

COMPARISON OF FLAPS VERSUS GRAFTS IN PROXIMAL HYPOSPADIAS SURGERY

CURT R. POWELL, IRENE MCALEER, MADHU ALAGIRI AND GEORGE W. KAPLAN

From the Department of Urology, Naval Medical Center San Diego and Children's Hospital and Health Center, San Diego, California

ABSTRACT

Purpose: We analyzed the complication rate in patients who underwent proximal hypospadias repair using preputial skin as a flap or free graft.

Materials and Methods: We retrospectively reviewed the records of 142 patients who underwent proximal hypospadias repair. Repairs were subdivided into tubed and onlay repairs within the flap and free graft groups. We analyzed postoperative complications, including fistulas, proximal strictures, diverticula and meatal stenosis.

Results: Median patient age at followup was 11.3 months and median followup was 9.4 months. Two-thirds of the repairs were performed with free grafts. A proximal stricture developed in 8 and 0 patients who underwent free tubed graft and free onlay repair, respectively ($p = 0.047$). Otherwise there was no significant difference in the complication rate of the various types of repair. Of the 43 patients who had stricture, fistula or meatal stenosis 29 (67%) presented more than 1 year after surgery.

Conclusions: In repairs performed with free grafts there is a significantly higher proximal stricture rate when a tube rather than an onlay is used. Otherwise we noted no significant difference in the complication rates of flaps and grafts used to repair proximal hypospadias. A significant number of complications presented more than 1 year postoperatively and they may even present as late as 4 years. This finding suggests that longer followup may be necessary to assess completely the outcome of proximal hypospadias surgery.

KEY WORDS: abnormalities, hypospadias, surgical flaps, transplants, urethra

Many have reported their success rate with various methods of hypospadias repair. However, direct comparison of the success or failure of these techniques is difficult due to differences in patient population, type of repair and surgeon experience. We report our experience with primary hypospadias repair using preputial grafts and flaps, and compare the 2 techniques.

MATERIALS AND METHODS

We retrospectively reviewed the records of patients who underwent hypospadias repair between February 1981 and September 1997 to determine the location of the native meatus, type of repair and postoperative complications. Only patients with proximal hypospadias were included in our study. Those with a distal meatus and a dysplastic urethra with normal urethral tissue extending no further than the proximal penile shaft were considered to have proximal hypospadias. Study exclusion criteria were a previous attempt at hypospadias repair or chordee release, repair with a graft other than preputial skin, distal hypospadias amenable to meatoplasty and glanuloplasty,¹ and a meatal based Mathieu or Barcat flap.² The techniques of repair in our cohort of patients were transverse island preputial flaps used as a tube³ or onlay,⁴ an inner preputial graft with an outer preputial flap for ventral skin coverage⁵ and preputial grafts with ventral skin coverage as a tube or onlay.⁶ Patients generally presented for followup at 1 and 3 months. They were then asked to return after toilet training and every few years thereafter until puberty.

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We analyzed postoperative complications with respect to fistulas, proximal strictures, diverticula and meatal stenosis. Patients were divided into groups based on whether they underwent vascularized flap or free graft repair, and then further subdivided according to tube and onlay use. Statistical analysis was performed using logistic regression analysis and Fischer's exact test to determine whether the location of the native meatus, use of a flap or graft and tubed or onlay repair were predictors of subsequent failure.

RESULTS

Of the 153 patients treated during this period followup was available for 142 (92.8%) with a median age at repair of 11.3 months. These patients comprise our study group. Median followup was 9.4 months (range 1 to 79). A total of 62 patients were followed at least 1 and 12 were followed at least 4 years. Of the patients 133 (94%) had a native meatus at the penoscrotal junction, or at the distal or mid shaft with a dysplastic distal urethra, requiring repair to extend from the penoscrotal junction to the glans. The remainder of the patients had a meatus proximal to the penoscrotal junction. Flap repair in 47 cases (33%) was done as a tube in 27 and as an onlay in 20. Of the 95 cases in which free graft repair was performed a tube was used in 61 and an onlay was used in 34.

