

NOVEL URETHROPLASTY TECHNIQUE: A PROSPECTIVE STUDY ON MEATAL STENOSIS RISK

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ABSTRACT

Background: Hypospadias is an abnormal opening of the urethral meatus on the ventral aspect of the penis. The aim of hypospadias repair is to create a normal continuous urethra with a wide, slit-like; scar free meatus. The incidence of meatal stenosis may range from 0 % to 23% in both national and international literature. In this study, we have introduced a novel technique for the quantification of urethral plate applicable to both adults and children.

Methodology: It was a prospective cohort study including 96 patients operated at an interval of one year. The width of the urethral plate taken as 2 or 3 cm depending on glans circumference. There is no incision around the site of neo-meatus. The rest of the technique for repair is the same as standard in Bracka repair, Snodgraft or Snodgrass.

RESULTS: Among 96 patients, 36 (37.5%) were 5 years or younger. In terms of urethral plate width, 36 (37.5%) had a width of 2, while 60 (62.5%) had a width of 3.1. The incidence of meatal stenosis is 0% after using the novel technique in all ages.

Conclusion: This hypospadias technique is a versatile technique. It is an easy to learn, reproducible and effective technique with a lesser degree of meatal stenosis. It can be applicable to all standardised techniques of hypospadias repair as one of its components.

KEYWORDS: Hypospadias, Meatal stenosis, Aivar Bracka repair, Snodgraft repair, Snodgrass repair, Dorsal Inlay graft

INTRODUCTION

Hypospadias is an abnormal opening of the urethral meatus on the ventral aspect of the penis. It is a common congenital genitourinary anomaly. There is incomplete development of the anterior part of urethra and it may be associated with chordee (1). It affects around 1 in 250 newborn males (2). The aim of hypospadias repair is to create a normal continuous urethra with a wide, slit-like; scar free meatus. Multiple procedures for urethroplasty have been described in literature to achieve these goals (3-4). The most common complications arise after urethroplasty include meatal stenosis, wound dehiscence, fistula formation, urethral stricture, infection and diverticula formation (4-5). However, one quarter of patients still require second procedure to deal with these complications (6).

Meatal stenosis is narrowing of urethra at the external meatus. It is a challenging problem for reconstructive surgeons especially secondary to urethroplasty. The incidence of meatal stenosis may range from 0 % to 23% in both national and international literature (7,8,9,10,11). The symptoms include difficulty in passing urine, deviated urinary stream, hard-to-aim, painful urination and spraying of stream. Clinical examination shows a pinpoint meatus usually with thin stream, forceful micturition and incomplete bladder emptying. (12) The initial treatment starts with urethral dilatation at an interval of time but severity may necessitate the need of meatoplasty as a last resort.

Hence, there are hundreds of surgical techniques available; to prevent these complications but one turned out to be seamless. In this study, we have introduced a novel technique for the quantification of urethral plate applicable to both adults and children. This technique can be implemented in Stage 2 Aivar Bracka repair, TIPS, TIPU and dorsal inlay graft with TIPU repair. Our aim is to identify the risk of meatal stenosis in urethroplasty after using the below defined technique.

METHODOLOGY

This study had been conducted in Northwest Hospital & Research center between July 2023 to June 2024. It was a prospective cohort study with non probability purposive sampling. The sample size was 96 by keeping the anticipated frequency of meatal stenosis after surgery 6.67% (12), confidence limit of 95% and 5% margin of error.

The ethical approval for the study protocol was taken (IRB & EC/2024-GH/0188). Consent for publication was obtained from all patients and their families of those under 18 years of age. A comprehensive clinical examination was conducted for all include participants and routine investigations performed to assess anesthesia fitness.

Inclusion criteria:

- All patients from 2 years to 45 years
- All hypospadias non syndromic cases ranging from distal to penoscrotal hypospadias
- All cases operated with urethroplasty technique including Stage 2 Aivar Bracka repair, TIPS, TIPU and dorsal inlay graft with TIPU repair.
- Minimum or no chordee.

Exclusion criteria

- Patients above 45 years
- Crippled hypospadias
- Hypospadias with ambiguous genitalia.
- The patients have major surgical problems other than hypospadias.
- Patients where surgery could not be done due to other medical problems such as Uncontrolled Diabetes Mellitus (DM), Bleeding disorder, Malignant diseases, etc.

Surgical Technique:

This technique is based on the marking of five 5 points.

