Hypospadias Repair Using Skin Flaps: Analysis of 50 Cases

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Abstract

Objective: To analyze the outcome of primary one-stage hypospadias repair using skin flaps (Mathieu, onlay, Duckett) with particular reference to technique and current related literature.

Patients and methods: The study comprised 50 patients who underwent primary skin flap hypospadias repair with at least one year follow-up. All were operated by the authors and in the same institution during the period from 1995 to 2002. Their medical records were retrospectively reviewed for age, type of hypospadias, and nature of skin flap.

Main related morbidity and success are reported after an average follow-up of 28.3 months. Reference to technique was also made.

Results: Majority of patients were between 2 and 4 years of age. 70% of them had distal anomaly with a mild degree of chordee. 23, 19 and 8 underwent Mathieu's, Onlay's and Duckett's repair, respectively. 24% were circumcised at the time of surgery. Overall morbidity was noted in 16 patients (32%). The commonest complications were meatal stenosis (14%) and fistula (8%). Comparable morbidity was noted in both Mathieu's (17.4%) and Onlay's (15.8%) flaps. Unacceptable complication rate was associated with Duckett's tubularized skin flap repair. The overall success rate was markedly improved after the year 1998 with a rise from 80% at a mean of 1.22 procedures to 93.1% at a mean of 1.07 procedures. Our outcome data compared well with the literature except for Duckett's form of repair.

Conclusion: Skin flaps have an established and valuable place in hypospadias repair. Meatus-based and onlay flaps have fairly better outcome than both grafts and tubularized flaps. Attention to technique, selection, auditing and experience are keys to better anatomical, functional and cosmetic results.

Keywords: hypospadias, skin, flaps, Mathieu, Duckett.

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Introduction

Hypospadias can be defined as a hypoplasia of the tissues forming the ventral aspect of the penis beyond the division of the corpus spongiosum. Classically, such anomaly is composed of a dorsal penile hood with deficient ventral prepuce and more proximally located external urethral meatus. Urethral diseases in children form 20%

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of all infantile urologic conditions with hypospadias occurring in around one third of them. [1] The overall incidence of hypospadias in general population is 5 in 1000 male births [2] with three fourth of them being of the distal variety. [3] Treatment of this rather common anomaly has always been challenging and ever evolving. More than 95% of men, in general, have their external meatus at the tip of the penis. [4] It is, therefore, the right of every male to have his meatus at the correct position with straight penis for forward urination and ejaculation. All methods developed, over the last century, were tailored to achieving these objectives and they were all embraced in the field of "hypospadiology".

At our institution, Hypospadias repair was evolving from the use of classical local penile skin tubes/flaps to buccal mucosa urethral substitutes. This review deals with our earlier experience in using skin flaps. Newer techniques such as Snodgrass are being considered in upcoming articles.

Patients and Methods

From Jan 1995 to June 2002, the medical records of all patients who underwent primary one-stage hypospadias repair were reviewed. There were 50 cases with skin flap repair and had at least one year follow-up. Their medical records were retrospectively analyzed for age, related clinical data, operative details and follow-up notes. They were all managed in Princess Basma Teaching Hospital at the North of Jordan. A hospital which drains around 1.25 million inhabitants and is affiliated to the Faculty of Medicine, Jordan, University of Science and technology.

The classification of hypospadias was based on meatal position after inducing artificial erection intraoperatively. This was achieved by saline intracavernosal infusion using a butterfly cannula and penile tourniquet.

The type of skin flap selected was mainly dependant on the degree and severity of chordee in addition to intraoperative meatal location. In general, Mathieu's flaps [5] were adopted for distal variety where less than 2 cm urethral length was required (Fig 1). Onlay flaps, [6] on the other hand, were more utilized for mid/proximal hypospadias (Fig 2). One–stage Duckett flaps [8] were reserved for patients with proximal meatus and severe chordee (Fig 3).

