JOURNAL OF
Endoluminal Endourology

Original Article
doi: 10.22374/jeleu.v1i2.21

THULIUM LASER ENUCLEATION OF THE PROSTATE (THULEP) AS A TECHNIQUE FOR TREATMENT OF BPH: EVALUATION OF A SIX-YEAR EXPERIENCE AT A SINGLE INSTITUTION

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Submitted: August 15, 2018. Accepted: September 10, 2018. Published: October 15, 2018.

ABSTRACT

Background and Objective

Transurethral resection of the prostate (TURP) has been the undisputed reference standard for elderly men with lower urinary tract symptoms (LUTS) caused by benign prostatic enlargement (BPE).

However, morbidity after TURP remains significant, with increased risks of bleeding and TUR syndrome. In recent years, there has been a gradual increase in the role of laser technology for the treatment of symptomatic BPE.

The aim of our study was to evaluate the efficacy and safety of the novel technique Thulim laser enucleation of prostate (ThuLEP) developed for the first time in 2009 by Imkamp et al. in treating symptomatic BPE.

Materials and Methods

Analysis of the data from electronic records, case notes, clinic letters all the patients who had undergone ThuLEP using a 70 W thulium laser (Revolix) for symptomatic outflow obstruction over a 6-year period was done. We looked at the pre-procedure PSA, maximum urinary flow rate (Qmax), Post void residual (PVR) and hemoglobin, comparing it with the post-operative hemoglobin.

Results

Two-hundred twenty-two patients underwent ThuLEP procedure performed by 2 surgeons. We found a 159% improvement in Q max, a 61% improvement in PVR. No mortalities occurred and only 1 patient required post-operative blood transfusion.

ThuLEP represents a safe, effective surgical option in patients with symptomatic BPH with relatively little complications, producing significant improvements in both Qmax and PVR.

The aging men commonly develop benign prostatic hyperplasia (BPH) and its related lower urinary tract symptoms (LUTS), with an increasing ageing population the incidence of LUTS will inevitably increase. LUTS are now typically categorized into storage symptoms (frequency and urgency), voiding symptoms (poor flow, hesitancy, straining) and post-voiding symptoms (post-micturition dribbling).

LUTS (previously called prostatism) may result from bladder outlet obstruction (BOO) due to benign prostatic obstruction (BPO) usually from benign prostatic enlargement (BPE) which is usually due to histological benign prostatic hyperplasia (BPH). Some studies have estimated that BPH is likely to affect 75% of men in the seventh decade of life and as high as 88% of men by the ninth decade.[1]

In addition to this national data shows that BPH and its associated LUTS remains the most common reason for urology consult visits among men aged 40–70 years.[2] If left untreated BPH not only can lead to a sequelae of complications such as urinary tract infection (UTI), hematuria, renal failure, but also can lead to a significant decrease in quality of life, with one study showing a strong association between depression and LUTS.[3]

Although Transurethral resection of the prostate (TURP) remains the undisputed gold standard for the management of BPH. In recent years there has been a gradual increase in the role of laser technology for the treatment of symptomatic BPH. Multiple lasers are now available and have become a popular alternative for TURP, with several reports showing their efficacy with less blood loss and a shorter hospital stay compared to TURP.[5]

The Thulium:Yttrium-Aluminium-Garnet (YAG) laser (2014 nm wavelength) is one of four contemporary groups of laser system used for BPH,. Others include Neodynium:YAG, Holmium:YAG, and potassium-titanyl-phosphate (KTP) green light.

Neodynium: Yttrium-aluminium-Garnet (Nd:YAG) has a wavelength of 1064 nm. The medium used consists of neodymium atoms in an yttrium-aluminium-garnet rod/crystal. This causes coagulation necrosis and sloughing of tissues. Nd:YAG is poorly absorbed by water and penetrates tissues deeply. It has good hemostasis effects on tissues by thermal coagulation.

Ho:YAG (Holmium:Yttrium-Aluminium-Garnet) has a wavelength of 2140 nm. It uses crystals of yttrium-aluminium-garnet with holmium ions as its medium. Holmium laser is absorbed by water resulting in deeper tissue penetration. Tissue must be in contact with the laser. Holmium vapourizes, resects, and enucleates tissue. Holmium lasers can be used with all sizes of prostate and do not result in TUR syndrome as saline is used as the irrigation.

Potassium-Titanyl-Phosphate (KTP laser) "green light (PVP)" has a wavelength of 532 nm. It uses KTP crystals to double the frequency of the Nd: YAG laser. Comparing with Nd: YAG laser, KTP laser is more easily absorbed by oxyhemoglobin and has less depth of penetration (2 mm). It is designed to vapourize the tissue therefore there is no tissue for histological analysis post-procedure. So, greenlight laser is used in BPH in non-high-risk patients.

