Are Outcomes of Thulium Laser Enucleation of the Prostate Different in Men Aged 75 and Over? A Propensity Score Analysis

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OBJECTIVE To evaluate the outcomes of thulium laser enucleation of the prostate (ThuLEP) in men aged ≥75 years compared to youngers. Traditional surgery has increased and significant morbidity in older men. Lasers have been introduced as an alternative approach to overcome the morbidity of traditional surgery.

MATERIAL We retrospectively evaluated 412 men who underwent en bloc ThuLEP. Inclusion criteria were lower urinary tract symptoms refractory to medical therapy, maximum urinary flow rate (Qmax) ≤15 mL/s, International Prostate Symptom Score (IPSS) ≥8 and absolute indications for surgery. Prostate volume, prostate specific antigen, IPSS, and Qmax, antiplatelet/anticoagulant therapy, ASA score, operation time, length of catheterization, discharge day, early complications, and reoperations were gathered. Differences between groups were estimated using propensity scores, by fitting a stepwise logistic regression model with age group as the dependent variable.

RESULTS One hundred twenty-nine patients were aged ≥75 years (Group 2). Mean age was 65.6 ± 6.0 years in Group 1 and 79 ± 3.7 years in Group 2. Propensity scores retrieved 206 patients. Median operation, catheterization time, and hospital stay were similar in both groups (55 minutes, 2 and 3 days). Overall, 85.9% of men had no complications, with no differences between the groups (82.5% in Group 1 and 89.3% in Group 2). The incidence of Clavien grade III-IV complications was comparable (3.8% in Group 1, 1% in Group 2). By 1 year, there were no statistically significant differences in IPSS, Qmax, QoL, or reoperation rate between the groups.

CONCLUSION En bloc ThuLEP is a safe and effective treatment even in men aged ≥75 years old. UROLOGY 132: 170–176, 2019.

Benign prostatic hyperplasia (BPH) is an aging process, with a histologic prevalence of 80%-90% for men in their 70s and 80s.[1] Benign prostatic enlargement (BPE), low peak-flow rate and lower urinary tract symptoms (LUTS) are age related, with an incidence of moderate-to-severe symptoms of 28% in men aged more than 70 years old.[2] LUTS have a great impact on quality of life (QoL) in elderly men; indeed, men in their 70s were 4.6 times more likely as younger to seek medical attention for LUTS treatment.[3] Traditional surgery, mainly transurethral resection of the prostate (TURP) and open prostatectomy (OP), are still the gold standard surgery of clinical BPH, but urologists may hesitate to offer them in elderly because of their increased and significant morbidity in this population.[4-6] Furthermore, elderly men undergo BPH surgery for absolute indications (acute urinary retention, recurrent hematuria, recurrent urinary tract infection) more often than youngers.[5,6] Nevertheless, laser technology has been introduced in the last decades as an alternative approach to overcome morbidity of traditional surgery (TUR-syndrome, blood transfusion, extended postoperative catheterization, and hospital stay). Several studies have recently shown the noninferiority of thulium laser enucleation of the prostate (ThuLEP) compared to TURP and OP in terms of efficacy,

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and its superiority concerning morbidity.[7,8] Furthermore, Chang et al have recently demonstrated that ThuLEP is a safe and effective procedure even for men with prostate larger than 80 mL.[9] The present study aims to evaluate whether the outcomes and complications of ThuLEP are different in elderly men compared to youngers.

