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The Experiences of Thulium laser enucleation of the prostate (ThuLEP)

Thulium Lazer ile Prostat Enükleasyonu(ThuLEP) deneyimleri

Eymen Gazel[1], Mehmet Yilmaz[2], Halil Cagri Aybal[3], Engin Kaya[4], Serdar Yalcin[4], Sercan Yilmaz[4], Onur Acikgoz[5], Lutfi Tunc[6]

1 Acibadem University Ankara Hospital, Department of Urology, Ankara, Turkey
2 Zile State Hospital, Department of Urology, Tokat, Turkey
3 Ankara Oncology Training and Research Hospital, Department of Urology, Ankara, Turkey
4 Health Sciences University,Gülhane Training and Research Hospital, Department of Urology, Ankara, Turkey
5 Pendik State Hospital,Department of Urology, Istanbul, Turkey
6 Gazi University School of Medicine, Department of Urology, Ankara, Turkey

ÖZET

Amaç: 1998'den bu yana, Gilling prostatın Holmium Lazer Enükleasyonu'nu (HoLEP) ilk kez tarif ettikten sonra, prostat cerrahisinde lazer kullanımı yaygınlaşmıştır. Prostatın endoskopik cerrahilerinde Thulium lazer enükleasyonu (ThuLEP) da uygulanmaktadır. Thulium lazer cihazı şu anda Türkiye'deki sınırlı sayıda merkezde kullanılmaktadır. Bu çalışmada Türkiye'de ilk ThuLEP vakasının da gerçekleştirildiği merkezimizin sonuçlarını literatüre kazandırmayı amaçladık.

Gereç ve Yöntemler: Temmuz 2018 ile Eylül 2019 arasında ThuLEP ameliyatı olan 60 hastanın verileri retrospektif olarak tarandı . Enükleasyon süresi (ET) (dak), morselasyon süresi (MT) (min), toplam operasyon süresi (OT-toplam) (min), enükleasyon etkinliği (EE) (g / dak) ve morselasyon etkinliği (ME) (g / dak), enükle edilen doku ağırlığı (RTW) (g), enükle edilen doku yüzdesi (PWR) gibi perioperatif veriler ile intraoperatif ve postoperatif komplikasyonlar kaydedildi. Qmax, Qave, Qmax'a Kadar Süre, Voiding Süresi (VT), IPSS, QoL verileri ve postoperatif kontinans durumu postoperatif 1. ay ve 6. ay takibi ile karşılaştırıldı.

Bulgular: Postoperatif fonksiyonel sonuçları gösteren tüm parametrelerde istatistiksel olarak anlamlı iyileşme gözlendi (p <0.001). Hastaların kontinans durumu ile ilgili olarak SUI, UUI ve PMR sırasıyla% 5,% 6.64 ve% 9.96 olarak gözlendi. Bu oranların hastaların 1. ay takibinde gerilediği gözlendi. Hiçbir hastanın 6. ay takiplerinde SUI, UUI ve PMR gözlenmedi.

Sonuç: Bu çalışma Türkiye'den bildirilen ilk ThuLEP serisidir. ThuLEP hakkında daha geniş serilere sahip prospektif randomize çalışmaların literatüre katkı sağlayacağına inanıyoruz.

Anahtar Kelimeler: ThuLEP, prostat, lazer, thulium, turkey

This study was approved by the Local Ethics Committee of Acıbadem University (Approval number: 2020-06/2, April 30). All research was performed in accordance with relevant guidelines/regulations, and informed consent was obtained from all participants.

Corresponding Author : Mehmet Yılmaz, Zile State Hospital, Kahya Mah. Ata St. No:1 60400 Zile, Tokat / Turkey
GSM: +90 506 701 21 68 ***e-mail:*** yilmazmehmet88@hotmail.com
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ABSTRACT

Objectives: Since 1998, after Gilling described Holmium Laser Enucleation of the Prostate (HoLEP) for the first time, laser using in prostate surgery has spread. Thulium laser enucleation of the prostate (ThuLEP) is also applied in endoscopic surgeries of the prostate. Thulium laser device is currently used in a limited number of centres in Turkey. In the present study, we aimed to contribute to the literature with the data of the cases carried out in our centre where the first case of ThuLEP was performed in Turkey.

