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Surgical and other invasive therapies of benign prostatic hyperplasia

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Disclosures

All topics are updated as new evidence becomes available and our peer review process is complete.
Literature review current through: Jan 2012. | **This topic last updated:** Oct 6, 2010.

INTRODUCTION — Benign prostatic hyperplasia (BPH) becomes increasingly common as men age. BPH can lead to urinary symptoms that may benefit from medical or surgical treatment. However, many men with BPH are asymptomatic or have only mild symptoms, and may not require therapy.

The surgical and other invasive therapies of BPH will be reviewed here. Medical therapy, the clinical manifestations, natural history, and diagnosis of BPH, and the epidemiology and pathogenesis of BPH are all discussed separately. (See "Medical treatment of benign prostatic hyperplasia" and "Clinical manifestations and diagnosis of benign prostatic hyperplasia" and "Epidemiology and pathogenesis of benign prostatic hyperplasia".)

Transurethral resection of the prostate (TURP) has been the major treatment for men with BPH for many years, and it remains the standard against which other treatments should be compared. The costs, morbidity, and to a lesser degree the mortality rates associated with this procedure, along with the high prevalence of the disorder, have encouraged development of not only medical but also less invasive surgical treatment.

DEFINITIONS — A number of different terms and abbreviations are used when discussing symptomatic BPH. These include:

- Lower urinary tract symptoms (LUTS)
- Benign prostatic enlargement (BPE)
- Benign prostatic obstruction (BPO)
- Bladder outlet obstruction (BOO)

BPE is the physical enlargement of the prostate that occurs as the result of the histologic changes of BPH. BPO is BOO in the setting of BPE.

BPE and BOO secondary to BPH are frequently diagnosed clinically on the basis of LUTS. We will use the abbreviation BPH/LUTS for LUTS presumed to be secondary to BPH, sometimes called symptomatic BPH.

INDICATIONS FOR THERAPY — The common symptoms of BPH are increased frequency of urination, nocturia, hesitancy, urgency, and weak urinary stream. These symptoms typically appear slowly and progress gradually over a period of years. (See "Clinical manifestations and diagnosis of benign prostatic hyperplasia" and "Clinical manifestations and diagnosis of benign prostatic hyperplasia", section on 'Natural history'.)

In general, these symptoms only require therapy if they have a significant impact on a patient's quality of life [1]. Even without therapy, many men will experience stabilization or improvement in symptoms over time [2,3]. One review found that over a follow-up period of 2.6 to 5 years, 16 percent of men had stable symptoms and 38 percent improved [4]. Thus, the decision to treat BPH/LUTS involves balancing the severity of the patient's symptoms with potential side effects of

therapy. Many men with BPH/LUTS will be able to be managed with medical therapy. (See "Medical treatment of benign prostatic hyperplasia".)

BPH may also require therapy if BOO is creating a risk for upper tract injury such as hydronephrosis or renal insufficiency, or lower tract injury such as urinary retention, recurrent infection, or bladder decompensation (eg, low pressure detrusor contractions; post-void residuals of >25 percent of total bladder volume) [1]. In general, patients who develop these symptoms will require invasive therapy, as will patients with bladder calculi or persistent gross hematuria [3].

Antimicrobial prophylaxis — Antimicrobial prophylaxis is generally given for transurethral resection of the prostate and other genitourinary procedures. The data and regimens are discussed separately. (See "Overview of control measures to prevent surgical site infection", section on 'Genitourinary surgery'.)

SURGICAL PROCEDURES — Data on long-term outcomes are limited for most procedures other than transurethral resection of the prostate (TURP), and there are also a limited number of high quality trials comparing TURP, different minimally invasive procedures, and non-TURP surgical procedures. The choice of procedure is based upon patient values and medical risk.

Transurethral resection of the prostate — A TURP can be performed with a regional block under or general anesthesia. The procedure takes 60 to 90 minutes and generally requires a 24 hour observation period in the hospital.

A resectoscope loaded with a diathermy loop is introduced into the bladder (figure 1). Under direct vision, strips of prostatic adenoma are resected one at a time and dropped into the bladder. This is continued until the entire adenoma is resected. At the end of the operation, the prostate chips are evacuated from the bladder and hemostasis achieved with electrocautery.

The prostatic fossa is left with a wide open, bound by its capsule (figure 2). The cavity will be lined by a regenerated epithelial surface in 6 to 12 weeks. Until the fossa is completely epithelialized, the patient is vulnerable to bleeding; the patient should avoid straining for at least six weeks.

Efficacy and safety — TURP has been the mainstay of therapy for men with BPH for many years. Most men who undergo this operation experience a marked decrease in symptom scores (table 1) and a substantial increase in maximal urinary flow rates [5-7].

However, indications for this operation have varied widely, and complications are common. These facts led the Veterans Administration to conduct a study comparing no therapy (watchful waiting) and TURP in 556 men with moderate symptoms [5]. Of the 280 men assigned to surgery, 249 underwent the operation within two weeks. The average follow-up was 2.8 years.

