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Original Article

Long-Term Outcomes of Dartos-Augmented Snodgrass Repair in Distal and Mid Hypospadias

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Abstract

Objective: Despite (Snodgrass technique) surgical innovations of in 1994, hypospadias repair remains challenging due to persistent risks of postoperative complications. This study presents a comparative analysis with an excellent 12-year follow-up, evaluating the long-term efficacy, complication rates, and cosmetic outcomes of the modified Snodgrass procedure with a vascularized dartos flap versus the original Snodgrass technique for distal and mid penile hypospadias.

Methods: This quasi-experimental study was conducted in the Department of Urology, Dhaka Medical College, and a Private Hospital, Dhaka, Bangladesh, between January 1, 2007, and December 31, 2008. A total of 64 patients aged 3–18 years with distal or mid penile hypospadias were enrolled. Group A underwent the modified Snodgrass urethroplasty with vascularized dartos flap wrap, while Group B underwent conventional Snodgrass urethroplasty. Follow-up assessments were scheduled at two weeks, one, three, and six months of time, and then annually for 12 years (until 2020). The evaluation approach included history, physical examination, urine testing, and uroflowmetry. An assessor who was blind to the procedure recorded every outcome. The rate of urethrocutaneous fistula is the main result in outcome measurements. Secondary consequences include cosmetic results (glans form and meatal configuration) and other issues (chronic chordee, flap sloughing, urethral stricture, and meatal stenosis).

Results: The mean age was 5.4 ± 2.17 years in Group A and 7.6 ± 2.81 years in Group B. Complications were fewer in the modified technique group, with urethrocutaneous fistula developing in 6.25% of cases compared to 9.37% in the control group ($p < 0.05$). After a 12-year follow-up,, 93.75% of Group A patients achieved satisfactory urinary flow rates versus 84.37% in Group B. A normal conical glans with a vertical slit-like meatus was achieved in 84.37% of Group A versus 75% in Group B.

Conclusion: The modified Snodgrass urethroplasty with vascularized dartos flap wrap yields superior cosmetic and functional outcomes with fewer complications. This technique is simple, reliable, and suitable for use in resource-constrained settings, and it should be considered the preferred approach for distal and mid penile hypospadias repair.

Key Words: "Distal and Mid penile hypospadias repair," "Snodgrass urethroplasty," "modified Snodgrass urethroplasty".

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Introduction

Hypospadias, derived from the Greek term 'spadon', refers to an abnormal ventral opening of the urethral meatus located anywhere from the glans penis to the perineum.[1] Hypospadias is one of the most common congenital anomalies in male children, characterized by a proximally located urethral meatus on the ventral aspect of the penis, often associated with ventral curvature (chordee) and a dorsally hooded prepuce.[2]

With an incidence of approximately 1 in 300 live male births, its surgical correction remains a cornerstone of pediatric urology.[3]

The goals of hypospadias repair are to create a straight penis with a terminal, slit-like meatus, a uniform neourethra, and a satisfactory cosmetic appearance.[4]

Despite numerous surgical innovations, hypospadias repair remains challenging due to persistent risks of postoperative complications. Among the over 300 described techniques, the Tubularized Incised Plate (TIP) urethroplasty, popularized by Snodgrass in 1994, has gained widespread acceptance for its ability to create a cosmetically normal-looking meatus. [5] The Snodgrass technique was a major advancement in urethral reconstruction but complications such as fistula formation and meatal stenosis still occurred.

Nevertheless, the most frequent complication, urethrocutaneous fistula and Urethral strictures etc., persist with reported rates in some series.[6, 7] To address this, modifications have been introduced, the most significant being the use of a well-vascularized intermediate layer, such as a dartos flap, to cover the neourethral suture line.[8] This layer acts as a robust barrier, theoretically reducing the risk of fistula formation by providing additional blood supply and separating the urethral and skin suture lines.

While short-term studies have supported this modification, long-term data are scarce. This study presents a comparative analysis with an excellent 12-year follow-up, evaluating the long-term efficacy, complication rates, and cosmetic outcomes of the modified Snodgrass procedure with a vascularized dartos flap versus the original Snodgrass technique for distal and mid penile hypospadias.

Materials and Methods

This quasi-experimental study was conducted in the Department of Urology, Dhaka Medical College, and Private Hospital, Dhaka, Bangladesh, between January 1, 2007, and December 31, 2008. The study received ethical approval, and written informed consent was obtained from all parents or guardians. Sixty-four patients aged two to eighteen years with primary distal or mid penile hypospadias were included. Patients with glandular, proximal, or posterior hypospadias, previous failed repairs, or ambiguous genitalia were excluded. In group allocation and surgical technique, Patients were chronologically numbered and randomly allocated to one of two groups. Patients in Group A (Study Group, 32) underwent a one-stage modified Snodgrass urethroplasty using a vascularized dartos flap wrap. Patients in Group B (Control Group, n=32) underwent a one-stage original Snodgrass urethroplasty (TIP).

