TREATMENT OF BENIGN PROSTATIC HYPERPLASIA

BY

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MASTER OF NURSING

WASHINGTON STATE UNIVERSITY
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To the Faculty of Washington State University:

The members of the Committee appointed to examine the clinical project of Barbara J. Heil find it satisfactory and recommend that it be accepted.

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First, to my daughter, Elizabeth, for her constant emotional support and love—never a negative word. I could not have done this without her.

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To Christ, through His grace I was admitted to and able to complete this program. Hopefully, He will continue His blessings and find me a job!
Benign prostatic hyperplasia (BPH) is a nonmalignant condition in which the aging prostate undergoes alterations in consistency and/or size in men over 50 years of age. Normal prostate size does not rule out BPH, just as the degree of enlargement does not determine the severity of symptoms. The presenting symptom is usually dysuria. Based on the severity of symptoms and the possible medical complications, the disease can have a significant impact on the patient's quality of life and health status. Different general approaches are currently available for management of BPH. These include watchful waiting, medical therapy, and surgical interventions (Mosier, 1998).
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Treatment of Benign Prostatic Hyperplasia

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Abstract

Benign prostatic hyperplasia (BPH) is a nonmalignant condition in which the aging prostate undergoes alterations in consistency and/or size in men over 50 years of age. Normal prostate size does not rule out BPH, just as the degree of enlargement does not determine the severity of symptoms. The presenting symptom is usually dysuria. Based on the severity of symptoms and the possible medical complications, the disease can have a significant impact on the patient's quality of life and health status. Different general approaches are currently available for management of BPH. These include watchful waiting, medical therapy, and surgical interventions (Mosier, 1998).
Introduction

Half of 60-year-old men and more than 80% of men over age 80 have benign prostatic hyperplasia (BPH). BPH is characterized by enlargement of the prostate gland accompanied by increased muscle tone in the bladder neck and prostate. The etiology of BPH is uncertain, but age related changes in levels of testicular hormones and in steroid hormone receptors are believed to play a role in its onset.

The enlarged prostate gland exerts pressure on the urethra. The increased pressure leads to reduced urinary flow, the sensation of having a full bladder after voiding, and a frequent and urgent need to urinate, especially at night. Complications of BPH include urinary tract infection and kidney failure.

Because men are living longer and the incidence of BPH increases with age, the clinical and economic impact of this disease is becoming increasingly greater. Although transurethral resection of the prostate (TURP) has been the treatment of choice for patients with enlarged prostates and serious obstructions, drug treatment can be effective and improve the quality of life in patients with mild to moderate symptoms, for whom surgery is not a necessity (Nixon, 1997).

The vast majority of cases of BPH are mild to moderate and can be managed by primary care practitioners rather than urologists. Watchful waiting and pharmacological interventions have replaced invasive surgical procedures as the gold standard of treatment for uncomplicated cases of BPH (Mosier, 1998).
Anatomy

The urethra divides the prostate sagitally into an anterior fibromuscular portion, which is mostly smooth muscle that passes from the detrusor down to the anterolateral prostate, and a posterior, predominantly glandular, portion that has two zones (peripheral and central. Figure 1A).

The central zone is composed of larger irregular acini separated by thick fibromuscular trabeculae. The peripheral zone is composed of small regular acini separated by narrow fibromuscular trabeculae. Two small lobules of prostate lie just lateral to the preprostatic sphincter (called the transition zone. Figure 1B). This zone is considered to be the site of origin of BPH. The periurethral region consists of small glands within the periurethral smooth muscle that may also give rise to the predominantly stromal form of BPH (Cooper, 1995).

Etiology and Pathogenesis

Benign prostatic hypertrophy can produce infravesical obstruction via two different mechanisms. Mechanical (anatomic) obstruction of the bladder outlet (Figure C) by the enlarged prostatic adenoma is due to the enlargement of the transition zone of the prostate. Gonadotropin-releasing hormone (GnRH) from the hypothalamus stimulates the anterior lobe of the pituitary gland to release luteinizing hormone, which in turn stimulates the testicular Leydig’s cells to release testosterone. Testosterone circulates to the prostatic epithelial cell, where under the influence of 5-alpha reductase, converts to the potent androgen dihydrotestosterone (DHT). Dihydrotestosterone then induces cellular hyperplasia of both the glandular and stromal components of the gland. Inhibition of any
step along the hypothalamic-pituitary-gonadal hormonal axis will lead to a subsequent
decrease in protein synthesis by prostatic cells and shrinkage of the prostatic adenoma (Keetch, 1997).

