

# Common Questions About the Diagnosis and Management of Benign Prostatic Hyperplasia

RYAN PEARSON, MD, *Kaiser Permanente, Folsom, California*

PAMELA M. WILLIAMS, MD, *Mike O'Callaghan Federal Medical Center, Nellis Air Force Base, Nevada*

Benign prostatic hyperplasia (BPH) is a common condition that increases in prevalence with age. A history should include onset, duration, and severity of lower urinary tract symptoms and medication use to rule out other causes of symptoms. Physical examination includes a digital rectal examination and assessment for bladder distention or neurologic impairment. Recommended tests include serum prostate-specific antigen measurement and urinalysis to help identify infection, genitourinary cancer, or calculi as an alternative cause of lower urinary tract symptoms. BPH severity is assessed using validated, self-administered symptom questionnaires such as the American Urological Association Symptom Index or International Prostate Symptom Score. Mild or nonbothersome symptoms do not require treatment. Bothersome symptoms are managed with lifestyle modifications, medications, and surgery. Alpha blockers are first-line medications for BPH. Surgical referral is indicated if BPH-related complications develop, medical therapy fails, or the patient chooses it. Dietary supplements, such as saw palmetto, pygeum, cernilton, and beta sitosterols, and acupuncture are not recommended for the management of BPH. (*Am Fam Physician*. 2014;90(11):769-774. Copyright © 2014 American Academy of Family Physicians.)



More online at  
<http://www.aafp.org/afp>.

**CME** This clinical content conforms to AAFP criteria for continuing medical education (CME). See CME Quiz Questions on page 760.

Author disclosure: No relevant financial affiliations.

► **Patient information:** A handout on this topic is available at <http://familydoctor.org/familydoctor/en/diseases-conditions/benign-prostatic-hyperplasia.html>.

The prevalence of benign prostatic hyperplasia (BPH) increases with age.<sup>1</sup> BPH can present as lower urinary tract symptoms such as incomplete emptying, frequency, intermittency, urgency, weak stream, straining, or nocturia. The physician must determine if the symptoms are secondary to BPH or other causes and provide appropriate treatment. This article provides evidence-based answers to common questions about the diagnosis and management of BPH.

## What Should Be Included in the History and Physical Examination in Men with Symptoms Suggesting BPH?

*Onset, duration, and severity of lower urinary tract symptoms, along with additional history to rule out other causes of symptoms, should be determined. Physical examination should include a digital rectal examination and assessment for bladder distention or neurologic impairment.*

### EVIDENCE SUMMARY

The initial history and physical examination focus on excluding etiologies of lower urinary tract infections other than BPH (*Table 1*).<sup>1-5</sup> In addition to onset and duration of symptoms,

any history of fever, dysuria, gross hematuria, pain suggestive of stones, or previous urethral instrumentation should be obtained. Identification of medication use is helpful because medications account for 10% of lower urinary tract symptoms in men.<sup>4</sup> Other key information includes history of diabetes mellitus, tobacco use, intake of bladder irritants (e.g., caffeine), sexual dysfunction, or conditions resulting in neurologic impairment (e.g., neurogenic bladder), and a personal or family history of prostate or bladder cancer.<sup>2,5</sup> Assessing overall health can guide eligibility for future medical and surgical interventions.<sup>2</sup>

The physical examination should include a digital rectal examination assessing prostate size, nodularity, and asymmetry, which may raise suspicion for malignancy.<sup>2</sup> A digital rectal examination is recommended by the American Urological Association (AUA) despite limitations such as interexaminer variability, low sensitivity (59%), and low positive predictive value (28%) for detecting prostate cancer.<sup>2,6,7</sup> The physician should assess for bladder distention, motor and sensory deficits of the lower extremities and perineum, and decreased anal sphincter tone to identify neurogenic bladder as a cause of lower urinary tract symptoms independent of BPH.<sup>3</sup>

**SORT: KEY RECOMMENDATIONS FOR PRACTICE**

Clinical recommendation	Evidence rating	References
Physicians should obtain a history and perform a physical examination, including digital rectal examination and assessment for bladder distention and neurologic impairment, to rule out causes of lower urinary tract symptoms independent of BPH.	C	2, 3
Recommended tests for men with symptoms of BPH include serum prostate-specific antigen and urinalysis.	C	2, 3, 11
Alpha blockers are effective first-line treatments for patients with bothersome, moderate to severe BPH symptoms.	A	2, 15, 19
The addition of a 5-alpha reductase inhibitor is effective in men with bothersome, moderate to severe BPH symptoms and a documented enlarged prostate when alpha-blocker monotherapy is not effective.	A	2, 9, 23, 26, 27
Complementary and alternative treatments (e.g., saw palmetto) are not recommended for the management of BPH.	B	2, 29-33

BPH = benign prostatic hyperplasia.

