Evaluation of Urethral advancement and Glanuloplasty in Hypospadias repair

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الخلاصة:

خلال العقود الأخيره كان هنالك تقدم كبير في جراحة تقويم مجرى البول الذكري في حالات المبال التحتاني. عدة طرق معقده تطورت لتقويم قصور مجرى البول بأختلافات كبيره في نسب النجاح، ولكن لم يوجد لحد هذه الفتره لمجرى البول بديل أمثل كمجرى البول نفسه.

في الأنسان مجرى البول الذكري له قابليه كبيره للأستطاله بالشد، هذه القابليه هي الأساس لعملية تقديم مجرى البول التي تستخدم لتقويم قصورها في حالات المبال التحتاني بأستخدام مجرى البول نفسه.

الهدف من هذه الدراسه هو تقييم عملية تقديم مجرى البول الذكري مع تجميل حشفة القضيب في حالات المبال التحتاني.

خلال فترة سنه واحده ، ٢٠ طفل بأعمار تتراوح بين ٢-١٦ سنه، عولجوا بعملية تقديم مجرى البول الذكري مع تجميل حشفة القضيب لحالات المبال التحتاني المتضمن من الحشفه الى منتصف القضيب.

٧٥٪ من المرضى، تم الحصول على فتحة الأحليل عند أو بالقرب من قمة حشفة الأحليل، ٨٥٪ منها ذات حجم مناسب، ٨٥٪ أحليل مستقيم، ٧٠٪ حشفه مخروطية الشكل. بينما المضاعفات التي سجلت هي ١٥٪ تضيق فتحة الأحليل، ٢٥٪ تراجع فتحة الأحليل، ٥٪ ناسور مجرى البول، ٣٥٪ نزيف مع تجمع دموي، ١٠٪ لكل من التهابات المجاري البوليه و التهابات الأنسجه الرخوه للأحليل، ٢٠٪ عدم ألتآم جروح العمليه، ١٥٪ تناثر مجرى البول، ١٠٪ مجرى بول تحتاني.

الأستنتاجات التي تم التوصل لها في هذه الدراسه هي:

***متابعة المرضى لفتره طويله هو أمر أساسي في عمليلت تقويم المبال التحتاني بضمنها عملية تقديم مجرى البول الذكري مع تجميل حشفة القضيب.**

*** تحرير مجرى البول بصوره كافيه او كامله لتقديمه يقلل من نسب حدوث مضاعفات في تراجع و تضيق فتحة الأحليل.**

***النسبه الأقل لحدوث الناسور في عملية تقديم مجرى البول الذكري مع تجميل حشفة القضيب تدعم العباره "لم يوجد لحد هذه الفتره لمجرى البول بديل أمثل كمجرى البول نفسه".**

Abstract

Background:

There has been great progress in reconstructive surgery of the male urethra in the last decades. Several complex techniques were developed to correct urethral defects with great variations in the success rate. However, there is no an ideal substitute for the male urethra as good as the urethra to our knowledge at this time .

Human male urethra has a large capacity to extend under traction. This extensibility is the principle of urethral advancement technique used to correct urethral defect in hypospadias by using the urethra itself.

The objective of this study was to evaluate the urethral advancement and glanuloplasty (UGPI) procedure in hypospadias repair**.**

During a period of 1 year, 20 boys ranging between 2-16 years old underwent repair of glanular to midshaft hypospadias by UGPI procedure. At or near the tip meatus was accomplished in 75% of the patients, with 85% adequate meatal size, 85% straight penis and 70% of conical glans shape. While the complications were 15% meatal stenosis (MS), 25% meatal retraction (MR), 5% fistula , 35% bleeding and haematoma, 10% for cellulites and UTI (infection), 20% wound dehiscence, and 10% abnormal urine stream.

Adequate mobilization of the urethra for advancement decreases the incidences of complications of MR and MS.

The lower incidence of fistula in UGPI procedure support the sentence of ***"There is no an ideal substitute for the male urethra as good as the urethra"*.**

INTRODUCTION

Hypospadias repair represents a surgical challenge in that it is not a single defect, but a spectrum of malformations ranging from minor to severe foreshortening of the urethra possibly associated with ventral curvature and/or corporal disproportion. Restoration of a normal appearing and functioning penis, minimal surgical bother and discomfort for the patient, and a rate of complication near zero are the goals of modern "hypospadiology." [1].

