Comparative study between de-epithelized perimeatal dartos flap and preputial flap (Byar's flap) as a second layer during the Snodgrass technique for distal Hypospadias Repair

Thesis

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My sincere thanks goes to **my father**. It is because of God then because of him that I stand here today; thank you dad.

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I would like to dedicate this to **my wife**, *Doaa*. I owe you my life.

Mohammed
Essam El Din

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List of Abbreviations

Abb.	Meaning
AD	Anno Domini
AR	Androgen receptor
BC	Before Chris
ER	Estrogen receptors
FGF	Fibroblast growth factor
HCG	Human chorionic gonadotrophin
MAGPI	Meatal advancement and granuloplasty
PDD	Penile developmental disorder
SNPs	Single-nucleotide polymorphisms
SRD	Steroid 5-a reductase
SRY	Sex-determining region Y
TIP	Tubularised Incised Plate
VC	Ventral chordee

INTRODUCTION

Hypospadias is the most common congenital malformation of the penis. The prevalence of hypospadias has been estimated to range between one per 200 to 300 live male births; however, its prevalence may vary among different populations around the world ***(Baskin et al., 2001).***

Hypospadias is a penile developmental disorder (PDD) in which the opening of the urethra is in an abnormal position at the penis ventral surface, on the scrotum or even on the perineum. It is known that this PDD may result from several factors including endocrine-related abnormalities that usually occur between weeks 8 and 14 of gestation, drug exposure, in vitro fertilization, placental insufficiency and growth restriction ***(Sun, 2009).***

The most common classifications of hypospadias are based on the location of the urethral opening, which can be classified as glanular, coronal, subcoronal, distal penile, midshaft, proximal penile, penoscrotal, scrotal or perineal ***(Duckett, 1998).***

Hypospadias repair, for centuries, was doomed to live in the dark, a puzzle that could wound the ego of even the most talented surgeons, and amputate even the most optimistic spirits. But, with the birth of the last century, these concepts

were all changed, and history was rewritten. The armamentarium to combat such a condition was expanded, and the tools made at hand, to utilize in the correction, have become uncountable. A wide variety of choices exist now that the amateur surgeon may get overwhelmed by a long list ***(Omar, 2010).***

New techniques and modifications for surgical correction of hypospadias are continually developed with hopes of minimizing complications and improving functional and cosmetic results ***(Steckler, 1997).***

Correction of distal hypospadias is one of the most common surgical procedures for pediatric urologists, and many surgical techniques have been developed to correct this type of hypospadias ***(Caione, 1997).***

In 1994 Snodgrass described a technique for distal hypospadias repair based on urethral plate tabularization, associated with a longitudinal incision in its groove ***(Rich, 1989; Snodgrass, 1994).***

The advantage of this procedure is that it facilitates mobilization of the urethral plate, providing less tension of the neourethra suture line with a vertical slit meatus, leading to good results ***(Snodgrass, 1999).***

Many authors consider that, since its introduction, the technique of tubularized incised urethral plate associated with

the coverage of the suture with well-vascularized tissue (de-epithelialized subcutaneous, dartos fascia or tunica vaginalis flaps) has significantly decreased complications in the postoperative period, and that it may be considered the best surgical technique in patients not previously subjected to surgery (primary hypospadias) ***(Snow, 1986; Belman, 1994; Cheng, 2002; Djordjevic, 2006).***

However, Complications after hypospadias repairs are common, with fistula formation accounting for approximately 75% ***(Charles et al., 2005)*** some patients still develop glans dehiscence & meatal stenosis ***(Jayanthi 2003; Sarhan, 2009).***

Regardless the technique employed for repair of hypospadias and its associated defects attention to urethroplasty, suturing technique, hemostasis, dressing and skin coverage are universal concern in the rate of repair success. Second layer coverage of the neourethra with the use of various vascularized flaps has significantly decreased urethrocutaneous fistula as a complication of hypospadias repair ***(Belman, 1988)***.

To summarize, a lot of techniques have been tried to decrease the incidence of complications after Snodgrass technique. This thesis will try to present a backup in case of fistula formation after Snodgrass technique repair.

