MANAGEMENT OF COMPLICATIONS OF URETHROPLASTY

Essay For partial fulfillment of master degree in urology

Presented By

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2012

Introduction

Urethral strictures are documented in ancient literature dating from the Greek and Egyptian period. Currently urethral stricture disease is relatively common, most strictures being acquired from injury or infection. Blunt perineal trauma causes injury to the bulbar urethra but iatrogenic causes, including urological instrumentation and placing indwelling catheters which result in strictures anywhere in the urethra, are probably the most common cause (***Andrew C et al.,2004***).

The primary concern in the patient with pelvic fracture urethral distraction injury is resuscitation of the patient to preserve life because of associated injuries, Divert urine away from the site of injury, Preserve the residual sphincter mechanism at the bladder neck and avoiding jeopardizing sexual function. All these aspects can be safely addressed by the time-tested and gold standard immediate suprapubic cystostomy placement and delayed repair (***S.Joseph Philipraj ,2010***).

Contrast studies and endoscopy very accurately identify the length and location of the apparent stricture,What is never accurately defined is the true length of spongiofibrosis and in many cases its depth and density. Ultrasound has been proposed as an adjuvant to contrast studies and endoscopy (***Narumi Y et al.,1993***).

Surgery for urethral stricture can be accomplished in most cases with minimal morbidity and minimal opportunity for complication.The most common complications are recurrent stricture, wound infection, wound failure, haematoma, fistulous formation and ejaculatory dysfunction. Factors such as poor graft take, poor flap survival and poor technique of primary anastomosis can contribute to the failure of reconstruction for stricture (***Kizer et al.,2005***).

Urethral reconstruction is usually performed with few concerns about infection, very important to make every effort to sterilize the urine in advance of urethral reconstruction. In the patients with suprapubic

cystostomy tubes, this is done by obtaining preoperative cultures and treating with culture-specific antibiotics ,IV antibiotics in the hospital if required.In most cases,the patients can be treated with oral antibiotics (***Rosario et al.,2000***).

Urethral surgery is not attended with massive hemorrhage.The blood vessels that are encountered are usually easily controlled with cautery. In the case of the patient with paraurethral hematoma should be promptly drained .The entity of erectile dysfunction (ED) has to be addressed with any urethral reconstructive surgery. With regard to the avoidance of ED, the only information that can be provided is that one needs to limit dissection strictly to the anatomic planes. In the case of posterior urethral reconstruction, incisions or excisions of scar need to be very strictly limited to the midline where possible (***Wright et al.,2005***).

Other uncommon complications have been reported,usually in patients with long penile or pan-urethral stricture. They include graft loss, anastomotic breakdown, penile skin necrosis and penile cordee or deformity, these complication are usually much less frequent after buccal mucosal urethroplasty than fasciocutaneous urethroplasty.The successful management of urethral stricture means an increase of long-term positive outcome and alow rate of complications and it depends on different factors including surgical skill as well as right criteria for patient and surgery selection (***Hosam S. Al-Qudah et al.,2005***).

Aim of work

The ultimate aim of this work is to review the most common complications of urethroplasty and to optimize the measures to avoid and the approach to manage these complications.

Anatomy of the penis and male urethra

*Anatomy of the penis:-

The bulk of the penis is made up of three erectile bodies: two corpora cavernosa and the single corpus spongiosum (Fig.1.1). The dorsally located corpora cavernosa contain erectile tissue within a compliant sheath of connective tissue, the tunica albuginea. Within the shaft of the penis, there is free communication between the corpora cavernosa through an incomplete midline septum .This septum is composed of multiple strands of connective tissue, similar to that of the tunica albuginea. The septum becomes more complete at the tip of the penis and toward the penile hilum, where the corpora cavernosa become independent and form separate crura ***(Devine et al.,1994).***

