



# Electrosurgery or laser for benign prostatic enlargement: trumpcard or pitfalls

Maximilian Pallauf<sup>a</sup>, Thomas Herrmann<sup>b</sup>, David Oswald<sup>a</sup>, Peter Törzsök<sup>a</sup>,  
Susanne Deininger<sup>a</sup> and Lukas Lusuardi<sup>a</sup>

## Purpose of review

To summarize and comment on publications of the last 2 years in the field of endoscopic surgery for benign prostatic enlargement, focusing on similarities and differences of laser and electrosurgery.

## Recent findings

Because of good hemostasis and safety, invasive endoscopic surgery has evolved to a choice of treatment for vulnerable patients with ongoing antithrombotic medication and in same-day surgery. Recent publications show a good perioperative course and no deterioration in the postoperative outcome. Furthermore, alterations to the original surgical techniques of resection, enucleation, and vaporization have increased the preservation rate for antegrade ejaculation, advancing them to an appealing choice of treatment for sexually active men. Favorable outcomes can be achieved in both laser and electrosurgery. Only the choice of the surgical technique determines the outcome.

## Summary

Various invasive endoscopic surgical techniques are available, offering different advantages and disadvantages for the patient. All of them can be performed with laser and electrosurgery. Therefore, focusing on the proper choice of surgical technique instead of the energy source will guarantee the patient to benefit most.

## Keywords

antegrade ejaculation, antithrombotic medication, electrosurgery, laser surgery, same-day surgery

## INTRODUCTION

Even though transurethral resection of the prostate (TURP) using electric current is still considered the gold standard for the treatment of benign prostatic enlargement (BPE) of patients nonresponding to or unsuitable for pharmacologic treatment, the focus of research is trending towards ‘new’ surgical techniques. These include endoscopic enucleation of the prostate (EEP), prostate vaporization (PV), and vaporesection of the prostate (VRP). As a result, endoscopic laser surgery is getting into the spotlight [1]. In addition to their different physical properties and effect on the prostatic tissue, multiple types of lasers have been tested for the various BPE surgical techniques. Nevertheless, electrosurgery is in frequent use for EEP, VRP, and PV as well. There is an ongoing debate to what extent the energy source attributes to the success of the surgery. Driven by the constant introduction of new laser variants, it will not settle soon. Therefore, current research trends focus on matching surgery type and energy source with the patient’s needs, rather than

identifying the best surgical technique above all. This narrative review aims to highlight and comment on recent publications (April 2019 to April 2021) in the field of endoscopic BPE surgery, focusing on similarities and differences between laser and electrosurgery.

<sup>a</sup>Department of Urology, University Hospital Salzburg, Paracelsus Medical University, Austria and <sup>b</sup>Department of Urology, Spital Thurgau AG, Frauenfeld, Switzerland

Correspondence to Lukas Lusuardi, Department of Urology, University Hospital Salzburg Müllner Hauptstraße, 48 5020 Salzburg, Austria.  
Tel: +43 57255 27401; e-mail: l.lusuardi@salk.at

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## KEY POINTS

- Invasive BPE surgery is well tolerated in patients with ongoing antithrombotic medication.
- Invasive BPE surgery is feasible in same-day surgery and will be followed more intensively in the future because of the universal necessity of cost reduction.
- Modifications to the original surgical techniques of enucleation, resection, and vaporization can preserve antegrade ejaculation.

## PATIENTS TAKING ANTITHROMBOTIC MEDICATION

Hematuria resulting in clot retention and blood transfusions have always been a concern in endoscopic prostate surgery. As a result, there was an unmet need for treatment strategies in patients unable to discontinue antithrombotic medication. Throughout the last years, several surgical techniques were tested in patients with ongoing antithrombotic medication.

Zheng *et al.* published a meta-analysis including 11 trials and comparing 2299 patients on and off antithrombotic medication receiving greenlight laser prostate vaporization (GL-PV). No differences in surgery time or laser time were found between the two groups. The same is true for complications and blood transfusions. Furthermore, only one patient in the antithrombotic medication group received a blood transfusion. The only difference was found for catheterization time, which was 0.54 days longer for patients on antithrombotic medication [2<sup>¶</sup>]. The study outlines the good hemostatic capabilities of the greenlight laser and its utility in treating patients at high risk of bleeding. However, the study has a major drawback. It does not differentiate between antithrombotic medication types, which could have made differences appear less pronounced between the groups.

