

Outcome of tubularized incised plate (TIP) urethroplasty: A single-center experience with 307 cases

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Abstract

Introduction: In order to assess our skill in the tubularized incised plate (TIP) urethroplasty technique in children with hypospadias.

Material and Methods: Of 307 children (mean age 38 month) who received a TIP urethroplasty, all had primary hypospadias. Patients who were referred with complication were eliminated from our study. The hypospadias defects were subcoronal in 25 (8%), distal penile in 236 (76%), midpenile in 25 (8%), proximal in 14(4%) and unknown in 7(2%) cases. Chordee was present in 53 (17.2%) patients. Presence of complications requiring reoperation and overall general appearance was recorded.

Results: The mean follow-up was 36 (19-72) months. Overall success rate was 70 % (215). Re-operation was required in 92 patients (30%): for urethrocutaneous fistula in 79 (26%), complete disruption of the repair in 2(0.6%) cases and meatal stenosis requiring meatoplasty in 12 (3%). Complete glans dehiscence occurred in 3 patients, which was repaired using the MAGPI technique. Partial breakdown of the glans occurred in 10 cases which did not require further surgery. One case had a huge urethral diverticulum.

Conclusions: This technique is relatively common compared to other accessible operations, but attention to details is necessary in order to achieve good results. It appears that complications, such as fistulas and meatal stenosis are more common in this method than other techniques, which require more research in the future.

Keywords: Hypospadias; Urethral plate; Urethroplasty; Meatal stenosis; Fistula

Introduction

Hypospadias repair is a reformative surgery that corrects the position of urethra and phallus. The important aim in surgery is voiding in correct situation and unrestricted sexual performance in adults. Achievement of an aesthetic penile appearance is another goal.

There are several techniques in hypospadias repair. In 1994, Snodgrass⁶ introduced tubularization of the urethral Plate (TIP) technique; as an easy method for distal hypospadias repair. In this study we assessed the surgical outcome of our patients with TIP repair.

Material and Methods

Using a questionnaire we collected all the information from files of patients who had

undergone primary hypospadias repair, in a 6-year period from 2006 until 2012. Patients who were referred with complications were removed from our study. The operative technique for TIP urethroplasty was based on basic steps of Snodgrass. At first, a circumscribing skin incision was made 3-5 mm proximal to the meatus, and the penis was degloved completely. Then a “U” shaped incision was made ventrally around the margin of the urethral plate. Next an artificial erection was made, and a mild ventral curvature less than 30° was created by dorsal plication, in the midline. For a more harsh curvature, the corpus spongiosum closest to the plate was dissected off the corporal bodies in combination with dorsal plication. The main contraindication to TIP repair was severe penile curvature requiring transection of the

urethral plate. When these straightening maneuvers were unsuccessful, the plate was transected, and ventral dermal grafting of the scrotal skin was utilized. The glans wings were dissected with parallel longitudinal incisions. Midline incision of the urethral plate was done, extending from meatus distally to the tip of the plate. The urethral plate was tubularized with a 6-0 Vicril or PDS running sutures placed through all layers or sub-epithelially. Typically, a 6-8 F stent was used in order to prevent narrowing. The neourethra was covered with a dartos pedicle flap obtained from the dorsal prepuce and shaft skin. The glans wings were approximated in the midline, tension free. Then, the skin was closed using a classic Byars flap. A sandwich dressing was applied in all cases and the stent was kept in place for approximately 1 week. Dressing was changed 2 days after surgery. Oxybutinin was administrated postoperatively until catheter removal. In all the patients a routine meatal dilation by stent or ophthalmic ointment was performed after surgery. Patients were visited 2 weeks, 1 month and 6 month postoperatively. After that a follow up call was made to all children more than 3 years old and a follow up visit and uroflowmetry was done.

Results

In the preoperative evaluation of 307 patients with hypospadias; 236 (76%) were distal penile, 25 (8%) were subcoronal, 25 (8%) were midpenile, 14(4%) were proximal and in 7(2%) cases the type of hypospadias was not recorded. Age at surgery ranged from 3 to 168 months (mean, 38 months). The most common associated anomaly was inguinal hernia (8%). Penile Curvature was noted in 53(17%) cases. Fifty of which were corrected by dorsal plication. In 3 patients with a more severe chordee, in

