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Original Research Article

Modified Tubularized Incised Plate (TIP) Urethroplasty in Distal Penile Hypospadias - A Tertiary Care Experience

Pruthwiraj Singh*, Tanmaya Mahapatra, M. Siva Rama Krishna, Prem Prakash Mallick
Department of Plastic & Reconstructive Surgery
M.K.C.G. Medical College & Hospital, Berhampur, Dist. Ganjam, Odisha

Corresponding Author: Pruthwiraj Singh (drpruthwiraj@hotmail.com)

ABSTRACT

Background: After the advent of the Snodgrass tubularized incised plate (TIP) urethroplasty technique for the correction of distal penile hypospadias and urethroplasty complications like urethrocutaneous fistula, meatal stenosis, and glans flap dehiscence in 2% of cases in the year 1994, it became a popular technique among hypospadias surgeons for the correction of distal penile hypospadias irrespective of the intrinsic clinical parameters. The issue of the thin membranous distal urethra, inadequate urethral plate, small conical glans and associated complications following the TIP procedure are well described. Objectives of the study is to find out the surgical procedure undertaken and the outcomes in distal penile hypospadias in our institute.

Materials and Methods: This is a retrospective study on distal penile hypospadias operated on in the department of plastic surgery of our institute from April 2017 to March 2022.

Results: The present study had a total of 96 boys with distal penile hypospadias; ages ranged from 2 years to 26 years, with a mean age of 5.02 years and a standard deviation of 3.47 years. It was found that 84 (87.5%) of cases of distal penile hypospadias were managed with the modified TIP procedure, and 12 (12.5%) cases were managed with Byars' stage procedures. It was found that 64 (66.7%) of the outcomes were uneventful, and in 32 (33.3%) cases, urethroplasty complications were noted, consisting of preputial flap loss in 3.1%, glans flap dehiscence in 9.4%, meatal stenosis in 9.4%, urethrocutaneous fistula in 8.3% of cases, meatal stenosis with fistula in 1%, and urethral stricture in 1 (2.1%) of cases.

Conclusion: Tubularized incised plate urethroplasty, or its modified version of including an extra 3mm to 4mm of penile skin lateral to the urethral plate on either side, is found suitable in the majority (87.5%) of the cases of distal penile hypospadias but not all.

Keywords: Hypospadias, TIP Urethroplasty, Urethroplasty complications

INTRODUCTION

Hypospadias is a congenital malformation of the penis in which the external urethral meatus opening is abnormally situated on the ventral aspect of the penile shaft and not in the normal anatomical position in the tip of the glans penis. The external urethral meatus opening caliber may vary from pinhole meatus to normal caliber meatus. The skin around the distal end of the urethra may vary from normal-quality skin to very thin, transparent skin. The size and the type of the glans and the urethral plate characteristics also vary. The shaft of the penis may be ventrally bent, called chordee, that determines the procedure to be chosen for correction of hypospadias.

Clinically, hypospadias is classified into distal penile, mid-penile, or proximal penile variety according to the location of the external urethral meatus, and the other clinical parameters described above are not taken into account. Distal penile hypospadias constitutes approximately 70% of hypospadias.[1,2]. In the literature, chordee, inadequate urethral plate, small and conical glans, and thin membranous distal distal urethra are described as independent parameters predicting the outcomes of the surgical intervention.[3,4,5,6]

After the advent of the Snodgrass tubularized incised plate (TIP) urethroplasty technique for the correction of distal penile hypospadias and urethroplasty complications

like urethro-cutaneous fistula, meatal stenosis, and glans flap dehiscence in 2% of cases, in the year 1994, it became a popular technique amongst the hypospadias surgeons for the correction of distal penile hypospadias irrespective of the various intrinsic clinical parameters.

