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Original Research / Özgün Araştırma

How Is High Power (200w) Thulium Laser Vapoenucleation of the Prostate Impacting Functional Parameters? Short-Term Follow-Up Results

Prostatın Yüksek Güçlü (200w) Thulium Lazer Vapoenükleasyonu Fonksiyonel Parametreleri Nasıl Etkiliyor? Kısa Dönem Sonuçlarımız

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Özet

Amaç: Literatürde yüksek güçlü Thulium:YAG lazer vapoenükleasyon tekniğinin sonuçlarını irdeleyen çalışmalar kısıtlıdır. Sunulan çalışmada, benign prostat hiperplazisi tedavisinde kullanılan 200 W Thulium:YAG lazer vapoenükleasyonun, etkinlik ve güvenilirliğinin, bu prosedürün alt üriner sistem semptomları, erektil, ejakülatuar fonksiyonlar üzerindeki etkisininin analiz edilmesi amaçlanmıştır.

Gereç ve Yöntemler: Aralık 2021 ile Haziran 2022 arasında, benign prostat hiperplazisinin belirti ve semptomlarını tedavi etmek için kliniğimizde Thulium vapoenükleasyon (ThuVEP) uygulanan hastaların verileri prospektif olarak toplandı. Hariç tutma kriterleri uygulandıktan sonra 50 vakalık bir örneklem büyüklüğü elde edildi ve veriler retrospektif olarak analiz edildi. Ameliyatı takip eden 1. ve 6. aylarda tüm hastalar alt üriner sistem semptomları, erektil fonksiyon ve ejakülasyon semptomları açısından ameliyat öncesi durumları ile karşılaştırıldı. Oluşan komplikasyonları sınıflandırmak için Modifiye Clavien-Dindo Sınıflandırması da kullanıldı.

Bulgular: Hastaların IPSS skorlarında 6 aylık takip sonunda belirgin ve anlamlı bir iyileşme görüldü (27'ye karşı 5; p<0.001). Ameliyat öncesi durumla karşılaştırıldığında, IIEF-5 skoru ile ölçülen erektil fonksiyonlar ameliyatla önemli ölçüde değişmedi (17'ye karşı 18; p=0.067). Takip süresinin sonunda, MSHQ-EjD skoru ile ölçülen ejakülasyon fonksiyonlarında önemli bir bozulma

Abstract

Objective: There are limited studies in the literature analyzing the results of the high-power Thulium:YAG laser vapoenucleation technique. In this current study, it was aimed to examine the effectiveness and reliability of 200 W Thulium:YAG laser vapoenucleation used in the treatment of benign prostatic hyperplasia and the effect of this procedure on lower urinary tract symptoms, erectile and ejaculatory functions.

Material and Methods: Data were collected prospectively from patients who underwent Thulium vapoenucleation (ThuVEP) in our clinic between December 2021 and June 2022 to treat signs and symptoms of benign prostatic hyperplasia. Following the application of the exclusion criteria, a sample size of 50 cases was obtained, and the data were analyzed retrospectively. In the first and sixth months following surgery, all patients were compared to their preoperative status in terms of lower urinary tract symptoms, erectile function, and ejaculatory symptoms. The Modified Clavien-Dindo Classification was also used to classify the complications that occurred.

Results: The patients' IPSS scores showed a notable and significant improvement at the end of the 6-month follow-up (27 vs. 5; p<0.001). When compared to the preoperative state, erectile functions as measured by the IIEF-5 score did not significantly change with the surgery (17 vs. 18; p=0.067). At the end of the follow-up period, there

This study was reviewed and approved by the Kafkas University Faculty of Medicine Ethics Committee 30.11.2012/09.
All research was performed in accordance with relevant guidelines/regulations, and informed consent was obtained from all participants.

oldu (10'a karşı 6.5; p<0.001). İşlem sırasında ve sonrasında hastaların 2'sinde (%4) Clavien 3a seviyesinde komplikasyon görüldü, ancak bu seviyenin üzerinde komplikasyon görülmedi.

