Benign prostatic hyperplasia: an approach for the internist

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SUMMARY In benign prostatic hyperplasia, urodynamic testing and the many available drugs and surgical procedures have complicated the issue of what to do for whom. Although the severity of a patient's symptoms and his informed preferences should be the driving forces, specialized tests can help tailor treatment to the individual patient.

KEY POINTS The American Urological Association symptom index, which is derived from a short questionnaire, should be the primary determinant of treatment. Patients with mild symptoms need reassurance and yearly follow-up, but no medical or surgical treatment. I recommend baseline urodynamic testing for patients with moderate symptoms. Those with no signs of bladder decompensation can receive medical therapy; if there are signs of bladder decompensation, surgery is offered. The first-line medical therapy most commonly used is an alpha adrenergic blocking agent (either terazosin or doxazosin) in titrated doses. Surgery is offered if the symptoms do not abate with maximal medical therapy. Patients with severe symptoms usually need one of the more aggressive surgical procedures.

INDEX TERMS: PROSTATIC HYPERTROPHY
CLEVE CLIN J MED 1996; 63:226–236

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DIAGNOSING and treating benign prostatic hyperplasia (BPH) have become increasingly complicated. Although urodynamic tests can reveal much about the pathophysiology of BPH and new drugs and surgical procedures provide more treatment options, these advances paradoxically leave less certainty about what to do for the individual patient. Additionally, since internists are assuming greater primary care of patients with BPH (because new drug therapies are available), there is less certainty about when to refer a patient to a urologist.

Our strategy in some ways diverges from the recommendations of the Agency for Health Care Policy and Research (AHCPR).[1] Although the severity of a patient's symptoms and his informed preferences should be the driving forces in choosing what treatment to give, I advocate greater use of specialized studies to tailor BPH treatment to the individual patient. We are gathering data obtained from such studies before therapy to develop a large, standardized database to scientifically

evaluate and compare the outcomes of different therapies. Ultimately, this effort may help to distinguish between patients who will benefit from medical therapy and those who require surgery.

DIAGNOSTIC DILEMMAS

BPH is a syndrome that can cause multiple symptoms in any one patient. Traditionally, symptoms of BPH have been classified as irritative (frequency, nocturia, urgency) and obstructive (hesitancy, difficult voiding, weak stream, sensation of incomplete emptying).

For a long time it was believed that the symptoms of BPH resulted entirely from obstruction of the bladder outlet. We now know that BPH may be obstructive or nonobstructive; further, neither "irritative" or "obstructive" symptoms correlate with outlet obstruction, and no single sign or symptom indicates obstruction.[2]

Complicating this dilemma for the clinician, the behavior of the bladder varies regardless of whether outlet obstruction is present or absent. An obstructed detrusor muscle may be normally contractile or weak; conversely, an unobstructed detrusor can vary in compliance and contractility.[3]

A trabeculated bladder (one that contains multiple small diverticuli—referred to as cellules—that result from increased detrusor compliance) has long been considered the hallmark of an obstructed bladder outlet. But an obstructed bladder is not always trabeculated, whereas the unstable unobstructed bladder is often trabeculated. Thus, the permutations are multiple and confusing.

DIAGNOSTIC EVALUATION

Given the wide range of presentations of BPH and the subjective nature of its symptoms, clinicians must obtain as much information as possible about the patient's symptoms and the interaction between the bladder and prostate.

Men of middle age or older who experience symptoms of BPH should undergo a complete history and physical examination. This should include a digital rectal examination to estimate the size of the prostate and to look for prostate cancer. It should also include a focused neurologic examination.[1]

Laboratory tests should include a urinalysis (to rule out urinary tract infection and hematuria) and a measurement of the serum creatinine concentration (to assess renal function).[1] In addition, I recommend measuring the prostate-specific antigen (PSA) level, both to screen for prostate cancer and to establish a baseline value, as some of the drugs used to treat BPH can decrease the PSA concentration considerably (see below).

Symptom assessment and diagnostic tests

A variety of tests are available to assess the patient with symptoms of BPH.

American Urological Association symptom index. The most important aspect of the initial evaluation is the American Urological Association symptom index, derived from a questionnaire in which patients rate how often they experience each of seven symptoms on a scale of 0 (least often) to 5 (most often). These numbers are totalled to classify the symptoms as mild (0 to 7), moderate (8 to 19), or severe (20 to 35) (*Table 1*).[4] The symptom index should be the primary determinant of treatment (see below). It should also be used to follow disease progression and response to treatment.

