INTRODUCTION

The Prostate and Its Problems

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The prostate is a gland located in the pelvic area directly beneath the bladder. It surrounds the urethra (the tube that conducts urine from the bladder to the penis). The prostate is both a gland and a muscle. As a gland it produces a milky, alkaline fluid that is mixed with sperm (produced in the testicles) to produce the fluid (semen) ejaculated during sexual intercourse and masturbation. The prostate gland also contains an enzyme, 5-alpha-reductase, which converts testosterone to dihydrotestosterone. As a muscle the prostate works to propel seminal fluid through the urethra and out of the penis during ejaculation. The muscle part of the prostate also acts as a "gate" for the flow of urine. There are two shut-off valves that control urination, one (internal sphincter) at the junction of the bladder and the upper part of the prostate, the other (external sphincter) at the base (apex) of the prostate. Both are required to prevent incontinence and dribbling. The upper shut-off valve also prevents seminal fluid from "shooting backwards" into the bladder during ejaculation (retrograde ejaculation).

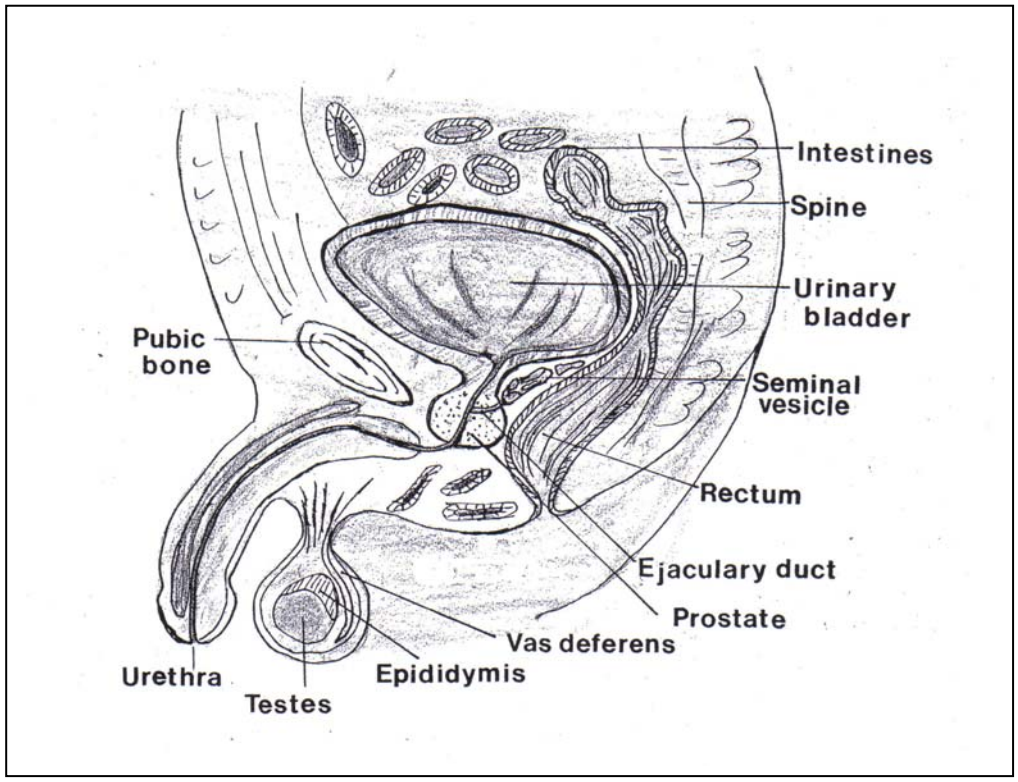

Figure 1-1. Male Pelvic Area

The prostate, prior to puberty, is quite small, about the size of a marble. It undergoes a rapid growth spurt during puberty and reaches the size of a walnut in adolescence. In middle age the prostate usually begins enlarging again and can exceed the size of a golf ball. The average weight of a normal adult prostate is 20-40 grams.

The prostate is surrounded by a dense fibrous capsule and can be divided into three zones – the peripheral zone, the central zone, and the transition zone.