Sonuç: Semptomatik benign prostat hiperplazisinin cerrahi tedavisinde kullanılan yüksek güçlü (200 W) ThuVEP yöntemi kısa dönem sonuçlarına göre fonksiyonel sonuçlar açısından güvenilir ve etkilidir.

Anahtar kelimeler: thulium, lazer vaporizasyon, impotans, alt üriner sistem semptomları

was a substantial deterioration of ejaculatory functions as measured by the MSHQ-EjD score (10 vs. 6.5; p<0.001). During and after the procedure, complications at the Clavien 3a level were seen in 2 (4%) of the patients, but no complications above this level were seen.

Conclusion: The high-power (200 W) ThuVEP method used in the surgical treatment of symptomatic benign prostatic hyperplasia is reliable and effective in terms of functional results according to short-term results.

Keywords: thulium, laser vaporization, impotence, lower urinary tract symptoms

INTRODUCTION

A century after its anatomical description in 1550, Herr hypothesized that an enlarged prostate could cause retention by interfering with urine flow (1). Since then, there has been a huge improvement in the knowledge about the pathophysiology of benign prostatic hyperplasia (BPH) and methods for treating it. More than 210 million men around the world currently have been diagnosed with BPH (2). Many new options for the interventional treatment of symptomatic BPH have arisen thanks to remarkable developments in technology and surgical instruments, but transurethral resection of the prostate (TUR-P) is still the gold standard3. However, laser-assisted prostate enucleation in prostates larger than 80 ml has been incorporated into recommendations (3).

Two methods, thulium laser vapoenucleation of the prostate (ThuVEP) and thulium laser enucleation of the prostate (ThuLEP), were primarily described for the surgical management of BPH using thulium: yttrium-aluminum-garnet (Tm: YAG) lasers (4,5). Both approaches attempt to enucleate the adenoma over the capsule, with the primary distinction being the relative intensity of the laser energy and the mechanical force utilized. Anatomical dissection using lower power and more mechanical force is often preferred in ThuLEP, even though enucleation with a higher amount of vaporization using a higher laser intensity is acceptable in ThuVEP (6). According to the latest guidelines, ThuLEP seems to offer similar efficacy and safety when compared to TURP, bipolar enucleation, and holmium laser enucleation of the prostate (HoLEP); whereas, ThuVEP is not supported by randomized controlled trials (RCT). Based on the limited number of RCTs there is a need for ongoing investigation of these techniques3. Therefore, it is of great priority to investigate the effects of the ThuVEP technique, which incorporates enucleation and vaporization simultaneously.

A 200-watt Tm: YAG laser was acquired by our urology clinic at the end of 2021 to begin the ThuVEP procedure because we were unable to ignore the advice made in the guidelines and the rapidly growing laser prostatectomy trend. We conducted the current observational study using a high-power (200 W) Tm: YAG laser system in order to evaluate the safety and effectiveness of ThuVEP and determine how it affects patients' lower urinary tract symptoms, erectile, and ejaculatory functions. We aimed to investigate this since we realized there wasn›t enough information in the literature.

MATERIAL AND METHODS

Between December 2021 and June 2022, we prospectively gathered information about patients who had ThuVEP to treat symptoms of benign prostatic hyperplasia in our clinic. The research project that we conducted was sanctioned by the university's board of ethics (30.11.2022; 80576354-050-99/178). The Helsinki Declaration's ethical guidelines were strictly followed. All patients gave their written consent after being fully informed of all potential risks and benefits.

The patients were informed about the ThuVEP technique and it was emphasized that this technique is one of the newest methods applied in the surgical treatment of BPH and is not yet among the first treatments recommended in the guidelines. The study did not include patients with a history of bladder outlet obstruction surgery (one patient), neurogenic bladder (one patient), or prostate cancer (three patients). In addition, the study did not include patients who were not sexually interested (two patients). Moreover, patients who had indwelling bladder catheters for longer than 1 month were not included in the study due to concerns that this factor could bias the results of surveys (two patients). In addition, the results of three patients who did not come for follow-up examinations were not included in the study. Based on these assessments, we obtained a sample size of 50 patients. A flowchart of the study is given in Figure 1.