The main results of this important study were:

- The symptom score decreased from 14.6 to 4.9 in the surgery group and from 14.6 to 9.1 in the watchful-waiting group. The latter finding suggests that men gradually adapt to the symptoms.
- Surgery resulted in a decrease in residual urine volume (60 mL versus 41 mL decrease with watchful waiting) and an increase in maximal urinary flow rate (6 mL/sec versus 0.4 mL/sec).
- The primary outcome of treatment failure (death, repeated or intractable urinary retention, residual urinary volume over 350 mL, the development of bladder calculus, new and persistent incontinence, a high symptom score, or a doubling of the serum creatinine concentration) occurred less frequently in the surgery group (8 versus 17 percent). Only 24 percent of men treated with watchful waiting underwent surgery during the follow-up period, although by the end of five years of follow-up 36 percent had undergone surgery [8]. There were 13 deaths in the surgery group and 10 in the watchful-waiting group.
- There were no deaths associated with TURP, but 9 percent of the men had complications within the first 30 days. These included the need for recatheterization (4 percent), perforation of the

prostatic capsule (2 percent), hemorrhage requiring transfusion (1 percent), urinary tract infection (1 percent) and thrombophlebitis (0.4 percent).

- Late postoperative complications included contracture of the bladder neck requiring surgery (4 percent), urethral stricture requiring dilation (4 percent), and obstruction requiring a second TURP (3 percent). Four men (2 percent) in each group had persistent incontinence. There was no difference between the groups in sexual performance. However, retrograde ejaculation occurs in most men who undergo TURP.

These results indicate that surgery is more effective than watchful waiting for men with moderate symptoms, but watchful waiting is a reasonable alternative.

Surgical safety appears to have improved over time. A comparison of surgical outcomes in the period from 2000 to 2005 with those from 1979 to 1994 found lower rates of transfusion (0.4 versus 7.1 percent), clot retention (2 versus 5 percent), urinary tract infection (1.7 versus 8.2 percent), urinary retention (3 versus 9 percent), and TUR syndrome (0 versus 1.1 percent) [9]. TUR syndrome (postprostatectomy syndrome) refers to symptoms from rapid hyponatremia caused by absorption of irrigating fluid. (See "Hyponatremia following transurethral resection or hysteroscopy".)

Sexual dysfunction — In the study described above, sexual function was similar after surgery or watchful waiting [8]. However, in a second study in which men with BPH were randomly assigned to TURP, laser therapy, or watchful waiting, reduced ejaculation was common in the surgery and laser groups. On the other hand, erectile function and pain on ejaculation were both improved in the surgery group compared with the other two groups [10]. Similarly, a prospective study found worsening ejaculatory function after TURP, but trends toward improved erectile function and pain on ejaculation [11]. (See "Evaluation of male sexual dysfunction".)

Incidental prostate cancer — Prostate cancer is identified incidentally in about 5 percent of patients undergoing TURP for BPH [12]. Transrectal ultrasound-guided biopsy of the prostate should be performed three months after the TURP. The information from this biopsy will help determine whether the detected cancer is clinically significant and necessitates intervention or merits only continued monitoring. (See "Interpretation of prostate biopsy", section on 'Gleason score' and "Clinical presentation, diagnosis, and staging of prostate cancer".)

Laser prostatectomy — Several methods for laser prostatectomy have been developed, including ultrasound- and endoscopic-guided approaches [13-15]. A systematic review evaluated 20 randomized trials involving 1898 patients, including 18 comparing TURP with contact lasers, noncontact lasers, and hybrid techniques [16]:

- The pooled percentage improvements for mean urinary symptoms ranged from 59 to 68 percent with laser treatments and from 63 to 77 percent with TURP.
- Improvements in mean peak urinary flow ranged from 56 to 119 percent with laser treatments and from 96 to 127 percent with TURP.
- Laser-treated subjects were less likely to require transfusions (less than 1 percent versus 7 percent) or develop strictures (4 versus 8 percent), and their hospitalizations were one to two days shorter.
- Reoperation occurred more often after laser procedures than TURP (5 versus 1 percent).

Data were too limited to come to conclusions about the preferred laser technique or to compare laser treatment with other minimally invasive procedures, but patients treated with noncontact laser prostatectomy were more likely to have dysuria than patients treated with TURP or contact laser prostatectomy.

In many centers, laser treatment of BPH has evolved from coagulation to enucleation with the holmium laser (HoLEP: holmium laser enucleation of the prostate). This instrument is not dependent

upon prostate size, and tissue can be preserved for histology [17]. A meta-analysis of four small randomized trials comparing TURP with HoLEP found significant heterogeneity across studies but concluded that peak flow rates were similar after either therapy and that TURP required less operating room time but resulted in more blood loss, longer catheterization times, and longer hospital stays [18].

PVP — Another laser technology using a high-power KTP (potassium titanyl phosphate) laser is gaining popularity in many centers including our own [19]. This technique relies on photoselective vaporization of prostatic tissue (PVP) and produces a defect in the prostate similar to a TURP.

PVP is slightly slower than a TURP, but the blood loss is significantly less. A small randomized trial found efficacy outcomes with PVP to be similar to those with TURP, and patients treated with PVP had shorter lengths of stay and length of catheterization [20].

PVP can be performed under local/regional anesthesia and can be performed as an outpatient procedure. However, we typically observe patients for one day after either TURP or PVP given that even with PVP there is still some risk for bleeding.

PVP is a particularly good option for the following two groups of patients who are not candidates for TURP:

- Patients who are anticoagulated
- Patients who cannot tolerate general anesthesia

The main disadvantage of PVP is that it takes more time than a TURP. Also, in many instances, less prostatic tissue is removed with PVP than with TURP such that we continue to prefer TURP to PVP in good risk patients with moderate to large prostates.