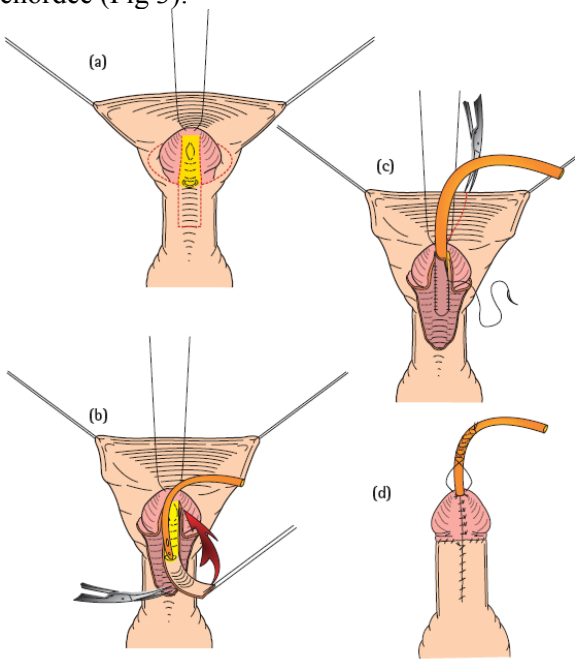

Fig. (1): Mathieu procedure.*

** Courtesy of P.D.E Mouriquand and P.Y. Mure. Current concepts in Hypospadiology. BJU int. 2004; 93 suppl: P 29.*

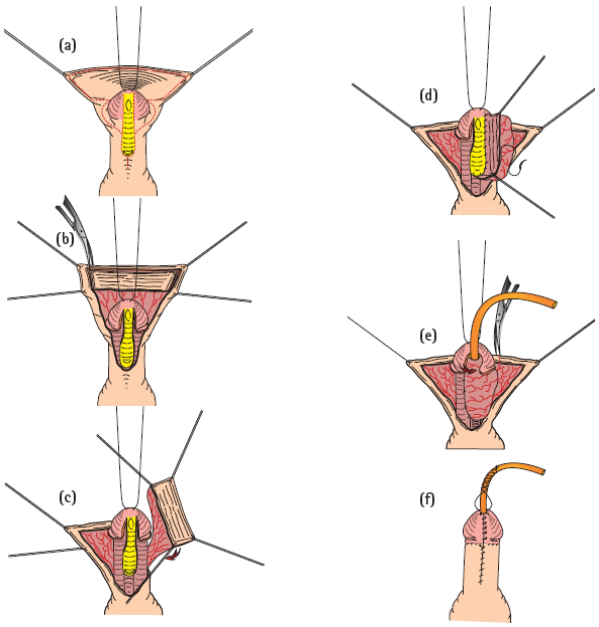

Fig. (2): Onlay procedure.*

** courtesy of P.D.E Mouriquand and P.Y. Mure. Current concepts in Hypospadiology. BJU int. 2004; 93 suppl: P 29.*

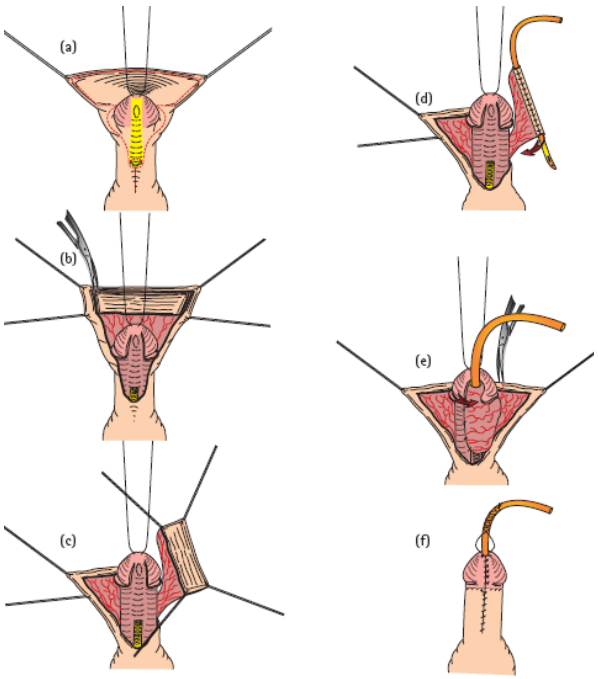

Fig. (3): Duckett procedure.*

** courtesy of P.D.E Mouriquand and P.Y. Mure. Current concepts in Hypospadiology. BJU int. 2004; 93 suppl: P 31.*

Preoperative testosterone cream was not used. No loops or microscopes were utilized. The repair was done using 6 or 7/0 polygalactin sutures.

Hemostasis during the procedure was achieved using no. 8 Fr Foley's catheter clamped at the root of degloved penis. All repairs were stented using silicone-coated feeding tubes with suprapubic drainage. Stents were kept for 6 to 10 days. Dressing was made by sofratol-coated gauze removed usually at the time of stent removal. Glanuloplasty and meatoplasty were achieved by tunneling or fashioning of glanular triangular wings.

