Perioperative Outcomes of Transurethral Resection, Open Prostatectomy, and Laser Therapy in the Surgical Treatment of Benign Prostatic Obstruction: A “Real-World” Data Analysis from the URO-Cert Prostate Centers

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Keywords

Lower urinary tract symptoms · Health service research · Real-life data · Routine care · URO-Cert

Abstract

Introduction: The aim of the study is to compare length of hospital stay, transfusion rates, and re-intervention rates during hospitalization for transurethral resection of the prostate (TUR-P), open prostatectomy (OP), and laser therapy (LT) for surgical treatment of benign prostatic obstruction

(BPO). **Methods:** URO-Cert is an organization, in which clinical data of prostatic diseases from 2 university, 19 public, and 3 private hospitals and 270 office-based urologists are collected in order to document treatment quality. Data on diagnostics, therapy, and course of disease are recorded web based. The analysis includes datasets from 2005 to 2017. **Results:** Of 10,420 patients, 8,389 were treated with TUR-P, 1,334 with OP, and 697 with LT. Median length of hospital stay was 6 days (IQR: 4–7) for TUR-P, 9 days (IQR: 7–11) for OP, and 5 days (IQR: 4–6) for LT ($p < 0.001$). Risk for a hospital stay ≥ 7 days was higher for OP versus TUR-P (OR: 7.25; 95% CI =

6.27–8.36; $p < 0.001$) and LT (OR: 17.89; 95% CI = 14.12–22.65; $p < 0.001$) and higher for TUR-P versus LT (OR: 2.47; 95% CI = 2.03–3.01; $p < 0.001$). OP had a significantly higher risk for transfusions than TUR-P (OR: 2.44; 95% CI = 1.74–3.41; $p < 0.001$) and LT (OR: 3.32; 95% CI = 1.56–7.01; $p < 0.001$). Transfusion rates were not significantly different between TUR-P and LT (OR: 1.36; 95% CI = 0.66–2.79; $p = 0.51$). Risk of re-intervention was not different between all 3 approaches. **Conclusion:** OP was associated with higher transfusion rates and longer hospital stay than TUR-P and LT. Risk of transfusion was not different between TUR-P and LT, but TUR-P was inferior to LT concerning length of hospital stay. Re-intervention rates during hospitalization did not differ between the groups.

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Introduction

Lower urinary tract symptoms due to benign prostatic obstruction (BPO) represent one of the major conditions in urology. In the German population, >40% of men older than 50 years suffer from symptoms requiring treatment [1]. There are many different procedures available for the surgical treatment of BPO. In addition to the historically established procedures transurethral resection of the prostate (TUR-P) and open prostatectomy (OP), a large number of minimally invasive procedures have been introduced into therapy in recent years. The most advanced of these techniques is transurethral laser therapy (LT), including enucleation, vaporization, and resection. Most notably, the use of laser enucleation techniques in particular has increased significantly in recent years [2].

European and German guidelines recommend TUR-P as the standard surgical procedure for men with prostate sizes of 30–80 mL and OP for prostate sizes of >80 mL [3, 4]. LT is recommended as an alternative to TUR-P and OP for all prostate sizes, whereby particularly laser enucleation can also be used as an alternative to OP for larger prostate volumes.

Comparative studies and meta-analyses have shown that LT demonstrates favorable results for transfusion, bleeding, and length of hospital stay [5–9], but increased long-term re-interventions compared with TUR-P and OP [10–12]. Noteworthy, most of these studies are clinical trials with limited number of patients from academic centers performed by highly experienced surgeons. Since this does not necessarily reflect the real-life condition, the question arises whether these results are reproducible in the daily routine care.

In this context, the aim of this study is to compare length of hospital stay, transfusion rates, and re-intervention rates during hospitalization for TUR-P, OP, and LT, using a large database of URO-Cert prostate centers. URO-Cert is an organization that promotes care of patients with diseases of the prostate (BPO, prostate cancer, and prostatitis) through certified quality standards with intersectoral (inpatient and outpatient) and interdisciplinary collaborations. Additionally, data on the treatment of patients with prostatic disease in the routine care are collected [13].

Materials and Methods

Since 2005, URO-Cert (formerly the Governing Body of German Prostate Centers) has been certifying networks of urological clinics and associated office-based urologists in Germany as “prostate centers” according to specific quality criteria. At present, 22 intersectoral networks hold a valid certificate as a “prostate center” nationwide, including 2 university hospitals, 19 public hospitals, 3 private hospitals, and 270 office-based urologists.