addition to mobilization of the corpus spongiosum, urethral plate was transected and ventral dermal grafting carried out. Mean follow-up after TIP was 3 years. Fourteen (4.5%) patients had undergone circumcision in other centers. Preoperative hormone therapy was carried out in 7 cases (2%). Eighty four percent of patients received oxybutinin after surgery, and 46% of repairs were done with a magnifying loupe. The most common complication after surgery was urethrocutaneous fistula; which was seen in 79 (26%) patients. Rate of fistula was 33% for subcoronalhypospadiasis, 19% in distal penile cases, 24% in mid-penile and 64% in proximal type patients. In 78% of patients with fistula redo repair was carried out once, in 11% twice, in 1% three times, in 1% four times and in one case five times. Most of the fistulas were repaired using a multilayer technique, but in 13 cases the TIP technique was used again. Nearly all of the patients suffered from early meatal stenosis after catheter removal, so in all the patients routine meatal dilation was performed by stent or ophthalmic ointment after surgery. In 12 patients with meatal stenosis, meatoplasty was carried out.

Complete failure was seen in 2 cases which were repaired with a re do TIP procedure. In 7 cases chordee recurred. One boy had a urethral stricture at the site of the original midshaft meatus; which resolved with repeat dilation under anesthesia. Complete glans dehiscence occurred in 3 patients, and was repaired with the MAGPI technique. Partial breakdown of the glans occurred in 10 cases but did not require further surgery.

One case had a huge urethral diverticulum with impacted stone that was corrected successfully with a second procedure. Follow up uroflowmetry was done in 72 patients all of which were more than 3 years old and mean voiding volume was 130

+138 cc. Mean time to peak flow was 8 second with minimum 0.3 to maximum 42 second. Mean flow time was 14 second with minimum 1.2 to maximum 48 second. Average flow was 8 ml/s with minimum 2.3 and maximum 24 ml/s. Average Uroflow-Maximum flow was 11 ml/s with minimum 2 and maximum 35 ml/s.

Discussion

In 1994, Snodgrass explained, a novel technique for distal hypospadias repair in which tubularization of the urethral plate without skin flaps was performed by midline plate incision⁶. Snodgrass introduced this tubularized incised plate (TIP) technique as an easy choice for distal hypospadias repair because the operation was effective despite the different meatal and urethral plate configurations⁷. The TIP procedure due to its adaptability and relative ease, enumerates as an attractive procedure. Furthermore, good outcomes in distal hypospadias surgery have directed many surgeons to the use of this technique in proximal hypospadias and some cases of reoperation. Later he employed the TIP technique for proximal hypospadias and recommended it for more special situations^{8,9,10}.

SelamiSozubir and Warren Snodgrass in 2003 reported outcomes of hypospadias repair of 106 patients. They claimed that decision for repair was not decided only based on meatal position, but also harshness of curvature and appearance of the incised urethral plate were important. There for except in cases were severe curvature necessitated plate transaction or in cases of "unhealthy" incised plate, TIP repair can be carried out for most hypospadias operations. In our study penile curvature was noted in 53(17%) cases, 50 of which were corrected by dorsal plication. In 3 patients with more severe chordee, in addition to mobilization of the corpus spongiosum, urethral plate was

transected and ventral dermal grafting carried out. In 7 cases chordee recurred and patients underwent redo operation. The chief complication in these patients was fistula formation. Regardless of the employment of a dartos flap as a barrier layer in all cases in our study, fistula happened in 5% of distal and 19% of proximal repairs² in our study.

In the study by SelamiSozubir and Warren Snodgrass, other complications of TIP urethroplasty was meatal stenosis and neourethral stricture, each occurring in one patient. In general, they believed meatal stenosis is a technical mistake resultant from tubularizing the plate too far distally, thus they recommended generation of an appropriated sized, oval-shaped neomeatus. Snodgrass consistently makes a slit-like, vertically oriented meatus and a functional neourethra. The stricture was only 1 mm long at the original midshaft meatus and resolved with a dorsal plate incision. Instead in our study nearly all of the patients had early meatal stenosis after catheter removal; therefore meatal dilation was routinely performed in all the patients by stent or ophthalmic ointment after surgery. In 12 patients with meatal stenosis, meatoplasty was necessary. One concern for TIP repair after urethral plate incision is neourethral strictures, but this occurred only once in their study and was an unusual complication¹¹. In our study one boy had a urethral stricture at the site of the original midshaft meatus which resolved with repeat dilation under anesthesia.