Material and Methods: The data of 60 patients who underwent ThuLEP surgery between July 2018 and September 2019 were used in the retrospectively designed study. Perioperative datas such as Enucleation time (ET) (min), morcellation time (MT) (min), total operation time (OT-total) (min), enucleation efficiency (EE) (g/min) and morcellation efficiency (ME) (g/min), enucleated tissue weight (RTW) (g), enucleated tissue percentage (PWR), intraoperative and postoperative complications recorded. Parameters such as Qmax, Qave, Time to Qmax, Voiding Time (VT), IPSS, QoL data and postoperative continence status were compared postoperative 1st month and 6th month follow up.

Results: Statistically significant improvement was observed in all parameters showing functional results after the surgery ($p<0.001$). Regarding the continence status of patients, SUI, UUI and PMR were observed at 5%, 6.64% and 9.96%, respectively. These rates were observed to regress at the 1st month follow-up of patients. No SUI, UUI, and PMR were observed at the 6th month follow-ups of any patients.

Conclusion: The present study is the first ThuLEP series reported from Turkey. We believe that prospective randomized studies about ThuLEP with larger series would be a contribution to the literature.

Keywords: ThuLEP, prostate, laser, thulium, Turkey

INTRODUCTION

Lower urinary tract symptoms (LUTS) due to benign prostatic obstruction (BPO) are one of the most common health problems in adult men1. Although it has not been included yet in the guidelines as the gold standard, the use of laser in BPO surgery is now considered an alternative minimally invasive approach to Transurethral Resection of the Prostate (TUR-P)2,3. Holmium:YAG, Thulium, potassium-titanyl-phosphate (KTP), lithium triborate (LBO) laser, Diode lasernand Neodymium-yttrium-aluminium-garnet (Nd-YAG) laser are the types of lasers currently used for the surgical treatment of symptomatic BPO2. In particular, it has been revealed that Holmium Laser Enucleation of the Prostate (HoLEP), a minimally invasive method which is performed by using Holmium laser and is independent of the prostate size, has surgical results comparable to conventional TUR-P2,4,5. In 1998, Gilling et al. described HoLEP for the first time6. HoLEP is now among the top options in the guidelines for the surgical treatment of BPO as a result of the satisfactory outcomes obtained in studies conducted with large series7,8.

Following HoLEP, Thulium vapoenucleation of the prostate (ThuVEP) and Thulium laser enucleation of the prostate (ThuLEP) methods are also applied in endoscopic surgeries of the prostate4. ThuLEP was described in 2010 by Hermann et al.9. Although Thulium laser is not as common as Holmium laser, the use of Thulium laser in BPO surgery has been shown to be as effective and safe as Holmium laser2,3,10-12.

As in all over the world, the interest in laser enucleation has recently been on the increase in Turkey as well. Although there are many centres in Turkey that have Holmium laser devices with suitable characteristics for HoLEP surgery, Thulium laser device is currently used in a limited number of centres. In the present study, we aimed to contribute to the literature with the data of the cases carried out in our centre where the first case of ThuLEP was performed in Turkey.

MATERIAL AND METHODS

Study Design

The present study was submitted to the approval of the Local Ethics Committee of Acıbadem University and approval was obtained(Date: 30.04.2020 , Approval number: 2020-06/2). The data of 60 patients who underwent ThuLEP surgery between July 2018 and September 2019 were used in the retrospectively designed study. These operations were performed by a single surgeon (LT) with more than 500 cases of laser enucleation experience.

