ORIGINAL ARTICLE

SNODGRASS HYPOSPADIAS REPAIR AT AYUB TEACHING HOSPITAL: AN AUDIT OF COMPLICATIONS AND OUTCOMES

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Background: There are many reported techniques for the repair of hypospadias, and new ones are being reported, which suggests that none is perfect. This study reports the anatomical success rate when using Snodgrass Technique. **Methods**: In this descriptive case series, 296 patients who fulfilled the inclusion criteria, by being treated by Snodgrass urethroplasty, were enrolled. The study was conducted at the Department of Surgery, Unit-C, MTI, Ayub Teaching Hospital Abbottabad between May 2008 and June 2021. **Results:** Mean age of the patients was 2.4±.8 years, 79.7% (n=236) had anterior (glanular, coronal, sub coronal) meatal location and 20.3 % (n=60) had middle urethral meatus (distal & mid-shaft). The mean operative time was 52 min. 5.1% of patients developed neo-meatal stenosis (n=15), 7.1% (n=21) patients develop a urethral-cutaneous fistula (compared to 5% in larger centers, 16% from smaller centers), 11.8% (n=35) developed wound infection, 2% (n=6) had complete disruption. The cosmetic appearance of the penis was "excellent"/good (shape of meatus was slit-like and vertically oriented) in 60.1% (n=178) patients, "acceptable" in 30.1% (n=89), and "not acceptable" in 9.8% (n=29). **Conclusion**: Snodgrass technique has a low complication rate, offers an acceptable cosmetic outcome and can be successfully applied to a wide range of defects from distal to mid-shaft hypospadias. Common complications include urethral-cutaneous fistula and meatal stenosis; both occur in a low and acceptable number of patients.

Keywords: Snodgrass Repair; Tubularized; Urethroplasty; Hypospadias; Meatal stenosis; Urethral-cutaneous fistula; Wound infection

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INTRODUCTION

Hypospadias refers to the abnormal placement of the urethral meatus on the ventral aspect of the penis.[1] Hypospadias is derived from the Greek words, *'Hypo,'* below, and *'Spadon,'* meaning a "rent."[2] Three anatomical defects, the abnormal ventral opening of the meatus, ventral curvature of the penis (Chordee) and hooded foreskin are observed in variable numbers.[1,2] Afflicted individuals may have problems with urination (deflected or spraying urinary stream), intercourse and sperm deposition and psychological issues if not treated.[3]

It is a common anomaly with an incidence of 1/300 male live births.[1] Its aetiology is still unknown, but possible factors include genetics (for example 5-α Reductase deficiency, abnormalities of androgen receptors and genetic defects), as well as environmental factors like exposure to hormonal disruptors, low birth weight, advanced maternal age and obesity.[3]

Hypospadias occurs due to hypoplasia of tissues forming the ventral aspect of the penis, it is characterized by a ventral triangular defect whose apex is the division of corpus spongiosum, the sides are represented by two pillars of atretic spongiosum and the base is the glans.[4] Surgical correction is the only treatment and is indicated in mid-shaft and distal hypospadias.[5]

A large number of techniques of Hypospadias Repair have been reported: Modifications and new techniques are being developed and suggested frequently.[6] This suggests that none of the techniques is perfect; none can deal with the full spectrum of anatomical defects.[1] Snodgrass, in 1994, described Tubularized Incised Plate Repair (TIP) for distal hypospadias.[7] It was initially used successfully for relatively simple, distal hypospadias, but later it was popularized for secondary, complex, distal and proximal defects with encouraging results.[8] This technique is now widely accepted and has a low complication rate with acceptable functional and cosmetic results.[9, 10] We adopted the technique quite early on, with acceptable outcomes; and we designed this surgical audit to evaluate our results and compare these to published results of larger centers.

MATERIAL AND METHODS

It was a descriptive case series in which data was retrospectively collected. All primary patients, with a midshaft or distal hypospadias, minimal or no chordee, a well-developed urethral plate and adequate glans width were included in the study. Patients who were lost to follow-up had intra-operative findings necessitating a different procedure and parents'/patient's insistence on specific treatment were excluded.

A total of 296 patients were operated upon using the Snodgrass technique, from May 2008 to June 2021 at the surgical C unit of Ayub Teaching Hospital, Abbottabad. Case notes and surgical records were analyzed.

The study was approved by the medical ethics committee of Ayub medical college. Medical records were reviewed, and written informed consent was obtained from the parents/patients.

