

Comparative study between Snodgrass technique with preputioplasty and Snodgrass technique with circumcision in treatment of distal hypospadias

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Abstract

Background: Hypospadias is a common congenital anomaly, affecting approximately 1 of 300 live male births making hypospadias the second most common birth defect in boys after cryptorchidism. There are more than 100 techniques for urethral reconstruction among these techniques the tubularized incised urethral plate (TIP) which was proposed by Snodgrass and has been the most popular technique for the repair of primary hypospadias. The aim of this work is to assess preputioplasty with Snodgrass technique in cases of distal hypospadias without severe chordea in comparison to correction of hypospadias with circumcision in Snodgrass technique regarding to the results and the outcome. **Methods:** This is a prospective randomized study that included 40 children with distal hypospadias. Our patients were randomized into two groups. Group 1: (20 patients) underwent Snodgrass technique with preputioplasty. Group 2: (20 patients) underwent Snodgrass technique with circumcision.

Results: In the present study, 18 (90%) of patients in group 1 was satisfied from surgery outcomes and 2(10%) weren't satisfied. the incidence of early complications was 8 (40%) of cases in group 1 while in group 2, was 5 (25%). The incidence of late complications was 4 (20%) cases in group 1 in group 2, was 6 (30%). **Conclusion:** Preputioplasty with Snodgrass urethroplasty does not increase the urethroplasty complication rate. In addition, we think that it adds an important cosmetic benefit, that is the normal appearance of penis compared with circumcision.

Key words: Snodgrass technique ; preputioplasty ;circumcision ; distal hypospadias

Introduction:

Hypospadias is the most common penile congenital malformation characterized by abnormal positioning of the urethral opening due to abnormal embryological development of the urethral fold and the ventral foreskin of the penis (1).

Although hypospadias incidence is 1 to 300 live births, hypospadias surgery is not considered routine daily work surgery because it is considered as reconstructive surgery and needs more experience to deal with. Hundreds of surgical techniques of hypospadias repair had been described with no single procedure dedicated as the gold standard for repair. Many techniques and modifications were developed to enhance the outcome of surgery (2).

Snodgrass has described tubulized incised plate (TIP) urethroplasty and since that time, it became the most popular technique for repair of distal penile hypospadias and some forms of proximal hypospadias. The main concern in all hypospadias surgeries is to get the penis straight with a slit-like orthotopic meatus for good urine outflow with good cosmeses for child self-satisfaction later on his life (3).

Many modifications had been made to enhance the TIP technique outcome. Despite all precautions, the complications such as meatal stenosis and fistula formation can develop indicating the importance of the

structural alteration in hypospadias patients and anatomical preoperative factors such as anogenital distance, meatal site, glanular shape, chordea degree, plate width and GMS score (1).

Hypospadias is almost always associated with an abnormality of the prepuce, resulting in an incomplete and hooded prepuce. Most surgical procedures for correction of hypospadias involve the use of foreskin for an adequate correction of the urethral defect. In Egypt and some countries, circumcision is performed routinely, considering the absence of the foreskin as an esthetic and functional result to be preferred to a normally retractable foreskin (4).

Some parents and the children themselves during school age consider this appearance unnatural and esthetically unacceptable, asking to preserve the integrity of the foreskin. Many hypospadiologists do not perform the foreskin reconstruction because prior studies have demonstrated inconsistent results with an increase in complications from urethroplasty (5).

Many studies confirmed the safety of preputioplasty, demonstrating that preputial reconstruction does not increase the urethroplasty complication rate. However, preputial reconstruction has specific complications such as partial or total dehiscence or phimosis (4).

The aim of this work is to assess preputioplasty with Snodgrass technique in

cases of distal hypospadias without severe chordee in comparison to correction of hypospadias with circumcision in Snodgrass technique regarding to the results and the outcome.

Patients and Methods

Patients:

This is a randomized prospective study that included 40 children with distal hypospadias. These patients were managed at Menoufia and Benha University Hospitals after taking the approval from the local ethical committee (MD23-11-2019) and obtain an informed consent from the parents. All patients meeting the inclusion criteria were subjected to our study after proper history taking, full clinical examination and required preoperative investigations. The study period was from December 2021 till August 2022.