In addition, Urolift is another novel technique for the treatment of BPH and LUTS. It is recommended by NICE for men over age 50, with a prostate volume under 100 g and those without a obstructing middle lobe. It avoids the risk to sexual function associated with TURP and HoLEP. It can be used in the day case setting under local anesthetic and therefore can be utilized in the unfit patient who cannot undergo a general anesthetic.

To shed light on this topic, we report our experience with the Thulium Laser Enucleation of the Prostate (ThuLEP) as a technique for treatment of BPH over a six-year period we study the outcome of 222 patients operated with ThuLEP, evaluating is safety and efficacy.

METHODS

A retrospective analysis of the data from patients undergoing ThuLEP surgery was conducted over a 6-year period (2010–2016). During the study data were gleaned from electronic records, case notes, and dictated clinic letters of the patients who had undergone ThuLEP using a 70 W thulium laser (Revolix) and carried out by two surgeons during the course of the 6-year study.

All patients underwent routine clinical evaluation and completed a validated symptom questionnaire, the IPSS questionnaire, prior to surgery. Data collected and analyzed were based on the following parameters:

1. Mass of prostatic tissue removed.
2. Pre- and post-operative prostate-specific antigen (PSA).
3. Pre- and post-operative maximum urinary flow rate (Qmax)
4. Pre- and post-operative post-void residual (PVR).
5. Pre- and post-operative hemoglobin (Hb)
6. Incidental prostate carcinoma pick-up rate.

The only exclusion criteria used during the study involved patients with less than 40-grams resected. This was decided because it was deemed that any mass resected less than 40 grams would be too little/ insignificant to be able assess the post-operative criterion sited above.

RESULTS

A total of 604 patients underwent ThuLEP procedure performed by 2 surgeons with 382 cases were excluded due to less than 40 grams being resected; giving a gross total of 222 cases being analysed. Mean patient age was 73 years (49 and 88 lower and upper limit respectively). The average prostate volume resected was 65.5grams (40-122grams). In terms of PSA reduction, a mean reduction 70.5% post ThuLEP was observed (see Table 1)

There was a mean improvement in the maximum urinary flow rate post ThuLEP calculated as the Q-Max of 171.4% with a mean reduction of 79.8% in the PVR. Furthermore, post-operatively a mean drop of 8.1% in Hb was recorded, with only 1 out of 222 (0.45%) patient requiring post-operative blood transfusion due to persistent hematuria which did not subside after 24 h with continuous bladder irrigation (see Table 1). No mortalities were recorded throughout the course of the study.

Finally, histopathological examination of the enucleated tissue showed an incidental adenocarcinoma of the prostate in 6.1%. Only 3 out of 222 patients (previously on long-term catheters) (1.4%) required long-term re-catheterization or continued intermittent self-catheterization after ThuLEP procedure.

TABLE 1 Table of results, showing ThuLEP outcomes and results.

Total Number of patients	**222**
Mean Age	73 (49-88)
Mean prostate volume resected	65.5(g) (40-122)
Mean PSA reduction post op	70.50%
Mean Improvement in Q-max	171.40%
Mean reduction in PVR	79.80%
Mean drop in post-Op HB	8.10%
Post Op blood transfusion	0.45%

DISCUSSION

TURP has been the undisputed reference standard for elderly men with LUTS secondary to BPE.[4] However, it is well documented that TURP is limited to small and medium-sized prostates, this being the logic for excluding patients with less than 40 g of prostatic tissue resected in our study. Furthermore, morbidity after TURP remains significant, with increased risks of bleeding both in the intra-operative and post-operative period, which necessitates admission for at least 24 hours for observation and continuous bladder irrigation. Given the current state of the NHS with increasing demands for inpatient beds for acute emergencies, one could argue that beds occupied for post TURP patients may be utilized in a more constructive fashion. One study concluded that the overall morbidity rate is15–20%[5]

In addition to this there is the theoretical risk of the development of TUR syndrome due to the use of a hypotonic irrigating solution during the procedure. However, with the introduction of bipolar TURP, which utilizes normal 0.9% saline for irrigation rather than glycine during TURP, the risk of TUR syndrome is very much reduced.

Various lasers have been introduced as alternatives to TURP. It is important to bear in mind that the action of different lasers is by no means the same. Each laser has its distinct wavelength with a unique tissue interaction characteristic that makes one wavelength act

differently in tissue than another wavelength. Hence, it is often misleading when different laser treatment modalities are all described as "laser prostatectomy" instead of differentiating the laser types and technique employed such as coagulating from vaporizing, incisional, resecting, or enucleating techniques.