Voiding flow rate. This test consists of voiding into a cylinder that contains transducers connected to a personal computer to measure the flow rate throughout the voiding cycle. For this test to be accurate, the patient should void at least 125 mL. Patients with normal flow rates (> 15 mL/second mean) are less likely to benefit from therapy.

Pressure-volume studies. By measuring the pressure inside the bladder while the patient voids, this invasive test can detect problems with bladder contraction due to either neurologic disease or detrusor decompensation.

Measurement of residual urine after voiding, by either catheterization or ultrasonography, may be useful in monitoring the course of BPH. Patients with large residual urine volumes are at increased risk of bladder infections and stones.

Cystoscopy reveals information about the prostate size and shape that may be useful in deciding which surgical procedure to perform.

MANAGEMENT BASED ON SYMPTOMS

Patients seek treatment for BPH because of bothersome symptoms that affect the quality of their lives. To the patient, relief of symptoms is the single most important outcome—not flow rate, detrusor pressure, or residual urine volume after voiding. Therefore, my management strategy is based

TABLE 1
AMERICAN UROLOGIC ASSOCIATION SYMPTOM INDEX FOR BENIGN PROSTATIC HYPERPLASIA*

Questions	(Circle one answer for each question)					
	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
1. During the last month or so, how often have you had a sensation of not emptying your bladder completely after you finished urinating?	0	1	2	3	4	5
2. During the last month or so, how often have you had to urinate again less than 2 hours after you finished urinating?	0	1	2	3	4	5
3. During the last month or so, how often have you found you stopped and started again several times when you urinated?	0	1	2	3	4	5
4. During the last month or so, how often have you found it difficult to postpone urination?	0	1	2	3	4	5
5. During the last month or so, how often have you had a weak urinary stream?	0	1	2	3	4	5
6. During the last month or so, how often have you had to push or strain to begin urination?	0	1	2	3	4	5
Question	**None**	**One time**	**Two times**	**Three times**	**Four times**	**Five times**
7. During the last 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	1	2	3	4	5

*From Barry et al, reference 4, used with permission from the American Urological Association

primarily on the symptom index, and only secondarily on the other tests listed above. However, I do believe the other tests should be used more often. Specifically, I recommend measuring the voiding flow rate, performing pressure-volume studies, and measuring the residual urine volume after voiding in all patients with moderate or severe symptoms, and performing cystoscopy in all candidates for surgery (*Figure 1*).

Although this approach may seem excessive to some, I believe it is necessary if we are to scientifically evaluate and compare the outcomes of the different medical and surgical therapies. Only a large standardized database will allow us to optimally study our results. Currently, we have no clear prognostic variables indicating which patients will respond to medical therapy and which need surgery. Nor do we know which surgical patients do better with newer laser or microwave technologies vs a standard transurethral prostatectomy (TURP). Answers to these questions will come when our workup for BPH is systematically performed and our treatments are longitudinally quantitated.

Mild symptoms (score 0 to 7)

Generally, patients with mild symptoms do not need additional testing or treatment and can begin a program of observation or "watchful waiting," with yearly follow-up. Patients with mild symptoms can be followed up on a yearly basis. Many patients actually have improvement in their symptoms without treatment. However, if symptoms worsen, the voiding flow rate should be measured and treatment considered.

Worsening symptoms also raise the possibility of early prostate cancer and should prompt a review of the patient's past PSA values to determine the "PSA velocity" (ie, how fast the PSA value is increasing). Any confirmed increase in PSA of more than 0.75 ng/mL within 1 year necessitates a

