Abstract

Post prostatectomy voiding dysfunction especially PPI is one of the most important and devastating complication for both the patient and the surgeon. Regardless the type of prostatectomy, or the nature of the prostate disease, several risk factors are common to all and they include preexisting detrusor and sphincteric dysfunction, increasing age, and surgical expertise.

However, the recommendations for treatment options are still only given generally without a clear association with stage and severity of incontinence or retention. This limitation can only be overcome in the future if sufficient evidence is provided by future clinical studies. Moreover, there's no single precise definition for incontinence, therefore a comparison of study results is often not possible.

In recent years, numerous minimally invasive treatment options with different success rates have been investigated. But new surgical techniques must at least match the results of the artificial sphincter. Nevertheless, the patient demand for minimally invasive treatment options is high, and often, poorer results are accepted by the patients in order to avoid an artificial sphincter.

Keywords: treatment, postradical-prostatectomy, incontinence.

INTRODUCTION

Despite advances in surgical techniques, urinary incontinence remains a relatively common complication following radical prostatectomy ***(Doherty and Almallah, 2012)***.

The true incidence of postprostatectomy incontinence (PPI) is difficult to ascertain owing to the lack of a single definition of what actually constitutes continence after radical prostatectomy. Prostatectomy remains one of the most important causes of iatrogenic incontinence in men. Reported prevalence rates of urinary incontinence after prostatectomy vary from 5% to more than 60% depending on the definition of urinary incontinence in terms of timing as well as method of evaluation ***(Eastham et al., 1996; Hunter et al., 2007).***

European Association of Urology (EAU) guidelines define continence following radical prostatectomy as either total control with no leakage or pad usage, no pad use but loss of a few drops of urine, or use of up to one “safety” pad per day ***(Schroder et al., 2010).***

With the increasing number of radical prostatectomies currently performed, the incidence of PPI is also likely to rise ***(Doherty and Almallah, 2012).*** PPI has a significant impact on quality of life and the time of continence after the removal of the urethral catheter is one of the most frequently asked questions by the patient ***(Catalona, 1999).***

The pathphysiology of PPI can be related to many factors such as internal/external sphincter deficiency (SD) induced by either surgical injury or denervation, detrusor instability (DI), or decreased bladder compliance ***(Filocamo et al., 2005).*** Loss of integrity of the muscle structures and/or an anastomotic stricture can be considered as another major cause. In order to minimize the effects of such conditions, various treatment modalities are used for their advantages in continence recovery ***(Parekh et al., 2003).***

Risk factors for PPI include pre-existing abnormalities of detrusor contractility and older age possibly due to progressive reduction in sphincter striated muscle cells with age. Other risk factors include previous TURP, preoperative radiotherapy, trauma, spinal cord lesion, new obstruction due to recurrence, bladder neck contracture, or urethral stricture, Parkinson’s disease, dementia, and medications. A surgeon’s inadequate skill and expertise and having surgery in a hospital which performs fewer than 20 radical prostatectomies a year may also be a factor ***(Kondo, 2002; Jacobsen, 2007).***

AIM OF THE WORK

Aim of this essay is to discuss the new modalities in diagnosis and managements of post retropubic radical prostatectomy incontinence as serious postoperative complication and a point of worry of both the patient and the surgeon.

ANATOMY OF THE PROSTATE

The term "prostate" was originally derived from the Greek word "prohistani", meaning "to stand in front", and has been used to describe the organ located in front of the urinary bladder ***(Lowsley, 1912).***

The prostate is a fibromuscular and glandular organ lying just inferior to the bladder. The prostate is perforated posteriorly by the ejaculatory ducts, which pass obliquely to empty through the verumontanum on the floor of the prostatic urethra just proximal to the striated external urinary sphincter ***(Emil and Tom, 2013).***

The prostate gland lies behind the pubic symphysis. Located closely to the posterosuperior surface are the vasa deferentia and seminal vesicles. Posteriorly, the prostate is separated from the rectum by the two layers of Denonvilliers' fascia, serosal rudiments of the pouch of Douglas, which extended to the urogenital diaphragm ***(Raychaudhuri and Cahill, 2008).***