The second mechanism of infravesical obstruction is dynamic, caused primarily by the
tone of the smooth muscle in the bladder neck and prostatic capsule. These smooth
muscle fibers are richly innervated with alpha 1-adrenergic receptors. Stimulation of these receptors leads to increased tension of the smooth muscle fibers and an increase in resistance to urinary outflow. Blockade of the adrenergic receptors relaxes the smooth muscle tension of the urinary outflow tract, resulting in improvement of the patient's signs and symptoms (Keetch, 1997).

Two risk factors for the development of BPH are aging and the presence of dihydrotestosterone (DHT). Aging has a gradual, but profound effect on testicular function and androgen metabolism. Forty percent of 70-year-old men have symptomatic bladder-outlet obstruction. With increasing age, there is decreased responsiveness of the testes to luteinizing hormone, which in turn decreases stimulation of cells in the testes that secrete testosterone. Also, the binding capacity of sex-hormone-binding globulin is increased because of increases in plasma estradiol levels that stimulate the synthesis of binding proteins by the liver. The net effect of the changes in aging is a decrease in free testosterone; however, levels of estradiol are maintained, thus increasing the ratio of estradiol to testosterone (Cooper, 1995).

The amount of DHT bound to specific receptors in the cell nucleus is the final critical step for the role of androgens in stimulating prostate growth. In addition, increasing
estrogen levels later in life, may either induce androgen receptors or decrease the rate of epithelial or stromal cell death (Cooper, 1995).

Clinical Manifestations

Bladder outlet obstruction reduces the cross-sectional area of the urethra, and thus decreases the flow rate, and subsequently increases the bladder pressure. This places a demand on the detrusor to exert more muscular energy per milliliter of urine flow. As the bladder empties, the power of the detrusor contraction has to be maintained throughout voiding. With obstruction, detrusor contraction may overcome increased urethral resistance at the beginning of micturition when the bladder is full. At lower volumes of urine the detrusor cannot overcome the resistance of the urethral closure, which leads to urinary retention (residual urine). With chronic retention, the detrusor slowly stretches the bladder neck open, rendering it incompetent which leads to overflow incontinence. Voiding with a smaller urethral opening changes the volume of the stream so that it is smaller than normal. As the power of the detrusor fails, voiding flow is reduced to a dribble (Cooper, 1995).

Typically, the presenting symptom of BPH is dysuria, which occurs when the enlarged prostate pushes into the bladder, raising the internal urethral orifice and distorting the prostatic urethra. In some cases, the enlarged prostate forms a valvelike mechanism at the urethral orifice, and straining to urinate only worsens the condition (Mosier, 1998).

The early symptoms of mechanical obstruction, which typically result in detrusor muscle decompensation, include difficulty initiating urination (hesitancy—the urethra opens slowly), a weak urine stream (smaller urethral opening), involuntary postvoid dribbling of urine, the sensation of incomplete bladder emptying (detrusor pressure cannot
maintain flow), small voided volumes, and overflow incontinence. The early irritative symptoms of incomplete bladder emptying—usually the result of detrusor muscle instability—include urinary frequency or urgency, nocturia, urge incontinence, and painful urination (Drugs & Therapy Perspectives, 1997; Mosier, 1998).

 Symptoms

The American Urological Association Symptom Index (AUA-SI), which is also endorsed by the World Health Organization under the name International Prostate Symptom Score (IPPS), is used to quantify the level of lower urinary tract symptoms in a standardized way (Table 1). The frequency of each symptom is quantified by the patient on a scale from 0-5, with the maximum total score being 35. Patients with a total score of <=7 are classified as having mild symptoms, whereas those with total scores of 8-19 and >=20 have moderate to severe symptoms, respectively (Drugs & Therapy Perspectives, 1997).

