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ORIGINAL ARTICLE

Prostate Disease

Sexual outcome of patients undergoing thulium laser enucleation of the prostate for benign prostatic hyperplasia

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Treatment of patients with lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH) may affect the quality of sexual function and ejaculation. The effect of new surgical procedures, which are currently available to treat BPH, on erection and ejaculation, has been poorly studied. This study aimed to assess the effect of thulium laser enucleation of the prostate (ThuLEP) on sexual function and retrograde ejaculation in patients with LUTS secondary to BPH. We performed a prospective study in 110 consecutive patients who had undergone ThuLEP to analyze changes in sexual function and urinary symptoms. To evaluate changes in erection and ejaculation, and the effect of urinary symptoms on the quality of life (QoL), five validated questionnaires were used: the ICIQ-MLUTSsex, MSHQ-EjD, International Index of Erectile Function 5, International Prognostic Scoring System (IPSS) questionnaire, and QoL index of the intraclass correlation coefficients. Patients also underwent IPSS and flowmetry to assess the outcome of flow. Patients were evaluated before surgery and 3–6 months after ThuLEP, whereas those with previous abdominal surgery were excluded. The patients' mean age was 67.83 years. Postoperative urinary symptoms improved after surgery. No significant differences in erectile function before and after surgery were observed. As compared with other techniques described in the literature, the percentage of patients with conserved ejaculation increased by 52.7% after ThuLEP. ThuLEP positively affects urinary symptoms and their effect on the QoL of patients as assessed by questionnaire scores. While endoscopic management of BPH (e.g. transurethral resection of the prostate) causes retrograde ejaculation in most patients, those who undergo ThuLEP have conserved ejaculation and erectile function.

Asian Journal of Andrology (2015) **17**, 802–806; doi: 10.4103/1008-682X.139255; published online: 23 January 2015

Keywords: antegrade ejaculation; benign prostatic hyperplasia; sexual function; thulium laser enucleation of the prostate

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a common medical condition. Transurethral resection of the prostate is currently considered the surgical gold standard worldwide to treat BPH, as well as open prostatectomy (Millin *vs* the transvesical approach) for an enlarged prostate. Nevertheless these procedures often expose older patients to increased perioperative morbidity.^{1,2}

Indications for surgical treatment of BPH are explained in the EAU Guidelines and are strictly related to lower urinary tract symptoms (LUTS).³ Holmium laser enucleation of the prostate (HoLEP), which is a further option, is also performed as an accepted alternative to transurethral resection of the prostate and open procedures.⁴ The effects of the latest surgical procedures for treating BPH have been poorly studied, and their effect on the quality of sexual function, mainly associated with ejaculation, is unknown. Previous studies have reported a consistent decrease in the International Index of Erectile Function 5 (IIEF-5) score, which measures orgasmic function, without any difference among analyzed procedures.⁵

Thulium laser enucleation of the prostate (ThuLEP) is a new procedure for treating BPH.⁶ The 2010 nm-wavelength thulium laser conducts through saline and enables incision and coagulation of prostatic tissue. Similar to HoLEP, ThuLEP has been implemented

with development of the soft tissue morcellator to allow complete enucleation.⁷

To the best of our knowledge, sexual function in men who have undergone ThuLEP has not been evaluated in a prospective study relying on validated instruments. Therefore, in the current study, we assessed the effect of ThuLEP on sexual function of some patients with LUTS secondary to BPH and retrograde ejaculation.

PATIENTS AND METHODS

Patients' selection

We performed a prospective study on changes in sexual function. The study was approved by our Local Ethical Committee. A total of 180 consecutive patients, who had symptomatic BPH and had a surgical indication according to EAU Guidelines,³ were enrolled in this study from January 2012 to January 2013. Patients who were older than 80 years old who had previous open or endoscopic management of BPH and abdominal surgery, were not included in the study to avoid any bias related to postsurgical overactive bladder syndrome.