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/afpsort>.

**How Is BPH Severity Quantified?**

BPH severity is quantified using a validated, self-administered symptom questionnaire such as the AUA Symptom Index (AUA-SI) or International Prostate Symptom Score (I-PSS).

**EVIDENCE SUMMARY**

Assessing BPH severity is important because it guides management decisions. The AUA-SI (Figure 1) has been validated as a clinical tool and may be used throughout management.<sup>8</sup> BPH severity is quantified as mild (AUA-SI score of 0 to 7), moderate (8 to 19), and severe (20 to 35). A three- or four-point improvement in AUA-SI score is clinically significant.<sup>2,9</sup> The I-PSS is identical to the AUA-SI but asks one more question regarding impact of symptoms on quality of life, which can help guide management.<sup>10</sup>

**What Tests Are Recommended in Men with Symptoms Suggesting BPH?**

Recommended tests are serum prostate-specific antigen (PSA) measurement and urinalysis. Optional tests include postvoid residual urine measurement if history and physical examination findings suggest urinary retention, and use of a frequency volume chart if nocturia is the predominant symptom. Pressure flow studies, ultrasonography of the prostate or upper urinary tract, endoscopy of the lower urinary tract, and serum creatinine measurement are not recommended.

**EVIDENCE SUMMARY**

The purpose of laboratory or radiologic testing is to identify alternative causes of symptoms (Table 1).<sup>1-5</sup> A urinalysis is recommended in all men with lower urinary tract

symptoms.<sup>2,3,11</sup> Additional workup and treatment should be pursued if hematuria, proteinuria, or evidence of urinary tract infection is found. The AUA recommends a serum PSA measurement in men with lower urinary tract symptoms and a life expectancy greater than 10 years.<sup>2</sup> BPH is not an established risk factor for prostate cancer; the risk of prostate cancer is lower in men with lower urinary tract symptoms and an elevated PSA level than in those without symptoms.<sup>12</sup> The decision to order a PSA measurement should be individualized after discussing with the patient the risks of false-positive and false-negative results, as well as the possible need for biopsy.<sup>2,12</sup>

Postvoid residual urine measurement using a bladder scanner (normal residual urine is less than 100 mL) should be performed if history and physical examination

**Table 1. Differential Diagnosis of Lower Urinary Tract Symptoms in Men**

Benign prostatic hyperplasia	Neurogenic bladder
Bladder calculi	Obstructive sleep apnea (nocturia)
Bladder cancer	Overactive bladder
Bladder irritants (e.g., caffeine)	Polyuria (isolated nocturnal, 24-hour polyuria)
Diabetes mellitus	Prostate cancer
Medication use	Prostatitis
Anticholinergics (incomplete emptying)	Urethral or bladder neck strictures
Antidepressants, such as tricyclics (frequency, incomplete emptying)	Urethritis/sexually transmitted infections
Antihistamines (incomplete emptying)	Urinary tract infection
Bronchodilators (straining)	
Diuretics (frequency)	
Opioid analgesics (incomplete emptying)	
Sympathomimetics (straining, incomplete emptying)	

Information from references 1 through 5.

## American Urological Association Symptom Index

Over the past month or so:	Not at all	Less than 1 in 5 times	Less than one-half of the time	About one-half of the time	More than one-half of the time	Almost always
How often have you had the sensation of not completely emptying your bladder after you finished urinating?	0	1	2	3	4	5
How often have you had to urinate again less than 2 hours after you finished urinating?	0	1	2	3	4	5
How often have you found that you stopped and started again when urinating?	0	1	2	3	4	5
How often have you found it difficult to postpone urination?	0	1	2	3	4	5
How often have you had a weak urinary stream?	0	1	2	3	4	5
How often have you had to push or strain to begin urination?	0	1	2	3	4	5
	<i>None</i>	<i>1 time</i>	<i>2 times</i>	<i>3 times</i>	<i>4 times</i>	<i>5 times</i>
How many times do you typically get up to urinate from the time you go to bed at night until the time you get up in the morning?	0	1	2	3	4	5
<b>Total score:</b> _____						

**Figure 1.** American Urological Association Symptom Index to assess severity of benign prostatic hyperplasia (BPH). A score of 0 to 7 indicates mild BPH, 8 to 19 moderate BPH, and 20 to 35 severe BPH.

