Two Stage Buccal Mucosal Graft (Bracka's Technique) for Failed Hypospadias Repair

Abstract

Background: Hypospadias is relatively common congenital anomaly affecting 0.3–0.4% of the population worldwide.The purpose of this study was to assess functional and cosmetic outcomes as well as the complications of the usage of the graft of the buccal mucosal in two stage repairs for selected cases of recurrent hypospadias repair.

Methods: This prospective work was performed on 60 pediatric patients presenting with failed penile hypospadias. Each participant was exposed togeneral assessment, local examination (Examination of the penis and examination of the testis and scrotum), oral examination, conventional lab tests [full blood picture, liver enzymes, kidney functions, and prothrombin time and activity], and ultrasonography.

Results: Age, number of previous operations, type of previous urethroplasty, associated chordee, the length of uretheral defect were no statistically significant variation among the study groups.

Conclusions: The procedure known as staged buccal mucosa graft The Bracka's urethroplasty approach is a straightforward and adaptable method that is very easy to acquire and may be used in challenging situations of unsuccessful hypospadias repair, particularly when there is a shortage of suitable local skin. this technique not only has high success rate and low complication rate, but also gives good cosmetic appearance.

Keywords: Two Stage Buccal Mucosal Graft, Bracka's Technique, Failed Hypospadias Repair

Introduction:

Hypospadias is a frequently occurring congenitalcondition affecting 0.3–0.4% of the population worldwide [1].

It is described as an aberrant location of the urethral opening along the ventral surface of the penis, ranging from the glans to the perineum. The primary objective of the repair procedure is to rectify any curvature in the penis, thereby enabling straightness and facilitating successful intercourse. Additionally, the procedure aims to create a functional neourethra that directs the stream of the urine forward and achieves an aesthetically typical physical characteristics of the penis, with a slit-like meatus at the glans' tip[2].

Hypospadias repair failures frequently happens because to penile skin loss or inadequate local tissue, resulting in scarring, reduced length, and decreased blood supply to the penis. Currently, this is regarded to be among of the most difficult issues encountered by reconstructive surgeons [3].

Possible procedures for re-operative hypospadias repairs, where an appropriate urethral plate is present, include island onlay flap (IOF), tubularized incised plate (TIP), and dorsal inlay graft urethroplasty [4]. However, if there is visible scarring on the urethral plate or if there is a large persistent ventral curvature, the available surgical alternatives for subsequent urethroplasty are restricted.

In 1941, Humby was the first to propose the surgical application of buccal mucosa for urethral reconstruction [5]. In 1986, Duckett documented the use of buccal mucosal grafts (BMG) from the cheek for the purpose of repairing epispadias, as well as for following difficult hypospadias redo surgeries for the treatment of urethral strictures. The buccal mucosa offers benefits compared to both skin and bladder transplants. The neourethral reconstruction is more suited for the thick epithelial layer due to its numerous elastic fibres, reduced propensity to shrink, and excellent imbibition qualities [6-8].

Since its first publication in 1941, the usage of BMG has gained significant acceptance among patients who have had several unsuccessful hypospadias procedures [9]. Complicated cases in urethral reconstruction are often approached using a two-stage method, as it has been shown to be more effective in ensuring the success of the BMG and maintaining proper blood flow to the urethra [10]. Gill proposed that the two-stage Bracka's technique might serve as a viable alternative for treating different forms of hypospadias, which includes severe cases [11]. The purpose of this work was toassess functional and cosmetic outcomes as well as the complications of the usage of BMG in two stage repair for selected cases of recurrent hypospadias repair.

Patients and Methods:

This prospective work was performed on 60 pediatricindividuals presenting with failed penile hypospadias, age less than 18 years, unhealthy or scarred urethral plate, severe persistent ventral chordee, and inadequate local tissue to ensure both dermal coverage and reconstruction of the neourethra, it was conducted at Urology Departments of Tanta University Hospital and Tanta Health insurance Hospital between May 2019 to May 2022.

Exclusion criteria were patients presented before 6 months from the primary surgery, need only simple fistula closures, diverticulum repair and skin revisions, with oral pathology, with bleeding diathesis and who refused to participate in the study.

All participants had been exposedtocomprehensive taking of history, general assessment, local examination (Examination of the penis and examination of the testis and scrotum), oral examination, conventional lab tests [full blood picture, liver enzymes, kidney functions, and prothrombin time and activity], and ultrasonography.