Patient Selection and Preopreative Data

The diagnoses of patients were confirmed before ThuLEP surgery by considering their urine flow test (uroflowmetry), prostate volume obtained by urinary tract ultrasound (USG), post-voiding residual urine determination (PVR), and International Prostate Symptom Score (IPSS). In addition; age, haemoglobin (Hb) and Prostate-Specific Antigen (PSA) values of the patients were recorded. All patients included in the study received medical treatment (alpha-blocker and/or 5-alpha reductase) for at least 6 months before the procedure. All patients were evaluated by the anaesthesia department before the procedure and their comorbidities were recorded. Treatment of patients using anticoagulant/antiaggregant therapy was discontinued for 5 to 7 days. Patients with IPSS≥8, maximum flow rate (Qmax) ≤15 ml/s, average flow rate (Qave) ≤ 10ml/s, PVR ≥50 ml and a prostate volume of over 80 cc were included in the study, whereas patients with a history of previous prostate surgery, as well as those diagnosed with prostate and/or bladder cancer, neurogenic bladder and urethral stenosis were not included in the study.

Surgical Equipment and Surgical Technique

All surgical procedures were performed under spinal anaesthesia and in the lithotomy position. 200W Thulium-YAG laser (Cyber TM; Quanta System, Solbiate Olona, Varese, Italy) and 550-µm end-ignition laser fiber were used during the operation. Enucleation was performed with the help of a 26F laser bridge resectescope (Karl Storz Endoscopy, CA, USA) with continuous flow. Morcellation was performed with a tissue morcellator (Hawk, Minitech Co., China) inserted through a nephroscope with 19F inner sheath (Karl Storz Endoscopy, CA, USA).

Laser enucleation was performed by a single surgeon (LT) using the previously described "Omega Sign" technique13. In this technique, the median and lateral lobes of the prostate are enucleated and properly morcellated preserving the anterior part of the prostate with some specific mucosal incisions. The process is finished by the beginning of continuous irrigation after the 3-way foley catheter is inserted into the urethra.

Perioperative Data

Enucleation time (ET) (min), morcellation time (MT) (min), total operation time (OT-total) (min), enucleation efficiency (EE) (g/min) and morcellation efficiency (ME) (g/min), enucleated tissue weight (RTW) (g), enucleated tissue percentage (PWR), Laser energy (joule), laser efficiency (LE) (g/min) data recorded during surgery were included in the statistical analysis. Intraoperative complications were also noted.

Postoperative Data

Following the normalization of urine color of patients, their urethral catheters were removed. They were then discharged following spontaneous urination. Accordingly, catheter time (CT) and hospitalisation time (HT) were recorded. Post-operative haemoglobin values were analysed and recorded. Patients were called in for follow-up at the first and sixth months after their discharge. Their uroflowmetry test data, PVR, IPSS, QoL, continence status and PSA values were recorded at these follow-ups. Postoperative complications were evaluated and recorded according to the Clavien-Dindo classification method14. Patients' continence status, i.e. presence of stress urinary incontinence (SUI) and urge urinary incontinence (UUI); as well as post-micturition symptoms (PMS) were evaluated according to the standards proposed by the International Continence Society (ICS)15. Patients with a score of 1-4 according to ICS-PMS scoring were considered positive for the presence of PMS.

Statistical Analysis

The Statistical Package for Social Sciences 23.0 software (SPSS 23.0, Chicago, IL, USA) was utilized. The Kolmogorov-Smirnov, Kurtosis, and Skewness Tests were used to assess the normality of the data. Descriptive statistics of the scale samples were expressed as mean ± standard deviation. Wilcoxon or paired t-test was used to evaluate changes in continuous measurements before and after surgery. In all statistical tests, $p < 0.05$ was considered statistically significant.

RESULTS

Preoperative and postoperative PSA values, Hb values and decrease rates along with age distribution and prostate size of patients are summarized in Table 1. The average age of 60 patients who underwent ThuLEP operation is 67.07 years. The largest prostate operated was 204 g, while the prostate with the smallest volume was 93 g. A statistically significant difference was observed between preoperative and postoperative Hb values (p=0.001). A statistically significant difference was also observed between preoperative and postoperative PSA values (p = 0.001).