Transurethral incision of the prostate — Transurethral incision of the prostate refers to a procedure in which a longitudinal incision is made in the prostate gland widening the bladder neck and prostatic urethra without removal of any prostate tissue. The resectoscope is loaded with a diathermy knife and introduced into the bladder under direct vision. Usually, two deep incisions are made starting distal to each ureteral orifice and proceeding in a retrograde fashion through the bladder neck and the prostatic adenoma distally toward the verumontanum of the prostate. The incisions go down to, but not through, the capsule of the prostate. Bleeding is controlled with electrocautery.

TIP can be performed either under a short general anesthetic or with a regional block, and generally requires a 24 hour observation period in the hospital.

Transurethral incision of the prostate (TIP) may be recommended for men with bladder outlet obstruction who have relatively little prostate enlargement, especially those with complicating illnesses. One study involved 120 men with obstructive symptoms and estimated prostate weight below 20 g who were randomly assigned to therapy with transurethral incision or TURP and followed for an average of 34 months [21]. The improvement in symptoms and in maximal urinary flow rates was similar; 16 percent of the men in the TURP group and 23 percent of those in the incision group required additional therapy.

For men with mild to moderate BPH, a systematic review and metaanalysis of 10 randomized trials found that TUIP offered a similar level of symptomatic relief as measured by symptom scores but with a significantly lower risk for blood transfusion compared to TURP (relative risk [RR] 0.06, 95% CI 0.03-0.16). Reoperation rates were significantly higher with TUIP [22].

In another randomized study of men with small to medium-sized prostate glands who were followed for up to 60 months, urine flow rates were significantly higher in men who underwent TURP than TIP, and more men undergoing TIP required a second procedure [23].

Electrovaporization — Electrovaporization (TVP) refers to the process of vaporizing tissue with electrical energy. When used to remove prostatic tissue obstructing urine flow through the urethra, it

has the advantage of not causing sloughing of the tissue and is associated with less blood loss than TURP.

A meta-analysis of 20 randomized trials comparing TVP with TURP found similar improvements in maximum urinary flow rates and symptom scores [24]. Patients treated with TVP had lower transfusion requirements (0 versus 4 percent) and shorter length of stay (1.7 versus 3.4 days), but were at higher risk for urinary retention (8 versus 3 percent) and reoperation (5 versus 2 percent).

Open prostatectomy — Open prostatectomy accounts for less than five percent of operations for BPH in the United States [25], but it is performed more often in other countries [26]. It usually is offered only to those men who are good surgical candidates and in whom the prostate is estimated to weigh more than 50 g [27]. In some studies, open prostatectomy had lower complication and mortality rates than TURP [28], but the difference probably relates to patient selection for the procedures.

In a prospective study of 902 men in Germany who underwent open prostatectomy (mean prostate size 96 mL; baseline IPSS 20.7), the mortality rate was 0.7 percent and the complication rate was 17 percent with 7.5 percent requiring transfusion, 5.1 percent treatment for urinary tract infection, and 3.7 percent reoperation for severe bleeding [26]. Mean peak urine flow increased from 10.4 to 23.1 mL/sec, and post-void residual decreased from 145.1 to 17.5 mL.

A study comparing laparoscopic prostatectomy with historical controls who received open prostatectomy concluded that the procedures have similar efficacy but that the laparoscopic procedure required longer operating room time, but led to a shorter hospital stay and less blood loss [29].

A retrospective study analyzed outcomes in 421 men treated by TURP and 106 men treated by open prostatectomy after an average follow-up of 71 months [30]. The overall survival rates in the two groups were similar (77 and 78 percent, respectively).

MINIMALLY INVASIVE PROCEDURES — Transurethral needle ablation of the prostate (TUNA) and microwave thermotherapy are attractive because they are office procedures that do not require hospitalization or general/spinal anesthesia. The improvements in urodynamic and symptom score parameters are inferior to those with TURP, TVP, or laser prostatectomy. However, those more invasive procedures can still be performed subsequently if needed.

Transurethral needle ablation of the prostate — Transurethral needle ablation of the prostate (TUNA), a minimally invasive therapy performed under local anesthesia, has been shown to improve symptom scores and urinary flow rates [31,32].

A randomized trial compared TUNA with TURP in 121 men with BPH/LUTS [33]. Patients treated with TURP had a greater improvement in symptom scores for the first four years of the study, though symptom scores were similar in the fifth year. Peak urinary flow was higher and post-void residual volume was lower with TURP. However, patients treated with TUNA had fewer adverse events including retrograde ejaculation (0 versus 41 percent), erectile dysfunction (3 versus 21 percent), urinary incontinence (3 versus 21 percent), and urethral stricture (2 versus 7 percent). More patients treated with TUNA required retreatment (14 versus 2 percent). Similar results were seen in a meta-analysis that included both randomized and nonrandomized studies [34].

In a study of long-term outcomes (five years of follow-up) in 188 patients who underwent TUNA, clinical improvement was maintained in most patients, but approximately 25 percent required additional treatment (medical or surgical) [35].

TUNA is a good procedure for men with significant comorbid disease, particularly in patients requiring chronic anticoagulation. However, it is less efficacious than TURP and should not be used in patients on the verge of urinary retention or in patients with deteriorating renal function caused by obstructive uropathy.

