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Surgical Reintervention Rates after Invasive Treatment for Lower Urinary Tract Symptoms due to Benign Prostatic Syndrome: A Comparative Study of More than 43,000 Patients with Long-Term Followup

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Purpose: No large-scale comparison of the 4 most established surgical approaches for lower urinary tract symptoms due to benign prostate obstruction in terms of long-term efficacy is available. We compared photoselective vaporization, laser enucleation and open simple prostatectomy to transurethral resection with regard to 5-year surgical reintervention rates.

Materials and Methods: A total of 43,041 male patients with lower urinary tract symptoms who underwent transurethral resection (34,526), photoselective vaporization (3,050), laser enucleation (1,814) or open simple prostatectomy (3,651) between 2011 and 2013 were identified in pseudonymized claims and core data of the German local health care funds and followed for 5 years. Surgical reinterventions for lower urinary tract symptoms, urethral stricture or bladder neck contracture were evaluated. Surgical approach was related to reintervention risk using the Kaplan-Meier method and Cox proportional hazards models.

Results: A total of 5,050 first reinterventions were performed within 5 years of primary surgery (Kaplan-Meier survival without reintervention: 87.5%, 95% CI 87.2%–87.8%). Photoselective vaporization carried an increased hazard of reintervention (HR 1.31, 95% CI 1.17–1.46, p <0.001) relative to transurethral resection, open simple prostatectomy carried a lower hazard (HR 0.43, 95% CI 0.37–0.50, p <0.001) and laser enucleation of the prostate did not differ significantly (HR 0.84, 95% CI 0.66–1.08, p=0.2). This pattern was more pronounced regarding reintervention for lower urinary tract symptom recurrence (photoselective vaporization: HR 1.52, 95% CI 1.35–1.72, p <0.001; laser enucleation of the prostate: HR 0.84, 95% CI 0.63–1.14, p=0.3; open simply prostatectomy: HR 0.38, 95% CI 0.31–0.46, p <0.001 relative to transurethral resection).

Conclusions: Five-year reintervention rates of transurethral resection and laser enucleation did not differ significantly, while photoselective vaporization had a substantially higher rate. Open simple prostatectomy remains superior to transurethral resection with respect to long-term efficacy.

Key Words: prostatic hyperplasia, transurethral resection of prostate, prostatectomy, laser therapy, urethral stricture

Abbreviations and Acronyms

AOK = Allgemeine Ortskrankenkassen (German local health care funds)
BNC = bladder neck contracture
BPO = benign prostatic obstruction
LEP = laser enucleation of the prostate
LUTS = lower urinary tract symptoms
OSP = open simple prostatectomy
PVP = photoselective vaporization of the prostate
SHR = subdistribution hazard ratio
TURP = transurethral resection of the prostate
US = urethral stricture

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OVER the past decades, transurethral prostatectomy on the one hand and open simple prostatectomy for large prostate volumes (>80 cc) on the other have been the gold standard in surgery for lower urinary tract symptoms due to benign prostatic obstruction.[1,2] More recently, a trend toward less invasive treatments, in particular photoselective vaporization of the prostate and laser enucleation of the prostate, has emerged.[3–5] These techniques need to be evaluated against the therapeutic gold standard in terms of safety and efficacy.[1,2,6,7] The surgical reintervention rate is considered the most robust long-term quality indicator.[6–8] Surgical reinterventions after procedures for lower urinary tract symptoms may be due either to recurrence or persistence of symptoms or to complications, most importantly urethral stricture or bladder neck contracture.[7–9]

Recently, Eredics et al published an analysis of 21,674 cases from a nationwide Austrian database with TURP (94%) or OSP (6%) performed between 2002 and 2006, and reported 8-year reintervention rates of 12.7% and 8.8%, respectively.[6] However, to date there have been no comparable large-scale studies of the long-term outcome of PVP or LEP as compared to TURP or OSP, resulting in a lack of evidence regarding their long-term merit relative to the largely favorable results of TURP and OSP.[9,10]

The present study uses claims data of Germany's largest provider of statutory health insurance (AOK). It is based on the records of >40,000 patients who received TURP, OSP, PVP or LEP for LUTS due to BPO between 2011 and 2013. The study aimed to compare PVP, LEP and OSP against TURP with regard to 5-year rates of reintervention for LUTS recurrence or persistence, US or BNC.