By computer assisted randomization or card system our patients were randomized into two groups:

Group A : (20 patients) underwent Snodgrass technique with preputioplasty .

Group B: (20 patients) underwent Snodgrass technique with circumcision.

Inclusion criteria:

Repair of hypospadias in boys ;

1. Age until age of 12 years old;

2. Distal hypospadias.

Exclusion criteria:

Repair of hypospadias in boys ;

1. Severe chordee;
2. Circumcised children;
3. Recurrent cases.

Methods:

Preoperative assessment

Preoperative Assessment

A. History taking:

- **Mother:** Age, Occupation, previous pregnancy, infertility and drug intake, bleeding in early pregnancy and single or twin pregnancy.
- **Father:** Age, occupation, same condition.
- **Family history:** For the same condition.
- **Brothers:** for the same condition.
- **Medical history:** Associated anomalies and medical history.

B. General examination:

- For associated anomalies, and general well-being.

C. Local examination:

- **Penis:** Size, Prepuce size, glanular size, meatus site, urethral plate width and length, chordee.

- **Scrotum:** Development, bifid or not, transposition.
- **Testes:** Presence or absence, size, hernia sac.

D. Laboratory investigation:

Routine tests as complete blood count, prothrombin concentration, liver function, kidney function and urine analysis.

E. Radiology: Not routine

Every case was documented on the basis of completion of this sheet.

Data for Distal hypospadias:

- **Personal data:** as birth date, name, hospital number, address, mobile number... etc.
- **Preoperative assessment:** as history and family history (Consanguinity and similar condition).
 - **Mother:** age, occupation, previous pregnancies & offspring and drugs during pregnancy.
 - **Medical history:** included associated anomalies and medical diseases:
- **Clinical examination:** included general and local examination:
 - **Penis:** (size, prepuce, glans, meatus, urethral plate length and width, also chordee).
 - **Scrotum:** (size, bifid, transposition, and testes).

- **Preoperative hormonal therapy:** (route, duration and effect).
- **Operative data:** (date of operation, age at time of operation, operator, duration, hemostasis, sutures, catheter and dressing).
- **Post-operative:** (removal of dressing, dressings, catheter removal, and early complications included: bleeding, edema, infection, disruption, urine retention and stenosis).
- **Outcome:** (chordee, glans, meatus, site, caliber, urethra, stream, caliber and fistulae).

Data for follow-up:

A) Personal data: (birth date, name, hospital number, address and mobile number).

B) Operation: (Type of hypospadias, Type of operation, early complication and late complication).

C) Voiding: (after toilet training)

- **Questionnaire:** (Satisfaction with voiding, Stream, Spraying and straining, Stand /sit and Post voiding dribbling).
- **-Uroflow:** (Volume and Qmax).
- **Ultrasound:** (Residual volume and Prostate).
- **Score:** International prostate symptom score

D) Cosmosis:

- **Questionnaire:** Concern about abnormal appearance and satisfaction with result.
- **Examination:** (penile size, ashamed/fear of undressing, being ridiculed and curvature).
- **Score:** (junior genital perception scale, PPS and HOPE).

E) Psychology: (school age and older)

- **Questionnaire:** (Goldberg general health questionnaire, pediatric quality of life inventory, Spielberger

state-trait anxiety questionnaire, Minnesota multiphasic personality inventory and child behavior checklist).

Operative technique:

Snodgrass technique (TIP):

All procedures were performed under general anesthesia with caudal anesthesia for postoperative analgesia. First we ensure sterilization by bovidone iodine solution (Betadine solution) then; examination under anesthesia (**Figure 1**).



Figure(1): Sterilization of the glans and examination

A 4-0 suture is placed into the glans in a sagittal orientation for traction and to later secure the urethral catheter. 6F or 8F Foly's catheter, Nelaton catheter or Silicone catheter is passed into the hypospadiac meatus. Then we put a tourniquet at the root of the penis or injection of diluted adrenaline. Circumferential incision is made about 5 mm from the coronal sulcus and, a U shaped incision is extended proximally to healthy

skin about 2mm from the hypospadiac meatus, the lines of incision are immediately adjacent to the longer urethral plate. The penis may be degloved just around the incision or to the penoscrotal junction. Then the plate is separated from the glans by parallel incisions and the glans wings are mobilized laterally. After that a midline relaxing incision is made from within the meatus to the distal extent of the plate. This