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. 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 ***(Benjamin et al., 2012).***

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 tendinous fascia pelvis to avoid injury to the venous complex. In the process, the endopelvic fascia overlying the levator ani is actually peeled off the muscle and displaced medially with the prostate. Although this is truly a parietal endopelvic fascia, it is commonly referred to as the "lateral prostatic fascia". The cavernosal nerves run posterolateral to the prostate in the substance of the parietal pelvic fascia (lateral prostatic fascia). Thus to preserve these nerves, this fascia must be incised lateral to the prostate and anterior to the neurovascular bundle. Therefore an understanding of the fascial layers that overlie the prostate is crucial in the performance of an accurate nerve-sparing radical prostatectomy ***(Benjamin et al., 2012).***

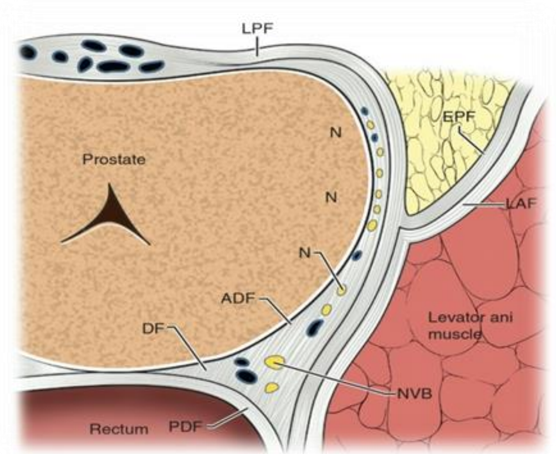

Figure (1): Cross section of prostate with prostatic fascial layers outlined including the lateral prostatic fascia (LPF), endopelvic fascia (EPF), levator ani fascia (LAF), Denonvilliers fascia (DF), anterior lamina of Denonvilliers fascia (ADF), posterior lamina of Denonvilliers fascia, neurovascular bundle (NVB), and lateral nerves (N) ***(Walz et al., 2007).***

In 1912, Lowsley demonstrated the first detailed description of the anatomy of the prostate. This traditional concept, divided the prostate into lobes: an anterior, posterior, middle and two lateral lobes. This method has been used to identify the prostate and prostatic disease for about 60 years ***(Lowsley, 1912).***

The understanding of the gross and microscopic anatomy of the prostate has changed during the past few decades. Since 1965, a zonal concept of anatomy has evolved initially developed by McNeal and then modified over about three decades. After a comprehensive analysis of 500 prostates, McNeal (1981) divides the prostate into four zones: peripheral zone, central zone (surrounds the ejaculatory ducts), transitional zone (surrounds the urethra), and anterior fibromuscular zone (Figure 2) ***(Myers et al., 2010).***

The prostate is best considered to be a fusion of different glandular regions contained within a discontinuous capsule. The prostate is composed of four glandular regions and a nonglandular region which is the anterior fibromuscular stroma. This (FMS) region is generally considered to be of less clinical significance. The peripheral zone (PZ) comprises the largest portion of the glandular prostate in young men (70%). The PZ is situated posteriorly, posterolaterally and a thin layer of this tissue also extends up laterally and anterolaterally. Distal to the verumontanum, the PZ often surrounds the urethra and occupies the apical region if the prostate. The transition zone (TZ) is situated on both sides of the proximal prostatic urethra and comprises only 5 to 10% of the glandular tissue. The surgical capsule is an interface between the PZ and TZ. The periurethral glandular zone (PUG) consists of mucosal glands in the prostatic urethra itself and represents only a tiny fraction of the glandular prostate. This zone may become hyperplastic with age to form the “median lobe” which may obstruct the bladder neck. The central zone (CZ) is cone-shaped with its base forms the base of prostate, bordering the urinary bladder and seminal vesicles and its apex is at the verumontanum, The CZ forms about 25% of the glandular prostatic tissue. The CZ surrounds the ejaculatory ducts throughout their entire courses in the prostate. The site where the ejaculatory ducts enter the CZ is devoid of prostatic capsule ***(McNeal, 1988).***