Treatment and follow-up

According to the exclusion criteria mentioned below, 110 patients were recruited and each of them was treated with ThuLEP with the

Cyber TM 150 device (Quanta System, Solbiate Olona, Varese, Italy). All of the surgical procedures were performed by three surgeons (LC, SC, and GB) who were fully trained in ThuLEP. This surgical technique has already been previously described.⁶ A maximum power of 110 W was set for each case. The Piranha Morcellator device (Richard Wolf, Knittlingen, Germany) was used at the end of the enucleation step. Postoperative Foley catheter irrigation was performed and removed the day after surgery. Patients were assessed by a prostate physical examination, total serum prostate specific antigen levels, digital rectal examination, urine culture, transrectal ultrasound (TRUS) (to evaluate prostatic volume), the International Prognostic Scoring System (IPSS), and uroflowmetry. Some of them also underwent a urodynamic study to assess whether detrusor hypocontractility could explain altered flow. Patients with a prostate specific antigen level higher than 4 ng ml⁻¹ underwent TRUS biopsy to exclude cases of prostatic carcinoma.

Questionnaires and statistical analysis employed

To assess changes in erection and ejaculation, and the effect of urinary symptoms on the quality of life (QoL), five validated questionnaires were used: the ICIQ-MLUTSsex, MSHQ-EjD,⁸ IIEF-5, IPSS questionnaire, and QoL Index of the intraclass correlation coefficients. Patients were evaluated preoperatively and at 3 and 6 months after ThuLEP. Flowmetry was performed during the follow-up period to assess changes in flow. Patients were asked not to ride a bicycle or motorbike during the 1st month after surgery to decrease the risk of hematuria and clot retention.

The collected data were analyzed by an online regression (Student's *t*-test, Chi-square test, and logistic regression analysis) tool at www.xuru.org using linear least squares fittings. For all statistical comparisons, significance was considered at *P* < 0.05.

RESULTS

Table 1 shows the patients' characteristics. The patients' mean age was 67.83 years (standard deviation [s.d.]: 7.74; range: 52.28–85.13 years). The mean prostate volume was 75.46 ml (s.d.: 43.75; range: 21.77–235.12 ml). Sixty-nine (62.7%) patients had been previously treated with alpha blockers, while six of them (8.7%) received a combination of finasteride and alpha blockers. Not all of the patients (16/110, 14.5%) reported a stable heterosexual relationship of at least 6 months duration. Thirty-one (28.2%) patients had undergone TRUS biopsy before ThuLEP.

Table 2 shows the changes in scores of the questionnaires used. **Table 3** shows flowmetry results. A significant and sustained improvement in the scores of questionnaires for evaluating urinary symptoms was observed. There was no significant difference in patients' erectile function before and after surgery. Analysis of the postoperative MSHQ-EjD showed 58 (52.7%) patients with consistent ejaculation function (EF) after ThuLEP. This rate was 78.4% (58/74) when we excluded patients with previous ED, no possibility of having sexual intercourse, and those with previous ejaculatory dysfunction not related to alpha blockers. Seven of the 58 patients (12.1%) reported painful ejaculation. Analysis of the postoperative ICIQ-MLUTSsex questionnaire showed no significant change in erectile function after ThuLEP. A similar result was obtained for the IIEF-5 Questionnaire (**Table 4**). Interestingly, patients who maintained their antegrade ejaculation were found to be more sexually satisfied than the other patients.

A total of 51.7% (30/58) of patients expertise blood in seminal liquid after the surgical procedure. All of these patients who had

Table 1: Patients characteristics

Patient characteristics	Mean±s.d. (range)
Age (year)	67.83±7.74 (52.28–85.13)
Weight (kg)	76.92±10.98 (52.50–110.00)
Height (m)	1.72±0.07 (1.60–1.91)
BMI	25.82±3.57 (18.30–35.50)
Prostatic volume (cm ³)	75.46±43.75 (21.77–235.12)
Aden volume (cm ³)	42.93±31.57 (7.30–167.54)
PSA (ng ml ⁻¹)	3.52±3.21 (0.42–14.73)
Dysuria (year)	5.51±4.13 (1.50–10.25)
Alpha-blocker, <i>n</i> (%)	69 (62.7)