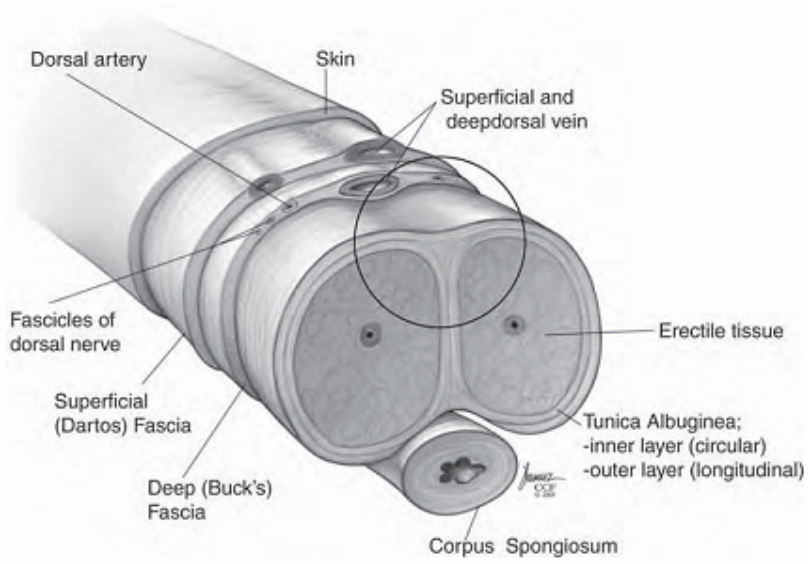

Fig.1.1: Erectile bodies of the penis ***(Andrew C et al.,2006).***

The erectile bodies are surrounded by the deep penile fascia (Buck's fascia), the superficial penile fascia (dartos fascia) and the skin.

Buck's fascia is the sturdy layer immediately surrounding and loosely attached to all three corpora. On the superior aspect of the corpora cavernosa ,the deep dorsal vein, dorsal arteries, and dorsal nerves lie within Buck's fascia above the tunica albuginea .Ventrally, Buck's fascia splits to surround the corpus spongiosum. Consolidations of the fascia lateral to the corpus spongiosum fix this structure firmly to the tunica albuginea of the corpora cavernosa. Buck's fascia is attached distally to the undersurface of the glans penis at the corona. Beyond the base of the penis, it extends into the perineum encompassing the crura of the corpora cavernosa and the bulb of the corpus spongiosum ***(Goldstein et al.,1990).***

The dartos fascia of the penis consists of loosely arranged areolar tissue that is typically devoid of fat. It separates the two layers of the preputial fold and continues proximally beneath the penile skin, loosely attached to the skin and to Buck's fascia. The dartos fascia contains the superficial arteries, veins, and nerves of the penis. At the base of the penis, it fuses with the dartos of the scrotum and extends into the perineum, where it is continuous with the layers of the superficial perineal fascia. The penile skin is attached distally to the glans penis at the corona and folds upon itself to form the prepuce or foreskin overlying the glans. The inner layer of the prepuce is confluent with the glabrous skin covering the glans, which in turn is continuous with the mucous membrane of the urethra at the external meatus. The skin covering the penis is very thin and mobile due to the supple nature of the underlying dartos fascia ***(Goldstein et al.,1990).***

The tunica albuginea consists primarily of collagen and elastic fibers, which are oriented into an inner circular layer and an outer longitudinal layer encompassing the majority of the corporal bodies (Fig. 1.2). The only exception is that there are no outer layer fibers between the 5 and 7 o'clock positions adjacent to the corpus spongiosum. At their attachment in the midline dorsally and ventrally, the fibers of the septal strands are interwoven with the fibers of the inner circular layer of the tunica albuginea. The inner space of the corpora cavernosa is filled with erectile tissue consisting of arteries, sinusoids lined with endothelial cells, veins, nerves ,smooth muscle fibers and trabeculae arising from the tunica

albuginea. Between this tissue and the tunica albuginea, there is a very thin layer of areolar connective tissue containing a number of vessels ***(Brock et al.,1997).***