incision extends through the epithelial surface of the plate deeply into underlying connective tissues down to the corpora cavernosa. With the surgeon and assistant maintaining counter-traction using fine forceps, division of the plate is observed to significantly widen it until further incision yields no additional mobility. This midline relaxing incision is made by a knife. Plate configuration determines the depth of this relaxing incision. When the urethral plate is flat, the incision will obviously be deeper than when the plate is already naturally

grooved. Then the urethral plate is tabularized using a 6-0 vicryle with round needle through and through subcuticular continuous sutures in two layers. The entire neourethra is covered by a thin dartos pedicle mobilized and sutured to cover the neourethra.

1- Snodgrass technique (TIP) with preputioplasty:

After completion of standard Snodgrass TIPU, 2 stay sutures were placed at the mucocutaneous junction on either sides and the prepuce is stretched **Figure 2**.



Figure (2):Elevation and stretch at the mucocutaneous junction in both sides of the prepuce.

A plane was opened on both sides and dissected into three separate layers: inner layer, dartos fascia and outer preputial skin. With vicryl 6/0 the prepuce is reconstructed in 3 layers using interrupted sutures for the inner and dartos layer while continuous subepithelial suture for preputial skin. To prevent preputial stenosis, on reaching the

level of the glans tip, the vertical skin incision at the distal end was transversely stitched using interrupted sutures making the preputial ring wide. The retractability of the preputial hood over the glans is checked and viewed as sufficient when the prepuce can easily be rolled over the glans.

2- Snodgrass technique (TIP) with circumcision:

After completion of standard Snodgrass TIPU, Excess terminal skin is equally excised from both sides for circumcision **Figure 3**.



Figure (3): Circumcised penis after Snodgrass technique (TIP).

After completing skin closure, the urinary catheter is secured by the suture which was taken in the glans. Then, the penis is dressed by a gauze dressing after application of topical antibiotic ointment. The catheter is maintained for about 7 to 10 days.

Postoperative care:

All patients had daily clinical evaluation during the admission period and follow up visits after discharge **Figures 4-5**.



Figure (4): 2 months post-operative in patient underwent Snodgrass technique with preputioplasty.



Figure (5): 7th day post-operative in patient underwent Snodgrass technique with circumcision.

Statistical methods:

- The collected data was tabulated and presented in suitable figures.
- Quantitative data was summarized using mean and standard deviation, while, qualitative data by using frequency and percentage.
- The collected data were tabulated and analyzed using SPSS version 24 software (Spss Inc, Chicago, ILL Company). Categorical data were presented as number and percentages. Chi square test (χ^2), were used to analyze categorical variables. Quantitative data were expressed as mean \pm standard deviation, median and range. Student "t" test was used to analyze normally distributed variables among 2 independent groups. P value was set at < 0.05 for significant results

and < 0.001 for highly significant results.

Beneficiaries:

All patients that underwent our procedures had direct benefit from the management in the form of correction of the deformity and restore the optimum function and aesthetic form.

Ethical consideration:

An informed consent was obtained from patients before participation. An approval from the research ethics committee in Benha Faculty of Medicine was obtained.

Results:

The operation time was 72.5 min. in average in group 1 ranging between 60 to 85 min. and was 58.5 min in group 2 ranging between 50 to 70 min. There was a statistically

significant difference between both groups regarding operation time ($p < 0.0001$) (**Table 1**).

The mean of hospital stay duration in group 1 was 3.4 days ranging between 2 to 5 days versus 2.3 days (ranging between 2 to 3 days) in group 2. Hospital stay was extended until all early complication resolved like edema and hematoma.

There was a statistically significant difference between both groups regarding duration of operation ($p = 0.0005$) (**Table 2**).

18 (90%) of parents in group 1 were satisfied from surgery outcomes and 2(10%) weren't, while in group 2, 14 (70%) of parents were satisfied from surgery outcomes and 6(30%) weren't. There was no statistically significant difference between both groups regarding parents' satisfaction ($p = 0.118$) (**Table 3**). The incidence of early complications was 8 (40%) of cases in group 1, in contrast to 5 (25%) in

group 2. In group 1, edema happened in 4(20%) of cases, preputial dehiscence, irregular preputial hood in 3 (15%) of cases and infection in one (5%) case. In group 2, edema happened in 2(10%) of cases, glans dehiscence in one case (5%), and infection in two cases (10%). There was no statistically significant difference between both groups regarding early complications ($p = 0.2079$) (**Table 4**).

