

# MODULE 3: BENIGN PROSTATIC HYPERTROPHY

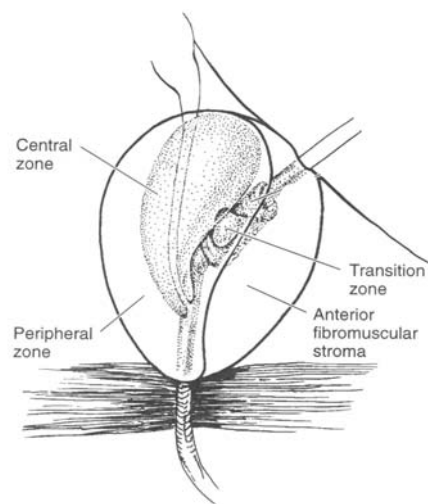
**KEYWORDS:** Prostatic hypertrophy, prostatic hyperplasia, PSA, voiding dysfunction, lower urinary tract symptoms (LUTS)

At the end of this clerkship, the medical student will be able to:

1. Identify and name the major anatomic and histologic features of the prostate gland
2. Identify the predominant location in the prostate where BPH develops and describe how this fact relates to the symptoms and signs of BPH
3. Define BPH
4. Describe the distinctive epidemiological features and natural history of BPH
5. List the symptoms and signs of BPH
6. List the important components of the history when interviewing a patient with BPH
7. List the important components of the physical exam of a patient with BPH
8. Summarize the laboratory, radiologic, or urodynamic tests, if any, that should be ordered in a patient with BPH
9. List the indications for treatment of BPH
10. List the medical and surgical treatment options for BPH.
11. Describe when a patient with BPH should be referred to a urologist

## PROSTATE ANATOMY

There are three basic anatomic regions of the prostate: the anterior prostate, central gland and peripheral gland, as illustrated in Figure 1.



**Figure 1:** The zones and glandular regions of the normal prostate.

The arterial blood supply to the prostate is from the inferior vesical artery. The anterior prostate is entirely fibromuscular and non-glandular, and it appears to have little significance in prostatic function or pathology. This area comprises approximately 20% of the bulk of prostatic tissue. The central gland is composed of the proximal urethra, the prostate tissue around the posterior urethra and the smooth muscle of the internal sphincter, which is mediated by  $\alpha_1$  A receptors. It forms the central portion of the prostate and extends from the base of the prostate to the verumontanum. The transition zone surrounds the urethra, and although this region accounts for only 10% of prostate glandular tissue in young men, it exhibits significant growth with age. Indeed, it is in the transition zone is where benign prostatic hypertrophy (BPH) develops. The peripheral gland or zone is composed entirely of acinar tissue. It comprises the posterior surface of the prostate, including the apical, lateral, posterolateral and anterolateral portions of the prostate. The peripheral zone represents approximately 70% of glandular volume in the normal adult prostate. The vast majority of prostatic carcinomas arise in this region of the prostate.

## **BENIGN PROSTATIC HYPERPLASIA DEFINITION**

The term "benign prostatic hyperplasia (BPH)" has been used to describe a constellation of voiding symptoms that occurs in men with aging. These symptoms include decreased force of stream, hesitancy, straining, incomplete bladder emptying, and nocturia; dysuria is usually not a symptom of BPH. Such symptoms are generally referred to as obstructive in nature. Irritative symptoms are also associated with BPH and include urinary frequency, urgency, and occasionally dysuria. BPH has been used synonymously with "prostatism" and "bladder outlet obstruction", implying that obstruction to urinary outflow, secondary to prostatic enlargement, is the cause of such symptoms. More recently, it has been recognized that prostatic enlargement is not necessary for such symptoms. Furthermore, women may experience similar symptoms with age. Thus, "lower urinary tract symptoms" (LUTS) is currently the preferred term to describe this complex of obstructive and irritative urinary symptoms that occur in both sexes with age.