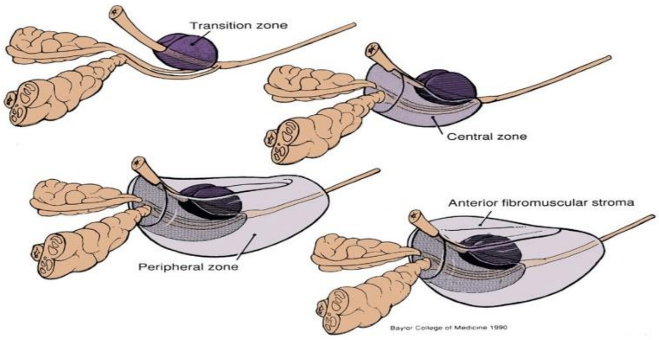

Figure (2): Zonal anatomy of the prostate as described ***(McNeal, 1988).***

The segment of urethra that traverses the prostate gland is the prostatic urethra. It is lined by an inner longitudinal layer of muscle (continuous with a similar layer of the vesical wall). Incorporated within the prostate gland is an abundant amount of smooth musculature derived primarily from the external longitudinal bladder musculature. This musculature represents the true smooth involuntary sphincter of the posterior urethra in males ***(Myers et al., 2010).***

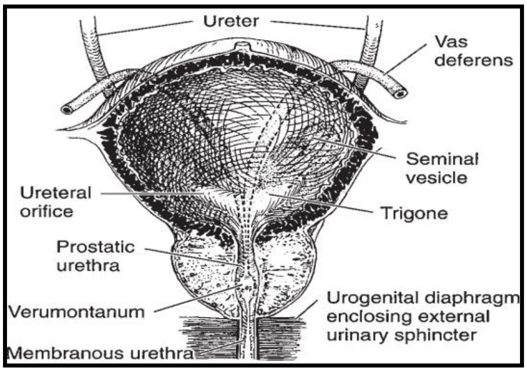

Figure (3): Anatomy and relations of the ureters, bladder, prostate, seminal vesicles, and vasa deferentia (anterior view) ***(Emil and Tom, 2013)***.

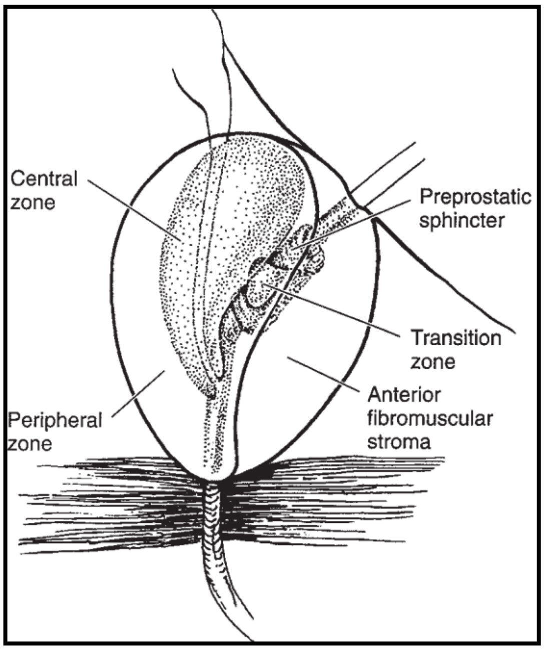

Figure (4): Anatomy of the lower urinary tract ***(Emil and Tom, 2013)***

Histologically the prostate consists of a thin fibrous capsule under which is circularly oriented smooth muscle fibers and collagenous tissue that surrounds the urethra (involuntary sphincter). Deep in this layer lies the prostatic stroma, composed of connective tissues and smooth muscle fibers in which are embedded the epithelial glands. These glands drain into the major excretory ducts (about 25 in number), which open chiefly on the floor of the urethra between the verumontanum and the vesical neck. Just beneath the transitional epithelium of the prostatic urethra lie the periurethral glands ***(Emil and Tom, 2013).***

Blood Supply

A. Arterial

The arterial supply to the prostate is derived from the inferior vesical, internal pudendal, and middle rectal (hemorrhoidal) arteries.