Aim of the Work

The aim of this thesis is to assess the efficacy of de-epithelized perimeatal dartos flap as a second layer in the Snodgrass repair as regard success and failure rate to spare preputial flap (Bayr's flap) as a backup in second layer if needed.

Chapter One

ANATOMY & EMBRYOLOGY OF MALE URETHRA

Urogenital system development

Until gestational week 7, the embryo has a cloaca, a single orifice at the caudal aspect. During gestational week 7, the urogenital membrane grows caudally, dividing the cloaca into ventral (urogenital sinus) and dorsal (rectum) components (Fig).

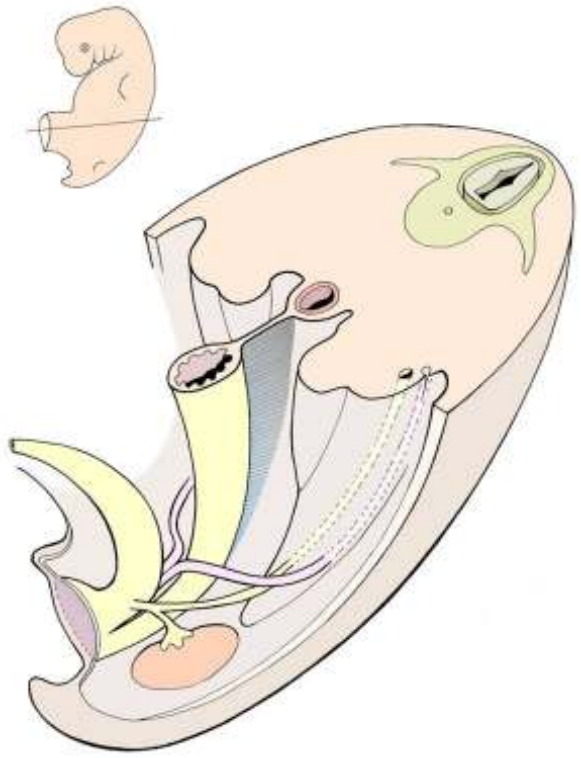

Figure (1): Caudal end of the embryo – hindgut (yellow). paramesonephric ducts (light purple).

The urogenital sinus can be further subdivided into cranial (future bladder) and caudal (future prostate, urethra, and external genitalia) portions. The vesical epithelium is entirely derived from the endodermal layer of the urogenital sinus. The mesonephric duct gives rise to the ureter. With continued caudal growth of the embryo, the proximal (bladder) end of the mesonephric duct is progressively absorbed caudally, such that the common portion of the mesonephric duct is absorbed into the bladder trigone and urogenital sinus, and the discrete "branches" of the mesonephric duct destined to become the male genital ducts and ureters are now distinct entities attached to the urogenital sinus. Although the trigone is generally accepted to derive from the mesonephric ducts, the manner in which this is accomplished is not completely understood, and recent work suggests that the trigone may form primarily through vitamin A-mediated apoptosis of the common nephric duct rather than from true incorporation of the mesonephric ducts ***(Cathy Mendelsohn, 2009)***.

The nonepithelial layers of the detrusor (non-trigone) portion of the bladder arise from condensations of splanchnic mesenchyme. The lumen of the allantois, which connects the bladder and the anterior abdominal wall, closes over time, yielding the urachus. Over time, the urachus becomes more fibrotic and becomes the median umbilical ligament ***(Moore and Persaud, 2003).***

Urethra

The urethra is derived from the urogenital sinus, with endoderm giving rise to the epithelium and splanchnic mesenchyme giving rise to the surrounding soft tissue. The formation of the urethra starts with the early adhesion of the arms of the genital tubercle. In this way an epithelial plate is formed, located in the ventral midline, that is in continuity with the cloacal membrane. Male sex differentiation takes place following rupture of this cloacal membrane through programmed cell death. Fusion of the urogenital swellings with primary luminization gives rise to the penile urethra, whereas the glandular part of the urethra is formed through secondary luminization of the epithelial cord that is formed during fusion of the arms of the genital tubercle, i.e., the glans.