Many surgical procedures for hypospadias repair have been proposed, popularized and sometimes forgotten. While there is general agreement on the basic principles of modern urethral reconstructive surgery, it is still debated which technique should be used in specific anatomical situations. Anterior hypospadias represents the most common variant of male genitalia defects that the hypospadiac surgeons treat. A major breakthrough in the problem of anterior hypospadias was made by the meatal advancement and glanuloplasty (MAGPI) procedure, popularized by Duckett, and its variants. However, extending the indications of meatal advancement and glanuloplasty to subcoronal or distal shaft defects with a patulous or thin and hypoplastic meatus resulted in failure or poor cosmesis [1].

The technique was named distal urethral advancement and glanuloplasty (UGPI) specifically intended for distal hypospadias repair with or without mild chordee, with this perspective we reviewed the outcome of this technique after a 1 year follow-up.

The penis consists of a root, a body and a glans. The root; consist of 3 masses of erectile tissue called; the bulb, the right & left crura of penis [2] .while The body of the penis consist of a pair of corpora cavernosa located dorsally and of corpus spongiosum ventrally. All have erectile tissues that are contained by a tough & fibrous tunica albuginea. The corpura are surrounded (from deep to superficial) by Bucks fascia, Dartos fascia and skin. [3].

The Tunica Albuginea is a Tough fibrous shield that envelop the erectile tissue of corpus cavernosus & spongiosus. Around corpora cavernosa It has 2 layers an inner circular layer & outer longitudinal, these are proximally insert in to the pubic bones (Fig.1). It provides the rigid covering (which has a thick adventitia and its collagen fibers form a complex structure)[4] That is necessary to occlude the venous drainage of corpura cavernosa and to support the penis during an erection but it is limiting the penile extensibility. While around corpus spongiosum the tunica albuginea, composed of only the circular layer (which has a thin adventitia and its collagen fibers do not form a complex structure)[4]. ***So it permits more extensibility to the corpus spongiosum and the urethra in comparison to the cavernosa which is the principle of UGPI procedure***[3].

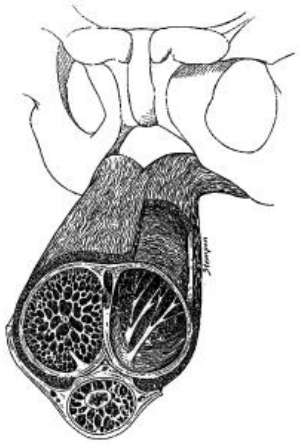

Fig 1 structure of tunica albuginea

The corpus spongiosum encase urethra and it is contain large sinusoid spaces. This portion of erectile bodies engorged to ***provide a blood filled cushion around the urethra***. Corpus spongiosum & glans penis communicate with each other . The cone shape glans hugs the tips of the corpora cavernosa distally.[3]

The urethra and corpus spongiosum are supplied by the bulbourethral artery which course along them ***, this make complete mobilization of the urethra with the corpus spongiosus is possible without compromising their vascularity***[3] . While Venous drainage is partly by way of veins that accompany the arteries[5].

Smooth muscle cells & elastic fibers are major components of the extracellular matrix of the urethra, in addition to its spongy feature; ***they provide the male urethra with a large capacity to extend under traction.***[4].

According to the new theory of Urethral development, Histological analysis of the distal glanular urethra showed no evidence of solid ectodermal ingrowths of old theory. Rather, the new theory supported by Immunostaining of the urethra at different development stages suggested of the endodermal urethral plate differentiation into a stratified squamous epithelium [6], ***So urethral advancement does not disturb the normal urethral origin and further growth***.

Morbid anatomy in Hypospadias Fig. 2

- Any interruption of androgenic stimulation during urethral development lead to arrest in the normal progression in the fusion of the urethral folds results in the urethral meatus being placed proximally along the course of the phallus anywhere from the perineum to the glans[7].
- Undifferentiation of the corpus spongiosa, buck's fascia and Dartos fascia to a layer of inelastic fibrous tissue causing what's called Chordee.
- Absent ventral prepuce.
- Flat glans with ventral furrow.[8]

