

Endourologic Procedures for Benign Prostatic Hyperplasia

Review of Indications and Outcomes

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Purpose: To discern the positive and negative attributes of the various treatment modalities for benign prostatic hyperplasia.

Materials and Methods: A comprehensive literature review is presented for endoscopic treatment of the bladder outlet obstruction with an emphasis on current randomized controlled trials available comparing these treatment modalities.

Results: Transurethral resection of the prostate remains the gold standard when assessing alternative treatment options available for benign prostatic hyperplasia. Holmium laser enucleation of the prostate demonstrates equivalent efficacy with a more favorable risk profile. Photoselective vaporization, transurethral needle ablation, and transurethral microwave therapy have demonstrated safety and short-term efficacy; however, data on long-term efficacy are currently lacking.

Conclusion: The current endoscopic methods may offer favorable safety and efficacy for the treatment of the bladder outlet obstruction. However, further research is needed to establish long-term efficacy for many of the currently available treatment options.

Keywords: benign prostatic hyperplasia, minimally invasive, treatment outcome, prostatectomy

*Urol J. 2011;8:171-6.
www.uj.unrc.ir*

INTRODUCTION

The management of benign prostatic hyperplasia (BPH) has become more diverse during recent years with introduction of various novel pharmaceuticals and minimally invasive techniques. The goal for surgical management of BPH is to reduce the bulk of the prostatic tissue causing the bladder outlet obstruction and lower urinary tract symptoms (LUTS).

The gold standard treatments include open prostatectomy and transurethral resection of the prostate (TURP). Open prostatectomy is an invasive surgical procedure with associated morbidity requiring extended

lengths of hospitalization.

Traditional TURP is the gold standard regarding minimally invasive treatments; however, up to 20% of patients have significant complications with 10% to 15% requiring a second procedure within ten years.⁽¹⁾

With increasing concern regarding the soaring rise of health care costs with mediocre results, minimally invasive therapies for the management of BPH will become ever increasingly important regarding cost effectiveness. The use of minimally invasive therapies for BPH has been driven to a great degree by changes in Medicare reimbursement during the past

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Received April 2011
Accepted July 2011

few years as they are now considered to be office procedures.⁽²⁾ However, the perceived efficacy and long-term durability of these therapies remain to be proven. Our aim was to review the literature on minimally invasive endoscopic treatment options for BPH focusing on patient selection and treatment outcomes for each modality.

MATERIALS AND METHODS

PubMed and MEDLINE searches were conducted in December 2010 using the search terms of “laser prostatectomy, photoselective vaporization, transurethral microwave therapy, transurethral needle ablation” alone and combined with the phrase “randomized controlled trial (RCT).”

All the abstracts were reviewed for relevance and all RCTs were reviewed in full. Studies other than RCTs were reviewed when there were no RCTs on the topic, or when multiple abstracts with a lower level of evidence produced contradictory results to a single RCT.

RESULTS

Endourologic Procedures for BPH

Histological changes of BPH are nearly universal with advanced age, and an estimated quarter of men will have undergone surgical treatment for LUTS secondary to BPH by the age 80.⁽³⁾

Transurethral resection of the prostate and open prostatectomy are well-established gold standard treatments for LUTS secondary to BPH with excellent long-term results.⁽⁴⁾ Despite the well-established efficacy of TURP, complications approach 20%⁽⁵⁾ and in recent decades, multiple minimally invasive techniques have been developed with the goal of similar long-term outcomes with a lower rate of complications. Herein, we review promising new minimally invasive surgical treatment options available for the management of the bladder outlet obstruction secondary to BPH.

Photoselective Vaporization Prostatectomy

Photoselective vaporization prostatectomy (PVP) utilizes a 532-nm wavelength laser to rapidly vaporize the prostate tissue through selective absorption of hemoglobin.⁽⁶⁾ The laser

is commercially available as the GreenLight Laser (American Medical Systems, Minnetonka, Minnesota, USA) at 80 W (potassium titanyl phosphate [KTP]) and 120 W (lithium borate [LBO]), which allows creation of a TURP-like defect using saline irrigation. A major advantage of PVP is coagulation during tissue vaporization that allows use of the technique for patients on anticoagulation therapy, including aspirin, coumadin, and clopidogrel.⁽⁷⁾

Multiple studies have demonstrated safety and short-term efficacy for PVP for most patients with BPH, including those with acute urinary retention.⁽⁸⁾ Short-term improvements in urodynamic parameters, including urethral opening pressure and detrusor pressure at maximum flow (Pdet at Qmax) have been reported.⁽⁹⁾ However, some studies have shown high retreatment rates in the short-term, and there is insufficient long-term efficacy data.⁽¹⁰⁾