 Diagnosis

 History

Evaluating a patient who may have BPH begins with a detailed history. Patients with BPH may present with obstructive symptoms such as urinary hesitancy, decreased force of urinary stream, dribbling, or even acute urinary retention. Patients may also complain of irritative symptoms such as urinary frequency, nocturia, dysuria, urgency, and urge incontinence which are the symptoms of functional manifestation of detrusor instability accompanied by bladder outlet obstruction. In the absence of symptoms such as in “silent prostatism”, the diagnosis of BPH should be suspected in the presence of azotemia and confirmed by an ultrasound finding of bilateral hydronephrosis (Randrup & Baum, 1997).
Physical Exam

Physical exam includes an abdominal exam (palpation for masses and lymphadenopathy), palpation for the bladder above the pubic symphysis for presence of distention, a search for costovertebral angle (CVA) tenderness and inguinal hernias, and examination of the external genitalia. A digital rectal exam (DRE) should include inspection of the anal area, assessment of rectal sphincter tone (this evaluates the sacral reflex arc by eliciting a sharp contraction of the anal sphincter induced by the squeezing of the glans penis which is an indirect reflection of the state of vesicle innervation), feeling the rectal wall circumferentially for any possible mucosal abnormalities, and evaluation of the prostate gland for size, shape, symmetry, surface contour, consistency, and sensitivity. The normal prostate size is 2.5 cm by 3.0 cm. In BPH the prostate is enlarged, smooth, rubbery, and without a median sulcus (Nelson & Schumann, 1998; Randrup & Baum, 1997). A neurological exam should be performed to assess the sacral nerve roots for injury or multiple sclerosis (Presti, Stroller, & Carroll, 1999).

Laboratory Tests

Recommended laboratory tests should include urinalysis, urine culture and sensitivity if urinalysis is abnormal, Sequential Multiple Analysis (SMA-6), serum creatinine and blood urea nitrogen (BUN) for renal function, and prostate-specific antigen (PSA). PSA is optional and the level increases 0.3 units for every gram of BPH (Weiss & Fair, 1997).

Other Diagnostic Tests

Uroflow measurement, called uroflowmetry, is done by measuring the urine flow rate while the patient is voiding into a uroflowmeter. This test is reliable only if the total
volume voided exceeds 150 ml. A peak flow rate of <10 ml per second is indicative of infravesical obstruction (Table 2).

Normal values are:

- <40 years of age => 22 cc/second
- 40 to 60 years of age => 18 cc/second
- > 60 years of age => 13 cc/second (Presti & Carroll, 1999; Weiss & Fair, 1997).

Post-void residual urine measurement is a test that measures the amount of urine in the bladder after voiding via ultrasound or straight catheterization (Weiss & Fair, 1997). While there is no absolute volume of residual urine that is considered abnormal, residual urine volumes greater than 150 ml in adults are considered significant since they constitute approximately one-third of normal bladder volume (Smith, 1995).

Urodynamics is the evaluation of the neurologic and motor activity necessary for voiding under fluoroscopic monitoring to visualize the bladder anatomy. A catheter with pressure monitors at its tip and at the bladder neck is placed via the urethra. As the bladder is filled with radiopaque dye, intrabladder and bladder neck pressures are monitored. While the catheter remains in place, the patient is asked to void. Voiding pressure is then monitored while bladder, bladder neck, and prostatic fossa are visualized under fluoroscopy (Weiss & Fair, 1997).

Urethrocystoscopy can provide direct visualization of the prostatic fossa and bladder to identify detrusor muscle hypertrophy (trabeculation), diverticula, tumors and bladder stones (both of these can be a cause of bladder irritability). This test can also determine the site and degree of bladder obstruction and indicate the length of prostatic fossa (an important measurement in preparation for TURP) (Weiss & Fair, 1997). This test is
recommended in patients with a history of microscopic or gross hematuria, urethral stricture disease, bladder cancer or prior lower urinary tract surgery. This is an optional test in men with moderate to severe symptoms who have chosen or require surgical or other invasive therapy (Clinical Practice Guideline, 1994).

Radiological Studies

Ultrasonography (US) is used more frequently than intravenous pyelography (IVP) for several reasons:

- faster and less expensive than IVP
- no iodine necessary, alleviating the risk of nephrotoxicity and/or allergic reaction
- can identify masses or hydronephrosis in kidneys and upper urinary tracts
- can evaluate bladder capacity pre-and postvoid
- rectal US provides direct inspection of prostatic tissue with estimated size (Weiss & Fair, 1997)

Intravenous pyelography should be performed in patients with hematuria associated with BPH. This test is contraindicated in patients with compromised renal function, dehydration, iodine allergies, and multiple myeloma (Weiss & Fair, 1997). (Table 3).

