INTRODUCTION

Prostate cancer is the second most frequently diagnosed cancer (15% of all male cancers) and the sixth leading cause of cancer death in males worldwide ***(World Cancer Report, 2014).***

Radical retropubic prostatectomy (RRP) is one of the most common interventions to treat prostate-limited cancer. This technique allows the complete removal of both prostate and seminal vesicles ***(Walsh and Donker, 2002).***

In most cases, post prostatectomy incontinence(PPI) is caused by a dysfunction of the sphincter, which can result from rhabdosphincter injury during the apical dissection, or as a result of denervation caused by injury to the neurovascular bundles ***(Kim and Cho, 2012).***

Most patients with intrinsic sphincter deficiency complain of stress urinary incontinence (SUI) ***(Porena et al., 2007).*** Bladder outlet obstruction (BOO) caused by vesicourethral anastomotic stenosis can induce urine leakage or urge incontinence as well as urinary retention. Therefore, those patients with PPI complain of not only SUI but also urgency with urge incontinence ***(Wang et al., 2012).***

Radiation can also be a contributing factor with respect to postoperative incontinence. Among patients who undergo RP after failed radiation therapy, the incidence of urinary incontinence has been reported to be as high as 44% ***(Ward et***

al., 2005). Reported rates of incontinence after radiation and high-intensity focused ultrasound alone are 6.6% to 23% and 0.5% to 15.4%, respectively ***(Moore et al., 2009).***

Most investigators agree that the time required for evaluating the exact degree of continence is at least 1 year ***(Gerullis et al., 2011).*** Initial clinical assessment includes taking a medical history, physical examination, postvoid residual urine, urine analysis, voiding diary, incontinence questionnaire for subjective assessment, and pad test ***(Bauer et al., 2009).***

Management of incontinence includes Conservative management or behavioral management which is generally recommended during the first year after prostatectomy. Pelvic floor muscle training (PFMT) is the most commonly used conservative management and is a first-line treatment that is used to restore pelvic floor or bladder function after radical prostatectomy ***(Joon and Kang, 2012).***

After the initial clinical assessment, noninvasive or conservative management can be started. If the noninvasive treatment fails, a specialized clinical assessment, such as urodynamic study (UDS) and urethrocystoscopy is indicated, especially before a surgical treatment for PPI. The accurate method for determining the cause of incontinence after prostatectomy is UDS. Urethrocystoscopy is performed to identify the vesicourethral anastomotic stenosis and anatomic position of the external sphincter ***(Mariotti et al., 2009).***

Pharmacologic treatment: may include the use of Duloxetine in male SUI, combined serotonin/norepinephrine reuptake inhibitor, which increases the activity of the striated urethral sphincter and affects the excitability of the pudendal motor neurons by stimulating the Onuf's nucleus ***(Jost and Marsalek, 2004).***

Injection therapies that include various substances (collagen, Teflon, silicone macroparticles, autologous fat, autologous chondrocytes, and dextranomer/hyaluronic acid copolymer) have been used for decades as bulking agents ***(Koski et al., 2011).***

Sling surgery, which is based on the concept of passive external urethral compression, as a treatment option for PPI has been recently reviewed. Although long-term outcomes are unknown, the sling performs reasonably well in the intermediate term. Sling surgery is adequate for patients with mild to moderate degrees of SUI who have not had previous radiation therapy, who have adequate detrusor contractility, or who demand a less invasive procedure or a non-mechanical device, as opposed to a device such as the artificial urinary sphincter (AUS) ***(Castle et al., 2005).***

Adjustable continence balloons, which are one of the most recent treatments, create passive compression of the urethra by two balloons located on either side of the urethra ***(Kjær et al., 2012).***

The artificial urinary sphincter (AUS) implantation provides high rates of long-term continence and patient satisfaction, and is currently considered the gold standard for the treatment of PPI ***(Trigo et al., 2008).***

Stem cells represent a self-renewing population of cells derived from healthy tissue which can be differentiated into a variety of other cells. The ideal strategy for curing SUI using stem cell therapy would allow for the regeneration of functional periurethral tissue to provide adequate mucosal coaptation and to restore resting urethral closure pressures ***(Staack and Rodriguez, 2011).***

AIM OF THE ESSAY

This essay aims to spot a light on the choice of modalities in treatment of post radical prostatectomy incontinence and their efficacy in curing incontinence at a short and long term.