MATERIALS AND METHODS

This is a retrospective analysis of consecutive patients who underwent en bloc ThuLEP in 2 Italian departments (IRCCS-INRCA, Ancona, and Ospedale di Circolo e Fondazione Macchi, Varese). Inclusion criteria were persistent LUTS despite a trial of conservative and medical therapy, maximal urine flow rate (Qmax) ≤15 mL/s, IPSS ≥8 and absolute indications for surgery according to European Association of Urology guidelines.[4] Exclusion criteria were a diagnosis of prostate cancer, previous urethral/prostatic surgery, neurogenic bladder, urethral stricture, prior pelvic irradiation, and concomitant transurethral surgery. All men were evaluated preoperatively with transrectal ultrasound prostate volume (PV), digital rectal examination, prostate specific antigen (PSA), Qmax, IPSS, including QoL index, American Society of Anesthesiologists (ASA) score, and hemoglobin levels. No patients underwent surgery under oral anticoagulants (vitamin K and nonvitamin K antagonists) or dual antiplatelet. Oral anticoagulant agents were stopped and dual antiplatelet agents were switched to single antiplatelet in preparation to surgery, according to local neurological or cardiological consultation. If indicated, patients were switched to subcutaneous low molecular weight heparins. Postvoiding urine volume, laser emission time, and total energy delivered were not available in most cases and were not considered. Both en bloc ThuLEP surgical techniques have previously been described in detail.[10,11] Postoperative collected data were hemoglobin at 24 hour, length of catheterization, discharge day, and complications. Follow-up visits were scheduled at 1, 6, and 12 months. Complications were classified according to the Clavien-Dindo system and considered as early when they occurred within 30 postoperative days. Supplementary Table 1 shows all the different early complications in the present series. Surgery for urethral stenosis, residual tissue, bladder neck contracture, and prostatic fossa sclerosis after 30 days was considered as reoperation. All patients signed an informed consent. The study has been approved by a local Ethical Board (DGEN 421/2017).

Grouping of the Study Population

An accepted definition of elderly still lacks, and the age, per se, is usually not enough to define it. Geriatrics identifies elderly with a decrease in functional reserve, frailty, and vulnerability that increase with aging.[12] However, the World Health Organization highlighted that people aged more than 75 years old have much more disability and need for assistance than the youngers.[13] Furthermore, Kaufman et al showed that most people aged ≥75 have multiple pathologies, an average of ≥3 chronic diseases and 50% of them are on polymedications.[14] Therefore, the age of 75 can be considered a valid threshold and the study population was divided into 2 groups (Group 1 included men <75 years old and Group 2 the remaining).

Statistical Analysis

Continuous variables were assessed using the Shapiro-Wilk test and reported as either mean and standard deviation or median and interquartile range based on their distribution. Comparison of variables between groups was performed according to their distribution by unpaired Student *t* test or Mann-Whitney *U* test. Categorical variables were expressed as absolute frequency and percentage and analyzed by chi square test. Non-normal outcome variables (Δ IPSS after 6 and 12 months; ΔQmax after 1, 6, and 12 months) were dichotomized into under the median or above (or equal to) the median of the variable itself. Normal outcome variables (ΔIPSS after 1 month; QoL improvement after 1, 6, and 12 months) were treated as linear. Differences between the 2 age groups were estimated using linear or logistic regression as appropriate, adjusted for age group, PV, baseline PSA, IPSS and QoL, Qmax, antiplatelet/anticoagulant therapy, indwelling catheter history, ASA score, and operation time. All analyses were repeated after propensity scores (PS) matching in order to adjust for the bias inherent to the different patient characteristics at baseline. The PS were estimated by fitting a stepwise logistic regression model with age group as the dependent variable and the following independent variables: ASA score, PV and baseline PSA, IPSS, Qmax, and QoL. A 2-tailed *P* value <.05 was considered significant. Data were analyzed using STATA version 15.1 (StataCorp, College Station, TX). The original dataset of this study is available on *Mendeley Data* (https://data.mendeley.com/datasets/mtfw7rxhr6/2).