The incidence of late complications was 4 (20%) cases in group 1 while in group 2, it was 6 (30%). In group 1, urethra-cutaneous fistula happened in two (10%) cases, meatal stenosis in one (5%) case and urethral stricture in one (5%) case. In group 2, urethra-cutaneous fistula happened in 4 (20%) cases, meatal stenosis in 2 (10%) cases. There was no statistically significant difference between both groups regarding late complications ($p = 0.435$) (**Table 5**).

Table (1) : Duration of operation in both groups

		Group 1	Group 2	t	p
Duration of operation	Mean	72.5000	58.5000	5.913302	<0.0001
	Std. Deviation	8.35086	6.50910		
	Minimum	60.00	50.00		
	Maximum	85.00	70.00		

Table (2) : Length of hospital stay in both groups

		Group 1	Group 2	t	p
Length of hospital stay	Mean	3.4000	2.3000	-3.98186	0.0005
	Std. Deviation	1.14248	.47016		
	Minimum	2.00	2.00		
	Maximum	5.00	3.00		

Table (3): Parents' satisfaction in both groups

		Group 1		Group 2		X2	p
		Frequency	Percent	Frequency	Percent		
Parents' satisfaction	satisfied	18	90.0	14	70.0	2.55	0.118
	not satisfied	2	10.0	6	30.0		

Table (4) : Early complications in both groups

		Group 1		Group 2		X2	p
		n	%	n	%		
Early complications	Edema	4	20	4	10	4.55	0.2079
	Glans dehiscence	0	0	1	5		
	Preputial dehiscence, irregular preputial hood	3	15	0	0		
	Infection	1	5	2	10		
Total		8	40	5	25		

Table (5) : Late complications in both groups

		Group 1		Group 2		X2	p
		n	%	n	%		
Late complications	urethrocutaneous fistula	2	10	4	20.0	1.667	0.4346
	Meatal stenosis	1	5	2	10		
	Urethral stricture	1	5	0	0		
Total		4	20	6	30		

Discussion

In the present study, the operation time is 72.5 min. in average in group 1 ranging between 60 to 85 min. This results were near to **Hussein and Abdel-Aal, (6)** study as they reported a time operation of 81 ± 19.8 min which ranged from 40 to 100.

In the present study, the operation time is 58.5 min in group 2 ranging between 50 to 70 min. There is a statistically significant difference between both groups regarding operation time ($p < 0.0001$)

In the same line with **Rady et al., (7)** study, the average time for Snodgrass technique with circumcision was 65.64 minutes \pm 8.76. Also, **Hamid et al., (8)**, revealed that the mean operative time in 52 cases that did TIP repair was 63.7 ± 14.3 (45-90) minutes.

The operative time is longer in **Eldeeb et al., (9)** than our studies for patients who underwent the Snodgrass procedure: 78 min. (55–95 minutes)

In the present study, the mean of length of hospital stay in group 1 is 3.4 days ranging between 2 to 5 days. Hospital stay extended until all acute complication resolved like edema and hematoma.

In coordination with our results, **Haider et al., (10)** reported the mean hospital stay was 2.83 ± 1.33 days. while **Hashish et al. (11)** mentioned that the hospital stay was 2 to 10 days

In the present study, the mean length of hospital stay in group 2 is 2.3 days ranging between 2 to 3 days. There is a statistically significant difference between both groups regarding hospital stay ($p = 0.0005$)

The hospital stay is longer than our study which is due to different health assurance protocols in different countries. In **Maheshwari et al., (12)** study the average period of hospital stay was 7 days.

The hospital stay duration ranged between 5 and 10 days in **Al-Awadi et al., (13)** study and in **Bhat study**, the average period of hospital stay was 7 days.

In the present study, 18 (90%) of the parents in group 1 was satisfied from surgery outcomes and 2(10%) weren't.

Also, in **Bhat et al., (14)** twenty four (88.88%) patients and/or their parents were fully satisfied with the outcome of surgery and cosmosis.

