

Effect of Suturing Technique and Urethral Plate Characteristics on Complication Rate Following Hypospadias Repair: A Prospective Randomized Study

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Abbreviations and Acronyms

TIP = tubularized incised plate

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Purpose: We studied the effect of suturing technique and the impact of urethral plate characteristics on the complication rate following tubularized incised plate urethroplasty.

Materials and Methods: We prospectively studied 80 boys (mean age 4.5 years, range 3 to 7) with primary hypospadias in a randomized fashion between January 2004 and May 2005. Of the patients 64 had anterior and 16 had mid penile hypospadias. Patients were allocated into 2 groups according to suture technique, with continuous sutures used in 40 boys and interrupted sutures in 40. We evaluated urethral plate depth, length and width before and after incision. Correlation between suture technique, plate type, width and length, and complication rate was performed.

Results: Mean followup was 3 years. Success rates were 90% and 69% for anterior and mid penile hypospadias, respectively ($p = 0.037$). Complications developed in 11 patients (13.8%) and consisted of fistula (8), dehiscence (2) and meatal stenosis (3). On univariate analysis the suture technique, depth and length of urethral plate, width after incision and presence of hypoplasia had no impact on complication occurrence. However, urethral plate width before incision was significantly related to complication occurrence ($p = 0.048$).

Conclusions: Suture technique has no influence on the outcome of tubularized incised plate urethroplasty. Urethral plate characteristics do not affect the complication rate except for plate width, which significantly affects the outcome. Adequate urethral plate width (8 mm or greater) is essential for successful tubularized incised plate repair.

Key Words: fistula, hypospadias, postoperative complications, suture techniques, urethra

MANAGEMENT of hypospadias has drastically improved in recent years. While achieving a functional result was once considered a sufficient surgical outcome, a normal looking penis and minimum morbidity are now expected as well.¹ In 1994 Snodgrass described tubularized incised plate urethroplasty, a modification of the Thiersch-Duplay technique, for distal hypospadias repair.² Later reports documented the efficacy of this proce-

cedure in proximal and recurrent hypospadias.^{3,4}

Although TIP repair is well described, variations in surgical technique can affect functional and cosmetic outcomes. Moreover, predictors of success of TIP repair are yet to be definitively determined. The role of the urethral plate, a flat epithelial strip of tissue extending from the urethral meatus to the glans penis, has been questioned.⁵⁻⁷

Figure 1. Types of urethral plate configuration. *A*, deep plate. *B*, intermediate plate. *C*, shallow plate

While there is general agreement on the use of absorbable sutures, the method (continuous or interrupted) remains debated.^{8,9} To our knowledge no prospective study has compared the outcomes of continuous vs interrupted suture in TIP urethroplasty. We performed a prospective randomized study to compare continuous vs interrupted suture in Snodgrass repair of hypospadias. We also evaluated the impact of urethral plate characteristics on operative success.

MATERIALS AND METHODS

We prospectively studied 80 boys with primary hypospadias (anterior penile in 64, mid penile in 16) in a randomized fashion between January 2004 and May 2005. Mean patient age was 4.5 years (range 3 to 7). Signed parental consent was obtained before the start of the study. Only primary cases with anterior or mid penile hypospadias were included, while those with glanular, recurrent or proximal hypospadias, or severe chordee were excluded. All patients underwent TIP urethroplasty by 1 surgeon (OS) using a modification of the technique described by Snodgrass.²

Patients were prospectively allocated into 2 groups according to suture technique, with continuous sutures used in 40 boys and interrupted sutures in 40. The neourethra was closed in a subcuticular fashion with 6 and 7-zero polyglactin sutures. A second covering layer from the dorsal prepuce was used in all cases. Patients were discharged home with an 8Fr

indwelling catheter, which was removed on postoperative day 5 to 7. Antibiotics (amoxicillin-clavulanate) were given perioperatively in all cases with or without antimuscarinics (0.4 mg/kg oxybutynin daily). All surgery was performed with magnification loops.