Adapted with permission from Barry MJ, Fowler FJ Jr, O'Leary MP, et al.; The Measurement Committee of the American Urological Association. The American Urological Association symptom index for benign prostatic hyperplasia. *J Urol.* 1992;148(5):1555.

suggest urinary retention.<sup>2,3,13</sup> If significant nocturia is the main symptom, consider using a frequency volume chart that documents date/time, fluid intake, and urine voided (*eFigure A*) or a sleep study to find alternative causes, such as isolated nocturnal polyuria (more than 33% of urine output at night), 24-hour polyuria (3 L or more of urinary output in 24 hours), or sleep apnea.<sup>2,3</sup>

Pressure flow studies, ultrasonography of the prostate or upper urinary tract, and endoscopy of the lower urinary tract are not recommended in the routine evaluation of lower urinary tract symptoms.<sup>2,3</sup> Serum creatinine measurement is not indicated because the incidence of baseline renal insufficiency in men with BPH is similar to that in the general population.<sup>2,9</sup>

### How Should BPH Severity Guide Management?

*Mild symptoms (AUA-SI score of 0 to 7) as well as nonbothersome moderate (8 to 19) to severe (20 to 35) symptoms require no treatment. Individuals bothered by moderate to severe lower urinary tract symptoms can be treated with lifestyle modifications, medications, and surgery.*

#### EVIDENCE SUMMARY

Most men with BPH and symptoms that do not impact quality of life are unlikely to experience future complications.<sup>2,9,14</sup> As a result, men presenting with mild symptoms or nonbothersome moderate to severe symptoms do not require further treatment.<sup>2,14</sup> In the Medical Therapy of Prostatic Symptoms Study, the placebo arm (n = 737) demonstrated BPH progression (i.e., four-point increase in AUA-SI score, acute urinary retention, renal insufficiency, recurrent urinary tract infection,

or urinary incontinence) at a rate of 4.5 events per 100 person-years.<sup>9</sup>

Men presenting with bothersome, moderate to severe BPH symptoms may be treated with lifestyle modifications, medications, or surgery (*Table 2*).<sup>2,3,5,14-22</sup> Regardless of symptom severity score, complicated lower urinary

**Table 2. Treatment Options for Bothersome, Moderate to Severe Benign Prostatic Hyperplasia**

#### Lifestyle modifications

- Losing weight
- Decreasing evening fluid intake
- Avoiding excess alcohol, caffeine, or highly seasoned foods
- Limiting medications known to cause lower urinary tract symptoms

#### Medications

- Alpha blockers
- 5-alpha reductase inhibitors
- Anticholinergic agents

#### Surgery

- Photoselective vaporization of the prostate
- Transurethral incision of the prostate
- Transurethral laser prostatectomy (holmium:yttrium-aluminum-garnet [YAG] laser ablation, enucleation, or resection of the prostate)
- Transurethral microwave thermotherapy
- Transurethral needle ablation of the prostate
- Transurethral resection of the prostate
- Transurethral vaporization of the prostate

Information from references 2, 3, 5, and 14 through 22.

**Table 3. Medical Therapies for Benign Prostatic Hyperplasia**

Medication	Daily dosage	Cost*	Adverse effects	Comments
<b>Nonselective alpha blockers</b>				
Doxazosin (Cardura)	1 mg; titrate to maximum of 8 mg daily	\$20 (\$80)	Orthostatic hypotension	Requires blood pressure monitoring and dose titration; less expensive
Terazosin	1 mg; titrate to maximum of 20 mg daily	\$10 (NA)		
<b>Selective alpha blockers</b>				
Alfuzosin (Uroxatral)	10 mg	\$20 (\$400)	—	Low risk of hypotension; no blood pressure monitoring or dose titration
Silodosin (Rapaflo)	8 mg	NA (\$170)	Retrograde ejaculation	
Tamsulosin (Flomax)	0.4 mg; titrate to maximum of 0.8 mg daily	\$30 (\$190)	Decreased ejaculation; highest risk of intraoperative floppy iris syndrome	
<b>5-alpha reductase inhibitors</b>				
Dutasteride (Avodart)	0.5 mg	NA (\$155)	Ejaculation disorder, decreased libido, erectile dysfunction	No dose titration; three to six months to take effect; decreases prostate-specific antigen by 50%; combination therapy with an alpha blocker recommended in patients with an enlarged prostate
Finasteride (Proscar)	5 mg	\$10 (\$135)		
<b>Anticholinergic agents†</b>				
Fesoterodine (Toviaz)	4 to 8 mg	NA (\$210)	Dry mouth and eyes, constipation	Assess postvoid residual urine before starting; for patients with predominantly irritative symptoms
Oxybutynin extended release (Ditropan XL)	10 mg	\$40 (\$175)		
Solifenacin (Vesicare)	5 mg	NA (\$240)		
Tolterodine extended release (Detrol LA)	4 mg	\$150 (\$265)		

