Introduction

Benign prostatic hyperplasia (BPH), is one of the most common diseases of aging men, it can be associated with bothersome lower urinary tract symptoms (LUTS) that affect quality of life by interfering with normal daily activities and sleep patterns ***(Welch et al., 2002).***

Lower urinary tract symptoms whether irritative ; urinary frequency, urgency, nocturia or obstructive; decreased force of stream, and incomplete bladder emptying - comprise a major health concern for many older men ***(anville, 2002).***

A wide range of treatment methods have been introduced, ranging from watchful waiting ***(AUA Practice Guidelines Committee, 2003)***, medical management using Alfa-blockers or 5-α Reductase inhibitors ***(Dubeau, 2003),*** Phytotherapy, minimally invasive prostatectomy as laser prostatectomy and invasive by transurethral resection of the prostate (TURP) and finally transvesical prostatectomy .

When surgical treatment is considered, transurethral resection of the prostate (TURP) is still the gold standard to which all other modalities are compared ***(Emberton et al., 1995).*** Although the morbidity associated with TURP can be low when performed by experienced surgeons, complications such as TUR syndrome and bleeding can still occur. For this reason, many alternative energy modalities have been developed in an attempt to not only provide an effective surgical treatment for BPH, but also to minimize the risk of complications and the period of hospital stay ***(Mebust et al., 1989).***

Attempts at developing office-based surgical therapies with lower morbidity and efficacy rivaling TURP have led to the emergence of several minimally invasive techniques. Currently available are laser prostatectomy ,transurethral electrovaporization of the prostate (TUVP), transurethral needle ablation (TUNA), high-intensity focused ultrasound (HIFU) and transurethral microwavetherapy (TUMT) ***(Chapple, 2006).***

Laser prostatectomy is a new technology that provides minimal morbidity while attempting to treat bladder outlet obstruction. The new laser procedures can deliver sufficient heat to the prostate so that either coagulation necrosis or frank vaporization occurs. Types of laser include Neodymium:Yttrium-Aluminum-Garnet (Nd:YAG) lazer and Potassium Titanyl Phosphate (KTP) laser where coagulation and vaporization occurs. Holmium:Yttrium-Aluminum-Garnet (Ho:YAG) laser, Diode laser and Greenlight photoselective vaporization laser system where vaporization occurs ***(Anson, 2004).***

Recently, Plasma kinetic vaporization of the prostate with bipolar energy (PKVP) was introduced as a technical modification of TURP.As the bipolar electrosurgical equipment simultaneously vaporizes tissue and controls bleeding, resulting in a clear operative field, and eliminates risk of TUR syndrome, it provides a new option among minimally invasive surgical treatments for BPH. It is also claimed to be easier to master ***(Botto et al., 2001).***

The biggest advantage of bipolar current in TURP is the use of saline for irrigation (transurethral resection in saline ,TURis), which may reduce the morbidity associated with the absorption of fluid . Performing TURP with saline, eliminates the risk of TUR syndrome, thereby enabling the removal of a larger bulk of prostatic tissue by resection or vaporization ***(Eaton et al., 2002).***

Aim of the work

Is to evaluate the rule of plasma kinetic vaporization of the prostate (PVP) in the treatment of benign prostatic hyperplasia (BPH).

Anatomy of prostate

Anatomic Relationships

The normal prostate weighs 18 g; measures 3 cm in length, 4 cm in width, and 2 cm in depth; and is traversed by the prostatic urethra . Although ovoid, the prostate is referred to as having anterior, posterior, and lateral surfaces, with a narrowed apex inferiorly and a broad base superiorly that is contiguous with the base of the bladder. It is enclosed by a capsule composed of collagen, elastin, and abundant smooth muscle. Posteriorly and laterally, this capsule has an average thickness of 0.5 mm, although it may be partially transgressed by normal glands. Microscopic bands of smooth muscle extend from the posterior surface of the capsule to fuse with Denonvilliers' fascia ***(Myers, 1994).***

Loose areolar tissue defines a thin plane between Denonvilliers' fascia and the rectum. On the anterior and anterolateral surfaces of the prostate, the capsule blends with the visceral continuation of endopelvic fascia. Toward the apex, the puboprostatic ligaments extend anteriorly to fix the prostate to the pubic bone . The superficial branch of the dorsal vein lies outside this fascia in the retropubic fat and pierces it to drain into the dorsal vein complex ***(Myers, 1994).***