During surgical procedures, both groups used a Glans traction suture. They made a circumscribing incision and degloved the penis. An artificial erection verified the restoration of the chordee. Parallel incisions were made all around the urethral plate. The midline of the urethral plate was cut longitudinally in Group A (Modified Snodgrass). The neourethra was tubularized in two layers with 6/0 Vicryl. A formal vascularized dartos flap, which was obtained from the dorsal preputial/subcutaneous tissue and translated ventrally through a buttonhole, completely covered the neourethra (Fig-1). In Group B (Snodgrass), the urethral plate was cut in a similar manner. The

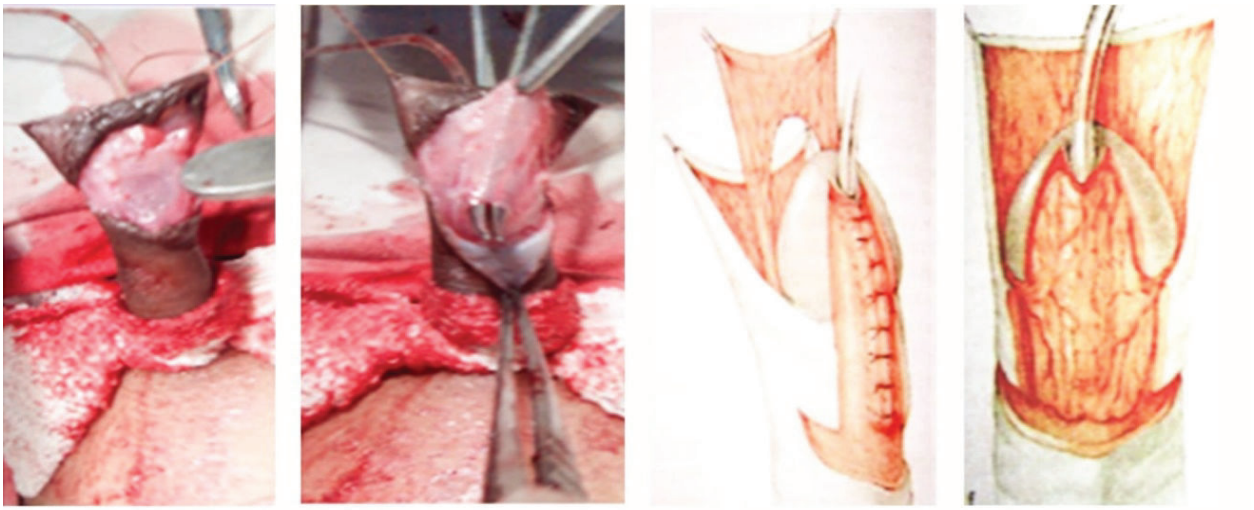

Fig.-1: *A vascularized dartos flap, which was obtained from the dorsal preputial/subcutaneous tissue and translated ventrally through a buttonhole*

neourethra was tubularized with interrupted 6/0 Vicryl sutures. Rather than a formal, harvested dartos flap, the suture line was covered with vascularized subcutaneous tissue from the prepuce or shaft. Glans wings were approximated in both groups, and Byars flaps covered the ventral skin. For 7-10 days, a urethral stent (6-10 Fr) was placed.

After surgery, analgesics and antibiotics were administered to patients as part of postoperative management and aftercare. Follow-up assessments were scheduled at two weeks, one, three, and six months of time, and then annually for 12 years (until 2020). The evaluation approach included history, physical examination, urine testing, and uroflowmetry. An assessor who was blind to the procedure recorded every outcome. The rate of urethrocutaneous fistula is the main result in outcome measurements. Secondary consequences include cosmetic results (glans form and meatal configuration) and other issues (chronic chordee, flap sloughing, urethral stricture, and meatal stenosis).

In statistical analysis, The data were analyzed using SPSS. The unpaired Student's t-test was used to compare continuous variables, which were reported as mean ± standard deviation. The Chi-squared (X^2) test was used to compare categorical variables. Statistical significance was defined as a p-value of less than 0.05.

Results

The mean age was 5.4 ± 2.17 years in Group A and 7.6 ± 2.81 years in Group B. The average age was 5.4 ± 2.17 years in Group A and 7.6 ± 2.81 years in Group B. The majority of patients in both groups came from low-income households (75% in Group A and 62.5% in Group B). Distal penile hypospadias was the most common kind (81.25% in Group A and 75% in Group B). All baseline parameters were comparable between the groups (Table 1). The mean operative time for Group A (128 ± 25.65 min) was longer than for Group B (110 ± 20.65 min), although this difference was not statistically significant (p=0.546).