- Point A (position of neomeatus)
- Point B (first angle observed on glans on right side of the glanular wing)
- Point B' (same as point B on the opposite side)
- Point C (second angle observed on the glanular wing on right side)
- Point C' (same as point C on the opposite side).

The width of the urethral plate should be 2 cm in cases of children (distance from point B to B'). Our technique is to make the urethral plate approximately 2 times of Nelatan catheter circumference. We make the width of the urethral plate 2 cm when the glans circumference is 2 cm and when the glans circumference is 3 cm or above, the urethral plate size can be made to 3 cm. There should be no scar around the new meatal position means no incision around A to B or A to B'. Hence, we choose the catheter size should be 8 F which can be easily accommodated in urethral tube formation in children; in cases of stage 2 Aivar Bracka repair. However, in cases of adults the size of the urethral plate should be 3 cm and should allow the catheter size of 12 F respectively. Similarly in cases of TIPS, TIPU and dorsal inlay graft technique, the urethral plate size has been taken the same as stated above, although the difference is to utilize a 10 F catheter in children and a 14 F catheter in adults respectively. The reason for using a wide bore catheter in above stated procedures is to prevent the neo urethra from scar contracture which can occur in the above stated technique. However, the rest of the technique for urethroplasty remains standardised as briefed by Aivar Bracka and Snodgrass respectively (13,14,15,16,17). Post operatively, oxybutynin used to prevent overactive bladder and spigot used to plug the Nelaton catheter. The spigot prevents the loss of bladder control in its emptying. The follow up visits of patients occurred at intervals of one week, one month, three months, six months and one year post operatively, during which complications were documented.

DATA ANALYSIS

Data were analyzed by using SPSS version 25. Mean $\pm$ Standard Deviation and Median (IQR) was calculated for Numerical/Quantitative Variables like age. Frequencies and percentage were calculated for Categorical variables like Urethral Plate Width (B to B'), occurrence of meatal stenosis, symptoms of meatal stenosis and treatment of meatal stenosis. The chi-square test was used to evaluate the relationship between Urethral Plate Width (B to B'), surgical procedure used, age categories and occurrence of meatal stenosis. The p value of less than and equal to 0.05 considered statistically significant.

RESULTS

The study included a total of 96 patients, with a median age of 7 years (IQR=7), ranging from 1 to 36 years. Among the patients, 36 (37.5%) were 5 years or younger, 32 (33.3%) were between 6-10 years, 15 (15.6%) were between 11-18 years, 3 (3.1%) were between 19-25 years, and 10 (10.4%) were older than 25 years. In terms of urethral plate width, 36 (37.5%) had a width of 2, while 60 (62.5%) had a width of 3.1. The majority of patients (82, 85.4%) underwent a 2-stage AB hypospadias repair, with 8 (8.3%) and 6 (6.3%) receiving Snodgrass and Snodgrass repairs, respectively. Complications, particularly meatal stenosis, were observed in 0 (0%) patients. Symptoms of meatal stenosis included spraying of the stream, difficulty in urination, post-void dribbling, and thinning of the stream, all

reported by none. There were no instances of patients being unable to void. Management of meatal stenosis included 1 (1%) patient undergoing meatoplasty and 2 (2.1%) patients receiving steroids with catheter self dilatation.

Table 1: Demographic and clinical characteristics of patients

Variable		N (%)
Age Category	≤ 5 years	36(37.5%)
	6-10 years	32(33.3%)
	11-18 years	15(15.6%)
	19-25 years	3(3.1%)
	> 25 years	10(10.4%)
Urethral Plate Width (B to B')	2	36(37.5%)
	3.1	60(62.5%)
Type of Procedure	2 stage hypospadias repair	82(85.4%)
	Snodgraft repair	8(8.3%)
	Snodgrass repair	6(6.3%)
Complication	Meatal Stenosis	0(0%)
Symptoms of Meatal Stenosis	Spraying of Stream	0(0%)
	Difficulty in Urination	0(0%)
	Post Void Dribbling	0(0%)
	Not Able to Void	0(0%)
	Thinning of Stream	0(0%)
Treatment	Meatoplasty	0(0%)
	Use of Steroids with Catheter Calibration	0(0%)

The table examines the association between meatal stenosis and various factors. It shows that there is no significant relationship between urethral plate width, or age category with the occurrence of meatal stenosis, as indicated by the p-values (0.24 and 0.185). Specifically, no cases of meatal stenosis were observed in patients with a urethral plate width of 2 and 3 cm and none of the patients developed meatal stenosis.