The issue of thin membranous distal urethra, inadequate urethral plate, small conical glans[4] and associated complications following the TIP procedure are well described.[7,8] With this background, we wanted to retrospectively review the surgeries undertaken in distal penile hypospadias cases in a tertiary care hospital from April 2017 to March 2022. The data of clinical presentation of the distal penile hypospadias and the technique of surgery chosen and complication resulted thereof were collected, documented, and analyzed. The objectives of the study is to report the outcomes of modified TIP urethroplasty procedure in distal penile hypospadias in a tertiary care institute of Southern Odisha.

MATERIALS AND METHODS

This is a retrospective study on distal penile hypospadias operated on in the department of plastic surgery of our institute from April 2017 to March 2022.

Inclusion Criteria:
The study included all the primary cases of distal penile hypospadias who had undergone correction surgery in the study period.

Exclusion Criteria:
All the cases of mid-penile and proximal penile hypospadias, secondary cases, and age < 6 months are not included in this study.

Study Design:
It is a retrospective observational study on distal penile hypospadias operated on in the department of plastic surgery, M.K.C.G. Medical College & Hospital, Berhampur, from April 2017 to March 2022. The total number of cases included in the study was 96 boys, who qualified for the inclusion criteria.

Ethics:
The study was approved by the Institutional Ethics Committee of our institute vide registration no. 1210/2023 chairman-IEC MKCG Medical College, Berhampur. The procedures followed were in accordance with the ethical standards of the institutional ethics committee and Helsinki's declaration of 1975, as revised in 2013.

Methods:
Patients' bedhead tickets with a diagnosis of distal penile hypospadias, operation theater notes, registers, and follow-up case sheets with a diagnosis of distal penile hypospadias were thoroughly examined for the age of the patient, location of the external urethral meatus, its size and shape, the size of the glans penis, the status of the urethral plate, para-meatal skin quality, degree of chordee, history of retention of urine, surgical procedure undertaken, suture material used, the criteria for choosing the procedure, and associated complications, if any, and the data were collected.

Data about the width of the urethral plate in distal penile hypospadias were collected and grouped into adequate urethral plates if the width was more than 6 mm and inadequate urethral plates if the width was 6 mm or less.[8,9,10]

Data about thin membranous distal urethra, when the distal urethral skin cover is very thin and transparent and less than 5 mm or more than 5 mm, were recorded and made into two groups.[7]

Data about the shape of the glans were grouped into glans with deep grooves, glans with shallow (narrow) grooves, and flat glans were collected, grouped, and analyzed.[6]
Most of the patients with distal penile hypospadias had undergone modified TIP urethroplasty procedures.[11]

The criteria mentioned for choosing the surgical procedures were both adequate or inadequate urethral plate width and less than 5 mm long membranous distal urethra without chordee or minimal chordee. In the modified TIP procedure, an additional 3 to 4 mm of penile skin adjacent to the urethral plate on either side were used for tubularization after incising the urethral plate as described by Snodgrass. Polyglactin (6-0) suture was used for tubularization, and (5-0) suture was used for glans wings approximation and skin flap closure. Infant feeding tubes numbered 6 Fr to 10 Fr were used for urinary stents and drainage of urine, depending on the age of the patient. Non-adhesive floppy gauze dressing was applied in all patients.

Other patients, with chordee more than 300 or distal thin membranous urethra of length 5 mm or more, had undergone Byar's two-stage procedure.[12,13] In the first stage, chordee correction and ventral transposition of the hooded prepuce had been done. In the second stage, tubularization urethroplasty over an adequately sized infant feeding tube had been conducted six months to one year after the first procedure.

In both these groups, patients were discharged on the 6th postoperative day after the primary dressing change with

the urinary catheter in situ. The urinary catheter was removed on the 10th to 12th postoperative day at the outpatient department.
Data about patient follow-up were recorded. Outcomes like uneventful recovery, or no complications, preputial flap loss, glans flap dehiscence, meatal stenosis, urethra-cutaneous fistula, and stricture urethra were documented.