SURGICAL ANATOMY OF THE PROSTATE AND PELVIC FLOOR

Anatomy of prostate:

The prostate gland (normal weight: 20 g) encircles the urethra as it emerges from the base of the bladder. It comprises glandular (secretory acini) and non-glandular (smooth muscle and fibrous tissue) components enclosed by a fibrous capsule. It has a rich blood supply and venous drainage via the large, thin-walled sinuses adjacent to the capsule ***(O'Donnell and Foo, 2009)***.

It is described as having four histological zones (McNeal zones): the central, peripheral, anterior (fibromuscular), and transitional (periurethral) zones (Figure 1). The transitional zone surrounds the proximal urethra in two pear-shaped lobes. It comprises 5% of normal prostatic volume and is the site of Benign Prostatic Hyperplasia (BPH) and also 10% of prostatic carcinoma. Twenty percent (20%) of men aged 40 years have hyperplasia of the transitional zone, increasing to 50% at 50 years and 70% at 60 years. The hyperplastic tissue eventually encroaches on the proximal urethra, causing obstruction. The normal prostatic tissue becomes compressed against the capsule, and is often referred to as the ‘surgical capsule’ ***(McNeal, 1988).***

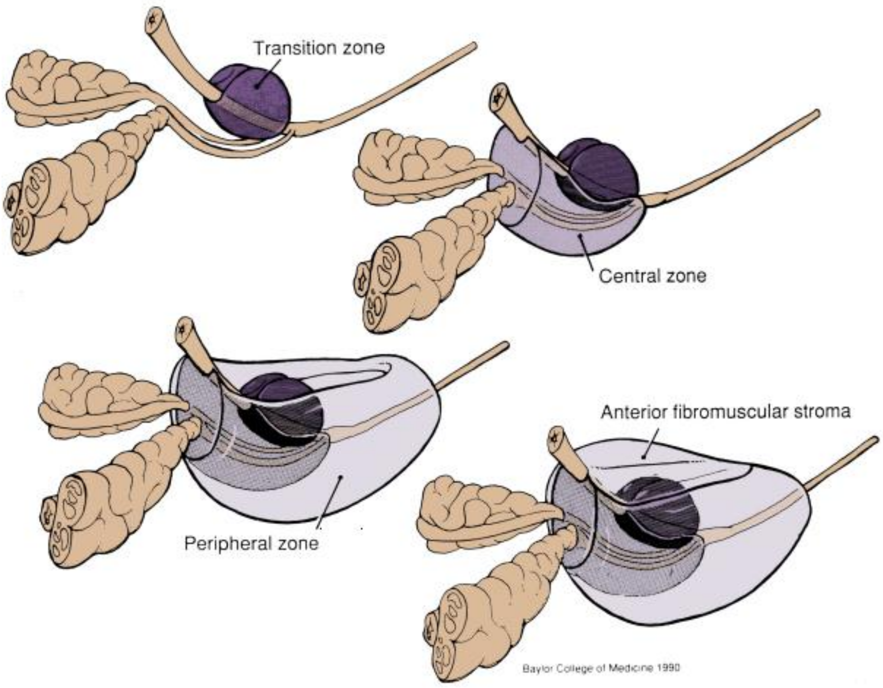

Figure (1): Zonal anatomy of the prostate ***(McNeal, 1988).***

The prostate has the thinnest and narrowest part anteriorly (at the 12-o'clock position when viewed through a cystoscopy). Care should be taken when operating in this area to avoid perforating the prostatic capsule, especially if this portion of the prostate is resected early in the operation. Abundant venous blood vessels are located in the area just anterior to the prostatic capsule, which can cause significant bleeding that cannot be easily controlled if the vessels are damaged during resection ***(Collins et al., 2014)***.

The external sphincter muscle tends to be slightly tilted, with the most proximal portion located anteriorly, opposite the verumontanum. The external sphincter can be identified cystoscopically by its wrinkling and constricting action as the resectoscope is withdrawn. Upon reinsertion, the superficial mucosa in front of the telescope tends to bunch up. This is because the external sphincter muscle is imbedded within the urogenital diaphragm, which is relatively fixed in position, while the prostate has some limited mobility ***(Cockett and Koshiba, 1996)***.