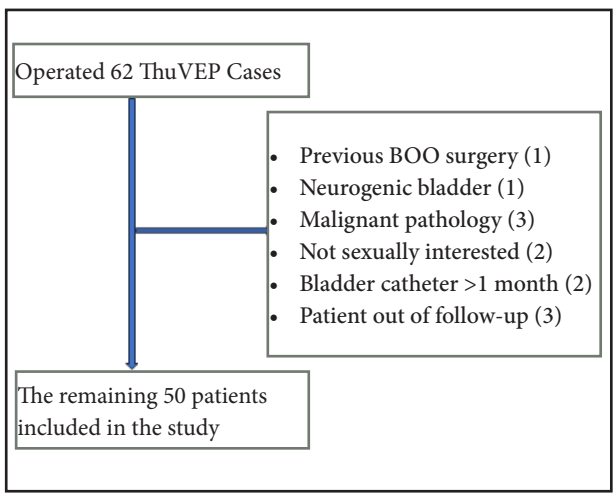

Figure 1. Flowchart of the study
BOO: Bladder outlet obstruction.

Demographic data, including the patients who had a detailed physical examination and a set of tests in the laboratory, including prostate-specific antigen (PSA), were recorded. If the patient had a high PSA level or suspicious digital rectal examination, a 12-core transrectal ultrasonography-guided prostate biopsy was performed. In addition, preoperative uroflowmetry and postvoid residual volume (PVR) evaluations were carried out as part of the standard preoperative procedures (if the patient did not have a catheter). PVR was measured with a transabdominal probe using the prolate ellipsoid formula (Volume = length x width x height x 0.52). Also, all patients had to go through a detailed ultrasonic evaluation (Aplio 400, ®Toshiba Medical Systems Corporation), and prostate volumes were calculated using a transrectal probe with the prolate ellipsoid formula (7). Additionally, patients were asked to complete 3 validated questionnaires preoperatively and at postoperative follow-up. These were the International Index of Erectile Function (IIEF)-5, International Prostate Symptom Score (IPSS), and Male Sexual Health Questionnaire-Ejaculatory Disease (MSHQ-EjD) (8,9,10). All data were collected prospectively and analyzed retrospectively.

Technique

All operations were performed under general anesthesia. All operations were performed by 3 different experienced surgeons with more than 10 years of endourology background. A Cyber TM 200 W device (Quanta System, Solbiate Olona, Varese, Italy) was used for every surgery, and a 26 French resectoscope (Karl Storz™) was used to send a 550 m laser fiber through it. Enucleation was done using the earlier-described en-bloc technique (11). The bladder neck was approached after an early apical release and a circumferential advance. For the purpose of apical liberation, settings of 60 W resection and 40 W coagulation were chosen. Since we are surgeons at the beginning of the learning curve for this technique, entering the right plan in circumferential en-bloc enucleation was frequently not achievable. The tissue leaves created were swiftly vaporized with 200 W power in all of our 50 cases. A Hawk morcellator (Hawk Medical Instrument Co. Ltd.) was used for all morcellation processes. Each patient had a 22 Fr three-way urethral catheter inserted, and their bladder was irrigated continuously until the urine turned a clear color. Enucleation time, morcellation time, and specimen weight were recorded for every instance. Vaporization of the remaining adenomatous tissue after enucleation is shown in Figure 2.

