

Surgical Management of Male Voiding Dysfunction



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KEYWORDS

- Benign prostatic hypertrophy • Lower urinary tract symptoms
- Transurethral resection of the prostate • Holmium laser enucleation of the prostate
- Photoselective vaporization of the prostate • Open simple prostatectomy

KEY POINTS

- BPH is a common, surgically correctable cause of voiding dysfunction and troublesome lower urinary tract symptoms in males.
- Indications for surgical intervention in the management of BPH include urinary retention, recurrent urinary tract infections, bladder stone formation, upper urinary tract deterioration, and failure of medical management.
- Numerous surgical interventions are available for the management of BPH. The procedure of choice is determined by patient and surgeon preference, desired outcome, prostate size, and other patient-related factors (ie, anticoagulation use).



Video content accompanies this article at <http://www.surgical.theclinics.com>

INTRODUCTION

Male voiding dysfunction is associated with various genitourinary conditions including urethral stricture, idiopathic detrusor overactivity, neurogenic bladder (ie, from spinal cord injury), neurologic disorders (ie, stroke, parkinsonism), poorly controlled diabetes, and benign prostatic hyperplasia (BPH). All of these conditions are associated with troubling lower urinary tract symptoms (LUTS), which can have a negative impact on quality of life. This article focuses on the management of male voiding dysfunction and LUTS related to BPH.

Disclosure Statement: J. Mandeville has provided educational lectures for Lumenis, but has no financial relationship with the company. A. Mourtzinis has nothing to disclose.

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Surg Clin N Am 96 (2016) 491–501

<http://dx.doi.org/10.1016/j.suc.2016.02.006>

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ETIOLOGY AND EPIDEMIOLOGY OF BENIGN PROSTATIC HYPERPLASIA AND LOWER URINARY TRACT SYMPTOMS

BPH is a histologic diagnosis characterized by enlargement of the prostate gland from a nonmalignant proliferation of glandular and stromal elements in the transition zone of the prostate.¹ Development of BPH in males is an age-related process. Histologic evidence of BPH is identified in approximately 10% of men in their 30s, in 50% to 60% of men in their 60s, and in up to 90% of men in their 70s and 80s.^{1,2}

BPH may be entirely asymptomatic or associated with a wide variety of LUTS. The LUTS develop as a result of bladder outlet obstruction from the enlarged prostate. LUTS is separated into voiding-related symptoms or storage-related symptoms (Box 1).^{2,3} Numerous self-completed, validated questionnaires exist for the assessment of LUTS related to BPH and the most commonly used tool is the International Prostate Symptoms Score. Symptoms are considered mild if the score is seven or less, moderate if the score is 8 to 19, and severe if the score is 20 to 35. The quality of life question response ranges from zero to six, with a score of zero indicating the patient is “delighted” with their symptoms and a score of six indicating the symptoms are “terrible.” Severity of symptoms is not well correlated with prostate size or patient age. However, the risk for developing urinary retention does increase with increasing symptom score and higher preoperative symptoms scores are associated with successful postoperative outcomes in patients undergoing surgery for BPH/LUTS.^{1,2} The International Prostate Symptoms Score is also useful for assessing treatment success (medical or surgical).

MANAGEMENT OF BENIGN PROSTATIC HYPERPLASIA AND LOWER URINARY TRACT SYMPTOMS

A wide variety of treatments are available for the management of BPH/LUTS. The most commonly used initial measures are conservative (watchful waiting, behavioral modification, oral fluid management, or medical therapy with α -blockers and/or 5 α -reductase inhibitors). However, these management options are outside of the scope of this review.

Surgical intervention is often necessary for patients with complications related to BPH including urinary retention, development of bladder calculi, recurrent urinary tract infections, recurrent prostatic bleeding, or impairment of renal function related to upper urinary tract obstruction. Additional indications for surgical intervention are severe symptoms, failure of medical therapy, intolerance of medical therapy, or patient preference to avoid medications.

Currently, urologic surgeons and their patients have a wide variety of surgical treatment options available for management of BPH/LUTS. These treatments include

Box 1
Lower urinary tract symptoms that may be associated with BPH

Voiding symptoms

- Slowing urinary stream
- Hesitancy in initiating urinary stream
- Straining to initiate urinary stream
- Sensation of incomplete bladder emptying
- Postvoid dribbling of urine

Storage symptoms

- Increased daytime urinary frequency (>7 voids per day)
- Nocturia (waking to void at night)
- Urgency of urination
- Urgency-related incontinence of urine

office-based procedures, operating room–based transurethral surgeries, and open or laparoscopic surgeries (**Box 2**). The treatment of choice depends on patient and surgeon preference, expected outcomes, prostate size, and other patient-related factors (ie, surgical risk, anticoagulation, anatomic abnormalities).