Perioperative Results

Perioperative results are provided in Table 2. Accordingly, the mean ES and MS were 82.28 min and 10.4 min, respectively. The mean EE and ME were 0.99 g/min and 8.33 g/min, respectively. The mean OT-total is 92.68 min. The mean RTW was found to be 80.13 g.

Table 1. Patients' baseline characteristics and pre-post operative PSA and Hgb values

Value	Mean	Minimum	Maximum	P
Age (years)	67.07	49	88	
Prostate size (g)	138.1	93	204	
PSA-pre*(ng/ml)	7.09	0.7	29.3	
PSA-post* (ng/ml)	0.84	0	2	
PSA-drop (ng/ml)	6.26	0.33	28.37	0.001
Hgb-pre* (g/dl)	15.11	12.4	17.9	
Hgb-post* (g/dl)	14.92	12.1	17.7	
Hgb-drop (g/dl)	0.19	0.1	0.3	0.001

*Statistically analyzed with Wilcoxon test; others are demographic datas.

BMI: body mass index; **PSA**: prostate-specific antigen; **PSA-pre:** preoperative PSA value; **Hb**: hemoglobin
Hb-drop: hemoglobin change; **Hb-post:** postoperative hemoglobin level; **Hb-pre:** preoperative hemoglobin level

Table 2: Perioperative outcomes of patients

Value	Mean	Minimum	Maximum
ET (min)	82,28	41	140
EE (g/min)	0,99	0,45	1,69
PRW (%)	80	70	93
MT (min)	10,4	2	22
ME (g/min)	8,33	3,67	19,2
OT- total (min)	92,68	52	150
Laser (Joule)	88,11	34	121
LE (g/min)	1,19	0,77	3,33
RTW (g)	80,13	32	132

ET: enucleation time; **EE:** enucleation efficiency; **MT:** morcellation time; **ME:** morcellation efficiency;
OT-total: total operation time; **RTW:** resected tissue weight; **PRW:** percentage of resected tissue weight; **LE :** Laser efficiency

Postoperative Results

Comparison of parameters such as Qmax, Qave, Time to Qmax, Voiding Time (VT) in preoperative uroflowmeter test and PMR, IPSS, QoL data and postoperative 1st month and 6th month follow-up data are summarized in Table 3. HT and CT are also given in this table. Accordingly, statistically significant improvement was observed in all parameters showing lower urinary tract symptoms and functional results after the surgery (p<0.001).

Classification of intraoperative and postoperative complications according to the Clavien-Dindo classification and management methods are shown in Table 4. Accordingly, the most common intraoperative complications were bleeding (non-transfusion-required) (1.66%) and capsular perforation (1.66%). For both complications, prolonged urethral catheterization was performed, which lasted 36 hours. The most common postoperative complication was urinary tract infection (3.32%). The continence status of patients at the 1st and 6th month is summarized in Table 5. Regarding continence status, SUI, UUI, and PMR were observed at 5%, 6.64% and 9.96%, respectively, when the urethral catheter was removed. These rates were observed to regress to 1.66%, 0% and 4.98%, respectively at the 1st month follow-up of patients. No SUI, UUI, and PMR were observed at the 6th month follow-ups of any patients.

In pathological examination performed after the surgeries, prostate cancer (Gleason score 3+3) was detected in one of the patients. Oncological follow-up of this patient was conducted in line with the recommendations of the departments of medical oncology and radiation oncology. All pathologies of other patients were reported as benign prostatic hyperplasia.