B. Venous

The veins from the prostate drain into the periprostatic plexus, which has connections with the deep dorsal vein of the penis and the internal iliac (hypogastric) veins.

Nerve Supply

The prostate gland receives a rich innervation from the sympathetic and parasympathetic nerves of the inferior hypogastric plexus.

Lymphatics

The lymphatics from the prostate drain into the internal iliac (hypogastric), sacral, vesical, and external iliac lymph nodes ***(Emil and Tom, 2013).***

Prostatic Urethra ***(Standring, 2008)***

The prostatic urethra is 3–4 cm in length and tunnels through the substance of the prostate, closer to the anterior than the posterior surface of the gland. It is continuous above with the preprostatic part and emerges from the prostate slightly anterior to its apex (the most inferior point of the prostate).

Throughout most of its length the posterior wall possesses a midline ridge, the urethral crest. On each side of the crest there is a shallow depression, the prostatic sinus, the floor of which is perforated by the orifices of 15–20 prostatic ducts. An elevation, the verumontanum (seminal colliculus), is seen at about the middle of the length of the urethral crest. At this point the urethra turns anteriorly by 35° and contains the slit-like orifice of the prostatic utricle. On both sides of, or just within, this orifice are the two small openings of the ejaculatory ducts.

The prostatic utricle is a cul-de-sac 6 mm long, which runs upwards and backwards in the substance of the prostate behind its median lobe. Its walls are composed of fibrous tissue, muscular fibres and mucous membrane. The prostatic utricle develops from the paramesonephric ducts or urogenital sinus, and is thought to be homologous with the vagina of the female. It is sometimes called the ‘vagina masculina', but the more usual view is that it is a uterine homologue and hence the term ‘utricle'. The lowermost part of the prostatic urethra is fixed by the puboprostatic ligaments and is therefore immobile.

Age Changes in the Prostate ***(Standring, 2008)***

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, the epithelium of the ducts, seminal colliculus and prostatic utricle display hyperplasia and squamous metaplasia, 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.

At puberty, between the ages of approximately 14 and 18 years, the prostate gland enters a maturation phase and more than doubles in size during this time. Growth is almost entirely due to follicular development, partly from endbuds 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. The glandular epithelium is initially multilayered squamous or cuboidal, and is transformed into a pseudostratified epithelium consisting of basal, 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 phosphatase, prostate-specific antigen and β-microseminoprotein. 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 decade the glandular epithelium grows by irregular multiplication of the epithelial infoldings into the lumen of the follicles. After the third decade, the size of the prostate remains virtually unaltered until 45–50 years, when the epithelial foldings tend to disappear, follicular outlines become more regular, and amyloid bodies increase in number: all signs of prostatic involution. After 45–50 years the prostate tends to develop BPH: an age-related condition. If a man lives long enough then BPH is inevitable, although not always symptomatic.

Anatomy of the urethral sphincter

Within the deep perineal pouch, a group of muscle fibers surround the urethra and form the urethral sphincter. Two muscles as urethral sphincters are used to control the exit of urine in the urinary bladder through the urethra. The two muscles are the internal and EUS ***(Walz et al., 2010).***

IUS

The IUS is located at the inferior end of the bladder and the proximal end of the urethra. The IUS also lies at the junction of the urethra with the urinary bladder and is a continuation of the detrusor muscle. In males, the proximal fibers are a bundle lying between the base of the bladder and the superior border of the prostate. The muscle fibers form a horseshoe-like arrangement that is continuous with the smooth muscle fibers of the bladder. Because the IUS is composed of smooth muscle, it is not under voluntary control. However, the IUS is controlled through the autonomic nervous system. The IUS muscle controls the flow of urine by contracting around the internal urethral orifice. The sympathetic nervous system maintains tonic contractions of the internal urethral muscle. However, the parasympathetic nervous system relaxes the internal sphincter muscle during micturition. The IUS is made of a layer of smooth muscle, which is surrounded by layers of striated muscle. Thus, the combination of the smooth muscle of the IUS and these striated muscles surrounding the IUS acts to control the removal of fluids from the body ***(Ashton-Miller and DeLancey, 2007).***