

# Results of One-Stage Urethroplasty for Hypospadias in Pediatrics – Single Surgeon’s Experience

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**Abstract Introduction:** Hypospadias repair is a challenging technique in pediatric urology with a long learning curve. This study presents the results of urethroplasty performed by a single surgeon to repair hypospadias in children and compares the surgical outcomes at different periods. **Materials and Methods:** From January 2009 to February 2016, patients who were less than 18 years old and were operated for hypospadias were retrospectively reviewed and divided into two groups: group I (from January 2009 to February 2012) and group II (from March 2012 to February 2016). All operations were performed by the same pediatric surgeon, and surgical outcomes of the two periods were compared. **Results:** This study considered 150 patients (69 in group I/81 in group II). The Mean operative age was  $30.4 \pm 32.7$  months in group I and  $33.6 \pm 43.3$  months in group II ( $p=0.309$ ). The selected procedures mainly depended on the subjective anatomical analysis in the operating room and the surgeon’s preference. The mean follow-up duration was  $21.7 \pm 28.31$  months in group I and  $13.6 \pm 16.6$  months in group II ( $p=0.033$ ). The overall complication rate was 44.9% in group I and 35.8% in group II ( $p=0.316$ ). The incidence of glanular disruption significantly decreased from 21.7% to 6.2% ( $p=0.007$ ) because of the wide dissection of the glanular wings and the deep incision of the urethral plate, which led to tension-free sutures for glanular reconstruction. **Conclusions:** One-stage repair of hypospadias may achieve satisfactory outcomes in cosmetic appearance and voiding function. Surgical outcomes could be improved by increasing practice.

**Keywords:** Urethroplasty, Hypospadias, Pediatrics

## 1. Introduction

Hypospadias is a common congenital disease of the male genitourinary system. However, its repair is a challenging technique in pediatric urology and has a long learning curve.[1,2] More than 300 surgical techniques for hypospadias repair have been described in literature. In 1994, Snodgrass introduced the tubularized incised plate (TIP) for distal hypospadias repair, and it eventually gained popularity with relatively good results even in proximal hypospadias repairs.[3-6] Moreover, he attempted to simplify the learning course for beginners and developed an algorithm for repairing various extents of hypospadias that only included TIP and two-stage graft repair.[4,7-9]

However, TIP is contraindicated in proximal hypospadias with severe ventral penile curvature, and leads to urethral plate transection and in most cases, reoperation and crippleness.[4,10] One- or two-stage urethroplasty with flap or graft may be considered under these circumstances.[2,10-12] One-stage vascularized skin flap and free-graft urethroplasty could deliver

relatively satisfactory results; however, researchers disagree on which is better.[2,10,13,14] One-stage urethroplasty can achieve a complete reconstruction of the urethra and a chordee correction at one time. Barbagli et al. reported that one-stage graft urethroplasty attains a higher success rate (80%) than that of flap (67%) [12], whereas Snodgrass suggests two-stage graft urethroplasty except for cases that can be corrected by TIP.[8,10] Staged operation could achieve adequate straightening and lengthening of the penis at the first stage of repair. Additionally, the pedicle skin flap, either tubularized or onlay, has better vascularization than the free graft, which relies only on revascularization. Furthermore, the free graft, preputial skin, or oral mucosa, may provide a smooth, uniform, and well-fixed neo-urethral plate on the corpora to avoid diverticulum or urethrocele formation.[2,10,13]

The procedures for varying degrees of hypospadias were selected based on the subjective anatomical analysis and the surgeon's background and preference.[6,11] This study presents the results of urethroplasty and/or related procedures performed by a single pediatric surgeon to repair hypospadias with or without chordee in children, and compares the surgical outcomes at different periods.

## 2. Materials and Methods

Patients who were less than 18 years old and operated at our institute for hypospadias between January 1, 2009 and February 29, 2016 were reviewed. All operations were performed by the same pediatric surgeon. Patients were followed up through regular medical visits or phone interviews, and those that cannot be contacted were excluded. The surgeon attended a live surgery workshop for hypospadias repair in the Children's Medical Center Dallas, Dallas, Texas, on February 24 - 25, 2012. The surgeon modified some details of the operative technique, including using a wider dissection of glanular wings and a deep incision of the urethral plate to achieve tension-free sutures for glanular reconstruction, as well as the use of different suture materials. The patients were divided into two groups: group I (from January 1, 2009 to February 29, 2012) and group II (from March 1, 2012 to February 29, 2016). All parameters, including age, types of hypospadias, fresh or re-do case, operative techniques, use of pre-operative testosterone and complications, and representative data at routine follow-up visits, were retrospectively reviewed from the patient files of the most recent outpatient visits or through phone calls before February 28, 2018. Statistic calculations were performed by using Student's t test for continuous variables and Fisher's exact test for categorical variables.