After a 12-year follow-up, Group B had a significantly higher complication rate (25%) than Group A (15.63%) (p<0.05). Three patients (9.37%) in Group B and two individuals (6.25%) in Group A had urethrocutaneous fistula. Two patients (6.25%) in Group B and one patient (3.12%) in Group A had meatal stenosis. In addition, there was one instance of proximal urethral stricture, skin flap sloughing, and persistent chordee in Group B. These specific issues were absent in Group A (Table 2).

Table 1. *Baseline Patient Characteristics*

Characteristic	Group A (Modified Snodgrass) (n=32)	Group B (Snodgrass) (n=32)	p-value
Mean Age (years)	5.4 ± 2.17	7.6 ± 2.81	NS*
Distal Hypospadias	26 (81.25%)	24 (75%)	NS
Mid Penile Hypospadias	6 (18.75%)	8 (25%)	NS
Presence of Chordee	28 (87.5%)	30 (93.75%)	NS

*NS = Not Significant

Table 2. *Long-Term Postoperative Complications*

Complication	Group A (Modified Snodgrass) (n=32)	Group B (Snodgrass) (n=32)	p-value
Overall Complications	5 (15.63%)	8 (25%)	<0.05
Urethrocutaneous Fistula	2 (6.25%)	3 (9.37%)	
Meatal Stenosis	1 (3.12%)	2 (6.25%)	
Urethral Stricture	0 (0%)	1 (3.12%)	
Persistent Chordee	1 (3.12%)	1 (3.12%)	

Regarding the functional and cosmetic outcomes, urine flow Taking 'good' and 'average' flow as success, Group A had a much higher success rate (93.75%) than Group B (84.37%) at the 6-month follow-up, a trend that remained long-term over time. Relating to cosmesis, 27 people (84.37%) in Group A compared to 24 patients (75%), had a normal conical glans with a vertical slit meatus.

Discussion

The core principles of successful hypospadias repair emphasize the use of meticulous technique with delicate tissue handling, ensuring reconstruction is tension-free, covering the neourethra with well-vascularized tissue, and avoiding overlapping suture lines to prevent complications.[9] Common vascularized tissue flaps include dorsal dartos fascia (from the foreskin or penile shaft) and tunica vaginalis (from the testicle). The choice depends on the specific repair technique and the availability of tissue.

In this study group (group A), the mean age of the patients was 5.4 years, SD ± 2.17 (range 2 - 16 years), while in the control group (group B), the mean age was 7.6 years, SD ± 2.81 (range 2-18 years). Both the study and control groups had comparable age distributions, which were consistent with previous investigations.[10, 11] Another study found that individuals with hypospadias who received tubularized incised plate urethroplasty ranged in age from six months to three years.[6] As a result, patients with hypospadias and chordee in other parts of the world received therapy earlier than those in this study in Bangladesh. Therefore, it is evident that Bangladeshi hypospadias patients were treated significantly later in childhood, which is older compared to international standards that recommend surgery between 6 and 18 months.[12] This delay is linked to parental illiteracy and misconceptions, contrasting with the recommended early repair aimed at minimizing psychological distress. In this series, the mean operative time was 128 ± 25.65 minutes and 110 ± 20.65 minutes in Group-A (Modified Snodgrass urethroplasty) and Group-B (Snodgrass urethroplasty) respectively. Our finding that the operative time difference between the two groups was not statistically significant, make unequal with some other studies.[13,14] The operative times of 110 and 128 minutes suggest that both standard and modified procedures in your series were likely performed for more complex cases.

This long-term comparative study demonstrates the clear superiority of the modified Snodgrass procedure with a vascularized dartos flap over the original technique. The significantly lower overall complication rate (15.63% vs. 25%) and the absence of severe complications like stricture and flap loss in the modified group highlight the protective role of the dartos flap. Our findings are consistent with earlier research. In a major multi-institutional study, Cheng et al. used a similar modification and reported a fistula rate of less than 1%.[8] Djordjevic et al. and Bakan et al. underlined that a well-vascularized dorsal dartos flap should be a key step in the Snodgrass technique to avoid fistulas.[15,16] The 6.25% fistula rate in our modified group, while greater than some series, is acceptable and reflects the difficult conditions of a high-volume tertiary facility. The 9.37% rate in the control group is in line with bigger, multi-center studies.[6]

There are several factors contributing to the better results. A large, well-proportioned neourethra is made possible by the urethral plate's deep midline incision. In order to effectively separate the urethral and skin closures and avoid overlapping suture lines, which is a crucial element in the etiology of fistulas, the harvested dartos flap offers a strong, independent vascularized layer. Moreover, careful treatment with delicate tools and sutures, as used in this investigation, promotes the best possible recovery.[17] The study's 12-year follow-up period is a major strength, showing the repair's lasting success. While most hypospadias complications emerge early within the first two years, our long-term data validates the stability of the modified technique's successful outcomes over an extended period. The study's limitations are its single-center design and small sample size, which could restrict its generalizability. Nonetheless, the thorough long-term follow-up strengthens the conclusions more trustworthy.

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Conflict of Interest: The authors declare that they have no competing interests.

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