DISCUSSION

Hypospadias is a common congenital anomaly (12). Several congenital conditions are associated with hypospadias; include disorders of sex development (DSD), maldevelopment of gonads, disorders of androgen synthesis, or defective androgen actions.(18,19,20) The risk factors for the development of hypospadias are multifactorial. The surgical outcomes depend on several factors that are related to the patient, the technique, surgeon's expertise and postop care (21)

Urethrocuteaneous fistula, wound dehiscence, strictures, meatal stenosis, and diverticulum are the most significant complications after hypospadias correction.Meatal stenosis is still one of the most exigent and controversial complications(22). The objective of this contemporaneous study is to demonstrate a more reliable, easy to learn, reproducible, versatile technique which can be implemented to patients of all age groups.

The risk of meatal stenosis reported in our study is 0% showing the efficacy of our novel technique by achieving the scar free neomeatus. However, the study of Arshadi H et al. documented the risk to be 6.5 % after TIPS repair in proximal hypospadias (22) and may exceed to 53.33% in distal hypospadias (7). In a comparative study of Kocak OF et al. the incidence of meatal stenosis is more in Bracka repair (40%) than in Snodgrass repaired cases(35%)(23). It has been conveyed in a few systematic reviews that Dorsal inlay graft has been found to be superior to TIPU in decreasing meatal stenosis risk(24,25,26). Shimotakahara et al. also stated that Snodgrass technique with grafting the plate had an added value of minimizing the incidence of meatal stenosis and urethral stricture(27).Infact, few of the studies have clearly explained that the postoperative complications after hypospadias repair is not related to the surgical techniques and showed the association is not statistically significant(28).

The literature has shown a lot of difference in frequency of meatal stenosis after hypospadias repair even after using the same technique as seen in study of Sadoon HH, showing the incidence as 0% after 2 stage Bracka 's repair (29). This clearly reveals our purpose of study is to identify the cause of meatal stenosis and give a solution to it. The main

cause of meatal stenosis is the incision around the points A to B and A to B' and the width of the urethral plate. The incision should be avoided around the neo-meatal site and the width of urethral plate should be minimum two times of catheter's circumference and equal to glans circumference.

In our study, we have found the incidence of meatal stenosis is 0% after utilization of all standard techniques (i.e AB repair, Snodgrass and dorsal inlay graft). The reason for having meatal stenosis in Snodgrass and Snodgrass is most likely the scar contraction in these cases; after an incision on the urethral plate. However, the cause of meatal stenosis in Dorsal inlay graft is graft contracture. Hence, we can conclude that the incidence of meatal stenosis is very less after using Bracka's technique because the tissues get stabilised before the formation of the urethral tube(29).

Most studies have reported outcomes in the young boy who is <10 years old. However, our study has collected the outcome in grown ups also (31). Dale et al found that patients older than two years were more prone to postoperative complications than younger patients(32). However, our study negates this study by showing the incidence in older age groups as 3.1% in age 19-25 years. Hence, a few studies have shown no statistical difference between age and postoperative complications.(29,33,34). The studies have expressed the complication rates in adults are similar as in the pediatric age group(35) which is contrary to our study.

Children with meatal stenosis responded well to meatal dilatation (7) same as in adults showing remittance with self dilation in approx 50 % of patients. However, the other half of individuals may require augmentation urethroplasty or meatoplasty as a secondary procedure.(35-36). The urethral dilatation is the primary treatment for stenosis.(37-38) This is also reflective through our study showing remittance of symptoms in 66% by self dilatation only and only 1 patient treated with meatoplasty.

The follow up by patients is mandatory at regular intervals. All of our patients remain in follow-up for 12 months and 92% have shown up after 2 years. However, Batra et al. has shown only 64% of patients presented for their postoperative check within 3 months(39). The follow may vary in other studies (28), but there is a great need to have a long term follow up and then the incidence of complications may get documented better.

CONCLUSION

This hypospadias technique is a versatile technique with a smaller extent of complication. It is an easy to learn, reproducible and effective technique with a lesser degree of meatal stenosis. It can be applicable to all standardised techniques of hypospadias repair as one of its components.