Statistical Analysis
The data was analyzed by IBM SPSS, version 21, using descriptive study methods, and crosstabs and Pearson's chi-square test were used for significance testing, and a p-value of ($P < 0.05$) was considered significant.

RESULTS

The present study had a total of 96 boys with distal penile hypospadias; age ranged from 2 to 26 years, with a mean age of 5.02 years and a standard deviation of 3.47 years.

It was found that, based on the intrinsic clinical parameters, distal penile hypospadias had adequate urethral plates in 51 (53.1%) cases, inadequate urethral plates in 45 (46.9%), pin-hole meatus in 7 (7.3%), normal caliber meatus in 89 (92.7%), thin membranous distal urethra in 12 (12.5%), and normal urethra in 84 (87.5%). Similarly, the glans was deeply grooved in 50 (52.1%) cases, shallowly grooved in 33 (34.4%) cases, and flat in 13 (13.5%) cases.
It was found that 84 (87.5%) of cases of distal penile hypospadias were managed with the modified TIP procedure, and 12 (12.5%) cases were managed with Byars' stage procedures.

Table-1: Demographic data and clinical parameters

Age	
Min.	2
Mean age	5.02
Max	26
St. Deviation	5 ± 3.5 Yrs.
Urethral Plate Characteristics	
Adequate	51 (53.1%)
Inadequate	45 (46.9%)
Urethral Skin Characteristics	
Thin Membranous	12 (12.5%)
Normal Thickness	84 (87.5%)
Caliber of Meatus	
Pin Hole	7 (7.3%)
Adequate / Normal Caliber	89 (92.7%)
Glans Shape	
Deeply Grooved	50 (52.1%)
Shallow grooved	33 (34.4%)
Flat Glans	13 (13.5%)
Surgical Procedures undertaken	
Modified TIP	84 (87.5%)
Byars Two Stage Procedure	12 (12.5%)
Outcomes	
Overall complications	32 (33.3%)
Uneventful recovery	64 (66.7%)

The demographic data, clinical data, and outcomes of surgical procedures in distal penile hypospadias related to the intrinsic clinical parameters like urethral plate width, membranous distal urethra with minimal chordee or remarkable chordee, and glans shape were depicted in Table- 1 to 4 and Figure-1-4.

Table-2: Surgical procedures undertaken in distal penile hypospadias

Procedures (n=96)	**Modified TIP (n=84)**		**Byar's Two Stage Procedure (n=12)**		**p-value**
	No.	**%**	**No.**	**%**	**0.32**
Uneventful recovery	55	65.50	9	75.00	
Urethrocutaneous fistula	6	7.10	2	16.70	
Preputial flap loss	3	3.60	1	8.30	
Glandular Dehiscence	9	10.70	0	0	
Meatal Stenosis	9	10.70	0	0	
Meatal Stenosis and fistula	1	1.20	0	0	

Table-3: Outcomes with respect with urethral plate characteristics

Characteristics (n=96)	**Adequate Urethral plate (n=51)**		**Inadequate Urethral Plate (n=45)**		**p-value**
	No.	**%**	**No.**	**%**	
Uneventful recovery	38	74.5	26	57.8	
Urethrocutaneous fistula	3	5.9	5	11.1	
Glandular Dehiscence	2	3.9	7	15.6	**0.146**
Meatal Stenosis	6	11.8	3	6.7	
Preputial flap loss	1	2.0	2	4.4	
Urethral Stricture	--	--	2	4.4	

Table-4: Outcomes with respect to glans characteristics

Characteristics (n=96)	Deep Groove (n=50)		Shallow Groove (n=33)		Flat Glans (n=13)		p-v
	No.	%	No.	%	No.	%	
Uneventful recovery	38	76.0	17	51.0	9	69.2	
Urethrocutaneous fistula	3	6.0	3	9.1	2	15.4	
Glandular Dehiscence	2	4.0	7	21.2	0	0	**0.04**
Meatal Stenosis	1	2.0	3	9.1	0	0	
Preputial flap loss	1	2.0	2	6.1	1	7.7	