Table 1 shows the complications of graft and flap repair. Table 2 lists the complications subdivided according to whether tubed or onlay repair was done. Early in the series glans separation in 3 patients who underwent tubed graft repair with a resultant coronal meatus. We noted no cases of glans separation after the surgical technique was modified to provide deeper glans splitting before placing the graft. One patient with a pedicled tube repair had an early postoperative infection with breakdown of the ventral skin overlying

TABLE 1. *Complications of grafts versus flaps*

	No. Pts.	No. Grafts (%)	No. Flaps (%)
All complications	46	31 (33)	15 (32)
Fistula*	28	18 (19)	10 (21)
Stricture	10	8 (8)	2 (4)
Meatal stenosis	5	3 (3)	2 (4)
Diverticulum	3	2 (2)	1 (2)

* All p values not significant, and 1 patient presented with stricture and fistula.

TABLE 2. *Complications of grafts versus flaps subdivided by tubed and onlay repairs*

	No. Tubed Flap (%)	No. Tubed Graft (%)	No. Onlay Flap (%)	No. Onlay Graft (%)
All complications	9 (33)	21 (34)	6 (30)	10 (29)
Fistula	7 (26)	11 (18)	3 (15)	7 (21)
Stricture	1 (4)	8 (13)	1 (5)	0 (0)
Meatal stenosis	1 (4)	1 (2)	1 (5)	2 (6)
Diverticulum	0 (0)	1 (2)	1 (5)	1 (3)

the repair. In the graft repair group there was a significantly higher proximal stricture rate for tubed versus onlay repair (8 versus 0 patients, $p = 0.047$). Otherwise there was no statistically significant difference in the overall complication rates, or the rate of fistulas, strictures, diverticula or meatal stenosis among the various types of repair.

DISCUSSION

Comparing the results of various series of hypospadias repair is often difficult due to differences in patient populations and surgeon experience. Of the 142 cases reported 93 (65%) were treated by one of us (G. W. K.). The remainder of the cases were treated by other pediatric urologists in our group during that period. We observed no significant difference in the complication rate among surgeons. The use of preputial, bladder or buccal mucosal tissue for a graft may introduce variability into the analysis because each tissue has unique characteristics that result in certain advantages and disadvantages. In an attempt to minimize these variables we excluded from analysis all patients who underwent repair with other than preputial skin.

The type of repair performed reflects our changing preferences. Tubed repairs were done almost exclusively in earlier cases. Since the original description of Elder et al of onlay urethroplasty,⁴ we have come to perform preferentially onlay repair when using a flap or graft. In our opinion onlay repair has the advantage of easier dissection since the whole urethra need not be mobilized. Hollowell⁷ and Baskin⁸ et al reported a decreased complication rate with onlay compared with tubed repair. Our onlay population also had a significantly lower stricture rate and a lower rate of other complications, although the differences between tubes and onlays were not statistically significant. Stratifying cases by flap

versus graft repair did not demonstrate any significant difference in the complication rate. One patient with a stricture required 2-stage repair and the remainder of the strictures were treated with visualized internal urethrotomy or dilation. All fistulas were corrected by local excision and layered closure of the fistulous tract.

Two-thirds of repairs were performed using grafts. Duckett believed that flap repair has an advantage over grafts since the normal blood supply to the tissue is thought to be intact.⁹ Our results do not confirm this presumed advantage and several others have reported results with graft repair that are comparable to those of flap repair.^{5, 10-12} There were no significant differences in the complication rate of our graft repairs compared with those of flap repair (tables 3 and 4).^{4, 7, 8, 10-24} We believe that grafts provide several advantages over flaps. Graft harvesting is often easier than dissecting out the vascular pedicle of a flap. Placing a thin graft on the urethra produces less tissue bulk than a flap and there is no torsion of the repair, as there may be with a flap. This result aids in skin closure, glanular reapproximation and improved cosmesis. We also think that graft immobilization is essential to ensure a good outcome. For this reason our patients were routinely placed in a pantalon spica cast postoperatively, as described previously.²⁵ Depending on the caliber of repair an 8 to 10Fr silicone Foley catheter or a 6 or 8Fr silicone stent was placed for urinary diversion in 68 (48%) and 22 (25%) patients, respectively. Type of diversion was not available in the operative report of 52 patients.

Tables 3 and 4 show the complication rates in our patient population and in those reported in the literature.^{4, 7, 8, 10-24} Our results are consistent with those of previous studies. It is interesting to note the time at which complications presented after surgery. Of the 28 patients with fistula 18 (64%) presented more than 12 months postoperatively (average 23.9, range 0.3 to 77). Of the patients with proximal stricture and meatal stenosis 8 of 10 (80%) and 3 of 5 (60%) presented more than 1 year after surgery (average 30.9 months, range 2.8 to 53.9 and average 21.3, range 3.1 to 37.8, respectively). One patient presented at 22.9 months postoperatively with a proximal stricture and fistula. Few previous series indicate the median followup of cases, and in those that do followup is short. Our results suggest that with longer followup the incidence of complications may increase. A study of a larger number of patients and longer followup is required to answer this question.