Efficacy and adverse outcomes may be influenced by the surgical technique, and the extent of adenoma removal may vary. The International GreenLight Users Group published recommendations on the surgical technique in 2008 in order to establish guidelines for the use of PVP and maximize results.⁽¹¹⁾

Two randomized controlled trials were identified comparing subjective and objective outcomes for PVP with the KTP laser versus TURP. At 1-year follow-up, Bouchier-Hayes and colleagues found no difference in the decrease in the International Prostate Symptom Score (IPSS) or post void residual (PVR) between PVP and TURP, with advantages in the PVP group having no transfusions, with shorter catheter duration and hospital stay.⁽¹²⁾ Horasanli and associates studied patients with the prostates larger than 70 gram with a 6-month follow-up period, and demonstrated lower IPSS scores (6.4 versus 13.1), Qmax (20.7 versus 13.3 cc/s), and PVR (22.9 versus 78.9 cc) with a high retreatment rate in the PVP group (7 of 39 patients).⁽¹³⁾ These different results are in contrast to prior studies, including a prospective, single-center study by Pfitzenmaier and coworkers, which did not find a difference in flow rate for patients irrespective of the prostate size.⁽¹⁴⁾

No reports of catastrophic complications were observed in this review. Postoperative irritative voiding symptoms, including urge incontinence, are commonly reported with a rate up to 25.7% and may require anti-inflammatory or analgesic medication.⁽⁴⁾ Urethral stricture has been reported, but may be related to improper technique, and the bladder neck contracture occurs at low rates.⁽⁴⁾ There are few reports of sexual side effects from PVP with significant improvement in International Index of Erectile Function scores.⁽⁹⁾ However, retrograde ejaculation was reported in over 50% of patients in the trial by Horasanli and colleagues, which may be due to TURP-like complete removal of the adenoma.⁽¹³⁾

Transurethral Needle Ablation

Transurethral needle ablation (TUNA) utilizes low-level radiofrequency energy (460 kHz) to induce necrosis of hyperplastic tissue under local anesthesia on an outpatient basis. It was first used in 1993 and radiofrequency generators and disposable ablation catheters are currently commercially available through Medtronic (Medtronic, Minneapolis, Minnesota).

Multiple comparative and non-comparative studies have evaluated exclusion criterion, safety, and efficacy of TUNA for BPH. Overall, TUNA appears to be suitable for most of the patients with BPH and offers a low complication rate and short-term efficacy.⁽¹⁵⁾

A prospective, multicenter trial of 65 and 54 patients randomized to TUNA and TURP, respectively, demonstrated equivalent improvement in subjective parameters, including IPSS and quality-of-life scores, sustained over a 5-year follow-up period despite less improvement in objective parameters, including PVR and Qmax, and a re-treatment rate of 14% for patients undergoing TUNA.⁽¹⁶⁾

A recent meta-analysis of 35 studies showed an improvement of 41% to 61% in subjective parameters with a trend towards decreased subjective urinary improvement after 3 years. There was a maximum improvement of 35% in objective urodynamic parameters.⁽¹⁵⁾

The most frequent adverse effect of TUNA is hematuria, which is mild or transitory in most cases in the non-comparative studies pooled in the meta-analysis by Bouza and colleagues.⁽¹⁵⁾ Transient urinary retention is common, but rarely sustained, and routine postoperative catheterization is at the discretion of the surgeon. The procedure is well-tolerated under local anesthesia with conscious sedation with few reports of severe pain leading to termination of the procedure.⁽¹⁷⁾ Sexual side effects are uncommon in the meta-analysis with no retrograde ejaculation, stricture, and a 3% rate of new erectile dysfunction.⁽¹⁵⁾

Few studies have reported on the selection of ideal candidates for TUNA. While one study found poor improvement in objective parameters for the prostates over 50 grams,⁽¹⁸⁾ this finding has not been confirmed in other studies. The meta-analysis by Bouza and associates demonstrated a 70% spontaneous voiding rate for patients undergoing TUNA for acute or chronic urinary retention.⁽¹⁵⁾

Transurethral Microwave Therapy

Thermotherapy for the treatment of BPH has evolved since the 1980s culminating in specialized available transurethral catheters that use microwave therapy to induce stromal necrosis by achieving temperatures of 45° to 60° C.

Multiple transurethral microwave therapy (TUMT) catheter models are available and most, but not all, employ urethral cooling mechanisms that, in theory, protect the urethra, bladder neck, and striated sphincter while allowing for maximum thermal damage to hypertrophic tissue and minimizing the time of therapy.⁽²⁾

Clinical improvement of LUTS after TUMT is due to decreased prostatic volume, and also possibly, smooth muscle tone.⁽¹⁹⁾ Transurethral microwave therapy can be accomplished in the outpatient setting.