Apart from the ThuLEP, Holmium laser enucleation of the prostate (HoLEP) appears to be a size- independent new gold standard as far as laser techniques is concerned.[6] It allows patients with large prostates who traditionally require open prostatectomy to be treated endoscopically[7].

However, it has been suggested that ThuLEP may have several advantages over the holmium laser, including improved spatial beam quality, more precise tissue incision, and operation in continuous-wave/pulsed modes.[8]

It is evident that BPE is primarily a disease of the elderly; henceforth they will have underlying conditions or risk factors increasing their anesthetic risk. This means in some cases patients may not be a candidate for routine TURP surgery and may have to suffice with conservative management. Moreover, one study conducted by Johann et al assessed readmissions, complications, and outcomes of high anesthetic risk patients who have undergone laser prostate surgery, and found 88% of patients undergoing laser prostate surgery were successfully discharged 24 hours post-operatively. In addition to this only of which 6/57 patients (11%) were readmitted within 90 days post operatively, 4 for hematuria and clot retention, 2 for other cardiac indications.[9]

Recent studies comparing TURP with laser prostate surgery have also shown improved intra-operative bleeding outcomes. Xia et al. illustrated that ThuLEP results in a significantly lower HB drop than TURP, with no significant change in HB pre-operatively and post-operatively in Thulep.[14] Furthermore, 4.2% (2) patients who had TURP required blood transfusions compared to none of those who had ThuLEP.[14] Looking at multiple studies comparing HoLEP, the current gold standard, with TURP, only 1% (19/1847) required a blood transfusion in HoLEP, compared with 2.7% (31/1130) in TURP[15] (refer to Figure 1)

These results mirror our findings, with only 1 out of 222 (0.45%) patient requiring post-operative blood transfusion due to persistent hematuria with continuous bladder irrigation (refer to Figure 2).

Further analyzing this case, it was revealed that the patient was on dual anti-platelet therapy in the form of Aspirin and Clopidogril for Cardiac coronary stents. The patient was subsequently taken back to theatre and given 2 units of Red blood cells (RBC) post-operatively.

CONCLUSION

ThuLEP represent a safe, effective surgical option in patients with symptomatic BPH producing significant improvements in both Qmax and PVR. Furthermore,

FIG. 1 Graph comparing maximum urinary flow rates after ThuLEP and HoLEP.[15]

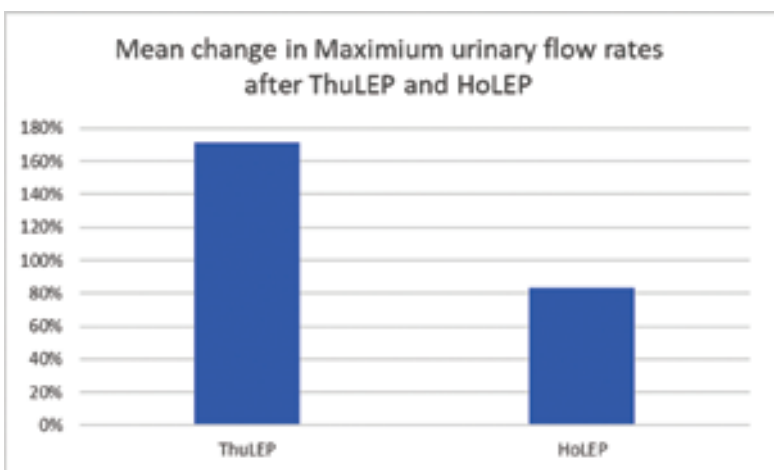
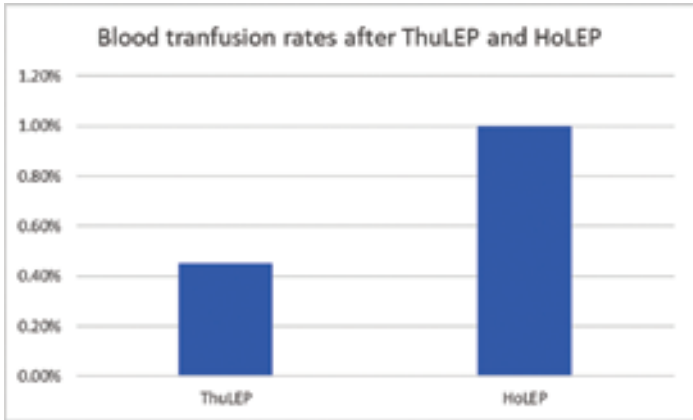


FIG. 2 Graph comparing blood transfusion rates after ThuLEP and HoLEP.[15]



ThuLEP offers the advantage of decreased bleeding complications and the possibility to treat patients with bleeding disorders or on anti-coagulation therapy.

CONFLICT OF INTERESTS

Nil.

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