The URO-Cert certificate relates to a cross-center quality management system with standards in diagnostics and therapy of BPO, including quality parameters, that are regularly reviewed [14]. Data on diagnosis, therapy, and course of disease are systematically collected with the UroCloud database (Fa. Docxcellence, Berlin, Germany). Data are collected web based via electronic documentation forms. UroCloud only processes pseudonymized data, after a written informed consent has been obtained from the patients.

This analysis is based on the URO-Cert database from 2005 to 2017. The preoperative parameters collected include age, prostate-specific antigen, prostate volume, International Prostate Symptom Score (IPSS), and Quality of life score (IPSS-QoL). Postoperative parameters include length of hospital stay, transfusion rates, and re-intervention rates during the period of hospitalization, in which the form of re-intervention is not specified in detail in the URO-Cert database. Similarly, the specific type of TUR-P (monopolar vs. bipolar) [15] is not mentioned, and LT encompasses enucleation, vaporization, and resection and all sources of energy.

Statistical Analysis

Data were analyzed using IBM’s statistical program SPSS, version 22. Metric variables were evaluated by means of univariate ANOVA and categorical variables analyzed using the χ^2 test or Fisher’s exact test. Dichotomous data were expressed as proportions, and the treatment effect was reported as odds ratios (OR). The significance level was set at 5% for all calculations.

Results

Of 14,337 patients with instrumental BPO therapy, 3,917 were excluded due to “other” forms of treatment (e.g., catheterization, prostatic stents, transurethral microwave thermotherapy, and prostatic urethral lift system) or because an

Table 1. Patient characteristics for TUR-prostate, open prostatectomy, and laser therapy

	TUR-prostate (<i>n</i> = 8,389)		Open prostatectomy (<i>n</i> = 1,334)		Laser therapy (<i>n</i> = 697)		<i>p</i> value
	median	(IQR)	median	(IQR)	median	(IQR)	
Age, years	72	(65–77)	72	(66–77)	73	(66–77)	0.032
PSA, ng/mL	3.3	(1.6–3.3)	5.9	(3.3–5.9)	2.7	(1.2–5.1)	<0.001
Prostate volume, mL	45	(32–96)	87	(62–110)	45.5	(33–63)	<0.001
IPSS	19	(13–19)	19	(14–19)	19	(13–25)	0.684
IPSS-QoL	4	(3–5)	4	(3–5)	4	(3–5)	0.123

IQR, interquartile range; PSA, prostate-specific antigen; IPSS, International Prostate Symptom Score; QoL, quality of life; TUR, transurethral resection.

assignment to a primary form of treatment was not possible. Finally, data from 10,420 patients were available, of which 8,389 (80.5%) were treated with TUR-P, 1,334 (12.8%) with OP, and 697 (6.7%) with LT. Preoperative characteristics are shown in Table 1. Patients with LT were slightly older than TUR-P and OP (73 vs. 72 years, $p = 0.032$), while OP patients had larger prostate volumes than TUR-P and LT (87 vs. 45 vs. 45.5 mL, $p < 0.001$). No differences were seen in the median values of IPSS (19, $p = 0.684$) and IPSS-QoL (4, $p = 0.123$). For TUR-P, OP, and LT, median length of hospital stay was 6 days (IQR: 4–7), 9 days (IQR: 7–11), and 5 days (IQR: 4–6) ($p < 0.001$) (shown in Fig. 1a); transfusion rates were 1.5, 3.6, and 0.9% ($p < 0.001$) (shown in Fig. 1b); and re-intervention rates were 6.0, 5.2, and 4.4% ($p < 0.001$) (shown in Fig. 1c).

Risk for a hospital stay ≥ 7 days was higher for OP versus TUR-P (OR: 7.25; 95% CI: 6.27–8.36; $p < 0.001$) and LT (OR: 17.89; 95% CI: 14.12–22.65; $p < 0.001$) and higher for TUR-P versus LT (OR: 2.47; 95% CI: 2.03–3.01; $p < 0.001$). OP had a significantly higher risk for transfusion than TUR-P (OR: 2.44; 95% CI: 1.74–3.41; $p < 0.001$) and LT (OR: 3.32; 95% CI: 1.56–7.01; $p < 0.001$). Transfusion rates were not significantly different between TUR-P and LT (OR: 1.36; 95% CI: 0.66–2.79; $p = 0.51$). No differences were seen in re-intervention rates between TUR-P and OP (OR: 1.14; 95% CI: 0.88–1.48; $p = 0.34$) and LT (OR: 1.39; 95% CI: 0.96–2.02; $p = 0.8$) and between OP and LT (OR: 1.22; 95% CI: 0.79–1.89; $p = 0.39$) (shown in Table 2).