Glans' width was measured by using a calliper ruler.[15] A 5/0 Prolene suture was placed on the dorsal aspect of the glans for traction and control, an 8–10 size NG tube was passed to act as a stent and a catheter, and fixed with the Prolene suture. Tourniquet was applied at the base of the penile shaft & 1:200,000 Epinephrine was infiltrated into the ventral glans and distal superficial shaft tissues. Parallel longitudinal incisions were made at the edges of the urethral plate; at this stage, the plate was usually narrow. A deep midline relaxing incision was made which starts from within the meatus to the distal end of the plate. This was deepened through underlying connective tissues down to Corpora Cavernosa with tenotomy scissors; this generously widened the plate, enough for tabularization, without the need for supplemental flaps. The urethral plate was then tabularized in two layers over the NG tube with 7/0 Vicryl on a cutting needle to create a neo-urethra, ensuring that all brown tissue (epithelium) was inverted. A Dartos fascia, a pedicled flap, was transposed ventrally over the neo-urethra to provide a water-proofing layer. Glansplasty was performed, with slight under-correction to achieve a slit like vertical orientation of the neo-meatus.

Circumcision was added as a religious ritual, pressure dressing was applied, the tourniquet was released, and the patient was retained in the ward for observation for one day with prescribed antibiotics and analgesia.[16–18] post-operatively patients were discharged on oral antibiotics, analgesics and glycerine suppositories (to avoid constipation), and were asked to come back if there was a catheter blockage, bleeding from the wound or if the dressings got soiled or soaked.

Follow-up was scheduled on 10th post-op day for catheter removal and dressing change (earlier, if the dressing was soiled or soaked); subsequent follow-up visits were scheduled for the first month, then after 3 and 6 months. The clinical findings on follow-up visits were recorded on the patient's notes.

Vertical, slit-like and slightly under corrected meatus was considered excellent/good; acceptable result meant that the meatus was not slit-like or more proximal, but still on the glans; and unacceptable or poor when the neo-meatus was below the corona or more proximal.

RESULTS

The mean age of the patients (n=296) was 2.4±0.9 years (Table-1). Around 13.5% (n=40) of our patients were older than 12 years. A lesser number (n=33), were younger than 1 year. However, more than half (n=155) were aged between 1 and 6 years: the remaining, (n=68) were between 7 and 12 years old. Informed consent was obtained from parents as well as patients, where the relatively older patients (more than 12 years of age) were considered competent.

Proximal hypospadias and those associated with chordee were not included in the study, and therefore, a vast majority of the abnormal meatuses were in a distal location, around 80% (n=236), glanular, coronal or sub-coronal: The remaining, around 20 % (n=60), had a distal shaft or midshaft meatal position. Table-2. The mean operative time for the repair was 52 minutes. There was no statistically significant difference in the time taken to complete the surgery in either the mid-shaft or the more distal Hypospadias. Table-3.

All in all, 102 complications occurred (Table-4). Urethro-cutaneous fistula developed in 7.1% (n=21) patients, and all the fistulas developed in patients with wound infection. Neo-meatal stenosis developed in 5.1% (n=15), again occurring in patients with wound infection. Wound infection developed in 11.8 % (n=35) and complete disruption in 2% (n=6). The position of the abnormal meatus had no significant impact on the development of complications like infection, urethra-cutaneous fistula, meatal stenosis, and complete disruption of the repair. Similarly, the operative time, which we expected to be longer in the mid-shaft hypospadias as compared to the more distal ones, did not show a statistically significant difference.

At follow-up, cosmetic appearance was assessed as good/excellent in 60% (n=178), acceptable in 30% (n=89) and unacceptable in 10% (n=29) patients.

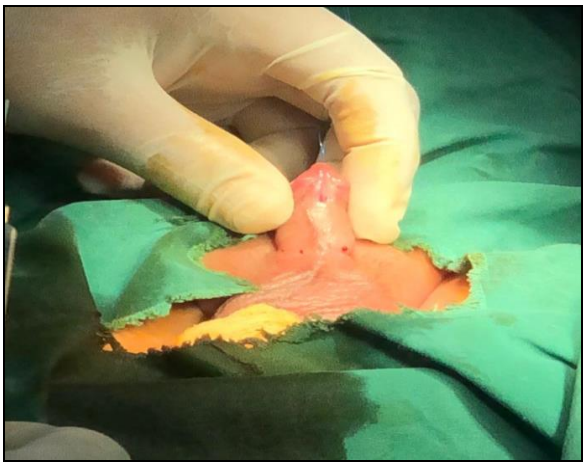

Figure-1: Subcoronal hypospadias in a study participant.