In **Kallampallil et al., (5)** study, all parents were satisfied after hypospadias repair with preputioplasty. Also, in **Hayashi et al., (15)** study, a satisfactory cosmetic result was achieved in all 11 patients involved in his study.

In the present study in group 2, 14 (70%) of the parents were satisfied from surgery outcomes and 6(30%) weren't satisfied. There was no statistically significant difference between both groups regarding parents' satisfaction ($p=0.118$).

It was same to **Salam et al., (16)** study as the satisfactory cosmetic and functional outcomes were observed in 49 patients (94.23%) of group-A (circumcision) and all families of group-B (preputioplasty) were happy with aesthetic and functional outcomes.

In Rady et al., (7), evaluating the appearance shows a satisfactory overall appearance for both groups.

Also, in **Maheshwari et al., (12)**, all the patients/parents (in the case of minors) were satisfied with the final cosmesis, urinary stream, and appearance of the penis at 3 months.

In the present study, the incidence of early complications was 8 (40%) of cases in group 1 while in group 2, it was 5 (25%). In group 1, edema was advanced in 4(20%) of cases, preputial dehiscence,/irregular preputial hood in (3 (15%) of cases and infection in one (5%) case.

Only 2 (3%) in **Snodgrass et al., (17)** had glans dehiscences while, in **Shoor et al., (18)** study 3 of the 48 (6.25%) patients had complete dehiscence of reconstruction which in the long term appeared as an irregular preputial hood.

The most common complication in **Castagnetti et al., (19)** study was preputial dehiscence, which cumulative prevalence was 5.7% (121 of the 2115 patients)

In the present study, in group 2, edema was advanced in 2(10%) of cases, glans dehiscence in one case (5%), and infection in two cases (10%). There was no statistically significant difference between either groups regarding early complications ($p=0.2079$).

In Guler et al., (20) study glans dehiscence developed in 8 cases (4.9%) of circumcision group, with meatus dehiscence or meatus moving towards the coronal region in 9 cases.

In the present study, the incidence of late complications was 4 (20%) cases in group 1 and 6 (30%) in group 2. In group 1, urethro-cutaneous fistula was advanced in two (10%) cases, meatal stenosis in one (5%) case and urethral stricture in one (5%) case.

It was near to **Winberg et al., (21)** study, as the frequency of urethro-cutaneous fistula was 90 (13%).

In Workineh et al., (22) study, overall, 49 patients (38%) developed complications. Eighteen patients (14%) developed early complications whereas forty-two (32.6%) patients had late complications. UCF and meatal stenosis occurred in 27 (20.9%) & 14 (10.9%) patients respectively. Seven patients developed recurrent hypospadias and dehiscence of glans occurred in eight patients (6.2%).

In a meta-analysis done by **Winberg et al., (21)** on 17 studies, postoperative urethro-cutaneous fistula was assessed in 1572 patients. Fistula was the most common observed and reported complication in 13% (205/1572) of all studies.

In the present study, in group 2, urethro-cutaneous fistula was in 4 (20%) cases, meatal stenosis in 2 (10%) cases. There was no statistically significant difference between either groups regarding late complications ($p=0.435$).

In **Al-Awadi et al., (13)** study, the success rate was 93.3% and complications were reported in just 2 patients [6.7%], complications were in the form of edema 6.7%, urethro-cutaneous fistula [UCF] among 6.7% and skin infections among 3.3%. Otherwise, no patients had disruption, urethral stenosis or hematoma.

An early post-operative complication in **Maheshwari et al., (12)** study was preputial oedema and bladder spasm developed in 1 (4.7%) patient each. Meatal stenosis developed in 1 (4.7%) patient. None developed urethra-cutaneous fistula.

Excellent or good results were achieved in 39 patients in **Bhat et al., (14)** study, in group I and in 38 patients in group II. Early post-operative complications of Clavien Classification grade II were mainly mild prepuccial edema in 5 cases each in both groups, and hematoma in one patient in group I and two patients in group II, the difference in two group was not statistically significant ($p =0.585$). A urethral fistula was noticed in one case in group I & in 2 cases in group II. One patient in group II had

complete disruption of the wound. The fistulae and urethral disruption of Clavien Classification grade IIIb was repaired successfully. Mild meatal stenosis was noted in 3 cases each in both the groups and was successfully treated by meatal calibration (Clavien Classification grade IIIa). There was no statistically significant difference in early and late complications in both groups.