Rühle *et al.* prospectively assessed the outcome of 276 consecutive TURP patients on ongoing antithrombotic medication and compared them with a control group of 73 TURP patients, considering the type of antithrombotic medication. Surgery time and hospital stay for patients taking the antiplatelet medication acetylsalicylic acid ( $n = 130$ ) were comparable to the control group. In contrast, the antiplatelet medication clopidogrel ( $n = 16$ ) and the anticoagulant phenprocoumon ( $n = 57$ ) resulted in longer bladder irrigation times (24 vs. 22 h;  $P = 0.006$  and 24 vs. 22 h;  $P = 0.06$ ) and a more frequent need for blood transfusions (19 vs. 1%;  $P = 0.017$  and 9 vs. 1%;  $P = 0.09$ ). For the latter,

the difference was not statistically significant [3<sup>¶</sup>]. These results show that TURP is feasible in patients with ongoing antithrombotic medication but has an increased bleeding risk. Furthermore, these results emphasize the importance of distinguishing between the different antithrombotic medication types as it significantly impacts patient outcomes.

Compared with TURP, holmium laser EEP (HoLEP) seems to have favorable hemostatic properties in patients with ongoing antithrombotic medication. In a retrospectively collected propensity-score matched comparison for HoLEP ( $n = 111$ ) and TURP ( $n = 110$ ), HoLEP had a statistically significant lower intraoperative drop in hemoglobin level, irrespective of the type of antithrombotic medication. Furthermore, hematuria-related adverse events at least Clavien–Dindo II (CD II), including blood transfusions, were more frequent in TURP patients (10.9 vs. 3.6%;  $P = 0.041$ ) [4<sup>¶</sup>]. It is still uncertain to what extent the energy source and the surgical technique are responsible for TURPs increased bleeding risk. A retrospective propensity-score matched comparison between HoLEP and bipolar EEP (BipoleP) suggests the latter one might account for the major part: whenever comparing HoLEP and BipoleP in patients with and without ongoing antithrombotic medication, no differences in transfusion rates were found, regardless of the antithrombotic medication type. Furthermore, the postoperative drop in hemoglobin level was comparable between all HoLEP and BipoleP patients. However, the overall complication rate was higher in BipoleP patients with ongoing antithrombotic medication in comparison with patients not taking antiplatelet drugs or anticoagulants (37.5% BipoleP antiplatelet medication vs. 33.3% BipoleP anticoagulants vs. 13.8% BipoleP no antithrombotic medication;  $P = 0.001$ ). Notably, most were minor complications rated CD I and II. In contrast, no differences for HoLEP patients were found [5<sup>¶</sup>]. The safety for HoLEP in patients with ongoing antithrombotic medication is further strengthened by the results of a prospectively built multicenter database including 963 patients (28% antiplatelet medication, 11% anticoagulants). The overall blood transfusion rate was 5% and was only increased in patients with ongoing anticoagulant therapy. Furthermore, neither the decrease in the hemoglobin nor the hematocrit level was statistically different between patients with and without ongoing antithrombotic medication [6<sup>¶</sup>]. Likewise, the analysis of another prospectively assessed institutional database, including 268 patients (38.8% antithrombotic medication), showed no rise in complications for HoLEP and ongoing antithrombotic medication. However, ASA status, age, and prostate cancer were the main risk factors for surgical complications [7<sup>¶</sup>]. A

somewhat different picture is shown by the meta-analysis published by Zheng *et al.*, focusing on HoLEP in patients with ongoing antithrombotic medication. The analysis consists of nine retrospective trials and a total of 5528 patients. Patients without antithrombotic medication had lower rates of blood transfusion [odds ratio (OR) 0.21, 95% confidence interval (CI) 0.10–0.45;  $P < 0.0001$ ], bladder tamponade (OR 0.30, 95% CI: 0.13–0.69;  $P = 0.004$ ) and acute urine retention (OR 0.52, 95% CI: 0.30–0.89;  $P = 0.02$ ) in comparison with patients with ongoing antiplatelet or anticoagulant therapy. Despite the large number of patients included in this meta-analysis, the results must be viewed with caution. Only retrospective trials with considerable interstudy heterogeneity were selected.