Microwave thermotherapy — Microwave thermotherapy is another procedure that can be used to relieve symptoms in men with BPH. Hyperthermia refers to heating prostatic tissue to temperatures

below 45ºC (113ºF), while thermotherapy refers to heating to higher temperatures.

Microwave thermotherapy can be delivered either transurethrally (TUMT) or transrectally (TRMT) and is performed as a single outpatient visit requiring only local anesthesia and an oral analgesic.

Microwave thermotherapy has proven effective in improving symptom scores and urinary flow rates [36-39]. A systematic review of six randomized trials (n = 540) found a greater reduction in symptom scores with TURP than with TUMT (77 versus 65 percent) and a greater increase in peak urinary flow (119 versus 70 percent). Retrograde ejaculation was more common after TURP (58 versus 22 percent), as were transfusions (6 versus 0 percent) and retreatment for strictures (hazard ratio [HR] 9.8) [40]. Retreatment for BPH/LUTS was more common after microwave thermotherapy (HR 10.0).

This therapy has been associated with serious thermal injuries and related complications when not performed properly or in the right candidates [41].

Urethral stents — Urethral stents may provide safe and effective therapy for selected men, but long-term experience is limited. Insertion of a self-expandable metallic stent immediately increased peak urine flow rates to more than 8 mL/sec in 11 of 13 men with urinary obstruction, but bladder calculi formed in six men in whom the stent extended into the bladder during an average follow-up period of 37 months [42].

This procedure has been abandoned by most urologists. Exuberant granulation tissue growth through and around the stent causes secondary obstruction and difficulty in removing the stent, as well as other complications.

Botulinum toxin — Botulinum toxin appears to be effective for reducing symptoms associated with BPH, but it is not FDA-approved for this indication. It works by blocking acetylcholine release at the neuromuscular junction and in autonomic neurons. When injected into the rat prostate, it has been shown to induce selective denervation and subsequent atrophy of the gland [43].

The safety and efficacy of botulinum toxic was illustrated in a trial in which 30 elderly males with BPH were randomly assigned to transrectal ultrasound-guided transperineal injection of botulinum toxin A (200 U) or saline into the prostate [44]. The trial was limited to men who no longer responded to conventional medical treatment and had refused surgery. Compared to baseline values, botulinum injection significantly reduced the urinary symptom index, prostate volume, postvoid residual urine volume, and prostate specific antigen (PSA) levels (54, 42, 54, and 60 percent reductions, respectively); there were no significant reductions in the placebo group. The botulinum toxin group also had a significant increase in mean peak urinary flow rate compared to baseline values. These improvements persisted at 2, 6, and 12 months following the injection. No complications or side effects were reported in the follow-up period of 19 months [44].

A subsequent larger prospective study reported improvement in 55 of 77 patients with follow-up as long as 30 months [45]. Fourteen of the 22 patients who did not respond to the first injection were reinjected and showed improvement in subjective and objective urinary parameters. There were no adverse events.

Two National Institute of Health (NIH) sponsored randomized phase II clinical trials are currently recruiting patients to further validate this potential therapy.

ACUTE URINARY RETENTION — BPH is a common cause of acute urinary retention in older men. The incidence of acute urinary retention varies depending upon the population studied. In one report of more than 3000 men with BPH who were treated with either finasteride or placebo, the risk of needing surgery for BPH or developing acute urinary retention over four years ranged from 9 to 22 percent in the placebo group and 50 to 74 percent less in the finasteride-treated group [46]. The baseline serum PSA concentration and prostate volume were the best predictors of the development of acute urinary retention.

Catheterization is the initial treatment for men who develop acute urinary retention. Subsequent treatment varies; some urologists consider surgery necessary in all men with urinary retention who

have had symptoms of BPH, while others allow a trial of observation.

Many men who are able to void successfully after removal of the catheter will eventually have a recurrent episode of urinary retention. In one study of 228 men, as an example, 56 percent had a recurrence within a week after the initial episode and 68 percent within a year [47]. Factors predictive of preserved voiding ability included a retained volume less than 500 mL, a known provocative event, and a maximum flow rate of more than 5 mL/min after the episode of retention.

Finasteride decreases the incidence of acute urinary retention in men with BPH (figure 3) [48], but does not reduce the recurrence rate in men who are able to void successfully after an initial episode. Preliminary data suggests that treatment with an alpha-adrenergic blocker may improve the ability to void after catheter removal [49].

The outcome is good in men who undergo prostatectomy after an episode of acute urinary retention, but the complication rate is higher than in men who undergo the procedure for urinary symptoms alone. This was illustrated in a study of 3966 men undergoing prostatectomy in the United Kingdom [50]. Men who underwent prostatectomy for acute urinary retention had an excess risk of death at 30 and 90 days after the procedure and an increased risk of perioperative complications compared with men who had surgery for urinary symptoms alone. Some, but not all of this excess risk could be explained by the older age, larger prostate size, and higher comorbidity in the urinary retention group.

SUMMARY AND RECOMMENDATIONS

- Benign prostatic hyperplasia (BPH) becomes increasingly common as men age. BPH can lead to urinary symptoms that may benefit from medical or surgical treatment. However, many men with BPH are asymptomatic or have only mild symptoms, and may not require therapy. Additionally, many men with symptoms will improve or stabilize without therapy or will be able to be managed with medical therapy. (See 'Introduction' above and "Medical treatment of benign prostatic hyperplasia".)

