Medical Coverage Policy

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Coverage Policy Number 0159

Benign Prostatic Hyperplasia (BPH) Treatments

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Related Coverage Resources

Botulinum Therapy
High Intensity Focused Ultrasound (HIFU)
Oral Phosphodiesterase-5 (PDE5) Inhibitors

Overview

This Coverage Policy addresses surgical and minimally invasive procedures used in the treatment of benign prostatic hyperplasia (BPH).

Coverage Policy

Prostatic urethral lift (e.g., UroLift) is considered medically necessary for the treatment of symptomatic benign prostatic hyperplasia (BPH) when ALL of the following criteria are met:

- age 50 years or above
- estimated prostate volume < 80 cc
- no obstructive median lobe of the prostate identified on cystoscopy
- failure, contraindication or intolerance to at least three months of conventional medical therapy for BPH (e.g., alpha blocker, PDE5 Inhibitor, finasteride/dutasteride)

Water vapor thermal therapy (e.g., Rezūm System) is considered medically necessary for the treatment of symptomatic benign prostatic hyperplasia (BPH) when ALL of the following criteria are met:

- age 50 years or above

- estimated prostate volume ≥ 30 cm^3 and ≤ 80 cm^3
- failure, contraindication or intolerance to at least three months of conventional medical therapy for BPH (e.g., alpha blocker, PDE5 Inhibitor, finasteride/dutasteride)

The following treatments for benign prostatic hyperplasia (BPH) are considered experimental, investigational or unproven:

- absolute ethanol injection
- cryosurgical ablation
- high-intensity focused ultrasound (HIFU)
- histotripsy
- interstitial laser coagulation (ILC)
- plasma kinetic vaporization (e.g., PlasmaKinetic™ Tissue Management System)
- prostate artery embolization
- temporary implantable nitinol device (TIND)
- transrectal thermal therapy
- transurethral balloon dilation of the prostatic urethra
- transurethral ultrasound-guided laser incision of the prostate (TULIP)
- water-induced thermotherapy (WIT)
- waterjet tissue ablation (e.g., AquaBeam System)

Note: Pharmacologic therapy is not considered within the scope of this Medical Coverage Policy. Please refer to the applicable pharmacy benefit to determine availability and the terms and conditions of coverage related to the treatment of BPH.

General Background

Benign prostatic hyperplasia (BPH) is a common non-malignant condition in men that can result in bothersome lower urinary tract symptoms (LUTS) (Hoffman, 2007). The most frequent indications for surgical management are moderate-to-severe irritative voiding symptoms that are refractory to medical management, such as urgency to urinate, frequent urination, weak stream and straining, refractory urinary obstruction or retention, renal insufficiency, hydronephrosis, and recurrent gross hematuria. Other symptoms may include recurrent or persistent urinary tract infections, urosepsis, large bladder diverticula, and bladder stones.

Treatment Options

Treatment of BPH is individualized to the patient and involves evaluation of symptoms along with objective findings from examination and laboratory results. Initial treatment for BPH is usually drug therapy (e.g., alpha blocker, PDE5 Inhibitor, finasteride/dutasteride) designed to relieve obstruction, but this often provides only modest relief, and up to 30% of patients require surgical intervention. There are several proposed surgical treatments for BPH that involve burning, cutting, or removal of prostatic tissue (Moul, et al., 2019; American Urological Association [AUA], 2010/2014/2018/2019). Transurethral resection of the prostate (TURP) is considered the gold standard for surgical treatment of BPH.

Food and Drug Administration (FDA)

Several devices have received FDA approval for the treatment of BPH, including the following:

- The AquaTherm device, formerly known as the Thermoflex™ Water-Induced Thermotherapy System (ACMI, Southborough, MA, previously Argomed, Inc., Cary, NC) is a catheter-based thermal therapy device for the treatment of symptoms due to urinary outflow obstruction secondary to BPH. FDA 510(k) class II approval was received in 1999.
- The Indigo® OPTIMA Laser System (Ethicon Endo-Surgery, Inc., Cincinnati, OH) was noted by the FDA (December, 2001) to be substantially equivalent to the Indigo LaserOptic Treatment System which received FDA clearance in December, 1997. It is intended to be used in the non-contact mode to photocoagulate, vaporize/ablate soft tissue (muscle, connective tissue, organ) and for cutting, incision,

excision, and for coagulation in the contact mode for open/closed surgical procedures. The Diffuser Tip Fiberoptic is intended for the treatment of BPH.

- In July 2003, the PlasmaKinetic Superpulse System (Gyrus, Maple Grove, MN) received 510K premarket notification that the device is substantially equivalent to predicate devices and is safe and effective in its intended use. It is intended for use for ablation, removal, resection and coagulation of soft tissue and where associated hemostasis is required. Predicate devices are the PlasmaKinetic Generator, the PlasmaKinetic Endourology Generator, and the Endourology Axipolar Resectoscope Electrode.

Surgical and Minimally Invasive Therapies
Although well-designed clinical trials evaluating some surgical and minimally invasive therapies are lacking, the therapies have been widely used and are supported by relevant professional societies. Generally, data in the published, peer-reviewed literature demonstrate improved outcomes, and support the safety and effectiveness of surgical and minimally invasive therapies for the treatment of BPH. These therapies are as follows:

TREATMENT	CPT® CODE
Contact laser ablation of the prostate (CLAP)	52648
Holmium laser ablation, enucleation, resection (HoLAP, HoLEP, HoLRP)	52649
Laser vaporization and laser ablation/coagulation)	52647, 52648
Open/laparoscopic prostatectomy	55801, 55821, 55831
Photoselective vaporization of the prostate (PVP)	52648
Stents (e.g., UroLume® endourethral prosthesis)	53855
Transurethral resection of the prostate (TURP)	52601, 52630
Transurethral needle ablation (TUNA), also known as radiofrequency needle ablation (RFNA)	53852
Transurethral electrovaporization (TUVP, TVP, TUEP), also known as transurethral vapor resection of the prostate (TUVRP)	52648
Transurethral microwave thermotherapy (TUMT)	53850
Transurethral incision of the prostate (TUIP)	52450

Professional Societies/Organizations
American Urological Association (AUA): The 2018 (amended 2019) AUA evidence-based guideline: Surgical Management of Benign Prostatic Hyperplasia/Lower Urinary Tract Symptoms addresses surgical and minimally invasive procedures used in the treatment of benign prostatic hyperplasia (BPH).

Recommendations:

- **Strong Recommendations** are directive statements that an action should (benefits outweigh risks/burdens) or should not (risks/burdens outweigh benefits) be undertaken because net benefit or net harm is substantial.
- **Moderate Recommendations** are directive statements that an action should (benefits outweigh risks/burdens) or should not (risks/burdens outweigh benefits) be undertaken because net benefit or net harm is moderate.
- **Conditional Recommendations** are non-directive statements used when the evidence indicates that there is no apparent net benefit or harm or when the balance between benefits and risks/burden is unclear.

Body of evidence strength:

- **Grade A** in support of a Strong or Moderate Recommendation indicates that the statement can be applied to most patients in most circumstances and that future research is unlikely to change confidence.
- **Grade B** in support of a Strong or Moderate Recommendation indicates that the statement can be applied to most patients in most circumstances but that better evidence could change confidence.
- **Grade C** in support of a Strong or Moderate Recommendation indicates that the statement can be applied to most patients in most circumstances but that better evidence is likely to change confidence.

Where gaps in the evidence existed, the Panel provides guidance in the form of Clinical Principles or Expert Opinion:

- **Clinical Principle** is a statement about a component of clinical care that is widely agreed upon by urologists or other clinicians for which there may or may not be evidence in the medical literature.
- **Expert Opinion** refers to a statement, achieved by consensus of the Panel, that is based on members' clinical training, experience, knowledge, and judgment for which there is no evidence.

Guideline Statements:

Laser Enucleation

- Clinicians should consider holmium laser enucleation of the prostate (HoLEP) or thulium laser enucleation of the prostate (ThuLEP), depending on their expertise with either technique, as prostate size-independent suitable options for the treatment of LUTS attributed to BPH. (*Moderate Recommendation; Evidence Level: Grade B*)

Photoselective Vaporization of the Prostate (PVP)

- Clinicians should consider PVP as an option using 120W or 180W platforms for patients for the treatment of LUTS attributed to BPH. (*Moderate Recommendation; Evidence Level: Grade B*)

Simple Prostatectomy

- Clinicians should consider open, laparoscopic or robotic assisted prostatectomy, depending on their expertise with these techniques, for patients with large prostates. (*Moderate Recommendation; Evidence Level: Grade C*)

Transurethral Incision of the Prostate (TUIP)

- TUIP should be offered as an option for patients with prostates ≤ 30g for the surgical treatment of LUTS attributed to BPH. (*Moderate Recommendation; Evidence Level: Grade B*)

Transurethral Microwave Therapy (TUMT)

- TUMT may be offered to patients with LUTS attributed to BPH; however, patients should be informed that surgical retreatment rates are higher compared to TURP. (*Conditional Recommendation; Evidence Level: Grade C*)

Transuretheral Needle Ablation (TUNA)

- TUNA is not recommended for the treatment of LUTS attributed to BPH. (*Expert Opinion*)

Transurethral Resection of the Prostate (TURP)

- TURP should be offered as a treatment option for men with LUTS attributed to BPH. *(Moderate Recommendation; Evidence Level: Grade B*)
- Clinicians may use a monopolar or bipolar approach to TURP, depending on their expertise with these techniques. (*Expert Opinion*)

Transurethral Vaporization of the Prostate (TUVP)

- Bipolar TUVP may be offered to patients for the treatment of LUTS attributed to BPH. (*Conditional Recommendation; Evidence Level: Grade B*)