Promising results were published for other enucleation procedures, such as diode laser EEP (DiLEP) as well. Zhang *et al.* retrospectively compared the perioperative and postoperative outcomes of 144 DiLEP patients with (34%) and without (66%) ongoing antithrombotic medication. Results showed that the rates for complications and blood transfusions were comparable between the groups, just as the postoperative functional outcome. Solely catheterization time and hospitalization time were longer for patients with ongoing antithrombotic medication [8].

The first results show that endoscopic prostate surgery is feasible in patients with ongoing antithrombotic medication. Laser techniques and endoscopic enucleation promise a favorable outcome with fewer bleeding complications. However, prospective randomized trials, differentiating between the type of surgery, the energy source in use, and the type of antithrombotic medication are missing to draw definitive conclusions and identify the best treatment for patients with ongoing antithrombotic medication.

### SAME-DAY SURGERY

With an aging population in western countries, assessment of BPE treatment costs is gaining further interest. Recently, the assessment of a prospective multinational registry comparing treatment costs for symptomatic BPE patients showed that medical treatment is more cost-effective than TURP, even for more extended treatment periods. Although the cost-benefit varied widely between the drugs and the countries, the advantage of medical therapy over surgery was permanent [9<sup>\*\*\*</sup>]. This finding puts pressure on the surgical approach to offer cost-effective treatment strategies. As inpatient hospitalization makes up for a substantial part of overall treatment costs, same-day surgery (SDS) is gaining more popularity.

For successful same-day discharge, outstanding hemostatic properties and an excellent overall safety profile are the keys. Several BPE surgery techniques have been tested for SDS success. Most data can be found for HoLEP and greenlight laser surgery. A meta-analysis published by Salciccia *et al.* analyzed the overall failure rates for TURP, greenlight laser surgery, and HoLEP in SDS, including 18 trials and 1626 patients. The discharge protocol varied among the trials. Most importantly, patients were discharged with or without an indwelling catheter throughout the different studies. Data showed a pooled estimate failure rate of 7.8% (95% CI: 5.2–10.3), which was significantly different between the treatment procedures ( $P < 0.001$ ). Failure rate was 3% (95% CI: 1–4.9) for TURP, 7.1% (95% CI: 3.9–10.4) for greenlight laser surgery, and 11.8% (95% CI: 7–16.7) for HoLEP. However, subgroup analysis revealed that prostate size was associated with an increased failure rate: greenlight laser less than 40 cm<sup>3</sup> 4.1% (95% CI: 0.7–7.5) compared with 10.7% (95% CI: 6–15.4) greater than 40 cm<sup>3</sup>. Taking into consideration that HoLEP is more frequently performed in larger glands, selection bias might be an explanation for failure rate differences. However, complication rates and outpatient visits within 30–90 days after surgery were comparable. The pooled estimates were 18.6% (95% CI: 13.2–23.9) and 7.7% (95% CI: 4.3–11), respectively [10<sup>\*\*\*</sup>]. This meta-analysis highlights the feasibility of SDS for invasive endoscopic BPE surgery as it has shown low failure and complication rates. Nevertheless, heterogeneity between the studies was considerably high, making it difficult to draw definite conclusions.

The meta-analysis by Salciccia *et al.* identified prostate size as a significant risk factor for SDS failure. This assumption was confirmed by Klein *et al.*, who retrospectively analyzed 266 same-day HoLEP procedures conducted over 6 years. Prostate size greater than 90 cm<sup>3</sup> was the only risk factor increasing failure rates (OR 2.041;  $P = 0.047$ ). Interestingly, SDS failure became less common as surgery time and the application rate for laser energy decreased over time. These findings suggest that the surgeon's learning curve is also essential for the success of SDS [11]. In another trial, HoLEP SDS was tested for patients with exceptionally large glands at least 175 cm<sup>3</sup>. The retrospective study by Assmus *et al.* [12], including 55 patients, demonstrated a failure rate of 16%. Although this is higher than reported in other studies, it seems acceptable considering the large prostate volume.

