Cyanoacrylate Based Products as Interpositioning Substance versus Reintervention Alone for Urethrocutaneous Fistula Repair after Hypospadias

Thesis

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Andrew Makeen

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List of Abbreviations

Abb.	Full term
®	*Registered Sign*
AMH	*Anti-Müllerian hormone*
AV	*Arteriovenous*
AVM	*Arterio-venous malformation*
CA	*Cyanoacrylate*
CBC	*Complete blood count*
cm	*Centimetres*
DES	*Diethylstilbestrol*
DHT	*Dihydrotestosterone*
DSD	*Disorders of sex development*
e.g	*Exempli gratia "for example"*
EDCs	*Endocrine disrupting compounds*
EVDs	*External ventricular drains*
FDA	*Food and Drug Administration*
Fr	*French gauge system*
HCG	*Human Chorionic Gonadotropin*
i.e	*Id est "that is"*
ICSI	*Intracytoplasmic Sperm Injection*
INSL3	*Insulin-Like factor 3*
IVF	*In Vitro Fertilisation*
kg	*Kilogram*
MAGPI	*Meatal advancement and granuloplasty*
mg	*Milligrams*
ml	*Millilitres*
mm	*Millimetres*
NVB	*Neurovascular bundle*
PATIO	*Preserve the tract and turns it inside out*
PDS	*Polydioxanone*
PTFE	*Polytetrafluoroethylene*

List of Abbreviations (Cont...)

Abb.	Full term

SIS .....Small intestinal submucosa
SRY .....Sex Determining Region Y
TDS .....Testicular Dysgenesis Syndrome
TIP .....Tubularized incised plate
TV .....Tunica vaginalis
TVF .....Tunica vaginalis flap
™.....Trade mark
UCF .....Urethrocutaneous fistula
UTI .....Urinary tract infection

ABSTRACT

The concept of interpositioning layers was introduced to aid in the repair of urethrocutaneous fistula after hypospadias surgery and prevent its recurrence. Many flaps as dartos fascial flap and tunica vaginalis flap as well as synthetic tissue adhesives as cyanoacrylate glue were used for this purpose.

In our study, in the group of patients repaired with multilayered closure procedure using dartos facial flap only for covering, 14 patients (70%) were successfully repaired and 6 patients (30%) developed a recurrent fistula.

The success rate was higher for patients using cyanoacrylate glue as a protective interpositioning layer as 16 patients (80%) were successfully repaired and 4 patients (20%) developed a recurrent fistula. However, there was no statistically significant difference between 2 groups p-value was 0.465.

Keywords: Endocrine disrupting compounds - External ventricular drains - Human Chorionic Gonadotropin

INTRODUCTION

Urethrocutaneous fistula (UCF) is an epithelial-lined tract that provides a communication between urethral lumen and penile skin. UCF is the most frequent complication after hypospadias repair with an incidence up to 35% worldwide ***(Yildiz et al., 2013) (Hardwicke et al., 2015).***

The actual causes of fistula formation after hypospadias remain unknown although the most common reasons are technical and avoidable. Several factors may lead to fistula formation including:

Distal obstruction, impaired vascular supply to neourethra, crossing suture line, poorly vascularized flap covering the neourethra, postoperative wound infection and urinary extravasations ***(Sheriff and Mohamed, 2011).***

The site and number of fistula are identified by injecting methylene blue with a syringe through the meatus after applying manual pressure proximally at the penoscrotal region to close the urethra. Every case of fistula especially if recurrent should be investigated thoroughly prior to surgery either to define possible associated anomalies or causes of recurrence such as presence of a urethral diverticulum or distal urethral stricture, as it may lead to recurrence of the fistula ***(ElBakry, 2001) (Hadidi, 2004).***

The methods of fistula repair differ according to the localization and the size of the fistula. Small-sized fistulas may disappear spontaneously in response to regular dilatation, but most fistulas need surgical correction. Minimally invasive treatment may benefit patients with small epithelialized fistulae by disruption of the epithelial layer of the fistula tract. Cyanoacrylate and fibrin glue used for repair of urethrocutaneous fistula as their tensile strength maintain the contact of the edges of the fistula favouring the healing process ***(Waterman et al., 2002) (Prestipino et al., 2011) (Yurtçu et al., 2009).***

Large or giant fistulae (>5mm), are repaired using skin flaps usually in two steps; the creation of a well vascularized skin flap for urethral closure, preserving the urethral lumen; and skin cover of the penile shaft over the area of repair ***(Shapiro, 1999).***

Synthetic cyanoacrylate adhesives (alkyl-2-cyanoacrylates or alkyl-α-cyanoacrylates) are a family of liquid monomers consisting of the alkyl esters of 2-cyanoacrylic acid. They polymerize at room temperature in an exothermic reaction, releasing heat in the process, on contact with a small amount of water or basic fluid to form polymers, poly (alkyl-2-cyanoacrylates). They form strong adhesive bonds with a variety of substrates such as wood, metal, hard tissue (i.e., bone and tooth), and soft tissue (i.e., skin, vascular tissue). The non-toxic forms that are used in medicine are iso-butyl-2cyanoacrylate, iso-amyl-2-cyanoacrylate & 2-octyl cyanoacrylate with their synonyms ***(Mohamed et al., 2014) (Reda et al., 2015).***