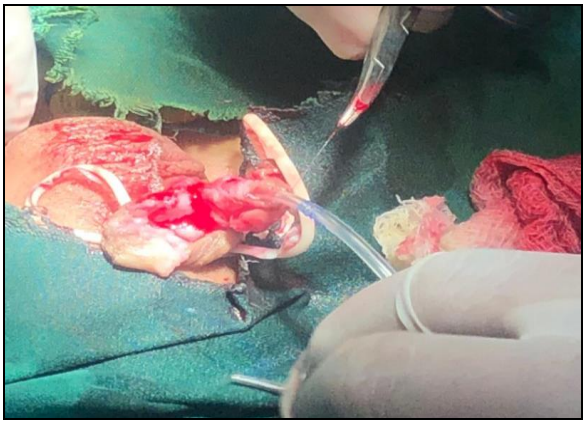

Figure-2: Creation of neourethra via Snodgrass repair

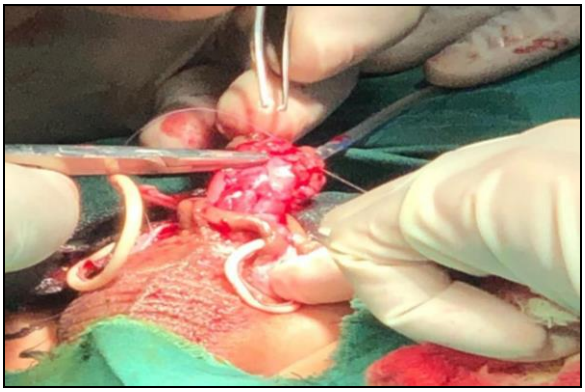

Figure-3: Transposition of dartos fascia pedicled flap to cover suture line.

Figure-4: Meticulous haemostasis and closure of skin

Table-1: Age at the time of surgery

Age (at the time of surgery)	Percent	(number)
Less than 1 year	11.1	(n=33)
1–6 years	52.4	(n=155)
7–12 years	23.0	(n=68)
More than 12 years	13.5	(n=40)
Total	100	(n=296)

Table-2: Position of Urethral Meatus

Meatus	Percent	(number)
Distal: Glanular, Coronal or Sub-Coronal	79.7	**(n=236)**
Mid-shaft or distal shaft	20.3	**(n=60)**
Total	**100**	**(n=296)**

Table-3: Operating time

	Percent	(number)
40 to 50 minutes	8.8	**(n=26)**
50 minutes to 1 hour	81.1	**(n=240)**
More than 1 hour	10.1	**(n=30)**
Total	**100**	**(n=296)**

Table-4: Major complications

Complication	Percent	(number)
Major Infection	11.8	**(n=35)**
Bad Cosmetic Result	9.8	**(n=29)**
Urethro-Cutaneous Fistula	6.8	**(n=20)**
Meatal Stenosis	4.1	**(n=12)**
Complete Disruption	2	**(n=6)**
Total	34.5	**(n=102)**

Table-5:

		Fistula	Good Cosmesis	Acceptable Cosmesis	Poor Cosmesis
Meatus	**Distal: Glanular, Coronal, Sub-Coronal**	6.4% (n=15/236)	59.7 % (n=141/236)	30.5% (n=72/236)	9.7 % (n=23/236)
	Proximal: Mid/Distal Shaft	8.3 % (n=5/60)	61.7 % (n=37/60)	28.3% (n=17/60)	10 % (n=6/60)
		p>0.05	*p*>0.05		

DISCUSSION

The purpose of hypospadias repair is to create a functionally & cosmetically normal penis that should be straight during erection, have an adequate-sized urethra for a single coherent stream, & a vertically oriented slit-like meatus at/near the tip. To achieve these goals more than 400 different techniques have been developed & more modifications are evolving.[11] We are using the Tabularised Incised Urethral Plate Repair, or Snodgrass technique, as developed and popularized by Warren T Snodgrass.[8,9] This technique has gained widespread acceptance owing to its ease of learning, versatility, low complication rate & creation of vertically oriented meatus.

Hypospadias continues to be a challenging problem for surgeons. The current operative concept in hypospadias surgery is based on a perfect single-stage repair of the malformation that should result in functional excellence and a cosmetically normal-looking penis.[11,12]

The most frequent complication in our series was an infection. Two significant and frequent complications seen with hypospadias repair are urethral-cutaneous fistula & meatal stenosis, and a less frequent, but more serious complication is complete disruption of the wound.[13] Cosmetic appearance is also important, especially when we consider patients' perceptions.

Our results show a large incidence of wound infection (11.8%, {n=35}), in spite of using pre- and post-operative antibiotics. Some patients with wound infection healed without developing any of the other, more serious complications; in some patients, other complications did occur. Other published series also support this finding.[14] Other centers are reporting lesser incidence of wound infection.[15,16] We are using polyurethane-based nasogastric tube, as opposed to a silicone tube, and although the literature is divided on the complications of one vs the other,[17] we believe that a polyurethane ng tube could be one of the reasons for a higher incidence of infection (we have availability issues). We are planning to develop a study to compare infection rates in these two stent types.