In the study by Assmus *et al.*, patients had been discharged with an indwelling catheter. However, removing the catheter on the day of surgery is also possible in HoLEP, at least in smaller sized glands.

Agarwal *et al.* presented the outcome of 30 patients (median prostate size 81 cm<sup>3</sup> IQR: 53–114.8) who underwent HoLEP with MOSES 2.0 technique and catheter removal on the day of surgery. Only patients with acceptable postoperative hematuria were offered early catheter removal. Twenty-seven (90%) patients successfully voided on the day of surgery without requiring repeat catheter placement. All patients were catheter-free on postoperative day 1. No complications and no reintervention occurred within 90 days after surgery [13]. The results of this retrospective study highlight the safety and good hemostasis of HoLEP. However, it has several drawbacks. Firstly, the patient population studied was highly preselected. Secondly, it remains unclear whether the success of catheter removal was influenced by the additional effect of the MOSES technology. These potential biases make it difficult to generalize the study results.

Furthermore, SDS has no adverse effect on HoLEPs functional outcome, as shown by Lwin *et al.*, retrospectively comparing 199 SDS and 178 non-SDS patients. At 1 year follow-up, no differences for maximum urinary flow rate ( $Q_{max}$ ) and post void residual urine (PVR) and the decline in International Prostate Symptom Score (IPSS) were found between the two groups. However, high-grade complications at least CD III were more common in the non-SDS group (0 vs. 2.8%  $P=0.04$ ). In addition, overall complications occurred earlier (median 2 days postsurgery vs. 10.5 days). However, these differences might be explained by discrepancies in prostate size and surgery time. The mean prostate volume was larger ( $96 \pm 55$  vs.  $83 \pm 49$  cm<sup>3</sup>;  $P=0.02$ ) and the surgery time longer ( $132 \pm 67$  vs.  $110 \pm 47$  min;  $P<0.011$ ) in non-SDS patients [14].

Promising results for GL-PV in SDS were presented as well. Two Chinese retrospective trials, Xu *et al.*, and Xia *et al.*, compared the outcome and costs of SDS GL-PV and inpatient GL-PV. Success rates of SDS were 96.5 and 95%. Complication rates were comparable between both groups. In one study, Xu *et al.*, a difference in the postoperative urinary retention rate was found, favoring inpatient surgery (12.3 vs. 5.1%;  $P=0.035$ ).  $Q_{max}$ , PVR, and the decline in IPSS 12 months after surgery were comparable between both groups. Treatment costs were significantly lower in SDS GL-PV ( $P<0.05$ ) [15,16].

All published trials promote the feasibility of SDS and same-day catheter removal for invasive endoscopic BPE surgery. This concept will be followed more intensively in the future because of the universal necessity of cost reduction. However, the level of evidence is limited as most trials are retrospective with high risks for bias, particularly in

patient selection and protocol for patient discharge. Although the trials assessed electrosurgery and laser surgery in SDS, significantly more data exists for the latter. Not a single trial tests electrosurgery EEP in SDS. Future prospective trials are needed to identify reliable criteria for SDS patient selection and outline advantages and disadvantages among the various surgical techniques and energy sources.

## PRESERVATION OF SEXUAL FUNCTION

As more and more minimally invasive techniques for BPE treatment, able to preserve antegrade ejaculation, have entered the market, the possibility to maintain sexual function and ejaculation has become of great interest for invasive endoscopic surgery techniques as well.

