INTRODUCTION

Hypospadias is an abnormality of anterior urethral and penile development in which the urethral opening is ectopically located on the ventrum of the penis proximal to the tip of the glans penis, which, in this condition, is splayed open. The urethral opening may be located as far down as in the scrotum or perineum. The penis is more likely to have associated ventral shortening and curvature, called chordee, with more proximal urethral defects ***(Redman, 2004).***

Hypospadias are among the most common birth defects of the male genitalia,occurring in approximately one in 250 to one in 300 live births ***(Shapiro, 2002).***

The goals of treating hypospadias are to create a straight penis by repairing any chordee (orthoplasty), to create a urethra with its meatus at the tip of the penis (urethroplasty), to re-form the glans into a more natural conical configuration (glansplasty), to achieve cosmetically acceptable penile skin coverage, and to create a normal-appearing scrotum ***(Dubois et al., 2007).***

The resulting penis should be suitable for future sexual intercourse, should enable the patient to void while standing, and should present an acceptable cosmetic appearance ***(Latifoglu et al., 2003).***

Complications after any surgical procedures are possible and these are higher in hypospadias surgery as compared to other reconstructive operations. The main causes of these surgical complications are poorly executed procedures, postoperative infection, wound dehiscence, urine extravasation, hematoma, or ischemia of augmenting tissues.

Therefore, general principles in hypospadias surgery depend on good initial evaluation of the patient regarding age of the patient, severity of hypospadias, associated chordee and selection of the proper surgical technique ***(Elbakry et al., 1998).***

The surgical technique should include delicate handling of tissue with minimal tissue trauma, minimal and pin point use of cautery, tension free repair in all layers and use of well-vascularized tissue closure in as many layers as possible ***(Jordan, 2005).***

In addition, the composition of the suture material with the technique of suture placement contributes significantly to the outcome of the repair. Also the use of optical magnification during surgery allows proper tissue handling and use of small sutures with great accuracy. Perioperative antibiotics have been shown to significantly decrease the rate of post-operative infection ***(Meir and Livne, 2004).***

Urethrocutaneous fistula is the commonest post-operative complication of hypospadias repair with a reported incidence of 4-25% and remains the main concern of the surgeons dealing with such congenital abnormality. The success of the operative technique has been measured by its efficacy in decreasing the incidence of urethrocutaneous fistula ***(Masterson et al., 2000).***

The occurrence of urethrocutaneous fistulae precludes a goal of hypospadias surgery. Unfortunately there is no one single perfect technique to repair a urethrocutaneous fistula. Factors that may affect results of their repair may be the conditions of local tissue, duration of time after hypospadias repair, the number, location and size of the fistula, use of magnification, patients age, previous fistula repairs and also the type of suture material used, skill of the operating surgeon and proper inversion of the edges ***(Nuininga et al., 2005).***

AIM OF THIS STUDY

The purpose of this study is to compare the outcome of two surgical techniques for the closure of urethrocutaneous fistula (UCF) after hypospadias repair, simple closure versus flap technique.

SURGICAL ANATOMY OF THE PENIS

1- Covering of the penis:

The shaft of the penis is surrounded by five layers of tissues; the penile skin, the superficial layer of the penile fascia, the telasubfascialis, the deep layer of penile fascia and tunica albuginea ***(Hodgson, 1999).***

A- The penile skin:

The skin over the penis is particularly movable and expandable to accommodate erection. The penile skin adapts readily to prolonged contact with urine, making it suitable material for urethral replacement. Other advantages of this skin for urethral construction are its distensability and abundant vascularity as well as its ready availability. At the neck of the penis; it is folded upon itself to form the prepuce or foreskin, which overlaps the glans for a variable distance. The internal layer of the prepuce is confluent along the line of the neck with thin skin, which covers and adheres firmly to the glans. On the urethral surface of the glans penis, a small median fold passes from the deep surface of the prepuce to the external urethral orifice; this is the frenulum ***(Hodgson, 1999).***

B- The superficial fascia of the penis (Dartos fascia):

It is part of the membranous layer of the superficial fascia of the groin and perineum (Colles' fascia) .Embedded in it is the vessels that supply the skin; the superficial penile arteries and the superficial dorsal veins. This layer is only loosely attached to the one beneath it and hence is quite mobile. The deep membranous layer of the colles' fascia forms a roof over the scrotal cavity. At the base of the penis,it is continuous as a fascial envelop (Dartos fascia of the penis).Thickening of the fascia at this level forms the two suspensory ligaments of the penis (**Barbagli et al., 2006).**

C- The telasubfascialis (Eberth):

Beneath the dartos fascia and Colles' fascia lies a very thin connective tissue layer, which is more prominent at the base of the penis, where it covers the extra corporeal segments of the cavernous arteries, veins and nerves.