CONCLUSIONS

The repair of severe hypospadias is associated with a significant complication rate. Most complications are minor and easily repaired with a subsequent procedure. Tubed graft repair has a higher stricture rate than onlay graft repair. Otherwise the complication rate of flaps and grafts for repair is not significantly different.

TABLE 3. *Complications of tubed flap repairs*

	No. Pts.	Median Followup (mos.)	% Complications			
			Overall	Fistula	Stricture	Meatal Stenosis
Present study	27	4.9	37	26	4	0
Monfort et al ^{13, *}	50		42	20	8	14
Bondonnay ^{15, *}	135		19.5	14.5		5
Barraza et al ¹⁶	50	Not reported	56	14	22	4
Sauvage et al ^{17, *}	100		31	14	2	9
Harris and Jeffery ¹⁸	100	3-15	24	13	6	3
Hollowell et al ⁷	85	Not reported	15-18			
Rickwood and Anderson ¹⁹	100	Not reported	28	9	12	4
Kass and Bolong ²⁰	175	10 or Greater	4.4	0.5	0.5	1
Wacksman ²¹	37		11	5		3

* As reported by Kumar and Harris.¹⁴

TABLE 4. *Complications of onlay flap, tubed graft and onlay graft repair*

References	No. Pts.	Median Followup (mos.)	% Complications			
			Overall	Fistula	Stricture	Meatal Stenosis
Onlay flap:						
Present study	20	5.4	25	15	5	10
Elder et al ⁴	50	Not reported	6	2		
Hollowell et al ⁷	66	Not reported				
Baskin et al ⁸	374	32.4	8.6	6		Less than 1
Tubed graft:						
Present study	62	11.1	34	18	13	5
Hendren and Crooks ¹⁰	45	Not reported	8.9	0	4.4	2.2
De Sy and Oosterlinck ²²	22	Not reported	27	22.7	9.1	4.5
Redman ²³	10	Not reported	30	30		0
Shapiro ²⁴	15	Not reported	20	13.3	0	6.7
Vyas et al ¹¹	28	Not reported	39.4	21.4	32.1	0
Rober et al ¹²	42	At least 1 yr.	50	45	12.5	0
Onlay graft:						
Present study	33	10.9	27	21	3	3
Vyas et al ¹¹	4	Not reported	39.4			
Rober et al ¹²	37	At least 1 yr.	38	46	5.4	0

Surgery was also performed by Drs. M. Packer, H. Scherz, B. Cilento and C. Devries.