Contrary to earlier assumptions, endoscopic BPE surgery does not pose a significant risk to erectile function. A systematic review published by Soans *et al.* showed no difference in preoperative and postoperative erectile function for most BPE surgery trials ( $n=86$ ). Furthermore, more trials showed an improvement in postoperative erectile function ( $n=16$ ) than deterioration ( $n=8$ ) [17<sup>■</sup>]. This finding is supported by the results of a meta-analysis published by Liu *et al.*, analyzing the effect of EEP and TURP on erectile function and ejaculation, including 10 trials and a total of 1435 patients. Overall, both EEP and TURP showed a postoperative improvement in erectile function, illustrated by an increase in International Index of Erectile Function (IIEF)-5 score. In addition, no difference in the rate of retrograde ejaculation was found but it affected more than 50% of the patients. However, in the long-run, more than 48 and 60 months after surgery, higher IIEF-5 scores were found for EEP. Suggesting that complete removal of BPE, as in EEP, results in a more durable perseveration of erectile function [18<sup>■</sup>].

Still, the meta-analysis by Liu *et al.* outlines that retrograde ejaculation is a common problem in BPE surgery. Nevertheless, antegrade ejaculation can be preserved by modifying the standard surgical technique, as several trials prove.

Gul *et al.* presented the data of 312 patients with a maximum follow-up of 12 years who had been treated with a modified TURP procedure, where only the middle lobe is being resected. The postoperative outcome revealed a low rate of new-onset ejaculatory dysfunction of 2.3% and erectile dysfunction of 0.3%. In addition, the IIEF-5 score did not change throughout the whole study period. Furthermore, improvements in functional outcomes were durable. Re-do surgery was only necessary for 2.2% of the patients [19<sup>■</sup>]. These results outline the possibility of



improving micturition parameters and preserving antegrade ejaculation in TURP in patients with moderate size prostates (mean volume  $79.8\text{ cm}^3$ , 30–178).

Further studies assessed the impact of various EEP techniques on sexual function and the preservation of antegrade ejaculation. A prospective randomized trial showed that BipoleP has lower anejaculation rates than conventional TURP. The trial published by Wang *et al.* includes 50 BipoleP patients and 51 bipolar TURP patients. Mean prostate volumes were  $119.51 \pm 18.14$  and  $121.72 \pm 18.78\text{ cm}^3$  ( $P=0.549$ ). Whereas postoperative functional outcomes and the IIEF-5 score were comparable 6 months after surgery, the onset of anejaculation was significantly lower in the BipoleP group (baseline 10 vs. 26% at 6 months and baseline 18 vs. 51% at 6 months;  $P < 0.05$ ) [20<sup>■</sup>].

Bebi *et al.* compared HoLEP ( $n=62$ ) and BipoleP ( $n=76$ ) in a retrospective fashion. No differences in the IIEF-5 score and the rate of anejaculation were found at baseline and the end of the 12-month follow-up period between both EEP techniques. However, there was a trend for more new-onset anejaculation (+33.3 vs. 19.5%) and higher rates of reduced postoperative semen volume (84.6 vs. 50%;  $P=0.04$ ) in the HoLEP group. In addition, early ejaculation discomfort was more common in the HoLEP group as well [21<sup>■</sup>]. Whether no major differences between HoLEP and BipoleP were found in terms of postoperative sexual function, the study shows a trend towards a more favorable outcome for enucleation using electric current. Caution is warranted. Hence the conclusions are drawn from a retrospective study, with substantial differences between patient cohorts showing larger prostates in the HoLEP group (median  $97\text{ cm}^3$ ; IQR: 76–121 vs.  $80\text{ cm}^3$ ; IQR: 60–110;  $P=0.01$ ). A prospective randomized trial by Huet *et al.* compared the impact of sexual function of GL-EEP and GL-PV. Both groups consisted of 100 patients with a mean prostate volume of  $110\text{ cm}^3$  (95% CI: 101–118) and  $107\text{ cm}^3$  (95% CI: 99–115) ( $P=0.68$ ). Patients were matched according to the erectile dysfunction risk factors hypertension, diabetes, and smoking. Antegrade ejaculation 12 months after surgery was preserved in 26.9% in the GL-PV group and 1.2% in the GL-EEP group ( $P < 0.001$ ). However, postoperative IPSS,  $Q_{\max}$ , and PSA decline were advantageous in the GL-EEP group and accompanied by a more favorable course of the IIEF-5 score. Furthermore, 10.1% of GL-PV patients needed retreatment, but none in the GL-EEP group ( $P=0.002$ ) [22<sup>■</sup>]. In addition to high rates of ejaculation dysfunction in both groups, the postoperative erectile function was associated with improvements in urinary tract function.