- In general, men who develop upper tract injury (eg, hydronephrosis, renal dysfunction), or lower tract injury (eg, urinary retention, recurrent infection, bladder decompensation) require invasive therapy. (See 'Indications for therapy' above.)

- Data on long-term outcomes are limited for most procedures other than transurethral resection of the prostate (TURP), and there are also only a limited number of studies comparing different minimally invasive procedures and non-TURP surgical procedures.

- For men who require an invasive procedure and are in good health, we suggest transurethral resection of the prostate (TURP) (**Grade 2B**). (See 'Transurethral resection of the prostate' above.) This recommendation places a relatively higher value on reducing symptoms and avoiding repeat treatment for BPH/LUTS and a relatively lower value on shortening length of stay and avoiding postoperative blood transfusions. Patients with different values might reasonably choose laser prostatectomy as an alternative where there is local expertise. (See 'Laser prostatectomy' above.)

- For men who require an invasive procedure but who are poor candidates for surgery, we suggest transurethral needle ablation of the prostate (TUNA) (**Grade 2B**). TUNA is a particularly good choice for men requiring chronic anticoagulation. TUNA is also an alternative for men who wish to undergo a procedure with lower urinary and sexual side effects than TURP, but with a smaller improvement in symptoms and a higher rate of need for retreatment. TUNA is less efficacious than TURP and should not be used in patients on the verge of urinary retention or in patients with deteriorating renal function caused by obstructive uropathy. (See 'Transurethral needle ablation of the prostate' above.)

- Other therapies may be reasonable options based on local expertise. (See 'Microwave

thermotherapy' above and 'Electrovaporization' above.)

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REFERENCES

1. Burnett AL, Wein AJ. Benign prostatic hyperplasia in primary care: what you need to know. J Urol 2006; 175:S19.
2. Roehrborn CG. The Agency for Health Care Policy and Research. Clinical guidelines for the diagnosis and treatment of benign prostatic hyperplasia. Urol Clin North Am 1995; 22:445.
3. Chapple CR. Pharmacological therapy of benign prostatic hyperplasia/lower urinary tract symptoms: an overview for the practising clinician. BJU Int 2004; 94:738.
4. Isaacs JT. Importance of the natural history of benign prostatic hyperplasia in the evaluation of pharmacologic intervention. Prostate Suppl 1990; 3:1.
5. Wasson JH, Reda DJ, Bruskewitz RC, et al. A comparison of transurethral surgery with watchful waiting for moderate symptoms of benign prostatic hyperplasia. The Veterans Affairs Cooperative Study Group on Transurethral Resection of the Prostate. N Engl J Med 1995; 332:75.
6. Benign Prostatic Hyperplasia: Diagnosis and Treatment. Clinical Practice Guide, AHCPR Pub. No. 94-0582, US Dept of Health and Human Services, 1994.
7. Barry MJ, Fowler FJ Jr, O'Leary MP, et al. The American Urological Association symptom index for benign prostatic hyperplasia. The Measurement Committee of the American Urological Association. J Urol 1992; 148:1549.
8. Flanigan RC, Reda DJ, Wasson JH, et al. 5-year outcome of surgical resection and watchful waiting for men with moderately symptomatic benign prostatic hyperplasia: a Department of Veterans Affairs cooperative study. J Urol 1998; 160:12.
9. Rassweiler J, Teber D, Kuntz R, Hofmann R. Complications of transurethral resection of the prostate (TURP)--incidence, management, and prevention. Eur Urol 2006; 50:969.
10. Brookes ST, Donovan JL, Peters TJ, et al. Sexual dysfunction in men after treatment for lower urinary tract symptoms: evidence from randomised controlled trial. BMJ 2002; 324:1059.
11. Muntener M, Aellig S, Kuettel R, et al. Sexual function after transurethral resection of the prostate (TURP): results of an independent prospective multicentre assessment of outcome. Eur Urol 2007; 52:510.
12. Melchior S, Hadaschik B, Thüroff S, et al. Outcome of radical prostatectomy for incidental carcinoma of the prostate. BJU Int 2009; 103:1478.
13. Anson K, Nawrocki J, Buckley J, et al. A multicenter, randomized, prospective study of endoscopic laser ablation versus transurethral resection of the prostate. Urology 1995; 46:305.
14. McAllister WJ, Absalom MJ, Mir K, et al. Does endoscopic laser ablation of the prostate stand the test of time? Five-year results from a multicentre randomized controlled trial of endoscopic laser ablation against transurethral resection of the prostate. BJU Int 2000; 85:437.
15. Carter A, Sells H, Speakman M, et al. A prospective randomized controlled trial of hybrid laser treatment or transurethral resection of the prostate, with a 1-year follow-up. BJU Int 1999; 83:254.
16. Hoffman RM, MacDonald R, Wilt TJ. Laser prostatectomy for benign prostatic obstruction. Cochrane Database Syst Rev 2004; :CD001987.
17. Kuntz RM. Laser treatment of benign prostatic hyperplasia. World J Urol 2007; 25:241.
18. Tan A, Liao C, Mo Z, Cao Y. Meta-analysis of holmium laser enucleation versus transurethral resection of the prostate for symptomatic prostatic obstruction. Br J Surg 2007; 94:1201.
19. Lee R, Gonzalez RR, Te AE. The evolution of photoselective vaporization prostatectomy (PVP): advancing the surgical treatment of benign prostatic hyperplasia. World J Urol 2006; 24:405.
20. Bouchier-Hayes DM, Anderson P, Van Appledorn S, et al. KTP laser versus transurethral resection: early results of a randomized trial. J Endourol 2006; 20:580.
21. Riehmann M, Knes JM, Heisey D, et al. Transurethral resection versus incision of the prostate: a

randomized, prospective study. Urology 1995; 45:768.