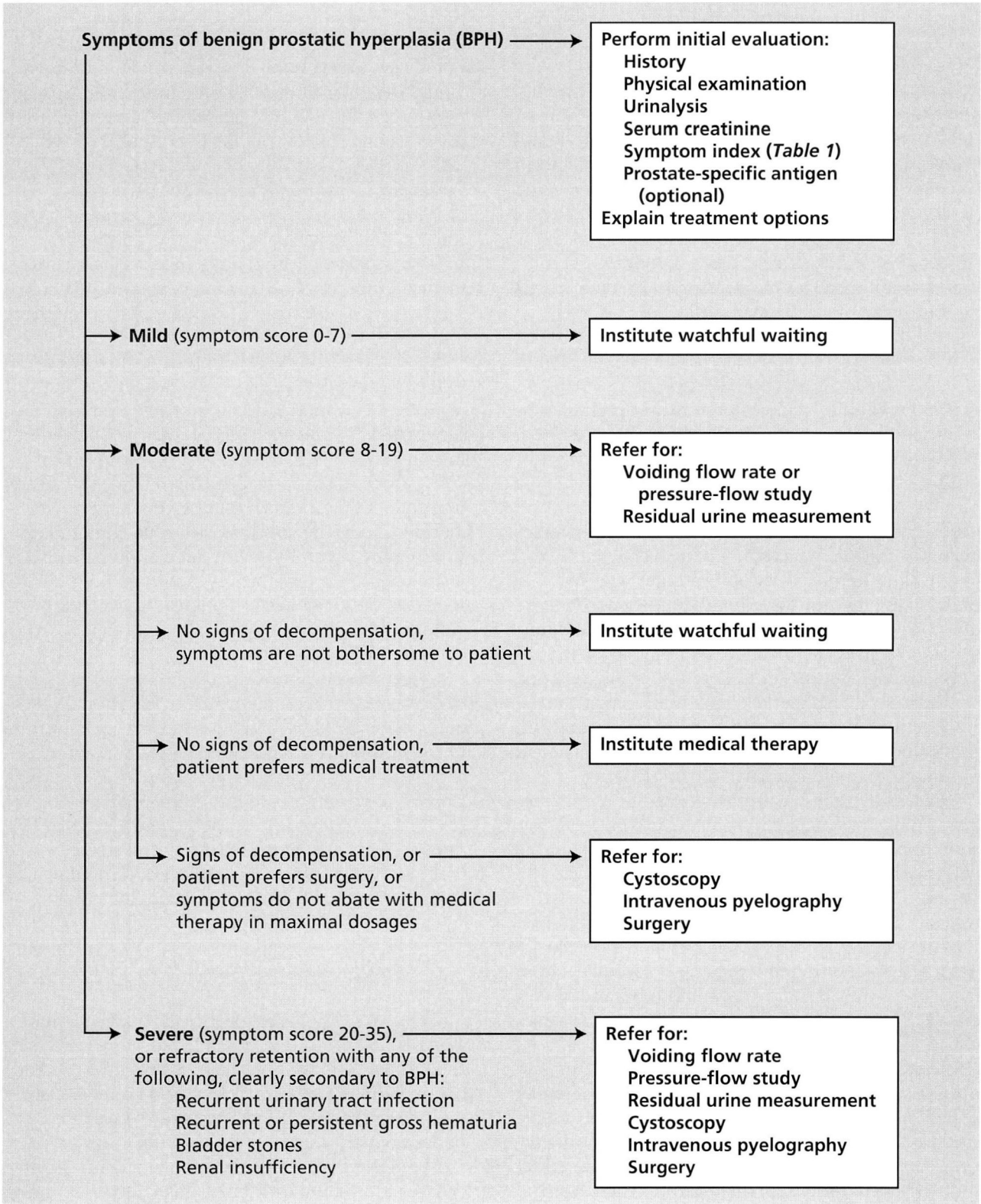


FIGURE 1. Algorithm for treating benign prostatic hyperplasia.

transrectal ultrasound-guided biopsy. Waiting for the PSA value to increase to more than 4.0 ng/mL often delays the diagnosis of prostate cancer.

Moderate symptoms (score 8 to 19)

Watchful waiting. Many patients with moderate symptoms have a compromised quality of life and want medical or surgical treatment. However, some patients can forego treatment if they are comfortable with their symptoms—although physicians need to be alert to exceptions. Therefore, I recommend obtaining baseline pressure-flow data on all patients with moderate symptoms.

Peak urinary flow rates less than 10 mL/second and postvoiding residual urine volumes greater than 100 mL indicate greater progression of disease and a higher probability of urinary retention and infection if the patient is not medically or surgically treated. Further, a patient with a maximum voiding detrusor pressure greater than 100 mm Hg and a peak flow rate less than 10 mL/second has significant urethral obstruction and, without treatment, risks bladder decompensation, which may be irreversible.

The long-term effects of "watchful waiting"—or of drug therapy—on functional detrusor activity are unknown. However, once decompensation occurs, subsequent medical or surgical treatment for BPH is not nearly as successful. Therefore, if urodynamic studies indicate bladder decompensation is occurring (ie, the flow rate and detrusor pressure are low and the residual urine volume is high), I advise surgical treatment to prevent further decompensation.