In **Gite et al., (23)** one patient had hematoma who was re-explored on the same day. He had no active bleeding except oozing and clots which were evacuated. Urethroplasty site was intact without any problem. His coagulation profile was done and found to be abnormal which was treated as per protocol. In another case, there was complete dehiscence of repair on a patient who underwent TIP urethroplasty after 6 months successfully. One patient had superficial skin blackening which was resolved with conservative treatment. Only one patient had meatal stenosis in the early part of our experience who needed correction. Urethro-cutaneous fistula developed in four cases. In all cases, fistula was at hypospadiatic meatus site, and they were successfully repaired with Durham-Smith pant-over-waist technique after 6 months.

The common complications associated with TIPU include urethra-cutaneous fistula, glans dehiscence, meatal stenosis, urethral

stricture, urethral diverticulum, lichen sclerosis, and recurrent penile curvature. The most common is the formation of urethra-cutaneous fistulas (> 60%). Various procedures and techniques have been described to reduce the incidence of fistula formation. However, no single technique can claim to achieve complete success. One of the most important factors is the protective intermediate vascularized layer between the neourethra and skin. The commonly harnessed intermediate layer includes the tunica vaginalis flap, dorsal preputial dartos flap, and spongioplasty, among others (14).

Between January 2007 and December 2011, 445 patients aged between 8 and 120 months underwent surgical correction of hypospadias (4). In 354 out of 445 patients, we performed the reconstruction of the foreskin. Urethroplasty was performed according to either the TIPU (tubularized incised urethral plate urethroplasty; Snodgrass) technique (233/354, 66%) or MAGPI (meatal advancement glanduloplasty incorporated) procedure (121/354, 34%).

Conclusion:

Preputioplasty with Snodgrass urethroplasty does not increase the urethroplasty complication rate. In addition, we think that it adds an important cosmetic benefit, that is the normal appearance of penis compared with circumcision.

References:

1. **Abdelhalim, K. M., Abdelwahab, H. A., Abdelgawad, E., Kadry, A. M., & Sherief, M. H. (2021).** Predictors of successful outcome of tubularized incised plate for primary distal hypospadias repair. *African Journal of Urology*, 27(1), 1-7.
2. **Stein R (2012)** Hypospadias. *Eur Urol Suppl* 11:33–45
3. **Snodgrass WT (2004).** Consultation with the specialist: hypospadias. *Pediatr Rev* 25(2):63–67
4. **Esposito, C., Savanelli, A., Escolino, M., Giurin, I., Iaquinto, M., Alicchio, F., et al. (2014).** Preputioplasty associated with urethroplasty for correction of distal hypospadias: A prospective study and proposition of a new objective scoring system for evaluation of esthetic and functional outcome. *Journal of Pediatric Urology*, 10(2), 294–299.
5. **Kallampallil, J., & Hennayake, S. (2013).** Foreskin retractility following hypospadias repair with preputioplasty – Medium term outcomes. *Journal of Pediatric Urology*, 9(6), 1204–1209.
6. **Hussein, H., Abdel-Aal, A. A. (2006).** Repair of Distal hypospadias with foreskin reconstruction provides a better anatomical penile appearance with a Favorable Outcome. *Med J Cairo Univ*, 74, 1-7.
7. **Rady, M. K., Abdalla, M. R., Abdelrahman, M. F., & Mohamed, A. S. (2022).** Outcomes of Snodgrass (TIP) versus Slit Like Adjusted Mathieu (SLAM) in distal penile hypospadias repair in pediatrics. *Minia Journal of Medical Research*, 33(1), 80-87.
8. **Hamid R, Baba AA, Shera AH. (2014)** Comparative Study of Snodgrass and Mathieu's Procedure for Primary Hypospadias Repair. *ISRN Urology*;2014: 249765.
9. **Eldeeb, M., Nagla, S., Abou-Farha, M., & Hassan, A. (2020).** Snodgrass vs Snodgraft operation to repair the distal hypospadias in the narrow urethral plate. *Journal of Pediatric Urology*, 16(2), 165-e1.
10. **Haider, N., Hashim, I., Iqbal, M. A., Wasti, A. R., Chaudhary, S. H., Ahmad, A., et al. (2019).** Outcome of urethral mobilization and advancement after anterior hypospadias surgery. *Annals of Pediatric Surgery*, 15(1), 1-4.