<u>Prostatic Urethral Lift (PUL)</u>

The UroLift System™ (NeoTract Inc., Pleasanton, CA) is a minimally invasive, prostatic urethral lift (PUL) system that provides anterolateral mechanical traction of the lateral lobes of the prostate, opening the urethral lumen, and reducing urinary obstruction. The delivery device contains a preloaded implant that deploys, self-adjusts, tensions, and trims a permanent tensioning suture. The suture runs from the urethra to the outer prostatic capsule and serves to compress the lateral lobe of the prostate. Implants are delivered bilaterally to separate the encroaching lobes. Four to 5 implants are typically inserted, but this varies with the size and shape of the prostate. The UroLift System is intended for the treatment of symptoms due to urinary outflow obstruction secondary to BPH in men ≥ 50 years of age. The UroLift may be used to treat prostate glands measuring <80 milliliters (mL) in size in the United States. The UroLift System is generally implanted by an urologist in an outpatient or inpatient setting. In order to determine whether a patient is an ideal candidate, the target locations and number of implants, and the ability to perform the procedure in the clinic, a planning cystoscopy and transrectal ultrasound (TRUS) are useful. The transurethral procedure to insert the UroLift is performed with the use of local or general anesthesia and oral sedation. The evidence suggests that the UroLift does not appear to compromise sexual function, which is an advantage of this device compared with the standard BPH treatment, TURP. It has been proposed that the adoption of this device for appropriately selected patients may lead to a reduction in the utilization of inpatient hospital services for more invasive procedures such as TURP (NeoTract, 2018; Hayes, 2017b; Roehrborn, et al., 2016, 2015a; Perera, et al., 2015; Barkin, et al., 2012).

Food and Drug Administration (FDA)
In 2013, the FDA granted a de novo classification clearance for the NeoTract® UroLift System (NeoTract, Inc., Pleasanton, CA); the system was classified as an implantable transprostatic tissue retractor system (K130651). The de novo process provides a route to market for medical devices that FDA considers to be low to moderate risk but receive class III classification because FDA has found them to be “not substantially equivalent” to any previous device that is already legally marketed. According to the FDA summary document, the UroLift system “is indicated for the treatment of symptoms due to urinary outflow obstruction secondary to [BPH] in men age 50 and above.” The FDA contraindications state:

The UroLift System should not be used if the patient has:
- prostate volume of >80 cc
- an obstructive or protruding median lobe of the prostate
- a urinary tract infection
- urethra conditions that may prevent insertion of delivery system into bladder
- urinary incontinence
- current gross hematuria
- a known allergy to nickel

In December 2013, FDA granted 510(k) clearance for a modified version of the NeoTract UroLift System, with the prior version serving as the predicate device.

In January 2017, FDA granted 510(k) clearance for UroLift System (UL400 and UL500) for the treatment of symptoms due to urinary outflow obstruction secondary to BPH, including lateral and median lobe hyperplasia, in men 45 years of age or older. The UroLift System includes two generations of the device, the UL400 and the UL500. Both generations use the same UroLift Implant. The only differences are in the delivery device. The median lobe clinical study was the prospective Median Lobe Prostatic UroLift System Procedure (MedLift) study. The FDA contraindications were updated.

The FDA 510(k) summary states that the clinical data demonstrates that treatment of the median lobe with the UroLift System has the same safety and effectiveness as treatment of the lateral lobes (K173087). In addition, literature data and medical opinion support lowering the age indication from 50 years old to 45 years old since there is no clinical difference between the two patient populations. The overall risk profile remains the same for the UroLift System. As such, the UroLift System is substantially equivalent to the UroLift System cleared in K133281 and K172359.

The UroLift System should not be used if the patient has:
- prostate volume of >80 cc
- a urinary tract infection
- urethra conditions that may prevent insertion of delivery system into bladder
- urinary incontinence due to incompetent sphincter
- current gross hematuria

Literature Review
Evidence in the published, peer-reviewed scientific literature consists of randomized controlled trials (Roehrborn, et al., 2013, Roehrborn, et al., 2015a, Roehrborn, et al., 2015b, Roehrborn, et al., 2017a; Sønksen, et al., 2015; Gratzke, et al., 2017) and smaller prospective, retrospective, and case series studies. The evidence suggests that PUL using the UroLift System relieves symptoms in men age 50 years or older who have urinary outflow obstruction secondary to BPH however there is a lack of large randomized studies with long-term outcomes data comparing PUL with other established BPH treatments including TURP (Rukstalis, et al., 2016; Bozkurt, et al., 2016; Shore, et al., 2014; Cantwell, et al., 2014; McVary, et al., 2014; Roehrborn, et al., 2013; McNicholas, et al., 2013; Chin, et al., 2012; Woo, et al., 2011,2012). Studies on the PUL procedure have been conducted in the United States, Canada, Europe, and Australia. Patient inclusion and exclusion criteria were relatively consistent between the large trials, with patients 50 years old or older, in International Prostate Symptom Score (IPSS) greater than 12, and Qmax less than 12 to 15 mL/s. Prostate volume ranges have varied, with the US studies ranging from 30 to 80cm^3 and European and Australian studies typically ranging up to 100cm^3 (Roehrborn, 2016).

The pivotal study evaluating the efficacy and safety of the UroLift System for treatment of symptomatic BPH is the L.I.F.T. Study (Luminal Improvement Following prostatic Tissue approximation for the treatment of LUTS secondary to BPH) (Roehrborn et al., 2013). Inclusion criteria included patients at least 50 years old, washouts of two weeks for alpha-blocker, three months for 5 alpha-reductase inhibitor and three days for anticoagulants, no prior surgical treatment for BPH, (American Urological Association Symptom Index) (AUASI) ≥13, Qmax ≤12 ml/s with a 125 ml voided volume and prostate ≥ 30 to ≤80 cc per ultrasound. Exclusion criteria included median lobe obstruction, retention, post-void residual volume (PVR) >250 ml, active infection, PSA >10 ng/ml (unless negative biopsy), cystolithiasis within three months and bacterial prostatitis within one year. An average of 4.9 implants were delivered (range 2-11) in prostates ranging from 30 to 77 cc. All but one procedure was conducted using local anesthesia.

The L.I.F.T. Study randomized 206 patients with BPH to implantation of the UroLift device (n=140) versus a sham procedure (n=66) and met its primary endpoint finding that patients treated with the device had a ≥ 25% reduction in the American Urological Association Symptom Index (AUASI) (p<0.0001) at three months compared with the sham controls, which was sustained at one year. Other endpoints that were improved at three months and at one year in the UroLift group compared with the controls included the Benign Prostatic Hyperplasia Impact Index (BPHII) (p<0.001 for both time points and maximum urinary flow rate (Qmax) (p<0.0001 for both time points). Changes in scores on the Male Sexual Health Questionnaire for Ejaculatory Dysfunction (MSHQ-EjD), MSHQ-bother, and International Index of Erectile Function (IIEF-5) were similar between the UroLift group and the controls at three months and at one year. These clinical benefits were sustained through two years as shown by follow-up of 106 patients available for analysis (Roehrborn et al., 2015a) and through three years. Over the three years follow-up 129 were accounted for and 11 patients were lost to follow-up. Of the 129 available patients 93 were included in the effectiveness analysis. At three years follow-up fifteen of the patients originally randomized to PUL required surgical reintervention for treatment failure. Reported procedure retreatment for PUL was 10.7% by 3 years versus 2.3-9.7% TURP, 20-40% TUNA/TUMT and 6.7-34% laser vaporization (Roehrborn et al., 2015b).

Roehrborn et al. (2017a) reported five year results of the L.I.F.T. study. At five years of follow-up data were available for 104 of 140 PUL subjects (74.3%). A total of 18 were lost to follow-up, nine died of unrelated causes; nine exited the study. Surgical retreatment for failure to cure was 13.6% with 4.3% receiving additional PUL implants and 9.3% undergoing TURP or laser ablation. Sustained improvements were reported in symptoms (36% IPSS), quality of life (50% QOL, 53% BPHII) and urinary flow rate (44% Qmax) and an acceptable low surgical retreatment rate of 2-3% per year.

In a 2016 review of PUL, Roehrborn reported 4 year results of the L.I.F.T. study. Of the 140 originally randomized patients, 32 were lost by the 4-year follow-up visit. Six losses were deaths. Of the remaining 108 patients for whom data were available, an additional 29 patients were excluded from analysis for BPH retreatment or protocol deviations. For the 79 (56%) of the 140 subjects included in the analysis, change in IPSS score was -8.8 or -41% (p<0.001). Significant improvements compared to baseline were reported for QOL, BPH-II, and Qmax. Sexual Health Inventory for Men (SHIM) scores did not differ statistically from baseline. Fourteen percent of the 140 participants had surgical retreatment by 4 years. The author reported that as is true of all lower urinary tract symptoms therapies, some patients fail to respond and desire additional surgical intervention. TURP (unipolar and bipolar) and laser vaporization have been conducted on small cohorts of patients with UroLift implants. These procedures were conducted without complications due to the presence of the UroLift implants. The author stated that additionally, there are some reports of radical prostatectomy years after UroLift implantation; these procedures were also conducted routinely with report of preservation of dissection planes (Roehrborn, 2016).

After 3 months, the L.I.F.T. was unblinded and an open-label crossover study was performed involving 53 patients from the sham group who elected for treatment with the UroLift (Cantwell et al., 2014). At 1 year, the device had improved urinary and prostate symptom and sexual function outcomes assessed by the IPSS ($p<0.001$), Health Related Quality of Life ($p<0.001$), BPHII ($p=0.024$), and MSQ-EjD ($p=0.003$). There were no significant changes on the IIEF-5 or in the Qmax compared with those measures ascertained at the end of sham therapy. Two year results were reported to the L.I.F.T. study (Rustalis et al., 2016). At 2 years after PUL, there were reported 36%, 40%, 54%, and 77% improvements from baseline in IPSS, quality of life, BPH II and Qmax, respectively. Over the 24-month follow-up period, three patents had their encrusted devices removed, and one additional patient underwent removal of a non-encrusted device prophylactically. In each case LUTS either remained stable or improved after removal. Four patients required TURP intervention and one patient required additional PUL implants.