Waterman¹² assessed factors influencing repairs of urethrocutaneous fistula after hypospadias surgery. Their study proposed that there was no obvious difference in stent versus no stent and microscope versus loupes, patient age at the time of fistula repair had no effect on the outcome, but the technique of primary hypospadias repair was important¹³. In our study the most common

complication after surgery was urethrocutaneous fistula which occurred in 79 (26%) patients.

It is recognized that children have an obstructive pattern of voiding after hypospadias repair⁴. As Dr Snodgrass previously stated; “a neourethra is not a normal urethra”⁵ and the TIP repair usually results in obstructed flow at uroflowmetry, due to meatal stenosis or secondary to non-compliant neourethra. Holmdal G et al.¹⁴ evaluated flow rates of patients 2 months and 1 year after TIP repair. They reported many boys with a low Qmax who did not complain of obstructive symptoms after urethral calibration and an anatomic obstruction was seen in less than half of the patients. In a more recent study by Marie Andersson they reevaluated these boys. Follow up uroflowmetry was done and voiding history taken 3-10 years (median 7 years) after TIP repair in the same cohort of patients; to assess whether the obstructive pattern continued, deteriorated or resolved. Spontaneous improvement was seen 7 years after TIP repair; although many boys still had a Qmax in the low normal or obstructive range. In our study follow up uroflowmetry was done in 72 patients, all of which were more than 3 years old and mean voiding volume was 130 ± 138 cc. Mean time to peak flow was 8 second with minimum 0.3 to maximum 42 second. Mean flow time was 14 second with minimum 1.2 to maximum 48 second. Average flow was 8 ml/s with minimum 2.3 and maximum 24 ml/s. Average Uroflow-Maximum flow was 11 ml/s with minimum 2 and maximum 35 ml/s.

Postoperative meatal/neourethral stenosis after tubularized incised plate urethroplasty is common, in order to prevent this complication, many authors have explained technical modifications, such as formation of a wide

and oval neomeatus, eversion of the neomeatus, restrictive midline incision distally, postoperative bougienage of the neourethra, skin grafting, or buccal mucosal grafting¹⁶. Shimotakahara A. et al.³ used a dorsal inlay graft (DIG) harvested from the inner prepuce and sutured it to cover the longitudinal midline incision of the urethral plate. They suggested that DIG be done routinely during TIP procedure.

In order to reduce the rate of fistula formation after hypospadias repair, some surgeons advocate creating well-vascularized suture lines. In this study nearly all of the patients had early meatal stenosis after catheter removal; thus all the patients routinely underwent meatal dilation by stent or ophthalmic ointment after surgery.

Optical magnification, gentle fragile tissue handling, and excellent suture materials are effective in reducing the incidence of fistula formation. Other principles of hypospadias repair consist of the avoidance of overlapping suture lines and interposition of layers of well-vascularized tissue between the suture lines of neourethra and the skin¹⁷. The use of the abortive spongiosum as an additional layer over the urethral suture line was established to diminish fistula formation with the Barcat technique¹⁸. Miroslav¹⁹ after performing the standard TIP urethroplasty in 126 patients; harvested a longitudinal dorsal dartos flap and transposed it to the ventral side by the buttonhole manoeuvre. The flap was fixed to the glans and the corpora cavernosa to entirely wrap the neourethra with well-vascularized subcutaneous tissue. The major contraindication for proximal TIP repair is ventral penile curvature (VC) leading to urethral plate (UP) transection²¹. Fistula formation was most common in the proximal type, thus we recommend other techniques of repair of this type of hypospadias.

A perfect protocol should consist of an early assessment within 1 to 3 months of surgery, followed by a visit at 1 or 2 years, and again at 4 or 5 years. The quality of voiding should be evaluated. With the beginning of rapid growth at puberty there is the possibility for new complications to arise; a previously unrecognized and asymptomatic microfistula might begin to leak; a scarred neourethra may not succeed to develop adequately; or the shape of the penis may cause anxiety. The patient should therefore be re-evaluated at puberty and again approximately the mid-teens, by which time genital maturation will be at or near completion and the patient will be able to comment about social and sexual feature of the penile surgery²⁰.

Conclusions

This technique of hypospadias repair seems simple but, if carried out without careful attention to details would lead to many complications such as fistulas and meatal stenosis; more than other techniques. Evaluation of long term outcomes of the TIP procedure; not only aims at the correct position of the urethral meatus and chordee correction, it is also a middle ground between patient pleasure and surgeon satisfaction.

It should be noted that the best technique for each patient is based on characteristics of that special case. In order to achieve the best result we need to learn from our experiences.