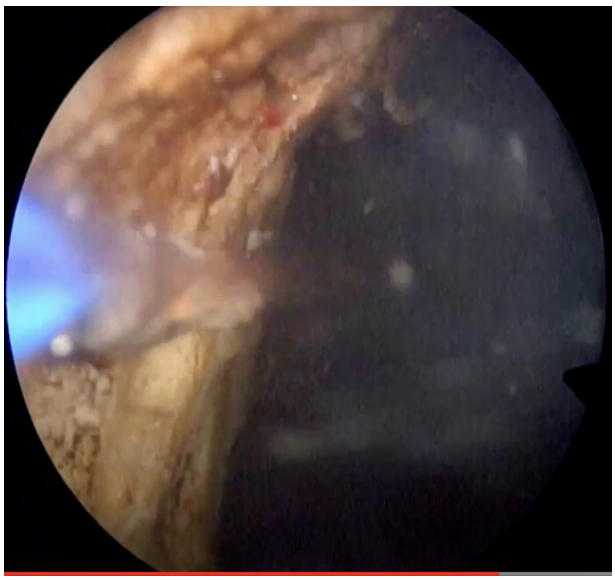

Figure 2. Vaporization of the remaining adenomatous tissue after enucleation

Follow-up

Patients were assessed with PSA levels, uroflowmetry, and PVR as a part of the periodic examination. Additionally, the three valid questionnaires (IIEF, IPSS, and MSHQ-EjD) that patients completed before the procedure were asked to be repeated, taking into account their altered condition, at both the postoperative first and sixth month.

We used Modified Clavien-Dindo Scoring System to evaluate and classify the complications (12). All demographic data, laboratory findings, and valid questionnaire scores were given in a comprehensive manner.

Statistical Analysis

The SPSS v25.0 statistical package was used for the analyses (SPSS Inc, Chicago, IL, USA). The Shapiro-Wilk test was utilized to examine the distribution for normalcy between the groups. Numbers and percentages were provided for the categorical variables, while the median and interquartile range were provided for the continuous variables. When comparing across repeated measurements, the Wilcoxon test was utilized. The significance level for the p-value was set at 0,05.

RESULTS

A total of 50 men underwent surgery. Prior to surgery, PVR was estimated to be at a median of 150 mL (IQR=100–200), and Qmax was 1.75 ml/s (IQR= 0-8.4). The median prostate size was 60 mL (IQR= 76-100). The median enucleation weight was 26 g (IQR= 26-39), and the median enucleation time was 49.5 min. (IQR= 35-70). The estimated median enucleation efficiency was 0.5 g/min (IQR= 0.4-0.8). The median total operation time was found to be 64.5 min (IQR= 45-80), while the median morcellation time was 13.5 min. (IQR= 10-20). Our measured Hgb decrease value was found to be a median of 0.35 g/dL, while the median postoperative catheter stay time was 1 day (IQR= 1-2). The hospital stay was 1 day (IQR= 1-2). Demographic and operative data of patients are given in Table 1.

The median IPSS [27, (IQR=23-30)] statistically significantly reduced at the first [5, (IQR=2-8), p <0.001] and six-month follow-up first [5, (IQR=2-8), p <0.001]. PVR [150, (IQR= 100-200)] was statistically significantly decreased at both first [0, (IQR= 0-25)] and sixth-month [0, (IQR= 0-50)] examinations. Additionally, Qmax (ml/s) was statistically increased at the first-month follow-up [19.00 (16.00-23.00), p < 0.001]. However, Qmax changes decreased at the six-month follow-up, but it was still significantly higher than the baseline value [18.25 (IQR=15-21), p < 0.001]. Additionally, the postoperative IIEF score was pretty similar at first [17.00 (IQR=11.7-20), p=0.357] and sixth months [18.00 (IQR=14.00-21.00), p=0.067] when compared to the preoperative status [17, (IQR= 11.7-20)]. Patient's postoperative MSHQ-EjD scores were significantly lower than their preoperative ratings [10, (IQR= 6-15.2)] at both the first [6.5, (IQR= 4.75-9)] and sixth-month [6.5, (IQR= 4.75-9)] evaluations. Postoperative outcomes are given in Table 2.

Perioperative complications were seen in only 4 (8.0%) patients, and capsular perforation was seen in only two (4.0%) patients. Partial right ureteral orifice resection was observed in 1 patient, which did not require any additional intervention, while bleeding requiring cauterization with a resectoscope due to

intraoperative bleeding was observed in another patient. The postoperative complications were generally minor complications, and Clavien 3a complication was seen in only two (4.0%). These patients experienced urethral stricture following surgery and needed cystoscopic dilatation. Stress incontinence was a complication for one of our patients, which resolved on its own without further medical attention. Perioperative and postoperative complications are given in Table 3.