We recommend the use of antibiotics preoperatively, continuing for at least 10 days post operatively, till the stent is in situ, and stenting for 10 days. We also recommend avoiding straining while passing stools and keeping the dressing clean and dry, to prevent infection. The dressing may be opened on the 10th post-op day in the clinic (earlier, if found soiled or wet), and before removal, it is soaked to avoid inadvertent wound damage. These precautions may help to promote a successful outcome.

In our study, urethro-cutaneous fistula, meatal stenosis, complete disruption of the repair, and poor or barely acceptable cosmetic appearance, were not related to the level of abnormal meatus (Table-5).[18] Urethro-cutaneous fistula developed in 7.1%, and complete wound dehiscence in 2% of our patients. These serious complications developed only in those patients that developed an infection. Our incidence is comparable to series from other institutions with a 6% incidence of fistula, and 4% of complete disruption.[14] Another study reported 2% fistula, 2% meatal regression and 2% glans repair disruption.[12] Another study, in contrast, shows a strong relationship between the severity of hypospadias and the development of complications, in a grossly similar patient group of distal and midshaft hypospadias. However, authors of the same study agree that the fistula rate was significantly higher in patients who developed an infection.[19] To prevent urethral-cutaneous fistula formation, we invert all brown tissue (urethral plate epithelium) and transpose a pedicled dartos fascia flap ventrally, secure it over the neourethra to provide a waterproofing layer and completely cover the anastomotic line.[16] To avoid infection, we initiate antibiotic prophylaxis at the time of induction of anaesthesia (Cefuroxime) and continue it for at least 10 days post-operatively (or till the ng tube is in situ). In patients that developed a fistula, or complete disruption, we performed a second procedure after a delay of 6 months or more, after the resolution of all fibrosis due to previous surgery.

We had meatal stenosis in 5.1% (n=15) whereas in other series it is variously reported between 2–12%.[12,13] Eleven of our patients responded to repeated dilatations, two required meatotomies and 2 required meatotomy and application of a small graft. A 2015 study, reported meatal stenosis in three of their 30 patients (10%); two of them responded to repeated dilatations and one needed mentoplasty. Another two patients had meatal retraction proximally but still within the glans; only one required a second procedure. In a similar study,[12] reported four out of 171 patients, (2%) developing meatal stenosis. We believe that meatal stenosis develops more commonly if tabularization is performed too far distally; we recommend that it should be a little under-corrected & meatoplasty stitches should be applied to prevent stenosis and proximal migration of neo-meatus.

We did not have any hematoma development, but 26 patients had minor bleeding post-operatively, which necessitated an earlier change of dressing. Since these patients did not

need an additional hospital stay or a secondary procedure, we have not mentioned these in the table of major complications. Hassan *et al*[14] reported that, among their 30 patients, three cases had a postoperative hematoma (10%), which were managed conservatively and resolved spontaneously. An earlier study[13] reported that, among their 26 patients, four cases had postoperative bleeding (15%) and one of them was returned to the theatre to stop the bleeding; in contrast, another study[12] reported no early complications such as bleeding, hematoma and wound infection. We recommend opening the tourniquet before the urethral plate repair, coagulating all the significant bleeders with bipolar cautery, re-application the tourniquet, and using a pressure dressing to reduce the incidence of bleeding and hematoma formation post-operatively.

For this study, we defined good, acceptable and poor cosmetic results as referred to above (material and methods), and we believe that our cosmetic results (good or satisfactory in 60%, and acceptable or poor in 40%) were overall comparable to other centers.[20] However, we acknowledge that we have not used validated scoring systems like HOSE (Hypospadias Objective Scoring Evaluation), PPPS (Paediatric Penile Perception Score), or other validated questionnaires, or pictures; We also have not evaluated the functional outcome by using Uroflowmetry.[20–22]

We assessed the patients, as objectively as was possible, with a method that may have physician bias, but with an added advantage that the surgeons knew the pre-operative morbid anatomy, that all these scoring systems neglect: still, use of a validated tool may improve the quality of assessment. We acknowledge that some of the acceptable results may be graded as otherwise when assessed on a validated tool.[23] other authors have compared, and found cosmetic results of the Snodgrass technique superior to other techniques,[24] we did not compare Snodgrass with any other techniques. In itself, we believe that Snodgrass produces acceptable results.

CONCLUSION

The Snodgrass technique has a low complication rate, offers an acceptable cosmetic outcome and can be successfully applied to a wide range of defects from distal to mid-shaft hypospadias. Common complications include urethral fistula and meatal stenosis; both occur in a low and acceptable number of patients.

AUTHORS' CONTRIBUTIONS

SA: Literature Review, manuscript drafting. FAK: Data collection & statistical analysis. SA: Data Interpretation. HK: Proofreading. HR: Manuscript drafting. IK: Expert opinion and manuscript revision.

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