Differential Diagnosis

Irritative symptomatology include urinary tract infections, prostatitis, bladder cancer, bladder stones, interstitial or radiation-induced cystitis, and uninhibited bladder contraction (resulting from cerebrovascular accidents). Obstructive symptomatology include urethral stricture, urethral valves, prostate cancer, bladder neck contracture, or poorly contracting bladder (in response to paraplegia). Mixed obstructive and irritative
symptomatology include spinal cord injury, multiple sclerosis, Parkinson’s disease, or prostatitis (Konan, 1998).

Treatment Options

Watchful Waiting

Watchful waiting for patients with mild lower urinary tract symptoms and an American Urological Association (AUA) score of 0 to 7, a normal PSA level of 0 to 6.5 ng/ml, and a normal DRE is a sensible and reasonable approach. Patients should receive an explanation of their symptoms and education on signs and symptoms of urinary retention. They should be instructed on obtaining symptomatic relief by regular, relaxed, and frequent voiding, decreasing fluid intake several hours before bedtime, avoidance of salt, diuretics, alcohol, caffeine, spicy foods, anticholinergics, antihistamines, tranquilizers, and antidepressants. Annual monitoring is advisable for these patients (Nelson & Schumann, 1998; Randrup & Baum, 1997).

Pharmacological Management

Treatment with medication is recommended for mild-to-moderate BPH. There are 7 different drug therapies utilized: hormonal therapy, androgen receptor blockers, muscarinic receptor antagonist, 5-alpha-reductase inhibitor, alpha-adrenergic receptor blockade, combination therapy, and herbal therapy. Thus far, 5-alpha-reductase inhibitor, alpha-adrenergic receptor blockers and combination therapy are the mainstay of therapy (Keetch, 1997) (Table 4).
Hormonal therapy.

Gonadotropin-releasing hormone agonists inhibit the secretion of testosterone. The side effects are hot flashes, decreased libido, and impotence. Annual cost is approximately $5,000 (Keetch, 1997).

Andrenergic receptor blockade.

A nonsteroidal antiandrogen such as flutamide competes with DHT for androgen receptor sites thus decreasing andrenergic stimulation which leads to decreased cellular protein synthesis, cell shrinkage, and cell death. The side effects are breast pain, gynecomastia, and diarrhea. Annual costs are approximately $2,500 (Keetch, 1997).

Muscarinic receptor antagonist.

Tolterodine is used to control overactive bladder by reducing bladder contractility through blocking the muscarinic receptor sites. This drug should be used cautiously in patients with narrow-angle glaucoma, gastrointestinal obstructive disorders, or clinically significant bladder outflow obstructions (Mosier, 1998). Side effects include phototoxicity, dizziness, gastrointestinal upset, headache, tendonitis, and tendon rupture (Nurse Practitioners’ Prescribing Preference, 1999). Annual cost is approximately $1,200 (price based on 2 mg bid dosing).

5-Alpha-reductase inhibitor.

Finasteride blocks the intracellular conversion of testosterone to DHT which in turn reduces the actual size of the prostate and therefore decreases obstructive urinary outflow. If the prostate gland is enlarged (50 gms or greater), treatment with finasteride is a reasonable option (Walsh, 1996). The major concern of finasteride therapy is the falsifying effect on serum PSA levels, which decrease by 50% after 6 months of treatment.
Clinicians should multiply the PSA value by 2 after 6 months of treatment to obtain a true PSA value (Randrup & Baum, 1997). It is recommended that before initiating finasteride therapy, all patients should be screened for prostatic cancer with a DRE and serum PSA. If the results of either test prove abnormal, the patient should undergo transrectal sonography and biopsy prior to initiation of treatment (Keetch, 1997). Side effects include impotence, decreased libido, and decreased volume of ejaculate. Annual costs are approximately $700 (Wasson, 1998).

Alpha-andrenergic receptor blockade.

Alpha-1 blockers such as, terazosin, doxazosin, and tamulosin, relax the smooth muscle of the prostate and bladder neck without interfering with bladder contractility thus decreasing bladder resistance to urinary outflow. Alpha-1 blockers are also used in treatment of hypertension and can decrease total cholesterol levels. Side effects are listed in Table 4. Dosing should be titrated to lessen these side effects. Annual cost is approximately $460 (Weiss & Fair, 1997).

Combination therapy.

Because BPH produces obstruction by mechanical and dynamic means, it would follow that combining medications to treat each mechanism of obstruction simultaneously would be more effective than treating only one at a time. By combining finasteride to shrink the enlarged adenoma with a long-acting alpha-1 antagonist to relax the prostatic smooth muscles, an increase in urinary outflow and decrease in symptoms should occur. Again, finasteride should be used in combination therapy, only if the prostate is greater than 50 grams (Keetch, 1997).
Herbal therapy.