Voiding dysfunction in the aging male may be due to a variety of factors including changes in the bladder, prostate and/or urethra. Intrinsic changes in the bladder, such as bladder instability, decreased bladder compliance and decreased bladder capacity may all lead to LUTS. However, in many men these symptoms are due to BPH, mediated via  $\alpha_1$  A receptors. With age, the prostate exhibits glandular enlargement, increased smooth muscle tone and decreased compliance secondary to altered collagen deposition; these changes can lead to altered urinary symptoms. Urethral stricture and bladder neck contracture are other forms of obstruction or blockage that can present with similar symptoms.

BPH is one of the most frequent diagnoses leading to urology referral. It is commonly found in men of all ages. It begins to develop before age 30 with almost 10% of men having histologic evidence of BPH by 40 years of age, and 50% of men showing

evidence by age 60. Overall, nearly 80% of men will develop BPH, and as many as 30% will receive treatment for it. In studies that examine the natural history of BPH, the incidence of acute urinary retention or the development of a significant post-void residual urinary volume is 2% per year. Thus, the burden of BPH on the healthcare system is substantial.

## BENIGN PROSTATIC HYPERTROPHY-DIAGNOSIS

After excluding other causes of LUTS, both objective and subjective parameters are used to decide whether or not treatment is indicated. Objective parameters include determination of prostate size, measurement of urinary flow rate and determination of the post-void residual urine volume. While it is useful in assessing the size of the prostate gland, the main objective of the digital rectal exam in evaluation of men with LUTS is to identify prostatic nodules. Although several subjective instruments are available to quantify the severity of LUTS, the American Urological Association Symptom Score Index (AUASI) also known as the International Prostatic Symptom Score (IPSS) is used by most clinicians (Figure 2). This questionnaire consists of seven items that determines the severity of irritative and obstructive voiding symptoms.

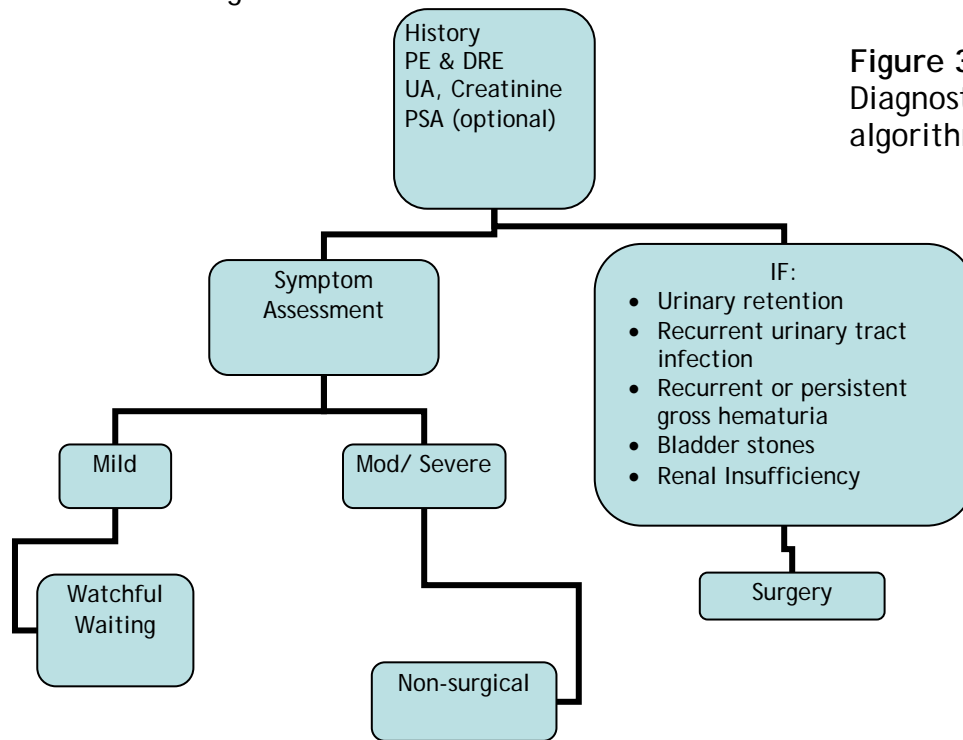
International Prostate Symptom Score (I-PSS)						
Patient's Name						
Date of Birth	Date Completed					
	Not at all	1/2 times	1 time	2 times	3 times	4 times
1. Incomplete emptying Over the past month, how often have you had a sensation of not emptying your bladder completely after you finished urinating?	0	1	2	3	4	5
2. Frequency Over the past month, how often have you had to urinate again less than two hours after you finished urinating?	0	1	2	3	4	5
3. Intermittency 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. Urgency Over the past month, how often have you found it difficult to postpone urination?	0	1	2	3	4	5
5. Weak Stream Over the past month, how often have you had a weak urinary stream?	0	1	2	3	4	5
6. Straining Over the past month, how often have you had to push or strain to begin urination?	0	1	2	3	4	5
	None	1 time	2 times	3 times	4 times	5 times or more
7. Nocturia 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	1	2	3	4	5
Total IPSS Score						
Quality of Life Due to Urinary Symptoms						
	Not at all	1	2	3	4	5
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?						
	0	1	2	3	4	5