PREOPERATIVE EVALUATION

Preoperatively, digital rectal examination and prostate-specific antigen are assessed to evaluate for the presence of underlying prostate cancer (although prostate-specific antigen can often be elevated simply from prostatic enlargement). Urine culture should routinely be obtained before surgery and any infection treated with culture-specific antibiotics. In patients with hematuria or a history suggesting causes of LUTS other than BPH (ie, history of stricture), cystoscopy should be carried out before surgery. Transrectal ultrasound sizing of the prostate is optional and is helpful in determining the most appropriate surgical approach and planning operative times.

OFFICE-BASED PROCEDURES

Transurethral Microwave Therapy

With the development of new technologies and changes in reimbursement schedules, some treatments for BPH have moved into the office environment. Typically these procedures are performed in patients with small glands or in patients who cannot tolerate an anesthetic. Transurethral microwave therapy (TUMT) is a heat-based therapy considered an alternative office-based treatment to transurethral resection of the prostate (TURP) in patients who have LUTS. Because of its ease of administration and minimal discomfort, it has become an attractive option for many patients. TUMT treatment is based on increasing intraprostatic temperatures greater than 45°C, which cause coagulation necrosis in the targeted periurethral glandular tissue of the transition zone.⁴ The heat is delivered through a catheter with a microwave antenna to carefully selected sections of the prostate gland. Several devices are available commercially; the main differences between the various systems are the degree of energy delivered, the design of the antenna, and the cooling system.

TUMT is performed in an outpatient setting without the need for an anesthesiologist.⁵ Local anesthesia is administered with intraurethral 2% lidocaine jelly

Box 2

Surgical management options for BPH/LUTS

Office-based procedures

- Transurethral microwave therapy
- Transurethral needle ablation

Transurethral electrosurgical procedures

- Transurethral resection of the prostate
- Bipolar transurethral vaporization of the prostate

Transurethral laser procedures

- Holmium laser ablation of the prostate
- Holmium laser enucleation of the prostate
- Photoselective vaporization of the prostate (green light)

Open surgical procedures

- Open simple prostatectomy (transvesical or retropubic)

Laparoscopic/robotic procedures

- Robotic-assisted laparoscopic simple prostatectomy

approximately 10 to 15 minutes before the procedure. The bladder is subsequently emptied with straight catheterization and 50 mL of 2% lidocaine solution is instilled into the bladder for 10 minutes. With the assistance of a transrectal ultrasound, the TUMT catheter is placed into the bladder and the balloon is inflated. The rectal probe for temperature assessment is inserted and treatment is begun. The most common complications are prolonged postoperative catheterization times; urinary tract infections; and irritative voiding symptoms, such as dysuria and urinary frequency.⁶

Transurethral Needle Ablation

Transurethral needle ablation (TUNA) of the prostate is another temperature-based minimally invasive alternative in men with LUTS resulting from prostatic hypertrophy. TUNA uses the thermal properties of radiofrequencies.⁷ The TUNA catheter is fitted with two deployable needles angled 40° from each other. The needles deliver thermal energy from an automated generator that maintains a target temperature of more than 45°C at the periphery and approximately 100°C at the center.⁸ Coagulation necrosis is achieved at a mean of 3 mm from the tip of the needles through agitation of water molecules causing friction and subsequent heat. Depth of penetration of the needles is based on prostate volume assessment and urethral length measurements. Protective shields are deployed 5 to 6 mm over the shaft of the needle to protect the urethra. This is considered one of the major advantages of the TUNA technique because it protects the integrity of the urothelium and theoretically allows the performance of the procedure with minimal discomfort to the patient.⁹ At the end of the procedure, the instrument is removed and the bladder is emptied. A catheter may or may not be placed at the end of the procedure. Patients reportedly tolerate the procedure well with minimal discomfort and significant symptom score improvement.¹⁰