Operative Technique: The procedure was done using magnifying surgical loups 2.5x.All patients underwent detailed examination under anathesia using magnifying surgical loupes to evaluate the location and dimensions of the meatus, the existence and extent of any remaining

or recurring curvature, and the shape of the glans. The glans was stabilized with a longitudinal midline dorsal traction suture using 5/0 proline, round needle.

A urinary catheter was inserted (6 Fr) feeding tube to calibrate the urethra. Initial skin incision was done circumferentially extending in a U-shaped fashion around the hypospadias meatus after marking it by skin marker.The ventral tissues that were fibrotic was removed through surgical excision, and the urethral plate had to be cut proximally until healthy urethral mucosa was visible. The dissection was also carried out distally to the penile tip, dividing the glans into two wings. Subsequently, the distance between the tip of the glans and the urethral meatus was precisely determined. This guarantees the exposure of a highly vascularized surface on the tunica albuginea.

Penile skin degloving is required to evaluate the severity of penile chordee and to release the shaft of the penis from its connection to the symphysis pubis. penile degloving was done between dartos and buck's facia reaching down to penopubic and penoscrotal junction. To achieve penile straightening, a procedure called artificial erection was conducted. This included applying a tourniquet at the penile base and infusing the corpus cavernosum with normal saline utilising a 25-gauge scalp vein needle, following the method described by Gittes and McLaughlin. After degloving, do another erection test to determine the extent of penile curvature following urethral plate removal. The penile curvature was managed with a surgical procedure called dorsal plication of the tunica albuginea. This included making two parallel incisions at the 12 o'clock positioning and suturing them together using non-absorbable sutures 5/0 proline. Whereas in patients with severe chordee straightening was achieved by extended bulbar dissection and ventral corporal lengthening by multiple ventral corporal relaxing incisions at the spot of greatest curvature with concomitant midline dorsal plication.

corporal relaxing incisions Graft take: The donor site (lower lip, inner check or both) was prepared and stay sutures by 3/0 vicryl taken at the angles of lower lip.The desired buccal graft was outlined with the consideration that the graft dimensions should exceed the bed dimensions by 20% in order to compensate for graft shrinking.Injecting of the submucosal margins was done using 1:100,000 diluted epinephrine to facilitate hemostasis and dissection. The graft's edges were cut with a scalpel and separated in the space between the mucosa and the muscle, 5mm away from the internal and external edges of the lower lip. Then, the full-thickness graft was obtained employing sharp scissors.

A thorough examination of the donor site was conducted to assess any signs of bleedingand haemostasias secured using bipolar diathermy if needed. The graft site was baked with gauze soaked in diluted epinephrin solution and left unsutered. The graft was defatted to remove all submucosal tissues. The graft was applied and secured to the prepared area utilising interrupted 6/0 vicryl sutures. A V-shaped cut was made on the dorsal wall of the urethral opening, and the transplant was secured inside the V-shaped gap to reduce the likelihood of urethral narrowing. The graft was attached to the tip of the glans penis, which was deeply cut. It was then stitched to the dartos fascia and penile skin, specifically to the raised glanular wings. This was done to make it easier to move the edges later and close them during the second stage. To enhance the graft uptake, several quilting sutures made of 6/0 vicryl were used to provide optimal contact between the graft and the bed.

12- The graft was encased with paraffin tulle gauze and a compressed dressing gauze surrounding the shaft penis for a single week, along with the insertion of an 8F or 10F urethral catheter.

Follow up after first stage: The participant was permitted to recommence oral intake of fluids and meals on the day following the surgical procedure, while the mouth cavity was cleansed using a solution of antiseptic. The discomfort was alleviated by oral ibuprofen at a

dosage of 4-10 mg/kg every 6-8 hours. Participants were released and received oral antibiotics on the 2nd day after surgery. The catheter and dressing had been taken off on the 7th day after the surgery. The graft was medicated with Betamethasone 0.05% ointment, along with frequent wetting and the use of a moisturising cream, for a period of 3 months. This treatment aimed to improve the success of the graft and reduce shrinking. The assessment included evaluating the success of graft integration and any issues related to the penis or the donor site, such as swelling, pain when eating, difficulty swallowing, numbness in the mouth, and speech difficulties. Monthly follow-ups were conducted to evaluate the condition of the graft and to identify any potential issues related to the penis or the donor location. The success of the graft was visually evaluated throughout the period of interval between phases. If the presence of scars or contracture was seen, which might potentially hinder the process of tubularization, a further surgical procedure was performed to repair the affected region prior to the second stage.