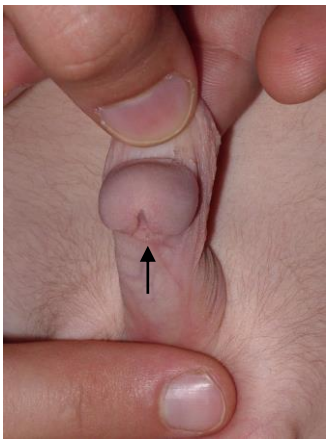

Fig. 2 features of distal Hypospadias

The incidence of hyospadias has been calculated as 1 in 300 live male births.
The children's hospital of Philadelphia reports these percentages of each type; 50% of anterior, 30% were in the middle, the anterior group was further classified as 19% glanular, 47% coronal, and 34% distal shaft[9]

History of urethral advancement

Advancing the urethra for hypospadias repair was first introduced in 1898 by Beck. The urethra was not mobilized widely and many patients had chordee. In 1977 Belman reported on a technique for hypospadias repair which involved wide urethral mobilization and advancement. [10]

Urethral extensibility applied to urethral advancement

As revealed by the anatomy and histology of the urethra and the surrounding tunica albuginea, the human male urethra has great capacity to extend under traction. This extensibility is the principle of urethral advancement technique used to overcome urethral defects[4], by complete freeing dissection (mobilization) of the urethra from the surrounding penile tissues and stretching for distal advancement. While excessive mobilization of the urethra is not desirable, The success rate of this surgical technique depends on the possibility of forming free tension anastomosis of the stretched urethra with the new meatus[4].

PATIENT AND METHODES

A total of 20 patients with glanular to mid shaft hypospadias with and without chordee have been managed in Al-Wasity hospital in Baghdad (specialized surgical hospital) by urethral advancement & glanuloplasty procedure.
Age of the patient ranging between 2 years to 16 years old, mean 5.9 years, Table 1 shows the distribution of the age groups.
For researching purposes the 20 patient included in this study divided into 3 groups as shown below in Fig 3:

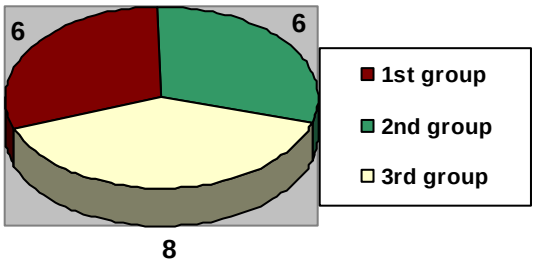

Fig 3 Division of the 20 patient into 3 groups

Surgical procedure:

Once the patient anaesthetized under general anesthesia and in supine position. After sterilization and toweling of the operative field, a traction 3/0 silk suture with round needle was placed high in the dorsum of the glans. then Urethral Dilators inserted through the meatus to dilate the meatal stenosis Fig 5-7.

There are some minor variations in the technique between the patient's groups which were illustrated but all have the same principle of mobilizing and advancing the urethra to the glans tip.

Group I

Marking drawing by Methylen blue done as shown in Fig 4.

After application of tourniquet, Incisions made as in Fig 4, the glans incised deeply in the ventral furrow to the distal corpora cavernosa and glans wings were spatulated laterally but not more dorsally because this may compromise the vascularity of the glans wings.

Elevation of the skin from the most distal urethra must be performed with a great care, which is often thin walled and almost translucent. Then ventral skin or the whole penile skin dissected in a sleeve like fashion releasing any cutaneous chordee distally and superficial tethers along the shaft skin proximally, and then the shaft skin degloved down to the penoscrotal junction. Most mild degrees of chordee are released after this step but any remaining chordee was corrected by excising any dysplastic tissues[2]. Then the urethral meatus was circumscribed by sharp dissection, laterally the dissection is deepened down to the corpora cavernosa, then the avascular plane between the corpora cavernosa and corpora spongiosa was developed and maintained proximally[10].

In this group it is found that the urethra without being defined specifically, can be separated from the cleft between the two corpora and, providing one stays in this plane, it is not at risk. [11].

The urethra mobilized as needed to obtain a tension-free anastamosis between the glans of taut phallus and the advanced urethra [10]**.**

Meatotomy was then done by widely spatulating the dorsal meatus**,** the glanular V shape was dissected as a flap of glanular mucosa and some supporting glandular tissue. The mobilized urethra with the surrounding corpus spongiosum advanced between the spatulated glans wings to the base of the V flap, then the end of the meatotomy fixed to the tip of the V flap. The two lateral points of the meatotomy are fixed to the bases of the V flap. 5/0 absorbable sutures were usually employed for fixation. The urethral meatus was further anastamosis to the glans with interrupted sutures.