SURGICAL PROCEDURES

Monopolar Transurethral Resection of the Prostate

Monopolar TURP is the historical gold standard therapy for LUTS secondary to obstruction from BPH (small to medium sized glands). In the 1980s, TURP was the most common operation in the Medicare population after cataract surgery.¹¹ Over the past 20 years, there has been a progressive decrease in the number of TURP procedures. This is caused by an increased use of medical therapies and minimally invasive surgical procedures (ie, TUMT, TUNA, laser, and vaporization techniques). Multiple factors have driven this trend, including reimbursement changes, but there has been no clear evidence that these new techniques are more efficacious or cost-effective than traditional TURP.¹²

The standard technique of the procedure has not changed. The patient is placed in the dorsal lithotomy position and the urethra is dilated to accommodate the resectoscope sheath (typically 26F catheter). The scope is then passed through the anterior and posterior urethra into the bladder under direct vision to prevent any urethral false passages. The resection technique varies according to the size of the prostate and user preference; however, it should be performed in an orderly fashion. A trough should be resected that identifies the capsule (typically between the 5- and 7-o'clock positions from the bladder neck to the verumontanum, encompassing the median lobe/median bar tissue) and resection of the lateral lobes is then continued down to the same plane (starting at the bladder neck and carried distally to the apex of each lateral lobe). Surgeons should take caution not to undermine the bladder neck and

should avoid resection distal to the verumontanum (to prevent injury to the external urethral sphincter). In addition, the ureteral orifices should be identified and not violated.

Typically, most urologists use nonhemolytic irrigating solutions, such as 1.5% glycine, 3% sorbitol, or 3% mannitol, because of the inherent danger of using water where absorption can cause hemolysis and shock. The other solutions listed are not isotonic and can also cause serious side effects if excessive amounts are absorbed, specifically TURP syndrome. TURP syndrome is characterized by hypertension, bradycardia, visual disturbances, mental confusion, and nausea caused by a dilutional hyponatremia. Cerebral or bronchial edema can result if left untreated. Serum sodium levels should be monitored frequently and corrected with judicious infusion of intravenous hypertonic sodium chloride and furosemide. Procedures are typically performed under spinal anesthesia to monitor patients for TURP syndrome. Several attempts have been made to improve the modern TURP by altering instrumentation focused on mainly improving hemostasis and safety. Nonetheless, regardless of the configuration of TURP loops, hemostasis is determined by the balance of wattage, power, voltage, surface contact, and exposure time to tissue.^{13,14}

TURP has durable very long-term follow-up results documented in urology literature, with follow-up ranging from 8 to 22 years.¹⁵ The data from most recent cohort studies do suggest that patient morbidity decreases with increased urologist caseload volume. Overall morbidity rates can range from 11% to 30% with urinary retention and urinary tract infections most commonly seen.¹⁶ Transfusion rates have been seen up to 20% in early studies; although more recent studies have shown rates as low as 2% to 4%.¹⁷ It is extremely important to alert any patient undergoing a bladder outlet procedure, especially TURP, of the high risk of retrograde ejaculation and the consequences for fertility and sexual functioning. Although most studies demonstrate objective long-term efficacy of TURP, quality of life and patient satisfaction measures are rare.

Bipolar Transurethral Resection of the Prostate

Bipolar TURP was developed to allow the operation to be performed in a normal saline environment and theoretically allow for longer and safer resection.¹⁴ The traditional monopolar TURP uses an active electrode to transmit energy into tissue and a return electrode at the skin to complete the circuit.¹¹ Bipolar technology allows high initializing voltage to establish a voltage gradient in the gap between two electrodes. The active and return poles are thus incorporated into the electrode design.¹⁸ This energy converts the saline into a plasma field of highly ionized particles disrupting the molecular bonds between the tissues. The high-temperature loop provides rapid vaporization and desiccation of prostate tissue and results in a “cut and seal” effect.¹⁹ Because these charge ions have only a short penetration of 50 to 100 μm , there should be less collateral thermal damage to the surrounding tissue and less tissue char.¹⁵ Bipolar TURP is performed in the exact same manner as monopolar TURP.

Several types of bipolar resection devices are available. In addition, surgeons are now performing bipolar transurethral vaporization of the prostate procedures. In these procedures, a bipolar button is used in a similar fashion as a bipolar loop with the intent of vaporizing the tissue instead of cutting the tissue. The vaporization procedure is carried out in essentially the same fashion as a TURP procedure ([Video 1](#)). Bipolar TURP allows for longer resection times without the risk of hyponatremia and TURP syndrome. Some have proposed that the slower pace of resection is also more comfortable for the resident in training and only enhances resident training in the future.¹⁴ To date, no case reports have documented any case of clinically significant TURP syndrome with saline bipolar TURP.