Three mechanisms may account for epithelial seam formation: (1) epithelial-mesenchymal transformation (2) apoptosis, and/or (3) tissue remodeling via cellular migration. The urethra forms by fusion of the epithelial edges of the urethral folds, giving a midline epithelial seam. The epithelial seam is remodeled via cellular migration into a centrally located urethra and ventrally displaced remnant of epithelial cells. The epithelial seam is remodeled by narrowing approximately at its midpoint, with subsequent epithelial migration into the urethra or penile skin. The epithelial cells are replaced by mesenchymal cells. This remodeling seam displays a narrow band (approximately 30 microns wide) of apoptotic

activity corresponding to the mesenchymal cells and not to epithelial cells. No evidence was seen of the co-expression of cytokeratin and mesenchymal markers (actin or vimentin). Any disruption of epithelial fusion remodeling, and cellular migration leads to hypospadias ***(Baskin et al., 2001).***

The consequence of fusion of the urogenital swellings is that their mesodermal cores unite on the ventral aspect of the penile urethra, where they differentiate into the integumental structures. The prepuce starts to develop as a fold of ectoderm with a mesodermal core after complete fusion of the entire urethra. In males, the most distal part of the urethra (the glanular portion) appears to arise from an ectodermal invagination which then joins with the endodermal epithelium of the proximal urethra to create a continuous channel ***(Van der Werff, 2000).***

External Genitalia

Differentiation of the external genitalia into male and female variants begins in the seventh gestational week. A genital tubercle arises from condensations of mesenchyme near the embryonic cloaca in the fourth gestational week; on either side, labioscrotal (genital) swellings and urogenital (urethral) folds develop. The urorectal septum grows toward the cloaca, and by the end of the sixth gestational week has divided the cloaca into urogenital (anterior) and anal (posterior) portions ***(Moore and Persaud, 2003).***

In the male, exposure to androgens results in growth of the genital tubercle to form a phallus, and the urogenital folds form the lateral borders of the urethral groove, and will ultimately fuse ventrally to cover the urethral plate (endoderm), which is contained within the urethral groove ***(Baskin et al., 2001) (Fig.)***

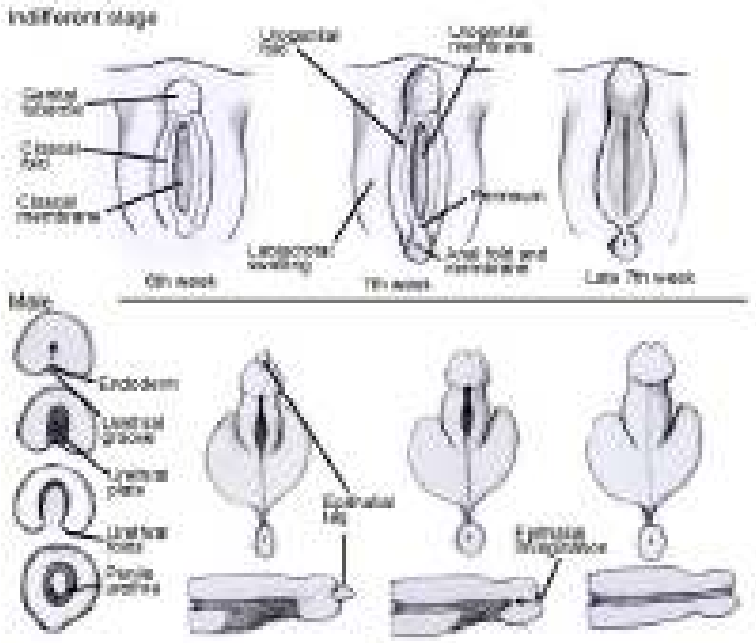

Figure (2): Stages of urehtral development

The urethra is further covered by ectoderm. The development of the glanular urethra has been debated; one theory is that tubularization of the urethral plate from fusion of the labioscrotal folds continues distally in the same manner as it is accomplished proximally, while another theory contends that ectodermal invagination of the tip of the glans penis with subsequent contact with the penile urethra gives rise to a fully