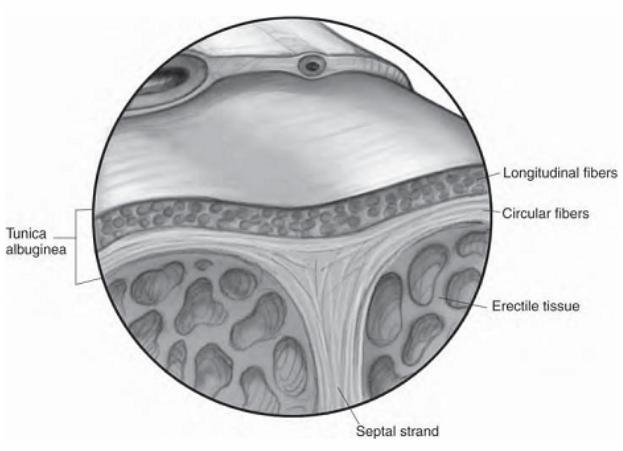

Fig. 1.2: The tunica albuginea ***(Andrew C et al.,2006).***

Proximally, the suspensory ligaments of the penis are located at its base (Fig. 1.3). The outer fundiform ligament is continuous with the lower end of the linea alba and splits into laminae that completely surround the body of the penis. The inner triangular-shaped suspensory ligament is attached to the anterior aspect of the symphysis pubis and blends with the fascia of the penis below it .Posterior to these ligamentous attachments, the corpus spongiosum enlarges between the crura of the corpora cavernosa to form the penile bulb ***(Tobin et al.,1944).***

The corpus spongiosum lies within the ventral groove between the two corpora cavernosa. The tunica albuginea surrounding this structure is much thinner than that of the corpora cavernosa, and less erectile tissue is present. The urethra runs the length of the penis within the corpus spongiosum. The corpus spongiosum expands distally to form a broad cap of erectile tissue called the glans penis, which covers the tips of the corpora cavernosa. The urethral meatus lies on the ventral aspect of the tip of the glans penis with its long axis in a vertical direction.The edge of the glans penis overhangs the penile shaft forming a rim called the corona, with the coronal sulcus just proximal to this. The frenulum is a

fold of skin attached at the most ventral point of the glans penis, where the corona forms a distally pointing V ***(Brock et al.,1997).***