Table 3 : Postoperative functional outcomes of patients

Value	Mean	Minimum	Maximum	*p*
Qmax-pre (ml/sec)	9.69	2.9	18.4	
Qmax-post 1st mo (ml/sec)	28.22	10	51.8	**<0.001**
Qmax-post 6th mo (ml/sec)	29.3	17	44.8	
Qave-pre (ml/sec)	4.26	1.2	7	
Qave-post 1st mo (ml/sec)	16.11	6.5	31	**<0.001**
Qave-post 6th mo (ml/sec)	15.39	8.5	23.7	
Time to Qmax-pre(ml/sec)	10.07	0.8	38.3	
Time to Qmax 1st mo(ml/sec)	8.25	0.5	10.23	**<0.001**
Time to Qmax 6th mo (ml/sec)	15.49	2	49	
VT-pre (ml/sec)	50.23	18	80	
VT-post 1st mo (ml/sec)	26.5	6	58	**<0.001**
VT-post 6th mo (ml/sec)	19.37	0	43	
PVR-pre (ml)	160.7	40	555	
PVR-post 1st mo (ml)	8.23	0	83	**<0.001**
PVR-post 6th mo (ml)	7.97	0	51	
IPSS-pre	28.28	17	35	
IPSS-post 1st mo	1.75	0	7	**<0.001**
IPSS-post 6th mo	1.5	0	5	
QoL pre	4.65	3	5	
QoL -post 1st mo	0.2	0	1	**<0.001**
QoL -post 6th mo	0.27	0	1	
HT (hours)	29.73	20	38	
CT (hours)	27.62	16	36	

Statistically analyzed with Wilcoxon test.

Qmax: maximum urinary flow rate; **Qave :** avarage urinary flow rate; **PVR:** post-void residual urine; **CT:** catheter time, **IPSS:** International Prostate Symptom Score; **QoL:** quality of life; **HT:** hospitalization time (length of stay); **VT:** Voiding time;

Table 4: The Intra- and post-operative complications according to Clavien-Dindo Classification related and managements.

Intraoperative Complications	n (%)	Management
Bleeding (required transfusion)	0	Transfusion (G2)
Bleeding (non-required transfusion)	1 (1.66)	Longer catheterization. 3 days (G1)
Capsular perforation	1 (1.66)	Longer catheterization. 3 days (G1)
Superficial bladder mucosal injury	0	Longer catheterization. 3 days (G1)
Device malfunction	0	
- Laser system malfunction - Cooling system failure - Laser scope detachment	0	Conversion to TUR-P under regional anesthesia (G3a)
- Morcellator malfunction - Blade failure	0	Cystotomy to collect the free floating prostate tissue. under general anesthesia (G3b)
Postoperative Complications	n (%)	Management
UTI	2 (3.32)	Intravenous antibiotic (G2)
Clot urinary retantion	1 (1.66)	Clot evacuation using urethral catheter. Irrigation (G3a)
Clot urinary retantion	0	Clot evacuation with cystoscopy. cystoscopic intervention under general anesthesia (G3b)
Re-catheterization	1 (1.66)	3 days with anti-inflammatory drug (G3a)
Bladder neck contracture	0	Bladder neck laser incision (G3b)
Urethral stricture	1 (1.66)	Internal urethrotomy (G3b)
Meatal stenosis	1 (1.66)	Meatoplasty (G3b)
Deviations from the normal postoperative course (postoperative emesis. electrolyte imbalance. pain etc.)	2 (3.32)	Treated with antiemetic's. antipyretics. analgesics. diuretics and electrolytes. and physiotherapy (G1)

UTI: Urinary tract infection

Table 5: The continence status of patients during follow-up period

Continence Status			
Catheter removal time	**SUI**	**UUI**	**PMS**
	n(%)	**n(%)**	**n(%)**
First day	3 (5)	4(6.64)	6 (9.96)
1st month after	1 (1.66)	0	3 (4.98)
6th month after	0	0	0

SUI: Stress urinary incontinence; **UUI:** Urge urinary incontinence; **PMS:** Post-micturition symptoms.

