annular strictures; visual internal urethrotomy is typically required in 20–30% of patients, especially those with complications or retention.[4,13,17] Endoscopic incision of the bladder neck is usually required in patients with BNC, with clear success rate.[13,14]

Limitations

The study's limitations include its retrospective nature and the relatively small number of patients. A prospective, randomized study with a larger number of patients is required; however, this will be challenging due to the low incidence of complications.

Conclusions

There is no significant difference between TURP and HoLEP regarding the incidence of US or BNC, although there is a tendency toward higher rate of US associated with bipolar TURP (vs. monopolar) and higher incidence of BNC associated with HoLEP. Larger prostate volume and longer operative time are associated with higher risk of US. Endoscopic treatment, with urethral dilatation, visual urethrotomy, or bladder neck incision, is effective management in most of patients.

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This paper has been peer-reviewed.

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Correspondence: Dr. Mohamed Elsaqa, Division of Urology, Department of Surgery, Baylor Scott & White Health, Temple, TX, United States; mohamed.elsaqa@alexmed.edu.eg