Figure 2: The validated AUA Symptom Score tool for voiding symptoms.

Symptom severity related to urinary frequency, nocturia, weak urinary stream, hesitancy, intermittency, incomplete bladder emptying and urinary urgency are assessed. On a scale of 0-35, mild symptoms exist with scores of 0-7, moderate symptoms with scores of 7-15 and severe symptoms with a score of >15. This index demonstrates predictive validity, reliability and internal consistency. There is some correlation between the objective and subjective measures in that the lower the peak

urinary flow rate, the more severe the urinary symptoms and the larger the prostate. Using the AUA Symptom score and the information from the clinical evaluation, treatment options can be reviewed, as outlined in Figure 3.

Importantly, there are several signs or symptoms that may coexist with voiding symptoms that can alter the treatment algorithm. If the patient has urinary retention, an acute condition in which urine is unable to be voluntarily voided, then immediate treatment with surgery may be indicated. A trial of Foley catheter or clean intermittent catheterization and alpha-blocker medication may avoid surgical treatment in the future in about 80% of cases in which retention coexists with LUTS. The likelihood of going into retention is related to prostate size, patient age, and the severity of the symptoms. Recurrent urinary tract infections, persistent or recurrent gross hematuria, and bladder stones are also coexisting conditions that may necessitate surgical instead of medical treatment.



**Figure 3.**  
Diagnostic and treatment algorithm for BPH.

## BENIGN PROSTATIC HYPERTROPHY-TREATMENT

### *Drug Therapy*

Medical therapy for BPH attempts to shrink or stop the growth of the prostate or open the urethral channel within the prostate, without using surgery. The FDA has currently approved six drugs to relieve the symptoms associated with an enlarged prostate.

Finasteride, FDA-approved in 1992, and Dutasteride, FDA-approved in 2001, inhibit production of the hormone dihydrotestosterone (DHT), which is responsible for growth of the acinar glands of the prostate. These drugs can either prevent progression of growth of the prostate or actually shrink the prostate in some men.

The drugs terazosin, doxazosin, tamsulosin, and alfuzosin are also used to treat BPH. These drugs belong to the class known as alpha-blockers, and all act by relaxing the smooth muscle of the prostate and bladder neck to improve urine flow and to reduce bladder outlet obstruction. Terazosin and doxazosin were developed as blood pressure pills, but tamsulosin and alfuzosin were developed specifically to treat BPH. There is excellent clinical trial data that shows that finasteride and doxazosin together is more effective than using either drug alone to relieve symptoms and prevent BPH progression. The dual-drug regimen reduced the risk of BPH progression by 67 percent, compared with 39 percent for doxazosin alone and 34 percent for finasteride alone.

Because drug treatment is not effective in all cases, a number of minimally invasive procedures have been developed to relieve BPH symptoms. In general, these procedures are less invasive than conventional surgery for BPH, which is the transurethral resection of the prostate (TURP).