The verumontanum is the single most important anatomical landmark during Trans urethral resection of prostate (TURP). It is a midline structure located on the floor of the distal prostatic urethra just proximal to the external sphincter muscle (Figure 2). It appears as a small, rounded hump that is best seen when withdrawing the telescope through the prostate while visualizing the prostatic floor at the 6-o'clock position ***(Dayson, 1995)***.

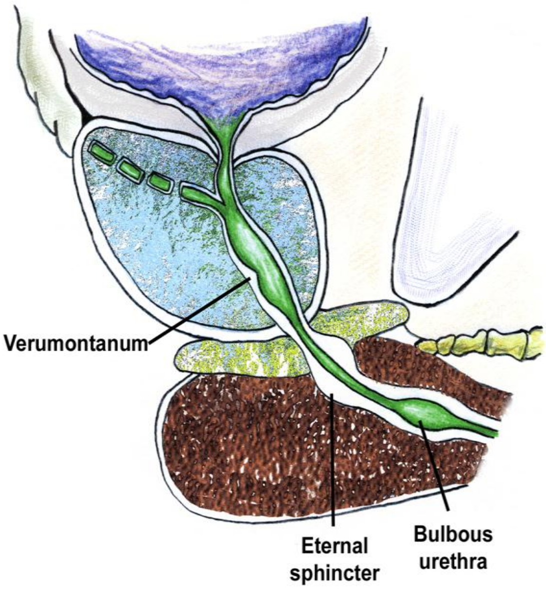

Figure (2): Basic anatomy of the prostate, sagittal section ***(Collins et al., 2014).***

The orifices of the ejaculatory ducts emerge in the verumontanum. Its importance lies in its position immediately proximal to the external sphincter muscle (Figure 3), which allows it to be used as the distal landmark for prostate resection. The precise distance between the verumontanum and the external sphincter demonstrates some slight individual variation and should be verified visually before starting the resection and periodically during the surgery (Figure 4) ***(Dayson, 1995).***

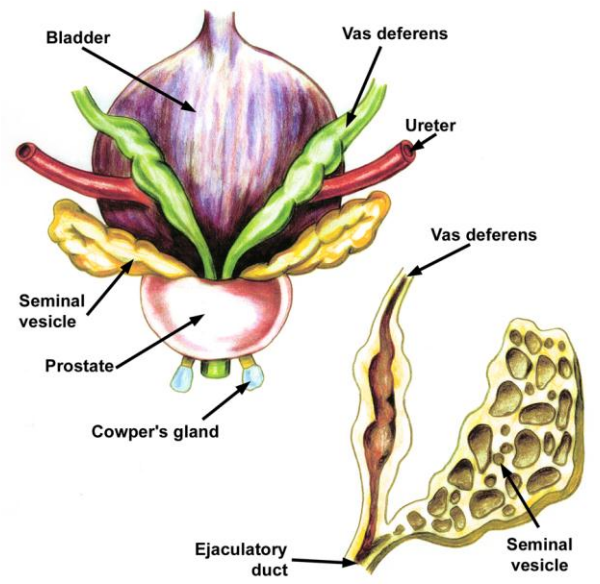

Figure (3): Anatomy of the prostate and bladder, posterior view ***(Collins et al., 2014).***