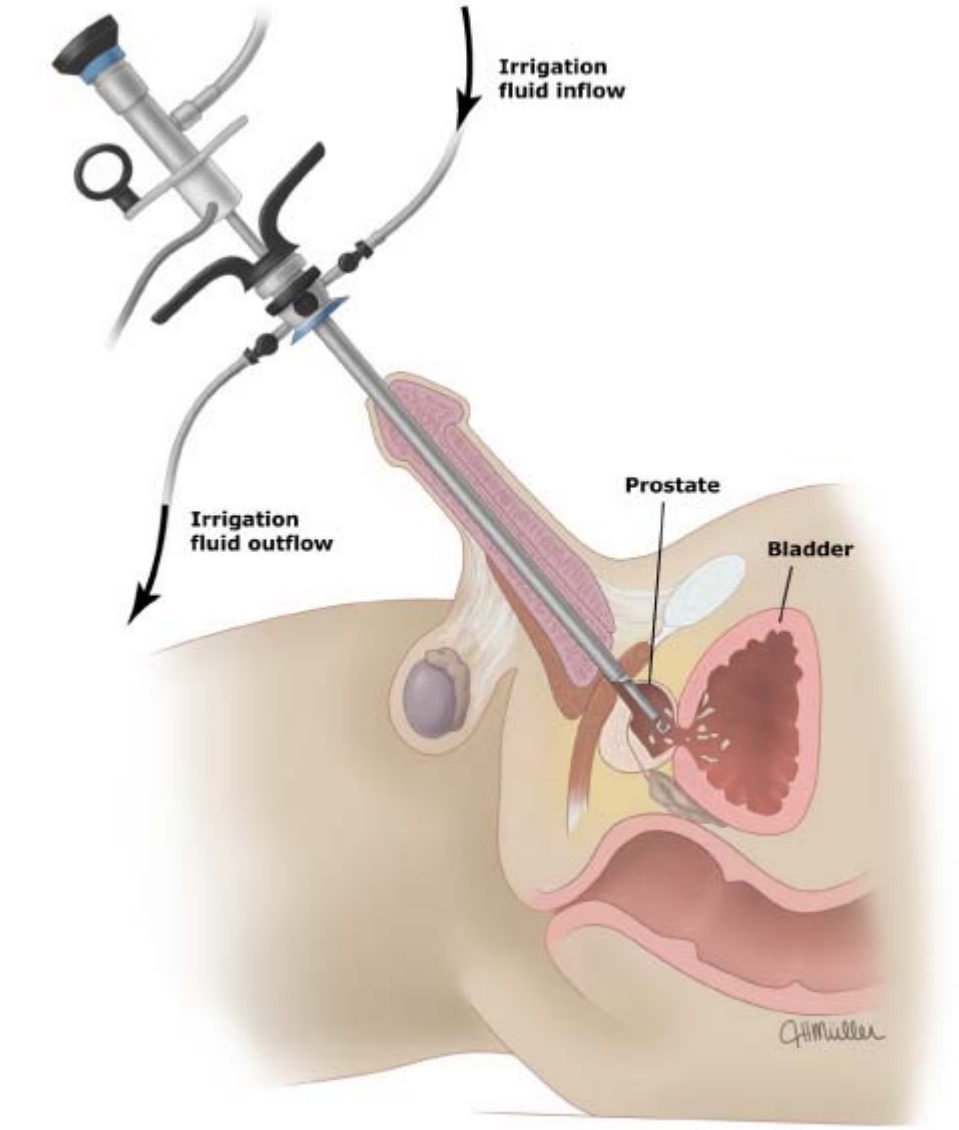
22. Lourenco T, Shaw M, Fraser C, et al. The clinical effectiveness of transurethral incision of the prostate: a systematic review of randomised controlled trials. World J Urol 2010; 28:23.
23. Jahnson S, Dalén M, Gustavsson G, Pedersen J. Transurethral incision versus resection of the prostate for small to medium benign prostatic hyperplasia. Br J Urol 1998; 81:276.
24. Poulakis V, Dahm P, Witzsch U, et al. Transurethral electrovaporization vs transurethral resection for symptomatic prostatic obstruction: a meta-analysis. BJU Int 2004; 94:89.
25. Sidney S, Quesenberry CP Jr, Sadler MC, et al. Reoperation and mortality after surgical treatment of benign prostatic hypertrophy in a large prepaid medical care program. Med Care 1992; 30:117.
26. Gratzke C, Schlenker B, Seitz M, et al. Complications and early postoperative outcome after open prostatectomy in patients with benign prostatic enlargement: results of a prospective multicenter study. J Urol 2007; 177:1419.
27. Helfand B, Mouli S, Dedhia R, McVary KT. Management of lower urinary tract symptoms secondary to benign prostatic hyperplasia with open prostatectomy: results of a contemporary series. J Urol 2006; 176:2557.
28. Roos NP, Wennberg JE, Malenka DJ, et al. Mortality and reoperation after open and transurethral resection of the prostate for benign prostatic hyperplasia. N Engl J Med 1989; 320:1120.
29. Baumert H, Ballaro A, Dugardin F, Kaisary AV. Laparoscopic versus open simple prostatectomy: a comparative study. J Urol 2006; 175:1691.
30. Crowley AR, Horowitz M, Chan E, Macchia RJ. Transurethral resection of the prostate versus open prostatectomy: long-term mortality comparison. J Urol 1995; 153:695.
31. Gonzalez RR, Te AE. How do transurethral needle ablation of the prostate and transurethral microwave thermotherapy compare with transurethral prostatectomy? Curr Urol Rep 2003; 4:297.
32. Roehrborn CG, Issa MM, Bruskewitz RC, et al. Transurethral needle ablation for benign prostatic hyperplasia: 12-month results of a prospective, multicenter U.S. study. Urology 1998; 51:415.
33. 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; 171:2336.
34. Bouza C, López T, Magro A, et al. Systematic review and meta-analysis of Transurethral Needle Ablation in symptomatic Benign Prostatic Hyperplasia. BMC Urol 2006; 6:14.
35. Zlotta AR, Giannakopoulos X, Maehlum O, et al. Long-term evaluation of transurethral needle ablation of the prostate (TUNA) for treatment of symptomatic benign prostatic hyperplasia: clinical outcome up to five years from three centers. Eur Urol 2003; 44:89.
36. D'Ancona FC, Francisca EA, Witjes WP, et al. Transurethral resection of the prostate vs high-energy thermotherapy of the prostate in patients with benign prostatic hyperplasia: long-term results. Br J Urol 1998; 81:259.
37. Wagrell L, Schelin S, Nordling J, et al. Three-year follow-up of feedback microwave thermotherapy versus TURP for clinical BPH: a prospective randomized multicenter study. Urology 2004; 64:698.
38. Gravas S, Laguna P, Ehrnebo M, et al. Seeking evidence that cell kill guided thermotherapy gives results not inferior to those of transurethral prostate resection: results of a pooled analysis of 3 studies of feedback transurethral microwave thermotherapy. J Urol 2005; 174:1002.
39. Hoffman RM, Monga M, Elliot SP, et al. Microwave thermotherapy for benign prostatic hyperplasia. Cochrane Database Syst Rev 2007; :CD004135.
40. Hoffman RM, MacDonald R, Monga M, Wilt TJ. Transurethral microwave thermotherapy vs transurethral resection for treating benign prostatic hyperplasia: a systematic review. BJU Int 2004; 94:1031.
41. Henney JE. From the food and drug administration: drug product problem reports. JAMA 2000; 284:2711.
42. Song HY, Cho KS, Sung KB, et al. Self-expandable metallic stents in high-risk patients with benign prostatic hyperplasia: long-term follow-up. Radiology 1995; 195:655.