The patients, regardless whether he was a fresh or re-do case, who received urethroplasty with or without chordee correction were included. The urethroplasty technique was selected based on the grade of hypospadias and the surgeon's decision. The surgical details that were modified for group II patients were the use of suture materials for urethral repair and covered layers of soft tissue (6-0 PDS II/5-0 vicryl in group I and 7-0 vicryl/6-0 PDS II in group II, Ethicon®), two-layer running sutures covered by two barrier layers instead of a single-layered running suture as in group I, and more experience for the same surgeon. Artificial erection tests were performed when necessary. All patients received indwelling catheters 6 Fr. except those who received meatotomy, meatal advancement and glanuoplasty incorporation (MAGPI), or chordee correction. The catheterization lasted for 7 days for TIP and 10–14 days for TIP with inlay graft or island flap urethroplasty. All subjects enrolled in this study were approved by the Institutional Committee on Human Research of Taichung Veterans General Hospital (TCVGH), Taichung, Taiwan, in accordance with the guidelines of the Declaration of Helsinki and the International Conference on Harmonization for Good Clinical Practice (Institutional Review Board TCVGH No. CE16227A).

## 3. Results

A total of 150 patients (69 in group I and 81 in group II) were included. The operative age, hypospadias classification and surgical variables in both groups are listed in Table 1. The mean operative age in group I was  $30.4 \pm 32.7$  months (ranging from 1.8 months old to 10 years and 2 months old) in group I and  $33.6 \pm 43.3$  months (ranging from 3 months old to 18 years old) in group II, and no statistical differentiation was found ( $p=0.309$ ). Similar to the statistical results in the literature, anterior hypospadias accounted for the largest proportion (approximately 40%) in the patients of both groups, whereas middle and posterior hypospadias each accounted for approximately half of the remaining. The surgical procedures applied

for urethroplasty included meatotomy, MAGPI, TIP, and tubularized transverse preputial island flap (TTPIF), and the method selection was based on the nature of the urethral plate and the degree of penile curvature in the operating room. Other miscellaneous procedures included repair of urethrocutaneous fistula and release of chordee on the basis of patients' problems. TIP procedure was used more often after the surgeon had attended the surgery workshop, which can be attributed to the preference and increasing confidence of the surgeon; this technique facilitated a quick procedure and improved droplet-shaped appearance of the urethral meatus.[3,15] The release of the chordee was conducted in more cases in group I, in accordance with the patients' problems. Pre-operative testosterone injection (intramuscular, 2 - 4 mg/kg/dose) was considered in the patients with glanular width of less than 14 mm, which was measured during outpatient visits because the literature reported that small glans may increase the complication rate.[9,15]

**Table 1. General data and surgical variables of the patients in both groups**

	<i>Group I</i> (2009.01-2012.02)		<i>Group II</i> (2012.03-2016.02)		<i>p value</i>		
Patient no.	69		81				
Op age (mean ±SD)	30.4±32.7 months		33.6±43.3 months		0.309		
<b>Classification</b>							
Anterior	Glanular	22	42%	Glanular	23	44.4%	0.869
	Coronary	7		Coronary	13		
Middle	Distal shaft	5	20.3%	Distal shaft	13	24.7%	0.562
	Mid-shaft	9		Mid-shaft	7		
Posterior	Proximal shaft	5	26.1%	Proximal shaft	4	25.9%	0.714
	Penoscrotal	12		Penoscrotal	15		
	Perineal	1		Perineal	2		
Chordee only	8	11.6%	4	5%	0.226		
<b>Operative procedures</b>							
Meatotomy	12		11		0.650		
MAGPI	14		16		1.000		
Mathieu	2		0		0.210		
TIP	18 (re-do 6)		41 (re-do 12)		0.003 (0.317)		
TTPIF	12		10		0.488		
Repair UCF	1 (re-do 1)		1 (re-do 1)		1.000 (1.000)		
Release chordee	8 (re-do 1)		4 (re-do 1)		0.013 (1.000)		
Suture materials (urethra/glans)	6-O PDS / 5-O vicryl		7-0 vicryl / 6-O PDS				
Pre-op testosterone (2-4 mg/kg/dose)	1		7		0.070		

Re-do means that patients received re-operation during the period.