One prospective uncontrolled study evaluated secondary endpoints of the L.I.F.T. Study and found that sexual function improved or remained stable in patients treated with the UroLift at three months and at one year after therapy. There were no new cases of erectile dysfunction (McVary et al., 2014).

Rukstalis et al. (2019) reported on the MedLift study, an FDA IDE extension of the L.I.F.T. randomized study designed to examine safety and efficacy of PUL for treatment of obstructive middle lobes (OML). The inclusion criteria for this non-randomized cohort were identical to the L.I.F.T. randomized study, except for requiring an OML: ≥ 50 years of age, International Prostate Symptom Score (IPSS) ≥ 13, and peak urinary flow rate (Qmax) ≤ 12 ml/s. Primary endpoint analysis quantified improvement in IPSS over baseline and rate of post-procedure serious complications. Quantification of symptom relief, quality of life, flow rate, and sexual function occurred through 12 months. Outcomes were compared to historical L.I.F.T lateral lobe (LL) results and were combined to demonstrate the full effectiveness of prostatic urethral lift (PUL). Of the 71 screened subjects, 45 were enrolled. At one, three, six, and 12 months, mean IPSS improved from baseline at least 13.5 points ($p<0.0001$). Quality of life and BPHII were similarly improved (>60% and >70%, respectively at three, six, and 12 months, $p<0.0001$). Mean Qmax improvement ranged from 90-129% ($p<0.0001$). At 1 month, 86% (CI 73–94%) reported ≥70 on the Quality of Recovery scale, 80% (CI 66–89%) reported being "much" or "very much better," and 89% (CI 76–95%) would recommend the procedure. Compared to LL subjects, OML subjects' symptoms improved at least as much at every time point (OML range 13.5–15.9, LL range 9.9–11.1, $p≤0.01$). On combining OML with LL data, >70% (range CI 63–81%) of subjects demonstrated ≥ 8 point improvement in IPSS through 12 months. Analysis of the combined dataset indicates ≥ 40% (CI 30–51%) of sexually active men improved the minimal clinically important difference in erectile function through 12 months. The authors summarized that the MedLift study demonstrated that outcomes from PUL treatment of OML are not dissimilar to PUL treatment of LL: rapid, significant, and sustained improvements in IPSS, QoL, and Qmax with a minimally invasive adverse event profile and no new onset, sustained erectile or ejaculatory dysfunction. Study limitations included non-randomized design, use of historical controls, limited long term follow up, and significant differences between the OML and LL only subjects in terms of age and symptoms at baseline.

Two smaller, prospective uncontrolled studies involving the same patients (n=64) found that the UroLift improved lower urinary tract symptoms (LUTS) and quality of life (QOL) without affecting sexual functioning during follow-up of up to two years; however, by later follow-ups, data on a high number of patients were not available for analysis (Woo et al., 2012, Chin, et al., 2012). Another prospective study examined short-term outcomes of the UroLift at one month (n=51) and found that treatment improved LUTS without affecting sexual function (Shore et al., 2014). One international retrospective registry (n=102) reported similar improvements in measures of LUTS, QOL, and sexual function. While these findings are consistent, this study is limited by its retrospective design and potential for recall bias particularly on symptom questionnaires (McNicholas et al., 2013).

A prospective, randomized study enrolled 80 patients at 10 European centers comparing PUL (n=45) to TURP (n=35) with regard to LUTS improvement, recovery, worsening of erectile and ejaculatory function, continence and safety (BPH6). At 12 month follow-up, preservation of ejaculation and quality of recovery were superior with PUL ($p < 0.01$). Significant symptom relief was achieved in both treatment arms. Study limitations were the small sample size, short-term follow-up and the inability to blind participants to enrollment arm (Sønksen, et al., 2015). Significant improvements in International Prostate Symptom Score (IPSS), IPSS quality of life (QoL), BPH Impact Index (BPHII), and maximum urinary flow rate (Qmax(Q) were observed in both arms throughout the two year follow up. Change in IPSS and Qmax in the TURP arm were superior to the PUL arm. Improvements in IPSS QoL and BPHII score were not statistically different between the study arms. PUL resulted in superior quality of recovery, ejaculatory function preservation and performance on the composite BPH6 index. Ejaculatory function bother scores did not change significantly in either treatment arm. TURP significantly compromised continence function at two weeks and three months. Only PUL resulted in statistically significant improvement in sleep (Gratzke, et al., 2017).

There were no major adverse events (AEs) related to UroLift implantation reported in any of the studies. The most common AEs were mild-to-moderate and transient and included postoperative dysuria, hematuria, urgency, and pain. The UroLift procedure appears to be safe; the only common AEs were transient and somewhat expected after cystoscopy and surgical manipulation. No trends in serious AEs were identified. Treatment with the UroLift, unlike other surgical approaches to treatment of BPH, appears to preserve sexual function. Complications unique to UroLift such as extrusion of the implants into the bladder lumen and encrustation of implants in the bladder neck often were managed conservatively and did not represent a major concern. The rates of retreatment in the reviewed studies ranged from 0% to 20% (e.g., transurethral resection of the prostate [TURP] or device removal).

In an updated 2017 Hayes Health Technology Brief on the UroLift System (NeoTract Inc.) for Treatment of Benign Prostatic Hypertrophy the authors summarized the available clinical evidence stating that "the literature search identified five clinical studies (n=51 to 206) that evaluated the efficacy and safety of PUL using the UroLift System for symptomatic BPH. The literature review consisted of two randomized controlled trials (RCTs), two prospective pretest/posttest studies, and 1 retrospective database review. In the only head-to-head RCT, results were mixed. When comparing PUL using UroLift with TURP, results suggested that UroLift was superior to TURP regarding ejaculatory function and early relief of BPH symptoms. However, improvements in postvoid residual (PVR) volume and peak urinary flow rate (Qmax) were statistically significantly greater following TURP than UroLift. In the remaining studies (1 sham-controlled RCT and three uncontrolled single-arm observational studies) results generally suggested that the UroLift System may relieve the symptoms of BPH while maintaining sexual function. Patients treated with UroLift had statistically significant improvements in the IPSS, IPSS QOL, BPHII, and Qmax. Results pertaining to ejaculatory function were mixed; in some studies, ejaculatory function was significantly improved following UroLift treatment and in other studies ejaculatory function was unchanged. In general, adverse events (AEs) associated with UroLift were minor. Limitations of the individual studies included small sample size, lack of comparison groups, limited follow-up duration, variation in number of patients with data at each time point, and substantial follow-up attrition" (Hayes, 2016; 2017b; 2018).

In a systematic review, Jones et al. (2016) identified, appraised, and synthesized the existing evidence for the UroLift device. UroLift studies with at least 12 months of follow-up were included. Seven studies were identified, which included four noncomparative studies, one crossover study, and two RCTs. The review included data from 440 patients. Only the data from men in the UroLift arms of these RCTs were included. A total of 440 patients (mean age 66 years) underwent Urolift for LUTS secondary to BPH (mean prostate volume 45 cc). Patients included in these studies were aged over 50 years, IPSS >13, Qmax <12 mL/s (<15 mL/s in some studies), PVR <250 mL (<350 mL in some studies), PSA <10 ng/mL, and with no previous BPH surgery. Exclusion criteria typically consisted of those with obstructive median lobes, active urinary infection, and a history of urinary retention. On average, 4.4 implants (range: 2-9) were delivered to achieve a satisfactory outcome. The authors reported that mean peak urinary flow rate (Qmax) increased from 8.4 mL/s to 11.8 mL/s, mean IPSS improved from 24.1 to 14, mean quality of life (QOL) improved from 4.5 to 2.3, and mean 5-item International Index of Erectile Function score improved from 17.7 to 18.2. The most frequent complications reported were dysuria, hematuria and pelvic pain. Across six studies, 6.9% (range: 1.4%-19%) of patients progressed to TURP at 12 months. The authors reported that this review has limitations. The number of studies on PUL remains limited in the literature. Additional randomized control trials with large patient samples comparing Urolift with reference treatments such as TURP and holmium laser enucleation of the prostate, which measure standardized outcome parameters and report complications systematically, are needed. The authors noted that in a number of the studies, the local protocol of certain institutions mandated use of general anesthesia and postoperative urethral catheterization in all patients. Forty-seven percent of patients underwent the procedure under a local anesthesia.

In a systematic review and meta-analysis, Perera et al. (2015) reported symptomatic, functional, and sexual outcomes following the PUL procedure. The authors reported that pooled estimates from between 452 and 680 patients from ten articles comprising six independent patient cohorts were included for analysis. The results suggest that this procedure is associated with minimal perioperative morbidity, whereas meta-analysis estimates suggest improvements in symptomatic and functional outcomes that are durable through 12-month follow-up. Preservation of the bladder neck and subsequent control of sexual function following PUL provide stark contrast to the medical and surgical alternatives for treatment of BPH. Further comparative trials with longer follow-up periods are required to guide clinicians as to the suitability of PUL in routine clinical practice.