Table 1. Demographic and operative data

		Value
Age (years) [a]		66.5 (60-72)
PSA (ng/mL) [a]		2 (1.2-5.19)
Preoperative PVR (mL) [a]		150 (100-200)
Preoperative Qmax [a]		1.75 (0-8.4)
ASA [b]	**ASA 1**	18 (36.0%)
	ASA 2	26 (52.0%)
	ASA 3	6 (12.0%)
Charlson Comorbidity Index [a]		2 (0-3)
Preoperative Catheter [b]	**None**	26 (52.0%)
	Urethral	24 (48.0%)
Preoperative Biopsy History		18 (36.0%)
Prostate Volume (mL) [a]		60 (76-100)
Enucleation Weight (g) [a]		26 (20-39)
Enucleation Time (min.) [a]		49.5 (35-70)
Morcellation Time (min.) [a]		13.5 (10-20)
Total Operation Time (min.) [a]		64.5 (45-80)
Enucleation Efficacy(g/min) [a]		0.5 (0.4-0.8)
Hgb Drop (g/dL) [a]		0.35 (0.1-0.8)
Postoperative Catheter (day) [a]		1 (1-2)
Hospitalization Time (day) [a]		1 (1-2)

[a] Data was expressed as median and interquartile range
[b] Data was expressed as count and frequency

Table 2. Postoperative outcomes

	Preoperative	Postoperative 1st month	Postoperative 6th month	*p value*
IPSS	27 (23-30)	5 (2-8)	5 (2-8)	<0.001, <0.001
IIEF-5	17 (12-20)	17 (11.7-20)	18 (14-21)	0.357, 0.067
MSHQ-EjD	10 (6-15.2)	6.5 (4.75-9)	6.5 (4.75-9)	<0.001, <0.001
Qmax (mL/s)	1.75 (0-8.4)	19 (16-23)	18.25 (15-21)	<0.001, <0.001
PVR (mL)	150 (100-200)	0 (0-25)	0 (0-50)	<0.001, <0.001
PSA (ng/mL)	2 (1.2-519)	Null	0.5 (0.3-2.4)	<0.001

Data was expressed as median and interquartile range
Wilcoxon test was used

Table 3. Perioperative and postoperative complications

		Value
Perioperative Complication	**Absent**	46 (92.0%)
	Present	4 (8.0%)
Postoperative Complication (Clavien-Dindo)	**None**	35 (70.0%)
	Clavien I	7 (14.0%)
	Clavien II	6 (12.0%)
	Clavien IIIa	2 (4.0%)

Data was expressed as count and frequency

DISCUSSION

Our study's vital finding was that high-power ThuVEP surgery considerably reduced lower urinary system symptoms while having no discernible positive or negative effects on erectile performance. Even though there was no discernible change in erectile function, ejaculatory functions were unquestionably negatively impacted.

The use of lasers to perform prostate enucleation is growing in popularity and is quickly becoming the gold standard for the surgical treatment of enlarged prostates. These developments have piqued the interest of endourologists in that region (13). Laser prostatectomy has advanced in recent years, and questions about its efficacy and safety have come with it. However, several studies have shown that this procedure is safe and effective (14). There was concern that the heat action of the laser on the prostate tissue would cause damage to the surrounding tissues when the use of high-power and continuous-wave (CW) thulium laser in the treatment of BPH was initially announced in 2005 (15,16). Theoretically, thulium CW lasers might generate beams between 2010 and 2013 nanometers in wavelength, depending on the manufacturer. At these wavelengths, electromagnetic energy is transformed into heat, which induces the evaporation of prostate tissue with a penetrating depth of around 0.2 mm (17,18).

Various functional aspects of the TURP procedure, which still maintains its status as the gold standard, have been repeatedly investigated. Studies have shown that although TURP provides significant improvement in lower urinary tract symptoms of patients, it does not have a significant effect on erectile functions. In addition, severe impairments in ejaculatory functions were observed after TURP. In the present study, the effect of ThuVEP on functional parameters was found to be similar to the aforementioned TURP studies (19,20). According to the results of a meta-analysis investigating the results of thulium vaporesection and bipolar-monopolar TURP, it was stated that thulium vaporesection was superior to other methods in terms of bleeding, catheterization time, and hospital stay, as well as causing severe regression in the symptoms of patients as in TURP (21).