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CONFLICT OF INTEREST:

There is no conflict of interest

DISCLOSURE INSTRUCTIONS:

None

REFERENCES

1. Khirallah M, El-Dossuky N. Hybrid mathieu urethroplasty: A simple modification outcomes. Research and Reports in Urology. 2021 Jul 5;473-8.
2. Wahyudi I, Raharja PA, Situmorang GR, Rodjani A. Associations between suturing techniques and suture materials with complications of tubularised incised plate urethroplasty: A systematic review and meta-analysis. Journal of Pediatric Surgery Open. 2023 Apr 1;1:100003.
3. Verla W, Van Nieuwenhuysse F, Hoebeke P, et al., Urethroplasty for failed hypospadias repair related strictures in adults: a retrospective analysis with long-term follow-up. Urology. 2020 Sep 1;143:248-54.
4. Kiliç S, Kaba M, Gecit İ. Comparative study in distal hypospadias repair: a meatal-based flaps technique vs. tubularized incised plate urethroplasty. BMC urology. 2024 Nov 11;24(1):249.
5. Zhang Y, Shen Z, Zhou X, et al. Comparison of meatal-based flap (Mathieu) and tubularized incised-plate (TIP) urethroplasties for primary distal hypospadias: A systematic review and meta-analysis. Journal of Pediatric Surgery. 2020 Dec 1;55(12):2718-27.
6. Halaseh, S.A.; Halaseh, S.; Ashour, M. Hypospadias: A Comprehensive Review Including Its Embryology, Etiology and Surgical Techniques. *Cureus* **2022**, *14*, e27544. [Google Scholar] [CrossRef] [PubMed]
7. Singhal VK, Al Khouli M, Suleman AM, Senofer N. The Clinical Outcome of Repair in Distal Hypospadias; A Tertiary Care Single Centre Experience. Medi Clin Case Rep J. 2024;2(1):180-3.
8. Springer A, Krois W, Horcher E. Trends in hypospadias surgery: Results of a worldwide survey. European urology. 2011;60(6):1184-9.

