



TO STUDY THE OUTCOME AND COMPLICATIONS OF SNODGRASS URETHROPLASTY IN HYPOSPADIAS REPAIR USING SPONGIOPLASTY AS AN ADDITIONAL COVER

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ABSTRACT

AIM: To study the result and complications encountered in the Snodgrass urethroplasty for hypospadias repair using spongioplasty as additional cover.

MATERIALS AND METHODS: This study was done to follow and evaluate the outcome of hypospadias in whom Snodgrass urethroplasty along with spongioplasty was done. All cases were studied after proper sampling (n=30) between November 2016 to April 2018. The patients were called for follow-up every week for two weeks, at three months and after one year. The minimum period of follow-up in this series was of three months. The clinical details of the patients were recorded according to the Proforma.

RESULTS: Out of 30 patients who had Snodgrass repair with spongioplasty, 01 were with significant chordee which was corrected after degloving and 29 were without chordee. Out of total 30 patients who had Snodgrass urethroplasty, 24 patients urethral plate was well formed and grooved, whereas 6 patients had wide and flat urethral plate. Among 30 patients, 24 patients were operated within 1 hrs and 6 patients were operated in more than 1 hrs to 1.25 hrs. In our study of 30 patients hospital stay was of up to 10 days in 18 patients and 11 days in 12 patients. Meatal stenosis was noted as a common complication. The incidence noted was 10% (3 out of 30 cases). Waterproofing with well vascularized spongioplasty prevent from meatal stenosis. Meatal stenosis itself increases resistance in urinary flow and predispose to fistula formation which is a dreaded complication of hypospadias surgery. In 1 case it was associated with urethra cutaneous fistula. In rest 2 cases it was improved by dilatation with feeding tube 8 Fr. In our study of 30 cases, 3 patients developed urethro-cutaneous fistula out of which all 3 healed conservatively. 3 patients developed fistula in patients with distal penile hypospadias, In all three a small coronal fistula was noticed on first follow-up. At the time of discharge they did not have a fistula. Meatal stenosis was observed with one of them, when the fistula was noticed. With regular dilatation of the meatus for a period of 3 months the fistula closed spontaneously. 2 cases had urethrocutaneous fistula corresponding to incidence of double stream. In our study of 30 cases we achieved satisfactory cosmetic appearance post surgery in 27 cases (90%). Poor cosmetic results were achieved in 3 cases (10%) in the form of torsion, necrosis and residual edema each in different patients.

CONCLUSION: Spongioplasty is a simple method to provide additional covering to the constructed neourethra, which achieves the goal of non-crossing suture lines and maximum vascularity.

KEYWORDS : Snodgrass Urethroplasty, Hypospadias, Spongioplasty.

INTRODUCTION

Hypospadias is one of the commonest congenital anomalies of the male genital system. The reported incidence in the USA in 2001 was 1 per 200–300 live male births,¹ while the rate in the Netherlands in 2002 was 3 per 1000 live male births.² In addition to the abnormal position of the urethral meatus on the ventral penile surface, it may also be associated with ventral curvature of the penis (chordee). Hypospadias causes not only functional problems but also psychological problems for patients and their parents. Many techniques have been described for repairing hypospadias, but none was considered the standard method. In 1994, Snodgrass described tubularized incised plate (TIP) urethroplasty for distal penile hypospadias repair. It was subsequently also applied to proximal hypospadias, with encouraging results.^{3,4} The longitudinal split of the urethral plate described by Snodgrass represents significant progress in urethral plate-preserving surgery, permitting tensionfree tubularization of the urethral plate to form a neourethra of adequate size. The technique is now widely accepted.⁵ The principal steps are a deep longitudinal incision of the urethral plate to allow tubularization, and addition of a layer between the neourethra and the overlying skin to avoid urethro cutaneous fistula.^{6,7}

The surgical goals of hypospadias repair are full straightening of the penis, formation of a hairless urethra of uniform caliber and adequate size, positioning of the meatus at the tip of the glans and normal penile appearance with minimum complications. Nevertheless, complications such as

fistula, meatal stenosis, urethral flap necrosis and dehiscence are still encountered. Surgeons use small variations in the technique to limit the complications. The distal limit of the deep longitudinal incision may be either the mid-glans or the tip of the glans. The covering flap of the neourethra is usually raised from the preputial skin; however, this may result in penile torsion and devascularization of the preputial skin that is often used in reconstruction of the penile skin.⁸ A ventral dartos flap has been used to cover the neourethra in order to avoid these complications. Despite such modifications, complications of hypospadias repair, such as fistulae, urethral stricture, meatal stenosis, penile torsion, persistent chordee, infections and wound dehiscence, are still reported.⁹ In this paper, we describe our experience with two variations in performing Snodgrass TIP urethroplasty with respect to postoperative complications and outcomes, with emphasis on meatal stenosis, fistulae formation, residual chordee and penile torsion.