Laterally, the prostate is cradled by the pubococcygeal portion of levator ani and is directly related to its overlying endopelvic fascia. Below the juncture of the parietal and visceral endopelvic fascia (arcus tendineus fascia pelvis), the pelvic fascia and prostate capsule separate and the space between them is filled by fatty areolar tissue and the lateral divisions of the dorsal vein complex. During a radical retropubic prostatectomy, the endopelvic fascia should be divided lateral to the arcus tendineus fascia pelvis to avoid injury to the venous complex ***(Walsh et al., 1983).***

The apex of the prostate is continuous with the striated urethral sphincter . Histologically, normal prostatic glands can be found to extend into the striated muscle with no intervening fibromuscular stroma or “capsule.” At the base of the prostate, outer longitudinal fibers of the detrusor fuse and blend with the fibromuscular tissue of the capsule. As mentioned, the middle circular and inner longitudinal muscles extend down the prostatic urethra as a preprostatic sphincter. As with the apex, no true capsule separates the prostate from the bladder. In surgically resected prostate carcinomas, this peculiar anatomic arrangement can make interpretation of these margins difficult and has led some pathologists to propose that the prostate does not possess a true capsule ***(Epstein, 1989).***

Structure

The prostate is composed of approximately 70% glandular elements and 30% fibromuscular stroma. The stroma is continuous with capsule and is composed of collagen and abundant smooth muscle. It encircles and invests the glands of the prostate and contracts during ejaculation to express prostatic secretions into the urethra ***(McNeal, 1972).***

The urethra runs the length of the prostate and is usually closest to its anterior surface. It is lined by transitional epithelium, which may extend into the prostatic ducts. The urothelium is surrounded by an inner longitudinal and an outer circular layer of smooth muscle. A urethral crest projects inward from the posterior midline, runs the length of the prostatic urethra, and disappears at the striated sphincter . To either side of this crest, a groove is formed (prostatic sinuses) into which all glandular elements drain . At its midpoint, the urethra turns approximately 35 degrees anteriorly, but this angulation can vary from 0 to 90 degrees ***(McNeal, 1972, 1988).***

This angle divides the prostatic urethra into proximal (preprostatic) and distal (prostatic) segments that are functionally and anatomically discrete . In the proximal segment, the circular smooth muscle is thickened to form the involuntary internal urethral (preprostatic) sphincter described earlier. Small periurethral glands, lacking periglandular smooth muscle, extend between the fibers of the longitudinal smooth muscle to be enclosed by the preprostatic sphincter. Although these glands constitute less than 1% of the secretory elements of the prostate, they can contribute significantly to prostatic volume in older men as one of the sites of origin of benign prostatic hyperplasia ***(McNeal, 1972, 1988)*** (Fig.1).