Professional Societies/Organizations

American Urological Association (AUA): PUL is discussed in the updated 2018 (amended 2019) AUA evidence-based Guideline: Surgical Management of Lower Urinary Tract Symptoms Attributed to Benign Prostatic Hyperplasia with the following statement:

- Clinicians should consider PUL as an option for patients with LUTS attributed to BPH provided prostate volume <80g and verified absence of an obstructive middle lobe; however, patients should be informed that symptom reduction and flow rate improvement is less significant compared to TURP. (*Moderate Recommendation; Evidence Level: Grade C*)
- PUL may be offered to eligible patients concerned with erectile and ejaculatory function for the treatment of with LUTS attributed to BPH. (*Conditional Recommendation; Evidence Level: Grade C*)

Use Outside of the US

European Association of Urology (EAU): EAU guidelines on management of non-neurogenic male LUTS include prostatic urethral lift recommendations stating to offer prostatic urethral lift (Urolift®) to men with LUTS interested in preserving ejaculatory function, with prostates < 70 mL and no middle lobe (Strength Rating: Strong) (Gravas et al., 2019).

Canadian Urological Association (CUA): The updated 2018 CUA guideline on male lower urinary tract symptoms/benign prostatic hyperplasia (MLUTS/BPH) recommendation for PUL states: We suggest that prostatic urethral lift (Urolift) may be considered an alternative treatment for men with LUTS interested in preserving ejaculatory function, with prostates <80 cc and no middle lobe (conditional recommendation based on moderate-quality evidence*)* (Nickel , et al., 2018).

National Institute for Clinical Excellence ([NICE] United Kingdom: In September 2015 NICE published a Medical Technology Guidance document on UroLift for Treating Lower Urinary Tract Symptoms of Benign Prostatic Hyperplasia. The NICE Committee concluded that ”the UroLift system is effective in relieving symptoms of benign prostatic hyperplasia. It noted that the degree of symptom relief outcomes is slightly less than that after transurethral resection of the prostate (TURP) or holmium laser enucleation (HoLEP), but it is sufficient and clinically important. The Committee recognized that the duration of symptom relief after using the UroLift system is uncertain. It concluded that it is similar in the medium term (up to 3 years) to the comparators but that further evidence on durability and the need for subsequent procedures would be useful.”

NICE recommendations state:

- “The clinical case for adopting the UroLift system for treating lower urinary tract symptoms of benign prostatic hyperplasia is supported by the evidence. The UroLift system relieves lower urinary tract symptoms while avoiding the risk to sexual function associated with transurethral resection of the prostate (TURP) and holmium laser enucleation of the prostate (HoLEP). Using the system reduces the length of a person's stay in hospital. It can also be used in a day-surgery unit.

- The UroLift system should be considered as an alternative to current surgical procedures for use in a day-case setting in men with lower urinary tract symptoms of benign prostatic hyperplasia who are aged 50 years and older and who have a prostate of less than 100 ml without an obstructing middle lobe."

Water Vapor Thermal Therapy (e.g., Rezūm System): A new approach to thermal therapy using convective radiofrequency (RF) water vapor energy has emerged to treat men with moderate-to-severe lower urinary tract symptoms (LUTS). The principles of RF-generated water vapor thermal energy are based on the thermodynamic properties of water and the use of convective versus conductive heat transfer to ablate tissue. Examples of conductive heat transfer technologies include TUNA using RF and TUMT using microwaves to generate thermal energy.

Food and Drug Administration (FDA)
In August 2015, the Rezūm® System (NxThera, Inc., Maple Grove, MN) received FDA 510(k) approval. The Rezūm System is classified by the FDA as an endoscopic electrosurgical unit. The FDA indications for use state: The Rezūm System is intended to relieve symptoms, obstructions, and reduce prostate tissue associated with BPH. It is indicated for men ≥ 50 years of age with a prostate volume ≥ 30 cm^3 and ≤ 80 cm^3. The Rezūm System is also indicated for treatment of prostate with hyperplasia of the central zone and/or median lobe. Per the FDA 510(k) Summary the device has also been tested in three clinical studies to evaluate the safety and effectiveness of the Rezūm device: 65 patients in the feasibility and pilot open label studies and in a 197 patient randomized placebo controlled study. All these studies showed that the device is safe and effective. The device converts water into vapor outside of the body and the vapor is delivered to the prostate tissue via a needle within the sterile Delivery Device. The vapor ablates the targeted tissue within the prostate via thermal ablation as energy is transferred from the vapor to the prostate tissue. The amount of vapor delivered is controlled by an RF Generator which also controls the amount of saline flush used to cool the urethra (FDA, 2015, 2016). The procedure can be performed in an office or outpatient treatment setting.

Literature Review
Although there is a paucity of data in the peer-reviewed scientific literature comparing water vapor thermal therapy (e.g., Rezūm System) to other treatment options for BPH such as microwave TUMT and radiofrequency TUNA, the therapy has been widely used and is supported by relevant professional societies. The evidence in the peer-reviewed scientific literature provides consistent results suggesting that the Rezūm System may be an effective treatment for LUTS associated with BPH. Improvements in urinary symptoms and BPH-related quality of life from baseline were generally consistent across studies. Treatment with the Rezūm System is generally safe and not associated with loss of sexual function.

McVary et al. (2016a) reported outcomes from a prospective, multicenter, double-blind randomized controlled trial (Rezūm II study) using transurethral prostate convective water vapor thermal energy to treat lower urinary tract symptoms (LUTS) associated with BPH. This FDA-approval study included a total of 197 men aged 50 years or older with an International Prostate Symptom Score (IPSS) of 13 or greater, maximum flow rate of 15 ml per second or less, and prostate size 30-80 cc. Patients were randomized 2:1 between thermal therapy with the Rezūm System (n=136) and control procedure with rigid cystoscopy with simulated active treatment sounds (n=61). Thermal water vapor was injected into the transition zone and median lobe as needed. After three months the study was unblinded. After unblinding, 53 of the 61 subjects elected and qualified to go to the treatment arm and received thermal therapy within the six month follow-up. There were 129 (95.6% of 135) thermal treatment subjects included in the per protocol analysis at six months and 120 at 12 months. The primary endpoint compared a reduction in IPSS at three months. Thermal therapy and control IPSS was reported as reduced by 11.2 ± 7.6 and 4.3 ± 6.9, respectively ($p<0.0001$). Participants in the Rezūm group had an IPSS reduction of 22 points from baseline at two weeks ($p=0.0006$) post-treatment and by 50% or greater at three, six and 12 months ($p<0.0001$). The peak flow rate increased by 6.2 ml per second at three months and was sustained throughout 12 months ($p<0.0001$). Adverse events were reported as mild to moderate and resolved quickly. This study is limited by small sample size and short-term follow-up. After three months the study was unblinded.

Roehrborn et al. (2017b) reported two year outcomes for the McVary et al., (2016a) randomized controlled trial above plus one-year results of the crossover trial. After blinded comparison of the active and control/sham groups the RF thermal therapy subjects were followed for 24 months and assessed for treatment responses using IPSS, QOL instruments, Qmax, incontinence, sexual function and adverse events. Crossover study subjects were similarly assessed during 12 months. Any subject who received RF thermal therapy in the RCT active arm or the crossover is included in annual follow-up evaluations for 5 years. Observed outcomes per protocol from baseline to six 12 and 24 months after thermal therapy indicated clinically significant relief of LUTS with mean IPSS reductions of 54%, 52% and 51%, respectively ($p<0.0001$). Based on IPSS responses in individuals with a mean IPSS of 22.0 ± 4.8 at baseline 87% had at least a three point or greater IPSS improvement, of whom 84% achieved five point or greater (moderate) decrease and 74% who achieved an eight point or greater (marked) IPSS decrease three months after convective thermal therapy. At 24 months these response levels were similarly sustained in 87%, 84% and 74% of subjects with IPSS decreases of three points or greater, five points or greater and eight points or greater, respectively. The maximum flow rate and quality of life measures improved by approximately 50% or more and remained significant and durable for two years ($p<0.0001$). Relief of urinary symptoms and bother was evident with improved scores at three months which were sustained through 24 months ($p<0.0001$). No negative effect on erectile function was reported throughout two years of follow-up. No significant changes in ejaculatory function scores ($p>0.3601$) occurred relative to baseline. Bother associated with ejaculation was significantly improved 12 and 24 months after treatment ($p\leq0.0118$). No late developing device or procedure related adverse events were reported during the 12-24-month follow-up. Storage and voiding urinary functions were significantly improved one month after convective RF thermal therapy and remained durable throughout assessments during two years ($p<0.0001$). The profile of IPSS responses for 12 months after crossover, open label convective thermal therapy is almost identical to that in the active arm of the RCT when observed at 12 months.

In an uncontrolled follow-up study, McVary and Roehrborn (2018) reported three year outcomes of the above study. A total of 97 of 135 subjects (72%) treated with convective radiofrequency thermal therapy were available for the three year evaluations. Maximal symptom relief of at least 50% improvement in IPSS, quality of life, Qmax, and BPH Impact Index remained durable throughout three years ($p<0.0001$). Subjects with a treated median lobe had similar responses. No late-related adverse events occurred, and no de novo erectile dysfunction was reported. The surgical retreatment rate was 4.4% over three years. McVary et al. (2019) reported four year outcomes. Blinded comparison with the control group was only available after three months. Of the original 135 participants in the Rezūm group at baseline, 90 had follow-up data at four years. Lower urinary tract symptoms were significantly improved within ≤ three months after thermal therapy and remained consistently durable (International Prostate Symptom Score 47%, quality of life 43%, Qmax 50%, BPH Impact Index 52%) throughout four years ($p<0.0001$); outcomes were similarly sustained in crossover subjects at three years. Surgical retreatment rate was 4.4% over four years. No disturbances in sexual function were reported. This study is limited by small sample size and high overall attrition through four year follow-up.