AIMS AND OBJECTIVES

- To study the types and varieties of hypospadias and their occurrence in our patient population.
- To study the result and complications encountered in the Snodgrass urethroplasty for hypospadias repair using spongioplasty as additional cover.

MATERIALS AND METHODS

This study was done to follow and evaluate the outcome of hypospadias in whom Snodgrass urethroplasty along with spongioplasty was done. All cases were studied after proper

sampling (n=30) between November 2016 to April 2018. The patients were called for follow-up every week for two weeks, at three months and after one year. The minimum period of follow-up in this series was of three months. The clinical details of the patients were recorded according to the Proforma.

INCLUSION CRITERIA:

1. Urethral plate of adequate width ($\geq 8\text{mm}$)
2. Coronal and distal penile hypospadias.

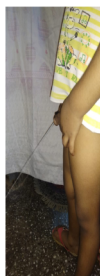
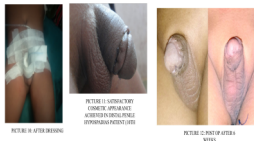
EXCLUSION CRITERIA:

1. Urethral plate of inadequate width,
2. Severe hypospadias requiring more complex repair
3. Intersex cases
4. Inadequate penile length

SURGICAL TECHNIQUE:

All the patients were primary cases and operated under general anesthesia with supplementation of caudal block. Firtlet collar incision was given; chordee was completely released by degloving of the penis. Glanular wings were raised. The plate was then incised in the midline from meatus to the glans. Incision was not extended to the tip of the glans, to prevent subsequent meatal stenosis. Deep incision was taken to divide all transverse webs and expose the corporal bodies. Mobility of the epithelial strips created by longitudinal incision of the plate was confirmed. The urethral plate was tubularized over infant feeding tube no. 7 with vicryl 6-0 continuous subcuticular vicryl sutures. Splayed out corpus spongiosum on either side of the urethral plate was mobilized and sutured over the tubularized urethra. Spongioplasty done in this way gave additional cover to the neourethra. A vertical midline incision was given in the dorsal prepuce skin extending up to the corona. Length of the skin required to cover the ventral skin defect was assessed. The excess skin which otherwise would have been discarded was de-epithelialized using blade no. 15. Incision was given over the inner aspect of prepuce and subcutaneous tissue was separated from the skin using sharp dissection. The de-epithelialized flap derived from the dorsal prepuce skin was sutured over the neourethra with vicryl 6-0. Glans wings were approximated with interrupted vicryl 5-0 suture. Rotated skin flaps were sutured in the midline. This helped in avoiding crossing over of suture lines. The neourethral suture line was in the midline, while the de-epithelialized flap suture line was laterally. Excess skin was trimmed and then approximated in midline using vicryl 5-0 interrupted sutures.

Transurethral feeding tube was kept per urethrally to drain urine. Sponge dressing was applied over the penis. Dressing was changed on fifth postoperative day. Per-urethral catheter was removed on the tenth postoperative day.



RESULTS

Table 1: Age distribution

Age (years)	No. of patients	%
1-4	11	36.67%
5-6	8	26.67%
7-8	7	23.33%
9-20	4	13.33%

Table 2: Position of meatus

Position of meatus	No. of patients	%
Subcoronal	15	50
Distal penile	15	50

Satisfactory cosmetic results were observed in all cases. The resultant neomeatus was vertically oriented, slit like and glans was looking normal which was cosmetically well accepted. The penile raphe was in the midline.

TABLE 3: Chordee

Chordee	No of patients	%
Absent	29	96.67
Present (corrected after degloving)	01	3.33

Preoperatively the meatal site was sub coronal in 15 patients (50%), distal penile in 15 patients (50%)

Out of 30 patients who had Snodgrass repair with spongioplasty, 01 were with significant chordee which was corrected after degloving and 29 were without chordee.