Urethral plate was categorized according to depth into shallow, intermediate or deeply grooved, as described by Nguyen and Snodgrass (fig. 1).⁷ Presence or absence of urethral hypoplasia was noted. We initially made parallel incisions along the edge of the urethral plate. Urethral plate length and width before and after the midline incision were also measured in mm using a flexible sterile ruler (fig. 2). The urethral plate was incised along its length deeply down to the corporeal bodies from the true meatus to the distal margin.

Patients were followed regularly at 6 weeks postoperatively and then every 3 months in the first year. The site and shape of the meatus were determined, and repairs were examined for complications. Urinary stream was assessed by observation during voiding. Finally the neourethra was calibrated using lubricated, appropriate sized feeding tubes.

Different factors were studied in relation to final surgical success. Correlation between suture technique, plate type, width and length, and complication rate was performed. Data were collected and processed using a commercially available software package (SPSS®, version 13 for Windows). Univariate analysis with Fisher's exact test was used to assess possible risk factors for reoperation. Mann-Whitney test was used for percent change correlation. A *p* value of less than 0.05 was considered statistically significant.

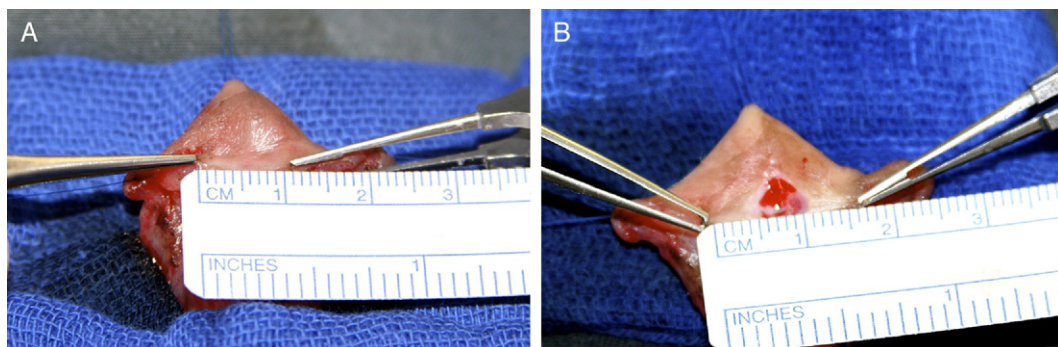


Figure 2. Measurement of urethral plate width. *A*, before incision. *B*, after midline incision

Univariate analysis of tested variables in relation to final outcome

	No. Pts	No. Complications (%)	p Value
Hypospadias type:			
Anterior penile	64	6 (9.4)	0.037*
Mid penile	16	5 (31.3)	
Suture technique:			
Continuous	40	5 (12.5)	0.500
Interrupted	40	6 (15)	
Urethral hypoplasia:			
Yes	22	3 (13.6)	0.647
No	58	8 (13.8)	
Urethral groove:			
Shallow	20	3 (15)	0.233
Intermediate	34	6 (17.6)	
Deep	26	2 (7.7)	
Urethral plate length:			
Less than 10 mm	40	5 (12.5)	0.500
10 Mm or greater	40	6 (15)	
Urethral plate width:			
Less than 8 mm	39	9 (23.1)	0.048*
8 Mm or greater	41	2 (4.9)	
Plate width after incision:			
Less than 12 mm	47	7 (14.9)	0.496
12 Mm or greater	33	4 (12.1)	

* Statistically significant.

RESULTS

Mean followup was 3 years (range 2 to 4.5). The urethral plate was shallow in 20 boys, intermediate in 34 and deeply grooved in 26. Mean urethral plate width before incision was 8 mm (range 5 to 10). After the relaxing incision the width increased to a mean of 12 mm (range 7 to 15). Success rates were 90% and 69% for anterior and mid penile hypospadias, respectively ($p = 0.037$). Complications developed in 11 patients (13.8%) and consisted of fistula in 8 (10%), dehiscence in 2 (2.5%) and meatal stenosis in 3 (3.8%).

