International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Review of Hypospadias Surgeries in Children

Akshat Sudhanshu[1], Samia Mohan[2], Priyanka Sharma[3], Amara Parvez Malik[4]

[1]Assistant Professor, Department of Surgery, Acharya Shri Chander College of Medical Sciences and Hospital, Jammu, India

[2]Assistant Professor, Department of Surgery, Acharya Shri Chander College of Medical Sciences and Hospital, Jammu, India

[3]Lecturer, Department of Microbiology, Government Medical College, Jammu, India

[4]Postgraduate Student, Department of Microbiology, Acharya Shri Chander College of Medical Sciences and Hospital, Jammu, India

Abstract: ***Hypospadias is the most common congenital deformity of male external genitalia. Hypospadias is a congenital deformity in which there is incomplete development of the urethra and presents with an abnormal, proximally placed urethral opening on the ventral aspect of the penis or even in the perineum. Aim of this article is to review literature of the various studies of treatment of hypospadias.***

Keywords: Hypospadias, urethral plate

1. Introduction

Hypospadias is the third most common congenital deformity after clubfoot and hydrocele, with an incidence of 3–4 per 1000 live births. Proximal penile, penoscrotal and scrotal types account for 20% of all cases [1, 2].

There have been many operations described for hypospadias. The earliest record of surgery for hypospadias was in 100–200 AD by Heliodorus and Antyllus, where the end distal to the abnormal meatus was amputated [3]. Since then there have been many operations described in the General Surgical, Urological, Pediatric Surgical and Plastic Surgical literature. This reflects the difficulty in getting optimum results from the surgery for this condition. Horton, Devine and Baran traced the pictorial history of Hypospadias repair [3].

2. Aims and Objectives

To evaluate the long term outcomes of different hypospadias surgeries like:-

- Surgical complications like Glans dehiscence, fistula formation, meatal stenosis etc.
- Need for Redo surgery.

3. Review of Literature

In 1994, Snodgrass W devised his technique of tubularised incised plate urethroplasty (TIPS) making narrow urethral plate wide enough for easy tubularization and provide vertically oriented neomeatus. Key step was to divide urethral plate by deep sagittal incision in midline. No fistulas occurred in postoperative period in 16 patients. They concluded that the key step in the procedure is the deep sagittal incision of the urethral plate which allows for its subsequent tubularization. [4]

In 1973, Smith D described de-epithelialized skin overlap flap for hypospadias. He reported only one fistula in 51 patients. However, he initially used it exclusively for two stage procedure. But with subsequent experience de-epithelialized skin was used to reinforce neourethra as second layer in single staged surgeries. [6]

In 1986, Snow BW performed tunica vaginalis blanket wrap in 22 patients among which 10 had a transverse preputial island pedicle flap, 6 had a transverse preputial island on lay flap, 2 had a Mustarde repair and 1 had a Mathieu repair. There were no urethrocutaneous fistulas in any of these patients with a follow up of 1 to 14 months. [7]

In 1988, BelmanAB reported the results in 84 hypospadias repairs using a de-epithelialized skin flap. A variety of single stage repairs were applied. In each repair a flap of transposed prepuce was swung ventrally, de-epithelialized and applied over the urethroplasty. UCF formed in 3 patients and reoperation was required in 7 patients. [8]

In 1995, Garibay JT, Reid CandGonzalezR retrospectively reviewed the records of 32 patients to determine the role of uroflowmetry in the evaluation of the functional results of hypospadias repair. Patients with a plateau pattern and a maximum flow rate 2 SD below the mean on more than 1 determination were considered to have urethral obstruction.7 patients had uroflow evidence of urethral stenosis among which 4 responded to dilation and 3 needed repeat urethroplasty for strictures. Only 2 of the 7 patients with strictures were symptomatic. [9]

In 1997, Malyon D, Boorman JG and BowleyN performed Uroflowmetry on 140 occasions in 90 patients with hypospadias before and after reconstructive surgery. Children with hypospadias tended to have lower maximum urinary flow rate for volume voided than the general population, lying around the population 5th centile. This was observed before any surgery was performed, and appeared from cross-sectional data to be unaffected by surgery. They also found that interventions were not required in most patients as they were asymptomatic. ([10]