TABLE 4: Urethral plate

Urethral plate	No. of Patients	%
Well formed, grooved	24	80
Wide and flat	6	20

Out of total 30 patients who had Snodgrass urethroplasty, 24 patients urethral plate was well formed and grooved, whereas 6 patients had wide and flat urethral plate

Table 5: Operative time

Operative time	No. of patient	%
Up to 1 hrs	24	80
> 1 to 1.25 hrs	6	20

Among 30 patients, 24 patients were operated within 1 hrs and 6 patients were operated in more than 1 hrs to 1.25 hrs.

Table 6: Hospitalization

Hospitalization	No. of patients	%
10 days	18	60
11 days	12	40

In our study of 30 patients hospital stay was of up to 10 days in 18 patients and 11 days in 12 patients.

Table 7: Meatal stenosis

Meatal stenosis	Number	%
Present	3	10
Absent	27	90

Meatal stenosis was noted as a common complication. The incidence noted was 10% (3 out of 30 cases). Waterproofing with well vascularized spongioplasty prevent from meatal stenosis.

Meatal stenosis itself increases resistance in urinary flow and predispose to fistula formation which is a dreaded complication of hypospadias surgery.

In 1 case it was associated with urethra cutaneous fistula. In rest 2 cases it was improved by dilatation with feeding tube 8 Fr.

Narrow stream of urinary flow was noted in 3 cases corresponding to meatal stenosis.

Table 8: Urethro cutaneous fistula

Urethro cutaneous fistula	Snodgrass	%
Present	3	10%
Absent	27	90%

In our study of 30 cases, 3 patients developed urethrocutaneous fistula out of which all 3 healed conservatively.

3 patients developed fistula in patients with distal penile hypospadias, In all three a small coronal fistula was noticed on first follow-up. At the time of discharge they did not have a fistula. Meatal stenosis was observed with one of them, when the fistula was noticed. With regular dilatation of the meatus for a period of 3 months the fistula closed spontaneously.

2 cases had urethrocutaneous fistula corresponding to incidence of double stream.

Table 9: Cosmetic appearance

Cosmetic appearance		Number
Satisfactory		27
Poor		
	Torsion	01
	Necrosis	01
	Residual edema.	01

In our study of 30 cases we achieved satisfactory cosmetic appearance post surgery in 27 cases (90%). Poor cosmetic results were achieved in 3 cases (10%) in the form of torsion, necrosis and residual edema each in different patients.

DISCUSSION

Surgical techniques for the repair of hypospadias are being developed continuously, implying that no single technique is considered as perfect for hypospadias. Although numerous techniques have become available for the correction of hypospadias to improve further cosmetic appearance and yield perfection, new methods are still described.

In European cohort study of 1072 Danish boys most common age of presentation to hospital was less than 5 yrs of age(55%).In joint international study of 8122 boys most common age of presentation to hospital was between hypospadias was between 0-3 yrs. In our study most common age group was 1-4 yrs.

Hypospadias arises by a failure of urethral folds to fuse and thus surgical techniques based on tubularization of the

urethral plate with no skin grafts have been described.

Duckett (1996) reported incidence of site of meatus as; anterior 50%, middle30% and posterior 20%. **Tuskewinsky (2014)** reported 70% anterior, 16% middle and 14% posterior meatus while **Standoli**reported 80% anterior, 14% middle and 6% posterior hypospadias.

We had 100% anterior (glanular hypospadias excluded). However this is a very small series of selected cases to comment on the percentage of the meatal location.

On meatal calibration with feeding tube no .8 it could not be passed in 20 patients, which was suggestive of meatal stenosis, whereas in rest of the cases meatus could be calibrated with feeding tube no.10. Dividing urethral plate in the midline was helpful in increasing the caliber of the meatus, which then could admit no.10 feeding tube easily. The more distal locations, in particular, are often associated with stenotic meatus.

Sweet et al (2017) reported 35% incidence of chordee, while in our series it was 3%.

Khuri et al (2005) have reported incidence of undescended testis as high as 10%. We had one patient of right undescended testis in our series of 30 cases (approximately 3%), reason for this low incidence may be the exclusion of posterior hypospadias cases in our study.

Snodgrass (1994) technique of tubularized incised plate urethroplasty makes a narrow urethral plate wide enough for easy tubularization and provides vertically oriented and a cosmetically normal neomeatus. The tubularized incised plate urethroplasty extend the concept of hinging the urethral plate described previously by **Rich et al (1989)** as a cosmetic modification of meatal-based onlay island flap repairs. The key step in the procedure is the deep sagittal incision of the urethral plate, dividing all transverse webs and exposing the underlying corporal bodies. This allows for its subsequent tubularization. This method in essence recapitulates the normal closure of the urethral folds, creating a neourethra of appropriate diameter and a vertically oriented normal appearing meatus. The deep incision of urethral plate does not compromise its viability, and the dorsal surface of the plate re-epithelized during the brief period of urinary diversion.