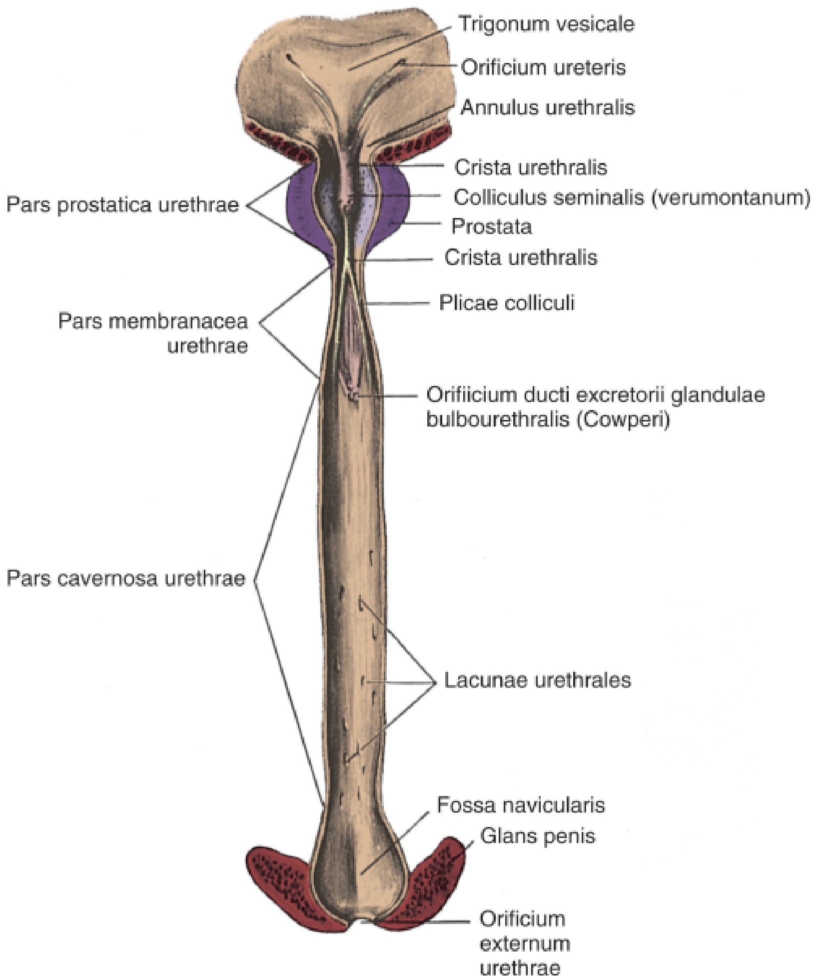

Fig. (1): Posterior wall of the male urethra. *(From Anson BJ, McVay CB: Surgical Anatomy, 6th ed. Philadelphia, WB Saunders, 1984, p 833).*

Beyond to the urethral angle, all major glandular elements of the prostate open into the prostatic urethra. The urethral crest widens and protrudes from the posterior wall as the verumontanum . The small slit like orifice of the prostatic utricle is found at the apex of the verumontanum and may be visualized cystoscopically. The utricle is a 6-mm müllerian remnant in the form of a small sac that projects upward and backward into the substance of the prostate ***(McNeal, 1988).***

To either side of the utricular orifice, the two small openings of the ejaculatory ducts may be found. The ejaculatory ducts form at the juncture of the vas deferens and seminal vesicles and enter the prostate base where it fuses with the bladder. They course nearly 2 cm through the prostate in line with the distal prostatic urethra and are surrounded by circular smooth muscle ***(McNeal, 1988).***

In general, the glands of the prostate are tubuloalveolar with relatively simple branching and are lined with simple cuboidal or columnar epithelium. Scattered neuroendocrine cells, of unknown function, are found between the secretory cells. Beneath the epithelial cells, flattened basal cells line each acinus and are believed to be stem cells for the secretory epithelium. Each acinus is surrounded by a thin layer of stromal smooth muscle and connective tissue ***(McNeal, 1988).***

The glandular elements of the prostate have been divided into discrete zones, distinguished by the location of their ducts in the urethra, by their differing pathologic lesions, and, in some cases, by their embryologic origin. These zones can be demonstrated clearly with transrectal ultrasonography. At the angle dividing the preprostatic and prostatic urethra, the ducts of the transition zone arise and pass beneath the preprostatic sphincter to travel on its lateral and posterior sides ***(McNeal, 1988).***

Normally, the transition zone accounts for 5% to 10% of the glandular tissue of the prostate. A discrete fibromuscular band of tissue separates the transition zone from the remaining glandular compartments and may be visualized at transrectal ultrasonography of the prostate. The transition zone commonly gives rise to benign prostatic hypertrophy, which expands to compress the fibromuscular band into a surgical capsule seen at enucleation of an adenoma. It is estimated that 20% of adenocarcinomas of the prostate originate in this zone ***(McNeal, 1988).***

The ducts of the central zone arise circumferentially around the openings of the ejaculatory ducts. This zone constitutes 25% of the glandular tissue of the prostate and expands in a cone shape around the ejaculatory ducts to the base of the bladder. The glands are structurally and immunohistochemically distinct from the remaining prostatic glands (which branch directly from the urogenital sinus), which has led to the suggestion that they are of wolffian origin . In keeping with this suggestion, only 1% to 5% of adeno-carcinomas arise in the central zone, although it may be infiltrated by cancers from adjacent zones ***(McNeal, 1988).***

The peripheral zone makes up the bulk of the prostatic glandular tissue (70%) and covers the posterior and lateral aspects of the gland. Its ducts drain into the prostatic sinus along the entire length of the (postsphincteric) prostatic urethra. Seventy percent of prostatic cancers arise in this zone, and it is the zone most commonly affected by chronic prostatitis ***(McNeal, 1988)*** (Fig.2).