D- The deep penile fascia (Buck's fascia):

It is a heavy elastic layer that covers not only the two corpora cavernosa but, in a somewhat separate compartment, the corpus spongiosum as well. It also encloses the deep dorsal vein and the dorsal arteries and dorsal nerves. The fascial layers of the penis and scrotum are continuous with similar layers in the perineum and the lower abdomen. The ischiocavernosus and bulbospongiosus muscles lie beneath the superficial penile

fascia and its extension as colles' fascia but are superficial to Buck's fascia ***(Breza et al., 1989).***

E- The tunica albuginea:

It is enclosing the corpora cavernosa and has two layers, an outer longitudinal coat and an inner circular coat. The intercavernous septum, separating the two corpora cavernosa, is perforated by the pectiniform septum, providing free vascular communication between the corpora. Flattened columns or sinusoidal trabeculae within the corporal bodies surround the endothelium-lined sinusoids or cavernous spaces. A row of structural trabeculae traverses each intracorporeal space ***(Breza et al., 1989).***

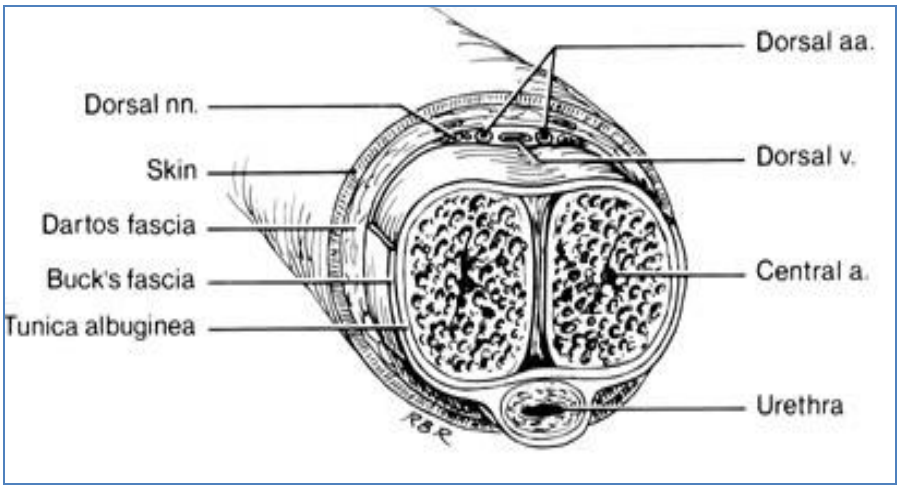

Fig (1): Cross section of the penis at the junction of its middle and distal thirds ***(Jordan GH: Peyronie's disease and its management: Clinical Urology. Philadelphia, JB Lippincott, 1994, pp1282).***

Blood supply of the penis

1- Arterial blood supply: The common penile artery continues in Alcock's canal, above the perineal membrane, and terminates in three branches to supply the erectile bodies. The bulbourethral artery penetrates the perineal membrane to enter the spongiosum from above at its posterolateral border. This large, short artery can be difficult to isolate and control during urethrectomy. It supplies the urethra, spongiosum, and glans. The cavernosal artery pierces the corporal body in the penile hilum to near the center of its erectile tissue. It gives off straight and helicine arteries that ramify to supply the cavernous sinuses. The dorsal artery of the penis passes between the crus penis and the pubis to reach the dorsal surface of the corporal bodies. It runs between the dorsal vein and the dorsal penile nerve and with them attaches to the underside of Buck's fascia. As it courses to the glans, it gives off cavernous branches and circumferential branches to the spongiosum and urethra. The rich blood supply to the spongiosum allows safe division of the urethra during stricture repair ***(Devine and Angermeier., 1994).***

It is not uncommon for a single cavernosal artery to supply both corporal bodies or to be absent altogether. Alternatively, an accessory pudendal artery may supplement or completely replace branches of the common penile artery. This artery usually arises from the obturator or inferior vesical arteries and runs anterolateral

to or within the prostate to reach the penis in the company of the dorsal vein. This artery has been identified in 7 of 10 cadaveric specimens ***(Breza et al., 1989).***