### *Minimally Invasive Therapy*

Transurethral microwave procedures: This device uses microwaves to heat and destroy excess prostate tissue. In the procedure called transurethral microwave thermotherapy (TUMT), the device sends microwaves through a catheter to heat selected portions of the prostate to at least 111 degrees Fahrenheit. A cooling system protects the urinary tract during the procedure. The procedure is performed on an outpatient basis in an hour without general anesthesia. TUMT has not been reported to lead to erectile dysfunction or incontinence. Although microwave therapy does not cure BPH, it reduces urinary frequency, urgency, straining, and intermittent flow. It does not correct the problem of incomplete emptying of the bladder. The long-term effects of microwave therapy are still not clear however.

Transurethral needle ablation (TUNA): The TUNA system delivers low-level radiofrequency energy through twin needles to burn away selected regions of the enlarged prostate. Shields protect the urethra from heat damage. The TUNA system improves urine flow and relieves symptoms with fewer side effects when compared

with conventional surgery, transurethral resection of the prostate (TURP). No incontinence or impotence has been observed with this procedure.

Water-induced thermotherapy: This therapy uses heated water to destroy excess tissue in the prostate. A catheter containing multiple shafts is positioned in the urethra so that a treatment balloon rests in the middle of the prostate. A computer controls the temperature of the water, which flows into the balloon and heats the surrounding prostate tissue. The system focuses the heat in precise regions of the prostate, while surrounding tissues in the urethra and bladder are protected. Destroyed tissue either escapes with urine through the urethra or is reabsorbed by the body.

High-intensity focused ultrasound (HIFU): The use of low frequency ultrasound waves to destroy prostate tissue is the youngest of the minimally invasive therapies developed for BPH. It appears as safe as other minimally invasive methods but long-term outcome data is not available as of yet.

Transurethral laser surgery: Surgical procedures that employ side-firing laser fibers and Nd: YAG lasers to vaporize obstructing prostate tissue are also used to treat BPH. A laser fiber is passed into the urethra near the prostate using a cystoscope and then several bursts of energy lasting 30 to 60 seconds are delivered through the laser fiber. The laser energy destroys prostate tissue and causes shrinkage. As with TURP, laser surgery requires anesthesia and a hospital stay. One advantage of laser surgery over TURP is that laser surgery causes less blood loss and allows for a quicker recovery. However, laser surgery may not be effective on larger prostates and the long-term effectiveness of laser surgery is unclear. There are two variations of laser surgery for BPH: Photoselective Vaporization of the Prostate (PVP) uses a high-energy laser to destroy prostate tissue and seal the treated area, and Interstitial Laser Coagulation involves placing the tip of the fiberoptic probe directly into the prostate tissue to destroy it.

### *Conventional Surgical Therapy*

Transurethral resection of the prostate (TURP): Surgical therapy with transurethral resection of the prostate (TURP) has traditionally been the "gold standard" treatment for men with BPH. In 1986, it was estimated that TURP accounted for 24% of the professional workload for practicing urologists in the U.S. In this type of surgery, no external incision is needed. After giving anesthesia, the surgeon reaches the prostate by inserting an instrument called a resectoscope through the urethra. The resectoscope is about 12 inches long and 1/2 inch in diameter, contains a light, valves for controlling irrigating fluid, and an electrical loop that cuts tissue and seals blood vessels. During the 60-90-minute operation, the surgeon uses the scope's wire loop to remove the obstructing tissue one piece at a time. The pieces of tissue are carried by the fluid into the bladder and then flushed out at the end of the operation. A TURP is used for approximately 90% of all prostate surgeries for BPH. In most patients, before TURP is performed, consideration has already been given to medical therapy. In

general, TURP is reserved for very symptomatic men or those who develop complications including urinary tract infection, urinary retention, bladder stones, or gross hematuria.

A variation of the TURP procedure is called transurethral incision of the prostate (TUIP). Instead of removing tissue, as with TURP, this procedure widens the urethra by making a few small cuts in the bladder neck, where the urethra joins the bladder, and in the prostate gland itself. Although some people believe that TUIP gives the same relief as TURP with less risk of side effects such as retrograde ejaculation, its advantages and long-term side effects have not been clearly established.