In 1998, Yamataka A developed a new simple technique to prevent UCF wherein the readily available external spermatic fascia surrounding the testis and cord was used as a pedicled blanket flap to cover the neourethra or the site of closure of a UCF. In 3 patients who had urethroplasty for hypospadias no UCF developed. It was also effective for closure of UCF in 5 patients. [11]

In 2000, Yerkes and colleagues described the Y to I spongioplasty that uses the distal spongiosum to wrap around the neourethra. They mobilized this tissue with the urethral plate away from the corpora cavernosa, subsequently wrapping it around various types of urethroplasty to prevent fistula formation in 25 patients. They noted no fistula or major residual chordee at 1 year of follow up with use of spongioplasty as intermediate layer. [12]

In 2003, ZakiA determined the role of uroflowmetry in the evaluation of the functional results of one-stage urethroplasty with parameatal foreskin flaps (OUPF) technique in 21 patients.12 children had Qmax above the 25th, 6 between the 5th and 25th and 3 less than the 5th percentiles of the normal population. A normal bell-shaped flow curve was obtained in 17 (80.6%) of the children. [13]

In 2005, Djordjevic evaluated the importance of neourethral covering using vascularized dorsal subcutaneous tissue for preventing fistula in the Snodgrass hypospadias repair on 67 children A longitudinal dartos flap was harvested from excessive dorsal preputial and penile hypospadiac skin, and transposed to the ventral side by a buttonhole maneuver; it was sutured to the glans wings around the neomeatus, and to the corpora cavernosa over the neourethra. He found that at a mean follow-up of 21 months, the result was successful, with no fistula or urethral stenosis, in all 67 children. [14]

In 2006, Gupta V and Sharma SB evaluated the efficacy of fascia lata graft in hypospadias repair in 10 patients with paucity of subcutaneous dartos pedicle or tunica vaginalis flap. In all the cases, the reconstructed neourethra was reinforced with blanket wrap of fascia lata graft, harvested from lateral aspect of mid-thigh. There were no complications experienced and none of the cases developed urethrocutaneous fistula. The cosmetic results were satisfactory. [15]

In 2006 Holmdahl G evaluated early uroflowmetry in 126 boys as a method for the diagnosis of neourethral stricture following hypospadias repair. Uroflowmetry was performed just once (at 2 months) in 49% of patients and twice (at 2 months and 12 months) in 30% of patients. If obstruction indicated by Qmax<10 ml/s or clinical symptoms indicative of obstruction, calibration of the neourethra was performed. Among the patients who underwent a single uroflowmetry session with DPH had a mean flow rate of 10.6 ml/s, with maximum flow rates of <10 ml/s recorded in 49% of patients. Among the patients who underwent two uroflowmetry sessions those with distal hypospadias had a spontaneous increase in maximum flow rate irrespective of whether or not interventions had been performed. [16]

In 2007, El-Kassaby AW, Al-Kandari AM et al presented their experience with a modification of tubularized incised plate (TIP) urethroplasty in 764 children with primary anterior penile hypospadias. The technique involved in addition to the standard TIP, the use of the dorsal prepuce which was divided in 2 flaps. The right flap was de-epithelialized on both the outer and inner sides and transferred as interposing layer between the neourethra and the coverings. The left flap was de-epithelialized on the inner side and transferred ventrally as skin coverage. They noted excellent functional results in 96%, with fistulae in 2% meatal stenosis in 1% and wound disruption in 0.8%. [17]

In 2007, Hayashi Y Kojima Y, Nakane Aet al applied the ventral based dartos flap wrapping technique to prevent the occurrence of urethrocutaneous fistula in 34 patients with hypospadias. Hypospadias was repaired without fistula formation in 31 patients while three patients developed a tiny fistula, which was later closed successfully by a simple procedure. [18]