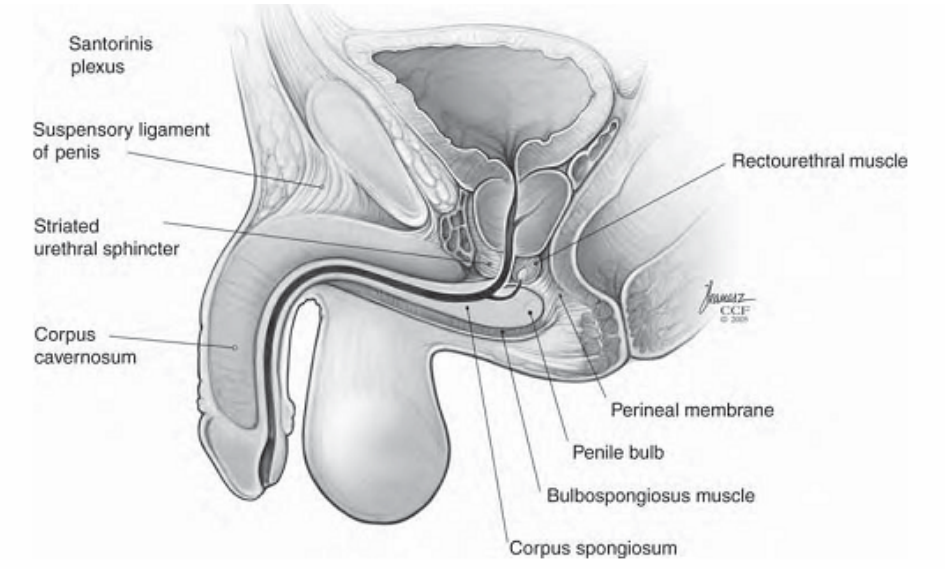

Fig. 1.3: Ligaments of the penis ***(Andrew C et al.,2006).***

*Anatomy of male urethra:-

The divisions of the urethra are as follows: (1) glanular, (2) pendulous or penile, (3) bulbous, (4) membranous and (5) prostatic (Fig. 1.4). The glanular urethra is lined with stratified squamous epithelium. Within the pendulous portion, the epithelium is primarily stratified or pseudostratified columnar with areas of stratified squamous epithelium. It maintains a lumen of constant size roughly centered within the corpus spongiosum. Within the bulb,the urethra widens and lies closer to the dorsal aspect of the corpus spongiosum. The urethra does not traverse the full extent of the bulb, but exits from its dorsal surface prior to the posterior attachment of the bulb to the perineal body. The bulbous urethra is lined with stratified or pseudostratified columnar epithelium, which continues proximally as the urethra progresses upward into the membranous portion. In this area, there is a gradual change to a transitional epithelium that lines the prostatic urethra. The periurethral (Littre's) glands open into the pendulous and bulbous portions of the urethra along its dorsal surface. Often there is a larger lacuna magna in

the dorsal wall of the fossa navicularis. The ducts of the bulbourethral (Cowper's) glands open into the urethra within the bulb. More superiorly these ducts are posterolateral to the membranous urethra, extending to the glands located within the striated urethral sphincter ***(Gosling et al.,1982)*** .

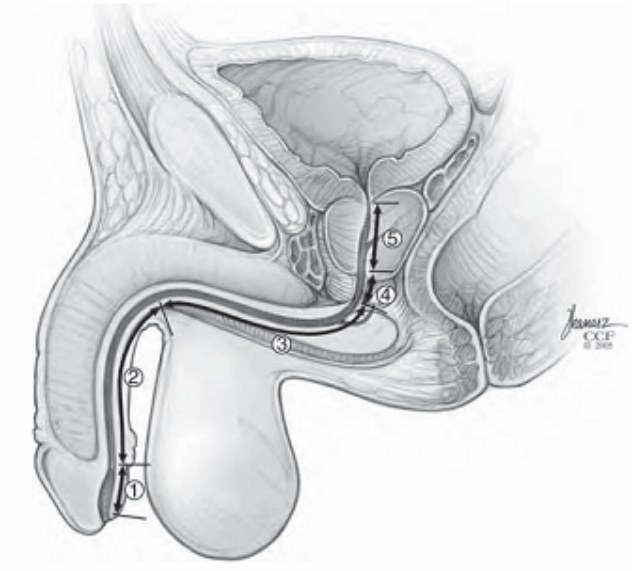

Fig. 1.4: Anatomy of male urethra ***(Andrew C et al.,2006).***

* Arterial supply of the penis:-

The superficial arterial supply to the penile skin and dartos is derived from the left and right inferior external pudendal arteries (Fig. 1.5). These vessels arise from the first portion of the femoral artery and cross the upper medial aspect of the femoral triangle to eventually divide into two main branches. These branches run dorsolaterally and ventrolaterally within the dartos fascia on the shaft of the penis, with extensive collateralization across the midline. Fine branches supplying the skin are given off at intervals to form a rich subdermal vascular plexus. Superficial venous drainage is provided by a number of vessels that run in the dartos fascia on the dorsolateral aspect of the penis. These veins unite at the base of the penis to form a superficial dorsal vein, which usually drains into the left saphenous vein. At times there is

acommunication between a superficial vein and the deep dorsal vein of the penis ***(Juskiewenski et al.,1982).***