Reference

- 1- Sarhan OS, El-Hefnawy AS, Hafez AT, et al: Factors affecting outcome of tubularized incised plate (TIP) urethroplasty: Single-center experience with 500 cases. *Journal of Pediatric Urology* 2009; 5:378-382.
- 2- Sozubir S, Snodgrass W: A New Algorithm for Primary Hypospadias Repair Based On Tip Urethroplasty. *Journal of Pediatric Surgery*,2003; 38(8): 1157-1161.
- 3- Shimotakahara A, Nakazawa N, Wada A, et al: Tubularized incised plate urethroplasty with dorsal inlay graft prevents meatal/neourethral stenosis: a single surgeon's experience. *Journal of Pediatric Surgery* 2011; 46: 2370–2372.
- 4- Olsen LH, Grothe I, Rawashdeh YF, et al: Urinary flow patterns in infants with distal hypospadias. *J Pediatr Urol* 2011; 7:434-8.
- 5- Snodgrass W. Response to Letter to the Editor 10-00238. *J Pediatr Urol* 2010; 7:174-7.
- 6- Snodgrass W: Tubularized, incised plate urethroplasty for distal hypospadias. *J Urol* 1994; 151: 464.
- 7- Snodgrass WT, Koyle M, Manzoni G, et al: Tubularized, incised plate hypospadias repair: Results of a multicenter experience. *J Urol* 1996; 156:839-841.
- 8- Borer JG, Bauer SB, Peters CA, et al: Tubularized incised plate urethroplasty: Expanded use in primary and repeat surgery for hypospadias. *J Urol* 2001; 165:581.
- 9- Mizuno K, Hayashi Y, Kojima Y, et al: Tubularized incised plate urethroplasty for proximal hypospadias. *Int J Urol* 9:88-90, 2002
- 10- Snodgrass WT, Lorenzo A: Tubularized incised-plate urethroplasty for proximal hypospadias. *Br J Urol Int* 2002; 89:90-93.
- 11- Snodgrass W: Does tubularized incised plate hypospadias repair create neourethral strictures. *J Urol* 1999; 162:1159.
- 12- Waterman BJ, Renschler T, Cartwright PC, Snow BW, Devries CR. Variables in

- successful repair of urethrocutaneous fistula after hypospadias surgery. *Journal of Urology* 2002; 168: 726–730.
- 13- Snodgrass WT, Nguyen MT. Current technique of tubularized incised plate hypospadias repair. *Urology* 2002; 60 (1):157-162.
- 14- Holmdahl G, Karström L, Abrahamsson K, et al: Hypospadias repair with tubularized incised plate. Is uroflowmetry necessary postoperatively? *J Pediatr Urol* 2006; 2:304-7.
- 15- Andersson M, Doroszkiewicz M, Arfwidsson C, et al: Hypospadias repair with tubularized incised plate: does the obstructive flow pattern resolve spontaneously? *J Pediatr Urol* 2010; 7: 441-445.
- 16- Singh RB, Pavithran NM: Lessons learnt from Snodgrass TIP urethroplasty: a study of 75 cases. *Pediatr Surg Int* 2004; 20:204-6.
- 17- Cooper C S, Noh PH, Snyder Howard M: Preservation of urethral plate spongiosum: technique to reduce hypospadias fistulas. *Pediatric Urology* 2001; 57 (2):531-4.
- 18- Spencer-Barthold J, Teer TL, Redman JF: Modified Barcatbalanic groove technique for hypospadias repair: experience with 295 cases. *J Urol* 1996; 155: 1735–1737.
- 19- Djordjevic ML, Perovic SV, Slavkovic Z, et al: Longitudinal Dorsal Dartos Flap for Prevention of Fistula after a Snodgrass Hypospadias Procedure. *European Urology* 2006; 50: 53–57.
- 20- Manzoni G, Bracka A, Palminteri E, et al: Hypospadias surgery: when, what and by whom? *B J U International* 2004; 9 4:1188 – 1195.
- 21- Snodgrass W, Bush N: Tubularized incised plate proximal hypospadias repair: Continued evolution and extended applications. *Journal of Pediatric Urology* 2011; 7: 2-9.
- 22- Parikh A.M, Park A.M, Sumfest J: Cumulative summation (CUSUM) charts in the monitoring of hypospadias outcomes: A tool for quality improvement initiative. *Journal of Pediatric Urology* 2014; 10: 306-311.