In a retrospective observational multicenter study (n=131) Darson et al. (2017) reported clinical outcomes with the Rezūm system in consecutive cases accrued by multiple community urologists for the treatment of moderate to severe LUTS associated with BPH. Follow-up was 12 months. There was no comparator. Pre- and post-procedure assessments included International Prostate Symptom Score (IPSS), quality of life, peak urinary flow rate, voided volume, and post void residual urine volume. Urologists used their own discretion for patient selection, with variable prostate sizes, LUTS severity, urinary retention, or presence of an obstructing median lobe. Safety signals and surgical retreatment rates were monitored prospectively. There were significant reductions in IPSS scores ($p<0.0001$) from baseline values at one, three, six and 12 months, in QoL (IPSS question 8) scores, and PVR volumes. These results were found for all patients and when split into moderate (IPSS 8 to 19) and severe (IPSS 20 to 35) subgroups. The differences from baseline for Qmax and voided volume were not statistically significant ($p>0.05$), except for Qmax three to six months, all patients and moderate LUTS. Post-procedure adverse events normally anticipated and related to endoscopic instrumentation were transient and mild–moderate in nature. This study is limited by lack of a comparator and short-term follow-up.

Dixon et al. (2015b, 2016) reported the one- and two-year clinical outcomes of thermal therapy using convective radiofrequency water vapor thermal therapy with the Rezūm System. The multicenter nonrandomized prospective pilot study included 65 men ≥45 years of age (mean prostate volume: 48.6 ± 20.5 cm^3) with moderate (32%) to severe (68%) LUTS (mean IPSS: 21.6±5.5; mean Qmax: 7.9±3.2 mL/s). Urinary symptom relief, urinary flow, quality of life (QOL) impact, sexual function, and adverse events (AEs) were assessed. A total of 43/65 (66%) individuals provided data up to two years. Clinically and statistically significant improvements in urinary symptoms (-6.5 point IPSS reduction from baseline), flow rate (2.0-point increase), and quality-of-life measures were evident as early as one month after treatment. The treatment responses were optimal at three–12 months (-12.6-point IPSS reduction from 21.6 at baseline to 9.2; a 4.6-point Qmax increase from 7.9 at baseline to 12 mL/s), each p<0.001; these responses remained consistent and significant over 24 months of follow-up. Both storage and voiding components of the IPSS showed significant improvements. No clinically significant changes in sexual function were reported in this study and no de novo erectile dysfunction occurred. Results suggested that the Rezūm System significantly improved LUTS without negative impact on sexual function. Complications were mild-to-moderate and transient in nature. Reinterventions with Rezūm occurred in 7.7% of patients. Study limitations included lack of comparison group; small sample size and high attrition at two year follow-up.

In a 2018 Hayes Health Technology Brief, the authors report "a very-low-quality body of evidence suggesting that the Rezūm System may improve LUTS associated with BPH. However, substantial uncertainty remains regarding the comparative effectiveness and safety due to a lack of comparative studies, as well as limited long-term evidence regarding the durability and safety of this treatment" (Hayes, 2018; annual review 2019).

Professional Societies/Organizations

American Urological Association (AUA): Water vapor thermal therapy is discussed in the updated 2018 (amended 2019) AUA evidence-based Guideline: Surgical Management of Benign Prostatic Hyperplasia/Lower Urinary Tract Symptoms. The recommendations were based on results of the randomized controlled trial conducted by McVary et al. (2016a), and this body of evidence was considered low strength, leading to a conditional recommendation (Grade C). The guideline recommendation states:

- Water vapor thermal therapy may be offered to patients with LUTS attributed to BPH provided prostate volume <80g; however, patients should be informed that evidence of efficacy, including longer-term retreatment rates, remains limited. (*Conditional Recommendation; Evidence Level: Grade C*)
- Water vapor thermal therapy may be offered to eligible patients who desire preservation of erectile and ejaculatory function. (*Conditional Recommendation; Evidence Level: Grade C*)

Use Outside of the US

European Association of Urology (EAU): The 2019 EAU guideline on Management of Non-neurogenic Male LUTS addresses techniques under consideration including convective water vapor energy (WAVE) ablation: The Rezūm system. The guideline practical considerations state that further RCTs against a reference technique are needed to confirm the first promising clinical results and to evaluate mid- and long-term efficacy and safety of water vapor energy treatment (Gravas et al., 2019).

Canadian Urological Association (CUA): The updated 2018 CUA guideline on male lower urinary tract symptoms/benign prostatic hyperplasia (MLUTS/BPH) recommendation for convective water vapor energy ablation states that Rezūm system of convective water vapor energy ablation may be considered an alternative treatment for men with LUTS interested in preserving ejaculatory function, with prostates <80 cc, including those with median lobe *(*conditional recommendation based on moderate-quality evidence*)* (Nickel , et al., 2018).

National Institute for Clinical Excellence ([NICE] United Kingdom: In 2018 NICE published an Interventional Procedure Guidance for the transurethral water vapor ablation for lower urinary tract symptoms caused by benign prostatic hyperplasia which includes the following recommendations:

- Current evidence on the safety and efficacy of transurethral water vapor ablation for urinary tract symptoms caused by benign prostatic hyperplasia is adequate to support the use of this procedure provided that standard arrangements are in place for clinical governance, consent and audit.
- This procedure should only be done by a urologist with specific training in the procedure, who should carry out their initial procedures with an experienced mentor.

Additional Therapies

There is insufficient evidence in the published peer-reviewed scientific literature to demonstrate safety and effectiveness of the following therapies:

Absolute Ethanol Injection: Injecting absolute ethanol into the prostate is a technique used to cause coagulation necrosis (chemoablation), which destroys the tissue. The National Institute for Clinical Excellence

(NICE) (United Kingdom) (NICE, 2015) does not recommend absolute ethanol injection for the treatment of BPH. Absolute ethanol injection for the treatment of BPH is not discussed in published guidelines of the AUA, CUA and EUA (Nickel, et al., 2018; Gravas et al., 2019).

Literature Review

Randomized controlled trials data are lacking regarding the safety and effectiveness of absolute ethanol injection compared to standard therapy for the treatment of BPH. Two small prospective nonrandomized studies without comparators and a case series study totaling 123 patients demonstrated improvements in International Prostate Symptom Score (IPSS), quality of life scores, and significant differences in peak flow volumes and post void residual after therapy (Arslan, et al., 2014; Sakr, et al., 2009; Magno, et al., 2008).

Cryosurgical Ablation: There are scarce data in the published peer-reviewed scientific literature to support the safety and effectiveness of cryosurgical ablation for the treatment of BPH. At this time the role of this therapy has not yet been established.

High-Intensity Focused Ultrasound (HIFU): High-intensity focused ultrasound (HIFU) is a procedure which uses a small probe to produce bursts of ultrasound that creates coagulation necrosis in a specific area of tissue. Frequencies range from 4–10 MHz, although 4 MHz is most frequently used. HIFU devices use imaging ultrasound for treatment planning and monitoring, and they deliver targeted high-intensity ultrasound that rapidly elevates the temperature in a precise focal zone. The increased tissue temperature is designed to kill excess prostate tissue (in the case of BPH). The same probe can be used for imaging, which allows both diagnostic and therapeutic testing at the same time.

There are scarce data in the published peer-reviewed scientific literature regarding the safety and effectiveness of HIFU for the treatment of BPH. Further, published guidelines of the AUA and EUA do not mention HIFU for the treatment of BPH. The National Institute for Clinical Excellence (NICE) (United Kingdom) (NICE, 2015) does not recommend HIFU as an appropriate treatment for benign prostatic hyperplasia (BPH). At this time the role of high-intensity focused ultrasound for the treatment of BPH has not been established.

Histotripsy: Histotripsy is an experimental extracorporeal ultrasound technology that has been proposed to treat BPH. Histotripsy is a form of focused ultrasound therapy that utilizes cavitational mechanisms to produce tissue necrosis in prostatic tissue. There are scarce data in the published peer-reviewed scientific literature to support the safety and effectiveness of histotripsy for the treatment of BPH. At this time the role of this therapy has not yet been established (Schuster et al., 2018; Lusuardi, et al., 2013; Hempel, et al., 2011).

Interstitial Laser Coagulation (ILC): ILC of the prostate by the transurethral route has been attempted using several laser and delivery devices. In the United States, a diode-laser device, the Indigo 830e (Ethicon Endo-Surgery, Cincinnati, OH) has been evaluated. The laser enters the prostate and the tissue is coagulated. Intraprostatic lesions reabsorb and the tissue atrophies. Consequently, some volume reduction occurs (AUA, 2010/2014).

Literature Review

Indigo 830e has been studied in the United States; however, its role in treating lower urinary tract symptoms has yet to be defined. The lack of randomized controlled studies comparing ILC to other approaches has resulted in no consensus on the ILC technique.

Ng et al. (2005) conducted a study to evaluate the impact of improvements in surgical techniques and patient selection of overall outcomes of ILC of the prostate. Over a four-year period, 66 patients underwent interstitial coagulation (ILC) using the Indigo 830e. They were stratified into two groups: group one consisted of those treated during the first two years (n=47) and those treated during the latest two years (n=19) were labeled as group two. At 12 months, maximum flow rates improved by 47% in group one and 85% in group two. Subjective measures were significantly improved from baseline in both groups but did not differ between groups. The incidence of adverse events was similar in the two groups. In a prospective study of 49 men with symptomatic benign prostatic hyperplasia (BPH) who underwent ILC, Daehlin et al. (2007) reported a decrease in International Prostate Symptom Scores (IPSS), and an increase in peak urinary flow; however, twenty-two patients (50%) required retreatment.

At present there is insufficient evidence in the published peer-reviewed scientific literature to support the effectiveness of interstitial laser coagulation (ILC); its role in the treatment of benign prostatic hyperplasia (BPH) has not yet been established.

Plasma Kinetic Vaporization using the PlasmaKinetic™ Tissue Management System: The PlasmaKinetic™ Tissue Management System (Gyrus ACMI, Southborough, MA) uses plasma energy to vaporize tissue with minimal thermal spread and enhanced hemostasis.