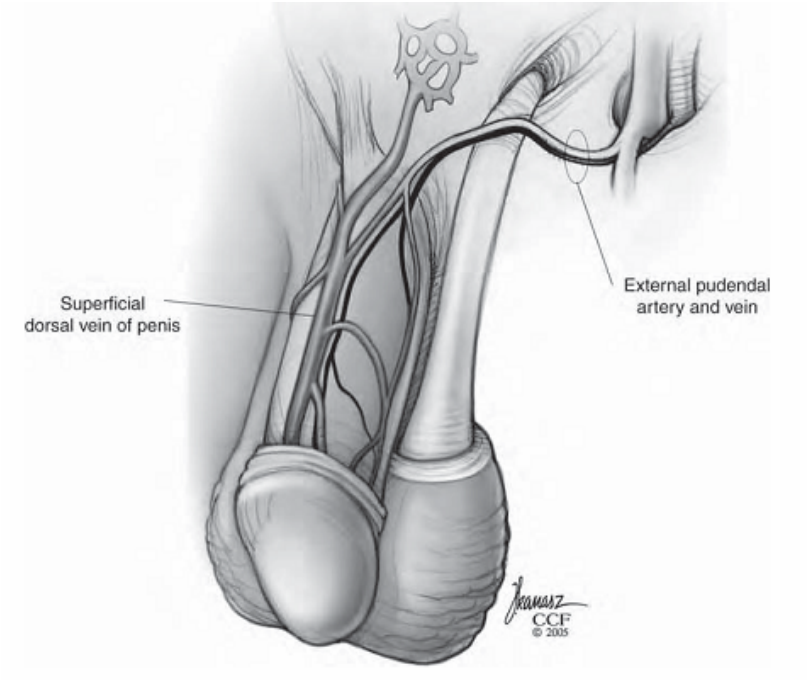

Fig. 1.5: Superficial arterial supply to the penis ***(Andrew C et al.,2006).***

The blood supply to the deep structures of the penis originates from the common penile artery, which is the continuation of the internal pudendal artery distal to the perineal artery (Figs. 1.6 and 1.7). The common penile artery travels along the medial margin of the inferior pubic ramus before dividing into its terminal branches near the urethral bulb. Occasionally one or more of the terminal penile vessels may be derived from an accessory pudendal artery arising within the pelvis, most commonly from the obturator artery or the internal pudendal artery before its entrance into the greater sciatic foramen. The accessory pudendal artery travels along the lower part of the bladder and the anterolateral surface of the prostate to reach the root of the penis. The first branch of the common penile artery is the bulbourethral artery, which traverses the perineal membrane to enter the bulb of the penis. It may also arise as a branch of the dorsal or cavernosal arteries. The urethral artery, which may emerge as a separate branch of the common penile artery, travels within the corpus spongiosum ventrolateral to the urethra and terminates in the

glans penis. The dorsal artery of the penis is the continuation of the common penile artery and generally has a constant course. It proceeds along the dorsum of the penis between the deep dorsal vein medially and the dorsal nerves laterally and has a coiled configuration in the flaccid state. It gives off 3–10 circumflex branches that accompany the circumflex veins around the lateral surface of the corporal bodies. The proximal circumflex arteries may also contribute to the blood supply of the corpus spongiosum and urethra. Occasionally abranch of the dorsal artery penetrates the tunica albuginea to supply the erectile tissue. The dorsal artery terminates in the glans penis, contributing to the dual blood supply of the corpus spongiosum, which is important in urethral reconstructive surgery. The final branch of the common penile artery is the cavernosal artery. It enters the corpus cavernosum at the hilum and runs the length of the penile shaft, giving off the many helicine arteries that comprise the arterial inflow portion of the erectile apparatus. The cavernosal artery may arise from an accessory pudendal artery, and variation may occur in the number of arteries and their configuration. There may be a communication between the cavernosal arteries in the midline prior to entering the corporal bodies or a branch from one may enter the corporal body on the opposite side. Occasionally a single artery will branch in the penile shaft to supply both sides ***(Breza et al.,1989).***