NA = not available.

\*—Estimated retail price for one month's therapy based on information obtained at <http://www.goodrx.com> (accessed August 1, 2014). Generic price listed first; brand price listed in parentheses.

†—Additional anticholinergic agents are available; medications listed are those included in the evidence summary.

Information from references 2, 3, 15, 19, 20, 23, and 24.

tract symptoms (suspicious digital rectal examination findings, hematuria, abnormal PSA findings, recurrent infection, distended bladder, or neurologic disease) should prompt a referral to urology before treatment is initiated.<sup>2</sup>

### Which Medical Therapies Are Effective in the Management of BPH?

*Alpha blockers are effective for bothersome, moderate to severe BPH and are recommended in men not undergoing planned cataract surgery. The combination of alpha blockers and 5-alpha reductase inhibitors is effective for long-term management of BPH and demonstrated large prostates. Anticholinergic agents can benefit selected patients with predominantly irritative lower urinary tract symptoms and a normal postvoid residual urine measurement.*

#### EVIDENCE SUMMARY

**Alpha Blockers.** Alpha blockers antagonize alpha<sub>1</sub>-receptors in the prostatic urethra and bladder neck,

resulting in smooth muscle relaxation and improvement of lower urinary tract symptoms, typically within two to four weeks after initiation.<sup>2</sup> The AUA recommends the alpha blockers alfuzosin (Uroxatral), doxazosin (Cardura), tamsulosin (Flomax), and terazosin as first-line treatments for men with BPH and bothersome, moderate to severe symptoms.<sup>2</sup> A meta-analysis of 21 studies (n = 6,333) comparing these four alpha blockers with placebo demonstrated 30% to 45% improvement in symptom scores over one month to one year; the alpha blockers were equally effective.<sup>15</sup> Silodosin (Rapaflo) is another alpha blocker with demonstrated effectiveness in BPH management.<sup>19</sup> The evidence for phenoxybenzamine (Dibenzylin) and prazosin (Mini-press) is insufficient, and these medications are not recommended.<sup>2</sup>

Adverse effect profiles vary among selective and non-selective alpha blockers (*Table 3*).<sup>2,3,15,19,20,23,24</sup> The AUA recommends avoidance of all alpha blockers in men with

**BEST PRACTICES IN UROLOGY: RECOMMENDATIONS FROM THE CHOOSING WISELY CAMPAIGN**

<i>Recommendation</i>	<i>Sponsoring organization</i>
Do not order creatinine or upper-tract imaging for patients with benign prostatic hyperplasia.	American Urological Association

SOURCE: For more information on the Choosing Wisely Campaign, see <http://www.aafp.org/afp/choosingwisely>. For supporting citations and to search Choosing Wisely recommendations relevant to primary care, see <http://www.aafp.org/afp/recommendations/search.htm>.

planned cataract surgery because of the risk of intraoperative floppy iris syndrome.<sup>2,20</sup> It is unclear if the dose, duration of therapy, or stopping the alpha blocker lowers this risk.

**5-Alpha Reductase Inhibitors.** Dutasteride (Avodart) and finasteride (Proscar) block the conversion of testosterone to dihydrotestosterone, resulting in a gradual decrease in prostatic volume. The AUA recommends combination therapy with a 5-alpha reductase inhibitor and alpha blocker when alpha-blocker monotherapy is not effective and the patient has an enlarged prostate based on digital rectal examination findings, volume measurement, or serum PSA level as proxy for volume measurement (1.5 ng per mL [1.5 mcg per L] or more).<sup>2</sup> Dutasteride and finasteride are equally effective and decrease the risk of BPH progression (urinary retention or prostate surgery).<sup>2,9,23,25-27</sup> The use of 5-alpha reductase inhibitors decreases prostate size and decreases serum PSA levels by 50%, although it takes at least three to six months.<sup>2,23,25,28</sup> These changes must be considered when assessing for prostate cancer.