MATERIALS AND METHODS

Database

We used pseudonymized nationwide administrative claims data for inpatient episodes (including diagnoses, procedures, length of stay, transfers and discharge type) and core data (including age, sex, insurance status and survival status) of the German local healthcare funds, which provide statutory health insurance for roughly 30% of the German population.[11,12] Using the German modification of the international classification of procedures in medicine (Operationen- und Prozedurenschlüssel, OPS), male AOK patients aged 40 years and over were identified who underwent TURP (OPS 5-601.0/.1), PVP (OPS 5-601.42), LEP (OPS 5-601.7) or OSP (OPS 5-603, excluding simple laparoscopic prostatectomy, 5-603.11) and cases with additional codes for minimally invasive (5-986) or robot-assisted surgery (5-987)) between 2011 and 2013 (based on date of discharge) and had benign prostatic hyperplasia as their primary diagnosis (ICD-10 code: N40). Patients were excluded if they had a diagnosis of neuromuscular dysfunction of the bladder, any prostatic surgery in the year preceding admission, a hospital diagnosis of prostate cancer either simultaneously or within 2 years prior to admission, or previous surgery for LUTS within 5 years prior to admission (fig. 1). Simple laparoscopic prostatectomies and OSP with additional codes for minimally invasive or robot-assisted surgery were excluded since these remain uncommon procedures in Germany (28 and 7, respectively, in the period under evaluation). Neither individual written consent nor ethical approval was required as the data were pseudonymized and no link to primary data was intended.

Outcome

Patients were followed from the date of index surgery (first date of TURP, LVP, LEP or OSP). We investigated 3 end points within up to 5 years (1,825 days) from the primary procedure: first overall surgical reintervention, first reintervention for LUTS recurrence (repeated TURP, PVP, LEP or OSP; from day 6 after primary surgery since earlier re-treatment was considered likely due to bleeding) and first reintervention for US or BNC (OPS 5-573.1 (bladder neck incision), 5-58 (urethral surgery), 8-139.0 (dilation of the urethra); from readmission since US and BNC are expected to occur after primary discharge). Overall reinterventions combine and are limited to surgery for LUTS recurrence and surgery for US or BNC.

Statistical Analysis

Baseline characteristics of the population are described in terms of medians, IQR and proportions. Unadjusted 5-year survival without overall reintervention, without reintervention for LUTS recurrence and without reintervention for US or BNC was estimated using the Kaplan-Meier method, with stratification by type of primary surgery. For all 3 outcomes, observations were censored at death or at admission for prostate or bladder cancer (competing risks), at the end of the last documented quarter of AOK membership, or at day 1,825 from primary surgery, whichever came first. Multivariable Cox proportional hazards models were estimated to evaluate the effect of surgical approach on risk of reintervention while adjusting for patient risk factors. We used cluster-robust standard errors in order to account for clustering of patients in hospitals. Surgical approach was represented by dummy-coded variables for TURP (reference), PVP, LEP and OSP. Models were adjusted for age (in quintiles, with 40-64 reference, of 65-70, 71-74, 75-78 and 79-98 years), antithrombotic medication and comorbid conditions. Antithrombotic medication was defined as a minimum of 90 defined daily doses of drugs with the codes B01AA, B01AB, B01AC, B01AE, B01AF or B01AX05 according to the Anatomical Therapeutic Chemical Classification System prescribed within 180 days before primary surgery. Comorbid conditions were defined as binary variables according to the definitions of Elixhauser et al using secondary diagnoses.[14,15] Only those conditions with $p < 0.1$ on prior univariate analysis were included in the multivariable model. The proportional hazards assumption was evaluated visually on plots of Schoenfeld residuals against time, which indicated no major deviations from the proportional hazards assumption