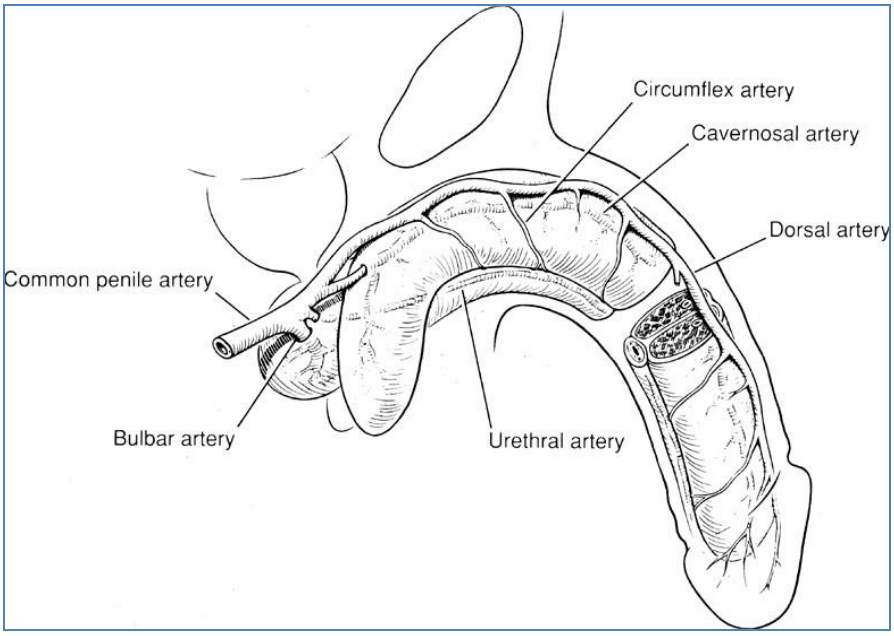

Fig (2): Arterial supply to the urethra and deeper structures of the penis (***Devine C.J., Jr. and Angermeier K.W.: Anatomy of the penis and male perineum. AUA Update series 13:12, 1994).***

2- Venous drainage: At the base of the glans, several venous channels coalesce to form the dorsal vein of the penis, which runs in a groove between the corporal bodies and drains into the preprostatic plexus.

The circumflex veins originate in the spongiosum and pass around the cavernosa to meet the deep dorsal vein perpendicularly. They are present only in the distal two thirds of the penile shaft and number 3 to 10. Intermediary venules form from the cavernous

sinuses to drain into a subtunical capillary plexus. These plexuses give rise to emissary veins, which commonly follow an oblique path between the layers of the tunica and drain into the circumflex veins dorsolaterally. Emissary veins in the proximal third of the penis join on the dorsomedial surface of the cavernous bodies to form two to five cavernous veins. At the hilum of the penis, these vessels pass between the crura and the bulb, receiving branches from each, and join the internal pudendal veins. Valves are found in the emissary, cavernosal, and deep dorsal veins and may thwart attempts to revascularize the penis by arteriovenous anastomosis ***(Sohn, 1994).***

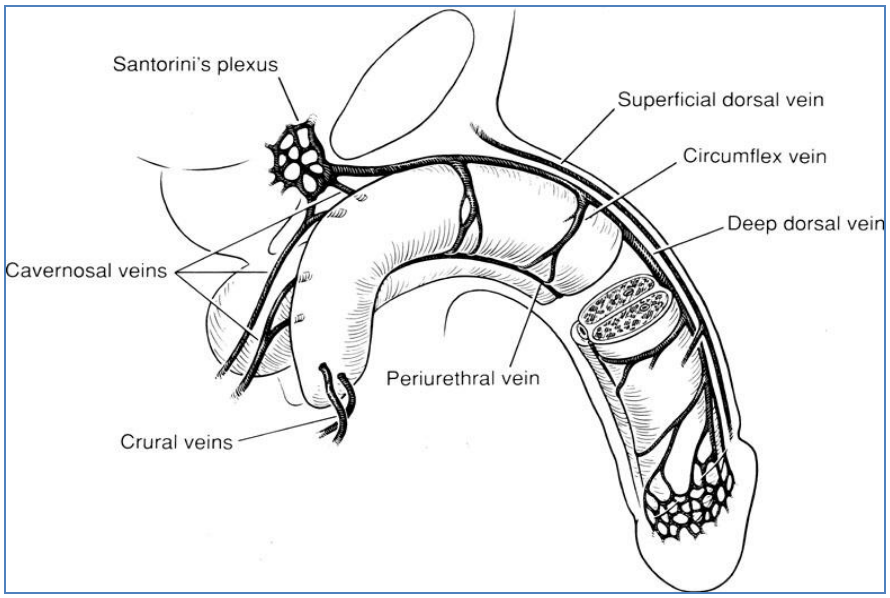

Fig (3): Deep venous drainage of the urethra and penis
(From Horton et al., 1990)