DISCUSSION

In the last 20 years, there has been a transition to the minimally invasive transurethral prostate enucleation surgery and laser use from transurethral prostate resection (TUR-P) and open prostatectomy for the treatment of Benign Prostate Hyperplasia (BPH) due to fewer complications and shorter hospitalisation time16,17. Thulium laser used for this purpose in prostate enucleation has a wavelength of 2013 nm and a tissue penetration depth of 0.25 mm2. Unlike Holmium laser, energy is constantly released in the form of waves2. Short depth of penetration leads to high energy density, which creates a rapid vaporisation effect in the tissue3,18. In addition, Thulium laser provides effective vaporisation and haemostasis, reducing blood loss and providing a clearer view during the operation18. Thulium laser can be used for vaporisation, resection or enucleation.

The reliability of surgery to be performed becomes a concern with increasing age in patients with BPH. It has been shown that laser prostatectomy can be safely performed in the elderly group of patients19,20. In a study conducted with 412 patients comparing ThuLEP results in BPH patients over and under 75 years of age, no significant difference was observed between two groups in terms of IPSS, Qmax, QoL and reoperation rate at the 1st year follow-ups21. Median operation time, catheterisation time and hospitalisation time were similar and comparable results were obtained between the groups in terms of Clavien III and IV

complications (3.8% vs. 1%). ThuLEP was performed safely in the present study where the oldest patient was 88 years old and the mean age was 67.07 years.

Open prostatectomy (OP) has been the standard treatment for large prostates for years, although it is associated with significant peri-postoperative complications such as severe bleeding22. With prostate enucleation becoming popular, studies have shown that both HoLEP and ThuLEP are minimally invasive prostate surgeries which are effective and can be an alternative to open prostatectomy in large prostates23-26. In a study by Bach et al. conducted in 90 BPH patients with >80 cc prostates who underwent ThuLEP , significant improvements were observed in IPSS, QoL, Qmax and PVR during 12 months of follow-up23. 1 (1.11%) patient had superficial urethral orifice injury due to large median lobe during enucleation, while 1 patient developed urethral stricture in postoperative follow-up. In 10 patients (11.11%), stress urinary incontinence (SUI) was was observed, and in 8 patients improvement was observed in SUI within 1 -6 months23. In a prospective study conducted by Becker et al. in 2019, in 90 patients with >85 ml prostates who underwent ThuVEP and whose median follow-up period was 36.5 (16-60) months, there was an improvement in functional parameters during 12-month follow-up, while urethral stricture developed in 1 patient (1.1%) , and 1 patient (1.1%) underwent ThuVEP again with a reoperation during 48-month follow-up24.

In another study, the functional results of Thulium vapoenucleation in prostate sizes of 75 ml and above were improved in 1-, 3-, 6- and 12-month follow-ups ($p<0.005$)25. Intraoperative bladder injury was observed in 2 patients (8%), and in the first 30 days after surgery, urinary tract infection (UTI) was observed in 5 patients (20%) , re-catheterization in 1 patient (4%) and gross hematuria in 3 patients (12%).

ThuLEP is a minimally invasive surgery, which is as effective as HoLEP and has a high safety profile in large prostates. In a randomized controlled study with an 18-month follow-up comparing ThuLEP and HoLEP in 116 patients with a prostate size of >80 ml, no significant changes were observed in morcellation time, weight of removed tissue, haemoglobin decline, catheterization time and hospitalisation time ($p>0.05$)26. After 18 months of follow-up, there was no significant difference between IPSS, PVR, QoL and Qmax in ThuLEP and HoLEP groups and between two groups in terms of postoperative urethral stricture and bladder neck contracture26. In the present study, there were also patients with large prostate volumes, and the mean prostate volume was 138.1 g, and the postoperative results were found to be consistent with the literature. In addition, in the present study, although the decrease in Hb after surgery was very low (0.19 g/dl), this difference was found to be statistically significant ($p = 0.001$). It can be considered that this decrease in Hb, which did not cause any clinical symptoms and did not require blood transfusion, developed due to the large volume of the enucleated prostates.

