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Complications following Staged Hypospadias Repair Using Transposed Preputial Skin Flaps

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Abstract

Purpose—Proximal hypospadias repair using a staged approach is a complex reconstructive operation with the potential for significant complications requiring repeat surgery. We report outcomes of staged hypospadias repair using transposed preputial skin flaps and factors predictive of postoperative complications.

Materials and Methods—We retrospectively analyzed patients who underwent staged proximal hypospadias repair using transposed preputial skin flaps between 2002 and 2013. Patient demographics, operative details, complications, reoperations and factors predictive of complications were reviewed.

Results—A total of 56 patients were identified with a mean age of 14.1 months (median 14.3) at first stage. Mean followup was 38.6 months (median 34.1). Complications requiring additional unplanned operation(s) were observed in 38 patients (68%), including fistulas in 32 (57%), diverticula in 8 (14%), meatal stenosis in 5 (9%), urethral stricture in 8 (14%) and glans dehiscence in 3 (5%). In addition, redo first stage repair was performed in 4 patients (7%). Since some patients had more than 1 complication, the total number of complications is greater than the number of patients undergoing a redo operation. On univariate analyses the use of small intestinal submucosa was significantly associated with an increased risk of fistula (91% vs 49%, $p = 0.02$) and urethral diverticulum (64% vs 24%, $p = 0.04$). Incision of the tunica albuginea of the corpora was associated with an increased likelihood of fistula (77% vs 44%, $p = 0.03$). Finally, patients with glans dehiscence were significantly younger at first stage (5.8 vs 14.8 months, $p = 0.01$).

Conclusions—The reoperation rate for complications in children undergoing staged hypospadias repair using transposed preputial skin flaps is higher than previously reported.

Keywords

hypospadias; postoperative complications; surgical flaps; treatment outcome

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Hypospadias is a common congenital anomaly of the penis, occurring in approximately 1 in 250 live births.¹ Distal or mid shaft hypospadias accounts for the majority of cases. Surgical repair for distal hypospadias can be performed using a 1-stage technique, such as TIP (tubularized incised plate) repair or MAGPI (meatal advancement and glanuloplasty), with great and reproducible success.^{2,3} However, some patients present with severe proximal hypospadias, generally associated with significant chordee. This population continues to provide a surgical challenge for the pediatric urologist. Although repair of hypospadias using single stage surgery is desirable, high complication rates, and poor cosmetic and functional outcomes have been reported when this technique is used for proximal hypospadias with severe chordee.⁴ Many surgeons believe that a 2-stage technique for repair of severe proximal hypospadias with severe chordee offers superior cosmetic and functional results.⁵⁻⁹

At our institution we perform 2-stage hypospadias repair to correct proximal hypospadias with severe chordee (generally defined as greater than 30 degrees) that cannot be corrected with dorsal plication alone, in reoperative cases, and when the urethral plate is involved by balanitis xerotica obliterans and is inadequate for use. It has been our experience that while staged hypospadias repair generally results in a distal meatus, satisfactory appearance of the phallus without chordee and a well directed stream, reoperation rates may be higher than previously suggested in the literature. We report outcomes of multiple surgeons at our institution who performed proximal hypospadias repair for severe hypospadias using a 2-stage technique during which preputial flaps were transposed during the first stage and tubularized at a later date. In addition, we report factors predictive of complications in patients undergoing this operation.

MATERIALS AND METHODS

We retrospectively analyzed patients who underwent staged proximal hypospadias repair using transposed preputial skin flaps at a single institution between 2002 and 2013. Patients were identified using CPT codes for staged hypospadias repair. Only patients who underwent both stages at our institution were included. Patient demographics, operative details, complications and reoperations were reviewed. Univariate analyses were conducted to determine factors predictive of complications. Factors evaluated included age at first stage operation, meatal location (perineal, penoscrotal, scrotal or shaft), use of concomitant plication, use of SIS or dermal graft, incision of tunica albuginea without concomitant use of SIS or dermal graft, and use of tunica vaginalis flap during second stage operation. Outcomes were assessed by noting complications consisting of fistula formation, diverticulum, meatal stenosis, stricture formation and glans dehiscence.