Additional procedures such as chordectomy or dorsal plication [10] were performed when necessary.

The main variables analyzed in this review included age at surgery, chordee, meatal position, type of skin flap and circumcision. The data were further stratified by the year 1998. After this year, two main modifications were introduced to our treatment protocol.

Duckett's flaps were no more used and the meatus was differently refashioned. It was everted and reshaped as a wide fish-mouth with Barcat's modification. [3, 11]

The assessment of surgical outcome was considered adequate if the repair was evaluated within at least one year of intervention. It included clinical exam, urethral calibration, observed voiding, flow rate, urologic ultrasonography with residual urine estimation and urine testing. Further contrast studies and endoscopy were performed when necessary. The outcome was considered excellent when anatomical, functional and cosmetic aspects were met and the patient required no further intervention.

Complicated cases can either be satisfactory where reoperation is not required or failed were surgical intervention is needed. Successful outcome includes both excellent and satisfactory results. [12]

Results

Table (1) details the main patient variables studied including the type of skin flap and morbidity. It confirms with our previous policy of operating on children around 3 years of age. 19 (38%) children were older than 3 years with around three fourth of them between 2 and 4 years. 35 cases (70%) were of the distal variety and the same number had no or mild associated chordee.

There was a significant number of patients (24%) with circumcision. Mean (range) follow- up period was 28.3 (13-56) months. The overall complication rate was noted in 32% (16/50) of patients. The majority of them were meatal stenosis (14%) and fistula (8%). High morbidity rate was seen in patients with Duckett's repair (87.5%). Failure requiring complete revision occurred in one case. This was procedure-unrelated and resulted from accidental pulling of the stent by the child with subsequent disruption. 2 patients (4%) developed tubal abnormalities.

Table (1):Features of patient groups and their complications.

No. patients (%)	*Repair*			
	Mathieu	***Onlay***	***Duckett***	***Overall***
Total	*23*	*19*	*8*	*50*
Age Group				
≤ 3	*15(65.2)*	*11(57.9)*	*5(62.5)*	*31(62)*
> 3	*8(34.8)*	*8(42.1)*	*3(37.5)*	*19(38)*
Type				
Distal	*23(100)*	*12(63.2)*	*-*	*35(70)*
Mid/proximal	*-*	*7(36.8)*	*8(100)*	*15(30)*
Chordee				
No/mild	*20(86.9)*	*15(78.9)*	*-*	*35(70)*
Severe	*3(13.1)*	*4(21.1)*	*8(100)*	*15(30)*
Circumcised	*12(52.2)*	*-*	*-*	*12(24)*
Complications				
Meatal stenosis	*3(13)*	*1(5.3)*	*3(37.5)*	*7(14)*
Fistula	*1(4.3)*	*1(5.3)*	*2(25)*	*4(8)*
Stricture	*-*	*-*	*2(25)*	*2(4)*
Diverticulum	*-*	*1(5.3)*	*-*	*1(2)*
Misalignment	*-*	*-*	*1(12.5)*	*1(2)*
Disruption	*-*	*-*	*1(12.5)*	*1(2)*
Overall	*4(17.4)*	*3(15.8)*	*9**	*16(32)*

****Some had > 1 complication***

Table (2) shows a summary of treatment options for the 16 complications. Repeated meatal dilatation was successful in treatment of 5 cases with meatal stenosis. This is usually done by the parents and in a reducing frequency from 3 to 6 months (time to scar maturity). 11 patients required reoperation. 6 cases of them were involving Duckett's flaps. The majority of revisions were dealing with either meatal or fistula problems.

Table (3) demonstrates surgical outcomes. Overall success rate was 80% at a mean of 1.22 surgical procedures. Most of the failures were linked to tubularized flap repair. Different outcome was obtained upon stratifying the results by the year 1998 (table 4). The overall complication rate dropped from 57.1 to 13.8% after 1998. 3 cases were with onlay flaps and only 1 case of meatal stenosis was with Mathieu's flaps. The overall success rate was 93.1% (27/29) at a mean of 1.07 surgical procedures. 2 cases with onlay flaps required reoperation (1 fistula, 1 diverticulum).

Table (2): Treatment of complications.