Medical therapy. Currently, most urologists prescribe alpha adrenergic blockers (terazosin or doxazosin, in titrated doses) as first-line drugs for patients with moderate symptoms. These drugs lower the symptom score relatively quickly (within 2 to 3 weeks), and their side effects are relatively minor. Finasteride is another option but it is not usually used as first-line therapy, because it can take 3 to 6 months to begin relieving symptoms and it decreases PSA levels, making screening for prostate cancer more difficult.

Surgery. Patients with moderate symptoms and urodynamic results indicating obstruction may benefit from one of the evolving minimally-invasive surgical procedures (see below). Different institutions favor noncontact or contact laser ablation, high-intensity focused ultrasound, transurethral electrovaporization, or microwave hyperthermia. Although these new procedures often reduce symptoms in the short term as much as standard transurethral resection of the prostate (TURP) does, they do not always increase the flow rate to the same degree. Thus, the long-term effects of minimally invasive treatments need to be determined before a consensus recommendation can be given.

Severe symptoms (score 20 to 35)

Patients with severe symptoms generally have some component of bladder outlet obstruction and need treatment. Although it is reasonable to try medical therapy with maximal dosages, most patients with severe symptoms need surgery to relieve symptoms.

I recommend a baseline pressure-flow study before either medical or surgical treatment; a low flow rate with an abnormally high or low detrusor pressure generally indicates surgery should be considered initially.

Cystoscopy (performed in the office), transrectal ultrasonography, or both often give additional information about the prostate size and configuration. Trilobar hypertrophy (with median lobe enlargement) as seen on cystoscopy generally does not respond as well to medical therapy. Transrectal ultrasonography is the most accurate method of determining prostate size.

Larger prostates (> 50 g) are difficult to treat with laser procedures and require more traditional procedures such as TURP and perhaps open prostatectomy. Although many urologists believe an upper-tract study is unnecessary if renal function is normal, I prefer to obtain a baseline intravenous pyelogram (IVP) before any lower-tract operation. An IVP often directs the emphasis of the cystoscopy and confirms the presence of a bladder diverticulum or a large intravesical (median) prostatic lobe.

MEDICAL TREATMENT OF BPH

The two medical approaches for treating symptomatic BPH are alpha adrenergic blockade (to reduce the sympathetic tone of the prostate—the dynamic component of the obstruction), and androgen deprivation (to reduce the prostate size—the static component of the obstruction) (*Table 2*).

I prefer to begin with an alpha blocker in titrated dosages (see below). If symptoms fail to respond to an alpha blocker in maximal doses, they generally will not respond to an androgen-deprivation drug

such as finasteride either. Therefore, I use finasteride mainly in patients who are not able to take alpha blockers for various reasons (such as concurrent antihypertensive therapy) or who have significant side effects. I have not found combining an alpha blocker and finasteride to be particularly more effective than using an alpha blocker alone, and it is much more costly.

ALPHA ADRENERGIC BLOCKADE

The selective alpha-1 blockers terazosin and doxazosin are antihypertensive agents that relax smooth muscle cells in the arterioles and also in the prostate, thereby relieving obstruction. According to a meta-analysis by McConnell et al,[1] 59% to 86% of patients experience some relief of symptoms with these agents, and the mean reduction in the symptom index is 51%. Terazosin has been studied more extensively than doxazosin, and is listed by the Food and Drug Administration as indicated in BPH. However, doxazosin has also undergone controlled trials and has been shown effective[5,6]; its potential advantage over terazosin is its longer half-life (24 hours vs 12).

Dosage and administration. The response of both drugs is dose-dependent. In one large trial of terazosin,[7] the symptom score decreased by more than 30% in 40% of patients receiving placebo, compared with 51% taking 2 mg of terazosin daily, 57% taking 5 mg, and 69% taking 10 mg, the difference being significant only with the 10-mg dose.

A study of doxazosin found that mean maximum flow rates significantly increased by 2.5, 4.6, and 3.2 mL/second in men taking 4, 8, or 12 mg/day respectively ($P < 0.01$) compared with placebo. No significant change in residual volumes was noted.[5] Another study found BPH symptoms improved significantly in patients receiving 4 to 8 mg/day. Mean doses of doxazosin were 6.1 mg for patients with hypertension and 3.8 mg for normotensive men.[6]

These drugs should be started at a low dosage (1 mg of terazosin or doxazosin daily at bedtime) and gradually increased. In fact, the longer the titration, the fewer side effects I have noticed. I try to increase the daily dose to 5 mg of terazosin or 4 mg of doxazosin over a 1-month period. If symptoms do not respond to these respective doses, I then increase the dose to the maximum level—10 mg of terazosin or 8 mg of doxazosin.