RESULTS

Between 2014 and 2017, 567 men underwent the surgical procedures. From this sample, 155 men were excluded (53 for not having completed 1-year follow-up, the remaining for missing data), leaving 412 patients available for analysis. Group 1 included 283 men and the mean age was 65.6 ± 6.0 years, while the mean age in Group 2 was 79 ± 3.7 years. PS matching retrieved 103 men in each group. Table 1 shows preoperative, intraoperative, and postoperative characteristics of the 2 groups, before and after matching. PV ranged between 20 and 240 mL (median value 58 mL) and was greater in Group 2 (64 mL vs 55 mL, *P*.008). Baseline PSA, IPSS, QoL, and Qmax were similar in the 2 groups. ASA scores 3-4 were prevalent in Group 2 (57.4% vs 17%). Men on antiplatelet/anticoagulant therapy and with indwelling catheter history were prevalent in Group 2 (20.2% vs 7.1%, *P*0.000; 29.5% vs 18.7%, *P*.015, respectively). Median operation time was 55 minutes and was not different between groups, before and after PS. Median catheterization time (2 days) and postoperative stay (3 days) were equal before and after matching in both groups. Overall, 86.2% (355/412) of patients had no early complications (84.8% in Group 1 and 89.2% in Group 2). The difference in complication rate was not statically significant between the 2 groups, before (*P*.743) and after PS (*P*.461). Most of the complications were mild-to-moderate (grade I-II) and grade III-IV were comparable between groups (3.8% in Group 1 vs 1% in Group 2 after PS). Transfusion rate was low and similar, before (2/103 [1,06%] in Group 1 vs 2/129 [1,5%] in Group 2) and after PS (2/103 [1.9%] in both Groups). No TUR-syndrome occurred. Reoperation after 30-day was similar after PS: 4/103 (3.9%) men in Group 1 and 5/103 (4.8%) in Group 2 (Supplementary Table 2). No deaths occurred during the study period. Urinary incontinence, defined as reported incontinence of any degree, was present at 1-year follow-up after matching in 5 men in Group 1 (4,8%) and 6 in Group 2 (5,8%). Main outcome results are shown in Table 2. Overall, 53.4% (220/412) of men had a difference (Δ) IPSS >23 at 6 months and 56.1% (231/412) >24 at 12 months. ΔIPSS was statistically significant

Table 1. Patient's preoperative and intraoperative characteristics <75-year-old vs ≥75-year-old

	Before propensity score matching				After propensity score matching			
	Overall(n = 412)	Group 1 <75 (n = 283)	Group 2 ≥75 (n = 129)	P Value	Overall (n = 206)	Group 1 <75 (n = 103)	Group 2 ≥75 (n = 103)	P Value
Preoperative variables								
Age (y)	69.8 ± 8.3	65.6 ± 6.0	79.0 ± 3.7	.000	72.7 ± 7.7	66.5 ± 5.4	78.9 ± 3.8	.000
Prostate volume (TRUS) (mL)	58(36.5)	55(34)	64(40)	.008	66(38)	70(37)	65(40)	.735
Baseline PSA (ng/mL)	2.9(3.2)	2.9(3.2)	2.9(3)	.699	3.2(3.3)	3.4(3.4)	3.0(3.3)	.940
Baseline IPSS	26(5)	26(5)	26(5)	.129	26(6)	27(6)	25(7)	.412
Baseline Q max (mL/s)	8.1 ± 2.8	8.1 ± 2.8	7.8 ± 2.8	.256	7.6 ± 2.8	7.4 ± 2.7	7.9 ± 2.8	.202
Baseline QoL	4.4 ± 0.9	4.3 ± 0.9	4.5 ± 0.9	.076	4.5 ± 0.9	4.4 ± 0.9	4.5 ± 0.9	.323
Antiplatelet/anticoagulant therapy	46(11.2%) 38	20(7.1%) 16	26(20.2%) 22	.000	36(17.5%) 30	13(12.6%) 9	23(22.3%) 21	.067
antiplatelet	8	4	4		6	4	2	
sLWH								
Indwelling catheter history	91(22.1%)	53(18.7%)	38(29.5%)	.015	60(29.1%)	26(25.2%)	34(33.0%)	.220
ASA score				.000				1.000
1	124(30.1%)	110(38.9%)	14(10.9%)		28(13.6%)	14(13.6%)	14(13.6%)	
2	166(40.3%)	125(44.2%)	41(31.8%)		82(39.8%)	41(39.8%)	41(39.8%)	
3-4	122(29.6%)	48(17.0%)	74(57.4%)		96(46.6%)	48(46.6%)	48(46.6%)	
Intraoperative variables								
Operation time (min)*	55(25)	55(25)	55(25)	.452	55(25)	55(30)	55(25)	.701
ΔHb (24h)	1.1(1.2)	1.1(1.2)	1.0(0.9)	.470	1.15(1.2)	1.4(1.1)	1.0(1.3)	.011
Postoperative variables								
Catheterization time (day)	2(0)	2(0)	2(1)	.046	2(2)	2(1)	2(1)	.084
Postoperative stay (day)	3(1)	3(1)	3(1)	.547	3(1)	3(1)	3(1)	.714
Clavien-Dindo classification of early complications				.743				.461
0	355(86.2%)	240(84.8%)	115(89.2%)		177(85.9%)	85(82.5%)	92(89.3%)	
I	38(9.2%)	30(10.6%)	8(6.2%)		16(7.8%)	10(9.7%)	6(5.8%)	
II	11(2.7%)	7(2.5%)	4(3.1%)		8(3.9%)	4(3.9%)	4(3.9%)	
IIIa	1(0.2%)	1(0.4%)	0(0.0%)		0(0.0%)	0(0.0%)	0(0.0%)	
IIIb	4(1.0%)	3(1.1%)	1(0.8%)		3(1.5%)	2(1.9%)	1(1.0%)	
IVa	3(0.7%)	2(0.7%)	1(0.8%)		2(1.0%)	2(1.9%)	0(0.0%)	
V	0(0.0%)	0(0.0%)	0(0.0%)		0(0.0%)	0(0.0%)	0(0.0%)	