MAGPI: Meatal advancement and glanduloplasty incorporated

TIP: Tubularized incisional plate

TTPIF: Tubularized transverse preputial island flap

UCF: Urethrocutaneous fistula

The operative complications and complication rates in different types of hypospadias (by Duckett's classification presented in 1996)[16] are listed in Table 2. The mean follow-up durations of patients in groups I and II were  $21.7 \pm 28.31$  and  $13.6 \pm 16.6$  months, respectively ( $p = 0.033$ ). The patients in these groups were collected in different periods; therefore, their follow-up durations significantly varied. The complication rate for fresh cases was 51.9% in group I and 33.8% in group II respectively ( $p = 0.316$ ), and that for re-operation cases both was 50.0%. The obtained data are comparable with previous findings that proximal and re-operation hypospadias have higher complication rates.[9,15] The overall complication rates were 44.9% in group I and 35.8% in group II ( $p = 0.060$ ), which seemed relatively higher than those reported in the literature. It should be attributed to that patients received only urethral sounding once was included. However, the incidences of glanular disruption significantly decreased from 21.7% in group I to 6.2% in group II ( $p = 0.007$ ) because of the wide dissection of the glanular wings and deep incision of the urethral plate to achieve tension-free sutures for glanular reconstruction. The complication rate for middle type hypospadias also significantly decreased from 71.4% in group I to 31.3% in group II ( $p = 0.018$ ), which may also be attributed to the same causes. For patients with post-operative complications that required another surgery, approximately half of the patients in both groups (58.1% in group I and 51.7% in group II) underwent follow-up operations to resolve complications. Two patients with meatal strictures in group II could be managed by urethral sounding alone. All patients with preputial masses received excision, and their pathologies were reported as epidermoid cysts.

**Table 2. Follow-up duration and complications of the patients in both groups**

	Group I (2009.01-2012.02)		Group II (2012.03-2016.02)		<i>p</i> value
Follow-up duration (mean±SD)	21.7±28.31 months		13.6±16.6 months		0.033
Glanular disruption	15	21.7%	5	6.2%	0.007
Phimosis	4	5.8%	5	6.2%	1.000
UCF	2	2.9%	4	4.9%	0.687
UTI	1	1.4%	3	3.7%	0.625
Meatal/urethral strictures	5	5.8%	2	2.5%	0.249
Recurrent chordee	2	2.9%	2	2.5%	1.000
Preputial mass	1	1.4%	2	2.5%	1.000
Penile shaft rotation	1	1.4%			0.460
Urethral breakdown			2	2.5%	0.500
Urethral diverticulum			1	1.2%	1.000
Buried penis			3	3.7%	0.250
<b>Fresh cases (patient no.)</b>					
Anterior	25.9% (7/27)		17.6% (6/34)		0.534
Middle	71.4% (9/11)		31.3% (5/16)		0.018
Posterior	78.6% (11/14)		73.3% (11/15)		1.000
Sum	51.9% (27/52)		33.8% (22/65)		0.060
<b>Re-operation</b>	50.0% (4/8)		50% (7/14)		1.000
Overall	44.9% (31/69)		35.8% (29/81)		0.316

UCF: Urethrocutaneous fistula

UTI: Urinary tract infection

For one-stage repair in this series, most patients were managed by TIP or TTPIF techniques, and the surgical outcomes are shown in Table 3. The complication rates of TIP significantly decreased from 72.2% in group I to 41.5% in group II, but were relatively higher than those reported in literature (8%–61.5%). [9,15,17] However, the incidence rates of dehiscence and fistula were only 50% in group I and 19.5% in group II, and the stricture rate was 5.6% in group I and 2.4% in group II (data not shown in tables). The complication rates of TTPIF in both groups reached 80% without statistical significance. Moreover, the incidence rates of dehiscence and fistula were 50% in group I and 10% in group II, and the stricture rate was 25% in group I and 20% in group II (data not shown in tables). In summary, the overall complication rates and patients who received follow-up operations were similar in both groups. However, the incidence of glanular disruption was considerably decreased after the surgeon attended the live surgery workshop.

**Table 3. Complication and re-operation rates of TIP and TTPIF procedures**

	<i>Group I</i> (2009.01-2012.02)	<i>Group II</i> (2012.03-2016.02)	<i>p value</i>
<b>TIP</b>	18	41	
Complication	13 (72.2%)	17 (41.5%)	0.047
Re-operation	8 (44.4%)	9 (22.0%)	0.118
<b>TTPIF</b>	12	10	
Complication	10 (83.3%)	8 (80%)	1.000
Re-operation	7 (58.3%)	5 (50%)	1.000