Saw Palmetto (serenoa repens) is a small palm tree found along the coastal southeastern United States and West Indies and is one of the most common herbal products sold in health food stores. At a dose of 160 mg bid, it has been said to improve BPH symptoms. The plant’s berry contains B-sitosterol, which is similar to the properties and activity of 5-alpha-reductase inhibitor. Clinical studies have not confirmed that B-sitosterol lowers DHT or PSA levels. However, a double-blind trial in patients with BPH showed a significant improvement in lower tract urinary symptoms. Side effects are the same as finasteride. Annual costs are approximately $180 (Randrup & Baum, 1997).

Surgery

Surgical intervention by any technique has a lower retreatment rate than initial therapy with drugs or watchful waiting. Long-term BPH can lead to renal insufficiency and recurrent urinary tract infections (UTI’s), prostate infections, hematuria, and bladder stones. In such cases, surgical intervention may be warranted. It can take up to 20 years following diagnosis for BPH to become sufficiently troublesome to require surgery (Mosier, 1998). When considering surgery you must also consider the indirect and intangible costs such as lost wages, absence from work, pain, suffering, potential post-operative complications, and anxiety related to the surgery and hospitalization. Pharmacological management is more cost effective than a surgical procedure, especially in older patients (the average age of surgical treatment for BPH is 67 years) and in those with a life expectancy of less than 10 years (Clinical Practice Guideline, 1994; Randrup & Baum, 1997).
There are a wide variety of surgical options available, ranging from the least invasive to most invasive, balloon dilation, radio frequency thermal therapy of the prostate by transurethral needle ablation (TUNA), transurethral microwave thermotherapy (TUMT), transurethral incision of the prostate (TUIP), endoscopic rollerball evaporation (EREV), transurethral resection of the prostate (TURP), transurethral laser ablation of the prostate (TULAP), and open prostatectomy (Bernier & Roehrborn, 1997; Issa, Myrick, & Symbas, 1998; Mosier, 1998). The total expected costs for a TURP and open prostatectomy in 1995 was $9,717 and $11,833, respectively (Cooper, 1995).

Conclusion

Benign prostatic hypertrophy has evolved from a disease managed by urologists with invasive procedures to a disease managed by primary care practitioners with drug therapy. These changes are supported and promoted by third party payers; treating BPH pharmacologically is more cost effective than surgery. The two most commonly used drugs, alpha-1 adrenergic blockers and 5-alpha-reductase inhibitor, appear to relieve the symptoms of mild to moderately severe BPH, as effectively as surgery. If men do not desire a watchful waiting approach, then medical therapy is a logical first line treatment for most patients. Only nonresponders to drug therapy, and patients with abnormal PSA and DRE findings need to be referred to a urologist (Randrup & Baum, 1997).

As primary care practitioners, it is our responsibility to educate the patient about the disease and treatment alternatives. Practitioners need to review the benefits and risks of each alternative, assess the patients attitude, and facilitate them in selecting an appropriate treatment option.
REFERENCES


International Prostate Symptom Score (I-PSS)

<table>
<thead>
<tr>
<th>Patient name:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>1. Incomplete emptying</th>
<th>0 1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the past month, how often have you had a sensation of not emptying your bladder completely after you finished urinating?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Frequency</th>
<th>0 1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the past month, how often have you had to urinate again less than 2 hr after you finished urinating?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Intermittency</th>
<th>0 1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the past month, how often have you found you stopped and started again several times when you urinated?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Urgency</th>
<th>0 1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the past month, how often have you found it difficult to postpone urination?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Weak stream</th>
<th>0 1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the past month, how often have you had a weak urinary stream?</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>6. Straining</th>
<th>0 1 2 3 4 5</th>
</tr>
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<tbody>
<tr>
<td>Over the past month, how often have you had to push or strain to begin urination?</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>7. Nocturia</th>
<th>0 1 2 3 4 5</th>
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<tbody>
<tr>
<td>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?</td>
<td></td>
</tr>
</tbody>
</table>

Total I-PSS score =

<table>
<thead>
<tr>
<th>Quality of life due to urinary symptoms</th>
</tr>
</thead>
</table>

If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?