REFERENCES

- Duckett, J. W.: MAGPI (meatoplasty and glanuloplasty): a procedure for subcoronal hypospadias. *Urol Clin North Am*, **8**: 513, 1981
- Wacksman, J.: Modification of the one-stage flip-flap procedure for repair of distal penile hypospadias. *Urol Clin North Am*, **8**: 527, 1981
- Duckett, J. W.: The island flap technique for hypospadias repair. *Urol Clin North Am*, **8**: 660, 1970
- Elder, J. S., Duckett, J. W. and Snyder, H. M.: Onlay island flap in the repair of mid and distal penile hypospadias without chordee. *J Urol*, **138**: 376, 1987
- Kaplan, G. W.: Repair of proximal hypospadias using a preputial free graft for neourethral construction and a preputial pedicle flap for ventral skin coverage. *J Urol*, **140**: 1270, 1988
- Devine, C. J., Jr., and Horton, C. E.: Hypospadias repair. *J Urol*, **118**: 188, 1977
- Hollowell, J. G., Keating, M. A., Snyder, H. M. et al: Preservation of the urethral plate in hypospadias repair: extended applications and further experience with the onlay island flap urethroplasty. *J Urol*, **143**: 98, 1990
- Baskin, L. S., Duckett, J. W., Ueoka, K. et al: Changing concepts of hypospadias curvature lead to more onlay island flap procedures. *J Urol*, **151**: 191, 1994
- Duckett, J. W.: The island flap technique for hypospadias repair. *Urol Clin North Am*, **8**: 503, 1981
- Hendren, W. H. and Crooks, K. K.: Tubed free skin graft for construction of male urethra. *J Urol*, **123**: 858, 1980
- Vyas, P. R., Roth, D. R. and Perlmutter, A. D.: Experience with free grafts in urethral reconstruction. *J Urol*, **137**: 471, 1987
- Rober, P. E., Perlmutter, A. D. and Reitelman, C.: Experience with 81, 1-stage hypospadias/chordee repairs with free graft urethroplasties. *J Urol*, **144**: 526, 1990
- Monfort, G., Jean, P. and Lacoste, M.: Correction des hypospadias posterierurs en un temps par lambeau pedicule transversal (intervention de Duckett). A propos de 50 observations. *Chir Pediatr*, **24**: 71, 1983
- Kumar, M. V. and Harris, D. L.: A long-term review of hypospadias repaired by split preputial flap technique (Harris). *Br J Plast Surg*, **47**: 236, 1994
- Bondonny, J. M., Barthaburu, D. and Vergnes, P.: L'Hypospadias balanique et penien. Les elements de la malformation; implicatins therapeutiques et resultats. A partir de l'etude de cent trent-cinq dossiers. *Ann Urol (Paris)*, **18**: 21, 1984
- Barraza, M. A., Roth, D. R., Terry, W. J. et al: One-stage reconstruction of moderately severe hypospadias. *J Urol*, **137**: 714, 1987
- Sauvage, P., Rougeron, G., Bientz, J. et al: L'utilisaiton dulambeau preputial transverse pedicule dans la chirurgie de l'hypospadias. A propos de 100 cas. *Chir Pediatr*, **28**: 220, 1987
- Harris, D. L. and Jeffery, R. S.: One-stage repair of hypospadias using split preputial flaps (Harris). The first 100 patients treated. *Br J Urol*, **63**: 401, 1989
- Rickwood, A. M. and Anderson, P. A.: One-stage hypospadias repair: experience of 367 cases. *Br J. Urol*, **67**: 424, 1991
- Kass, E. J. and Bolong, D.: Single stage hypospadias reconstruction without fistula. *J Urol*, **144**: 520, 1990
- Wacksman, J.: Use of the Hodgson XX (Modified ASOPA) procedure to correct hypospadias with chordee: surgical technique and results. *J Urol*, **136**: 1264, 1986
- De Sy, W. A. and Oosterlinck, W.: One-stage hypospadias repair by free full-thickness skin graft and island flap techniques. *Urol Clin North Am*, **8**: 491, 1981
- Redman, J. F.: Experience with 60 consecutive hypospadias repairs using the Horton-Devine techniques. *J Urol*, **129**: 115, 1983
- Shapiro, S. R.: Complications of hypospadias repair. *J Urol*, **131**: 518, 1984
- Cilento, B. G., Stock, J. A. and Kaplan, G. W.: Pantaloon spica cast: an effective method for postoperative immobilization after free graft hypospadias repair. *J Urol*, **157**: 1882, 1997

EDITORIAL COMMENT

These authors compared free grafts versus vascularized flaps for repairing proximal penile hypospadias. Their observation that onlay procedures, whether they used free graft or vascularized flaps, have a lower complication rate compared to tube procedures has also been our experience. Although I agree that a followup of 1 year is too short to draw any long-term conclusions, the use of the modified Asopa or Hodgson XX procedure for onlay or tube procedures with microscopic repair has afforded excellent results. Our relatively low complication rate with this microscopic technique will be presented subsequently, and hopefully we will have a much longer followup than originally published in 1986.

Despite the data of these authors I believe that an overall complication rate of less than 20% should be achievable, especially if the surgeon leaves the skin tube or onlay attached underneath the foreskin, as advocated by Hodgson. Although torsion has been indicated as a possible complication, if the preputial skin is mobilized to the penopubic angle dorsally, torsion is not a problem. I admit that bringing the tube around ventrally with the foreskin leaves some bulk on the lateral surface but this bulk almost always flattens out in 6 months to 1 year. We have rarely found it necessary to perform any skin revision.

We have treated an occasional diverticulum, which usually takes several years to develop, with our procedure. We have also treated 1 case of balanitis xerotica obliterans, which did not become apparent

for 10 years. I am surprised that the authors have not seen a higher percent of these complications, especially diverticular formation. Although we still perform the Hodgson XX procedure in patients who we do not believe are candidates for the long tubularized incised plate or onlay procedure, we still think that all of us must continually assess our procedures to achieve a low overall complication rate. We also need more series like the current study with long-term results

and excellent followup for comparing the results of different procedures.

*Jeffrey Wacksman
Division of Urology
Children's Hospital Medical Center
Cincinnati, Ohio*