In 2007, Singh RB, Dalal S, Pavithran NM, et al retrospectively analyzed soft tissue reinforcement interposition flaps (STRIF) interposed between neo-urethras and the covering skin to reinforce the neo-urethras against fistula formation in hypospadias repair. The STRIFs were harvested, without much donor site deformity, from: preputial skin, penile skin and scrotal skin by de-epithelialization or from Buck's fascia, corpus spongiosum and tunica vaginalis. They concluded that Use of STRIFs decreased fistula formation, reduced the size and prevent multiplicity of UCFs and located the UCFs eccentrically well away from the neo-urethra to facilitate their spontaneous as well as subsequent surgical closure. [19]

In 2011, González R and Ludwikowski BM reviewed publications relating to the results of urinary flow studies after hypospadias repair. Postoperative obstruction was defined by either a plateau curve or Qmax below the 5th percentile.24.6% met the uroflow criteria of obstruction with TIPS, 20% with Duplays, 17.6% with modified Mathieu, 5% with MAGPI. Similarly, they found obstructive flow pattern in nonoperated patients as well. They recommend that asymptomatic children should have one flow study after toilet training or 1 year after the surgery. [20]

In 2012, Perera M, Jones BC and Hutson JM assessed urethral function using uroflowmetry in 60 adolescents after undergoing hypospadias repair in infancy and compared this with 17 age matched controls. In the boys who underwent hypospadias surgery the urine flow rates were significantly lower compared to the control nomogram, with half of the patients having uroflow rates below 1 SD from the control mean but there was no significant association with lower urinary tract symptoms and poor urinary flow. At long-term follow up after hypospadias surgery urinary flow rates were significantly lower compared to age matched controls but still fell within the normal range. [21]

In 2013, AslamR, Campbell, S. Wharton, et al retrospectively reviewed medium to long-term results of 74 patients who had undergone single-stage Snodgrass hypospadias repair. Their overall complication rate was 7%. Two patients developed fistulae, one patient had mild glanular dehiscence and two patients had mild meatal stenosis. From a cosmetic perspective, two patients were noted to have some residual bulkiness of the skin around the corona and a further two patients were noted to have a small meatus, but with no functional symptoms. [22]

In 2013, Ahmed T. Hadidi reported functional urethral obstruction (FUO) following the tubularized incised plate

(TIP) procedure for hypospadias and found that the urethral plate incision has healed forming a scarred narrow, deep groove that yielded temporarily to dilatation and gave a false impression that the neo-urethra is not narrow. Patients with FUO present with obstructive voiding symptoms in spite of successful calibration or dilatation. [23]

In 2013, Baltrak YA, Karaman I and KaramanA evaluated63 patients with hypospadias, who underwent Uroflowmetric measurement before and after the operation.13 patients (20.6 %) had clinical complaints like narrow urine stream and difficulty passing urine. uroflow curves of the patients after the surgery revealed that 44 patients (69.8 %) had a bell-shaped curve and 19 patients (30.2 %) had a plateau pattern. In the postoperative group, in 16 patients (25.4 %) Qmax was smaller than-2SD according to the Sirokynomogram. [24]

In 2014, Spinoit AF, Poelaert F, Praetet CV al analyzed database of 474 children undergoing primary hypospadias surgery to identify independent predictors for re-intervention in primary hypospadias repair.114 patients needed re-intervention for fistula in 52 patients (46.4%), meatal stenosis in 32, cosmesis in 35 and for other in 14. The grade of hypospadias remains according to their retrospective analysis the only objective independent predicting factor for re-intervention in hypospadias surgery. [25]

In 2014, Alain P Antczak HC, Abdo A et al evaluated long-term uroflowmetry parameters evolution after TIP surgery and compared to normal children using established Miskolc nomograms. They observed that Qmax increased progressively according to time and age and in particular during the period covering adolescence with a similar trend regardless of the type of surgery. [26]