Adverse effects. The principal side effect of alpha-1 blockers is orthostatic hypotension, and some patients experience a marked hypotensive response with the first dose, especially if they are also taking other antihypertensive medications. Other adverse effects include asthenia, an influenza-like syndrome, dizziness, somnolence, nasal congestion, rhinitis, and impotence. Overall, these adverse effects are uncommon, minor, and reversible, but may cause some patients to stop taking these drugs. In an open-label study of terazosin, 43% of patients dropped out by 42 months, 11% because of treatment failure, 19% because of adverse events, and 13% because of administrative reasons.[8]

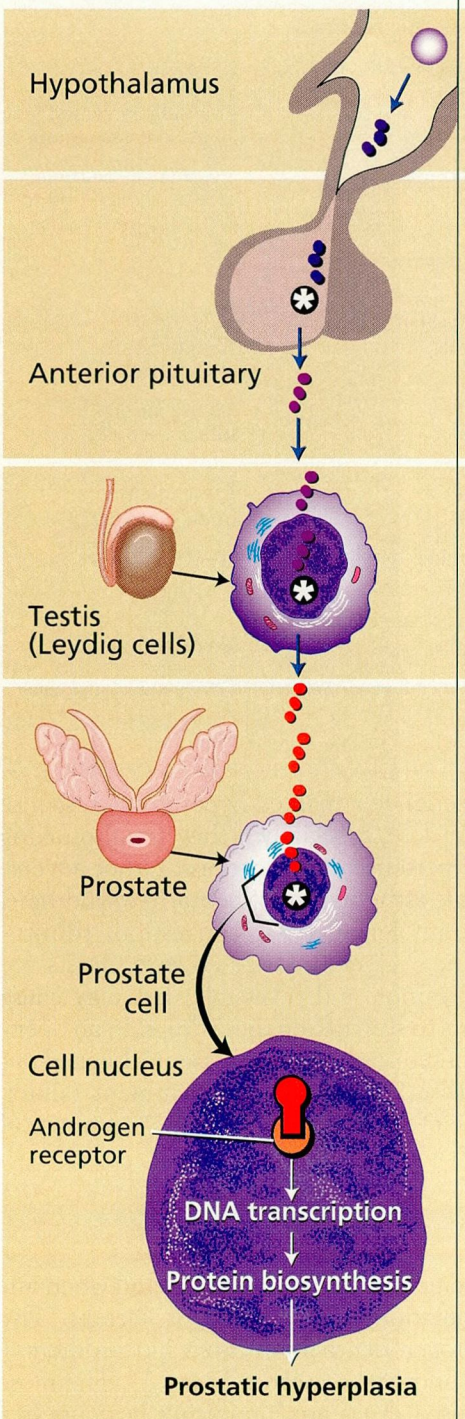
TABLE 2
DRUGS FOR TREATING
BENIGN PROSTATIC HYPERPLASIA

Strategy and drugs	Usual dosage
Alpha adrenergic blockade	
Selective alpha-1 blockers	
Terazosin (Hytrin)	1 mg/day at bedtime, gradually increased to 10 mg/day maximum
Doxazosin (Cardura)	1 mg/day at bedtime, gradually increased to 8 mg/day maximum
Androgen deprivation	
Luteinizing hormone-releasing hormone (LHRH) agonists	
Leuprolide (Lupron)	7.5 mg/month intramuscularly
Goserelin (Zoladex)	3.6 mg/month subcutaneously
Antiandrogens	
Flutamide (Eulexin)	125–250 mg three times a day
Bicalutamide (Casodex)	50–100 mg daily
5-Alpha reductase inhibitors	
Finasteride (Proscar)	5 mg/day

ANDROGEN-DEPRIVATION THERAPY

The prostate is androgen-sensitive, and when androgen stimulation is eliminated, it shrinks. The various androgen-deprivation drugs block different steps in the androgen cascade (*Figure 2*). The most commonly used drugs are luteinizing hormone-releasing hormone (LHRH) agonists, antiandrogens, and the 5-alpha reductase inhibitors.