IPSS, International Prostate Symptoms Score; PSA, prostate specific antigen; QoL, quality of life; sLWH, subcutaneous low weight heparin; TRUS, transrectal ultrasonography.
Note: Table values are n (%) or mean ± SD or median (IQR).
* From starting lasing to catheter insertion.

Table 2. Main outcome results

	Before Propensity Score Matching				After Propensity Score Matching			
	Overall (n = 412)	Group 1 <75 (n = 283)	Group 2 ≥75 (n = 129)	*P* Value	Overall (*n* = 206)	Group 1 <75 (*n* = 103)	Group 2 ≥75 (*n* = 103)	*P* Value
Δ IPSS (1 mo)	−18.9 ± 5.2	−19.3 ± 5.0	−18.0 ± 5.6	.019	−19.3 ± 5.6	−20.8 ± 4.9	−17.9 ± 6.0	.000
Δ Q max (1 mo) ≥12	218(52.9%)	160(56.5%)	58(45.0%)	.029	103(50.0%)	57(55.3%)	46(44.7%)	.125
Δ QoL (1 mo)	−3.0 ± 1.3	−3.0 ± 1.3	−3.0 ± 1.2	.803	−3.1 ± 1.3	−3.1 ± 1.4	−3.0 ± 1.2	.396
Δ IPSS (6 mo) ≥−23	220(53.4%)	144(50.9%)	76(58.9%)	.130	106(51.5%)	43(41.2%)	63(61.2%)	.005
Δ Q max (6 mo) ≥13.4	207(50.2%)	145(51.2%)	62(48.1%)	.550	113(54.8%)	62(60.2%)	51(49.5%)	.124
Δ QoL (6 mo)	−3.6 ± 1.1	−3.7 ± 1.1	−3.5 ± 1.1	.167	−3.7 ± 1.2	−3.9 ± 1.2	−3.4 ± 1.1	.007
Δ IPSS (12 mo) ≥−24	231(56.1%)	148(52.3%)	83(64.3%)	.022	115(55.8%)	49(47.6%)	66(64.1%)	.017
Δ Q max (12 mo) ≥14.4	208(50.5%)	148(52.3%)	60(46.5%)	.276	109(55.9%)	63(61.2%)	46(44.7%)	.018
Δ QoL (12 mo)	−3.8 ± 1.1	−3.8 ± 1.1	−3.8 ± 1.1	.708	−3.9 ± 1.1	−4.0 ± 1.2	−3.8 ± 1.1	.198

IPSS, International Prostate Symptoms Score; QoL, quality oflife.
Note: Table values are *n* (%) or mean ± SD.