BMI: body mass index; PSA: prostate specific antigen; s.d.: standard deviation

Table 2: Changes in scores on the questionnaires employed

Outcomes	Data preoperation	At 3 months	At 6 months
IPSS, mean±s.d.	18.12±6.73	6.85±5.36	4.38±4.99
QoL, mean±s.d.	4.23±1.44	2.16±1.77	1.49±1.60
IIEF 5, mean±s.d.	16.84±4.45	16.47±3.18	18.10±3.81
Erection conserved ICIQ-MLUTSsex, <i>n</i> (%)	87 (79.1)	87 (100)	87 (100)
Ejaculation conserved MSHQ-EjD, <i>n</i> (%)	74 (67.2)	58 (52.7)	58 (52.7)

s.d.: standard deviation; IPSS: International Prognostic Scoring System; QoL: quality of life; IIEF: International Index of Erectile Function

Table 3: Flowmetry improvement

Uroflowmetry months	Preoperation	At 3 months	At 6 months
Q _{max} (ml s ⁻¹)	9.60±6.11	20.20±10.23	22.14±9.85
Q _{avg} (ml s ⁻¹)	4.56±1.77	11.08±6.69	12.30±6.01
Volume (cm ³)	198±85	259±127	241±131

Data are presented as mean±s.d.

Table 4: Postoperative outcomes on erection and ejaculation (MSHQ-EjD and ICIQ-MLUTSsex)

ICIQ-MLUTSsex conserved MSHQ-EjD	Erection conserved, <i>n</i> (%)	Ejaculation, <i>n</i> (%)
Yes	87 (79.1)	58 (52.8)
No	0 (0)	16 (14.5)
Don't know	3 (2.7)	16 (14.5)
Previous ED	20 (18.2)	20 (18.2)
Total	110 (100)	110 (100)

ED: erectile dysfunction

undergone TRUS biopsy, also experienced it. Eight (7.3%, 8/110) patients were re-admitted because of clot retention. Adverse events, as well as operative and postoperative findings are shown in **Table 5**. Two patients had to be re-operated during hospitalization because of gross hematuria after accidental catheter removal. No ureteral strictures were observed during follow-up.

DISCUSSION

Benign prostatic hyperplasia is a common condition in middle-aged and older men. Many surgical treatments have been offered as alternative to current BPH gold standards.³ Most of these treatments are not as durable or effective as TURP and open prostatectomies for BPH, and these surgical techniques still have a consistent rate of morbidity. Even in skilled hands, bleeding and TUR syndrome remain the most



dangerous complications for patients undergoing TURP.^{9,10} Bleeding, length of hospitalization, and postoperative detrusor contractions, besides common complications following any open surgical approach, are quite frequent in any open prostatectomy performed for large BPH.^{1,2}

Laser-based techniques for BPH have increased in recent years. Their characteristics determine their versatility in BPH and endoscopic treatments for stones. HoLEP is equivalent to TURP and open prostatectomies with respect to clinical outcomes and QoL. However,

HoLEP is superior with regard to perioperative morbidity with reduced bladder irrigation, catheter time and hospital stay, even though an equivalent volume of prostatic tissue is resected or enucleated.¹¹

Thulium laser enucleation of the prostate is currently used to treat BPH.^{6,12,13} Gross *et al.*¹⁴ showed that, similar to HoLEP, thulium vapo-enucleation of the prostate (ThuVEP), which has a different surgical technique, has an equivalent clinical outcome on LUTS compared with gold standard techniques. ThuVEP also minimizes the transfusion rate, the length of hospitalization, and postoperative complications.

Some evidence supports the theory that BPH combined with sexual and ejaculatory dysfunction are simply coexisting, and this is mainly related to metabolic and hormonal changes, usually affecting men.⁵ The multinational survey of the aging male,

Table 5: Operative and postoperative findings and adverse events

Findings	Rate
Stop bladder irrigation (h, mean±s.d.)	20.21±12.82
Catheter removal (h, mean±s.d.)	33.00±13.93
Acute urinary retention, n (%)	8 (7.3)
Discharge (day, mean±s.d.)	2.44±1.45
Hemoglobin decrease (g dl ⁻¹)	Δ-1.05
Blood transfusion (n)	2
Operative time (min, mean ±s.d.)	82.00±43.77
Incidental tumors adenocarcinoma (n)	4
Presence of TCC of the bladder (n)	3
Coagulation of bleeders in the prostatic fossa (n)	2

