

Lasers

Dornier Thulio®'s in-vivo efficiency and safety for Endoscopic Enucleation of the Prostate

Lower urinary tract symptoms (LUTS) due to benign prostate hyperplasia (BPH) have long been predominantly treated with simple prostatectomy and transurethral resection of the prostate (TURP). Over the past 20 years, several laser-based procedures have been introduced as treatment alternatives in clinical practice. Laser endoscopic enucleation of the prostate (EEP) was shown to be more effective and caused fewer complications and less blood loss than TURP and open prostatectomy.¹

Holmium laser enucleation of the prostate (HoLEP) is the current gold standard surgical approach for BPH-related LUTS and first-line treatment for prostatic glands exceeding 80 cm³, in both the European Association of Urology and American Urology Association guidelines.^{2,3} HoLEP has been proven to be safe and efficient with excellent long-term clinical results.⁴ It uses a pulsed Holmium:yttrium-aluminium-garnet laser (Ho:YAG) with a 2120 nm wavelength and a peak power of up to 10 kW. Due to the high peak power, cavitation bubbles are created in water which emits a shock wave that exerts local pressure.⁵ This facilitates dissecting the prostate adenoma from the prostate's pseudo-capsule.⁵

As an alternative to Ho:YAG lasers, there are mainly two Thulium laser types used for EEP: the continuous wave Thulium:YAG (Tm:YAG) laser used for enucleation (ThuLEP), and the Thulium fiber laser (TFL). These two laser technologies offer potential benefits over Ho:YAG lasers, like precise tissue cutting and superior ablative and coagulative properties.^{6,7} However, these Thulium laser technologies (continuous wave Tm:YAG and TFL) do not permit the employment of cavitation bubble explosions for tissue dissection.⁸ To overcome the shortcomings of existing lasers, pulsed solid-state Tm:YAG lasers were introduced.^{9,10}

Real-World Experience with the New Pulsed Solid-State Thulium:YAG Laser (Thulio) for Endoscopic Enucleation of the Prostate¹¹

Objective

The study aims to examine the efficacy and safety of a new pulsed solid-state Thulium:YAG laser in its first human application.

Method

Data were retrospectively collected for the first 103 patients who underwent EEP with a new pulsed solid-state Tm:YAG laser (Dornier Thulio®, Dornier MedTech Systems GmbH, Wessling, Germany). Peri- and postoperative data were assessed. Procedure-specific complications were graded using Clavien-Dindo Classifications (CDC). Patients were interviewed 15 months after the surgery to evaluate functional and long-term outcomes. Statistical analysis was performed with Statistical Package for the Social Sciences (SPSS®).

All EEP procedures were carried out by three experienced surgeons (having done more than 250 EEPs) and applying the same en-bloc technique (three horseshoe-like incisions).¹² A 600 µm laser fiber and 26 French continuous flow resectoscope (Karl Storz SE & Co. KG, Tuttlingen, Germany) were used for the procedures with the laser power settings at 100 W at 2 J and 50 Hz. Following the hospital protocol for EEP, a high-frequency current cautery device (Erbe Elektromedizin GmbH, Tübingen, Germany) with a monopolar roller ball probe (Richard Wolf GmbH, Knittlingen, Germany) was used as an additional haemostatic measure after every enucleation. Standard saline (0.9%) solution was used to irrigate, and the bags were hung 60 cm above the operating table. Tissue morcellation was performed with the Piranha device (Richard Wolf GmbH, Knittlingen, Germany). Following the morcellation of the prostate tissue, a standard 20 Fr three-way catheter was inserted with continuous bladder irrigation.

Findings

The mean preoperative prostate volume was 105.6±55.0 ml. The median enucleation speed was 4.1 g per second (range 1.1-9.7). Short-term postoperative complications occurred in 21 patients (20.4%), which were well manageable clinically and were no high-grade complications (CDC ≥IV). Five patients suffered gross haematuria and required reintervention (CDC IIIb; 4.9%). After 15 months, 76 patients (73.8%) participated in the follow-up interview, where seven patients (9.2%) reported complications, including two reinterventions for urethral strictures (CDC IIIb; 2.6%). Most patients reported an improvement in continence (54.0%) and urine stream (93.4%), but no difference in erectile function (81.6%). No persistent dysuria was reported. Patient satisfaction with the surgery results was very high (96.1%).

In this real-world experience, the authors observed that the high-power pulsed Tm:YAG laser with a peak power of up to 3,700 W facilitated correct anatomic adenoma dissection even in cases of exceptionally large prostate volumes. Despite the relatively large size of the prostatic glands, the average enucleation time in this study was maintained at a relatively brief 18.3 min (and a maximum of 72 minutes), confirming the efficiency in EEP.

The present study was a single-arm observational real-world surgical care study, so no direct comparisons to other lasers were possible. Since the data only contain information on a 15-month period after the operation, the authors do not have any data on further possible long-term complications after this period. It is also possible that the complication rate in the first case series might be higher because of the relative lack of experience with the new laser device.

Conclusion

Laser EEP with Dornier Thulio® (the newly introduced pulsed solid-state Thulium:YAG laser) is a safe and effective treatment option that allows the anatomic enucleation of a prostate, resulting in very high postoperative patient satisfaction. More extensive and prospective studies will be required to establish the potential and clinical efficacy of the laser system.

Glossary

LUTS: Lower urinary tract symptoms

BPH: Benign prostate hyperplasia

TURP: Transurethral resection of the prostate

EEP: Endoscopic enucleation of the prostate

HoLEP: Holmium laser enucleation of the prostate

Ho:YAG: Holmium:yttrium-aluminium-garnet

Tm:YAG: Thulium:yttrium-aluminium-garnet

ThuLEP: laser enucleation of the prostate with continuous wave Tm:YAG support

TFL: Thulium fiber laser

CDC: Clavien-Dindo Classifications

SPSS: Statistical Package for the Social Sciences

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