One of the alarming consequences after laser prostatectomy is postoperative urinary incontinence. The prevalence of SUI after HoLEP can range from 4.9% to 12.5%27. SUI, which is temporary in most patients, may improve within 6 -12 months28. In the literature, incontinence after Thulium laser prostatectomy ranges from 0.5% to 6.7%2. In a study by Yuan et al. conducted in 188 patients who underwent ThuLEP, SUI rate was observed at 0.5% in the late period18. Fabrizio et al. have reported transient urge incontinence after ThuLEP at a rate of 6.7%29, and in a multi-centered prospective study conducted in 2216 patients, SUI was reported at a rate of 0.1% following Thulium laser prostate resection30.

A prospective randomized study comparing HoLEP (n=46) and ThuVEP (n =46) found transient urge incontinence at a rate of 2.1% in ThuVEP group and 8.7% in the HoLEP group (p=0.149), while early transient stress incontinence was reported at a rate of 18.8% in the ThuVEP group and 17.4% in the HoLEP group, and no significant difference was observed between two groups in terms of both urge and stress UI ($p = 0.491$) and no stress UI was observed in any patient at the 6th month follow-up16. In the present study, SUI and UUI were observed at 5% and 6.64%, respectively, in the early period (when the catheter was removed). Patients showed improvement in SUI, UUI and PMS at their 1st and 6th month follow-ups. No SUI, UUI and PMS were observed at their 6th month follow-ups. The present study has shown that postoperative incontinence rates after ThuLEP are similar to HoLEP and decrease in the follow-ups. It is known that incontinence after laser enucleation is closely related to the applied technique. The Omega sign technique we used in the present study is a newly defined technique for preserving the external sphincter structure.

In the study where this technique was first described, SUI, which was 3% when the catheter was removed in patients after HoLEP, decreased to 1% at the 1st month, and no SUI was observed in any patient at the 6th month follow-up13. In the present study, ThuLEP was performed with the Omega sign technique and it has been found that continence rates are similar to HoLEP.

Perioperative and postoperative complication rates are low in ThuLEP surgery2,10,12,18. In a study by Bach et al., bleeding was observed at a rate of 5.6%, urinary tract infection at 6.8%, urethral stricture at 1.6%, and re-operation at 2.2%10. In another study, blood transfusion rate after ThuLEP was 2.7%, urinary tract infection rate was 12.8%, while bladder injury during morcellation was reported at a rate of 1.3%29. Raber et al. have reported that the rate of blood transfusion was 0.01%, re-operation rate was 0.007%, and the rate of bladder neck contracture and urethral stricture was 0.01%12. In another study, the rate of bladder injury was found to be 1.6%, urethral stricture 1.1% and urinary tract infection 7.9%18. Studies show that post-ThuLEP complications are at similar rates. In the present study, the rate of intraoperative bleeding (non-transfusion-required) has been 1.66% and capsular perforation 1.66%. Transfusion required bleeding, device malfunction or superficial bladder mucosal injury did not occur in any patient. Urinary tract infection managed by intravenous antibiotic administration (3.32%) was the most common postoperative complication, while clot urinary retention (1.66%), re-catheterization (1.66%), urethral stricture (1.66) %), meatal stenosis (1.66%) were other less common postoperative complications. It can be said that the intraoperative and postoperative complications in the present study are compatible with the literature data and close to the lower limits.

Study Limitations

Retrospective study design, not evaluating sexual function in patients, not evaluating the learning curve and not performing cost analysis may be considered to be among the limitations of the present study.

CONCLUSION

ThuLEP is an effective and a reliable minimally invasive surgery that can be preferred in BPO surgery. The present study is the first ThuLEP series reported from Turkey. We believe that prospective randomized studies about ThuLEP with larger series would be a contribution to the literature.

Conflict of Interest: The authors declare that they have no conficts of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Ethical Approval: This study was approved by Local Ethics Committee of Acıbadem University (Approval number: 2020-06/2, April 30) and ethical standards described in the Helsinki Declaration Statement have been followed in this study.

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