(g)


(h)

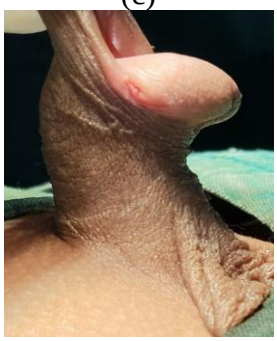
Figure – 1 (Clinical Parameters)
(a)Thin membranous distal urethra with shallow urethral plate . (b).Glans with shallow groove, pin-hole meatus, inadequate urethral plate.(c).Flat glans (d)Normal callibre external urethral meatus with minimal chordee (e) Chordee >30 degrees (f) Glans with deep groove (g) Adequate urethral plate with deep groove, with <5mm membranous distal urethra (h) Measurement showing inadequate urethral plate


(a)


(b)

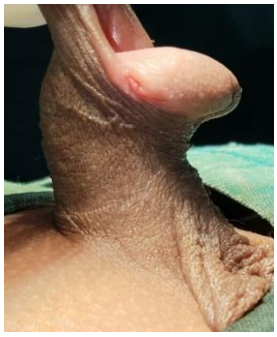

(c)


(d)


(e)


(f)


(a)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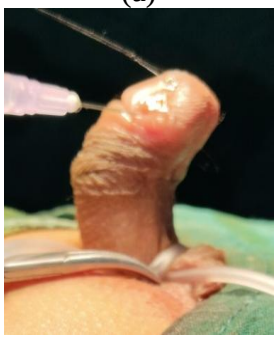
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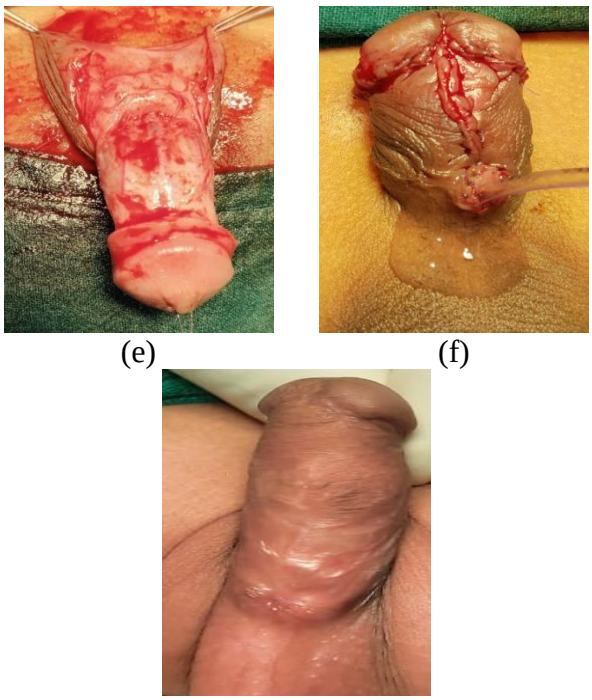

Figure: 2 (criteria for choosing Byar's two-stage procedure)
(a) Thin membranous distal urethra , pin-hole meatus , inadequate urethral plate and glans with shallow groove (b) Chordee >30 degree (c) Gitte's test (d) Marking for incision of release of chordee (e) Degloving of the penile skin (f)Ventral transposition of hooded prepuce and proximal mobilization of urethral meatus (g) Follow up after 6 months