The two glans wings were approximated over the urethra in two layers; the first layer incorporating the deep glanular tissue and corpora spongiosa together, followed with a second layer approximating the glans wings which should providing a generous mucosal cuff around the urethra, care should be taken to ensure that the glans closure is not tight around the urethra. Excision of the excess mucosa covering the glanular furrow in flat glans is performing to convert it to more conical glans. The meatal anastamosis was completed by placing ventral lateral sutures which will complete the **Meatoglanuloplasty** [10],(Fig 4).

Tourniquet release and Haemostasis secured by bipolar electrocautery. Closure of the wound using shaft skin (which in all cases sufficient) perform by 4/0 absorbable sutures.

Neither Urinary catheter for urine diversion nor dressings were used in this group.

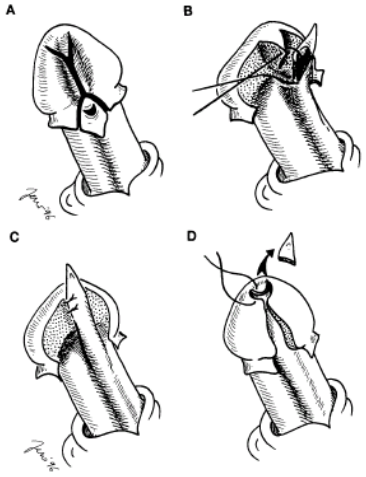

Fig 4 Distal urethral advancement glanuloplasty. A, perimeatal diamond and Y shaped glans incisions are made. *B,* glans is spatulated, leaving Midline dart of glanular tissue. C, distal urethra is mobilized and dorsal wide meatotomy is performed up to good corpus spongiosum. *D,* distal urethra is advanced and sutured to midline V flap of glans tissue and glanuloplasty is then performed as usual.

Group II:

Marking drawn as in group I but without the lower limb of Y shape because glanuloplasty it was not performed in this group. While staining of the urethra by Methylen blue for easily identification of the urethral tube walls was used.

Infiltration of adrenaline in 1:200000 concentration and cautary for Haemostasis was used in this group.

Incisions made on the marking as above, and after elevation of the shaft skin and correction of remaining chordee then the urethral meatus was circumscribed by sharp dissection, laterally the dissection is deepened down to the corpora cavernosa as in group I. The avascular plane between the corpora cavernosa and corpora spongiosa was developed and maintained proximally using the blue staining of the urethra as a guide to identify the urethral boundaries. The urethra together with periurethral corpora spongiosa are mobilized as needed to ensure a tension-free anastomosis between the glans of taut phallus and the advanced urethra [10]. Fig 10.

After meatotomy the mobilized urethra was then advanced through a glans tunnel made from the corona to the base of the V flap Fig 11, in turn this V flap is then imbricate to the meatotomy site of the urethra and fixed as in group I, closure of the shaft skin also performed as in group I.

Nasogastric or suction catheter of proper size then inserted from the new meatus to the bladder for urinary diversion, Topical antibiotics and non adherent 1st layer sandwich by a 2nd layer of dry gauze dressing was then applied with care to avoid excessive compression.

Group III

In this group of patients tourniquet use for Haemostasis and bipolar electrocautery preserved for only major bleeding vessels but no adrenaline was used. Marking performed as in group I, but the glans wings not spatulated deeply with excising the mucosal cover of the glanular furrow to do Glanuloplasty. The urethra is mobilized using the indwelling catheter for gentle counter traction[11] down to the base of the penis in most of the cases (Fig 9).

Then advance the urethra through a glans tunnel made as in Group II. To increase the urethral stability, anchoring stitches of absorbable suture material added from the corpora spongiosa to the

corpora cavernosa along the shaft that will maintain the urethra in advanced position Fig 12.

Dressing in this group is of the above 2 layers as in group II but with uniform compressing type with keeping the glans open for monitoring of it vascularity Fig 15.