Literature Review
There are scarce data in the published, peer-reviewed scientific literature regarding the safety or effectiveness of this therapy and its role in the treatment of BPH has not yet been established.

Prostate Artery Embolization: Prostatic arterial embolization (PAE) is proposed as a minimally invasive procedure as an alternative to transurethral resection of the prostate (TURP) or open prostatectomy for the treatment of BPH. PAE for BPH has been proposed to reduce the blood supply of the prostate gland, causing some of it to undergo necrosis with subsequent shrinkage. The procedure is performed under local anesthesia and sedation using a percutaneous transfemoral approach by an interventional radiologist, in consultation with the urologist. The arterial occlusion may be achieved through the use of polyvinyl alcohol particles, coil embolizers, or microspheres (Hayes, 2019).

Literature Review
Short and limited mid-term data in the published, peer-reviewed literature demonstrate improved outcomes of PAE as a minimally invasive procedure for the treatment of BPH. Additional large, well-designed studies with longer follow-up are needed to validate results (Hayes, 2019; Jiang et al., 2019; Zumstein, et al., 2018; Carnevale, et al., 2017; Kuang et al, 2017; Pyo et al., 2017; Wang et al, 2016; de Assisi, et al., 2015; Wang, et al., 2015; Russo, et al., 2015; Gao, et al., 2014; Bagla, et al., 2014; Pisco, et al., 2013).

In a prospective series matched study (n=160), Russo et al. (2015) evaluated one-year surgical and functional results and morbidities of prostatic artery embolization (PAE) vs open prostatectomy (OP). Inclusion criteria included lower urinary tract symptoms or benign prostatic obstruction, IPSS ≥ 12, prostate-specific antigen (PSA) <4 ng/mL, or PSA between 4 and 10 ng/mL but negative prostate biopsy, total prostate volume >80 cm^3, and peak flow (PF) <15 mL/s. Follow-up was performed at one month, six months, and one year. Primary end points of the study were the comparison regarding IPSS, International Index of Erectile Function-5, PF, post voidal residual (PVR), and IPSS quality of life (IPSS-QoL) after one year of follow-up. The authors reported that PAE was inferior to OP in terms of one-year functional outcomes such as the reduction of IPSS and PVR and the increase of PF. Further clinical trials comparing PAE with other minimally invasive surgical are required.

In a prospective randomized study (n=114), Gao et al., (2014) compared prostatic arterial embolization (PAE) (n=57) and transurethral resection of the prostate (TURP) (n=57) in the care of patients with benign prostatic hyperplasia (BPH). The groups were compared regarding relevant adverse events and complications. Functional results including improvement of International Prostate Symptom Score (IPSS), quality of life (QOL), peak urinary flow, postvoiding residual urine volume, prostate-specific antigen (PSA) level, and prostate volume-were assessed at one-, three-, six-, 12-, and 24-month follow up. Overall technical success rates for TURP and PAE were 100% and 94.7%, respectively; the clinical failure rates were 3.9% and 9.4%, respectively. The six functional results showed improvements after TURP and PAE at all follow-up time points when compared with preoperative values (p=0.001).The TURP group showed greater degrees of improvement in the IPSS, QOL, peak urinary flow, and postvoiding residual urine volume at one and three months, as well as greater reductions in the PSA level and prostate volume at all follow-up time points, when compared with the PAE group (p<0.05). The PAE group showed more overall adverse events and complications (p=0.029), mostly related to acute urinary retention (25.9%), postembolization syndrome (11.1%), and treatment failures (5.3% technical; 9.4% clinical). The authors reported that “the advantages of the PAE procedure must be weighed against the potential for technical and clinical failures in a minority of patients.”

A 2019 Hayes comparative effectiveness review of PAE for treatment of BPH summarized that low-quality, consistent evidence for PAE is associated with significant improvements in lower urinary tract symptoms, although improvements were significantly less robust than those associated with transurethral resection of the prostate (TURP) or open prostatectomy. The evidence suggests that PAE is associated with fewer complications than TURP or open prostatectomy. Uncertainty remains regarding optimal patient selection criteria for PAE versus TURP and the long-term safety and efficacy of PAE beyond two years. The evidence base for this report included ten studies that evaluated PAE for the treatment of BPH; five randomized controlled trials including a post hoc analysis of an RCT and five prospective or retrospective cohort studies.

In a 2019 meta-analysis, Jiang et al. evaluated studies comparing PAE to TURP and evaluated short-term outcomes with at least 12 months follow-up. Four studies were included in the review (n=506), two randomized controlled trials (Gao, et al., 2014; Carnevale, et al., 2016) and two comparative observational studies (Qiu, et al., 2017; Ray, et al., 2018). In a pooled analysis of data from two studies, there was no significant difference in post-operative IPSS. The post-operative peak flow rate (Qmax) was significantly higher in the TURP group than the PAE group. Similarly, the post-operative prostate volume and quality of life improved significantly more in the TURP group. Data from two studies found no statistically significant differences in complications in the two groups. The authors reported that additional multi-center high quality randomized controlled trials with large sample size are needed to verify the clinical efficiency of TURP and PAE for the treatment of BPH.

In a 2018 meta-analysis and systematic review, Zumstein et al. evaluated studies comparing PAE with TURP for patients with BPH. The authors included five studies (n=708); (Gao et al., 2014; Russo et al., 2015; Carnevale et al., 2016; Abt et al., 2018; Ray et al., 2018) with at least 12 month follow-up. The authors concluded that PAE was less effective than TURP and had less favorable IPSS scores, peak urinary flow, prostate volume reduction, and prostate void residual. In contrast, International Index of Erectile Function scores were better and complications were fewer for PAE versus TURP. The authors reported that additional randomized controlled trials with longer follow-up periods are needed to evaluate the mid- and long-term efficacy and safety of PAE and to assess its ideal spectrum of indications, also compared to less invasive procedures such as TUMT, TUNA, or prostatic urethral lift.

In a systematic review and meta-analysis, Wang et al. (2016) evaluated the efficacy and safety of PAE on LUTS related to BPH. Twelve prospective and retrospective studies involving 840 participants were included. Compared with baseline, the International Index of Erectile Function (IIEF-5; International Prostate Symptom Score) scores, the quality of life scores, peak urinary flow rate (Qmax) and post void residual volume all had significant improvements during the 24-month follow-up (all $P<0.00001$). Both prostate volume (PV) and prostate-specific antigen had significant decrease during the 12-month follow-up ($p<0.00001$ and $p=0.005$, respectively), except postoperative 24 months ($p=0.47$ and $p=0.32$, respectively). The IIEF-5 short form scores had significant increase at postoperative six months ($p=0.002$) and 12 months ($p<0.0001$), except postoperative one month ($p=0.23$) and 24 months ($p=0.21$). For large volume (PV ≥ 80 mL) BPH, the results were similar. There were no life-threatening complications. The major limitations of this study include heterogeneity in the participants chosen, different materials and sizes of embolic agents and bilateral or unilateral embolization. Additional limitation is the small sample sizes of some included studies with no long-term follow-up. Data in the studies covered by this meta-analysis are insufficient to determine whether or not PAE is as good as TURP. Similar conclusions were reported in a systematic review and meta-analysis of PAE for LUTS related to BPH by Pyo et al. (2017) and in a 2017 systematic review of PAE in the treatment of symptomatic BPH (Kuang, et al., 2017).

Professional Societies/Organizations

American Urological Association (AUA): PAE is discussed in the updated 2018 (amended 2019) AUA evidence-based Guideline: Surgical Management of Benign Prostatic Hyperplasia/Lower Urinary Tract Symptoms with the following statement:

- PAE is not recommended for the treatment of LUTS attributed to BPH outside the context of a clinical trial. (*Expert Opinion*)

Society of Interventional Radiology (SIR): In 2018, the SIR updated their 2014 position statement on PAE for treatment of LUTS attributed to BPH. The updated position statement addresses the global experience with PAE stating the joint position and recommendations of SIR, the Cardiovascular and Interventional Radiological

Society of Europe, Society Française de Radiologie, and the British Society of Interventional Radiology. The societies made the following recommendations for PAE (McWilliams, et al., 2018):

- PAE is an acceptable minimally invasive treatment option for appropriately selected men with BPH and moderate to severe LUTS. (Level of evidence: B; strength of recommendation: strong.)
- PAE can be considered as a treatment option in patients with BPH and moderate to severe LUTS who have very large prostate glands (> 80 cm^3), without an upper limit of prostate size. (Level of evidence: C; strength of recommendation: moderate.)
- PAE can be considered as a treatment option in patients with BPH and acute or chronic urinary retention in the setting of preserved bladder function as a method of achieving catheter independence. (Level of evidence: C; strength of recommendation: moderate.)
- PAE can be considered as a treatment option in patients with BPH and moderate to severe LUTS who wish to preserve erectile and/or ejaculatory function. (Level of evidence: C; strength of recommendation: weak.)
- PAE can be considered in patients with hematuria of prostatic origin as a method of achieving cessation of bleeding. (Level of evidence: D; strength of recommendation: strong.)
- PAE can be considered as a treatment option in patients with BPH and moderate to severe LUTS who are deemed not to be surgical candidates for any of the following reasons: advanced age, multiple comorbidities, coagulopathy, or inability to stop anticoagulation or antiplatelet therapy. (Level of evidence: E; strength of recommendation: moderate.)
- PAE should be included in the individualized patient-centered discussion regarding treatment options for BPH with LUTS. (Level of evidence: E; strength of recommendation: strong.)
- Interventional radiologists, given their knowledge of arterial anatomy, advanced microcatheter techniques, and expertise in embolization procedures, are the specialists best suited for the performance of PAE. (Level of evidence: E; strength of recommendation: strong.)