The first stage operation involves release of the preputial skin and careful dissection of the dysplastic chordee tissue from the ventral aspect of the penile shaft. An artificial erection is then produced. If the chordee at this point is mild (less than 30 degrees) and amenable to plication, dorsal plication is performed. The procedure is carried out in 1 stage. However, if chordee is deemed severe by the operating surgeon and not amenable to correction by plication alone, the urethral plate is transected and the procedure is carried out in 2 stages. The urethral plate is typically transected just proximal to the glans. The plate is dissected

free from the underlying corpora and preserved when possible by being sutured in its new, more proximal location. Adjunct techniques are performed to ensure chordee is completely corrected, including plication of the dorsal midline and incision of the tunica albuginea of the corpora ventrally.

The technique for tunica albuginea incision is dependent on surgeon preference and severity of chordee after release of the urethral plate. The various techniques used to perform this part of the operation include several transverse incisions in the tunica that are not grafted ("fairy cuts"), as well as 1 transverse incision with freeing of the tunica albuginea and insertion of a dermal or single layer SIS graft. At our institution we perform "fairy cuts" for milder chordee after release of the urethral plate, and we perform a more radical dissection with placement of a graft for more severe chordee. The glans is then incised in the midline to create a groove. The foreskin is incised dorsally in the midline. The preputial skin flaps are transposed around to the ventral aspect of the shaft and secured in place. Catheter drainage varies and depends on surgeon preference.

The second stage operation is the tubularization procedure. This step is usually performed 6 months or more after the first operation. The procedure includes tubularization of the neourethra and closure in multiple layers. The suture material varies among surgeons. Tunica vaginalis is used at times according to surgeon preference. All patients have a urethral stent left indwelling for 7 to 14 days. The drain typically used at our institution is a 7Fr Jackson-Pratt® drain, which is fashioned into a urethral stent. We use this drain because its proximal aspect, the portion inserted into the bladder, has multiple holes to allow for proper drainage.

RESULTS

We identified 56 patients meeting inclusion criteria who underwent the first stage operation between 2002 and 2013. Mean age at first stage was 14.1 months (median 14.3). Mean length of followup was 38.6 months (median 34.1). Average interval between the first and second stages was 8 months (median 6.1). Surgery consisted of plication during the first stage operation in addition to transection of the urethral plate in 40 patients (71%), "fairy cut" incision of the tunica albuginea without placement of a graft in 3 (5%), SIS graft in 11 (20%) and dermal graft in 8 (14%). Tunica vaginalis flap was used during the second operation in 6 patients (11%).

Of the patients 38 (68%) required a third procedure and 23 subsequently required additional surgeries. One or more fistulas developed in 32 patients (57%), diverticula in 8 (14%), meatal stenosis in 5 (9%), urethral stricture in 8 (14%) and glans dehiscence in 2 (4%). Four patients (7%) underwent revision of the first stage repair before the second stage repair was performed. Four patients (7%) underwent planned scrotoplasty after the second stage operation for penoscrotal transposition. Since it is often surgeon preference to perform scrotoplasty after the second stage repair, the need for scrotoplasty was not deemed a complication.

On univariate analyses the use of SIS was significantly associated with an increased likelihood of undergoing an unplanned operation (64% vs 24%, $p = 0.036$, table 1). SIS was also associated with an increased risk of fistula (91% vs 49%, $p = 0.02$) and urethral diverticulum (64% vs 24%, $p = 0.04$, tables 2 and 3). Incision of the tunica albuginea in any fashion was associated with an increased likelihood of fistula (77% vs 44%, $p = 0.03$). Patients with postoperative glans dehiscence were significantly younger at the first stage of repair (5.8 vs 14.8 months, $p = 0.01$). Multivariate logistic regression was attempted and was not feasible due to the small population size. Multivariate logistic regression with stepwise variable selection was performed but did not add any value to the univariate analyses.

DISCUSSION

Although great advances have been made in the correction of hypospadias and final outcomes have improved in the last several decades, proximal hypospadias with severe chordee remains a surgical challenge for pediatric urologists. Several techniques have been described and are used by surgeons. It is somewhat difficult to compare results of various studies because the patient population is heterogeneous and the classification of hypospadias as “severe” and requiring a 2-stage operation is subjective.