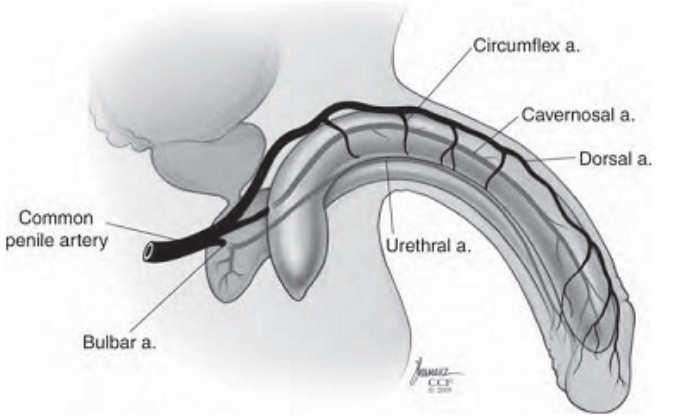

Fig. 1.6: Deep arterial supply to the penis ***(Andrew C et al.,2006).***

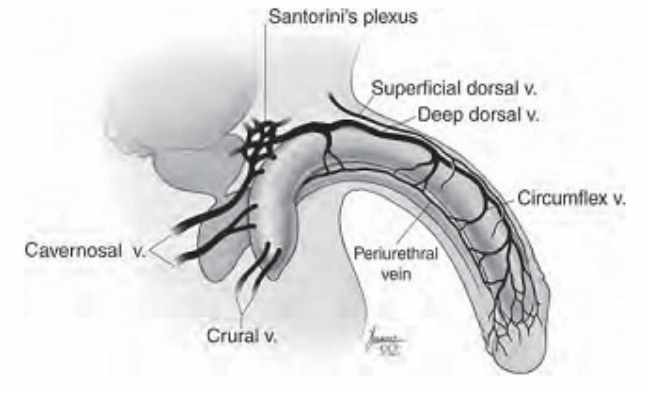

Fig. 1.7: Deep arterial supply to the penis ***(Andrew C et al.,2006).***

* Venous drainage of the penis:-

Veins emerging from the glans penis form a retrocoronal plexus that drains through three to five larger veins into the deep dorsal vein, which lies within Buck's fascia in the midline superior to the corporal bodies (Fig 1.8). The deep dorsal vein proximally passes deep to the suspensory ligaments and then beneath the symphysis pubis to join the prostatic (Santorini's) plexus and drains into the internal iliac veins. Along the penile shaft, the dorsal vein receives drainage from the erectile tissue as well. Small venules drain the blood from the lacunar spaces into a subtunical venous network. Emissary veins arising from this network follow a perpendicular or oblique course through the tunica albuginea. They emerge on the lateral or dorsal surface of the corpora cavernosa and empty into the circumflex veins or directly into the deep dorsal vein. The circumflex veins are present in the distal two-thirds of the penis. They arise from the corpus spongiosum and traverse the lateral aspect of the corporal bodies, passing beneath the dorsal arteries and nerves to empty into the deep dorsal vein. Confluences at the origins of the circumflex veins may form periurethral veins that run parallel to the corpus spongiosum on each side of the penis ***(Breza et al.,1989).***