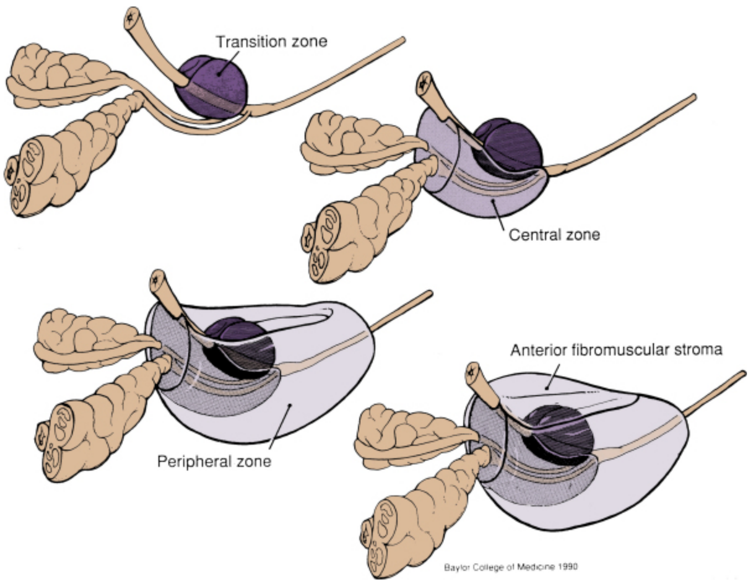

Fig. (2): Zonal anatomy of the prostate as described by J. E. McNeal (Am J Surg Pathol 1988;12:619-633). The transition zone surrounds the urethra proximal to the ejaculatory ducts. The central zone surrounds the ejaculatory ducts and projects under the bladder base. The peripheral zone constitutes the bulk of the apical, posterior, and lateral aspects of the prostate. The anterior fibromuscular stroma extends from the bladder neck to the striated urethral sphincter.

Up to one third of the prostatic mass may be attributed to the nonglandular anterior fibromuscular stroma. This region normally extends from the bladder neck to the striated sphincter, although considerable portions of it may be replaced by glandular tissue in adenomatous enlargement of the prostate. It is directly continuous with the prostatic capsule, anterior visceral fascia, and anterior portion of the preprostatic sphincter and is composed of elastin, collagen, and smooth and striated muscle. It is rarely invaded by carcinoma ***(McNeal, 1988).***

Clinically, the prostate is often spoken of as having two lateral lobes, separated by a central sulcus that is palpable on rectal examination, and a middle lobe, which may project into the bladder in older men. These lobes do not correspond to histologically defined structures in the normal prostate but are usually related to pathologic enlargement of the transition zone laterally and the periurethral glands centrally ***(McNeal, 1988).***

Vascular Supply

Most commonly, the arterial supply to the prostate arises from the inferior vesical artery. As it approaches the gland, the artery (often several) divides into two main branches . The urethral arteries penetrate the prostatovesical junction posterolaterally and travel inward, perpendicular to the urethra. They approach the bladder neck in the 1- to 5-o'clock and 7- to 11-o'clock positions, with the largest branches located posteriorly. They then turn caudally, parallel to the urethra, to supply it, the periurethral glands, and the transition zone. Thus, in benign prostatic hypertrophy, these arteries provide the principal blood supply of the adenoma . When these glands are resected or enucleated, the most significant bleeding is commonly encountered at the bladder neck, particularly at the 4- and 8-o'clock positions ***(Flocks, 1937).***

The capsular artery is the second main branch of the prostatic artery. This artery gives off a few small branches that pass anteriorly to ramify on the prostatic capsule. The bulk of this artery runs posterolateral to the prostate with the cavernous nerves (neurovascular bundles) and ends at the pelvic diaphragm. The capsular branches pierce the prostate at right angles and follow the reticular bands of stroma to supply the glandular tissues. Venous drainage of the prostate is abundant through the periprostatic plexus ***(Flocks, 1937)*** (Fig.3).