In 2014, Pfistermuller KLM, McArdle AJ and Cuckow PM reviewed literature of 49 studies to determine overall complication rates of the tubularized incised plate (TIP) repair and assess the effects of technical modifications, length of follow up and geographical location of reported results. Fistula rates were significantly higher in secondary repairs (15.5%) compared to primary proximal (10.3%) and primary distal (5.7%). Reoperation rates, meatal stenosis and strictures were significantly higher in the secondary repairs compared to primary repairs with no significant effect of mean length of follow-up on any of the complications analyzed for any operative group. Technical modifications to the TIP repair, in the form of additional dartos layers significantly decrease the complication rates specifically for fistula and re-operation. [27]

In 2014, Amilal B, Sabharwal K, Bhat Met al evaluated efficacy of spongioplasty alone as an intervening layer in the prevention of urethral fistula following tubularised incised plate urethroplasty (TIPU). Intra-operatively, spongiosum was taken to be poorly developed if it was thin and fibrous, moderate if good spongiosal tissue with good vascularization and well-developed if healthy robust spongiosum. Spongioplasty was done in a single layer after mobilization of spongiosum, starting just proximal to the native meatus and into the glans distally. Among 113 patients, Urethral fistula was seen in six patients (11.3%) with moderate spongiosum and three (23.03%) with poorly developed spongiosum with an overall 7.96% fistula rate. No patients with well developed spongiosum developed a fistula. [28]

In 2015, FaasseMA, Johnson EK, BowenDKet al reviewed data of 159 repairs and found there was no statistically significant association between glans width and urethroplasty complications (P=0.26) or glanular complications. [29]

In 2015, Hardwicke JT, Bechar J A, Hodson J et al. reviewed of 44 articles consisting 6, 603 and found that crude fistula incidence ranged from 0% to 27.8%; urethral stricture or meatal stenosis from 0% to 18%; and wound or glanular dehiscence from 0% to 12.8%. Other complications included infection, voiding difficulties, cosmesis and torsion. [30]

In 2016, Snodgrass W and Bush N, reviewed development and evolution of TIP hypospadias repair, including technical changes made to improve its outcome. From their review they concluded that Fistula and glans dehiscence were the two most common complications they encountered after TIP repair. Changes in urethral plate tubularization and barrier layers covering the neourethra resulted in a significant reduction in fistulas. Proximal meatal location and reoperation predicted increased complications. They also identified glans width ≤14mm as an independent risk factor for hypospadias urethroplasty complications. [31]

In 2016, Bush NC and Snodgrass W reviewed the concept which stated that urethral plate (UP) widths <8 mm before tubularized incised plate (TIP) incision increased urethroplasty complications. The UP width was <8 mm in 192/224 (86%) patients. Mean pre-incision width was 6.1 mm without difference in UP widths according to meatal location. Mean post-incision UP width was 12 mm. UP width was not different between patients with and without urethroplasty complications. ([32])

In 2016, Can I. Oztorun and H. TugrulTiryaki investigated whether the obstructive pattern found in the urethra was related to the surgery or was present previously by performing a uroflow investigation before and after surgery in 47 children operated for hypospadias and also in 32 children with normal urethra as a control group. Results showed that popstoperative flow rates were low in hypospadias group compared to control group, whereas there was no difference compared with the preoperative evaluation. No significant relationship was found between the type of surgery used and uroflowmetry evaluations in their study. [33]

In 2016, David J. Wilkinson **Green PA, Beglinger S**et al found complication rate was 18.1% from all centers performing hypospadias surgery in England. They also found out that High volume centers had significantly lower complication rates than low volume centers (17.5% vs.25%, p=0.01) and this was proven to be an independent predictor of outcomes. In their cohort, age at primary repair (p=0.554) and being operated on at a specialist centre for pediatric urology (0.273) were not significant predictors of secondary surgery. [34]