Fig 5 Subcoronal Hypospadias with MS

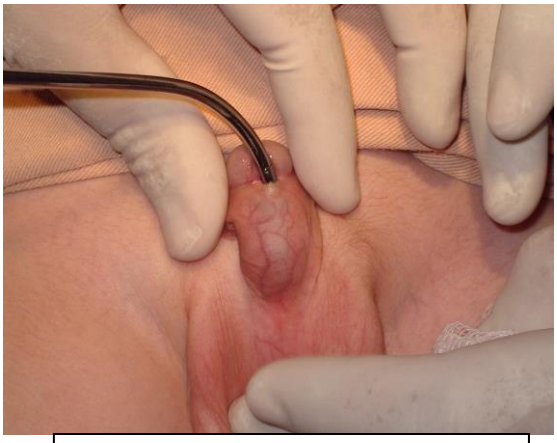

Fig 6 Meatal dilatation

Fig 7 meatus after dilatation

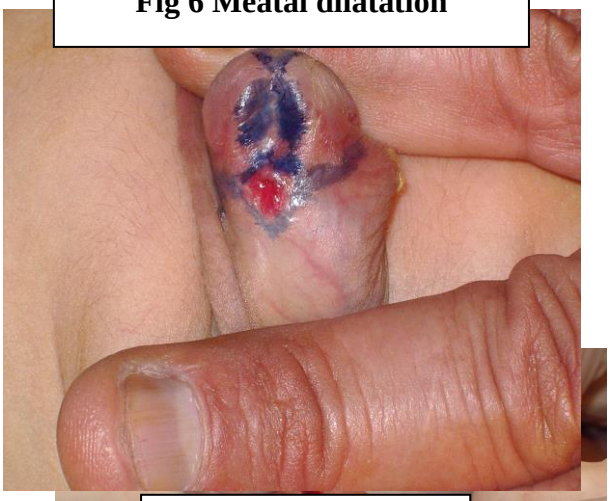

Fig 8 Marking

Fig 9 Mobilization aided by a catheter

Fig 10 Mobilization aided by staining

Fig 11 Tunneling

Fig 12 Anchoring stitches to the urethra

Fig 14 Postoperative meatus at tip

Fig 15 Dressing

Postoperative measures

The corrugated drain removes if it has been left and the patient discharge home in the next day.

The other measures are differing in each group as follow:

Change of dressing : in group II before discharge, in group III after 7-10 days.

Systemic antibiotics : Immediate postoperatively in all groups but for few days in group I, and to 2-3 days after urinary indwelling catheter removal in group II and III.

Urinary indwelling catheter and urethral stent : after 7-10 days completely remove in group II, while in group III it is incompletely remove to use it as a urethral stent for further 4-6 weeks,(Fig 15).

Urethral dilatation : After few days postoperatively in group I, after urinary diversion catheter removal in group II or after removal of urethral stent in group III the patient or his parents are instructed to lubricate the meatus using an ophthalmic ointment. Those cases already presenting with a small meatus were instructed to use the dispensing end of the ophthalmic ointment to dilate the urethral meatus at least once daily for 2-3 weeks Fig 16.

The patients were then kept under follow-up, on monthly basis with special emphases on reporting any change in the urine stream direction, meatal site, meatal size, glans shape, recurrent chordee & erection[12].

Fig 15 Urethral stent

Fig 16

Meatal dilatation by ointment tube

CASE 1

Fig 17
preoperative subcoronal meatus

Fig 18 postoperative glans tip meatus

CASE 2

Fig 19 preoperative ventral urine stream

Fig 20 postoperative straight urine stream

Results

Table 1. The distribution of the age groups in this study.

Patients age group	No.	%
2-5 years	12	60
6-10 years	6	30
≥ 10 years	2	10
Total	20	100

	Preoperative		Postoperative	
	No.	%	No.	%
	Meatal site			
At or near tip	0	0	15	75
Glanular	1	5	3	15
Coronal	7	35	1	5
Distal penile	10	50	1	5
Midshaft	2	10	0	0
	Meatal size			
Adequate	14	70	17	85
Small	6	30	3	15
	Chordee			
No	10	50	17	85
Mild	7	35	2	10
Moderate	3	15	1	5
	Glans shape			
Conical	8	40	14	70
Flat & furrow	12	60	6	30

Table 2. preoperative features and postoperative results after UGPI

Table 3. The incidence of complications in each group

Early		No.	%		No.	%		No.	%		No.	%
Bleeding & haematoma	Group I	3	50	Group II	3	50	Group III	1	12.5	Total	7	35
Infection		1	16.6		0	0		1	12.5		2	10
Dehiscence		3	50		0	0		1	12.5		4	20
Late												
MS		2	33.3		1	16.6		0	0		3	15
MR		3	50		1	16.6		1	12.5		5	25
Fistula		0	0		1	16.6		0	0		1	5
Abnormal stream		2	33.3		0	0		0	0		2	10