Discussion

In 2018, the Federal Statistical Office reports 81,281 surgical BPO therapies in Germany and thus >3 times as many as radical prostatectomies for prostate cancer [16].

Fig. 1. Length of hospital stay (median, IQR, Min, Max) (a), transfusion rates (b), and re-intervention rates (c).

Table 2. Comparison of length of hospital stay, transfusion rates, and re-intervention rates during the period of hospitalization for TUR of the prostate, open prostatectomy, and laser therapy

	OR	95% CI	p value
Length of hospital stay ≥ 7 days			
Open prostatectomy			
Versus TUR-prostate	7.25	6.27–8.36	<0.001
Versus laser therapy	17.89	14.12–22.65	<0.001
TUR-prostate			
Versus laser therapy	2.47	2.03–3.01	<0.001
Transfusion			
Open prostatectomy			
Versus TUR-prostate	2.44	1.74–3.41	<0.001
Versus laser therapy	3.32	1.56–7.01	<0.001
TUR-prostate			
Versus laser therapy	1.36	0.66–2.79	0.518
Re-intervention			
TUR-prostate			
Versus Open prostatectomy	1.14	0.88–1.48	0.343
Versus laser therapy	1.39	0.96–2.02	0.08
Open prostatectomy			
Versus laser therapy	1.22	0.79–1.89	0.391
TUR, transurethral resection.			

Nevertheless, there is a lack of health service research or BPO registries in which clinical data of treatment are recorded in a structured manner.

Most of the studies comparing different surgical treatment options for BPO are clinical trials from academic centers with limited generalizability due to small numbers of patients or procedures conducted only by highly experienced surgeons [17, 18]. It is obvious that results from these studies comprise a certain bias and cannot easily be transferred to routine care.

In this context, the URO-Cert database offers an approach to collect “real-life” data for surgical BPO therapy including data from university, public, and private hospitals, as well as office-based urologists, covering the entire spectrum of routine care. Thus, some of our observations reveal some important findings.

Choice of Treatment

Prostate volume appears to be the main factor in the choice of the surgical approach, since OP patients had significantly larger prostate volumes than patients with TUR-P or LT. A trend to treat larger prostates with LT (especially newer enucleation techniques) cannot yet be derived from our data [19]. Due to the increasing use of these enucleation techniques in recent years, this obser-

vation may be possible in future analyses. Furthermore, age also seems to influence treatment selection, since LT patients were slightly, but significantly, older than TUR-P and OP patients (73 vs. 72 years, $p = 0.032$). This might indicate a tendency to treat older patients with the supposedly least harmful therapy [20]. On the other hand, we could demonstrate that choice of treatment is independent of the extent of symptoms, since median IPSS (19; $p = 0.684$) and median IPSS-QoL (4; $p = 0.123$) did not differ between the groups.

Length of Hospital Stay

As expected, OP was associated with a longer hospital stay than TUR-P and LT. The shortest hospital stay was documented for LT patients, even in comparison with TUR-P. The probability of a hospital stay of ≥ 7 days was 2.5 times higher for TUR-P than for LT patients. These findings are in line with data from 2 large meta-analyses comparing TUR-P and LT in which laser enucleation of the prostate (LEP) and laser vaporization of the prostate (LVP) were associated with a shorter hospital stay than TUR-P [7, 9, 21]. Furthermore, 2 randomized controlled trials compared OP and LEP including patients with prostate sizes >100 mL. Both studies showed a shorter hospital stay for LT with a mean difference of 4.3 days [22, 23].

Transfusion and Re-Intervention

Transfusion rates were highest in OP (3.6%) and lowest in LT (0.9%); re-intervention rates were highest in TUR-P (6.0%) and lowest in LT (4.4%). The risk to receive a transfusion was higher in OP than in TUR-P and LT, but did not differ between TUR-P and LT. The percentage of re-interventions between all 3 approaches differed numerically but not significantly. Higher transfusion rates in OP are not surprising since it is an open approach and can be confirmed in the literature [24]. On the other hand, most studies comparing TUR-P and LT reveal lower risk for transfusion [6, 7] and fewer short-term re-interventions in LT patients [9, 25]. The lacking difference in our observation might be explained by the missing distinction of mono- and bipolar TUR-P and the different forms of LT. Lower transfusion rates and lower perioperative complications were reported mainly from studies comparing LVP with monopolar TUR-P [26]. On the other hand, most studies reveal that monopolar TUR-P is associated with a higher rate of perioperative complications compared to bipolar TUR-P [9, 20, 27]. In the future, a dedicated consideration of the different forms of LT (e.g., vaporization and enucleation) compared with

either monopolar or bipolar TUR-P might be able to derive more precise differences between the forms of therapy.