No. patients	***Mathieu***	***Onlay***	***Duckett***	***Overall***
Meatal dilatation	*2*	*-*	*3*	*5*
Meatotomy/plasty	*1*	*1*	*-*	*2*
Stricturoplasty	*-*	*-*	*2*	*2*
Fistula closure	*1*	*1*	*2*	*4*
Diverticulum	*-*	*1*	*-*	*1*
Realignment	*-*	*-*	*1*	*1*
Redo	*-*	*-*	*1*	*1*
Overall	*4*	*3*	*9*	*16*

Table (3): Patient groups according to repair outcome.

No. patients (%)	*Mathieu*	*Onlay*	*Duckett*	*Overall*
Total	*23*	*19*	*8*	*50*
Excellent	*19(82.6)*	*16(84.2)*	*1(12.5)*	*36(72)*
Satisfactory	*2(8.7)*	*-*	*2(25)*	*4(8)*
Complicated (needs surgery)	*2(8.7)*	*3(15.8)*	*4(50)*	*9(18)*
Failure	*-*	*-*	*1(12.5)*	*1(2)*

Table (4): Complications stratified by year 1998.

Year (%)	*≤ 1998*	*> 1998*	*Overall*
Total	*21*	*29*	*50*
Meatal stenosis	*5(23.8)*	*2(6.9)*	*7(14)*
Fistula	*3(14.3)*	*1(3.4)*	*4(8)*
Stricture	*2(9.5)*	*-*	*2(4)*
Tubal abnormalities	*1(4.8)*	*1(3.5)*	*2(4)*
Disruption	*1(4.8)*	*-*	*1(2)*
Overall	*12(57.2)*	*4(13.8)*	*16(32)*

Discussion

Hypospadias repair remains one of the most challenging procedures in surgical practice. Skin flaps in hypospadias repair were among the oldest sources for urethral replacement. In this review, it was possible to show that primary flap repair as a one-stage procedure carries an overall success rate of 80% at a mean of 1.22 surgical procedures. This outcome is durable and comparable to two-staged procedures. It supports the current trend toward one-stage repair. [13-15] Better outcome was obtained with non-tubularized flaps with 93.1% success rate at a mean of 1.07 procedures.

Repair utilizing free skin grafts (including buccal mucosa) have never been used in our institution. They are associated with low success rate of about 31-77% [16-19] and are generally replaced, in our hospital, by skin flaps and incised urethral plate reconstruction after Snodgrass. [20] The use of free grafts, as others believe, should be restricted to cases with tissue unavailability. [12,21,22]

Variable factors have been thought to influence repair outcome. Among those are age at repair, penile size, use of loops or microscopes, application of preoperative testosterone cream, stenting, urinary diversion, suture material and type of dressing. Stenting coupled with suprapubic diverion were classically considered in all cases. Recent data revealed that such precautions are not necessary in repairs of distal hypospadias. It is, however, well-established that the most important single factor is the anatomy. This relates mainly to meatal position and degree of chordee which dictate, in turn, the length of neourethra and flap viability. [12]

The small sample size and retrospective nature of our study design prevent randomization of patients to different flap repair types and make assessment of outcome-related factors less appropriate. The study, however, is useful in being a specific experience with fairly long follow- up period and in adding to analysis of comparable reviews.

Table (5) compares the complication rate associated with each flap repair to the current series. Non-tubularized flap repair carries 17.4% and 15.8% morbidity rates for Mathieu's and onlay flaps, respectively. These compare well with the reported figures in the literature. Our performance using tubularized repair (Duckett), on the other hand, has been less favorable. Best results, in general, were mainly reported and reproduced by the original surgeon. [6, 8, 22] This rather high complication rate may be due to small sample size, inadequate experience and selection

bias. Duckett's repair, in our series, was chosen for the most severe form of hypospadias i.e. proximal with severe chordee. The procedure was not in use after the year 1998 at our centre.

Table (5): Complication rates compared to current series.

Reference (s)	***Repair***		
	Mathieu	***Onlay***	***Duckett***
12,23, 24, 25, 26, 27	*3-17%*	-	-
5, 28, 29, 30, 31, 32	-	*5-27%*	-
7, 8, 12, 21	-	-	*16-50%*
Current series	*17.4%*	*15.8%*	*112.5%**

****9 complications in 8 patients***

Onlay flaps, in general, have a better and well-defined vascular pedicles than meatus-based ones. [7,8,12] They are more versatile, suitable and successful for different types of hypospadias. [12] Both flaps, in the current analysis, were associated with comparable outcome.