Table 4. Preoperative features and postoperative results in each group

Preoperative

		Chordee			Meatal site				Meatus size		glans	
		No	Mild	moderate	Glanular	coronal	Distashaft	Midshaft	Adequate	Small	conical	Flat & deep furrow
I	No.	1	3	2	0	2	2	2	3	3	3	3
	%	16.6	50	33.3	0	33.3	33.3	33.3	50	50	50	50
II	No.	3	2	1	1	2	3	0	6	0	4	2
	%	50	33.3	16.6	16.6	33.3	50	0	100	0	66.6	33.3
III	No.	6	2	0	0	3	5	0	5	3	1	7
	%	75	25	0	0	37.5	62.5	0	62.5	37.5	12.5	87.5
Total	No.	10	7	3	1	7	10	2	14	6	8	12
	%	50	35	15	5	35	50	10	70	30	40	60

Postoperative

		Chordee			Meatal site					Meatal size		glans	
		No	Mild	Moderate	At or near tip	glanular	Coronal	Distashaft	Midshaft	Adequate	Small	Conical	Flat & deep furrow
I	No.	4	1	1	3	1	1	1	0	4	2	4	2
	%	66.6	16.6	16.6	50	16.6	16.6	16.6	0	66.6	33.3	66.6	33.3
II	No.	5	1	0	5	1	0	0	0	5	1	4	2
	%	83.3	16.6	0	83.3	16.6	0	0	0	83.3	16.6	66.6	33.3
III	No.	8	0	0	7	1	0	0	0	8	0	6	2
	%	100	0	0	87.5	12.5	0	0	0	100	0	75	25
Total	No.	17	2	1	15	3	1	1	0	17	3	14	6
	%	85	10	5	75	15	5	5	0	85	15	70	30

Disscussion

In modern hypospadiology, a single stage procedure is universally accepted as reliable for all hypospadias problems[13].

The psychological status of the patient should be taken into consideration, because patient with hypospadias may not always develop into a well balanced socially adjusted personality. This is least likely to occur if he has had successful surgical treatment carried out at the optimal time with short stay in the hospital and no post operative complications[14].

Beside the desirability of completing the reconstruction in one operation, a single stage procedure has the additional advantage of using skin that is unscarred from previous surgical procedures and the normal blood supply of which has not been disrupted[9].

Of these single stage procedures, MAGPI has been used widely since its description in 1981 with varied success. Metal retraction (MR), meatal stenosis (MS) and round configuration of the glans have been reported as complications of this procedure.

Long term follow-up after hypospadias repair is essential; Hastie et al. demonstrated the time factor to evaluate MR in MAGPI procedure with a terminal meatus in 89% of the cases at a 3-month follow-up. However at late follow-up (2.9 years) he reports a 94% rate of MR, 3.5% rate of MS and 3.5% rate of fistula[11].

But MAGPI procedure with these complications is only applicable for glanular and coronal hypospadias[11]. This lead to the need of other single stage procedure with less complications and applicable to more proximal types. However, there is no an ideal substitute for the male urethra as good as the urethra for urethral reconstruction [1]. So urethral advancement and glanuloplasty (UGPI) a single stage procedure which is modification of MAGPI has been evaluated in this study.

The mean age of surgery in this series which is 5.9 years, reflects the late presentation of these patients for consultation asking to solve the problem, our population still believe that it is better to wait for 5-6 years before doing any surgery as shown in table(1).

Table (2) shows the differences of postoperative results of UGPI in comparison to the preoperative presentation of 1 year follow-up of the patients included in this study.

Regarding meatal site, 75% of the patients have at or near the tip meatus postoperatively, while only 5 cases (25%) develop MR, 3 of them still in the glans, 1 case in the corona which can be attributed to the age of the patient (16 year) with high incidence of retraction because of erection, While the last case retracted to subcoronal site because it is a case of mid shaft hypospadias with incomplete release of moderate chordee.

The result of MR in this study is less than the rate in MAGPI (94%) although MAGPI used in more distal types. This can be explained by that the urethral advancement (but not only the meatus as in MAGPI) will decrease the tension on the meatus in UGPI.