In this technique the urethral plate is divided into two epithelial strips that are approximated in the midline ventrally to form the roof of the neourethra, while the floor and the sidewalls are formed by the incised raw area that will be eventually covered by epithelium regenerating from the edges of the plate.

In **Dennis Browne (1953)** repair, the urethral plate forms the floor of the neourethra and the roof is formed by epithelial growth from the edges of the plate to cover the raw area underneath the skin cover around the stent.

A. Erol and Baskin (2000) did anatomical study of the urethral plate and stated its importance in hypospadias repair. They concluded that the urethral plate is well vascularised and it has a rich nerve supply and an extensive muscular and connective tissue backing and gland formation. This may explain the reported long-term success of this procedure and the excessive bleeding that can occur with the incision.

Dorsal incision of the urethral plate, which is integral part of Snodgrass repair, doesn't compromise the blood supply and re-epithelisation occurs rapidly without scarring. Also as it does not use skin flaps, previous circumcision or hypospadias repair is not a limitation.

In our series one patient was circumcised but had good urethral plate. In this case neourethra could be well constructed from the urethral plate with good result.

Various techniques have been described for correction of the distal hypospadias. The technique to be used depends on the meatal and glanular configuration. Meatal advancement and glanuloplasty (MAGPI, 1981) is a commonly used technique but it depends on the mobility of the urethra. If the urethra is not sufficiently mobile it may result in distortion of the glans and an elliptical meatus. In excessively thin or rigid ventral parametatal skin or a meatus too wide or proximal, MAGPI is not recommended.

The parametatal based flap (**Mathieu's procedure**, 2001) is a successful method for correcting more proximal hypospadias cases in the absence of chordee but it often results in a transversely oriented and rounded meatus which is cosmetically less acceptable than a normal vertical slit like meatus. In addition the two suture lines necessary for the flap increases the risk of developing a coronal urethro-cutaneous fistula. There is also an increased risk of meatal stenosis as the blood flow in the distal part of the flap is reduced. In the constructed neourethra skin is used to form half the circumference of urethra.

Snodgrass (1994) described additional coverage to neourethra by vascularised subcutaneous tissue dissected from dorsal prepuce and shaft skin. This dissection requires skill and there are chances that vascularity of the skin cover may get compromised resulting in subsequent dermal necrosis. As compared to this according to us, creation of de-epithelialized flap is a simpler alternative.

One of the causes of urethral meatal stenosis after hypospadias repair is known to be devascularization of the distal urethra. A reduction in the incidence of this complication in all series suggests that the de-epithelialized flap may also serve to prevent this problem by increasing vascularity of the neomeatus. The de-epithelialized flap might be compared to the omentum used in the abdomen in reconstructive and ablative surgery

Amilal bhatt (2017) in a study of 113 patients performed TIUP in 113 patients without any waterproofing except spongiosis, reporting a fistula rate of 12 % and meatal stenosis of 2%.

In 1994, **Snodgrass** reported tubularized incised plate urethroplasty for distal hypospadias. No fistula was reported. Later on he reported multicentric experience in tubularized incised urethroplasty (148 patients) in 1996. Complication was reported in 10 patients (7%). Five boys had fistula in the distal penile shaft or subcoronal region. There was no fistula involving the glans. Meatal stenosis was reported in three other boys including two who also had fistula.

In 1998, **Snodgrass** reported results of tubularized incised urethroplasty in proximal hypospadias. Complication occurred in 3 of 27 patients (11%), who underwent only tubularized incised plate repair. A fistula and meatal stenosis resulting in diverticulum formation developed in one patient each. He did not report any neourethral fistula.

A. Elbakry (2005) reported a series of 27 patients of distal hypospadias repair, done using Snodgrass technique with good functional and cosmetic results. Four patients had small fistula associated with meatal stenosis, which resolved spontaneously by regular dilatation.

J.Oswald et al (2000) reported 30 patient's comparative series of who underwent **Mathieu's** (Parametatal based flap) repair

had complication (two fistula and one meatal stenosis), compared with only one complication in Snodgrass group

Yerkes (2000) reported no fistulae in any of patients for whom spongioplasty was implemented in number of urethral repair techniques, where as **Beaudoin (2000)** described the anatomical characteristics of the spongiosal layer in the hypospadias penis and implemented spongioplasty in patients who underwent tubularization.