- 9.Khan F, Khan I, Shah SA, Tahir M, Hayat W. MEATAL STENOSIS: FREQUENCY OF MEATAL STENOSIS AFTER TWO STAGE BRACKA PROCEDURE FOR DISTAL PENILE HYPOSPADIAS. *The Professional Medical Journal*. 2018 Sep 10;25(09):1413-6.
- 10.Khan M, Majeed A, Hayat W, Ullah H, Naz S, Shah SA, et al. Hypospadias repair: A single centre experience. *Plastic surgery international*. 2014;2014:453039.
- 11.Yang T, Xie Q, Liang Q, Xu Y, Su C. Two-stage repair with long channel technique for primary severe hypospadias. *Urology*. 2014;84(1):198-201.
- 12.Leunbach TL, O'Toole S, Springer A, Williamson PR, Ahmed SF. A systematic review of core outcomes for hypospadias surgery. *Sexual Development*. 2020 Dec 20;13(4):165-70.
- 13.Bracka A. Hypospadias repair: the two-stage alternative. *British journal of urology*. 1995 Dec;76(6):31-41.
- 14.Snodgrass W, Bush N. Primary hypospadias repair techniques: A review of the evidence. *Urology annals*. 2016 Oct 1;8(4):403-8.
- 15.Bracka A. The role of two-stage repair in modern hypospadiology. *Indian Journal of Urology*. 2008 Apr 1;24(2):210-8.
- 16.Snodgrass W, Macedo A, Hoebeke P, Mouriquand PD. Hypospadias dilemmas: a round table. *Journal of Pediatric Urology*. 2011 Apr 1;7(2):145-57.
- 17.Manzoni G, Bracka A, Palminteri E, Marrocco G. Hypospadias surgery: when, what and by whom?. *BJU international*. 2004 Nov;94(8):1188-95.
- 18.Kalfa N, Philibert P, Werner R, et al. Minor hypospadias: the “tip of the iceberg” of the partial androgen insensitivity syndrome. *PLoS One*. 2013 Apr 30;8(4):e61824.
- 19.Eggers S, Sadein S, Van Den Bergen JA, et al. Disorders of sex development: insights from targeted gene sequencing of a large international patient cohort. *Genome biology*. 2016 Dec;17:1-21.
- 20.Nixon R, Cerqueira V, Kyriakou A, Lucas-Herald A, McNeilly J, McMillan M, Purvis AI, Tobias ES, McGowan R, Ahmed SF. Prevalence of endocrine and genetic abnormalities in boys evaluated systematically for a disorder of sex development. *Human Reproduction*. 2017 Oct 1;32(10):2130-7.
- 21.Springer A. Assessment of outcome in hypospadias surgery—a review. *Frontiers in pediatrics*. 2014 Jan 20;2:2.
- 22.Arshadi H, Sabetkish S, Kajbafzadeh AM. Modified tubularized incised plate urethroplasty reduces the risk of fistula and meatal stenosis for proximal hypospadias: a report of 63 cases. *International Urology and Nephrology*. 2017 Dec;49:2099-104.
- 23.Koçak ÖF, Avci V, Ayengin K. Comparison of Snodgrass and Bracka Methods In Terms Of Urethral fistula and Meatal Stenosis in Hypospadias Repair. *Eastern Journal of Medicine*. 2020;25(1):146-50.
- 24.Silay MS, Bhatt N, Quaedackers J, et al. Are there any benefits of using an inlay graft in the treatment of primary hypospadias in children? A systematic review and metanalysis. *Journal of Pediatric Urology*. 2021 Jun 1;17(3):303-15.
- 25.Fauzan A, Hidayatullah F, Salsabila S, et al. Comparison of the efficacy and safety of dorsal inlay graft urethroplasty (DIGU) method with tubularized incised plate urethroplasty (TIPU) method in primary distal hypospadias repair: a systematic review and meta-analysis. *Bali Medical Journal*. 2023 Jul 22;12(2):2251-7.
- 26.Borkar N, Tiwari C, Nair A, Mohanty D, Sinha CK, Mahajan JK. Tubularized incised plate urethroplasty and grafted tubularized incised plate urethroplasty: systematic review, meta-analysis and trial sequential analysis. *World Journal of Pediatric Surgery*. 2024;7(1).
- 27.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 Dec 1;46(12):2370-2.
- 28.Gabra A, Beyari BM, AlNuwaiser SJ, et al. Outcomes of Hypospadias Repair Based on Surgical Techniques: A 4-Year Retrospective Study. *Research and Reports in Urology*. 2024 Dec 31:79-87.
- 29.Sadoon HH, Abdulrazaq BH, Abdulrazaq GA. Evaluation of Two-Stage Bracka's Procedure with the Use of Oral Mucosa Graft in Proximal Hypospadias Repair. *IAR-Medical Series*. 2023 Nov 20;4:N-A.
- 30.Fihman M, Chertin L, Kocherov S, Jaber J, Chertin B, Dothan D. Re-do hypospadias surgery following failed previous repair: lessons learned over two decades of experience. *Pediatric Surgery International*. 2024 Dec;40(1):1-6.
31. Sinha I, Jones L, Smyth RL, Williamson PR. A systematic review of studies that aim to determine which outcomes to measure in clinical trials in children. *PLoS medicine*. 2008 Apr;5(4):e96.
- 32.Dale J, Woodward B, Elagami H. Age-dependent early complications of hypospadias repair: a single institutional experience. *Pediatric Surgery International*. 2023 Feb 11;39(1):115.
- 33.Bush NC, Holzer M, Zhang S, Snodgrass W. Age does not impact risk for urethroplasty complications after tubularized incised plate repair of hypospadias in prepubertal boys. *Journal of pediatric urology*. 2013 Jun 1;9(3):252-6.
- 34.Poerwosusanta H, Poerwosusanta AR, Poerwosusanta EE, Aditia D. Perioperative techniques and long-term outcomes in hypospadias: A systematic review. *Malays J Med Health Sci*. 2023 Sep 1.

- 35.Sahin C, Yeşildal C. Adult distal hypospadias repair: Case series. ESS Open Archive eprints. 2024 Jan;101:10140121.
- 36.Verma I, Sharma A, Sharma V. Standard Snodgrass tubularized incised-plate urethroplasty versus Mathieu technique combined with incision of the urethral plate in primary repair of distal and mid-penile hypospadias: A retrospective study. International Journal of Reconstructive Urology. 2024 Jul 1;2(2):197-202.
- 37.Mekki M, Fredj MB, Messaoud M, et al. The effectiveness of double dorsal dartos flap for urethroplasty coverage in distal hypospadias repair: A single surgeon approach to preventing urethrocutaneous fistula. International Journal of Urology. 2024 Aug 20.
- 38.Hossain MS, Islam S, Hossain MB, Roy AS, Ahmed ZU. The Outcome of a Single Stage Repair for Proximal Hypospadias in Otherwise Healthy Child at Mymensingh Medical College Hospital. Asian Journal of Pediatric Research. 2024 Jul 15;14(7):120-33.
- 39.Batra NV, Heiman J, Koehlinger J, et al. Adherence to Follow-up Ten Years after Hypospadias Repair. Journal of Pediatric Urology. 2024 Nov 22.