43. Doggweiler R, Zermann DH, Ishigooka M, Schmidt RA. Botox-induced prostatic involution. Prostate 1998; 37:44.
44. Maria G, Brisinda G, Civello IM, et al. Relief by botulinum toxin of voiding dysfunction due to benign prostatic hyperplasia: results of a randomized, placebo-controlled study. Urology 2003; 62:259.
45. Brisinda G, Cadeddu F, Vanella S, et al. Relief by botulinum toxin of lower urinary tract symptoms owing to benign prostatic hyperplasia: early and long-term results. Urology 2009; 73:90.
46. Roehrborn CG, McConnell JD, Lieber M, et al. Serum prostate-specific antigen concentration is a powerful predictor of acute urinary retention and need for surgery in men with clinical benign prostatic hyperplasia. PLESS Study Group. Urology 1999; 53:473.
47. Klarskov P, Andersen JT, Asmussen CF, et al. Symptoms and signs predictive of the voiding pattern after acute urinary retention in men. Scand J Urol Nephrol 1987; 21:23.
48. McConnell JD, Bruskewitz R, Walsh P, et al. The effect of finasteride on the risk of acute urinary retention and the need for surgical treatment among men with benign prostatic hyperplasia. Finasteride Long-Term Efficacy and Safety Study Group. N Engl J Med 1998; 338:557.
49. McNeill SA, Daruwala PD, Mitchell ID, et al. Sustained-release alfuzosin and trial without catheter after acute urinary retention: a prospective, placebo-controlled. BJU Int 1999; 84:622.
50. Pickard R, Emberton M, Neal DE. The management of men with acute urinary retention. National Prostatectomy Audit Steering Group. Br J Urol 1998; 81:712.