Use Outside of the US

Canadian Urological Association (CUA): The updated 2018 CUA guideline on male lower urinary tract symptoms/benign prostatic hyperplasia (MLUTS/BPH) recommendation for PAE states that PAE should not be offered at this time for the treatment of LUTS due to BPH *(*conditional recommendation based on moderate-quality evidence). The guideline authors note that PAE performed by interventional radiologists, at specialized centers, is associated with significant clinical improvements from baseline to one year. However, outcomes are inferior compared with TURP and open simple prostatectomy. Further, non-targeted embolization is associated with ischemic complications (e.g., bladder ischemia, transient ischemic proctitis, urethral and ureteral stricture, or seminal vesicles ischemia) (Nickel, et al., 2018).

European Association of Urology (EAU): The 2019 EAU guideline on Management of Non-neurogenic Male LUTS states that the selection of LUTS patients who will benefit from PAE needs to be defined. Several studies evaluating PAE have been published but there is a lack of long-term randomized controlled trials. To define the role of PAE as a potential option among established treatment modalities, a multidisciplinary approach involving urologists and interventional radiologists is needed (Gravas et al., 2019).

National Institute for Clinical Excellence ([NICE] United Kingdom: In 2018 NICE published an Interventional Procedure Guidance Prostate Artery Embolisation for Lower Urinary Tract Symptoms caused by benign prostatic hyperplasia which includes the following recommendations:

- Current evidence on the safety and efficacy of prostate artery embolisation for benign prostatic hyperplasia is adequate to support the use of this procedure provided that standard arrangements are in place for clinical governance consent and audit.
- Patient selection should be done by a urologist and an interventional radiologist.
- This technically demanding procedure should only be done by an interventional radiologist with specific training and expertise in prostatic artery embolization.

Temporary implantable nitinol device (TIND): The TIND (Medi-Tate®; Medi-Tate Ltd., Or Akiva, Israel) is a new device proposed to provide a minimally invasive means of increasing prostatic urethral patency to relieve the symptoms of urinary outflow obstruction secondary to BPH. The TIND is crimped and delivered through a cystoscope sheath, and then, when placed in the urethra, it is released from the cystoscope sheath to assume its expanded configuration, thereby reshaping the urethra and the bladder neck. It is removed after a few days under local anesthesia. The TIND has CE mark approval.The manufacturer website for the TIND device states the device is available in Europe, Canada and Hong Kong. At this time, the TIND is investigational in the US. There are scarce data in the published peer-reviewed scientific evidence to determine the safety and efficacy of the TIND as a treatment option for BPH. The 2018 CUA guideline on male lower urinary tract symptoms/benign prostatic hyperplasia (MLUTS/BPH) recommends that TIND should not be offered at this time for the treatment of LUTS due to BPH. TIND is not discussed in the 2019 amended AUA evidence-based Guideline: Surgical Management of Benign Prostatic Hyperplasia/Lower Urinary Tract Symptoms (AUA, 2019; Magistro, et al., 2018; 2018; Marcon, et al., 2018; Nickels, et al., 2018; Porpiglia, et al., 2015).

Transrectal Thermal Therapies: There are scarce data in the published peer-reviewed scientific evidence to determine the safety and efficacy of thermal therapy via the rectum as a treatment option for BPH. At this time the role of this therapy has not yet been established.

Transurethral Balloon Dilation of the Prostatic Urethra: Transurethral balloon dilation of the prostatic urethra, also known as endoscopic balloon dilation of the prostatic urethra, involves the insertion of a balloon catheter through the urethra into the prostatic urethra where it is inflated to stretch the urethra where it has been narrowed by the prostate.

Literature Review

There are scarce data regarding the safety and effectiveness of this therapy for the treatment of BPH and its role has not yet been established.

Transurethral Ultrasound Guided Laser Incision of the Prostate (TULIP): TULIP is a procedure that is similar to transurethral incision of the prostate except that cuts are made with a laser. Laser energy is delivered under ultrasound guidance, producing necrosis. TULIP is a difficult procedure with a very high incidence of incontinence, a delayed onset of improvement, and no ability to obtain tissue for histological examination. TULIP is rarely used by urologists because it has been surpassed by instruments that are easier to use (Fitzpatrick, 2011).

Literature Review

There are scarce data in the published, peer-reviewed scientific literature regarding the effectiveness of TULIP and the role of this therapy in the treatment of BPH has not yet been established.

Water-Induced Thermotherapy (WIT): WIT is a minimally-invasive therapy that uses hot water circulating through a urethral balloon catheter to deliver heat energy to prostate tissue and thereby shrink the prostate and treat symptoms of BPH. It is generally considered only for patients who cannot undergo TURP or who require less invasive treatments, however the long-term safety and effectiveness of this treatment in this or other proposed subsets of individuals has not been proven.

Literature Review

There are scarce data in randomized controlled clinical trials or comparative studies regarding outcomes of WIT as a treatment for BPH. Minardi et al. (2004) reported that WIT resulted in a reduction of prostatic volume of 5.2% compared with a decrease of 48.4% when transurethral resection of the prostate (TURP) was performed. The urine flow rate increased more after TURP (75.3%) than after WIT (16.7%). Residual prostate volume decreased more after TURP (89.8%) than after WIT (25.2%), an increase of maximum flow rate of 16.7% and a decrease of residual volume of 25.2%. The relief of bladder outlet obstruction was indicated by the decrease of detrusor pressure at maximum flow rate in comparison to baseline values; decreases of 27.5% were noted for WIT compared with decreases of 48% for transurethral resection of the prostate (TURP). The National Institute for Clinical Excellence does not recommend WIT as an appropriate option for the treatment of BPH (NICE, 2010, 2015).

At this time there is insufficient evidence in the peer-reviewed scientific evidence to determine the safety and effectiveness of WIT for the treatment of BPH. Additionally, there is insufficient direct comparison of WIT to other treatment options for BPH; optimal protocols have not been established and long-term information regarding duration of treatment effect or adverse effects is lacking.

Waterjet Tissue Ablation using the AquaBeam System: The AquaBeam System has been proposed as the first minimally invasive medical device that allows rapid removal of prostate tissue without leaving a zone of thermal damage on the treated tissue. The AquaBeam System uses proprietary heat-free high-velocity waterjet technology for automated tissue resection as well as for optical energy delivery for cauterization in the treatment of BPH. No heat sources are used for cutting. The AquaBeam system consists of three components: a single-use probe, a robotic hand piece, and a console. The procedure is carried out under transrectal ultrasound imaging. The AquaBeam probe is attached to the hand piece and inserted in the urethra; cystoscopic visualization is available continuously during the procedure. After mapping the desired tissue to be ablated, high-velocity sterile saline is delivered to the prostate tissue via the AquaBeam probe, which also provides a channel for aspiration of ablated tissue during the procedure. After excision of tissue from the prostate, the jet's pressure is reduced so that it can be used to carry a laser light beam to cauterize the excised area. The aim is to reduce the heat damage to adjacent tissue common in other available interventions.

Food and Drug Administration (FDA)

On December 21, 2017 the FDA granted a de novo classification for the AquaBeam system (PROCEPT BioRobotics Corporation, Redwood Shores, CA) for the resection and removal of prostate tissue for males suffering from LUTS due to BPH. FDA clearance was supported by the international WATER randomized controlled trial (NCT02505919) comparing AquaBeam with TURP in patients with LUTS due to BPH.

Literature Review

There is a paucity of evidence in the published peer-reviewed literature addressing waterjet tissue ablation and its role in the treatment of BPH. Evidence in the peer-reviewed literature for waterjet tissue ablation using the AquaBeam system includes a RCT (n=181) (Gilling, et al., 2019; 2018), a follow-up cohort study (n=90) (Kasivisvanatha, et al., 2018) and a prospective study (n=66) of the RCT (Pimentel, et al., 2019), an additional prospective study (n=21) (Gilling, et al., 2017) and a safety and feasibility study (n=15) (Gilling, et al., 2016). Longer-term data and comparisons with similar modalities such as the Holmium laser enucleation of the prostate (HOLeP) are needed to establish the safety and efficacy of the Aquabeam system. Although professional society recommendations state that Aquablation may be offered to patients with LUTS attributed to BPH, they note that patients should be informed that long term evidence of efficacy and retreatment rates remains limited.

In a double-blind, multicenter, prospective, randomized, controlled trial or the WATER (Waterjet Ablation Therapy for Endoscopic Resection of Prostate Tissue) trial (n=181), Gilling et al. (2018) reported on individuals with moderate to severe lower urinary tract symptoms related to BPH who underwent the gold standard transurethral prostate resection (n=116) or Aquablation (n=65). The primary efficacy end point was the reduction in International Prostate Symptom Score (IPSS) at six months. The primary safety end point was the development of Clavien-Dindo persistent grade 1, or 2 or higher operative complications. The study included men 45-80 years old with a prostate between 30-80 gm as measured by transrectal ultrasound, moderate to severe symptoms as indicated by IPSS 12 or greater and a maximum urinary flow rate less than 15 ml per second. Men were excluded from analysis if they had a history of prostate or bladder cancer, neurogenic bladder, bladder calculus or clinically significant bladder diverticulum, active infection, treatment for chronic prostatitis, diagnosis of urethral stricture, meatal stenosis or bladder neck contracture, a damaged external urinary sphincter, stress urinary incontinence, post-void residual urine greater than 300 ml or urinary retention, self-catheterization use or prior prostate surgery. Men receiving anticoagulants or bladder anticholinergics and those with severe cardiovascular disease were also excluded. Mean total operative time was similar for Aquablation and transurethral prostate resection (33 vs 36 minutes, p=0.2752) but resection time was lower for Aquablation (4 vs 27 minutes, p<0.0001). Mean IPSS had decreased from baseline by 16.9 points for Aquablation and 15.1 points for TURP. The mean difference in the change score at six months was 1.8 points greater for Aquablation (noninferiority p<0.0001 and superiority p=0.1347). At six months 100% of Aquablation vs 98% of TURP cases showed I-PSS improvement. Of the patients who underwent Aquablation and transurethral prostate resection 26% and 42%, respectively, experienced a three month primary safety end point, which met the study primary noninferiority safety hypothesis and subsequently demonstrated superiority (p=0.0149). Among sexually active men the rate of anejaculation was lower in those treated with Aquablation (10% vs 36%, p=0.0003). In men with a prostate greater than 50 ml, the rate of persistent grade 1 events was

(2% vs 26%, p=0.0003), the rate of persistent grade 1 events was substantially lower (2% vs 26%, p=0.0003) and the rate of Clavien-Dindo grade 2 and greater events trended in favor of Aquablation (19% vs 29%, p=0.3146). Each group achieved significant symptom relief compared to baseline with similar rates of Clavien-Dindo 2 or greater complications. The risk of anejaculation was lower with Aquablation. Larger prostates (50 to 80 ml) demonstrated a more pronounced safety and efficacy benefit. This study was limited by the short-term six month follow-up (ClinicalTrials.org: NCT02505919).