The technique used at our institution of transposed preputial skin flaps (also described as Byars flaps in the literature) has been performed and reported with varying complication rates. Wray et al reported on 253 patients with proximal hypospadias who underwent 2-stage repair using a Byars flap technique, with an overall complication rate of 22%.¹⁰ That study was conducted at a time when many operations were being performed in a 2-stage fashion for hypospadias that today would not be considered severe enough for this operation and would likely be performed with a 1-stage repair. Therefore, it is difficult to compare their patient population with the populations in more recent studies.

A more current study in which 100 patients underwent 2-stage hypospadias repair with this technique showed an 18% reoperation rate, mainly due to fistula formation.¹¹ Followup in that study ranged from 1 to 15 years, although mean followup was not reported. The severity of hypospadias is also difficult to deduce, as is the threshold for reoperating. Most of the children who required reoperation were those with fistula formation. There were no cystoscopic evaluations documented after repair and no mention of subsequent voiding symptoms.

It is difficult to determine if the search for a postoperative abnormality, such as a stricture or meatal stenosis, is more robust by some surgeons than others. One study of 128 children who underwent a 2-stage operation for proximal hypospadias using the Byars flap technique demonstrated a complication rate of 11.8%.¹² When comparing that series with our own study and others already published, it is noteworthy that all patients in that study underwent placement of a dartos fascia flap over the repair as a waterproofing layer, which perhaps accounts for the low fistula rate.

Another operation performed for proximal hypospadias involves use of a free graft from either the inner prepuce or the posterior auricular area.¹³ These concepts date back to

Humby and Higgins in 1941,¹⁴ and were later refined and popularized by others, most notably Bracka, who reported 600 cases performed with a 2-stage technique.¹⁵ That report included operations in children and adults, with approximately a third of the operations being redo procedures. The overall fistula rate was 5.7% and overall stricture rate was 7%. Of the patients 3.7% underwent revision of the first stage before proceeding to the second stage and 5.5% underwent revision for cosmetic reasons. Although the same difficulty in comparing this patient population to our own and other studies exists, this is undoubtedly a more complex group of patients. This technique has gained popularity and is in use today. Other reported complication rates for a 2-stage operation using a free graft have ranged up to 18%,⁹ and reports of complete loss of the free graft with need for replacement have been published.

At our institution the primary technique used to perform a 2-stage hypospadias repair when deemed appropriate by all surgeons has involved use of preputial skin in the form of transposed preputial skin flaps during the first operation, with subsequent tubularization during the second operation. Although the final outcome in these children generally seemed to consist of a satisfactory appearance of the phallus without chordee, with a distal meatus and a well directed stream, we hypothesized that the reoperation rate was in fact higher than suggested in the literature. Our data reveal a high reoperation rate, and specific factors predictive of reoperation include use of SIS, incising the tunica albuginea and operating in patients at a young age. However, it is noteworthy that use of SIS and incision of the tunica albuginea of the corpora are typically performed for the most severe chordee, and perhaps associated complications are related to the underlying degree of abnormality.

Another limitation of this study is that it is a single institution, retrospective review of hypospadias involving multiple surgeons. The technique varied somewhat from surgeon to surgeon, as well as from patient to patient, although the basis of the operation, namely that transposed preputial flaps be used for the first stage of the repair, was consistent across all patients. The data also were not maintained in a homogeneous fashion, and at times only subjective descriptors were recorded rather than objective data, such as exact degree of curvature on initial artificial erection or exact size of the glans. Thus, hypospadias severity was classified based on meatal location, as these data were more readily available. However, the limitation of not having prospectively collected data, including exact severity of chordee and exact glans size, is noted. Patient followup also was not uniform and was left to the discretion of the surgeon. Although most patients underwent immediate postoperative followup, some patients were lost to followup or did not have long-term followup data available.

CONCLUSIONS

Although children who undergo staged hypospadias repair using transposed preputial skin flaps can ultimately have a satisfactory result, the reoperation rate for complications is greater than initially perceived. Comparison of studies from different institutions is difficult due to a lack of consistent recording of concrete variables and the subjective nature of hypospadias classification. Future studies with randomization of patients comparing techniques, eg Byars flap vs Bracka grafting, based on objective criteria would be ideal.