In 2017, Baba AA, Wani SA, Bhat NA et al published their comparative study of 160 patients on use of dartos fascia and Buck's fascia as intermediate layers in prevention of the formation of UCF. They found UCF rate of 12.5% in dartos fascia group. But only 2.5%, in buck's fascia group. Similarly, they found meatal stenosis of 3.7% in dartos group but only in 1.2% in buck's fascia group as well as 3.7% of glanular dehiscence in dartos group only. They concluded that Use of Buck's fascia as an intermediate layer along with glanuloplasty is simple and very effective in preventing UCF formation and glanular dehiscence. (35)

In 2019, SaiadMO evaluatedthe modified multilayer coverage using two or three intermediate layers in 110 patients with distal and midshaft hypospadias. He used double intermediate layers of two dartos flaps in 52 patients and triple intermediate layers of two dartos flaps and spongiosum in 36 patients. The procedure was TIP in 60 patients, Duplay in 23 patients, dorsal inlay graft TIP in 4 patients, and meatal-based flap technique (Mathieu urethroplasty) in 1 patient. Three patients had meatal stenosis, one had fistula and one had glanular disruption. [(36)]

4. Conclusion

There are five components of complete and successful hypospadias repair surgery [(12):]-

- Orthoplasty.
- Urethroplasty.
- Meatoplasty with Glanuloplasty.
- Skin cover
- Scrotoplasty

References

[1] Baskin LS, Ebbers MB.: Hypospadias: anatomy, etiology, and technique. J Pediatr Surg.2006; 41 (3): 463-72 [DOI] [PubMed]
[2] Duckett JW.: Successful hypospadias repair. Contemp Urol.1992; 4 (4): 42-55
[3] Horton, C. E., Devine, C. J., and Baran, N.: Pictorial history of hypospadias repair techniques. in: C. E. Horton (Ed.) Plastic and reconstructive surgery of the genital areaLittle, Brown and Company, Boston, MA; 1973: 237-248.
[4] Snodgross W.: Tubularised incised plate urethroplasty for distal hypospadias. J Urol 1994; 151; 464-5.
[5] Bhat A and Manda AK.: Acute postoperative complications of hypospadias repair. Indian J Urol.2008; 24 (2): 241–248.
[6] Smith D. A. De-epetheliased overlap flap techniques in repair of hypospadias. Br. J. Plastsurg 1973; 26 (2): 106-114.
[7] Snow BW: . Use of tunica vaginalis to prevent fistulas in hypospadias surgery. The J Urol 1986; 136: 861-863.
[8] Belman AB: . De-Epithelialized Skin Flap Coverage in Hypospadias Repair. J. Urol 1988; 140: 1273-76.
[9] Garibay JT, Reid C andGonzalez R.: Functional evaluation of the results of hypospadias Surgery with uroflowmetry. J Urol 1995; 154: 835-836.
[10] Malyon D, Boorman J. G and Bowley N. Urinary flow rates in hypospadias. Br J PlastSurg 1997; 50: 530-535.
[11] Yamataka A. Pedicled external spermatic fascia flap for urethroplasty in hypospadias and closure of urethrocutaneous fistula. J Pediatr Surg.1998; 33 (12): 1788-89.
[12] Yerkes EB, Adams MC, Miller DA, et al. Y-to-I wrap: use of the distal spongiosum for hypospadias repair. J Urol.2000; 163 (5): 1536-1538.
[13] Zaki A, Anwar M, Kurokawa Y, et al.: Functional evaluation of one-stage urethroplasty with parameatal foreskin flaps repair of hypospadias using uroflowmetry. Int. J Urol.2003; 10 (6): 297-301.
[14] Djordjevic ML. Dorsal dartos flap for preventing fistula in the Snodgrass hypospadias repair. BJU Int 2005; 95 (9): 1303-9.
[15] Gupta V, Sharma SB.: Use of facialata graft blanket wrap to prevent fistulas in hypospadias repair. J Indian AssocPedSurg 2006; 11 (2): 89-91.
[16] Holmdahl G.: Hypospadias repair with tubularized incised plate.: Is uroflowmetry necessary postoperatively? J PediatrUrol 2006; 2: 304–307.
[17] El-KassabyAW, Al-Kandari AM, Elzayat T, et al. Modified Tubularized Incised Plate Urethroplasty for Hypospadias Repair: A Long-Term Results of 764 Patients Urology 2008; 71 (4): 671-75.
[18] Hayashi Y, Kojima Y, Nakane A, et al. Ventral based dartos flap for the prevention of the urethrocutaneous fistula urethroplasty. Int J Urol.2007; 14 (8): 725-28.
[19] Singh R. B, Dalal S, Pavithran N M, et al.: Soft tissue reinforcement interposition flaps in hypospadias repair. Indian J PlastSurg 2007; 40: 170-177.
[20] González R and Ludwikowski BM.: Importance of urinary flow studies after hypospadiasrepair: A systematic review Int J Urol 2011; 18: 757–761.
[21] Perera M, Jones B, O'Brien M et al.: Long-term urethral function measured by uroflowmetry after hypospadias surgery: comparison with an age matched control. J Urol 2012; 188: 1457-1462.
[22] Aslam R, Campbell K, Wharton S, et al.: Medium to long term results following single stage Snodgrass hypospadias repair. Journal of Plastic, Reconstructive & Aesthetic Surgery 2013; 66: 1591-1595.
[23] Ahmed T. Hadidi.: Functional urethral obstruction following tubularised incised plate repair of hypospadias. Journal of Pediatric Surgery 2013; 48: 1778–1783.
[24] Baltrak YA, Karaman I and Karaman A.: Uroflowmetric evaluation of patients with hypospadias. Med Res Rep 2018; 1s: 11-14.
[25] Spinoit AF, Poelaert F, Van Praet C, et al.: Grade of hypospadias is the only factor predicting for re-intervention after primary hypospadias repair: A multivariate analysis from a cohort of 474 patients. J PediatrUrol 2015; 11 (2): 70-76.
[26] Hueber PA, AntczakC, Abdo A, et al.: Long-term functional outcomes of distal hypospadias repair: A single centere retrospective comparative study of TIPs, Mathieu and MAGPI. J Pediatr Urol.2014; 09: 011.
[27] Pfistermuller K L M, McArdle A J, Cuckow P M.: Meta-analysis of complication rates of the tubularized