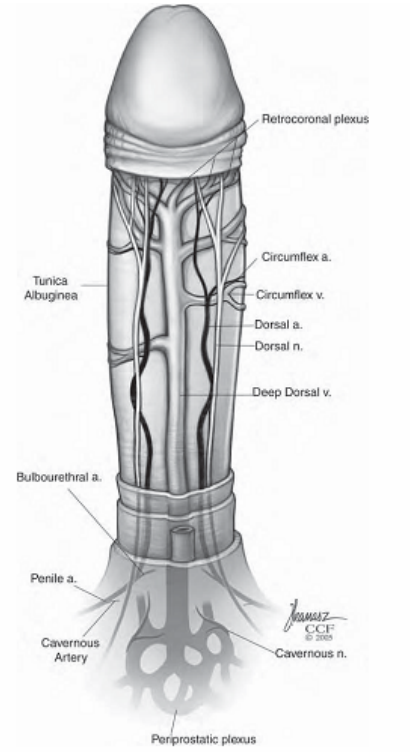

Fig 1.8: Venous drainage of the penis ***(Andrew C et al.,2006).***

*Nerve supply of the penis:-

The pudendal nerves provide somatic motor and sensory innervation to the penis (Fig. 1.9). These nerves enter the perineum with the internal pudendal vessels through the lesser sciatic foramen at the posterior aspect of the ischiorectal fossa. They travel within Alcock's canal to the posterior border of the perineal membrane. On each side the dorsal nerve arises as the first branch of the pudendal nerve within Alcock's canal. Distally these nerves continue along the dorsal aspect of the corporal bodies, assuming a position lateral to the dorsal artery. Multiple fascicles fan out from the dorsal nerve along the penile shaft, supplying the surface of the tunica albuginea as well as the skin and glans penis ***(Lue et al.,1984).***

The autonomic innervation of the external genitalia is derived from the pelvic plexus. This plexus is rectangular in configuration and located on either side of the rectum, with its midpoint at the tips of the seminal vesicles. The cavernous nerves emanate from this plexus and distal to the prostate are located posterolateral and lateral to the membranous

urethra just outside of the striated urethral sphincter. As they traverse this area, they send fibers to the bulbourethral glands before entering the corpora cavernosa dorsomedial to the cavernosal arteries. The cavernous nerves provide the autonomic innervation to the erectile tissues of the penis ***(Schlegel et al.,1987).***

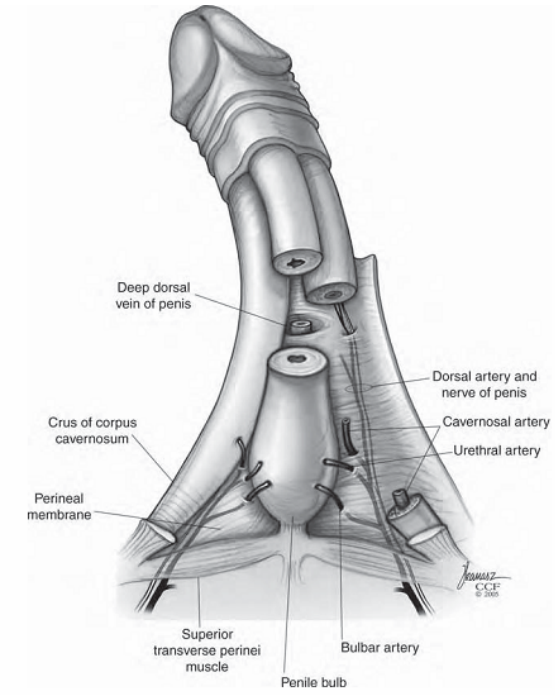

Fig. 1.9: Nerve supply to the penis ***(Andrew C et al.,2006).***

*lymphatic drainage of the penis:-

Lymphatic vessels draining the prepuce and skin of the penile shaft converge dorsally and then divide at the base of the penis to drain into the right and left superficial inguinal nodes (Fig. 1.10). Drainage from the glans penis is toward the frenulum, where large trunks are formed and encircle the corona to unite with those from the other side on the dorsum. They traverse the penis to the base within Buck's fascia, draining via presymphyseal lymphatics into the superficial inguinal nodes and the deep inguinal nodes of the femoral triangle ***(Rouviere .,1983).***

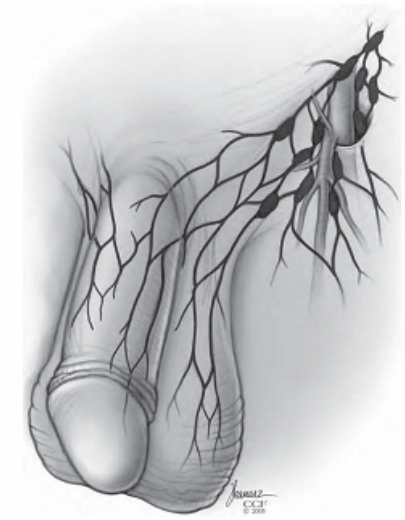

Fig. 1.10: Lymphatic drainage of the penis ***(Andrew C et al.,2006).***