Second stage: It was conducted following a minimum of six months following the first stage to ensure the graft's full development and prevent further contraction.

The graft had been tubularized over the urethral stent of an appropriate size based on the individual's age while they were under general anaesthesia. A U-shaped cut is performed, starting at the tip of the glans and continuing around the urethrostomy, with the intention of creating the ventral lip of the neomeatus. Special attention is given to avoid include hair follicles within the incision. The periphery of the graft was carefully separated to enable the creation of a tube without any stress. The procedure of urethroplasty included the use of 6/0 vicryl sutures to accomplish interrupted subcuticular inversion in two layers. The graft's suture line was covered by a second protective layer made from tunica vaginalis using 6/0 PDS non-overlapping stitches. Glanuloplasty was performed by stitching the glanular wings under the meatus using 6-0 polyglactin interrupted sutures. Effective control of bleeding and

closure of the skin of the pens with a 6-0 polyglactin suture. Aseptic bandaging was applied to the penis**.**

Statistical analysis

The statistical analysis was conducted using SPSS v25 (IBM Inc., Chicago, IL, USA). The quantitative parameters have been displayed as the mean and standard deviation (SD). The qualitative variables were shown in terms of frequencies and percentages (%). A two tailed P value < 0.05 was considered significant.

Results:

Table 1 demonstratesDistribution of the studied cases according to meatal position at presentation for redo surgery, number of previous repairs, type of previous urethroplasty, associated chordee, meatal position after chordee release and length of urethral defect.

Table 1: Distribution of the studied cases according tomeatal position at presentation for redo surgery, number of previous repairs,type of previous urethroplasty, associated chordee, meatal position after chordee release and length of urethral defect

		At time of first stage (n= 60)
Age (years)		6.72 ± 2.69
Meatal position at presentation before degloving	Proximal	20(33.3%)
	Mid penile	33 (55.0%)
	Distal	7 (11.7%)
Number of previous repairs	1	42(70.0%)
	2	12 (20.0%)
	3	4 (6.7%)
	4	2 (3.3%)
Type of previous last urethroplasty	TIP	15(25.0%)
	Unknown	31 (51.7%)
	TPIF	3 (5.0%)
	Mathieu	6 (10.0%)
	Staged urethroplasty	5 (8.3%)
Associated chordee		
Number of previous repairs	No chordee	27 (45.0%)
	Mild chordee	22 (36.7%)
	Severe chordee	11 (18.3%)
Meatal position after chordee release		
Number of previous repairs	Proximal	31(51.7%)
	Mid penile	24 (40.0%)
	Distal	5 (8.3%)
length of buccal mucosa graft	6-7 cm	12 (20.0%)
	5-6 cm	26 (43.3%)
	3-4 cm	22 (36.7%)

Data are presented as mean ± SD or frequency (%)

Figure 1: A case of significant wound infection

Figure 2: A case of significant graft scarring

Table 2 shows Descriptive analysis of the studied cases according to operative time 2nd stage in minutes and distribution of the studied cases according to early postoperative complications, late complications and different parameters.

Table 2: Descriptive analysis of the studied cases according to operative time 2nd stage in minutes and distribution of the studied cases according to early postoperative complications, late complications and different parameters

		At time of first stage (n= 60)	At time of second stage (n= 55)
Age		6.72 ± 2.69	7.39 ± 2.72
		(n= 55)	
Time between the 2 surgeries		8.76 ± 2.07	
Follow up period		3.71 ± 1.23	
Operative time 2nd stage in minutes		150.27 ± 19.89	
Early complications		28(50.9%)	
Catheter slippage		1 (1.8 %)	
Catheter blockage		4 (7.3 %)	
Penile edema		4 (7.3 %)	
Small hematoma		3 (5.5 %)	
wound infection		11 (20 %)	
Wound dehiscence		5 (9.1 %)	
Late complications		26 (47.3%)	
Partial Glanular dehiscence		2 (3.6 %)	
Complete Glanular dehiscence		3 (5.5 %)	
Recurrent hypospadias		12(21.8 %)	
Urethrocutaneous fistula		9 (16.36 %)	
Percentile	**5 – 25th**	4(9.6 %)	
	>25	42 (91.4 %)	
Uroflow Q-max (ml/s)		16.35 ± 4.39	
Voided volume (ml)		173.49 ± 61.77	

Data are presented as mean ± SD or frequency (%)

Age, number of previous operations, type of previous urethroplasty, associated chordee, the length of uretheral defect were no statistically substantial variation among the study groups. As regard success rate in relation to additional grafting procedure due graft loss after 1st stage, no statistically substantial variation was existed among the study groups. Table 3