Laser Therapy for Benign Prostatic Hyperplasia

The development of laser-based surgical techniques has challenged the idea that TURP and open simple prostatectomy should remain the gold standards for the management of BPH/bladder outlet obstruction. Traditionally, TURP has been considered the surgery of choice for managing small-to-moderate-sized glands (up to 60–80 g), whereas open simple prostatectomy has been considered the optimal treatment of larger glands (>80). With the advent of laser-based procedures that are less invasive and associated with fewer complications, these techniques have gained widespread acceptance among urologists and have begun to rapidly supplant more traditional surgical therapies.

Although numerous lasers suitable for the management of BPH exist, those most commonly used are the holmium:yttrium-aluminum-garnet (Ho:YAG) laser and the KTP (“green light”) laser. Additional laser therapies that are currently less commonly used include diode lasers and thulium lasers. The focus here is on Ho:YAG and KTP applications for BPH management.

Holmium laser physics

The Ho:YAG laser is a pulsed, solid-state laser that emits a wavelength of 2140 nm (infrared). It is rapidly absorbed by water and the depth of penetration is 0.5 mm. Therefore, when the laser fiber is more than 0.5 mm from the target tissue (ie, prostate) the energy is dissipated in water and no detrimental effects on the tissue occur. Because of the high water content of the prostate, the holmium wavelength is well absorbed allowing for either laser ablation or resection/enucleation of prostate tissue. The Ho:YAG laser energy is delivered through small (typically 550–1000 μm), flexible fibers that are precisely controlled by the surgeon. The energy is delivered in a saline milieu, removing the risk of developing hyponatremia and TURP syndrome, which is seen when prostate resections are done with hypotonic irrigants.^{20,21} An additional benefit of the Ho:YAG laser is its excellent hemostatic effects, which allows the surgeon to perform resection or ablation in the setting of antiplatelet or anticoagulation therapy when absolutely necessary (although cessation of antiplatelets and anticoagulants is typically preferred whenever possible). Finally, in patients with concomitant bladder stones, the stones are treated simultaneously using the Ho:YAG laser.

Holmium laser ablation of the prostate

Holmium laser ablation of the prostate (HoLAP) is typically carried out using a 26F catheter resectoscope with laser bridge and continuous-flow normal saline irrigation. The laser bridge steadies the fiber within the scope to allow for better control of the laser fiber. A 550- μm side-firing laser fiber is used to deliver the Ho:YAG laser energy. A Ho:YAG laser capable of generating a power of 80 W or higher is required.

Various HoLAP techniques have been described. One of the most commonly used techniques includes the creation of troughs at the 5- and 7-o'clock positions from the bladder neck to a point proximal to the verumontanum. The troughs are deepened until capsule is identified (a fibrous, shiny, white surface with delicate vessels). Next, the tissue between the 5- and 7-o'clock troughs (median lobe tissue) is ablated until capsule is identified. Ablation is carried out by positioning the laser fiber close to, but not touching the prostate tissue. The tissue is slowly ablated by rotating the side-firing laser fiber. After the median lobe tissue is ablated, the lateral lobes are ablated in a similar fashion starting at the bladder neck and moving distally toward the apex. Once capsule is identified throughout, the procedure is completed and typically, a catheter is left in place overnight.⁶

Before the development of high powered Ho:YAG lasers, HoLAP had limited utility in the management of BPH because of slow ablation times and inefficient tissue removal. However, with the advent of higher powered Ho:YAG lasers (80–120 W), HoLAP has re-emerged as a treatment option for small-to-moderate-sized glands, particularly because this procedure is simpler to perform than holmium laser enucleation of the prostate (HoLEP; discussed next).²⁰

Holmium laser enucleation of the prostate

Gilling and colleagues²² first described HoLEP in the mid-1990s. Over the past two decades, the HoLEP technique has been found to be an excellent option for the surgical management of prostates of all sizes, including extremely large glands, which previously would have been treated only with open simple prostatectomy. The procedure has evolved to become a minimally invasive, endoscopic equivalent to open simple prostatectomy, with significantly less morbidity (ie, less blood loss, significantly lower risk of blood transfusion, shorter hospital stay, and shorter length of catheterization).²⁰

HoLEP is also performed using a 26F catheter resectoscope with laser bridge and continuous-flow normal saline irrigation. A 550- μ m end-firing laser fiber is used to deliver the laser energy. A Ho:YAG laser capable of generating a power of 100 to 120 W is used. A morcellator device with 5-mm reciprocating blades controlled by foot pedal is also required to remove the enucleated tissue.