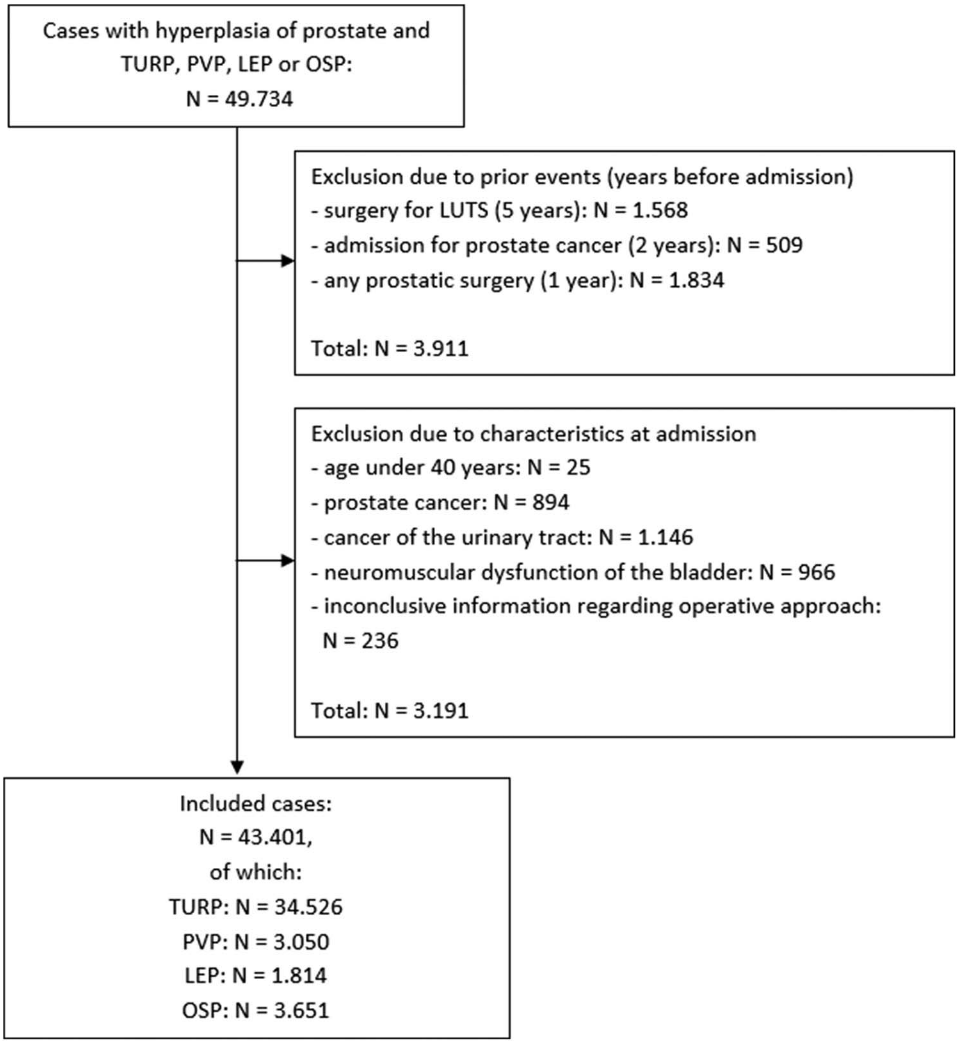

Figure 1. Selection criteria

(results not shown). In addition to Cox proportional hazard models, which estimate the cause-specific hazard that this analysis is focused on,[13] Fine-Gray subdistribution models, which would be indicated for the estimation of incidence, were estimated as sensitivity analyses, and built accordingly. All analyses were performed using Stata® 16.0. Alpha level was set to 0.05 for all analyses.

RESULTS

Study Cohort

A total of 43,041 AOK cases from 516 German hospitals fulfilled the inclusion criteria for TURP (34,526; 80.2%), PVP (3,050; 7.1%), LEP (1,814; 4.2%) or OSP (3,651; 8.5%) between 2011 and 2013

Table 1. *Patient characteristics at time of primary surgery*

	TURP	PVP	LEP	OSP
No. pts	34,526	3,050	1,814	3,651
Median yrs age (IQR)	72 (65—77)	73 (67—78)	72 (66—77)	73 (68—78)
No. comorbidity (%):				
Diabetes	7,298 (21.1)	773 (25.3)	353 (19.5)	801 (21.9)
Congestive heart failure	1,767 (5.1)	268 (8.8)	80 (4.4)	201 (5.5)
Cardiac arrhythmias	3,420 (9.9)	490 (16.1)	203 (11.2)	436 (11.9)
Coronary heart disease	4,822 (14.0)	724 (24.3)	255 (14.1)	471 (12.9)
Prior stroke or cerebral hemorrhage	479 (1.4)	82 (2.7)	17 (0.9)	42 (1.2)
Chronic renal failure	2,684 (7.8)	350 (11.5)	122 (6.7)	309 (8.5)
Chronic pulmonary disease	2,799 (8.1)	342 (11.2)	121 (6.7)	202 (5.5)
Obesity	1,820 (5.3)	161 (5.3)	56 (3.1)	260 (7.1)
Antithrombotic medication prior to surgery	7,710 (22.3)	1,182 (38.8)	436 (24.0)	719 (19.7)