better in younger at 1 months before (−19.3 ± 5.0 vs −18.0 ± 5.6, *P*.019) and after PS (−20.8 ± 4.9 vs −17.9 ± 6.0, *P*0.019), but older men had a statistically significant ΔIPSS at 6 and 12 month, before and after matching. Overall, QoL improved progressively over the time (−3.0 ± 1.3 at 1 month, −3.6 ± 1.1 at 6 month and −3.8 ± 1.1 at 12 month), with no difference between the 2 groups, except at 6 month after PS (−3.9 ± 1.2 in Group 1 vs −3.4 ± 1.1 in Group 2, *P*0.007). Overall, 50.5% (208/412) of men had a ΔQmax >14.4 mL/s at 12 month; youngers had a statistically significant better ΔQmax at all follow-up visits, before and after PS. Linear/logistic regressions of the main outcomes are shown in Table 3 (before PS) and 4 (after PS). ΔIPSS was statistically significant greater in Group 2 after matching at 1 month (β 1.55) and at 6 months (OR 3.24), but not significant at 12 months (OR 1.66). QoL improved slightly more in men >75 years at 6 months (β 0.38) and at 12 months (β 0.19). This finding was confirmed even at 1 month after PS (β 0.30). Age did not influence ΔQmax at all follow-up visits before and after PS, because the remaining covariates contributed to a greater extent. ASA score, catheter indwelling time, and PV did not influence the outcomes, before and after matching. Baseline IPSS, Qmax, and QoL influenced the homologous variations during follow-up, both before and after PS.

DISCUSSION

Over the last 2 decades we have witnessed a substantial increase in surgical interventions in older adults and this will indeed increase as the population age. However, surgical management of elderly poses challenges compared to younger, because people over 70 years old are more likely to have multiple comorbidities, reduced renal, cardiac and pulmonary reserve, with physical and cognitive impairments.[15] Those conditions increase the risk of perioperative complications and prolong hospital stay. Accordingly, surgical treatment of benign diseases, such as BPH, may not be justified in older patients. Moreover, TURP and OP are historically associated with remarkable morbidity, even if more recent series show better results.[5,6,16,17] However, the complication rate is still not negligible. Rassweiler et al showed in their literature review that the associated cardiovascular morbidity of TURP maintained a similar level of 1%, a transfusion rate of 2-7.1% and a mortality of 0.25%.[16] Gratzke et al reported in a large series of OP a transfusion rate of 7.5% and a mortality rate of 0.2%.[17] The transfusion rate in our study was lower, with 1.9% in both Groups after PS. Clavien grade IVa were extremely low in our series, with only 3 acute myocardial infarction (2 in Group 1 and 1 in Group 2 before PS) and no men died during the study period. Limited data are available on outcomes of laser surgery in the elderly. Mmeje et al retrospectively analyzed complications and functional outcomes of Holmium laser enucleation of the prostate in 311 men, divided into 4 groups based on age (50-59, 60-69, 70-79, >80 years).[18] The overall morbidity rates, the incidences of Clavien ≥III complications and length of hospital stay were similar among all groups.[18] Men >80 years had a longer catheterization time (3.4 days) than patients aged 50-59 years and it was slightly longer than in our series (2 days). However, the hospital stay was longer in our series

Table 3. Linear/logistic regressions of the main outcomes before propensity score matching—β/OR (95%CI)