**Anticholinergic Agents.** Anticholinergic agents block the effects of acetylcholine on muscarinic receptors in the bladder, resulting in decreased bladder contractions. Anticholinergic agents, such as tolterodine (Detrol), can benefit selected patients with predominantly irritative lower urinary tract symptoms (frequency, urgency) and a normal postvoid residual urine measurement.<sup>2</sup> There is an increased risk of urinary retention with a postvoid residual urine measurement greater than 250 mL.<sup>2</sup> A meta-analysis of seven randomized controlled trials (RCTs; n = 3,629) comparing combination anticholinergic and alpha-blocker therapy with alpha-blocker monotherapy demonstrated greater reduction of I-PSS scores in the combination group. There was one additional episode of acute urinary retention for every 101 men treated in the combination group.<sup>24</sup>

### **Which Patients Should Be Referred for Surgery?**

*Patients with BPH and bothersome, moderate to severe lower urinary tract symptoms should be referred for surgical consultation if BPH-related complications develop, medical therapy fails, or the patient chooses it.*

#### **EVIDENCE SUMMARY**

The AUA recommends surgery if medical therapy fails or the patient develops BPH-related complications, such as bladder calculi, bladder decompensation (decreased detrusor contractions), hematuria (gross and microscopic), recurrent urinary tract infections, renal

insufficiency, and urinary retention.<sup>2,14</sup> Patients should be informed that surgery is an option for initial treatment; however, the benefits and risks compared with no treatment and medical therapy should also be reviewed.

Transurethral resection of the prostate (TURP) is the standard against which other surgical procedures are compared. Because of cost, morbidity, and the need for hospitalization, less invasive procedures have been developed. There are limited high-quality studies comparing these interventions. *eTable A* summarizes the surgical options. A TURP procedure is recommended for healthy men with low surgical risk who require surgery, whereas men who cannot tolerate general anesthesia should consider non-TURP surgical intervention.<sup>2</sup>

### **Is There a Role for Complementary and Alternative Therapies in BPH Management?**

*Dietary supplements (i.e., saw palmetto, pygeum, cernilton, or beta sitosterols) and acupuncture are not recommended for the treatment of BPH.*

#### **EVIDENCE SUMMARY**

A 2012 systematic review of 32 RCTs involving 5,666 men treated for four to 72 weeks demonstrated that saw palmetto did not reduce nocturia, peak urine flow, prostate size, or AUA-SI scores compared with placebo in men with BPH.<sup>29</sup>

Systematic reviews of pygeum, cernilton, and herbs containing beta sitosterols found that trials were limited by short duration, small sample size, and varied doses and preparations. There is no current evidence to support their use.<sup>2,30-32</sup>

A small single-blinded RCT of acupuncture for BPH found no difference in I-PSS scores after three months among the following treatment groups: observation, acupuncture of the kidney-bladder distinct meridian, or sham acupuncture.<sup>33</sup>

**Data Sources:** We searched Ovid Medline and Essential Evidence Plus using the key term prostatic hyperplasia. The search included meta-analyses, systematic reviews, core clinical journals, and evidence-based medicine topic reviews. Search dates: December 2013, January and October 2014.

The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the U.S. Air Force, the Department of Defense, or Kaiser Permanente.

## The Authors

RYAN PEARSON, MD, is a physician with Kaiser Permanente, Folsom, Calif. When this article was written, he was assistant program director at the David Grant Medical Center Family Medicine Residency Program, Travis Air Force Base, Calif.

PAMELA M. WILLIAMS, MD, is director of medical education at Mike O'Callaghan Federal Medical Center, Nellis Air Force Base, Nev. At the time this article was written, she was program director at the David Grant Medical Center Family Medicine Residency Program.

Address correspondence to Ryan Pearson, MD, 2155 Iron Point Rd., Folsom, CA 95630. Reprints are not available from the authors.