On univariate analysis the suture technique, depth and length of urethral plate, width after incision and presence of hypoplasia had no impact on the occurrence of complications (see table). However, the urethral plate width before incision was significantly related to the occurrence of complications, as evidenced by development of complications in 9 of 40 cases with a urethral plate less than 8 mm compared to only 2 of the remaining cases with a plate of 8 mm or greater ($p = 0.048$). Mean change in urethral plate width after incision was 57%. When we correlated the complication rate with the percent change the relation was not statistically significant.

DISCUSSION

Hypospadias is relatively common, affecting more than 6,500 boys in the United States annually.⁹ In nearly all cases the standard of care is surgical repair to reconstruct a penis that is as normal ap-

pearing as possible, and to allow a forward directed urinary stream and coitus. Reported postoperative complication rates are 1% to 50%.¹⁰⁻¹² A multitude of techniques for the repair of distal hypospadias exist, including a recent modification involving a relaxing incision of the dorsal urethral plate described by Snodgrass.⁵ This modification allows tubularized urethroplasty to be applied to the majority of proximal and distal hypospadias repairs even in the absence of a deeply grooved urethral plate without the need for additional skin flaps.³ Another benefit of repair is the cosmetic outcome, since formation of a vertically orientated meatus provides the appearance of a normal circumcised penis.⁷

The urethral plate quality and width determine when TIP becomes an option in repair. While a narrow plate is inadequate for creating a good caliber urethra, the optimum width remains uncertain. A concern is that the relaxing incision of the urethral plate is equivalent to internal urethrotomy, which may scar rather than epithelialize, leading to neourethral stricture or meatal stenosis.⁷ This problem could potentially be more significant in patients with a flat and narrow rather than a deeply grooved and wide urethral plate due to the greater degree of mobilization required. Therefore, we prospectively performed this study to determine the influence of urethral plate depth and width on outcome with particular regard to fistula rate, urinary stream adequacy and meatal stenosis.

One multicenter study of TIP urethroplasty for distal hypospadias repair suggested use of the procedure was not influenced by plate configuration.¹³ However, no descriptions of the urethral plate were given to support this conclusion, and it is possible that some participating surgeons did not perform the procedure when the plate appeared flat or narrow. Holland and Smith were the first to evaluate outcomes according to plate configuration and width in a series of 48 patients.⁵ Meatal stenosis occurred in 13% of their cases with a flat plate but did not occur when the plate was moderately or deeply grooved. In addition, fistulas developed in 55% of the boys when the plate was less than 8 mm wide before relaxing incision but in no case when the plate was 8 mm or greater. Based on these observations, they concluded that the midline relaxing incision enabled tubularization but ultimately did not result in adequate neourethral caliber to avoid fistulas or meatal stenosis when the plate was narrow or flat, respectively.

In comparison, Nguyen and Snodgrass reported that TIP urethroplasty is a universal technique for hypospadias repair irrespective of the anatomical features of the urethral plate.⁷ In their study of 159 patients they found no meatal stenosis and only a 2% fistula rate. When the urethral plate was less

than 8 mm only 1 fistula developed. We also noted a higher percentage of complications if the urethral plate width was less than 8 mm, which confirms the results of Holland and Smith.⁵

The technique of suturing in hypospadias repair was also previously studied.^{9,14,15} The choice of suture technique is mainly dictated by surgeon preference. Ulman et al compared the use of 6-zero polyglactin in a single layer, full thickness, uninterrupted fashion to 7-zero polydioxanone performed in a subcuticular, uninterrupted fashion.⁹ They found that the complication rate following hypospadias repair could be reduced by using a subcuticular 7-zero continuous suture technique.