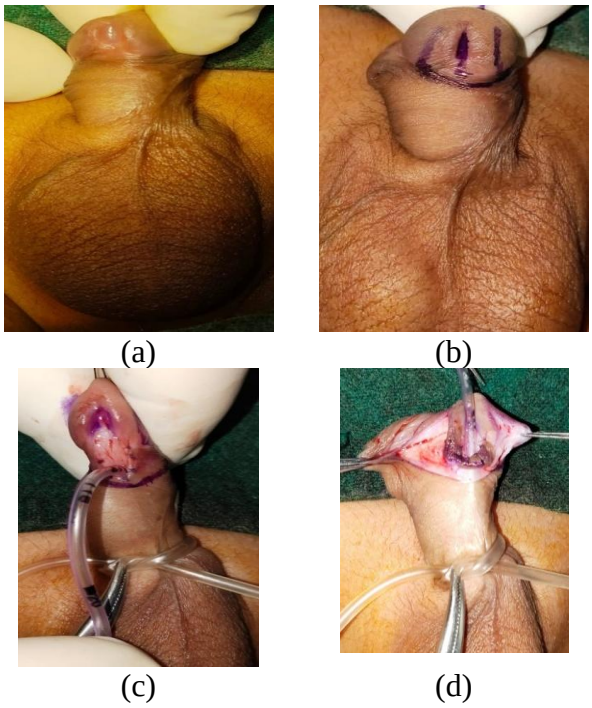

Figure -3(Criteria for choosing Modified TIP)
(a)Glans with shallow groove (b) Marking of Modified TIP (c) Following urethral plate incision in the midline (d) Raising lateral glanular flap (e) Tubularisation of urethra in MTIP (f) Dartos Flap by Baccala's technique (g) Post-op picture (h) Follow-up case of calibration with 8Fr IFT of urethral meatus

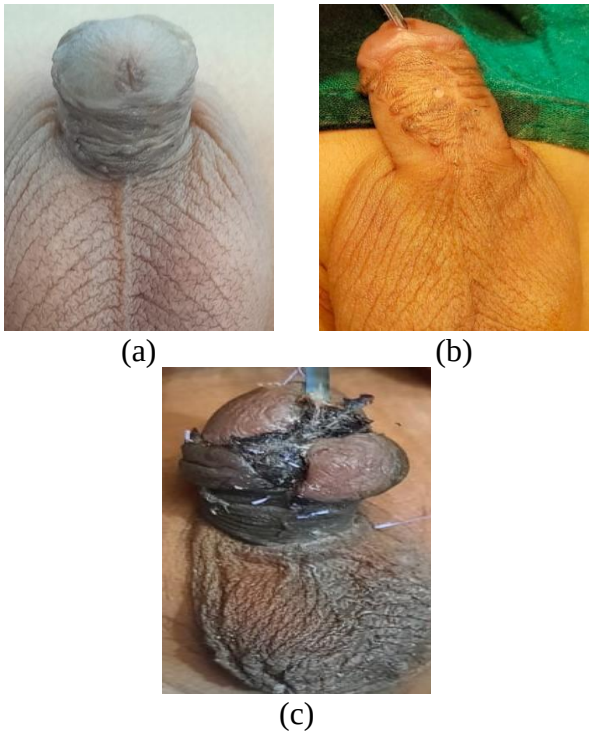

Figure-4 (Post-op results and complications)
(a)Split shaped external urethral meatus 6months after MTIP (b) Single small fistula after MTIP (c) One side Preputial flap necrosi after MTIP

DISCUSSION

In this study of 96 boys with primary distal penile hypospadias , the majority of the cases (87.5%) were managed by the modified TIP procedure, even in cases with thin membranous urethra less than 5 mm in length and minimal chordee <300, though 12.5% of cases needed Byar's two-stage procedure for correction of distal penile hypospadias, with thin membranous distal urethra more than 5mm in length and associated chordee >300.

In cases of thin or membranous skin over the distal urethra, Snodgrass used to incise the skin till the normal thickness urethra was found before the urethroplasty and TIP procedure.[2] In our study, when the thin membranous distal urethra was less than 5mm and chordee was minimal, we followed the Snodgrass technique. But in situations where the thin membranous distal urethra was more than 5mm and associated with gross chordee, we followed Byar's two-stage procedure.