Surgical "open" prostatectomy: In the few cases when a transurethral procedure cannot be done, because the prostate is too large, the bladder has been damaged or contains bladder stones or important identifying landmarks not visible for TURP, open prostatic surgery is indicated. With all open surgical procedures, anesthesia is given and an incision is made. Once the surgeon reaches the prostate capsule, he or she scoops out the enlarged tissue from inside the gland. Importantly, as with other types of surgery and procedures for BPH, the part of the prostate at risk for prostate cancer development is not removed and therefore men who have procedures for BPH are still at risk for developing prostate cancer.

## **BENIGN PROSTATIC HYPERPLASIA AND PSA**

Prostate Specific Antigen (PSA) is a serine protease produced by benign and malignant prostate tissue. Functionally, PSA is the enzyme responsible for liquefaction of the seminal fluid after ejaculation. Although produced in small amounts in other tissues, it should be considered to be prostate specific. A strong correlation exists between serum PSA level and prostate volume. PSA circulates in the serum in both free (unbound) and complexed (bound) forms. In addition to being elevated by BPH and prostate cancer, PSA may also be transiently elevated in cases of prostatic inflammation (prostatitis) or infarction, and after prostatic manipulation by biopsy. However, routine digital rectal examination (DRE) usually has little effect on serum PSA levels. The half-life of serum PSA is 2.2 to 3.2 days. Therefore, one should wait 4 to 8 weeks after prostate manipulation and inflammation (cystoscopy, prostate biopsy, and prostatitis) before obtaining a PSA.

The screening recommendations from the AUA advise that PSA screening be offered to men 50 years or older, and who have a life expectancy of at least 10 years. Men with a first-degree relative known to have prostate cancer or of African American ethnicity should consider PSA screening at 45 years of age. Men with one first-degree relative who has prostate cancer have a twofold increased risk of also developing the disease. Potential screening should be preceded by an informed discussion of the risks and benefits of screening, early diagnosis and treatment. Given the added cost and anxiety associated with PSA screening, in combination with a lack of randomized trials showing that screening decreases morbidity and mortality, such screening is not

recommended for everyone. With such information, the patient can make an individual decision regarding PSA screening.

## SUMMARY

- The prostate is composed of several regions and zones: two zones of interest are the peripheral zone, where most cancers arise, and the transition zone, where BPH arises.
- The diagnosis of voiding dysfunction due to BPH is made based on both subjective and objective findings on clinical evaluation.
- Medical treatment of BPH involves treatment that relaxes the muscular stromal tissue of the bladder neck and prostatic urethra (alpha-blockers) and reduction in the acinar-glandular volume of the prostate through reduced DHT production (5-alpha-reductase inhibitors).
- Indications for surgical intervention with BPH include urinary retention, gross hematuria, bladder stones, and urinary tract infection.
- Serum PSA, a serine protease that liquefies the ejaculate, increases over time with both BPH and prostate cancer, which makes it a difficult diagnostic marker for cancer alone.

## COMPUTER BASED LEARNING CASES

Benign Prostatic Hyperplasia 1 - The Case of Mr. Jones and the Urinal of Doom  
<[http://mycourses.med.harvard.edu/vp\\_view.asp?frame=Y&case\\_id=%7bA939D014-ACD7-4FCF-9ADD-F0A98B2751C7%7d](http://mycourses.med.harvard.edu/vp_view.asp?frame=Y&case_id=%7bA939D014-ACD7-4FCF-9ADD-F0A98B2751C7%7d)>

Benign Prostatic Hyperplasia 2 - The Case of Mr. Presley's Urinary Retention  
<[http://mycourses.med.harvard.edu/vp\\_view.asp?frame=Y&case\\_id=%7bB1246F38-64EF-457A-A8AF-1C815FEF5B27%7d](http://mycourses.med.harvard.edu/vp_view.asp?frame=Y&case_id=%7bB1246F38-64EF-457A-A8AF-1C815FEF5B27%7d)>

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