In 2003, **Dodat et al** showed no fistula formation in any of the 51 patients who underwent TIPU and spongioplasty. **El-Sherbiny et al (2004)** reported that covering the neourethra with a flap or spongioplasty minimized the risk of fistula formation. In a series of 500 cases, **Sarhan et al (2009)** used a dartos flap, spongioplasty, or a combination of these techniques in addition to TIP. They observed a statistically significant decrease in fistula formation in cases in which spongioplasty was implemented compared with cases in which it was not

Kamyar Tavakkoli Tabassi et al (2012) in their prospective study of 33 patients with penile hypospadias treated using a Tubularized Incised Plate Urethroplasty (Snodgrass method) and vascularized tunica vaginalis flap as a second layer, achieved good cosmetic results in 93.93% cases. They had fistula in 3 (10.34%), wound infections in 4 (13.79%), and meatal stenosis in 3 (10.34%) pattern.

Our results are comparable to **J. Oswald (2000)**. We had one patient in whom circumcision was already done. We saw additional advantage of this procedure that it can be done in circumcised patients, as construction of neourethra doesn't require any skin flap. At this point we would like to emphasize that this is a repair in which the urethra is entirely formed by urethral plate.

Uday S. Chatterjee et al (2004) in their comparative study of 49 patients (mean age 4.6 years, range 1–22) with hypospadias of different types (varying from coronal to penoscrotal) using the TIP technique, with dartos fascia wrap used in 20 and TVPW (Tunica vaginalis pedicle wrap) in 29. In the dartos fascia group three patients developed fistulae, but there were none in the TVPW group.

Aman Essam, et al (2011) in their study of 40 patients reported fistula formation in 1 patient. Their study comprised of 32 patients of distal and 8 of mid penile hypospadias. They used Snodgrass TIP urethroplasty in all cases with dorsal dartos vascularised flap in all cases.

So the fistula rate in our study is less than these studies showing de-epithelialized flap to be a better alternative as waterproofing.

One of our patients developed meatal stenosis with fistula. It was observed on first follow up when the fistula was also noticed. With regular dilatation of the meatus for a period of 3 months the fistula closed spontaneously.

The occurrence of meatal stenosis after Snodgrass repair is due to adherence of both raw sides of incised plates during healing. Jordon and Schlossberg explained in detail, the healing process of urethral wounds, if the epithelia are apposed wound healing occurs by primary intention resulting in stenosis. When epithelial apposition is prevented by separating both sides of the wound, healing occurs by secondary intention and the epithelium progresses slowly from the edges of the wound to cover the raw area.

M. Dayane in 2000 reported a series of 20 distal and 5 mid penile hypospadias cases. In distal, meatal stenosis occurred

in 1 patient and urethral fistula in another. The overall complication rate was 10% among midpenile cases, meatal stenosis was observed in one patient.

In this series of 30 patients we had 3 patients with midpenile hypospadias who developed fistula. This patient had spontaneous closure of the fistula with regular dilatations. The most reliable method to counteract the process of urethral wound contraction is long term and regular dilatation of the urethra. Neourethral dilatation is easy, painless and can be done by parents at home. W. Snodgrass reported that the neourethra in 10 of his patients was routinely calibrated at regular intervals for a period of 3 months

We believe that if the plate is incised deep enough then it will not heal by apposition and epithelium will grow to make the caliber of the urethra adequate. To prevent apposition of the incised flap we recommend keeping the stent for a longer duration i.e. 10 days.

In our study operative time was 1-1.25 hrs (100%) in all cases which is comparable to most other studies.

Hospital stay was 10 to 11 days in all cases (100%). Long hospital stay was adopted because most of our patients were from rural areas and there was risk of accidental catheter removal and uncertainty of strict follow up.

Shanberg et al in year 2000 stated that Snodgrass repair could be used successfully in re-operative hypospadias repair with relatively fewer complications.

We recommend Snodgrass urethroplasty with spongioplasty repair in all distal and subcoronal hypospadias. It can also be done in circumcised patients.

CONCLUSIONS

1. Snodgrass urethroplasty is a simple and versatile technique which is applicable to all varieties of hypospadias
2. The neourethra is formed entirely by urethral plate.
3. It gives an excellent cosmetic appearance to the glans with a vertically oriented slit like neomeatus.
4. Spongioplasty is a simple method to provide additional covering to the constructed neourethra, which achieves the goal of non-crossing suture lines and maximum vascularity.
5. This technique is a good alternative to meatal based and onlay island procedure.

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