## REFERENCES

1. McVary KT. BPH: epidemiology and comorbidities. *Am J Manag Care*. 2006;12(5 suppl):S122-S128.
2. McVary KT, Roehrborn CG, Avins AL, et al. Update on AUA guideline on the management of benign prostatic hyperplasia. *J Urol*. 2011;185(5):1793-1803.
3. Abrams P, Chapple C, Khoury S, Roehrborn C, de la Rosette J; International Scientific Committee. Evaluation and treatment of lower urinary tract symptoms in older men. *J Urol*. 2009;181(4):1779-1787.
4. Wuerstle MC, Van Den Eeden SK, Poon KT, et al.; Urologic Diseases in America Project. Contribution of common medications to lower urinary tract symptoms in men. *Arch Intern Med*. 2011;171(18):1680-1682.
5. Maserejian NN, Wager CG, Giovannucci EL, Curto TM, McVary KT, McKinlay JB. Intake of caffeinated, carbonated, or citrus beverage types and development of lower urinary tract symptoms in men and women. *Am J Epidemiol*. 2013;177(12):1399-1410.
6. Smith DS, Catalona WJ. Interexaminer variability of digital rectal examination in detecting prostate cancer. *Urology*. 1995;45(1):70-74.
7. Hoogendam A, Buntinx F, de Vet HC. The diagnostic value of digital rectal examination in primary care screening for prostate cancer: a meta-analysis. *Fam Pract*. 1999;16(6):621-626.
8. Barry MJ, Fowler FJ Jr, O'Leary MP, et al.; The Measurement Committee of the American Urological Association. The American Urological Association symptom index for benign prostatic hyperplasia. *J Urol*. 1992;148(5):1549-1557.
9. McConnell JD, Roehrborn CG, Bautista OM, et al.; Medical Therapy of Prostatic Symptoms (MTOPS) Research Group. The long-term effect of doxazosin, finasteride, and combination therapy on the clinical progression of benign prostatic hyperplasia. *N Engl J Med*. 2003;349(25):2387-2398.
10. Wadie BS, Ibrahim EH, de la Rosette JJ, Gomha MA, Ghoneim MA. The relationship of the International Prostate Symptom Score and objective parameters for diagnosing bladder outlet obstruction. Part I: when statistics fail. *J Urol*. 2001;165(1):32-34.
11. Madersbacher S, Alivizatos G, Nordling J, Sanz CR, Emberton M, de la Rosette JJ. EAU 2004 guidelines on assessment, therapy and follow-up of men with lower urinary tract symptoms suggestive of benign prostatic obstruction (BPH guidelines). *Eur Urol*. 2004;46(5):547-554.
12. U.S. Preventive Services Task Force. Screening for prostate cancer. May 2012. <http://www.uspreventiveservicestaskforce.org/prostatecancerscreening/prostatefinalrs.htm>. Accessed June 9, 2014.
13. Sarma AV, Wei JT. Clinical practice. Benign prostatic hyperplasia and lower urinary tract symptoms [published correction appears in *N Engl J Med*. 2012;367(7):681]. *N Engl J Med*. 2012;367(3):248-257.
14. Wasson JH, Reda DJ, Bruskewitz RC, Elinson J, Keller AM, Henderson WG. A comparison of transurethral surgery with watchful waiting for moderate symptoms of benign prostatic hyperplasia. *N Engl J Med*. 1995;332(2):75-79.
15. Djavan B, Marberger M. A meta-analysis on the efficacy and tolerability of alpha1-adrenoceptor antagonists in patients with lower urinary tract symptoms suggestive of benign prostatic obstruction. *Eur Urol*. 1999;36(1):1-13.
16. Hill B, Belleville W, Bruskewitz R, et al. Transurethral needle ablation versus transurethral resection of the prostate for the treatment of symptomatic benign prostatic hyperplasia. *J Urol*. 2004;171(6 pt 1):2336-2340.