Table 2. *Unadjusted followup data by type of surgery*

	TURP	PVP	LEP	OSP
No. pts	34,526	3,050	1,814	3,651
No. cases censored prior to day 1,825:	7,370	896	335	642
Death	5,550	704	258	492
Prostate or bladder Ca	1,464	158	57	113
Termination of AOK insurance	356	34	20	37
No. first reintervention:	4,188	473	189	200
For LUTS	2,840	380	128	119
For US/BNC	2,349	204	111	116
Median yrs to reintervention (IQR)	0.6 (0.1—1.8)	0.6 (0.1—1.9)	0.6 (0.1—1.7)	0.3 (0.1—1.0)
Median yrs followup for cases without reintervention (IQR)	5.0 (5.0—5.0)	5.0 (3.4—5.0)	5.0 (5.0—5.0)	5.0 (5.0—5.0)
Kaplan-Meier survival without reintervention (95% CI)	87.1 (86.7—87.5)	82.7 (81.3—84.1)	89.0 (87.4—90.4)	94.3 (93.5—95.0)

(fig. 1). The median age was 72 years (IQR 66—77; table 1). The degree of comorbidity differed between subgroups, with the greatest extent of comorbidity in PVP patients (table 1). LEP increased from 2.6% in 2011 to 5.6% in 2013, while TURP decreased from 81.7% (2011) to 78.3% (2013), and PVP (6.9% vs 7.6%) and OSP (8.8 vs 8.5%) remained fairly stable.

Overall Reinterventions

A total of 5,050 first overall reinterventions occurred within 5 years of LUTS surgery. In addition, 9,243 patients were censored prior to day 1,825 (7,004 deaths, 1,792 cases of incident prostate or bladder cancer and 447 cases where AOK insurance ended). Median followup for patients without reintervention was 5 years (IQR 5.0—5.0). The unadjusted Kaplan-Meier estimate for survival without reintervention after 5 years was 87.5% (95% CI 87.2%—87.8%) with significant differences between types of surgery (log-rank test p <0.001). Details by type of surgery are provided in table 2 and fig. 2.

Reintervention for LUTS Recurrence

A total of 3,467 patients had first reinterventions for LUTS recurrence. A total of 9,564 patients were censored prior to day 1,825 (7,236 deaths, 1,865 cases of incident prostate or bladder cancer and 463 cases where AOK insurance ended). Median followup for patients without reintervention was 5 years (IQR 5.0—5.0). The unadjusted Kaplan-Meier estimate for survival without reintervention for LUTS recurrence after 5 years was 91.5% (95% CI 91.2%—91.7%). Again, types of surgery differed significantly (log-rank test p <0.001). Details by type of surgery are provided in table 2 and fig. 3.

Reintervention for Urethral Stricture or Bladder Neck Contracture

A total of 2,780 patients had first reinterventions for US or BNC. A total of 9,832 patients were censored prior to day 1,825 (7,467 deaths, 1,897 cases of incident prostate or bladder cancer and 468 cases where AOK insurance ended). Median followup for patients without reintervention was 5 years (IQR 5.0—5.0). The unadjusted Kaplan-Meier estimate for survival without reintervention for US or BNC after 5 years was 93.0% (95% CI 92.8%—93.3%), also with significant differences by type of surgery (log-rank test p <0.001). Details by type of surgery are provided in table 2. The Kaplan-Meier plot (fig. 4) indicates that the reintervention hazard was initially lower after LEP than after OSP, but this pattern was reversed during the first postoperative year.

Multivariate Analysis

Multivariate survival analysis demonstrated that PVP carried a significantly increased hazard of overall reinterventions (HR 1.31, 95% CI 1.17—1.46, p <0.001) relative to TURP, while OSP was associated with a significantly lower hazard (HR 0.43, 95% CI 0.37—0.50, p <0.001). This pattern was more pronounced with respect to reintervention for LUTS recurrence (PVP: HR 1.52, 95% CI 1.35—1.72, p <0.001; OSP: HR 0.38, 95% CI 0.31—0.46, p <0.001; table 3). Regarding reinterventions for US or BNC, OSP was associated with a significantly lower hazard (HR 0.45, 95% CI 0.37—0.55, p <0.001), while PVP did not differ from TURP. Overall, LEP did not differ from TURP regarding the reintervention hazard. Fine-

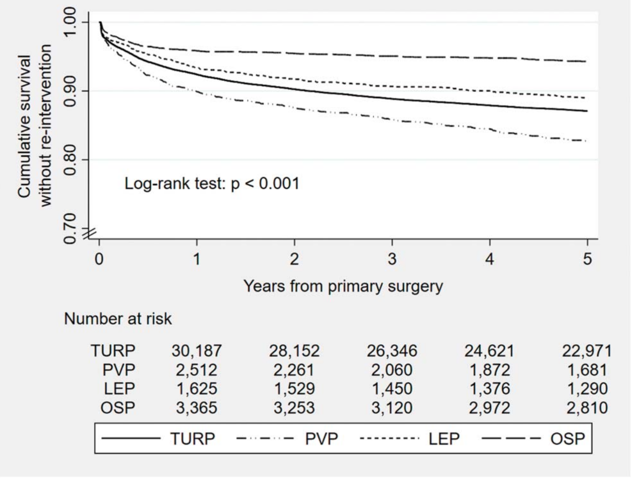

Figure 2. Kaplan-Meier 5-year survival without reintervention by type of surgery.