Synthetic cyanoacrylate tissue adhesives have been FDA approved to be used extensively as an alternative to current conventional treatments in clinical applications as in thoracic, gastrointestinal, neurologic, cardiovascular, ophthalmologic and vascular surgery. They also include the use of cyanoacrylates for embolization in neurologic, urologic and cardiovascular procedures ***(Cesare et al., 2013) (Mattamal, 2008) (Mohamed et al., 2014).***

Aim of the Work

Evaluation of success and failure rates of using cyanoacrylate based productes as an interpositioning substance in surgical repair of fistula after hypospadias in comparison to the classic surgical repair technique.

Chapter 1
ANATOMY OF THE PENIS

The penis is anatomically composed of three parts: posterior (root), central body or shaft and anterior portion composed of glans, coronal sulcus and foreskin ***(Velasquez et al., 2007) (Epstein et al., 2011).***

The shaft of the penis composed of three erectile tissues: two dorsolateral corpora cavernosa and a ventral corpus spongiosum surrounding the urethra ***(Brooks, 2007).***

Proximally, the corpora cavernosa separate to become the crura which spread apart under the ischium bilaterally and move medially under the pubis until they lie adjacent to each other. They are each enveloped in a fibrous tunica albuginea which share a septum when the crus are adjacent. This septum is perforated, allowing for communication of the cavernosal sinuses in the penis ***(Brooks, 2007).***

The distal end of corpus spongiosum expanded into a conical glans, which is folded dorsally to cover the ends of the corpora cavernosa and ends in a prominent ridge, the corona. The corona passes laterally and then curves distally to meet in a v ventrally and anterior to the frenulum, a fold of skin just proximal to the external urethral meatus ***(Brooks, 2007).***

Buck's fascia surrounds the paired corpora cavernosa and corpus spongiosum circumferentially. It splits into two leaves to surround the corpus spongiosum completely on the ventral aspect of the penis. An extension of Buck's fascia forms the suspensory ligament, which attaches the penis to the underside of the pubis. Buck's fascia is continuous with deep pelvic fascia ***(Brooks, 2007) (Dwyer et al., 2011).***

Superficial to Buck's fascia is Dartos fascia, which is a loose areolar subcutaneous tissue, devoid of fat and contains the superficial blood vessels, nerves and lymphatics. It is continuous with Scarpa's fascia of the abdomen and Dartos fascia of the scrotum ***(Brooks, 2007) (Dwyer et al., 2011).***

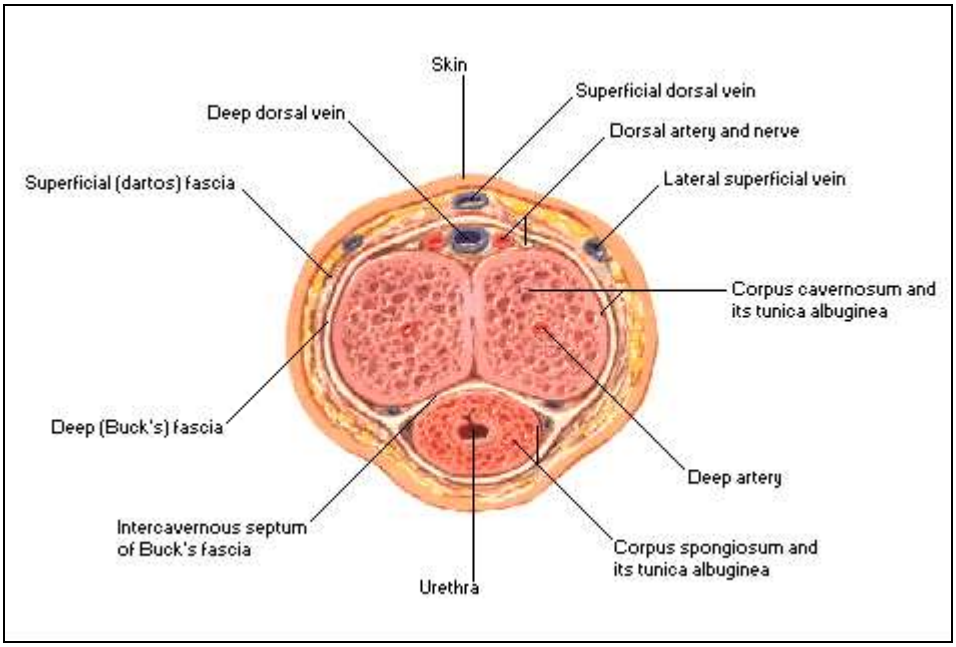

Figure (1): Anatomy of the penis ***(Chung et al., 2012).***