One of the few studies comparing all 3 treatment options (TUR-P, OP, and LT) is from the Research Institute of the German Local Health Care Funds (WIdO). Gilfrich et al. [12] identified 95,577 cases with a primary diagnosis of BPO who received TUR-P, OP, or LT (including LEP and LVP) between 2008 and 2013. In their analysis of these health insurance data, OP had the greatest risk of perioperative complications despite a low long-term re-intervention rate. LVP demonstrated favorable results for transfusion and bleeding, but increased long-term re-interventions compared with TUR-P, while LEP showed increased re-interventions for bleeding. Although this is one of the few studies comparing the 3 most common treatment options, it has to be considered that a general limitation of such claims data is the lack of clinical information, such as prostate volume and functional parameters. Compared to this analysis, our data confirm the median age at surgical treatment (72 years), as well as the length of hospital stay for TUR-P (6 days) and LT (5 days), and only hospital stay after OP was shorter in the URO-Cert prostate centers (9 vs. 12 days). No significant differences could be observed in the re-intervention rates (URO-Cert/WIdO: TUR-P = 6.4%/7.4%, OP = 5.6%/5.9%, and LT = 4.6%/6.9%). However, transfusion rates in our data were lower (URO-Cert/WIdO: TUR-P = 1.7%/3.4%, OP = 4.1%/14.4%, and LT = 1.0%/2.8%).

Strengths and Limitations

Strengths of our study include the large number of patients and study centers covering the whole spectrum of routine care, thus reflecting the reality of everyday conditions better than results of randomized controlled trials from single tertiary care centers. Limitations include the lack of differentiation between mono- and bipolar TUR-P and between the different forms of LT. Data from the current literature suggest that most interventions are performed by a monopolar TUR-P [28]; similarly, holmium enucleation is the most commonly used form of LT [21, 29].

Furthermore, no differentiation is made between the types of re-intervention, which can cover a wide spectrum from catheter insertion to open revision. In addition, re-interventions are only recorded for the period of hospitalization and do not include the further course of treatment.

Conclusions

The URO-Cert database provides health service research data on the surgical treatment of BPO. OP was associated with higher transfusion rates and longer hospital stay than TUR-P and LT. Risk of transfusion was not different between TUR-P and LT, but TUR-P was inferior to LT concerning length of hospital stay. Re-intervention during hospitalization did not differ between the groups.

In the future, the evaluation of functional parameters in the medium- to long-term follow-up is of particular interest. For example, a dedicated consideration of the different LT (e.g., vaporization and enucleation) might be able to demonstrate whether one of these procedures confirms the excellent long-term results of TUR-P. In this case, these registry data could result in therapeutic implications.

Statement of Ethics

UroCloud only processes pseudonymized data, after a written informed consent has been obtained from the patients. The present analysis was carried out retrospectively exclusively on anonymized datasets and constitutes no human subject research. After consultation with the Ethics Committee of the University of Cologne (Germany), no institutional review board approval was required.

Conflict of Interest Statement

The authors have nothing to disclose.

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Author Contributions

Conception or design of the work: Jan Herden and Peter Weib. Acquisition of data: Thomas Ebert, Daniel Schlager, Jana Pretzer, Daniel Porres, Wolfgang Schafhauser, Martin Kriegmair, Miguel Garcia Schürmann, Florian Distler, Frank Oberpenning, Michael Reimann, Gerald Haupt, Sebastian Schmidt, Sven Laabs, Bernhard Planz, Maximilian Cohausz, Eckart Gronau, Guido Platz, Stephan Buse, Jon Jones, Michael Waldner, Axel Heidenreich, Alexander Goell, Jürgen Zumbé, Wolfgang Schultze-Seemann, and Peter Weib. Interpretation of data for the work: Jan Herden. Drafting the manuscript: Jan Herden. Critically revising the manuscript: Axel Heidenreich, Herbert Ruebben, Ehsan Khaljani, Winfried Czempel, and Peter Weib. Approval of the final version of the work: all of the authors.

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