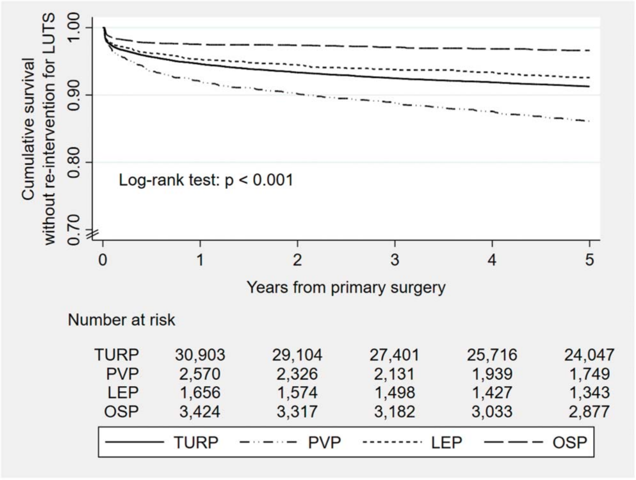

Figure 3. Kaplan-Meier 5-year survival without reintervention for LUTS recurrence by type of surgery.

Gray subdistribution hazard models produced essentially the same results (table 4). In addition to type of surgery, the hazard of overall reinterventions increased with antithrombotic medication prior to surgery, depression, coagulopathy and renal failure (for details see table 3).

DISCUSSION

The long-term surgical reintervention rate is considered a good indicator for the efficacy of surgery for LUTS due to BPO.[6–8] This study compared PVP, LEP and OSP to TURP in terms of 5-year surgical reintervention rates, based on a nationwide German administrative database. Our findings underline the importance of long-term studies, since a continuous increase in reinterventions was evident up to the fifth year from initial surgery for all 4 approaches (fig. 2). However, few large-scale studies with long-term followup exist. In an early multinational landmark study, Roos et al reported reintervention rates of 12% vs 4.5% after TURP and OSP for 36,703 Danish patients.[16] Eredics et al reported 8-year rates for secondary TURP, urethrotomy or bladder neck incision of 12.7% for TURP and 8.8% for OSP in an analysis of 21,674 cases from a nationwide Austrian database.[6] Regarding the more recent laser techniques, most long-term studies have been smaller in scale.[17–20] Mordasini et al reported 5-year reintervention rates of 11.9% and 14.3% for TURP and PVP, without a significant difference.[17] For 180 W GreenLight™ PVP, Calves et al reported a reintervention rate of 7.2% after a mean followup of 57 months, while Park et al reported a rate of 4.4% at 60 months after 120 W GreenLight PVP.[18,19] For thulium LEP, Gross et al reported a 5-year reintervention rate of 8.4%.[20] Sun et al compiled long-term reintervention rates from 37 prospective controlled studies of different surgical approaches between 1995 and 2016. Findings were somewhat inhomogeneous, but reintervention rates were highest for PVP and lowest for LEP.[9] In the only large-scale comparison of TURP and laser surgery, Welk et al evaluated 45,910 TURP and 6,838 PVP cases from Canadian administrative data and reported significantly increased surgical reinterventions in PVP (13.2%) compared to TURP (10.9%) after a median followup of 53 months.[21]

With 5-year risks of reintervention of 12.9%, 17.3%, 11% and 5.7% for TURP, PVP, LEP and OSP, our results for TURP and OSP correspond broadly to other findings. However, previous studies mostly reported lower reintervention rates for PVP and LEP. Regarding LEP, our cohort may reflect relatively early results for this most recent surgical technique. Generally, higher reintervention rates after laser surgery in claims data may result from the fact that these are real-world data, while other studies reflect outcomes in specialized hospitals with more expertise. Perioperative complications due to bleeding were not part of our analysis, but would increase overall reintervention rates. In a previous study of AOK patients with primary surgery for LUTS between 2008 and 2013, we found 30-day reintervention rates for bleeding of 7.4% for TURP, 6.9% for PVP, 9.0% for LEP, and 6.0% for OSP.[8]