In a univariate analysis the use of running sutures was significantly associated with a higher reoperation rate compared to interrupted sutures.¹⁴ However, in multivariate analysis suture technique had no independent significance. Our study supports this finding, as the use of interrupted and continuous sutures led to similar success rates.

Due to the marked differences between surgeons regarding postoperative results and complication rates, we disagree with the theory that most complications of TIP urethroplasty relate to technical fac-

tors rather than varying patient anatomy.¹⁶ There is undoubtedly an effect of urethral plate anatomy on the outcome of the repair.

In our series the success rate of mid penile hypospadias was similar to that reported previously.^{4,13,15} A clinical review of the records of 72 boys who underwent TIP urethroplasty for distal and proximal hypospadias using calibration, urethroscopy and uroflowmetry failed to identify any evidence of neourethral stricture.^{12,17} We similarly did not observe any cases of urethral stricture in our series. Based on our results, we believe in the necessity of careful evaluation of plate configuration and width before performing TIP urethroplasty.

CONCLUSIONS

Suture technique has no influence on the outcome of TIP urethroplasty. The choice of suture technique is mainly dictated by surgeon preference. Urethral plate characteristics also have a nonsignificant impact on the complication rate except for the plate width, which significantly affects the outcome. An adequate urethral plate width (8 mm or greater) is essential for successful TIP repair. Further randomized studies are needed to validate this finding.

REFERENCES

- Duckett JW and Baskin LS: Hypospadias. In: Adult and Pediatric Urology, 3rd ed. Edited by Gillenwater, JC Grayhack, JT HowardSS et al: St Louis: Mosby 1996; pp 2549–2587.
- Snodgrass W: Tubularized incised plate urethroplasty for distal hypospadias. *J Urol* 1994; **151**: 464.
- Yang SS, Chen SC, Hsieh CH et al: Reoperative Snodgrass procedure. *J Urol* 2001; **166**: 2342.
- Snodgrass W, Koyle M, Manzoni G et al: Tubularized incised plate hypospadias repair for proximal hypospadias. *J Urol* 1998; **159**: 2129.
- Holland AJ and Smith GH: Effect of the depth and width of the urethral plate on tubularized incised plate urethroplasty. *J Urol* 2000; **164**: 489.
- Baskin LS: Controversies in hypospadias surgery: the urethral plate. *Dial Pediatr Urol* 1996; **19**: 1.
- Nguyen MT and Snodgrass WT: Effect of urethral plate characteristics on tubularized incised plate urethroplasty. *J Urol* 2004; **171**: 1260.
- Paulozzi LJ, Erickson JD and Jackson RJ: Hypospadias trends in two US surveillance systems. *Pediatrics* 1997; **100**: 831.
- Ulman I, Erikci V, Avanoğlu A et al: The effect of suturing technique and material on complication rate following hypospadias repair. *Eur J Pediatr Surg* 1997; **7**: 156.
- Baran CN, Tiftikcioglu YO, Ozdemir R et al: What is new in the treatment of hypospadias? *Plast Reconstr Surg* 2004; **114**: 743.
- Oswald J, Korner I and Riccabona M: Comparison of perimeatal based flap (Mathieu) and the tubularized incised-plate urethroplasty (Snodgrass) in primary distal hypospadias. *BJU Int* 2000; **85**: 725.
- Snodgrass WT: Tubularized incised plate hypospadias repair: indications, technique, and complications. *Urology* 1999; **54**: 6.
- Snodgrass W, Koyle M, Manzoni G et al: Tubularized incised plate hypospadias repair: results of a multicenter experience. *J Urol* 1996; **156**: 839.
- El-Sherbiny MT, Hafez AT, Dawaba MS et al: Comprehensive analysis of tubularized incised-plate urethroplasty in primary and re-operative hypospadias. *BJU Int* 2004; **93**: 1057.
- Snodgrass WT and Lorenzo A: Tubularized incised-plate urethroplasty for proximal hypospadias. *BJU Int* 2002; **89**: 90.
- Snodgrass W and Nguyen MT: Current technique of tubularized incised plate hypospadias repair. *Urology* 2002; **60**: 157.
- Snodgrass W: Does tubularized incised plate hypospadias repair create neourethral strictures? *J Urol* 1999; **162**: 1159.