The procedure as described by Gilling²³ has been well documented. It begins with creating bilateral incisions extending from the bladder neck (5 and 7 o'clock) to the verumontanum. The incisions are deepened until capsule is identified (in instances where no median lobe is present, a single incision is made at the 6-o'clock position). After completion of the bladder neck incisions, the median lobe tissue is enucleated starting at the verumontanum. The fibers connecting the median lobe tissue to the capsule are divided, working side-to-side between the bladder neck incisions. The resectoscope beak is used to elevate the median lobe off of the capsule and create counter-traction during enucleation. The median lobe is pushed up through the bladder neck and the remaining fibers are divided to completely free the median lobe tissue. The lateral lobes can then be enucleated. The distal aspect of the bladder neck incision of each lateral lobe is extended inferolaterally and underneath the apex of the lobe. The apex is then lifted off of the capsule using the beak of the resectoscope. The apical incision is then carried up to the 2-o'clock position (left lobe) or 11-o'clock position (right lobe). Then, the bladder neck is incised at the 12-o'clock position (anterior commissure) to release the anterior aspect of both lobes. This incision is then carried distally and laterally toward the verumontanum. The anterior incision and the bladder neck incisions are joined along the plane of the capsule. The dissection is continued until each lobe is freed entirely and pushed into the bladder. After achieving excellent hemostasis in the prostatic bed, the tissue is morcellated in the bladder. A long rigid nephroscope (typically used for percutaneous kidney surgery) is used for morcellation. The bladder must remain fully distended throughout morcellation and contact between adenoma and morcellator blades must be carefully maintained at all times to prevent bladder injury.²³ After all tissue is morcellated, a catheter is left in place overnight.

The technique has been modified by Lingeman and colleagues²⁴ and is the preferred technique of the authors of this article. In this modification, one initial bladder neck incision is made and the median lobe dissection is incorporated into the dissection of one of the lateral lobes. Additionally, the dissection of the lateral lobe is continued across the entire anterior surface of the gland to open a space between

capsule and anterior commissure before division of the anterior commissure. Finally, the apical mucosal strips are divided by encircling the lateral lobes with the resectoscope and placing the tissue on stretch away from the sphincter.²⁴ (See videos at <http://www.urologybook.com/holmium-laser-enucleation-of-the-prostate-hole/>).²⁵

Photoselective Vaporization of the Prostate Physics

Photoselective vaporization of the prostate (PVP) is performed using a 532-nm laser. The laser was initially developed by doubling the frequency of a pulsed neodymium:YAG laser with a KTP crystal. This generates a visible green wavelength (532 nm) and thus the laser is referred to as a “green light” laser. This wavelength is rapidly absorbed by hemoglobin within the prostate tissue. This in turn allows for rapid photoselective vaporization secondary to rapid photothermal vaporization of heated intracellular water. The depth of penetration is 0.8 mm and the coagulation zone is 1 to 2 mm. These properties of the 532-nm wavelength laser allow PVP procedures to be performed in the setting of active antiplatelet or anticoagulant therapy when absolutely necessary. PVP procedures are performed using a variety of different laser systems with powers ranging from 60 to 180 W. The higher power systems allow for more rapid vaporization of prostate tissue.^{20,26}

Photoselective Vaporization of the Prostate Procedure

The goal of a PVP procedure is to create a defect similar to that created by standard TURP. The laser fiber is used at “near-contact” mode (0.5 mm distance between the fiber and the prostate tissue) to achieve maximal energy delivery. The formation of bubbles on the surface of the prostate tissue is a surrogate for efficient vaporization, whereas bubble diminishment is considered a sign of proximity to the capsule, where vaporization efficiency decreases secondary to decreased vascularity of the fibrous capsule. Various techniques for tissue removal exist. These including side-to-side sweeping from the bladder neck to the apex in a clockwise-counterclockwise fashion; the “spiral technique” where the middle lobe and lateral lobes are ablated in separate sections; and the vaporization-incision technique, which incorporates some aspect of HoLEP (bladder neck incision, apical incisions, high lateral lobe incisions) followed by ablation of the median lobe, lateral lobes, and apices. Placement of a catheter at the end of the procedure is done at the discretion of the surgeon, but is not mandatory.²⁷