Outcomes	ΔIPSS (1 mo)	ΔQmax (1 mo) ≥12	ΔQoL (1 mo)	ΔIPSS (6 mo) ≥−23	ΔQmax (6 mo) ≥13.4	ΔQoL (6 mo)	ΔIPSS (12 mo) ≥−24	ΔQmax (12 mo) ≥14.4	ΔQoL (12 mo)
Age (ref. <75)									
≥75	0.70(−0.19;1.59)	0.69(0.43-1.11)	0.19(−0.03;0.41)	1.37(0.66-2.85)	0.82(0.50-1.34)	0.38(0.21;0.54)***	1.86(0.81-4.30)	0.74(0.45-1.22)	0.19(0.05;0.34)**
ASA score (ref. 1)									
2	−0.49(−1.39;0.42)	0.76(0.47-1.24)	−011(−0.33;0.12)	1.62(0.74-3.54)	1.50(0.90-2.49)	0.05(−0.12;0.22)	0.73(0.30-1.73)	0.77(0.46-1.29)	−0.07(−0.22;0.08)
3-4	−0.20(−1.30;0.90)	0.71(0.39-1.28)	−0.16(-0.43;0.10)	0.92(0.38-2.25)	1.42(0.77-2.63)	−0.15(−0.35;0.06)	0.92(0.34-1.02)	0.94(0.50-1.74)	−0.02(−0.20;0.16)
Prostate volume	−0.00(−0.00;0.00)	1.00(0.99-1.00)	−0.00(−0.00;0.00)	1.00(0.99-1.01)	1.00(0.99-1.01)	−0.00(−0.00;0.00)	1.00(0.98-1.02)	1.00(0.99-1.01)	0.00(−0.00;0.00)
Baseline PSA	−0.00(−0.13;0.13)	1.03(0.96-1.11)	−0.02(−0.05;0.01)	1.02(0.91-1.15)	1.00(0.93-1.08)	−0.01(−0.03;0.01)	1.02(0.89-1.17)	0.97(0.91-1.01)	−0.02(−0.04;-0.00)*
Baseline IPSS	−0.85(−0.94;-0.76)***	1.01(0.96-1.06)	0.02(−0.00;0.04)	0.37(0.30-0.45)***	1.03(0.98-1.08)	−0.00(−0.02;0.02)	0.25(0.18-0.34)***	1.02(0.97-1.08)	−0.01(−0.02;0.01)
Baseline Q max	0.04(−0.09;0.18)	0.88(0.82-0.95)**	−0.02(−0.05;0.01)	1.15(1.01-1.30)*	0.82(0.75-0.88)***	−0.02(−0.04;0.01)	1.00(0.87-1.15)	0.77(0.71-0.84)***	0.01(−0.01;0.03)
Baseline QoL	0.10(−0.33;0.54)	0.99(0.78-1.25)	−1.01(−1.11;-0.90)***	1.06(0.71-157)	0.93(0.73-1.19)	−0.96(−1.04;-0.88)***	1.02(0.64-1.62)	1.03(0.81-1.31)	−0.98(−1.05;-0.91)***
Antiplatelet therapy	1.09(-0.17;2.36)	0.92(0.46-1.81)	0.04(-0.27;0.34)	1.14(0.37-3.50)	0.71(0.35-1.43)	0.16(-0.08;0.40)	4.59(1.06-19.86)*	0.82(0.40-1.67)	0.13(−0.08;0.33)
Indwelling catheter history	−0.10(−1.02;0.81)	0.87(0.53-1.44)	0.02(−0.20;0.24)	1.15(0.51-2.61)	0.96(0.58-1.62)	−0.05(−0.22;0.13)	0.72(0.28-1.86)	1.04(0.62-1.76)	0.00(−0.14;0.15)
Operation time	−0.01(−0.02;0.01)	0.99(0.98-1.00)	0.00(0.00;0.01)*	0.99(0.98-1.01)	0.99(0.98-1.00)	0.00(0.00;0.01)**	0.99(0.97-1.01)	1.00(0.99-1.01)	0.00(-0.00;0.00)

Note: $n = 412$.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

Table 4. Linear/logistic regressions of the main outcomes after propensity score matching—β/OR (95%CI)