11. **Hashish MS, Elsawaf MI, Moussa MA. (2017)** Urethral advancement procedure in the treatment of primary distal hypospadias: a series of 20 cases. *Ann Pediatr Surg.* 2017;13(1):29–37.
12. **Maheshwari, M., Gite, V. A., Agrawal, M., Sankapal, P., Shaw, V., Sharma, S., et al. (2022).** Outcome of spongioplasty alone as second layer of tubularised incised plate urethroplasty in patients with hypospadias. *African Journal of Urology*, 28(1), 1-7.
13. **Al-Awadi, A. S., Megahed, H. A., Ahmed Shahin, M. M., & Abdul Aziz, F. A. (2021).** The Use of Autologous Platelet Rich Fibrin Membrane as a Second Layer in Snodgrass Repair of Distal Hypospadias. *International Journal of Medical Arts*, 3(2), 1377-1383.
14. **Bhat, A. , Singla, M. , Bhat, M. , Sabharwal, K. , Kumar, V. , Upadhyay, R. et al. (2014)** Comparison of Results of TIPU Repair for Hypospadias with “Spongioplasty Alone” and “Spongioplasty with Dorsal Dartos Flap”. *Open Journal of Urology*, 4, 41-48.
15. **Hayashi, Y., Kojima, Y., Mizuno, K., Maruyama, T., Tozawa, K., & Kohri, K. (2008).** Modified foreskin reconstruction for distal hypospadias and chordee without hypospadias. *International journal of urology*, 15(7), 646-648.
16. **Salam A, Islam W, Hooda N, Islam F, Alam M. (2015).** Comparison between Outcomes of Tubularized Incised Plate Urethroplasty and Modified Tubularized Incised Plate Urethroplasty in the Primary Management of Distal Hypospadias. *Congress of the société internationale d’urologie*. 3 (17)
17. **Snodgrass, W., Nicholas Cost, Paul A. Nakonezny, Nicol Bush, (2011).** Analysis of Risk Factors for Glans Dehiscence After Tubularized Incised Plate Hypospadias Repair, *The Journal of Urology*, Volume 185, Issue 5, Pages 1845-1851, ISSN 0022-5347,
18. **Shoor, G., Sugandhi, N., Acharya, S. K., Chakraborty, G., Teckchandani, N., Dixit, A., et al. (2020).** Outcomes of preputioplasty in patients undergoing TIP urethroplasty (tubularization of incised urethral plate) for distal and mid penile hypospadias. *Journal of Pediatric Urology*, 16(3), 319-e1.
19. **Castagnetti M, Gnech M, Angelini L, Rigamonti W, Bagnara V, Esposito C. (2016).** Does preputial reconstruction increase complication rate of hypospadias repair? 20-year systematic review and meta-analysis. *Front Pediatr*;4:41.
20. **Güler, Y. (2020).** TIPU outcomes for hypospadias treatment and predictive factors causing urethrocutaneous fistula and external urethral meatus stenosis in TIPU: clinical study. *Andrologia*, 52(9), e13668.
21. **Winberg, H., Arnbjörnsson, E., Anderberg, M., & Stenström, P. (2019).** Postoperative outcomes in distal hypospadias: a meta-analysis of the Mathieu and tubularized incised plate repair methods for development of urethrocutaneous fistula and urethral stricture. *Pediatric surgery international*, 35(11), 1301-1308.
22. **Workineh, S. T., Woldeselassie, H. G., Temesgen, F., Taddese, A., Negussie, T., Kiflu, W., et al. (2022).** Outcomes of Tubularized Incised Plate Urethroplasty (TIPU) for Hypospadias at Tikur Anbesa Specialized and Menelik II Referral Hospitals: One-year Prospective Cohort Study. *Urology*, 168, 189–194.
23. **Gite, Venkat A.; Kandi, A. J.; Bote, S. M.; Nikose, J. V.; Patil, S. R. (2018).** Outcome of Snodgrass Repair for Various Types of Hypospadias: Our Experience. *Indian Journal of Surgery* , vol. 81, no. 3, 2018, pp. 216–220.

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