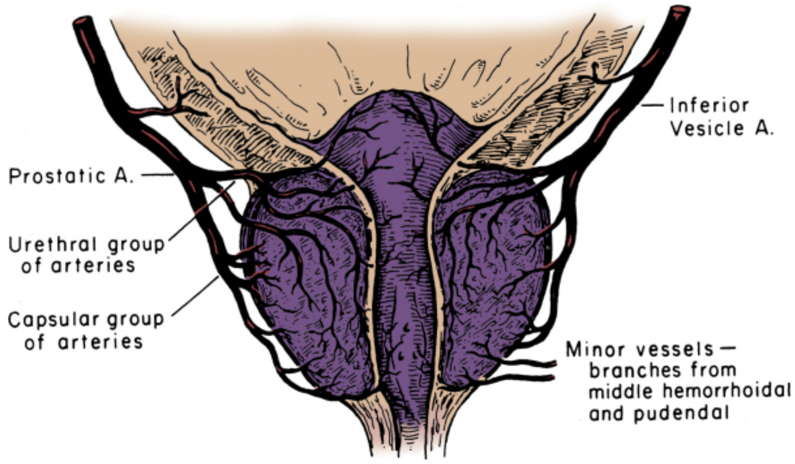

Fig. (3): Arterial supply of the prostate. *(Adapted from Flocks RH: The arterial distribution within the prostate gland: Its role in transurethral prostatic resection. J Urol 1937;37:524-548.)*

Lymphatic drainage

Lymphatic drainage is primarily to the obturator and internal iliac nodes . A small portion of drainage may initially pass through the presacral group, or less commonly, the external iliac nodes ***(Burnett, 1995).***

Nerve Supply

Sympathetic and parasympathetic innervation from the pelvic plexus travels to the prostate through the cavernous nerves. Nerves follow branches of the capsular artery to ramify in the glandular and stromal elements. Parasympathetic nerves end at the acini and promote secretion; sympathetic fibers cause contraction of the smooth muscle of the capsule and stroma ***(Burnett, 1995).***

α-Adrenergic blockade diminishes prostate stromal and preprostatic sphincter tone and improves urinary flow rates in men affected with benign prostatic hypertrophy; this emphasizes that this disease affects both the stroma and the epithelium. Peptidergic and nitric oxide synthase–containing neurons also have been found in the prostate and may affect smooth muscle relaxation . Afferent neurons from the prostate travel through the pelvic plexuses to pelvic and thoracolumbar spinal centers. A prostatic block may be achieved by instilling local anesthetic into the pelvic plexuses ***(Burnett, 1995).***

Age changes in the prostate

At birth, the prostate has a system of ducts embedded in a stroma which forms a large part of the gland. Follicles are represented by small end-buds on the ducts. Before birth there is hyperplasia and squamous metaplasia of the epithelium of the ducts, colliculus seminalis and prostatic utricle, possibly due to maternal oestrogens in the fetal blood. This subsides after birth and is followed by a period of quiescence lasting for 12-14 years ***(Mundy et al., 1999).***

At puberty, between the ages of approximately 14 and 18 years, the prostate gland enters a maturation phase: it more than doubles in size during this period. Growth is almost entirely due to follicular development, partly from end-buds on ducts, and partly from modification of the ductal branches. Morphogenesis and differentiation of the epithelial cords starts in an intermediate part of the epithelial anlage and proceeds to the urethral and subcapsular parts of the gland; the latter is reached by the age of 17-18 years ***(Mundy et al., 1999).***

The glandular epithelium is initially multilayered squamous or cuboidal, and is transformed into a pseudo-stratified epithelium consisting of basal, exocrine secretory (including mucous) and neuroendocrine cells. The mucous cells are temporary, and are lost as the gland matures. The remaining exocrine secretory cells produce a number of products including acid phosphatase, prostate-specific antigen and β-microseminoprotein ***(Mundy et al., 1999).***

This growth of the secretory component is associated with a condensation of the stroma, which diminishes relative to the glandular tissue. These changes are probably a response to the secretion of testosterone by the testis. During the third