While long-term reinterventions provide a good indicator of efficacy, this outcome may run counter to others. Of note, OSP has reliably demonstrated a better long-term efficacy than transurethral approaches,[6,16] but is associated with higher perioperative mortality, morbidity and risk of transfusion.[8] Perioperative risks might be addressed by robot-assisted simple prostatectomy. However, this procedure remains rare in Germany. Generally, the optimal choice of surgical approach needs to include

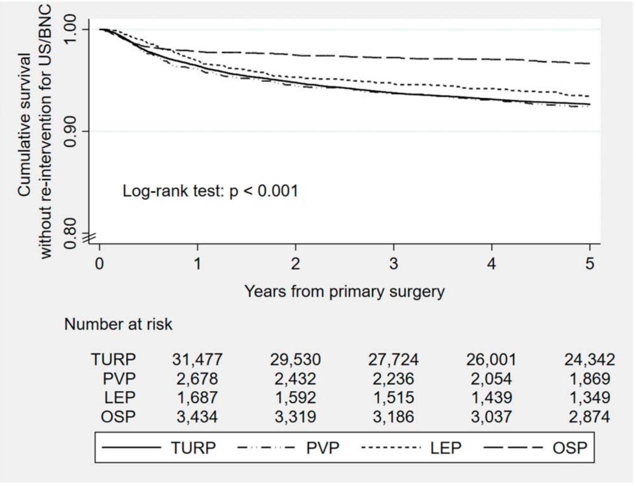

Figure 4. Kaplan-Meier 5-year survival without reintervention for US or BNC by type of surgery.

Table 3. *Effect of type of surgery on hazard of surgical reintervention after primary surgery for LUTS*

	Overall			For LUTS Recurrence			For US or BNC		
	HR	95% CI	p Value	HR	95% CI	p Value	HR	95% CI	p Value
Type of surgery:*									
PVP	1.31	1.17—1.46	<0.001	1.52	1.35—1.72	<0.001	1.03	0.87—1.22	0.7
LEP	0.84	0.66—1.08	0.2	0.84	0.63—1.14	0.3	0.88	0.67—1.17	0.4
OSP	0.43	0.37—0.50	<0.001	0.38	0.31—0.46	<0.001	0.45	0.37—0.55	<0.001
Age (yrs):*									
65—70	0.96	0.88—1.06	0.4	1.01	0.90—1.12	0.9	0.93	0.83—1.05	0.3
71—74	1.01	0.93—1.10	0.8	1.02	0.92—1.13	0.7	1.01	0.90—1.13	0.9
75—78	1.02	0.94—1.11	0.6	1.07	0.96—1.18	0.2	0.94	0.84—1.06	0.3
79—98	1.02	0.93—1.12	0.7	1.07	0.96—1.21	0.2	0.85	0.76—0.96	0.01
Antithrombotic medication	1.08	1.00—1.17	0.041	1.13	1.03—1.24	0.009	0.97	0.87—1.08	0.5
Comorbid conditions:									
Alcohol abuse	–	–	–	0.52	0.28—0.96	0.037	–	–	–
Psychoses	–	–	–	–	–	–	1.49	0.97—2.27	0.07
Depression	1.35	1.16—1.57	<0.001	1.40	1.17—1.68	<0.001	1.36	1.09—1.70	0.006
Metastatic Ca	1.89	0.90—3.95	0.09	2.23	1.03—4.84	0.042	–	–	–
Coagulopathy	1.21	1.04—1.42	0.016	1.22	1.01—1.48	0.039	–	–	–
Wt loss	–	–	–	1.60	0.92—2.80	0.1	–	–	–
Blood loss anemia	–	–	–	1.67	0.87—3.20	0.1	–	–	–
Deficiency anemia	1.29	0.91—1.83	0.15	–	–	–	–	–	–
Chronic pulmonary disease	1.07	0.97—1.18	0.2	1.05	0.94—1.18	0.4	1.11	0.97—1.28	0.1
Diabetes (uncomplicated)	1.05	0.98—1.13	0.2	–	–	–	–	–	–
Hypothyroidism	–	–	–	1.12	0.97—1.29	0.13	–	–	–
Renal failure	1.16	1.05—1.29	0.004	1.21	1.07—1.37	0.003	1.15	1.00—1.31	0.045
Congestive heart failure	1.01	0.87—1.17	0.9	1.02	0.87—1.20	0.8	–	–	–
Cardiac arrhythmias	0.96	0.88—1.06	0.4	1.01	0.91—1.13	0.8	–	–	–
Valvular disease	1.17	0.99—1.38	0.07	1.27	1.05—1.55	0.014	–	–	–
Pulmonary circulation disorders	1.18	0.79—1.77	0.4	1.20	0.75—1.92	0.4	–	–	–
Peripheral vascular disorders	1.06	0.92—1.22	0.4	1.00	0.84—1.17	1	1.15	0.95—1.39	0.2
Hypertension (uncomplicated)	1.04	0.97—1.11	0.2	–	–	–	1.09	1.01—1.19	0.036
Hypertension (complicated)	1.09	0.93—1.29	0.3	1.13	0.94—1.36	0.2	–	–	–
Paralysis	–	–	–	–	–	–	0.66	0.43—1.02	0.06