FIGURE 2
THE ANDROGEN CASCADE IN BENIGN PROSTATIC HYPERPLASIA AND HOW TO BLOCK IT



Site	*Androgen cascade*	*Drugs that block the cascade*
Hypothalamus	**Luteinizing hormone-releasing hormone** (LHRH) released into hypophyseoportal circulation in pulsatile fashion	
Anterior pituitary	LHRH binds to pituitary cells Pituitary cells secrete **luteinizing hormone** (LH) into systemic circulation	**LHRH agonists** (nafarelin, buserelin, goserelin, leuprolide) cause down-regulation of LHRH receptors
Testis (Leydig cells)	LH binds to Leydig cells Leydig cells secrete bound and unbound **testosterone**	
Prostate	Unbound testosterone enters prostate cells; most is converted in the presence of **5-alpha reductase** to **dihydrotestosterone** (DHT)	**5-alpha reductase inhibitor** (finasteride) blocks conversion of testosterone to DHT
Prostate cell Cell nucleus Androgen receptor DNA transcription Protein biosynthesis Prostatic hyperplasia	DHT and remaining testosterone bind to androgen receptor on cell nucleus and initiate DNA transcription, which initiates protein biosynthesis, resulting in cellular hypertrophy and hyperplasia	**Antiandrogens** (flutamide, bicalutamide) inhibit binding of DHT and testosterone

LHRH agonists

The LHRH agonists (nafarelin, buserelin, goserelin, leuprolide) probably reduce the prostatic volume more than any other drugs. However, preliminary studies showed that these agents take up to 9 months to produce their maximal effect, they do not reduce postvoiding retention, not all patients experience a decrease in symptoms, and, after these drugs are stopped, the prostate returns to its former size and symptoms recur.[9,10] LHRH agonists are also expensive, costing $4000 to $5000 per year.

The ideal candidates for these drugs may be elderly patients for whom surgery poses a high risk.

Dosage and administration. The most common dose of leuprolide is 7.5 mg/month, given intramuscularly. Goserelin, the other LHRH agonist widely used in the United States, is given subcutaneously at a dose of 3.6 mg/month.

Adverse effects. The LHRH agonists have multiple side effects. All men who take them become impotent and have decreased libido. Hot flashes, gynecomastia, and general lethargy are also very common. Further, the PSA level decreases by more than 80%, making PSA screening for prostate cancer less reliable.

Antiandrogens

Antiandrogens (flutamide, bicalutamide) act lower in the androgen cascade, thus producing a state of androgen deprivation without lowering serum testosterone and dihydrotestosterone levels (*Figure 2*). The FDA currently lists antiandrogens as indicated in combination therapy for advanced prostate cancer. However, clinicians also use them to treat localized prostate cancer and BPH.

Dosage and administration. Most studied is flutamide, a nonsteroidal antiandrogen metabolized in the liver to its active form, hydroxyflutamide. In a small, early trial, 100 mg three times a day for 12 weeks significantly increased urinary flow rates and decreased obstructive voiding symptoms, but had no effect on prostate size or residual urine volume.[11] In a later trial, 250 mg three times a day for 6 months decreased prostatic volumes by 40% and increased peak urinary flow rates by nearly 50%. Of interest, symptom scores decreased significantly with flutamide therapy, but also decreased just as much with placebo.[12]

Bicalutamide, a new antiandrogen, can be given once a day in a 50-mg tablet and may be as effective as flutamide. These features will make it an attractive option, and future studies can be expected.

Adverse effects. Fewer than 10% of patients taking flutamide experience side effects, notably gynecomastia, breast tenderness, and various gastrointestinal symptoms (nausea, diarrhea, flatulence). This drug does not appear to affect libido or potency, as it does not lower the serum testosterone level. The practical problems with flutamide are its cost (roughly $2500 per year), its effect on the PSA level (a reduction of approximately 80%), and its dosage schedule (two capsules three times a day, which diminishes compliance). Bicalutamide has similar costs and side effects, but its advantage may be that it has once-a-day dosing.

5-alpha reductase inhibitors

Finasteride is the only drug of this class that has been extensively studied in BPH therapy and has FDA approval for this purpose.

Dosage and administration. In a large trial, finasteride 5 mg/day produced a small but statistically significant improvement in symptom scores and in urinary flow rates and decreased prostatic volumes by a mean of 19%. In general, this regimen required at least 4 to 6 months to achieve the maximal therapeutic response.[13]

Adverse effects. Finasteride's side effects are minimal, with a 3% to 4% incidence of decreased libido, ejaculatory dysfunction, or impotence. However, it decreases the PSA level by 40% to 50% over time. What constitutes a significant increase in PSA during finasteride therapy is unknown. I advise patients to undergo transrectal ultrasonography and prostate biopsies if they have any increase in PSA level while taking this drug.