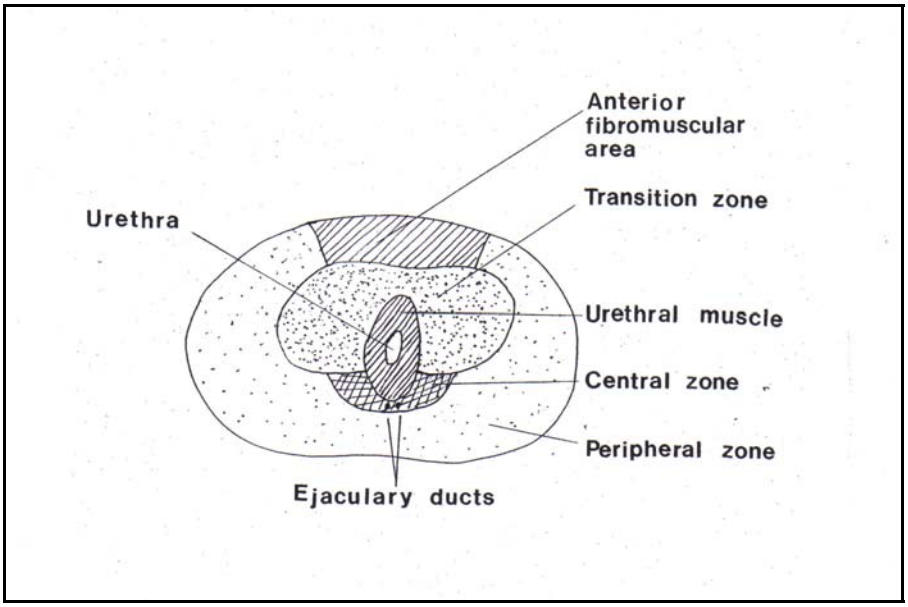

Figure 1-2. Prostate Cross-sectional View

The prostate contains three different types of cells:

- Stromal cells, which form the overall structure of the gland.
- Glandular cells, which produce a milky, alkaline fluid which, when mixed with sperm, become semen.
- Smooth muscle cells, which contract during sexual intercourse and squeeze the fluid produced by the glandular cells into the urethra. Here it mixes with semen and is then ejaculated through the penis.

As most men over the age of 50 years know only too well, the prostate is a prominent source of problems and discomfort, especially problems with urination and pain in the pelvic area. The three most common disease conditions associated with the prostate are prostatitis (inflamed prostate), prostate enlargement (benign prostatic hyperplasia or BPH), and the most feared of them all, prostate cancer. Both prostatitis and BPH usually manifest themselves through difficulties in urination (lower urinary tract symptoms or LUTS); thus it is important to understand how the urination (micturition) process works.

THE MICTURITION PROCESS

In infants, the micturition process is involuntary, in other words, it happens when it happens. However, after maturation of the nervous system the process becomes voluntary, in other words, the individual can control when and where to urinate. This control can be lost again as a result of aging, neural injury, or severe BPH. Losing control of normal bladder function is, unfortunately, very common. It is estimated that about 17 million men and women in the USA alone suffer from bladder control problems.[1]

The lower urinary tract (bladder, sphincters and urethra) is innervated by the two branches of the autonomic nervous system (ANS), the parasympathetic (vagal) branch and the sympathetic (adrenergic) branch, and also receives input from pudendal nerves originating in the somatic nervous system. These different nerves work in unison (most of the time) to control the two phases of the micturition cycle, the filling (storage) phase, and the voiding (elimination) phase. During the filling phase filtered urine flows from the kidneys through the ureter into the bladder. The bladder walls (detrusor muscle) are kept in a relaxed state by the combined action of the sympathetic and parasympathetic branches of the ANS and thus allows for filling. At the same time, sympathetic nerve activity keeps the bladder sphincter (shut-off valve) and urethra tightly closed so that leakage is avoided.

When the bladder reaches its storage capacity (about 100-150 mL or 3.5-5 ounces) a message is sent to the control center in the brain indicating that it is time for the emptying phase to begin. People without urinary dysfunction can, to a large extent, control the timing of voiding, but eventually the process must proceed. The voiding phase involves activation of vagal nerves in the bladder and expulsion of the urine through the bladder neck, sphincters and urethra. The successful voiding process needs the cooperation of the pudendal nerves and the sympathetic branch of the ANS to relax the sphincters and urethra and thus make voiding possible. It is also believed that the increased parasympathetic activity in the voiding cycle causes the release of nitric oxide, which further relaxes the outlet musculature.[2]

It is clear that the urination process is by no means simple and that things can easily go wrong. There is now evidence that some of the urinary difficulties (frequency, urgency, intermittent stream, and nocturia) involved in both prostatitis and BPH are, at least in part, due to excessive sympathetic activity which keeps the external sphincter and urethra compressed when they should be relaxed.[2,3]

The main neurotransmitter released by the nerve endings of the sympathetic branch is norepinephrine. It is well established that alpha-adrenoreceptor blockers, which inhibit the muscle-tightening effects of norepinephrine, can be helpful in dealing with prostatitis and BPH (see Chapters 1 and 2).