Contraindications to TUMT include implanted pacemakers, defibrillators, metallic pelvic or hip implants, and the prostate or bladder cancer. Traditionally, patients with the prostate over 100 grams or less than 30 grams as well as subjects

with ‘ball-valve’ median lobe enlargement are not candidates for TUMT.⁽²⁾ While some early reports showed limited efficacy for TUMT in the setting of chronic urinary retention, an 80% catheter-free rate is reported for 24 patients with chronic urinary retention using the CoreTherm TUMT system (ProstaLund, Lund, Sweden).⁽²⁰⁾

A review by Walmsley and Kaplan demonstrated short-term improvement in TUMT with decrease in IPSS of between 3 and 12.8 points and an improvement in Qmax of 12.6 to 17.8 cc/s.⁽²⁾ Earlier TUMT systems have shown inferior short-term outcomes compared to TURP,⁽²¹⁾ and a more recent meta-analysis confirmed these findings for more advanced high energy TUMT systems.⁽²²⁾ However, a multicenter RCT showed no difference in outcomes with a 5-year follow-up period for TURP and the CoreTherm device, with a 10% retreatment rate in the TUMT group versus 4.3% in the TURP group.⁽²³⁾ These long-term results may be subject to bias as only 66% of patients completed five years of follow-up.

While most series have shown a favorable side effect profile compared to TURP, particularly in terms of a lower rate of erectile dysfunction and retrograde ejaculation,⁽²⁴⁾ postoperative transient dysuria has been reported in up to 50% of patients. Additionally, in December 2000, the Food and Drug Administration warned against severe complications, such as penile necrosis and fistula;⁽²⁵⁾ however, these are very rare in reported series and may represent improper use of the device.⁽²⁾

Holmium Laser Enucleation of the Prostate

The holmium: yttrium-aluminum-garnet (Ho:YAG) 2010 nm wavelength laser is absorbed by water and produces precise vaporization of the prostate tissue with a depth of penetration of 0.4 mm and simultaneous coagulation.⁽²⁶⁾

Application of this laser to BPH was initially in the form of tissue ablation, but holmium enucleation of the prostate (HoLEP) became possible with advent of mechanical morcellators to retrieve the prostate fragments. Complete enucleation, including apical tissue, is possible even for the prostates up to 300 grams.⁽²⁷⁾

Multiple randomized and non-randomized prospective trials have shown equivalent or even superior short and long-term results with HoLEP over TURP.⁽²⁸⁾ Kuntz and associates randomized patients with the prostate larger than 100 grams to either open prostatectomy or HoLEP with 74 patients completing five-year follow-up. Outcomes were equivalent for both groups in terms of IPSS score, Qmax, and PVR with a low rate of re-operation for stricture or bladder neck contracture in both groups (5% versus 6.7%). Holmium enucleation of the prostate was a day surgery procedure for most of the patients.⁽²⁷⁾ Similarly, a case series by Larner and coworkers over 200 patients showed a transfusion rate of zero with over 90% of patients discharged without a catheter on either postoperative day zero or one.⁽²⁹⁾

Shah and colleagues published a single surgeon experience with 280 patients, 4.3% of whom needed to be converted to TURP due to malfunction of the laser or morcellation device and 3.9% sustained superficial bladder injury from the morcellator. There was a trend to more complications and conversions early in the series illustrating the high technical learning curve. Capsular perforation might occur in some patients, but did not change the management.⁽³⁰⁾

Fluid absorption does occur in up to 26% of patients, but normal saline irrigation is used and there are no reports of TUR syndrome after HoLEP.⁽³¹⁾ Overall, low rates of minor re-operations (0 to 5.4%) for stricture or bladder neck contracture have been reported.⁽⁴⁾

Holmium enucleation of the prostate is an endoscopic treatment for the bladder outlet obstruction that is compared favorably with TURP and open prostatectomy in terms of safety and efficacy. However, its adoption may be limited by a high technical learning curve and the presence of a small number of experts in the field.

CONCLUSION

Minimally invasive and endoscopic methods may offer high success rates with minimal complications, often in an ambulatory setting, for the treatment of the bladder outlet obstruction

secondary to BPH. Certain therapies, such as HoLEP, have shown equivalent long-term results to TURP. Other treatment options, such as PVP, TUMT, and TUNA, have shown acceptable short-term results; however, long-term efficacy is lacking. More robust long-term results may soon become available through the National Institute of Health sponsored Minimally Invasive Surgical Therapies Trial.

CONFLICT OF INTEREST

None declared.

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