Aromatase inhibitors

Another, seemingly paradoxical strategy might be estrogen deprivation, using aromatase inhibitors to prevent the conversion of testosterone and androstenedione to estradiol and estrone, respectively.[14–16] The rationale for this approach comes from evidence that with advancing age, the rate of testosterone production by the Leydig cells decreases, whereas free 17B estradiol and estrone concentrations remain relatively constant.[14] Thus, the ratio of estrogens to free testosterone becomes elevated at the age when BPH becomes prevalent. Various investigators have found estradiol-binding sites in both normal and BPH tissue.[15] Additionally, there is evidence that aromatase activity in the peri-

TABLE 3
SURGICAL TREATMENT OPTIONS FOR BENIGN PROSTATIC HYPERPLASIA

Common procedures
TURP (transurethral resection of the prostate)
Open prostatectomy
TUIP (transurethral incision of the prostate)
VLAP (visual [noncontact] laser ablation of the prostate)
CLAP (contact laser ablation of the prostate)
TVP (transurethral electrovaporization)
Less-common procedures
TULIP (transurethral ultrasound-guided laser-induced prostatectomy)
TUMT (transurethral microwave thermotherapy)
TUNA (transurethral needle ablation)
HIFU (transrectal high-intensity focused ultrasound)
TUBD (transurethral balloon dilatation)
Prostatic stents

urethral and transition zones of hypertrophic prostates is higher than in the same regions of normal prostates.[16] Two aromatase inhibitors are undergoing clinical trials: testolactone and atamestane. However, modest results in preliminary trials[17,18] cast doubt on whether estrogen deprivation by itself will make a major impact on symptomatic BPH.

SURGICAL TREATMENT OF BPH

Several minimally invasive procedures introduced over the past several years have increased the surgical options. While TURP stands alone in efficacy, it is now being compared with various new procedures (ie, transurethral electrovaporization, new contact and noncontact laser technologies, and microwave thermotherapy [*Table 3*]). Of these, only laser prostatectomy and transurethral electrovaporization of the prostate (TVP) can be considered standard treatment options as yet.

When considering a patient for surgical therapy, I usually think first of the standard TURP, which gives me the greatest flexibility to handle "difficult" prostates (those weighing > 50 g or with a large median lobe). Thus, in large glands with considerable obstruction, the standard TURP is my first choice.

However, every urologist needs a minimally invasive procedure in his or her repertoire to surgically relieve obstruction in high-risk patients, in whom bleeding can be a problem. At present, I use the transurethral electrovaporization of the prostate as my minimally invasive procedure. This procedure is fairly easy to learn and has not been complicated by any significant bleeding problems. The catheter is usually removed in the first day, and the patients have done well. Another commonly-used option is laser prostatectomy.

TURP: THE GOLD STANDARD

Wire loop electrocautery resection of the prostate, developed in the early 1930s, remains the gold standard for treating symptomatic BPH. McConnell and associates[1] calculate that TURP reduces symptoms in 88% of patients, decreases symptom scores by a mean of 85%, and increases peak urinary flow rates by a mean of 126%.

The immediate complications of TURP include failure to void (6.5% of patients), bleeding requiring transfusions (3.9%), clot retention (3.3%), and genitourinary infections (2.3%). Long-term complications include retrograde ejaculation (70%), impotence (14%), and incontinence (1%). The mean probability of retreatment within 5 years is 9.75%.

Mebust et al[19] found the rate of complications after TURP was higher in patients who had urinary retention before surgery: the incidence of infection was 4.3% vs 1.5%, failure to void 11% vs 3.6%, and hypotonic bladder 8.4% vs 1.7%. Men older than 80 years had more complications than younger men did.

Transurethral electrovaporization of the prostate (TVP)

TVP, a new electrosurgical technique for performing a TURP, uses a roller electrode that vaporizes as well as cauterizes (Vaportrobe; Circon ACMI, Santa Barbara, Calif).[20] Electrovaporization produces hemostasis and prevents water reabsorption by creating a zone of desiccation below the vaporized tissue. Because this new technique produces a visible "TURP defect," it is more appealing than current laser procedures. It decreases symptom scores and increases flow rates as much as TURP does—more than laser prostatectomy. The potential advantage of TVP over TURP is that patients do not experience a TURP syndrome and have only minimal bleeding. (The TURP syndrome occurs when venous channels are open, and fluid is absorbed into the systemic circulation, causing a severe dilutional hyponatremia. This may cause seizures and is treated with diuretics.) Early reports indicate that TVP is best used to treat prostates weighing less than 50 g and TURP is better for larger glands.[20]

MINIMALLY INVASIVE TECHNIQUES

Transurethral incision of the prostate (TUIP)

Popularized by Orlandi[21] in 1973, TUIP has become popular for patients who have a small prostate and a prominent bladder neck. Outcomes of TUIP in selected patients are nearly as good as those of TURP, with considerably less morbidity. Compared with TURP, TUIP is faster, causes less blood loss and fluid absorption, causes fewer bladder neck contractures, and leads to a higher rate of antegrade ejaculation.