SD: standard deviation; TCC: transitional cell carcinoma

Table 7: Sexual outcome compared to preoperative prostatic volume

Prostatic volume (ml)	Patient (n)	Erection conserved	Ejaculation conserved
<40	39	32	20
Between 40 and 100	39	28	20
>100	32	27	18
Total		87	58
P		>0.5	>0.5

Table 6: Outcome of male sexual function in different laser prostate surgical techniques

Author	Laser technique	Laser type	n	Assessment tool	Control	Outcome (EF and retrograde ejaculation) %
Montorsi <i>et al.</i> 2004 ²⁰	Enucleation (HoLEP)	Ho:YAG	52	IIEF-15	TURP	EF did not show a change from baseline -
Briganti <i>et al.</i> 2006 ¹⁹	Enucleation (HoLEP)	Ho:YAG	32	IIEF-15	TURP	Reduced orgasmic function domain significantly with marginal EF improvement 78.3
Wilson <i>et al.</i> 2006 ¹¹	Enucleation (HoLEP)	Ho:YAG	31	Nonvalidated questionnaire	TURP	Potency; 3.9 improved, 3.9 deteriorated 6.5 new onset ED 75
Meng <i>et al.</i> 2007 ²¹	Enucleation (HoLEP)	Ho:YAG	108	DanPSS sex	None	Do not affect the sexual functions significantly but improve ability to achieve early morning erection 70
Jeong <i>et al.</i> 2012 ²²	Enucleation (HoLEP)	Ho:YAG	38	IIEF	None	EF did not show a change from baseline 52
Bach <i>et al.</i> 2011 ²³	ThuVEP	Thulium:YAG	90	IIEF-5	None	Marginal nonsignificant EF improvement -
Yee <i>et al.</i> 2012 ²⁴	Vaporesection (ThuVaRP)	Thulium:YAG	113	-	None	20% experienced worsening erectile function 56
Elmansi <i>et al.</i> 2010 ²⁵	Ablation (PVP) (HoLAP)	Green light - KTP - Ho:YAG	30 33	IIEF-15	2 types of laser	EF did not show a change from baseline 43.3 36.3
Horasanli <i>et al.</i> 2008 ²⁶	Ablation (PVP)	Green light - KTP	39	IIEF-5	TURP	EF did not show a change from baseline 49.9
Kavoussi and Hermans 2008 ²⁷	Ablation (PVP)	Green light - KTP	105	SHIM	None	EF did not show a change from baseline -
Spaliviero <i>et al.</i> 2010 ²⁸	Ablation (PVP)	Green light - LBO	72	SHIM	None	No detrimental effect on EF 30
Bouchier-Hayes <i>et al.</i> 2010 ²⁹	Ablation (PVP)	Green light - KTP	60	BSFQ	TURP	EF did not show a change from baseline -
Bruyère <i>et al.</i> 2010 ³⁰	Ablation (PVP)	Green light - KTP - LBO	149 63 86	IIEF-5	None	Significant decrease in EF in patients with basal IIEF-5≥19 70
Kumar <i>et al.</i> 2012 ³¹	Ablation (PVP)	Green light - KTP	150	IIEF-5	None	Significant decrease in EF in patients with basal IIEF-5≥19 -
Hossack and Woo 2012 ³²	Ablation (PVP)	Green light - LBO	328	IIEF-5	None	Significant decrease in EF 65
Elshal <i>et al.</i> 2012 ³³	Enucleation (HoLEP) Ablation (HoLAP) Ablation (PVP)	Ho:YAG Green light	191	IIEF-15	Three types of laser	Laser prostate surgery using more size-related laser energy might have possible negative influence on sexual function 77.3 (HoLEP) 31 (HoLAP) 33.2 (PVP)

PVP: photoselective vaporization of the prostate; HoLEP: holmium laser enucleation of the prostate; HoLAP: holmium laser ablation of the prostate; ThuVEP: thulium vapo-enucleation of the prostate; ThuVaRP: thulium laser vaporesection of the prostate; IIEF: International Index of Erectile Function; Ho:YAG: holmium:yttrium aluminum garnet; LBO: lithium triborate laser; KTP: potassium titanyl phosphate; BSFQ: Brief Sexual Function Questionnaire; SHIM: sexual health inventory for men; TURP: transurethral resection of the prostate



a large-scale, multinational survey on approximately 14,000 men aged 50–80 years, reported that although 90% of men had LUTS, 83% of them still had sexual activity.¹⁵ This survey also highlighted that erectile and EF play an important role in the QoL, even in aged men with symptomatic BPH.