However, these studies are difficult to organize, given surgeon preference and expertise with particular operations. We would recommend, and have implemented at our institution, careful documentation of objective variables with frequent analysis to determine factors predictive of complications, along with alteration of individually preferred methods of performing operations based on results. Use of the electronic medical record to capture specific data consistently could perhaps aid in this endeavor. Although it is difficult to compare results between institutions, assessment of outcomes with particular techniques and consideration of alternative techniques should also be given great thought.

Abbreviations and Acronyms

SIS small intestinal submucosa

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Table 1

Association of covariates to number of unplanned reoperations

	No. Unplanned Reoperations			p Value
	0	1	2 Or More	
Mean age at first stage (mos)	15.0	14.7	13.0	0.48
No. meatal location (%):				0.89
Penoscrotal	7 (29.2)	9 (37.5)	8 (33.3)	
Perineal	5 (50)	3 (30)	2 (20)	
Scrotal	7 (35)	6 (30)	7 (35)	
Mid/distal shaft	0 (0)	1 (50)	1 (50)	
No. plication (%):				0.66
No	7 (43.8)	5 (31.2)	4 (25)	
Yes	12 (30)	14 (35)	14 (35)	
No. SIS (%):				0.03*
No	18 (40)	16 (35.6)	11 (24.4)	
Yes	1 (9.1)	3 (27.2)	7 (63.6)	
No. dermal graft (%):				0.89
No	16 (33.3)	17 (35.4)	15 (31.3)	
Yes	3 (37.5)	2 (25)	3 (37.5)	
No. corporeal incision (%):				0.20
No	14 (41.2)	12 (35.3)	8 (23.5)	
Yes	5 (22.7)	7 (31.8)	10 (45.5)	
No. tunica vaginalis (%):				0.14
No	15 (30)	17 (34)	18 (36)	
Yes	4 (66.7)	2 (33.3)	0 (0)	

* Result is statistically significant (p <0.05).

Table 2

Association of covariates to fistula formation

	Fistula		p Value
	No	Yes	
Mean age at first stage (mos)	13.7	14.7	0.98
No. meatal location (%):			0.61
Penoscrotal	9 (37.5)	15 (62.5)	
Perineal	5 (50)	5 (50)	
Scrotal	10 (50)	10 (50)	
Shaft	0 (0)	2 (100)	
No. plication (%):			1.00
No	7 (43.8)	9 (56.2)	
Yes	17 (42.5)	23 (57.5)	
No. SIS (%):			0.01 *
No	23 (51.1)	22 (48.9)	
Yes	1 (9.1)	10 (90.9)	
No. dermal graft (%):			1.00
No	21 (43.8)	27 (56.2)	
Yes	3 (37.5)	5 (62.5)	
No. corporeal incision (%):			0.02 *
No	19 (55.9)	15 (44.1)	
Yes	5 (22.7)	17 (77.3)	
No. tunica vaginalis (%):			0.07
No	19 (38)	31 (62)	
Yes	5 (83.3)	1 (16.7)	

* Result is statistically significant (p <0.05).

Table 3

Association of covariates to diverticulum

	Diverticulum		p Value
	No	Yes	
Mean age at first stage (mos)	13.9	16.5	0.73
No. meatal location (%):			0.77
Penoscrotal	20 (83.3)	4 (16.7)	
Perineal	8 (80)	2 (20)	
Scrotal	18 (90)	2 (10)	
Shaft	2 (100)	0 (0)	
No. plication (%):			0.41
No	15 (93.8)	1 (6.2)	
Yes	33 (82.5)	7 (17.5)	
No. SIS (%):			0.04*
No	41 (91.1)	4 (8.9)	
Yes	7 (63.6)	4 (36.4)	
No. dermal graft (%):			1.00
No	41 (85.4)	7 (14.6)	
Yes	7 (87.5)	1 (12.5)	
No. corporeal incision (%):			0.24
No	31 (91.2)	3 (8.8)	
Yes	17 (77.3)	5 (22.7)	
No. tunica vaginalis (%):			0.57
No	42 (84)	8 (16)	
Yes	6 (100)	0 (0)	

* Result is statistically significant (p <0.05).