EDITORIAL COMMENTS

I congratulate the authors for the design of their study. This type of prospective randomized study is so rare and difficult to realize in pediatric urology, and should be encouraged to validate our current surgical techniques.

It is interesting to see that the first aim of the authors was to compare the results of different types of suturing, and they ended by adding an interesting finding on the characteristics of the urethral plate. They confirmed a common belief among surgeons

that use of running or interrupted sutures makes no difference. We have all gone through the experience at the beginning of our hypospadias surgery training, questioning ourselves every day about why we have more complications than our mentors although we repeat the same surgical steps. Only years later do we start to understand that the way the tissues are handled is far more important than the type of suturing or suture material used.

This article deals with the pertinent question of when the urethral plate is wide enough to conduct a safe TIP procedure. We all have our own ideas and tips to identify the good and bad plate but we lack objectivity.

Another important question is whether we should deal with a 1-year-old and a 7-year-old child in the same way. The authors observed that penile size did not change significantly with patient age. A recent publication by Camurdan et al demonstrated that there is certainly penile growth in the first 5 years of life (from 4.8 cm at 1 year to 6 cm at 5 years).¹ In daily practice we would not use the same size urethral catheter for a 1-year-old and a 7-year-old child. It seems difficult to consider 1 value (8 mm) for all ages.

REFERENCE

1. Camurdan AD, Oz MO, Ilhan MN et al: Current stretched penile length: cross-sectional study of 1040 healthy Turkish children aged 0 to 5 years. *Urology* 2007; **70**: 572.

The authors are to be congratulated for putting together a nice prospective study about suturing technique and the impact of the urethral plate on TIP complication rates. Their results indicate that if the urethral plate is not initially of sufficient width, then complication rates tend to be significantly higher regardless of the depth, length or width obtained by subsequent posterior urethral incision. This finding makes great sense to me and confirms what I have been stating for years regarding the TIP procedure.

The authors consistently made their initial incisions, as originally described by Snodgrass, at the edge of the urethral plate before the midline relaxing incision. This approach generally creates a narrow width before posterior urethral incision and effectively burns a bridge in achieving adequate urethral width by relying solely on the midline urethral incision. I have long maintained that the posterior urethral plate incision will not yield the same diameter every time and, thus, have been a strong proponent of midline incision first, followed by parallel lateral incisions.

The authors note that those children with the lowest complication rates had urethral plates that

At the end of this significant article I was frustrated not to know how many mid penile cases had a plate of less than 8 mm and resulted in complications. The authors showed clearly that they had a higher complication rate with mid penile cases but in this prospective study we could not tell if there was another factor affecting the outcome (eg suturing, plate). This issue remains important because if we follow the conclusions, we can understand that we have to abandon the TIP procedure for plates less than 8 mm even for distal hypospadias, since no reasonable surgeon would opt for a procedure yielding a 23% complication rate in cases of a narrow plate. Finally I hope that such an important article will encourage more centers to be involved in prospective studies.

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were at least 8 mm wide. There is no issue with making these parallel incisions lateral to the urethral plate and into the glans to ensure that the overall circumferential width of the neourethral tube will be adequate. If one is concerned about the glans being too small, then stimulation with testosterone cypionate preoperatively will achieve an adequate glanular size to allow more lateral incisions and easy glans closure over the neourethra. In fact, in my hands use of this approach frequently precludes the need to do any midline urethral plate incisions, unless there is a transverse cleft that needs to be incised to smooth out the plate or one has a particularly flat urethral groove. If this article does nothing else but convince the hypospadiologist to make the midline incision first, see what width is achieved and then make the appropriate sized parallel glanular incisions, we will have been well served.

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