Zhou G et al. al reported that urethroplasty complications like inadvertent intraoperative urethrectomy and postoperative fistula, stricture, and repair breakdown rate are very high in cases of chordee with thin membranous distal urethra.[7]

Yang SS[14] et al. noted thin distal urethra in 23.4% of their series of primary hypospadias, where the length of the thin distal urethra was 8.2 mm. They were able to preserve the thin distal urethra and perform the operative procedure without compromising the surgical results of tubularized incised plate urethroplasty, which contradicts our results.

But in our series, such cases were managed by Byar's two-stage procedure, and urethroplasty complications like glans flap dehiscence, preputial flap necrosis, and meatal stenosis were not encountered; however, the urethra-cutaneous fistula rate was 16.7% (2/12), and the stricture urethra rate was 8.3% (1/12), and this finding is not significantly different from the urethroplasty complications of the modified TIP procedure of our series as p value is 0.32. This finding may be due to the small number of cases in Byars' two-stage procedure series.

G. Zhou et al.[7] has assigned three possible reasons for significant intraoperative and postoperative complications in cases of hypospadias with thin membranous urethra. According to him, the high complication rate may be due to overzealous attempts to preserve the thin membranous urethra. Severe chordee was corrected by shortening the penis and not by transecting the urethra or urethral plate. One-stage urethroplasty was performed regardless of the length of the urethral defect. In our series, we performed Byars' two-stage procedure to manage such cases.

In our series of 96 cases, irrespective of the width of the urethral plates, whether <6 mm or > 6mm, the modified TIP procedure was undertaken in 84/96 (87.5%) of distal penile hypospadias, and the urethroplasty complication rate was not significantly different in either variety of urethral plates.

Like the modified TIP procedure employed in our series, other authors also included penile shaft skin and glans skin lateral to the urethral plates in the lateral incision to ensure adequate plate width for tubularization after incising the urethral plate in the midline.[11,15].

But Nguyen et al. concluded that it was not necessary to widen a flat and/or narrow plate by incorporating glans and shaft skin into the urethral plate even if the urethral plate is 4 mm in width.[9] But in a meta-analysis by Pfistermuller, complications found in the TIP procedure were decreased by modifying the TIP procedure .[3,19]

Holland and Smith[16], in their series of 48 patients, reported meatal stenosis in 13% of cases, with flat urethral plates and urethral plates with deep grooves or moderate grooves not associated with any meatal stenosis. They reported urethra-cutaneous fistula in 55% of cases in the urethral plate with less than 8 mm width before relaxing incision, but no cases had developed fistula when the urethral plates were more than 8mm in width. In their finding, there was a significant difference between the two groups; they argued for careful evaluation of the urethral plate before contemplating tubularization incised plate urethroplasty, but in our study, the overall complication rate was not significantly different in either group of urethral plates.

Zhang et al.[8] has reported that urethral plate width is a potential risk factor for urethroplasty complication after TIP hypospadias repair. But by modifying the TIP procedure, the risk can be minimized, and this is observed in our study.

N. Guyen et al.[9] had found no meatal stenosis and only a 2% fistula rate in a large series of distal penile hypospadias repair. They concluded that most complications of the TIP procedure were related to technical factors rather than the intrinsic clinical parameters or varying anatomy. They had suggested sub-epithelial sutures to invert the epithelium and cover the neo-urethra with dartos flap to minimize fistula rate. To decrease the meatal stenosis, they suggested not tabularizing the urethral plate too far distally and to take care to leave the meatus oval and adequately sized. Singh

RB et al[17] and Jayanthi VR[18] emphasized the suturing technique to decrease the meatal stenosis.

As the observations made from our study show, we too agree that it is the technical expertise, skill, and experience of the surgeon that play an important role in obtaining successful outcomes of hypospadias surgery despite the various intrinsic anatomical and clinical parameters.

LIMITATIONS

The retrospective nature of the study and the gross inequality in the number of sample sizes in modified TIP urethroplasty as compared with Byar's two-stage procedure were the limitations.