The occurrence of meatal stenosis was notably the commonest complication among our patients (7/16). It may have partly contributed to the second highest morbidity, namely urethrocutaneous fistula (4/16). The stenosis was seen more frequently in both Mathieu's and Duckett's flaps (3 for each). This, we think, was due to a compromised vascularity and improper meatal fashioning. After the year 1998, we started to create wide fish-mouth meatus with everting sutures. This may prevent concentric contracture seen in circular orientation. We adopted, in addition, Barcat's modification in glanuloplasty. [3,11] These changes in technique were associated with considerable drop in the incidence of stenosis (23.8 vs. 6.9%) and fistula (14.3 vs. 3.4%) rates.

Such a drop may well be caused by other parameters such as increased practice or deserting Duckett's repair!

Another minor but significant finding in this review was the number of circumcised children (12/50=24%). This practice is particular to our culture and reflects both medical and public unawareness.

Hypospadias is falsely thought of, by some, as a form of "Angle's circumcision" and needs to be completed! This malpractice fortunately involved patients with milder forms of the anomaly.

In conclusion, the current personal analysis and review of related literature support the value of skin flaps in primary one-stage hypospadias repair.

Flaps, in general, are superior to free grafts in terms of anatomical and functional outcome. Utilization of Intact urethral plate with skin flaps is associated with a better outcome than Duckett's preputial tubes. The type of repair performed reflects our changing preferences. Tubed repairs were done almost exclusively in earlier cases. Attention to technical details such as meatal refashioning may result in noticeable improvements. Experience, revision and audit in hypospadias repair are the keys to better achievements.

Although newer modifications have been recently introduced (e.g. Snodgrass), skin flaps remain indispensable.

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إصلاح تشوهات فتحة الإحليل الخلقية باستخدام الرقع الجلدية المختلفة لخمسين مريضاً

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الملخص

الهدف: تهدف الدراسة إلى تحليل النتائج الناجمة عن علاج مرض تشوهات فتحة الإحليل الخلقية باستخدام ثلاثة أنواع من الرقع الجلدية المختلفة والتي تشمل:

- الرقعة المقلوبة (Mathieu's meatus-based flap)
- الرقعة الساقطة(Onlay preputial Flap)
- الأنبوب الكامل (Duckett's tubularized preputial flap)

مع الإشارة إلى الإجراء الجراحي ذاته والبحث المفصل للأبحاث والآراء المنشورة في هذا المجال.

الطريقة: تم دراسة حالة خمسين مريضا خضعوا للعلاج المذكور أعلاه لأول مرة ولفترة متابعة امتدت لأكثر من سنة خلال الفترة ما بين 1995 وحتى 2002 ميلادية. وقد تم تحديد الخصائص التالية لكل مريض بالرجوع لملفاتهم الطبية:

1) عمر المريض

2) نوع تشوه فتحة الإحليل

3) نوع الرقعة الجلدية المستخدمة

4) المضاعفات الناجمة

5) مدى نجاح العملية

وقد تم استقصاء نتائج العلاج خلال فترة متابعة استمرت بمعدل 28.3 شهرا.

النتائج: تراوحت أعمار غالبية المرضى بين 2 و 4 سنوات، 70% منهم كانوا يعانون من تشوه فتحة الإحليل البعيدة.

أجريت للمرضى ثلاثة أنواع من العمليات وهي:

1) الرقعة المقلوبة عدد 23

2) الرقعة الساقطة عدد 19

3) الأنبوب الكامل عدد 8

24% منهم كانوا قد خضعوا للختان في السابق. بلغت نسبة المضاعفات العامة للتداخل الجراحي 32% منها 14% تضيق فتحة الإحليل و 8% منها ناصور إحليلي. المضاعفات الناتجة عن الرقعتين المقلوبة والساقطة كانت متماثلة وأفضل بكثير من الطريقة الثالثة. كان هناك تحسن ملحوظ في نجاح العملية بعد عام 1998 مع تدن ملحوظ في نسبة المضاعفات.

الخاتمة: استخام الرقع الجلدية في علاج تشوهات الإحليل الخلقية يعتبر من أهم الطرق وأنجحها. وبالذات الرقع الجلدية التي يتم وصلها مع صحن الإحليل الأصلي.

الكلمات الدالة: تشوه فتحة الإحليل الخلقي، الرقعة الجلدية.