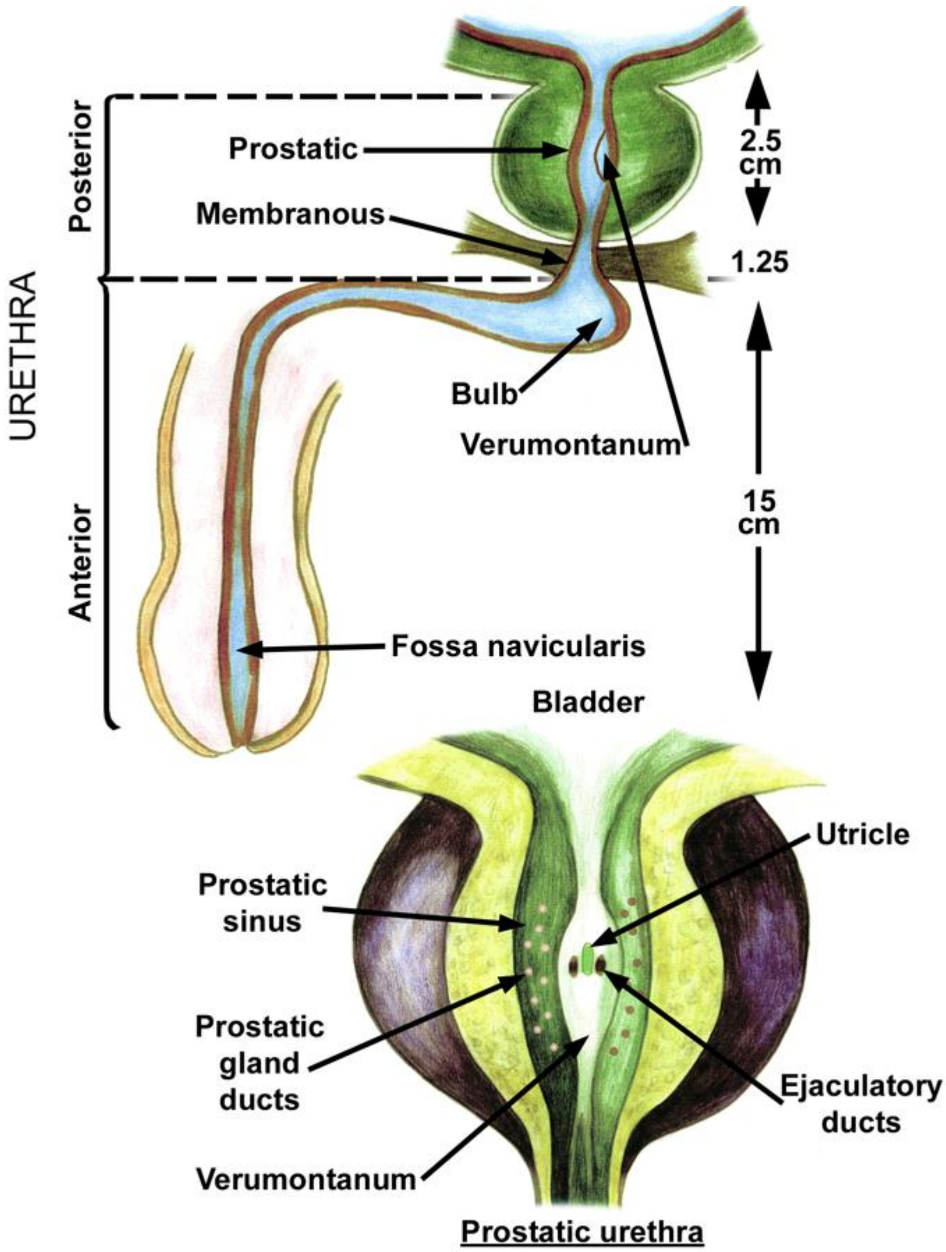

Figure (4): Anatomy of the prostate and urethra ***(Collins et al., 2014).***

The proximity of the ureteral orifices to the margin of the hypertrophied prostate varies, particularly in patients with an enlarged median lobe. This distance should be frequently assessed throughout surgery ***(Brooks et al., 2002).***

The prostate is surrounded by a dense fibrous capsule. The prostatic capsule is not present at the apex (transition to the external sphincter) and at the base (transition to the detrusor muscle of the bladder). Two puboprostatic ligaments fix the prostate to the pubic bone. The endopelvic fascia covers ventrally the prostate (visceral sheet). The endopelvic fascia (Fascia diaphragmatis pelvis superior) extends to both sides and covers the levator ani muscle (parietal sheet). The fold between visceral and parietal endopelvic fascia is called Arcus tendineus fascia pelvis. The cavernous nerves run in the parietal layer of the endopelvic fascia latero-dorsal to the prostate ***(Brooks et al., 2002).***

The Denovilliers' fascia separates the prostate from the rectum. The rectourethralis muscle is a smooth muscle that lies posterior to the apex of the prostate. It arises from the rectum and inserts on the perineal body fat, thereby separating the urethra from the rectum ***(Brooks et al., 2002).***

Arterial supply

The vascular anatomy of the prostate was accurately described in detail by ***Flocks (1937)***. The blood supply of the prostate comes primarily from branches of the inferior vesical artery, which is a branch of the internal iliac artery ***(Flocks, 1937)*** **(**Figure 5 & Figure 6).