Some studies have provided controversial evidence regarding postoperative erectile dysfunction (ED) after TURP and open prostatectomies for BPH.^{16,17} Wasson *et al.*¹⁸ investigated ED after TURP in an untreated group and did not find any increase in the rate of ED in the TURP group. Induced neuropraxia by different forms of energy has been indicated as a possible reason of a transient postoperative ED. Conversely, evidence has indicated a strict correlation between surgical management of BPH and retrograde ejaculation. To the best of our knowledge, our study is the first to focus on sexual and EF after ThuLEP.

Briganti *et al.*¹⁹ achieved an equivalent outcome with regard to ED and EF between TURP and HoLEP. This suggests that these two surgical approaches are similarly associated with a high risk of postoperative ejaculatory dysfunction, mainly owing to retrograde ejaculation. Our series, using different questionnaires preoperatively and postoperatively, showed an overall conservation rate of antegrade ejaculation of 52.7%. If only those patients with possibilities of sexual intercourse were included, this rate was 78.3%. However, the rate of ED after ThuLEP was only 2.7% (Table 4). Table 6 shows the outcomes of male sexual function in different laser prostate surgical techniques; the final results can be easily compared with those of the current study.^{11,20–33}

Several previous studies, mainly on alpha blockers, have shown how antegrade ejaculation can positively affect sexual satisfaction. There were also no significant differences in EF among three different groups with regard to prostatic volume (<40 ml, ≥40 ml and <100 ml, >100 ml). It is not the prostatic volume that may affect or not antegrade ejaculation after ThuLEP (Table 7). The reason for such a good result could be related to the surgical technique of laser enucleation of the prostate.⁶ A less deep incision typical of a thulium laser device (0.1–0.2 mm) can also determine the absence of transient ED because it does not involve neurovascular bundles of the capsule in the so-called neuropraxia phenomenon.³⁴ On the same hand similar aspects have been underlined by a recent study by Xia.³⁵ Further, from an anatomical and prospective view, further studies are required to better understand how EF can be better preserved. Also a comparison to TURP in a prospective study would have possibly shown the good results of ThuLEP regarding EF.

In our study, the good results on the postoperative IPSS and flowmetry showed that ThuLEP allowed radical prostatic adenoma enucleation. Preserved antegrade ejaculation was not correlated to partial enucleation of prostatic adenoma, as normally occurs during alpha blocker therapy when retrograde ejaculation appears and disappears once therapy is stopped.

A reduced learning curve is another important advantage of the proposed new surgical technique.⁶ This can be achieved with the help of a PC-based dry simulator and 15–20 tutored cases. The dry simulator is made by Quanta System.

In the current study, clot retention was the main complication owing to anticoagulants taken by patients because of cardiovascular issues. Blood in seminal fluid is a surgical-related side effect, mainly found in patients with a previous TRUS biopsy.

CONCLUSIONS

Thulium laser enucleation of the prostate is an efficient technique, which is performed with a safe energy source. ThuLEP represents a simple new shift in the endoscopic management of BPH and can

be used to treat prostates of any size. This technique improves the scores of questionnaires that are used to assess urinary symptoms and their effect on the QoL in patients. Antegrade ejaculation is mainly conserved in patients who undergo ThuLEP, with good effects on erectile function. Further, from a mainly anatomical and prospective view, further studies are required to better understand how EF can be better preserved with ThuLEP.

AUTHOR CONTRIBUTION

LC and GB have made the study design and the critical review. GB and SP has been involved in data interpretation, performed the statistical analysis and drafting the manuscript. AM and SM has been involved in data collections. SC was involved in drafting the manuscript with regards to layout. All Authors read and approved the final manuscript.

COMPETING INTERESTS

All authors declare no competing interests.

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