The percentage of small meatus dropped from 30% preoperatively to 15% postoperatively in this study by Urethral dilators with V flap meatotomy incorporated with UGPI and urethral stent with meatal dilatation postoperatively by the dispensing end of the ophthalmic ointment tube, But the incidence of MS in UGPI still higher than that in MAGPI (3.5%) and this can be explained by that the inadequate mobilization and advancement of the whole urethra in UGPI lead to a tension at the anastamosis between the glans and the urethra, as a result of this tension the meatus in long term event will contracted to smaller size and this can be explained by the physical

property of any elastic tube as the urethra do.

10 cases (50%) presented with chordee in hypospadias, release of chordee was done to all of the above cases. Postoperatively 2 cases have mild chordee with no meatal retraction or stenosis, while 1 case has moderate chordee due to incomplete release of chordee with MR to subcoronal position. So proper selection of the patient for UGPI is also important to prevent complications and it is less favorable in midshaft hypospadias &/or moderate chordee.

Regarding the glans shape in comparison to MAGPI which is complicated with round glans[11], In UGPI, glanuloplasty can change the ventrally flat glans with vertical furrow in 60% of hypospadias cases included in the study to more conical in shape in 70% (table 2).

Only 1 case (5%) in UGPI (which is slightly higher than 3.5% in MAGPI) the incidence of fistula has been reported in this study. This is expected because the dissection of the urethra for mobilization in UGPI increases the susceptibility of iatrogenic urethral injury which has been occurred in that case(table 3). While regarding the urine stream, there were 2 cases (10%) develop postoperative abnormal urine stream, of these 1 case because of MR and the other because of recurrent moderate chordee in addition to MR. Erection in the 14 and 16 years has been informed and it was normal and without pain (Table 3 Total).

The overall complication rate in this study was 55% which is although still less than the complication rate of urethral lengthening procedures 77% but its higher than the reported complication rate of urethral advancement 22% and its approximately equal to 54% the complication rate reported by Jody E. Nining et al. of long term follow-up (at least 10 years) of different types of single stage hypospadias repair procedures [15].

Dr. Zakaria Y. Arajy in his study to evaluate UGPI procedure in distal hypospadias with no or minimal chordee on 68 patient for 8 year follow-up between 1996-2003 he report a 9% MR, 14.7% MS and 5.8% rate of fistula formation [12]. Which is comparable to the results of study was done by Harrison and Grabbelar which report a 6.4% MR, 2.1 rate of fistula formationand no MS reported cases. [11].

In the above 2 long term studies the incidence of fistula formation is approximately similar and equal to our results regarding fistula (5%) . All of the above rates of fistula are lower than the reported incidence of fistula formation in published articles which varies between 7% to 23% of different procedures, depending on the severity of the initial deformity[15], this meaning that UGPI provide the most water tight urethroplasty in hypospadias repair.

While the incidence of MR in the patient included in this short term study 25% was higher than the results of the previous long term 2 studies, and because MR is the higher late complication reported in this study; So MR is the major cause of the high over all complication (55%) of the study. MR is related to the degree of urethral mobilization for advancement, so next we will study the extent of urethral mobilization and its relation to MR and some degree to MS.

In group I & II the urethral mobilization was done as needed to obtain a tension-free anastamosis between the glans of taut phallus and the advanced urethra, and the incidence of MR in these group was 16.6-50% and MS 16.6-33.3%, while in group III the mobilization was done down to the base of the penis in most of the cases with the least incidence of MR 12.5% and no case of MS as shown in table 3, So the more the extent of urethral mobilization the less incidence of MR & MS.

On the other hand extensive dissection of the urethra may lead to injury of the urethral blood supply, spongiosclerosis or vascular erectile dysfunction and according to the law of Laplace over stretching of the male urethra decreases its lumen and may cause high bladder pressure during voiding[1]. Although the above

complications were not reported in this series but long term follow-up may detect it. So what we need in the future, is to study the applicability of G-U ratio to determine the safe anatomical limit of urethral mobilization to avoid all the above complications.[4].

Two patients of midshaft with moderate chordee has been introduced in group I, postoperatively 1 of the patients develop subcoronal retraction with recurrent moderate chordee because of incomplete release, and the other patient has MR but still with in the glans and with recurrent mild chordee. So proper selection of the patients preoperatively is important to prevent postoperative complications as in group II & III in which all the patient selected to be distal shaft with no or minimal chordee which associated with lower rate of MR and MS as shown in table 4.