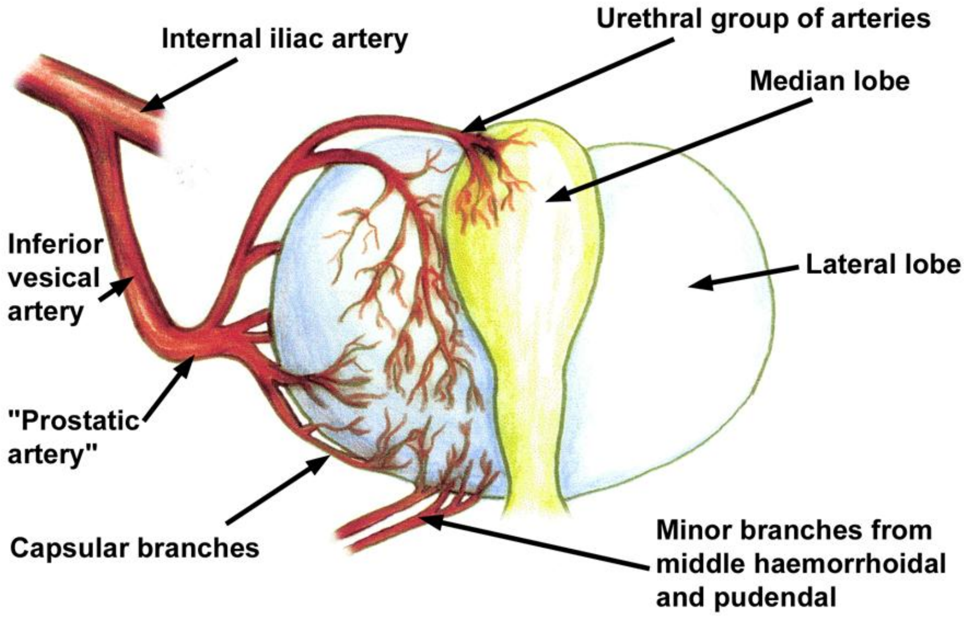

Figure (5): Blood supply to the prostate ***(Flocks, 1937).***

When the inferior vesical artery reaches the prostate just at the vesicoprostatic border, it branches into 2 groups of arteries. One penetrating group passes directly into the prostate toward the interior of the bladder neck. Upon reaching the prostatic interior near the urethra, most of these branches turn distally and parallel the prostatic urethra, while others supply the median lobe. Vessels that parallel the prostatic urethra supply most of the blood to the hypertrophied lateral lobes ***(Flocks, 1937)***.

The second large group of arteries follows the exterior of the prostatic capsule posterolaterally, periodically giving rise to perforating vessels, and supplies the area around the verumontanum ***(Flocks, 1937)***.

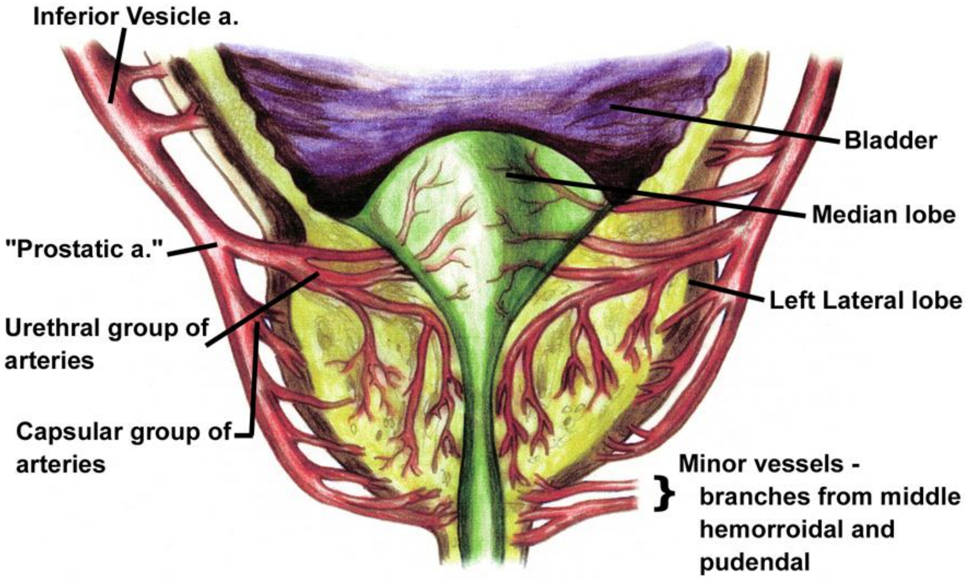

Figure (6): Blood supply to the prostate. Note the two main branches: urethral and capsular ***(Flocks, 1937).***