OPEN SIMPLE PROSTATECTOMY

With the advent of laser technologies and laparoscopic and robotic systems, use of open simple prostatectomy for the management of BPH is on the decline. However, for patients with very large prostates, patients with concomitant bladder stones or large bladder diverticuli, or patients with a urethral abnormality (ie, stricture) the procedure remains an effective and viable option, especially when laser and robotic platforms are not readily available.

Open simple prostatectomy is performed in a retropubic (incision directly through prostatic capsule) or transvesical fashion. The transvesical approach is preferred in the setting of concomitant bladder stones and/or bladder diverticula and is the most commonly used approach. In the transvesical approach, a midline incision from below the umbilicus to the pubic bone is typically used. The extraperitoneal prevesical space is then bluntly developed and self-retaining retractors are placed. The bladder is distended with saline through a 22F three-way Foley catheter placed in a sterile fashion before starting the procedure. A midline cystotomy is created

and the retractors are positioned such that the dome of the bladder can be retracted to aid exposure to the prostate. If necessary, 5F ureteral catheters are placed to help identify the ureteral orifices. Then, a circumferential incision is made around the prostate, distal to the trigone, and a plane between adenoma and prostatic capsule is sharply developed. Blunt finger dissection is then used to enucleate the adenoma. Finally, the apical prostatic urethra is transected by placing a finger at the apex of the prostate and pulling posteriorly. Hemostasis is achieved in the prostatic fossa using electrocautery and/or absorbable sutures. Vicryl sutures are then placed at the 5- and 7-o'clock positions to advance the bladder mucosa to the prostatic urethra. The bladder is then closed in two layers with Vicryl sutures. The 22F three-way Foley catheter is left in place.²⁸ A suprapubic tube can also be left in place at the surgeon's discretion but is often unnecessary. Typically a catheter is left in place for about 1 week and is removed after a postoperative cystogram reveals no leak.

ROBOTIC SIMPLE PROSTATECTOMY

Robotic simple prostatectomy is yet another option for the management of large prostatic adenomas. Bladder stones and bladder diverticuli can also be treated simultaneously with this approach.

At the author's institution, robotic simple prostatectomy is performed via a transperitoneal approach. The patient is positioned in the same fashion as used for a robotic radical prostatectomy and the same port configuration is used.²⁹ The procedure is carried out in a transvesical fashion in the same manner as an open simple prostatectomy. In this case, however, finger dissection is replaced by dissection using monopolar robotic scissors. Hemostasis in the prostatic fossa is achieved with electrocautery and suture ligation if needed. The bladder is closed and a Foley catheter is left in place (18–22F catheter). A Jackson Pratt drain can be left in place at the discretion of the surgeon. As with open simple prostatectomy, a catheter is left in place for a week and is removed after a cystogram reveals no leak.

COMPLICATIONS OF BENIGN PROSTATIC HYPERPLASIA SURGERY

Complications of all transurethral BPH surgeries include bleeding, need for blood transfusion, urinary tract infection, retrograde ejaculation (usually permanent), temporary or permanent urinary incontinence, painful urination, urethral stricture, bladder neck contracture, or bladder or ureteral injury. The incidence of each complication depends on the surgery performed and the experience of the surgeon. Additional complications of open or robotic simple prostatectomy include injury to surrounding organs (ie, bowel) or vascular structures, wound infection, surgical site hernia, and bladder leak. All potential complications should be extensively reviewed with the patient before proceeding with surgery.

SUMMARY

BPH is a common medical condition in aging males, which can lead to bothersome LUTS that can negatively impact quality of life. Fortunately, when symptoms are severe or BPH-related complications occur, such as urinary retention, recurrent urinary tract infections, recurrent hematuria, or upper tract deterioration, numerous interventions are available for surgical management. The appropriate technique depends on multiple factors including prostate size, anesthetic risk, need for uninterrupted anticoagulation, the presence of concomitant disease (ie, bladder stones or diverticula), available technology, and surgeon experience.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.suc.2016.02.006>.

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