Topic 8093 Version 3.0

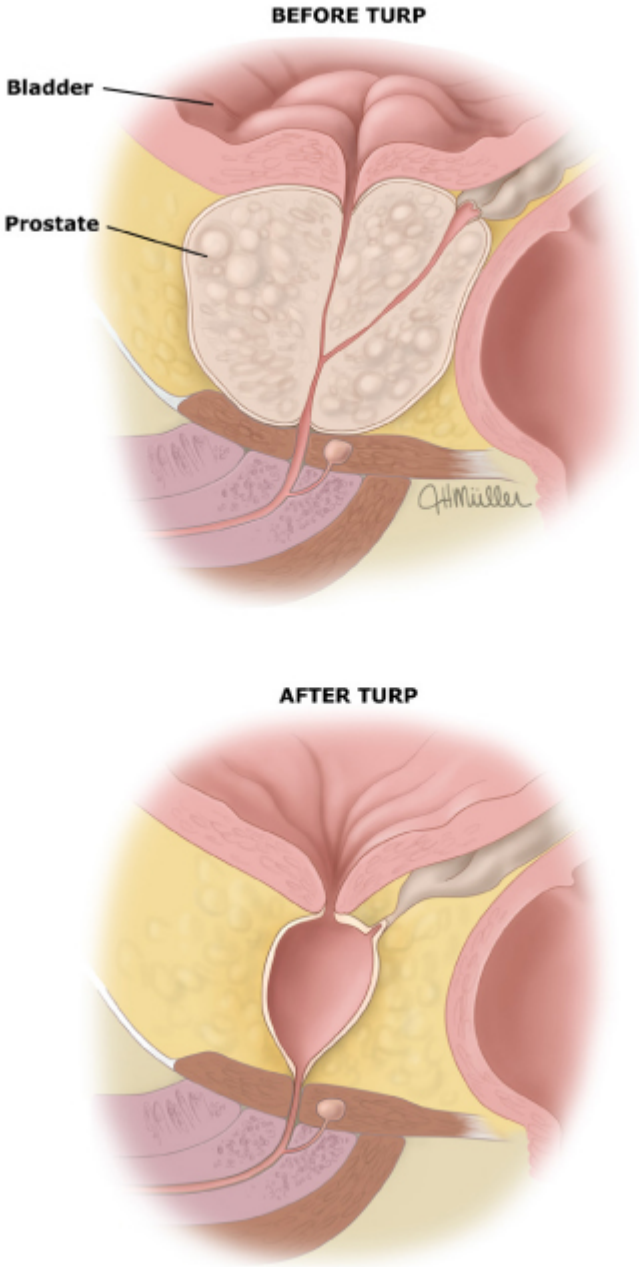
GRAPHICS

Transurethral resection of the prostate (TURP)



A resectoscope loaded with a diathermy loop is introduced into the bladder. Under direct vision, strips of prostatic adenoma are resected one at a time and dropped into the bladder. After the entire adenoma is resected, the prostate chips are evacuated from the bladder and hemostasis is achieved with electrocautery.

Prostate anatomy after transurethral resection



Following TURP, the prostatic fossa bound only by its capsule. The cavity will become lined with a regenerated surface in six to twelve weeks.

American Urological Association Urinary symptom score (International Prostate Symptom Score [IPSS])

Questions to be answered	Not at all	Less than 1 time in 5	Less than half the time	About half the time	More than half the time	Almost always
	(Circle one number on each line)					
1. Over the past month, how often have you had a sensation of not emptying your bladder completely after you finished urinating?	0	1	2	3	4	5
2. Over the past month, how often have you had to urinate again less than 2 hours after you finished urinating?	0	1	2	3	4	5
3. Over the past month, how often have you found you stopped and started again several times when you urinated?	0	1	2	3	4	5
4. Over the past month, how often have you found it difficult to postpone urination?	0	1	2	3	4	5
5. Over the past month, how often have you had a weak urinary stream?	0	1	2	3	4	5
6. Over the past month, how often have you had to push or strain to begin urination?	0	1	2	3	4	5
7. Over the past month, how many times did you most typically get up to urinate from the time you went to bed at night until the time you got up in the morning?	0 (none)	1 (1 time)	2 (2 times)	3 (3 times)	4 (4 times)	5 (5 or more times)
Sum of circled numbers (AUA symptom score): _____						
0 to 7: Mild symptoms						
8 to 19: Moderate symptoms						
20 to 35: Severe symptoms						

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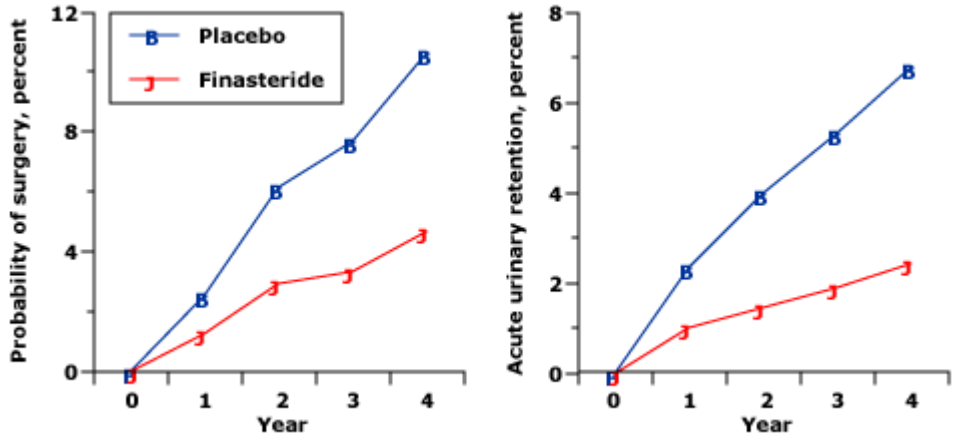
Finasteride reduces surgery and acute urinary retention in BPH



Effect of finasteride (5 mg/day) versus placebo on the probability of surgery and acute urinary retention in 3016 men with moderate to severe benign prostatic hyperplasia. Both endpoints were significantly (P<0.001) reduced in the men treated with finasteride. *Data from McConnell, JD, Bruskewitz, R, Walsh, P, et al, N Engl J Med 1998; 338:557.*

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