Venous drainage (Figure 7)

Venous drainage of the prostate is through prostatic venous plexus that joins the dorsal vein of penis. The dorsal vein of the penis passes between the inferior pubic arches and the striated urinary sphincter to reach the pelvis, where it trifurcates into a central superficial branch and two lateral plexuses ***(Reiner and Walsh, 1979).***

Part of this complex runs within the anterior and lateral wall of the striated sphincter; thus care must be taken not to injure the sphincter when securing hemostasis. The superficial branch pierces the visceral endopelvic fascia between the puboprostatic ligaments and drains the retropubic fat, anterior bladder, and anterior prostate ***(Reiner and Walsh, 1979).***

The lateral plexuses sweep down the sides of the prostate, receiving drainage from it and the rectum, and communicate with the vesical plexuses on the lower part of the bladder. Three to five inferior vesical veins emerge the vesical plexus laterally and drain into the internal iliac vein ***(Reiner and Walsh, 1979).***

The internal iliac vein is joined by tributaries corresponding to the branches of the internal iliac artery and ascends medial and posterior to the artery. This vein is relatively thin walled and at risk for injury during dissection of the artery. The external iliac vein travels medial and inferior to its artery and joins the internal iliac vein behind the internal iliac artery. One or more accessory obturator veins drain into the underside of the external iliac vein and can be easily torn during lymphadenectomy. To minimize blood loss at radical retropubic prostatectomy, the dorsal vein complex is best divided distally, before its ramification ***(Reiner and Walsh, 1979).***

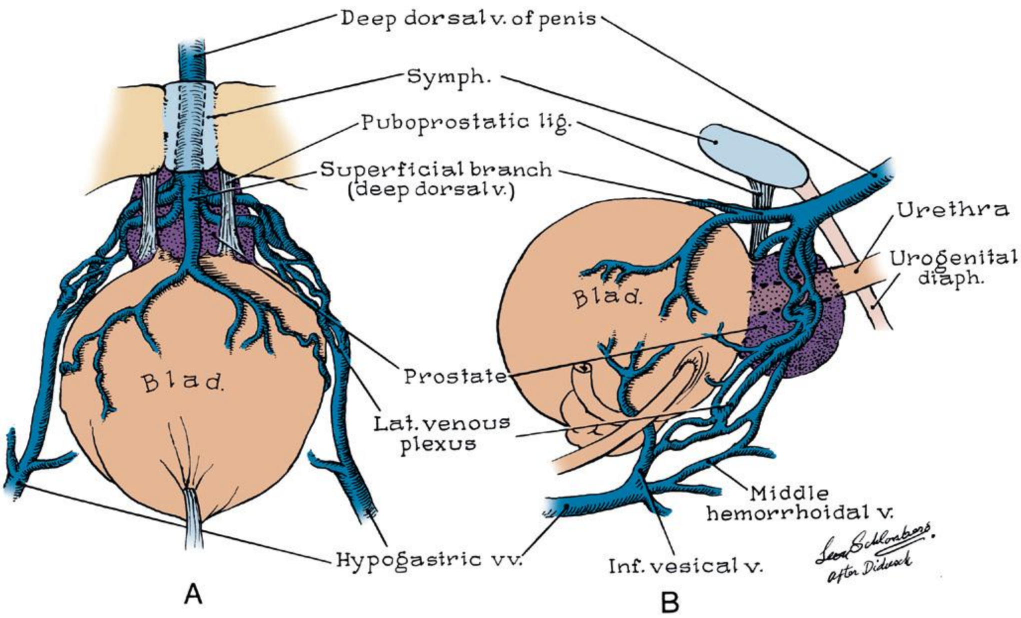

Figure (7): Venous drainage of prostate ***(Reiner and Walsh, 1979).***

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. 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" ***(Myers, 1994).***

Nerve supply

The nerve supply to the prostate arises from the prostatic plexus, which originates from the inferior hypogastric plexus, and carries both sympathetic fibers from T11 to L2 and parasympathetic fibers from S2 to S4. Pain fibers from the prostate, prostatic urethra, and bladder mucosa originate primarily from sacral nerves S2 to S4. Pain signals from