17. Bouchier-Hayes DM, Anderson P, Van Appledorn S, et al. KTP laser versus transurethral resection. *J Endourol*. 2006;20(8):580-585.
18. Lourenco T, Shaw M, Fraser C, MacLennan G, N'Dow J, Pickard R. The clinical effectiveness of transurethral incision of the prostate. *World J Urol*. 2010;28(1):23-32.
19. Ding H, Du W, Hou ZZ, Wang HZ, Wang ZP. Silodosin is effective for treatment of LUTS in men with BPH: a systematic review. *Asian J Androl*. 2013;15(1):121-128.
20. Bell CM, Hatch WV, Fischer HD, et al. Association between tamsulosin and serious ophthalmic adverse events in older men following cataract surgery. *JAMA*. 2009;301(19):1991-1996.
21. Hoffman RM, MacDonald R, Wilt TJ. Laser prostatectomy for benign prostatic obstruction. *Cochrane Database Syst Rev*. 2004;(1):CD001987.
22. Hoffman RM, Monga M, Elliott SP, et al. Microwave thermotherapy for benign prostatic hyperplasia. *Cochrane Database Syst Rev*. 2012;(9):CD004135.
23. Tacklind J, Fink HA, Macdonald R, Rutks I, Wilt TJ. Finasteride for benign prostatic hyperplasia. *Cochrane Database Syst Rev*. 2010;(10):CD006015.
24. Filson CP, Hollingsworth JM, Clemens JQ, Wei JT. The efficacy and safety of combined therapy with  $\alpha$ -blockers and anticholinergics for men with benign prostatic hyperplasia: a meta-analysis. *J Urol*. 2013;190(6):2153-2160.
25. Nickel JC, Gilling P, Tammela TL, Morrill B, Wilson TH, Rittmaster RS. Comparison of dutasteride and finasteride for treating benign prostatic hyperplasia: the Enlarged Prostate International Comparator Study (EPICS). *BJU Int*. 2011;108(3):388-394.
26. Roehrborn CG, Siami P, Barkin J, et al.; CombAT Study Group. The effects of dutasteride, tamsulosin and combination therapy on lower urinary tract symptoms in men with benign prostatic hyperplasia and prostatic enlargement: 2-year results from the CombAT study [published correction appears in *J Urol*. 2008;180(3):1191]. *J Urol*. 2008;179(2):616-621.
27. Roehrborn CG, Barkin J, Siami P, et al. Clinical outcomes after combined therapy with dutasteride plus tamsulosin or either monotherapy in men with benign prostatic hyperplasia (BPH) by baseline characteristics: 4-year results from the randomized, double-blind Combination of Avodart and Tamsulosin (CombAT) trial. *BJU Int*. 2011;107(6):946-954.
28. Gormley GJ, Stoner E, Bruskewitz RC, et al.; The Finasteride Study Group. The effect of finasteride in men with benign prostatic hyperplasia. *N Engl J Med*. 1992;327(17):1185-1191.
29. Tacklind J, Macdonald R, Rutks I, Stanke JU, Wilt TJ. Serenoa repens for benign prostatic hyperplasia. *Cochrane Database Syst Rev*. 2012;(12):CD001423.
30. Wilt T, Ishani A, Mac Donald R, Rutks I, Stark G. Pygeum africanum for benign prostatic hyperplasia. *Cochrane Database Syst Rev*. 2002;(1):CD001044.
31. Wilt TJ, Macdonald R, Ishani A, Rutks I, Stark G. Cernilton for benign prostatic hyperplasia. *Cochrane Database Syst Rev*. 2000;(2):CD001042.
32. Wilt T, Ishani A, MacDonald R, Stark G, Mulrow C, Lau J. Beta-sitosterols for benign prostatic hyperplasia. *Cochrane Database Syst Rev*. 2000;(2):CD001043.
33. Johnstone PA, Bloom TL, Niemtzwow RC, Crain D, Riffenburgh RH, Amling CL. A prospective, randomized pilot trial of acupuncture of the kidney-bladder distinct meridian for lower urinary tract symptoms. *J Urol*. 2003;169(3):1037-1039.