Table 3: Relation between success rate and age, the number of previous operations, type of previous urethroplasty, associated chordee, associated meatal position after chordee releaseand regrafting (n= 55) (% from raw)

	Success rate				**p**
	Success (n = 29)		**Failure (n = 26)**		
Age (years)					
2-4	6	75.0	2	25.0	0.230
4-7	23	82.1	5	17.9	
7-11	8	53.3	7	46.7	
11-16	3	75.0	1	25.0	
Number of previous repairs					
1	30	76.9	9	23.1	0.360
2	7	70.0	3	30.0	
3	2	50.0	2	50.0	
4	1	50.0	1	50.0	

Type of previous urethroplasty					
TIP	10			66.7	0.514
Unknown	24			80.0	
TPIF	2			66.0	
Mathieu	3			60.0	
Staged urethroplasty	1			100.0	
Associated chordee					
No chordee	20			76.9	0.800
Mild chordee	13			68.4	
Severe chordee	7			70.0	
Length of uretheral defect					
3 – 4 cm	17	85.0	3	15.0	0.298
5 – 6 cm	16	66.7	8	33.3	
6 – 7 cm	7	63.6	4	36.4	
Additional grafting	4	80.0	1	20.0	1.000

Discussion

Hypospadias is relatively common congenital anomaly affecting 0.3–0.4% of the population worldwide[1]. It is described as an aberrant location of the opening of the urethra throughout the penile ventral surface, ranging from the glans to the perineum. The primary objective of the repair procedure is to rectify any curvature in the penis, thereby enabling straightness and facilitating successful intercourse. Additionally, the procedure aims to establish a functional neourethra that directs the urinary flow forward, while also achieving a visually penile normal appearance with a slit-like meatus at the glans tip[2].

Our investigation found no instances of problems at the donor site following the harvesting of oral mucosa grafts. Similarly, Mokhles et al. [12]and Leslie et al. [13] both didn't encounter issues at the donor site. In contrast, in the study conducted by H. Badawy et al. [14], donor-site problems in the form of secondary haemorrhage from the lower lip occurred during the harvesting of oral mucosa grafts. It is worth noting that these consequences didn't require any surgical intervention.

The second stage was completed in 55 patients, it was done at least six months after successful first stage, however in cases of regrafting, we calculated the interval between the

1st and 2nd stage from the time of 1st unsuccessful operation. therefore, the mean range was about 8 months (8.76 ± 2.07 months).

Faure A et al[15]reported in their retrospective analysis on A total of 52 individuals received a two-stage graft urethroplasty procedure for hypospadias correction. The median duration between the 1st and 2nd rounds of the procedure was 8 months, with a range of 4 to 54 months.In our series we followed the recommended data regarding the waiting time before doing the second stage urethroplasty, we found this duration was sufficient for the graft to be well-formed and ready for urethroplasty.

Our results showed that 15 (27.3%) patients included in this study experienced unsuccessful repair with recurring hypospadias caused by total wound rupture or glans dehiscence, requiring further redo surgeries. Minor sequelae were seen in 9 instances (16.36%), manifesting as small fistulae and meatal stenosis. Afterwards, effective repairs of fistulae was carried out in those individuals, resulting in an overall success rate of 40 out of 55 cases (72.3%).

Barroso et al. [16]utilised a two-stage procedure including the usage of BMG in ten children who had experienced unsuccessful hypospadias correction in the past. The rate of complications had been 20%. A single individual had a pinpoint fistula, while second experienced a wound infections resulting in significant skin loss, but no urethral fistulas were seen.

In our study Urethro-cutaneous fistula occurred in 9/55 cases (16.36%) after two stage repairs. These results were found to be comparable to that reported by Catti et al. [17]who found that the incidence of fistula in individuals with severe hypospadias is increasing to 20%, and it occurs more often with free grafts compared to pediculated flaps.

Khan et al. reported that the rate of fistulae formation 5.8% with buccal mucosal graft[18].

Regarding to the age, our patients were stratified into four groups and our results showed same success rate was (75%) in the age group from (2-4) years and the age group (11-16) years and the success rate was (53.3%) in age group (7-11) years. The highest success rate was reported at the age of (4-7) years (82.1). however, no substantial variation was reported among the different age groups in our series.