Gilling et al. (2019) reported one year safety and efficacy outcomes for the WATER study above. BPH symptom score improvements were similar across groups with 12-month reduction of 15.1 points after TURP or Aquablation. In both groups, mean maximum urinary flow rates increased markedly postoperatively, with mean improvements of 10.3 cc/s for Aquablation versus 10.6 cc/s for TURP (p=0.8632). At one year, Prostate-specific antigen (PSA) was reduced significantly (p<0.01) in both groups by one point; the reduction was similar across groups (p=0.9125). Surgical retreatment for BPH rates for TURP were 1.5% and Aquablation 2.6% within one year from the study procedure (p=not significant [NS]). The rate of late complications was low, with no procedure-related adverse events after six months. The authors concluded that Aquablation for LUTS due to BPH provides sustained, 12-month, symptom-reduction efficacy with a low rate of late adverse events in men with prostates between 30 and 80 cc.

In a blinded, prospective, randomized multicenter study, Pimentel et al. (2019) compared urodynamic outcomes between aquablation vs transurethral resection of the prostate (TURP). Patients (n=66) were randomized 2:1 (aquablation [n=43]:TURP [n=23]) in the Waterjet Ablation Therapy for Endoscopic Resection (WATER) of prostate tissue study. Of 17 participating trial sites, seven centers performed urodynamic studies preoperatively and at a month after treatment. Urodynamic studies were optional; study centers that routinely performed urodynamic studies in clinical practice included these assessments in the trial. The primary urodynamic outcome measures were detrusor pressure at maximal flow rates (PDet@Qmax) and mean change in the Bladder Outlet Obstruction Index (BOOI). Urodynamics were measured at baseline and six months. At mean baseline pDet@qmax was 71 and 73cm H20 in the aquablation and TURP groups, respectively. At six-month follow-up, pDet@qmax decreased by 35 and 34cm H20, respectively. A large negative shift in bladder outlet obstruction index was observed, consistent with a large reduction in the proportion of subjects with obstruction at follow-up compared to baseline (79% to 22% in aquablation and 96% to 22% in TURP). The authors concluded that in this trial, improvements after aquablation in objective measures of bladder outlet obstruction were similar to those observed after TURP. Reported limitations include that urodynamics were optional in the WATER study. This analysis had limited subjects at the seven sites performing such evaluations in the trial, which could have introduced a bias. While sample size was large enough to detect statistically significant and clinically important changes from baseline in each group, it is possible that smaller differences in urodynamic responses across treatment groups might not be detectable due to limited sample size.

In a cohort study (n=90), Kasivisvanathan et al. (2018) reported the efficacy and safety at one year for the treatment of LUTS related to benign prostatic hyperplasia (BPH) in the United States cohort from the WATER study. Sixty individuals were treated with Aquablation and 30 were treated with TURP. A total of 87 individuals completed one year follow-up. The efficacy objective was reduction in IPSS. The safety objective was the occurrence of Clavien-Dindo persistent grade 1 or grade 2 or higher operative complications. Change in IPSS at one year between Aquablation and TURP was similar (14.5 vs13.8, respectively, p=0.7117). The number of subjects experiencing persistent Clavien-Dindo grade 1 or Clavien-Dindo grade 2 or higher adverse events was lower in the Aquablation group compared to the TURP group (20% vs 47% respectively, p=0.0132). Amongst sexually active subjects, the rate of an ejaculation was lower in patients treated with Aquablation than TURP (9% vs 45%, respectively, p=0.0006). The authors reported that further follow-up is needed to assess the durability of Aquablation. This study is limited by small sample size and short-term follow-up.

A 2019 Cochrane Systematic Review on Aquablation of the prostate for the treatment of LUTS in men with BPH included one RCT with 184 participants comparing Aquablation to TURP (Gilling, et al., 2018). The authors did not find other prospective, comparative studies comparing Aquablation to TURP or other procedures such as laser ablation, enucleation, or other minimally invasive therapies. The conclusions state that based on short-term 12 month follow-up, the effect of Aquablation on urological symptoms is probably similar to that of TURP (moderate-certainty evidence). The effect on quality of life may also be similar (low-certainty evidence). There is uncertainty whether patients undergoing Aquablation are at higher or lower risk for major adverse events (very low-certainty evidence) signalling major uncertainty about the true effect size. Reported adverse events include postoperative pain, hematuria, urinary tract infections, urethral stricture disease, acute urinary retention and one instance of blood transfusion (Gilling, et al., 2018). The reported rates of reoperations is 2.5% (Gilling, et al., 2018). The authors are very uncertain whether Aquablation may result in little to no difference in erectile function but offer a small improvement in preservation of ejaculatory function (both very low-certainty evidence). The conclusions are based on a single study of men with a prostate volume up to 80 mL in size. Longer-term data and comparisons with other modalities appear critical to a more thorough assessment of the role of Aquablation for the treatment of LUTS in men with BPH (Hwang, et al., 2019).

Professional Societies/Organizations
American Urological Association (AUA): Aquablation is discussed in the 2019 amended AUA evidence-based Guideline: Surgical Management of Benign Prostatic Hyperplasia/Lower Urinary Tract Symptoms. One low risk of bias RCT (n=181) assessing Aquablation was evaluable by the panel. The guideline recommendation states: Aquablation may be offered to patients with LUTS attributed to BPH provided prostate volume >30/<80g, however, patients should be informed that long term evidence of efficacy and retreatment rates, remains limited. (*Conditional Recommendation; Evidence Level: Grade C*) (AUA, 2019).

Use Outside of the US
Canadian Urological Association (CUA): The updated 2018 CUA guideline on male lower urinary tract symptoms/benign prostatic hyperplasia (MLUTS/BPH) recommends that aquablation be offered to men with LUTS interested in preserving ejaculatory function, with prostates <80 cc, with or without middle lobe. *(*conditional recommendation based on moderate quality evidence*)*. (Nickel, et al., 2018).

European Association of Urology (EAU): The 2019 EAU guideline on Management of Non-neurogenic Male LUTS states that the first clinical experience provides encouraging results, with a low risk of sexual dysfunction, but further modifications of the AquaBeam system may be necessary. Longer term follow up would help assess the clinical value of Aquablation (Gravas et al., 2019).

Centers for Medicare & Medicaid Services (CMS)
- National Coverage Determinations (NCDs): No NCD found.
- Local Coverage Determinations (LCDs): Multiple LCDs found. Refer to the LCD table of contents link in the reference section.

Coding/Billing Information

Note: 1) This list of codes may not be all-inclusive.
2) Deleted codes and codes which are not effective at the time the service is rendered may not be eligible for reimbursement.

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	Description
52441	Cystourethroscopy, with insertion of permanent adjustable transprostatic implant; single implant
52442	Cystourethroscopy, with insertion of permanent adjustable transprostatic implant; each additional permanent adjustable transprostatic implant (List separately in addition to code for primary procedure)
53854	Transurethral destruction of prostate tissue; by radiofrequency generated water vapor thermotherapy

HCPCS Codes	Description
C9739	Cystourethroscopy, with insertion of transprostatic implant; 1 to 3 implants
C9740	Cystourethroscopy, with insertion of transprostatic implant; 4 or more implants

Considered Experimental/Investigational/Unproven when used to report any procedure listed

in this policy as Experimental/Investigational/Unproven for the treatment of benign prostatic hyperplasia (BPH):

CPT®* Codes	Description
37242	Vascular embolization or occlusion, inclusive of all radiological supervision and interpretation, intraprocedural roadmapping, and imaging guidance necessary to complete the intervention; arterial, other than hemorrhage or tumor (eg, congenital or acquired arterial malformations, arteriovenous malformations, arteriovenous fistulas, aneurysms, pseudoaneurysms)
53852	Transurethral destruction of prostate tissue; by radiofrequency thermotherapy
53899	Unlisted procedure, urinary system
55873	Cryosurgical ablation of the prostate (includes ultrasonic guidance and monitoring)
55899	Unlisted procedure, male genital system
76999	Unlisted ultrasound procedure (eg, diagnostic, interventional)
0421T	Transurethral waterjet ablation of prostate, including control of post-operative bleeding, including ultrasound guidance, complete (vasectomy, meatotomy, cystourethroscopy, urethral calibration and/or dilation, and internal urethrotomy are included when performed).

HCPCS Codes	Description
C2596	Probe, image-guided, robotic, waterjet ablation (Code effective 1/1/2020)
C9734	Focused ultrasound ablation/therapeutic intervention, other than uterine leiomyomata, with magnetic resonance (MR) guidance

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