Sympathetic nervous system over-activity restricting urinary flow could potentially lead to a thickening of the bladder wall (development of more muscle power) in an attempt to overcome the obstruction. Obstruction of the urethra by overgrowth (BPH) can also result in the development of a thickened and overly muscular bladder wall (detrusor).

Thus, both prostatitis and BPH can affect bladder function and create a vicious feedback loop leading to a worsening of LUTS.

UNDERLYING CAUSES OF PROSTATE PROBLEMS

The three major prostate disorders, prostatitis, BPH and cancer, involve one or more of the following underlying problems:

- Uncontrolled cell growth (benign or malignant)
- Over-activity of the sympathetic nervous system (SNS)
- Bacterial infection
- Inflammation
- Neuromuscular spasm
- Severe emotional stress

Prostatitis may involve bacterial infection, inflammation, neuromuscular spasm, SNS over-activity and severe emotional stress. BPH involves SNS over-activity and benign, uncontrolled cell growth – or rather lack of controlled cell death (apoptosis). Prostate cancer involves malignant, uncontrolled cell growth and inhibited apoptosis and can, in the later stages, also involve LUTS due to pressure exerted on the urethra by the tumor.

PROSTATITIS

The name "prostatitis" is, unfortunately, somewhat misleading as neither the prostate nor an inflammation is necessarily involved. The causes, risk factors, prevention and treatment of this common disorder are discussed in detail in Chapter 1.

BENIGN PROSTATIC HYPERPLASIA (BPH)

The name "benign prostatic hyperplasia" or "enlarged prostate" is also, to some extent, a misnomer. Many cases of BPH do not involve an abnormally large prostate and are treated successfully with alpha-receptor blockers indicating that their main cause is SNS over-activity rather than overgrowth causing narrowing and pressure on the urethra. Furthermore, there is evidence that it is not really uncontrolled growth of benign cells in the transition zone (the zone bordering the urethra) that is the problem, but rather a lack of controlled cell death. The causes, risk factors, prevention and treatment of BPH are discussed in detail in Chapter 2.

PROSTATE CANCER

Prostate cancer involves the growth of abnormal (malignant) cells generally in the peripheral zone, most often close to the outer surface of the prostate. Prostate tumors thus do not, at least in the initial stages, put pressure on the urethra and thus produce

no urinary symptoms. Because the tumors are on the outer part of the gland they can, however, often be felt during a digital rectal examination (DRE).

While neither prostatitis nor BPH are life-threatening in their own right, prostate cancer certainly is. Thus, the main part of this book is devoted to this disease. Chapter 3 discusses causes and risk factors. Chapter 4 covers diagnosis, and Chapter 5 is devoted to prevention. Chapter 6 and 7 discuss conventional treatment of localized and advanced cancer respectively, while Chapter 8 provides information about alternative treatments and specialized cancer clinics. Chapter 9 is devoted to a discussion of emerging trends in diagnosis, procedures and treatment for prostate problems.

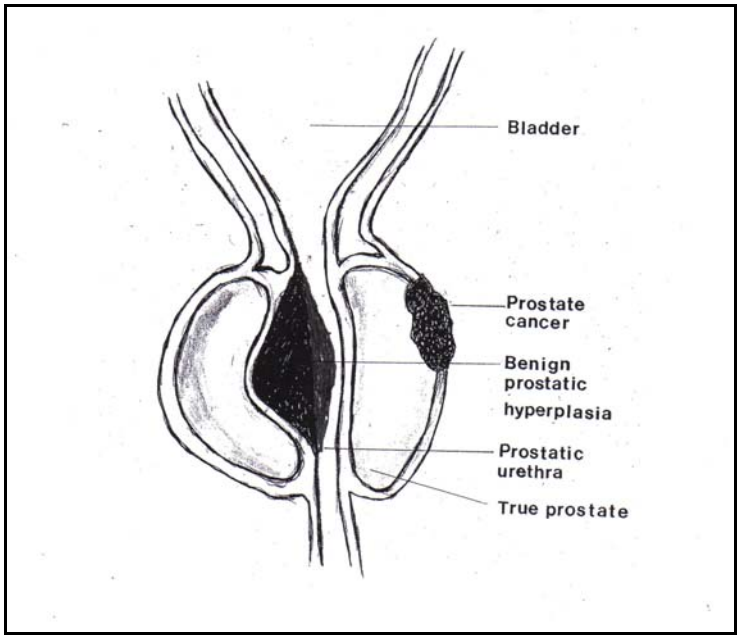

Figure 1-3. Location of BPH and Cancer

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