Multivariable Cox proportional hazard models were used to calculate ORs and 95% CIs.
* Reference for type of surgery was TURP. Reference for age was 40—64 years.

Table 4. *Sensitivity analysis: effect of type of surgery on hazard of surgical reintervention after primary surgery for LUTS*

	Overall			For LUTS Recurrence			For US or BNC		
	SHR	95% CI	p Value	SHR	95% CI	p Value	SHR	95% CI	p Value
Type of surgery:*									
PVP	1.27	1.14—1.42	<0.001	1.48	1.31—1.68	<0.001	1.01	0.85—1.19	0.9
LEP	0.85	0.67—1.09	0.2	0.85	0.64—1.15	0.3	0.90	0.68—1.19	0.4
OSP	0.44	0.38—0.51	<0.001	0.39	0.32—0.47	<0.001	0.47	0.38—0.57	<0.001
Age (yrs):*									
65—70	0.95	0.87—1.05	0.3	1.00	0.90—1.11	0.9	0.92	0.82—1.04	0.2
71—74	0.99	0.91—1.07	0.8	0.99	0.90—1.10	0.9	0.98	0.88—1.10	0.8
75—78	0.99	0.91—1.07	0.8	1.03	0.93—1.15	0.5	0.91	0.81—1.03	0.1
79—98	0.94	0.85—1.03	0.2	1.00	0.98—1.12	1	0.79	0.70—0.89	<0.001
Antithrombotic medication	1.07	0.99—1.15	0.08	1.12	1.02—1.22	0.016	0.99	0.89—1.10	0.8
Comorbid conditions:									
Alcohol abuse	–	–	–	0.49	0.27—0.90	0.02	–	–	–
Psychoses	–	–	–	–	–	–	1.43	0.94—2.19	0.1
Depression	1.32	1.13—1.54	<0.001	1.38	1.15—1.66	<0.001	1.33	1.06—1.66	0.012
Coagulopathy	1.15	0.98—1.34	0.08	1.19	0.98—1.44	0.08	–	–	–
Diabetes (uncomplicated)	1.04	0.97—1.12	0.2	–	–	–	–	–	–
Hypothyroidism	–	–	–	1.12	0.97—1.29	0.1	–	–	–
Renal failure	1.11	1.01—1.23	0.03	1.16	1.03—1.32	0.018	–	–	–
Congestive heart failure	–	–	–	0.99	0.84—1.15	0.9	–	–	–
Cardiac arrhythmias	–	–	–	1.00	0.89—1.11	1	0.88	0.77—1.00	0.051
Valvular disease	1.15	0.97—1.37	0.1	1.27	1.04—1.54	0.016	–	–	–
Hypertension (uncomplicated)	1.04	0.98—1.11	0.2	–	–	–	1.11	1.02—1.20	0.015
Hypertension (complicated)	–	–	–	1.15	0.95—1.39	0.2	–	–	–
Paralysis	–	–	–	–	–	–	0.63	0.41—0.97	0.04

Multivariable Fine-Gray subdistribution hazard models were used to calculate ORs and 95% CIs.
* Reference for type of surgery was TURP. Reference for age was 40—64 years.

long-term efficacy alongside short-term risks and benefits given individual patient characteristics. However, there is a lack of studies of long-term functional outcomes, which would have to be addressed by comparative studies in order to obtain a more comprehensive basis for the choice of approach.

To our knowledge, this is the only study to date with a 5-year followup for the 4 most established approaches in LUTS surgery. A major strength is the large data set of more than 43,000 patients from 516 hospitals. Since choice of hospital is free under German statutory health insurance, our data set includes hospitals ranging from major tertiary referral centers to smaller regional hospitals, which affords real-world data unbiased by the degree of hospital specialization in surgery for LUTS. Barring termination of AOK membership, subjects can be traced continuously after discharge, which allows for extended followup periods. Also, followup information is independent of whether reinterventions were handled by the same or a different hospital, so that followup to first reintervention or a competing event is virtually complete.