TIP: Tubularized incisional plate

TTPIF: Tubularized transverse preputial island flap

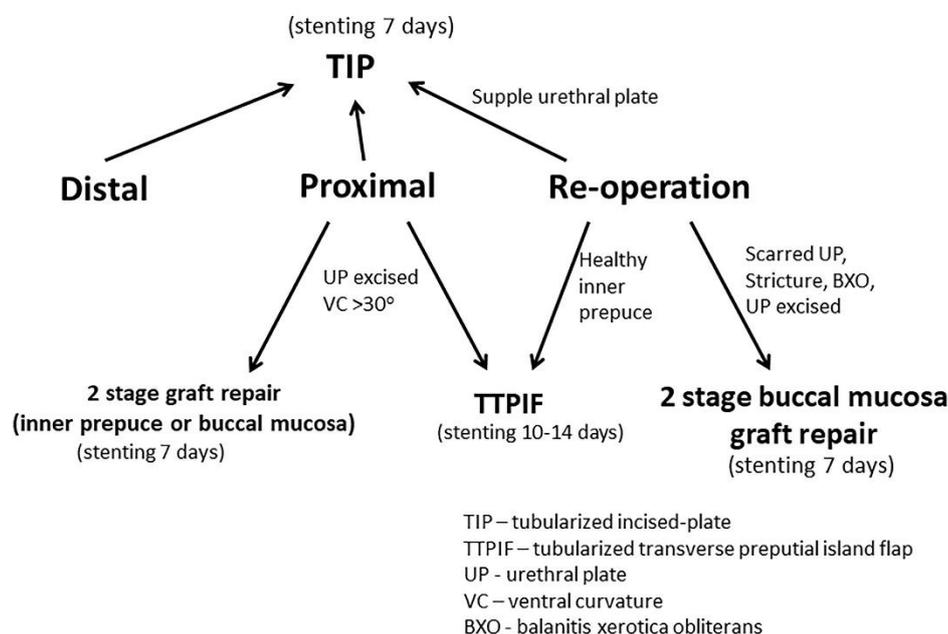
## 4. Discussions

One-stage repair is a desirable option to surgeons and parents because it may achieve the goal at one time and work on unscarred tissue, as well as reduce the hospital stay, anesthetic risk, and cost. [5,15,18,19] Literature reports that although the complication rate of one-stage repair (24%–46%) is slightly higher than that of two-stage repair (22.2%), the rates are comparable but without statistical difference. [15,17] In this series, the performed techniques in group II included changing the suture materials, increasing the extent of glanular dissection, and incising the urethral plate down to the erectile spongiosum and up to the tip of normal meatal depression on glans; the latter two modifications seemed to be the main factors that influenced surgical outcomes. [1,9,15,20] However, literature revealed that the grade of hypospadias (proximal type and severity of chordee) is the key factor predicting the outcome after primary hypospadias repair [19,21,22], regardless whether the procedure involved one-stage or multi-stage operation [15,17], interrupted- or continuous-suture urethroplasty [21,23], the use of pre-operative testosterone injection or not [22,24], and different kinds of procedures and suture materials. [17,25]

To simplify and shorten the learning curve for hypospadias repair, Dr. Warren Snodgrass developed an algorithm for repairing various extents of hypospadias that only includes TIP (with inlay inner preputial or buccal mucosal graft) and two-stage preputial or buccal mucosal graft repair. [4,7-9] In this series, the algorithm (Figure 1) was modified to one-stage repair for nearly all fresh cases by using TIP and TTPIF, and two-stage repair was typically devoted to re-operation cases that presented complications of scarred urethral plate, severe urethral stricture, balanitis xerotica obliterans, or hair in the urethra, because the urethral plates could not be preserved in these cases, and the inner prepuce was insufficient. For patients with narrowed but supple urethral plate, inlay graft with inner prepuce was performed prior to TIP completion. The overall complication rate of one-stage repair for fresh hypospadias reported herein was 29.7% (38/128), which was comparable with that reported in the literature. [15]

One-stage repair for hypospadias may avoid secondary procedures and achieve satisfactory outcomes in cosmetic appearance and voiding function. However, the surgeons must master few different procedures to overcome various troubling circumstances. [15,18,26,27] At present, two-stage repair is recommended for proximal or complex hypospadias

and re-operation in patients because it presents reduced post-operative complication rate and increased parent satisfaction.[15,28-31] Researchers have recommended that more than 50 procedures in a year is sufficient[9,15]; however, the surgical outcomes can be improved by learning from the experiences of skilled surgeons and accordingly modifying the operative details.



**Figure 1.** The algorithm of choosing the surgical procedure for hypospadias repair modified from that originally presented by Dr. Warren Snodgrass.

## Declaration

All authors disclosed no any financial and personal relationships with other people or organizations that could inappropriately influence their work.

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