CONCLUSION

Tubularized incised plate urethroplasty, or its modified version of including an extra 3mm to 4mm of penile skin lateral to the urethral plate on either side, was found suitable in the majority of the cases of distal penile hypospadias but not all. When distal penile hypospadias was associated with a thin membranous distal urethra more than 5mm and chordee and glans with a narrow groove, Byar's two-stage repair procedure was found suitable.

REFERENCES

1. Baskin LS, Ebbers MB. Hypospadias: anatomy, etiology, and technique. J. Pedi. S. 2006; 41, 463-472.

2. Snodgrass W. Tubularized, incised plate urethroplasty for distal hypospadias. J Uro. 1994; 151, 464-465.

3. Pfistermuller KL, McArdle AJ, Cuckow PM. Meta-analysis of complication rates of the tubularized incised plate (TIP) repair. J Pediatr Urol. 2015 Apr;11(2). doi: 10.1016/j.jpurol.2014.12.006. Epub 2015 Feb 26. PMID: 25819601.

4. Bush NC, Villanueva C, Snodgrass W. Glans size is an independent risk factor for urethroplasty complications after hypospadias repair. J Pediatr Urol. 2015;11(355):351-355.

5. da Silva EA, Lobountchenko T, Marun MN, Rondon A, Damiao R. Role of penile biometric characteristics on surgical outcome of hypospadias repair. Pediatr Surg Int. 2014;30:339–344.

6. Van der Horst HJR, de Wall LL. Hypospadias, all there is to know. Eur J Pediatr. 2017 Apr;176(4).

7. Zhou G, Yin J, Sun J, Liu X, Su J, Li S. Urethroplasty for chordee with a paper-thin hypoplastic urethra: A long-term study. 2022;l; 29(7):656-660.

8. Zhang B, Ruan S, Bi Y. Urethral plate in tubularized incised plate urethroplasty: how wide is enough? Transl Androl Urol 2021 Feb;10(2):703-709.

9. Nguyen MT, Snodgrass W. Effect of urethral plate characteristics on tubularized incised plate urethroplasty. J Urol 2004;171:1260-2.

10. Aboutaleb H. Role of the urethral plate characters in the success of tubularized incised plate urethroplasty. I J Pl Surg. 2024; 47(2): 227-231.

11. Bhattacharya S. A modified tubularized incised plate urethroplasty technique and a revised hypospadias algorithm. Indian J Plast Surg 2010;43:21-7.

12. Byars LT. A technique for consistently satisfactory repair of hypospadias. Surg Gynecol Obstet. 1955 Feb;100(2):184-90.

13. Yang T, Zou Y, Zhang L, Su C, Li Z, Wen Y. Byars two-stage procedure for hypospadias after urethral plate transection. J Pediatr Urol. 2014 Dec;10(6):1133-7. doi: 10.1016/j.jpurol.2014.05.002. Epub 2014 Jun 2.

14. Yang SS, Chen YT, Hsieh CH, Chen SC. Preservation of the thin distal urethra in hypospadias repair. J Urol, 2000; 164(1): 151-3.

15. Steckler RE, Zaontz MR. Stent-Free Thiersch-Duplay Hypospadias Repair With the Snodgrass Modification. Journal of Urology. 1997 Sep 1;158(3):1178–80.

16. Holland AJ, Smith GH. Effect of the depth and width of the urethral plate on tubularized incised plate urethroplasty. J Urol. 2000 Aug;164(2):489-91.

17. Singh RB, Pavithran NM. Lessons learned from Snodgrass TIP Urethroplasty: a study of 75 cases. Pediatr Surg Int 2004; 20:204-6.

18. Jayanthi VR. The modified Snodgrass hypospadias repair: reducing the risk of fistula and mental stenosis. J Urol 2003; 170(4 Pt 2): 1603-5.

19. Baccala AA, Ross JJ, Detore N, Kay R. Modified Tubularized incised plate urethroplasty (Snodgrass) Procedure for Hypospadias Repair. Urology, 2005; 66, 1305-1.

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