Nerve supply of the penis

The dorsal nerves provide sensory innervation to the penis. These nerves follow the course of the dorsal arteries and richly supply the glans. Small branches from the perineal nerve supply the ventrum of the penis near the urethra as far as the glans distally. These nerves must be anesthetized when performing a penile block to numb the ventrum of the penis. The route of the cavernous nerves has been described. After piercing the corporal bodies, they ramify in the erectile tissue to supply sympathetic and parasympathetic innervation from the pelvic plexus ***(Uchio et al., 1999).***

The skin of the penis is supplied by the pudendal nerve via the posterior scrotal and dorsal nerves. The later supplies the glans. The dermatome mainly involved is S2.A small area of skin on the dorsum of the proximal penis is supplied by the ilioinguinal nerve (L1).

Preputial anatomy:

1- **Musculature:** The prepuce has a sheath of smooth muscle tissue inside the skin which is called the peripenic muscle ***(Cold and Taylor, 1999).*** The muscle fibers are arranged in a whorl at the end of the foreskin to form a sphincter. The muscle fibers keep the foreskin snugly against the glans penis ***(Lakshmanan et al., 1980)***,

2- **Skin and mucosa:** The outer surface of the prepuce is skin; however the inner surface is mucosal membrane although it resembles skin in appearance. There is a muco-cutaneous boundary just inside the tip of the prepuce. The prepuce normally covers the glans penis and protects it from foreign matter, friction, drying, and injury.

3- **Sub-preputial moisture**: The sub-preputial area is normally slightly moist. Fleiss reported apocrine glands that produce cathepsin B, lysosyme chymotrypsin, neutrophil elastase, cytokine, and pheromones such an androsterone ***(Fleiss et al., 1988).***

Preputial blood supply:

I- Arterial:

The prepuce is supplied by the superficial penile arteries, which are two branches from the inferior external pudendal arteries. These usually divided into anterolateral and posterolateral branches. On reaching the preputial ring, the vessels become tortuous and minute and turn circumferentially before ending at the coronal sulcus. The superficial penile arteries do not communicate with the circulation to the rest of the penis ***(Breza et al., 1989).***

II- Venous:

The multiple small vessels in the skin of the shaft join one or two superficial penile veins that drain through the

inferior external pudendal vein into the saphenous vein. The branch arteries are accompanied by tributary veins that are larger and more prominent ***(Quartey, 1983)*.**

HYPOSPADIAS

Incidence of hypospadias

Hypospadias is a congenital anomaly of the penis which results in an incomplete development of the anterior urethra. Hypospadias is characterized by the degrees of deficiency of the urethra and of the corpus spongiosum and the corpora cavernosa ***(Baskin et al., 2001).***

Hypospadias is one of the most common congenital anomalies, occurring in approximately 1:200 to 1:300 live births. In Europe, the prevalence of hypospadias in the last three decades has been increasing without any reasonable explanation. Hypospadias has been evaluated as occurring in approximately 1 out of 200–300 live male births in the US population ***(Baskin et al 2001).***

Symptoms of hypospadias include:

- Urethral opening located on the underside of the penis.
- Foreskin is malformed, giving the penis a hooded look.
- The child must sit down to urinate.
- Presence of chordee, a tight fibrous band that results in a downward curvature of the penis, seen with erection.

Findings associated to hypospadias

I- Genetic association

There is a well-recognized familial clustering of hypospadias, and male relatives of boys with hypospadias are more likely to have this condition than would be expected by chance ***(Vilchis et al., 2000).***

II- Cryptorchidism and Inguinal Hernia

Associated abnormalities include cryptorchidism (8% to 9%) and inguinal hernia and/or hydrocele (9% to 16%).These overall rates for males with hypospadias increase significantly in those with more proximal defects. The concomitant occurrence of hypospadias and cryptorchidism even in the setting of non-ambiguous genitalia should alert the urologist to evaluate for the possible presence of an intersex state ***(Sorber et al., 1997).***

III- Intersex State

A high index of suspicion for an intersex state should accompany presumed males with any degree of hypospadias and cryptorchidism in a detailed evaluation of hypospadias level and exact status of concomitant cryptorchidism ***(Kaefer et al., 1999).***