incised plate (TIP) repair. J PediatrUrol 2015; 11 (2): 54-59.
[28] Bhat A, Sabharwal K, Bhat M, et al.: Outcome of tubularized incised plate urethroplasty with spongioplasty alone as additional tissue cover: A prospective study. Indian J Urol 2014; 30 (4): 392-397.
[29] Faasse M A, Johnson E K, Bowen D K, et al.: Is glans penis width a risk factor for complications after hypospadias repair? J PediatrUrol 2016; 12; 202-25.
[30] Hardwicke J T, Bechar J A, Hodson J, et al. Fistula after single-stage primary hypospadias repair – A systematic review of the Literature. J PlastReconstrAesthet Surg.2015; 68: 1647-55.
[31] Snodgrass W, Bush N. Tip hypospadias repair: A pediatric urology indicator operation. J PediatrUrol 2016; 12 (1): 11-18.
[32] Bush N C, Snodgrass W.: Pre-incision urethral plate width does not impact short-term tubularized incised plate urethroplasty outcomes. J PediatrUrol 2017; 13 (6): 625-26.
[33] Oztorun CI and Tiryaki HT.: Comparision of uroflow parameters before and after hypospadias surgery. Ann PediatrSurg 2018; 14: 27–30
[34] Wilkinson DJ, Green PA, Beglinger S, et al.: Hypospadias surgery in England: Higher volume centers have lower complication rates. JPediatr Urol.2017; 13 (5): 481-86.
[35] Baba AA, Wani SA, Bhat NA, Mufti GN, et al.: Buck's fascia repair with glanuloplasty in hypospadias surgery: A simple approach with excellent outcome. J PediatrUrol 2017; 13 (6): 633-1-633-5.
[36] Saiad MO.: The modified multilayer coverage of urethroplasty for distal hypospadias. J Indian AssocPediatrSurg 2018; 23: 140-3.