The impact of age on the first surgical treatment or subsequent corrective procedures for primary hypospadias has shown variability across various research investigations. Ru et al. [19]found no correlation between age and the risk of negative consequences in hypospadias re-operation. In Sheng et al.'s[20]investigation, it was evident that individuals with urethro-cutaneous fistulas were much older compared to individuals without urethro-cutaneous fistulas(14.46 ± 3.80 vs 6.82 ± 5.99).

The two-stage operation itself may significantly diminish the influence of age on the outcomes of urethroplasty. During two-stage repairs, it is possible to get grafts and flaps that are sufficiently long and broad to rebuild a well-vascularized neo-urethral plate following a period of 6 months. Additionally, it provided the opportunity for correction prior to tubularization and prevented the occurrence of neourethral stricture in cases where the newly formed urethral plate was deemed to have inadequate blood supply.

We also analyzed the relation between the complications rate and the final meatus location after penile degloving and release of chordee (if present) , the meatal location was proximal, mid-penile and distal in 29 (51.7%), 21 (40%), 5 (8.3%) cases respectively. The highest success rate (60%) was achieved among individuals with distal penile meatus while those with proximal meatus had success rate (55.2%). The lowest success rate was recorded among individualswith external urethral meatus at mid penile shaft (47.6%) with no statistically significant difference between the three study groups.

Bush et al. [21]reported that a total of 1552 individuals had surgery at an average age of 3.4 years and were followed up for an average of 15.4 months. Out of them, 1181 individuals received initial repairs (930 distal, 72 midshaft, 173 proximal, 6 unrecorded), but 371 individuals required further procedures (144 distal, 36 mid, and 183 proximal, 8 unrecorded), with a range of 1 to 21 previous urethral procedures. A substantially greater proportion of individuals with midshaft/proximal fractures required re-operations (60% re-operative mid/proximal vs. 21% original mid/proximal individuals).

Regarding the quantity of prior procedures, we stratified the patients in to four groups according to the number of previous operations. we noticed that the highest success rate 76.9% was achieved in the group of individuals who received just one operation before our surgery while decreases to 70% In those with previous two operations. The lowest success rate 50% was done in the group of patients with previous three or four operations meanwhile our statistical analysis showed no statistically significant difference between the four studied categories.

Similarly, Snyder et al. [22] did not include individuals who had undergone five or more repairs. They found that no variation was existed in outcomes following one to three further surgeries, despite the fact that 66% of the instances included just the closure of isolated fistulas(not recurrent hypospadias).

Regarding degree of associated chordee, we had 19 patients with mild chordee (<30 degree),10 patients with severe chordee (>30 degree) and 26 patients with no chordee. The success rate was (68.4%) in those with mild chordee (<30 degree) while those with severe chordee had (70%) and it was (76.9%) with those with no chordee as shown in table with a statistically significant difference between the three groups.

Ru, Wei, et al. [23]found that significant recurrent ventral curvature had the greatest chance of requiring several reoperations, significantly increased risk complication. they suspected that

recurrent ventral curvature which was resolved by cutting or removing constrictive tissue in the urethra. this procedure caused a significant loss of urethral tissue and made the operation more challenging, resulting in a greater likelihood of complications.

When we studied the success rate regarding the length of uretheral defect, we stratified our patients into three groups, the highest success rate (85%) was achieved in patients with 2-4 cm urethral defect, (66.7%) in those with 5-6 cm urethral defect. The lowest success rate (63.6%) was recorded in patients who had 6-7 cm urethral defect with no statistically substantial difference among the three study groups. In theory, a longer urethral defects might potentially make the operation more challenging, resulting in a greater likelihood of complications.

Huang et al. [24]found that urethro-cutaneous fistulas was seen in 8.2% of individuals with urethral defect lengths below two centimetres, 12.8% of instances with urethral defect lengths between 2 and 3 cm, and 22.6% of instances with urethral defect lengths between 3 and 4 cm. Nevertheless, the five participants with a urethral defect lengths more than four centimetres didn't suffer from the development of a urethro-cutaneous fistulas following surgical repair. The limited number of individuals with urethral defects above a length of 4 cm might be the cause of this occurrence. Khan et al.[18] also reached the similar results.

Conclusions:

The staged BMG Bracka urethroplasty method is a straightforward and adaptable procedure that is very easy to understand and perform. It is particularly useful in complex situations of unsuccessful hypospadias repair, especially when there is a shortage of suitable local skin. this technique not only has high success rate and low complication rate, but also gives good cosmetic appearance.

Ethical Approval and Consent

The research was conducted following the consent of the Ethics Committee of Tanta University. The parents provided informed written permission.

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