The use of data from a single provider constitutes a potential limitation. However, AOK membership is open to anyone regardless of factors such as professional affiliation. While the population covered by the AOK has somewhat higher comorbidity compared with other German providers of statutory health insurance, our analyses were adjusted to take potential effects of comorbidity and age into account.[22] Since this is a retrospective, nonrandomized study, we were unable to rule out selection bias in the choice of surgical approach. Our data indicate, for instance, that PVP patients had higher comorbidity and were more likely to have had antithrombotic medication prior to primary surgery (table 1). A general limitation of claims data is the lack of clinical information, such as prostate volume, International Prostate Symptom Score, and functional results, so that no information was available concerning the indication for primary surgery, or either indication for or outcome of surgical reintervention.[23] Surgeon experience was also unavailable. Especially in the case of LEP, the number of interventions performed has an impact on the complication rate.[24] Finally, the German procedure classification (OPS) used to record procedures in claims data does not differentiate between monopolar and bipolar TURP, so that possible differences within the TURP cohort cannot be traced in our data, nor does it allow for differentiation within PVP (80−180 W) or between types of laser (holmium vs thulium) in LEP.

CONCLUSIONS

The surgical reintervention rate after surgery for LUTS due to BPO is a robust criterion of the quality of treatment. Our results demonstrate that the reintervention rate continues to increase up to 5 years from primary surgery, which underscores the importance of studies with long followup periods in order to establish the long-term effectiveness of different surgical approaches. Compared to TURP, which continues to be the gold standard in BPO surgery, OSP had a lower 5-year reintervention rate. The long-term reintervention rate was similar after LEP, but significantly higher after PVP.

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EDITORIAL COMMENTS

As noted by the authors of this large study, reintervention rates for benign prostatic hyperplasia procedures are regarded as a good marker of their efficacy. This paper is a timely reminder of this parameter as one of the more important measures that we should still use to judge new treatments. Despite the current emphasis on International Prostate Symptom Score and retrograde ejaculation as primary end points in the pivotal trials of the newer treatments, durability is the key consideration for most patients, and the trade-off between an inpatient procedure that removes tissue and an office-based one with lesser efficacy is usually straightforward. Few patients want to undergo repeat treatment!

New treatments that do not acutely remove tissue but can be done in the office, such as UroLift®, do benefit from a decrease in procedural morbidity but the patient experience should be similarly uncomplicated when compared to a procedure such as holmium LEP. The difference between these 2, of course, comes with the need for re-treatment, which is becoming increasingly obvious as these newer procedures reach the 5-year mark. For the UroLift procedure repeat treatments have been estimated at 28.9% when dropouts are considered,[1] whereas for holmium LEP at 6.1 years we found that 1.4% of cases required reoperation, with high patient satisfaction rates.[2] Others have found a similarly low rate when a complete endoscopic enucleation is done. The Rezūm® procedure seems to provide intermediate results with re-treatments at 4 years of 4.4%,[3] and longer term data are awaited from Aquablation® and prostatic artery embolization in this regard.

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While we often rely on data from well controlled, randomized clinical trials with specific inclusion criteria, real life is often more complicated. Surgeries are performed by surgeons with varying levels of skill/experience, at centers that may have small volumes, and in patients who are sicker and more challenging than the idealized clinical trial participant. Hence, real-world cases from large administrative databases can provide much needed insight.

In this comparative study of 43, 000 men undergoing one of 4 BPO surgeries (TURP, PVP, LEP, OSP), there is 5-year followup reporting for surgical reintervention. The authors conclude that OSP has the lowest reintervention rate, while PVP has rates higher than LEP and TURP, which were roughly equivalent. At first glance, this appears informative, as the cohort is very large and the multivariate analysis attempts to smooth out as much bias as possible. We can see that reintervention occurs for all modalities and that overall the majority of men do well. However, we do not have any information regarding how the decision to select a specific modality was made. Additionally, we do not know prostate volumes. These unknowns make it very difficult to use these data to counsel patients. What we do know is that patients selected for PVP were older with higher comorbidity and were more likely to be anticoagulated. Therefore, the surgery may have been a more limited resection due to risk of bleeding and/or frailty of patients (simple PVP vaporization rather than GreenLight vapor incision technique for greater tissue removal).[1,2] Furthermore, unfortunately, the German OPS system does not differentiate between 80, 120 and 180 W PVP systems, the older of which were less powerful and more prone to under treatment.[3] As such, as this study has the largest cohort and the longest followup, it is meaningful insofar as it demonstrates that with all the tangible and intangible considerations of choosing the right operation for the right patient, reintervention is a possible expected outcome that must be discussed with every patient.

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