The rate of MR in group III decreases further by the addition of anchoring stitches between corpus cavernosus and corpus spongiosus which increase the stability of the advanced urethra.

The rate of MS in group III also decreases further by using the urinary diversion tube as a urethral stent for 4-6 weeks postoperatively.

The high percentage (50%) of postoperative bleeding and haematoma in group I & II in comparison to that lower percentage (12.5%) in group III as shown in table 3 can be explained by many causes:

1: In group I & II the blunt dissection for mobilization of the urethra (even by staining the walls of the urethra with methylen blue in group II causes more traumas to the urethra and the surrounding corpus spongiosus lead to high incidence of bleeding Fig.10, while in group III the use of urethral catheter that help to provide a countertraction[10], which will make the dissection easier, sharper and less traumatic with less bleeding Fig 9.

2: In group II the use of adrenaline solution for Haemostasis during the operation may mask the major bleeding and delay it to postoperatively, In contrast the use of tourniquet (but no adrenaline) in group III will make the major bleeding evident immediately after tourniquet release which can be secured by the use of minimal bipolar electrocauterization.

3: Also in group I no dressing applied to the penis postoperatively, while in Group III the application of uniform compressing dressing also attributed to the low incidence of bleeding.

The dressing was not applied postoperatively in group I which lead to 16.6% incidence of infections which is higher than in group III (12.5%) and group II with no reported cases. Table 3

Wound dehiscence of the glans wings was 50% in group I which can be explained by that leaving the wound without dressing increases postoperative oedema, infection and end with dehiscence, also inadequate mobilization of urethra causes traction on the glans wings and end with dehiscence too, while slight glans wings dehiscence in group III occur only in 1 patient (12.5%) which is the same patient with Table 3.

In addition to the glans wings dehiscence in group I, the advancement of the inadequately mobilized urethra between the glans wings may aggravate scar contracture of glanuloplasty and recurrence of ventrally flat glans and furrow in spite of glanuloplasty which is occur in 33.3% of the cases in group I. Table 4. In group II glanuloplasty was not performed and the advancing urethra pass through a glanular tunnel lead to decrease the incidence of MR (16.6%) Table 3 but that may bedo not correct the shape of the glans (the same percentage 33.3% between preoperative and postoperative finding) table 4.

While in group III glanuloplasty perform with advancing the mobilized urethra away through a glans tunnel, this separated techniques decrease the rate of

MR (12.5%) as in table 3**,** wound dehiscence and scar contracture.

The only 1 case (5%) of fistula reported in this study occur in group II **(**table 3) which occur due to iatrogenic technical injury of the urethra by blunt traumatic dissection (even by the staining of the urethral walls) without the use of urethral catheter as in group III which make the dissection easier and sharper (even though it thinning the urethral walls) by circumscribing the urethra and providing counter traction Fig 9. Abnormal urine stream more in group I due to high rate of MR and MS table 3.

Conclusion

- Long term follow up is essential to evaluate any surgical procedure including UGPI.
- The occurrence of MS or/& MR is depend on the degree of urethral mobilization which determine the severity of tension on the new meatus, so the more the mobilization the less the complication.
- The incidence of fistula formation in urethral advancement procedure is the lower reported in published articles, this support the sentence of ***" There is no an ideal substitute for the male urethra as good as the urethra for urethral reconstruction."***

Recommendations

1. proper selection of the patients who are candidate for UGPI which are with distal shaft with no or mild chordee is important to prevent MS and MR.
2. Adequate mobilization of the urethra decreases the incidence of MS and MR which can be determined by the application of Gap-urethral ratio or performing complete mobilization of the urethra to the base of the penis.
3. Dissection of the urethra is more easier with the use of urethral catheter by providing counter traction, and is more sharper and less traumatic by circumscribing the urethral walls which decreases the complication of needed extensive or complete mobilization.
4. The addition of anchoring stitches between corpus spongiosus of advanced urethra and the corpus cavernosus may add more stability to the advanced urethra.
5. Application of uniform compressing dressing decreases the incidence of oedema, infection, bleeding and dehiscence.
6. Urethral stenting for 4-6 weeks and then meatal dilatation by the dispensing end of the ophthalmic ointment tube at least 2-3 weeks decreases the incidence of MS.

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