Outcomes	ΔIPSS (1 mo)	ΔQmax (1 mo) ≥12	ΔQoL (1 mo)	ΔIPSS (6 mo) ≥−23	ΔQmax (6 mo) ≥13.4	ΔQoL (6 mo)	ΔIPSS (12 mo) ≥−24	ΔQmax (12 mo) ≥14.4	ΔQoL (12 mo)
Age (ref. <75)									
≥75	1.55(0.52;2.57)**	0.70(038-1.27)	0.30(0.03;0.57)*	3.24(1.07-9.80)*	0.79(0.43-1.45)	0.59(0.38;0.79)***	1.66(0.56-4.91)	0.56(0.30-1.03)	0.31(0.12;0.49)**
ASA score (ref. 1)									
2	0.14(−1.44;1.73)	0.43(0.16-1.14)	−0.07(−0.49;0.35)	3.96(0.71-22.11)	0.80(0.30-2.17)	0.18(−0.15;0.50)	0.45(0.09-2.13)	0.38(0.13-1.10)	0.01(−0.28;0.29)
3-4	1.17(−0.48;2.82)	0.52(0.19-1.40)	−0.03(−0.46;0.41)	3.33(0.60-18.51)	0.87(0.31-2.40)	0.18(−016;0.51)	0.61(0.13-2.78)	0.35(0.12-1.03)	0.15(−0.15;0.44)
Prostate volume	0.00(−0.00;0.00)	1.00(0.99-1.00)	−0.00(−0.00;0.00)	1.00(0.99-1.00)	1.00(0.99-1.00)	−0.00(−0.00;0.00)	1.00(0.99-1.00)	1.00(0.99-1.00)	0.00(−0.00;0.00)
Baseline PSA	−0.02(−0.00;0.00)	0.95(0.87-1.05)	−0.00(−0.05;0.04)	1.07(0.90-1.27)	0.92(0.83-1.02)	−0.00(−0.03;0.03)	1.18(0.96-1.46)	0.90(0.80-0.99)*	−0.01(−0.04;0.02)
Baseline IPSS	−0.90(−1.02;-0.79)***	1.00(0.94-1.07)	0.02(−0.01;0.05)	0.33(0.23-0.46)***	1.05(0.98-1.13)	0.01(−0.01;0.01)	0.30(0.20-0.43)***	1.05(0.98-1.13)	−0.01(−0.04;0.02)
Baseline Q max	−0.02(−0.21;0.17)	0.85(0.76-0.95)**	−0.02(−0.07;0.03)	1.21(0.96-1.51)	0.80(0.71-0.90)***	−0.04(−0.08;-0.00)*	0.99(0.79-1.24)	0.81(0.71-0.91)*	0.01(−0.02;0.05)
Baseline QoL	−0.25(−0.82;0.31)	1.01(0.72-1.40)	−1.02(−1.17;-0.88)***	1.02(0.54-1.93)	0.99(0.70-1.39)	−0.99(−1.11;-0.88)***	1.23(0.62-2.43)	1.15(0.82-1.62)	−1.02(−1.12;-0.92)***
Antiplatelet therapy	1.26(-0.21;2.73)	0.79(0.34-1.84)	0.09(-0.29;0.48)	1.15(0.25-5.25)	0.64(0.27-1.54)	0.12(-0.18;0.42)	6.94(1.22-39.64)*	1.07(0.45-2.55)	0.11(-0.15;0.37)
Indwelling catheter history	0.21(−0.91;1.34)	1.41(0.72-2.74)	0.12(−0.18;0.42)	0.73(0.23-2.32)	1.16(0.58-2.30)	0.08(−0.15;0.31)	0.40(0.12-1.34)	1.01(0.51-2.00)	0.00(−0.20;0.20)
Operation time	0.00(−0.02;0.03)	0.98(0.97-0.99)*	0.00(−0.01;0.01)	0.99(0.97-1.03)	0.98(0.97-0.99)*	0.00(−0.00;0.01)	0.99(0.96-1.02)	0.99(0.98-1.01)	0.00(−0.00;0.01)