**eTable A. Surgical Therapies for the Treatment of Benign Prostatic Hyperplasia**

Procedure	Description	Evidence summary	Pros	Cons
Photoselective vaporization of the prostate	A high-power potassium titanyl phosphate (KTP) laser vaporizes prostate tissue	A small RCT (n = 120) comparing photoselective vaporization with TURP found similar decreases in symptom scores over 12 months	Outpatient procedure Shorter catheterization time Good for patients on anticoagulation or for nonsurgical candidates Less bleeding	Slower and less prostatic tissue removed than with TURP Lack of large, high-quality studies with long-term outcomes
Transurethral incision of the prostate	Small cuts are made in the prostate to reduce urethral constriction for men with prostate size < 30 mL	A meta analysis of 10 low- to moderate-quality RCTs involving 795 patients and comparing transurethral incision with TURP found a similar decrease in symptom scores	Outpatient procedure Less blood loss and shorter hospital stay than with TURP Reduced ejaculatory problems	Higher rate of repeat procedure compared with TURP Lack of large, high-quality studies with long-term outcomes
Transurethral laser prostatectomy	A holmium:yttrium-aluminum-garnet (YAG) laser destroys enlarged prostatic tissue via ablation, enucleation, or resection of the prostate	A systematic review of 20 studies involving 1,898 men and comparing various laser techniques with TURP showed no difference in symptom scores over 6 to 36 months; limited data on preferred laser technique	Lower risk of transurethral resection syndrome (hyponatremia from absorption of hypotonic irrigation into bloodstream) Shorter catheterization time and length of hospital stay Fewer blood transfusions compared with TURP	Inpatient procedure Dependent on surgeon's level of experience Higher risk of dysuria, urinary tract infection, retention, and repeat procedure compared with TURP Lack of large, high-quality studies with long-term outcomes
Transurethral microwave thermotherapy	A device delivers heat transurethrally to destroy prostatic tissue	A systematic review of 6 RCTs (n = 540) comparing transurethral microwave thermotherapy with TURP showed a slightly larger decrease in symptom scores with TURP (77% vs. 65%), with a mean weighted difference of -1.00 (95% confidence interval, -2.01 to -0.03)	Outpatient procedure Lower risk of retrograde ejaculation, strictures, hematuria, blood transfusions, and transurethral resection syndrome compared with TURP	High retreatment rate Increased dysuria, and urinary retention compared with TURP Lack of large, high-quality studies with long-term outcomes
Transurethral needle ablation of the prostate	A needle delivers radio frequency energy to ablate the prostate	An RCT of 121 men comparing transurethral needle ablation (n = 65) with TURP (n = 56) found similar symptom scores (10.7 to 10.8; <i>P</i> = .98), but a higher retreatment rate in the transurethral needle ablation group (14% to 2%) after 5 years	Outpatient procedure Good for patients on anticoagulation or for nonsurgical candidates Fewer adverse effects than TURP	High retreatment rate Lack of large, high-quality studies with long-term outcomes
Transurethral vaporization of the prostate	A rollerball electrode vaporizes prostate tissue	Transurethral vaporization demonstrates similar improvement of symptom scores and urinary flow rates compared with TURP	Lower risk of transurethral resection syndrome	Higher risk of postoperative dysuria, retention, and need for repeat procedures compared with TURP Lack of large, high-quality studies with long-term outcomes
TURP	A resectoscope loop introduced into the bladder surgically removes prostate tissue	An RCT of 556 men comparing TURP (n = 280) with watchful waiting (n = 276) found surgery was more effective at decreasing symptom scores (9.6 to 5.5; <i>P</i> < .001) and increasing peak urinary flow rates (6.3 to 0.4 mL per second; <i>P</i> < .001) after 3 years	Robust data with proven long-term outcomes	Inpatient procedure Higher cost Longer hospital stay 5% risk of complications such as erectile dysfunction, irritative voiding, bladder neck contracture, blood transfusion, urinary tract infection, or hematuria Risk of transurethral resection syndrome

RCT = randomized controlled trial; TURP = transurethral resection of the prostate.

Information from:

McVary KT, Roehrborn CG, Avins AL, et al. Update on AUA guideline on the management of benign prostatic hyperplasia. *J Urol.* 2011; 185(5):1793-1803.

Wasson JH, Reda DJ, Bruskewitz RC, Elinson J, Keller AM, Henderson WG; The Veterans Affairs Cooperative Study Group on Transurethral Resection of the Prostate. A comparison of transurethral surgery with watchful waiting for moderate symptoms of benign prostatic hyperplasia. *N Engl J Med.* 1995;332(2):75-79.

Hill B, Belville W, Bruskewitz R, et al. Transurethral needle ablation versus transurethral resection of the prostate for the treatment of symptomatic benign prostatic hyperplasia: 5-year results of a prospective, randomized, multicenter clinical trial. *J Urol.* 2004;171(6 pt 1):2336-2340.

Bouchier-Hayes DM, Anderson P, Van Appledorn S, Bugeja P, Costello AJ. KTP laser versus transurethral resection: early results of a randomized trial. *J Endourol.* 2006;20(8):580-585.

Lourenco T, Shaw M, Fraser C, MacLennan G, N'Dow J, Pickard R. The clinical effectiveness of transurethral incision of the prostate: a systematic review of randomised controlled trials. *World J Urol.* 2010;28(1):23-32.

Hoffman RM, MacDonald R, Wilt TJ. Laser prostatectomy for benign prostatic obstruction. *Cochrane Database Syst Rev.* 2004;(1):CD001987.

Hoffman RM, Monga M, Elliott SP, et al. Microwave thermotherapy for benign prostatic hyperplasia. *Cochrane Database Syst Rev.* 2012;(9):CD004135.