Our study's functional findings corroborated those of other research that looked at ThuLEP's effect on erectile functions, which is a positive factor. The average IIEF-5 score at the conclusion of the 6-month follow-up did not significantly differ from the preoperative state, even though we used higher power (200W) than in prior investigations (22,23). Similar findings were seen after 12 months of follow-up in another prospective research of 72 individuals examining the influence of ThuVEP on erectile functions (24). Results from a 2016 study by Saredi et al., including the impact of ThuLEP on ejaculatory functions, were presented (25). The patients' mean MSHQ-EjD scores decreased dramatically, as seen in the study's follow-up data. This result is to be expected, given that our surgical approach does not involve conserving the bladder neck fibers.

In their ThuVEP series of 65 patients, Netsch et al. observed a significant decline in IPSS scores [21.5

(IQR 15.5-23.75) vs. 5 (IQR 3-8)] and a rise in Qmax median values [7.7 (IQR 6.3-10) vs. 28.3 (IQR 21.25-39.2) ml/s]. We found fairly comparable results in our study; however, there was a modest but not statistically significant drop in Q-max values between the first and sixth postoperative months. Using high power (150-200 W) with a thulium laser, Chang et al. also significantly reduced the IPSS in their series (26).

Median PSA levels at the 6-month follow-up in our research dropped by 75% compared to baseline levels (0.5 ng/mL against 2.0 ng/mL). This is significant since it provides evidence of the efficacy of enucleation, and comparable reductions have been documented in other research (25). However, in our series, there was a disparity between the median prostate volume (60 mL) and the enucleation weight (26 g), and we believe that this is because of the considerable quantity of tissue vaporized during ThuVEP. Due to the fact that we are at the beginning of our learning curve and the vaporization impact of the 200 Watt laser, we might assume that our enucleation efficiency appears to be lower than the studies in the literature (27).

In the operation and follow-up duration, 8 individuals experienced complications that were Clavien 2 or 3a, which translates to a rate of 16%. During the 6-month follow-up, 2 of our patients developed urethral stenosis that required endoscopic intervention. Additionally, we must emphasize that one of our patients had significant stress incontinence that spontaneously resolved five months after we discovered it. The absence of complications more than Grade 3a, or what we would consider severe complications, was consistent with the literature despite there are ThuLEP studies showing reduced overall complication rates (28–30). In terms of hemoglobin decline, ThuVEP surgery offered us a great deal of confidence, and like in other research, hemoglobin decrease was limited (31). In the study by Praiser et al., in which the outcomes of high-power thulium vaporization were reported, no complications above Clavien grade 3 were seen (32).

Limitations

There are limitations in our research, obviously. What stands out most is that our study did not include a control group. Additionally, our research was not randomized. One further drawback is that there is a limited number of cases. Additionally, more than the 6-month follow-up time may be required for monitoring some complications, such as bladder neck stricture. However, because we are a reference center, relatively few of our patients comply with long-term follow-up, as we have seen from our previous works. In addition, the fact that not all operations were performed by the same surgeon stands out as another handicap of the study. In spite of the fact that, the experience level of the surgeons is similar, different results may have been obtained specific to this procedure. Despite these drawbacks, we believe that providing the impact on functional outcomes with the data gathered prospectively in an area of interest, such as the employment of high-power thulium lasers in the treatment of BPH, will contribute to the literature.

CONCLUSION

The high-power (200 W) ThuVEP method used in the surgical treatment of symptomatic benign prostatic hyperplasia is reliable and effective in terms of functional results according to short-term results. In this area, more thorough follow-up randomized controlled trials are required.

Conflict of Interest Statement

The authors declare no conflict of interest.

Ethics Committee

Kafkas University Faculty of Medicine Ethics Committee 30.11.2012/09.

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