Note: $n = 206$.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

(3 days vs 1.68 days). All groups showed improvements in their LUTS and at 12-month follow-up there was no significant difference in IPSS among the groups, but older men had lower Qmax than the other 3 groups at all time follow-up.[18] These findings are in line with our results. Similarly, Elshal et al reported significant LUTS and Qmax improvement in 264 octagenarians who underwent holmium prostatectomy, with limited morbidity (17.7% Clavien ≥III complications, 2% transfusion rate) and no deaths.[19] Our transfusion rate was in line with theirs. Majumdar et al explored the safety and efficacy of GreenLight laser photoselective prostate vaporization in elderly men, comparing patients aged >75 years (49 men) with the youngers (153 men).[20] They showed no significant differences in transfusion rate (4.4% vs 0.7%, *P*.14), in Clavien III complications (2% vs 2.6%, *P*1.0), and in median IPSS and QoL at 9-month postoperative.[20] Again, these results are in line with ours. Rausch et al prospectively analyzed 234 patients who underwent 3-lobe ThuLEP in a single center.[21] Despite good functional outcome at 24 month with a low rate of major early complications (19.7%), they showed that men aged >80 years and ASA score were significant predictors of functional treatment failure (9% secondary surgery or long-term catheter placement).[21] Our results are better with an inferior overall complications rate (14.8%); moreover, age did not influence Qmax at all follow-up visits, ΔIPSS was not statistically significant different at 12 months between groups (Table 4) and ASA score did not influence the outcomes, before and after matching (Table 4). This difference may be correlated to the surgical technique. In fact, we already demonstrated that our en bloc techniques had minor pitfalls (findings the surgical capsule once, easier enucleation) and complications, with a reduced learning curve compared to the 3-lobe technique.[22,23] Mmeje, Elshal, Rausch, Majumdar, and our study showed no TUR-syndrome.[18-21] Even if recent studies have demonstrated a low incidence of mild-to-moderate TURP-syndrome (0.78%-1.4%), the elderly patients are a greater risk.[24] Indeed, the ability of their kidney to balance sodium and water is impaired and their reduced physiological reserve makes them less able to increase their cardiac output in response to fluid overload.[24] Therefore, the mortality rate in the elderly has been reported as high as 25% in case of severe TUR-syndrome.[24] All the studies analyzed above, except that of Rausch, showed excellent functional results in elderly men and our results are in line with theirs.[18-21] These noticeable functional outcomes achieved can be explained with the parallelism of afterload reduction in the treatment of congestive heart failure. In fact, hypertension and aging have a synergistic effect on heart with increased glycolysis and reactive oxygen species generation, increased energy use, decreased antioxidant defenses, and increased free-radical damage.[25] Afterload reduction is an established intervention for congestive heart failure (improvement of cardiac function and symptoms).[26] The aging bladder shares similarities with the aging heart, and bladder outlet obstruction (BOO) with hypertension. Indeed, aging and BOO cause increased glycolysis and free radical generation, decreased antioxidant defenses, increased oxidative stress and free-radical damage, ischemia, increased extracellular collagen/elastin deposition, increased work demand, and increased energy use.[27] These effects translate in detrusor overactivity, diminished bladder capacity and compliance, decreased contractility, decreased Qmax and incomplete emptying. LUTS in the aging bladder are the symptomatic manifestation of these degenerative modifications.[27] Therefore, BPE surgery may work in the age-related LUTS not only by relieving BOO, but also by reducing the afterload. In the light of these findings, considering the potential dangerous adverse events caused by α_1-blockers and anticholinergic agents in elderly (cognitive impairment, cardiac arrhythmias, asthenia, somnolence, risk of falling due to orthostatic hypotension, risk of dementia) and based on the present data, ThuLEP should play an important role in treating BPE-LUTS in aging male.[28,29] Our study is not devoid of limitations. First, its retrospective design. The use of PS matching allowed us to adjust selection bias inherent to the different patient characteristics at baseline and to demonstrate that ThuLEP has similar complications and outcomes in men aged >75 years compared to younger. Second, different surgical experiences and different operators cannot be controlled in the analytic phase, but we already demonstrated that our techniques were surgeon-independent and similar in terms of complications and outcomes.[22] Finally, a geriatric assessment, which was demonstrated to predict the outcomes and complications of endoscopic BPH surgery in elderly men, was not available in our series.[30] Nevertheless, even if the age of 75 years is arbitrary and strictly related to patients' status more than the biological age, it may be considered a valid threshold in developed countries to identify people with disability, multiple chronic diseases and need for assistance.[13,14]

CONCLUSION

In this real-life analysis, ThuLEP for the treatment of BPE-LUTS appears to be equally effective in men aged >75 years compared to younger in patients with small-to-medium sized prostates, with a short hospital stay, catheterization time and minimal complications. ThuLEP can be safely offered to older men to treat BPE-LUTS and improve QoL.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.urology.2019.06.025.

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