These findings outline the importance of a careful balance between aiming to preserve antegrade ejaculation and complete resection of the prostatic tissue.

Preservation of ejaculatory function in EEP might be possible by a modification of the original three-lobe HoLEP technique. A prospective randomized trial by Xu *et al.* comparing the three-lobe HoLEP technique ( $n=94$ ) with a modified two-lobe technique ( $n=97$ ) showed lower rates for retrograde ejaculation (13.3 vs. 50%;  $P=0.034$ ) and higher ejaculatory volume ( $1.8 \pm 0.6$  vs.  $1.2 \pm 0.2\text{ ml}$ ;  $P=0.003$ ) for the latter, in addition to similar functional micturition outcomes 12 months after surgery [23<sup>■</sup>]. Similar, low rates of new-onset retrograde ejaculation were found in the retrospective assessment of 704 EnBloc HoLEP patients by Li *et al.* With the modified EnBloc technique, where the bladder neck is being preserved, the rate of new-onset retrograde ejaculation was 11.7%. No differences before and after surgery in the IIEF-5 score and the Erection Hardness Grading Scale were found. Functional micturition outcomes improved significantly [24<sup>■</sup>]. Similar improvements in the preservation of antegrade ejaculation were presented for the modified ThuLEP technique. The technique presented by Bozzini *et al.* differs from the original technique described by Herrmann *et al.* in 2010 [25], as it spares the prostatic area around the verumontanum. The prospectively assessed outcomes of 283 patients showed preservation of antegrade ejaculation in 71.7% at 3 months and 77.4% at 6 months after surgery. Comparable to the other modified EEP techniques, functional micturition outcomes improved significantly, and complication rates were low [26<sup>■</sup>].

Hence PV also carries the risk for retrograde ejaculation an ejaculatory hood-preserving technique was invented. Similar to other ejaculation-preserving techniques, the area around the verumontanum is being spared. Abolazm *et al.* presented a prospectively randomized double-blinded trial comparing ejaculatory hood sparing ( $n=25$ ) and standard GL-PV ( $n=24$ ) in terms of erectile function and impact on antegrade ejaculation. Antegrade ejaculation was preserved in 85% of patients in the ejaculatory hood-sparing approach and only in 31.6% of patients with standard GL-PV. Similar, the Ejaculatory Domain of Male Sexual Health Questionnaire was significantly better for the ejaculatory hood-sparing approach throughout the follow-up period. Interestingly both techniques resulted in a decline of the IIEF-15 score at 1 year but it was statistically significant for standard GL-PV only ( $P=0.001$ ). Improvements in micturition parameters and retreatment rates were comparable between

both groups [27<sup>\*\*\*</sup>]. Data shows that the ejaculatory hood-sparing approach can also be safely performed in PV with electric current. A prospective randomized trial by Kini *et al.* comparing the ejaculatory sparing approach for GL-PV and bipolar PV showed similar rates of antegrade ejaculation 6 months after surgery for both techniques (85 and 78%). The decline in the Men's Health Questionnaire Ejaculations Scale was comparable. Furthermore, improvements in micturition parameters were durable throughout the study period in both groups [28<sup>\*\*</sup>]. Once more, this study outlines the predominance of the surgical technique over the energy source for the postoperative outcome.

Recent data shows that invasive BPE surgery most certainly improves erectile function, and antegrade ejaculation can be preserved. The alteration to the surgical technique but not the choice of the energy source, is decisive for the postoperative results. If the technique is followed correctly, sparing the prostatic areas essential for ejaculatory functioning, antegrade ejaculation can be maintained with endoscopic electrosurgery and laser surgery.

## CONCLUSION

This narrative review further highlights the importance of the surgical technique over the energy source in use. Therefore, the patient will only benefit from the correct indication of the surgical technique. All of them can be performed with laser and electrosurgery. The former might be advantageous in hemostasis, and therefore, in patients with an increased bleeding risk.

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## Conflicts of interest

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- of outstanding interest

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