TUIP can now be performed with a contact laser probe. Although some surgeons make two posterior incisions at the 5- and 7-o'clock positions, I prefer higher incisions away from the bladder trigone at the 8- and 4-o'clock positions. In theory, the higher incisions should reduce the early irritative symptoms often seen after TUIP. The incisions should be deep and through the prostatic capsule, into the periprostatic fat. Proper patient selection is key: the optimal patient has a small prostate (< 25 g) without a large intravesical lobe.

Visual laser ablation of the prostate (VLAP)

This promising procedure uses a neodymium-yttrium-aluminum-garnet (Nd:YAG) laser. The noncontact, side-firing fiber goes through the bridge of standard cystoscope, permitting VLAP to be performed under direct vision. Surgeons usually apply 40 watts for 90 seconds to each lateral lobe at four different positions—10-, 2-, 4-, and 8-o'clock. The probe is then pulled back, and another series of four circumferential laser burns is done. This power setting and duration favors coagulation necrosis (as opposed to vaporization) and delays postoperative sloughing of the prostatic tissue. Applying 60 watts for 60 seconds favors vaporization of the tissue and thus produces more of a cavity. Which technique is optimal is not known. The total number of joules (watts × seconds × 8 positions) is the same (28 800) with either technique.

Kabalin[22] performed a randomized study comparing VLAP (using a 40-watt, 60-second technique) and TURP. The mean operative time was shorter with VLAP (24 vs 58 minutes), and the mean decrease in symptom scores was similar (78% with VLAP vs 70% with TURP). Peak urinary flow rates increased equally after either procedure, from 8.5 to 20.5 mL/second (241%) after VLAP and from 9.0 to 22.9 mL/second (254%) after TURP. However, the initial VLAP procedure failed for 15% of the patients, and these treatment failures were censored from the outcome assessment.

We have begun using the laser fiber like an electrocautery loop to vaporize any obstructing tissue, rather than applying it at prescribed positions. This "random" technique requires a great deal more laser energy—often 70 000 to 100 000 J, especially with larger glands. We typically use 1500 to 2000 J/cc of prostate. Thus, a 40-g gland receives roughly 80 000 J. The Foley catheter is left in approximately 1 day for every 10 000 J. Only one of 15 patients so treated has had postoperative urinary retention, and none have had any new problems with erection or incontinence.

Transurethral ultrasound-guided laser-induced prostatectomy (TULIP)

TULIP uses a side-firing Nd:YAG laser probe built into a 7.5-MHz ultrasonic transducer. The laser fiber and ultrasonic transducer are placed within a 22F plastic sheath with a 36F to 48F low-pressure balloon located at the distal tip. The balloon is inflated in the prostatic urethra, and the probe's position is verified by ultrasonography. The surgical technique of four quadrant burns is similar to that of VLAP. The technical disadvantage of TULIP is that positioning of the laser fiber within the urethra is not exact, because the cystoscope cannot be used at the same time.

In a preliminary study, McCullough et al[23] found TULIP decreased symptom scores by 68% (a rate comparable to that of VLAP), but increased peak urinary flow rates by only 78% (6.7 mL/second before TULIP; 11.8 mL/second afterward). In contrast, both TURP and VLAP generally increase flow rates by more than 100%. Of interest, 22% of patients had some degree of urinary retention after the procedure. Other standard complications were minimal: the incidence of incontinence was 4%, urethral stricture 5%, and retrograde ejaculation 5%. Four percent of the patients required a subsequent TURP.

Other procedures

Transurethral balloon dilatation (TUBD), transurethral microwave thermotherapy (TUMT), transurethral needle ablation (TUNA) and intraprostatic stents offer little advantage over the traditional options and new laser procedures. Their results vary by institution, and they must be considered investigational at this time. Although they

have shown acceptable efficacy with relatively few complications, their expense and long-term effects need to be determined.

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