<table>
<thead>
<tr>
<th>None</th>
<th>1 time</th>
<th>2 times</th>
<th>3 times</th>
<th>4 times</th>
<th>5 or more times</th>
</tr>
</thead>
</table>

Table 1 International prostate symptom score (I-PSS). (From Noble J (ed): Textbook of primary care medicine, ed 2, St Louis, 1996, Mosby.)

(Ferri, 1999)
Results of UROFLOWMETRY

<table>
<thead>
<tr>
<th></th>
<th>T100</th>
<th>TQ</th>
<th>TQmax</th>
<th>Qmax</th>
<th>Qave</th>
<th>Vcomp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voiding time</td>
<td>14.0</td>
<td>13.0</td>
<td>5.0</td>
<td>19.0</td>
<td>12.1</td>
<td>161.0</td>
</tr>
<tr>
<td>Flow time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to max. flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. flow rate</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Average flow rate</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voided volume</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2

A. Uroflowmetry results in a normal 70-year-old patient with no evidence of BPH. B. Uroflowmetry results in a 70-year-old man with moderate symptoms of obstruction (symptom score of 15) due to BPH.

(Perinchery, 1995)
Table 3  Decision diagram. Although PSA and flow rate studies are considered optional by the CPG guidelines, these tests are relatively simple, inexpensive, and helpful in clinical management of most patients. (Adapted and reproduced from CPG: Clinical Practice Guide, U.S. Department of Health and Human Services, 1994.)

(Perinchery, 1995)
<table>
<thead>
<tr>
<th>Agent</th>
<th>Dosing</th>
<th>Mechanism of Action</th>
<th>Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-alpha reductase</td>
<td>5 mg p.o. bid</td>
<td>Blocks intracellular conversion of testosterone to DHT which reduces prostate size thus reducing obstructive urinary outflow.</td>
<td>False elevated PSA values. Impotence. Decreased libido. Decreased volume of ejaculate.</td>
</tr>
<tr>
<td>Alpha-adrenergic receptor blockers (Terazosin/Hytrin)</td>
<td>1 mg p.o. hs gradually titrated up to 10 mg. Recommended range is 1-5 mg daily or divided bid.</td>
<td>Relaxes smooth muscle of prostate and bladder neck, thus decreasing bladder resistance to urinary outflow.</td>
<td>Aesthenia, dizziness, headache, nervousness, parasthesia, somnolence, palpitations, peripheral edema, postural hypotension, tachycardia, nasal congestion, sinusitis, blurred vision, nausea, impotence, dyspnea, back pain, muscle pain.</td>
</tr>
<tr>
<td>(Doxazosin/ Cardura)</td>
<td>1 mg p.o. hs titrated up to 16 mg. Recommended range is 4-8 mg every hs.</td>
<td>Same</td>
<td>Dizziness, vertigo, somnolence, drowsiness, aesthenia, headache, orthostatic hypotension, edema, palpitations, arrhythmias, tachycardia, nausea and vomiting, diarrhea, constipation, rash, pruritis, rhinitis, arthralgia, myalgia, pain, dyspnea, pharyngitis, abnormal vision.</td>
</tr>
<tr>
<td>(Tamsulosin/ Flomax)</td>
<td>0.4 mg p.o. daily 30 minutes after the same meal each day. After 2-4 weeks, may increase dosage to 0.8 mg, if needed.</td>
<td>Same</td>
<td>Dizziness, headache, insomnia, somnolence, chest pain, amblyopia, diarrhea, nausea, abnormal Ejaculation, decrease</td>
</tr>
</tbody>
</table>
in libido, cough, pharyngitis, rhinitis, sinusitis, aesthenia, back pain, infection, tooth disorder.

(Nurse Practitioner's Drug Handbook, 2nd ed.)
Figure 1A Longitudinal and transverse view at mid prostate as visualized during transrectal ultrasonography with a sector scanner (Proscan, Textron, Inc., St Louis, MO) and 75 MHz probe. Longitudinal scan reveals the prostate urethra (PU), transition zone (TZ), ejaculatory duct (ED), peripheral zone (PZ), prostate apex (PA), and urethra (U). The normally hypoechoic zone can be differentiated from the more echogenic peripheral zone in the transverse view.

Figure 1B Transverse view of mid portion of prostate in a patient with an enlarged transition zone due to BPH. Note that the enlarged transition zone has compressed the peripheral zone.

(Perinchery, 1995)
Enlarged prostate
An enlarged prostate gland distorts the urethra, weakening the flow of urine. The bladder cannot empty completely, causing the need to urinate frequently.

Figure 2

(Clayman, 1995)