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A CLINICAL STUDY OF COMPLICATIONS OF SNODGRASS URETHROPLASTY FOR HYPOSPADIAS

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ABSTRACT

Background: Snodgrass explained TIP (tubularized incised plate) for hypospadias repair in 1994 as a method to improve and widen mobilization of the urethral plate while performing Thiersch-Duplay urethroplasty. Since its introduction, various studies have reported describing the success of modified procedures for repairing distal hypospadias lesions.

Aim: The present study aimed to assess the complications associated with Snodgrass urethroplasty (tubularized incised plate urethroplasty) in subjects presenting to the outpatient department.

Methods: The study included 50 male subjects with fresh cases of anterior, middle, and distal hypospadias. All the subjects underwent the Snodgrass procedure for hypospadias management. Intraoperative and postoperative data were gathered and analyzed statistically.

Results: No complication was encountered in 2% (n=1) subjects. Torsion and testicular ascent were seen in 2% (n=1) study subjects each. Urethral stricture and penile skin necrosis were seen in 6% (n=3) of subjects each. Meatal stenosis, urethrocutaneous fistula, and wound infection were seen in 10% (n=5) of study subjects each. Wound dehiscence was seen in 4% (n=2) of study subjects. Postoperative edema was seen in 30% (n=15) study subjects. Peri-catheter leak was recorded in 18% (n=9) of study subjects.

Conclusions: The present study concludes that a properly nourished patient with good personal hygiene, optimum operative time with less intraoperative bleeding, adequate tissue for covering the neo urethra, and adequate mobilization of the graft are the bare necessities of a good surgical outcome.

Keywords: complications, Hypospadias, repair, Snodgrass urethroplasty, urethroplasty

INTRODUCTION

Hypospadias is a developmental anomaly having characteristic urethral meatus that opens on the ventral surface of the penis and at the end of the glands. Hypospadias is derived from the Greek word where hypo means under and spadizo meaning tear off. Meatus in hypospadias can be seen anywhere along the shaft of the penis from the glans to the perineum. Hypospadiology is an in-depth study of the science and art of surgically managing the hypospadias which is sprinkled with eponyms where each represents a symbol for a principle or technique. Presently, controversies have been reported and challenged older truths so ingrained in historic techniques of correcting hypospadias.[1]

Few surgeons have attained perfection in managing hypospadias surgically, however, this success has not been widely accepted or is at least transferred to colleagues. Data from 1951 has suggested that surgical repair of hypospadias is not extremely difficult, unreliable, and dubious when tried and proven results are followed; good results can be seen in every case. Anything lesser suggest the compromise in surgery or technique or experience of the surgeon.[2]

The main objective of surgical hypospadiology is complete straightening of the penis, minimal complications, normal appearance of the penis, normalization of erection and voiding, meatus position at the tip of the glans, smooth urethra, and hairless urethra. Irrespective of malformation severity, urologists work hard to meet the demands resulting in over 350 operative modifications or procedures being described to manage males with hypospadias. However, no single procedure is considered a panacea for all types of hypospadias, and it remains one of the most challenging concerns in urological surgery. However, significant progress has been made in managing hypospadias as staged repairs are eliminated by single-stage surgeries. At the 20th century end, Snodgrass suggested a versatile TIP (tubularized incised plate) procedure for repairing most cases of hypospadias depicting favorable functional and cosmetic results.[3]

One-stage hypospadias repair was first introduced in 1900, and since its introduction, it has gained immense popularity in recent years. Changed concepts concerning chordee and urethral plate have increased confidence for the surgeons with the added advantages of using unscarred skin. The most common complication associated with hypospadias surgery is the formation of a fistula that needs re-operation. The fistula formation rate following a particular procedure is usually taken as the measure of the efficacy of surgical repair.[4]

Snodgrass explained TIP (tubularized incised plate) for hypospadias repair in 1994 as a method to improve and widen mobilization of the urethral plate while performing Thiersch-Duplay urethroplasty. Since its introduction, various studies have reported describing the success of modified procedures for repairing distal hypospadias lesions. Owing to the popularity of the technique, many other techniques used widely as transverse Island only or Mathieu procedure for distal hypospadias are being used less as they have more complications and poor results with more extensive nature such as tube urethroplasty compared to TIP or flaps.[5]

Modern treatment approaches in repairing hypospadias are the conservation of urethral plate when feasible. Owing to the relative simplicity of the operative concept, good cosmetic results, and low complication rates in distal hypospadias, the TIP procedure is being applied progressively to the defects present more proximally.[6] Hence, the present study aimed to assess the complications

associated with Snodgrass urethroplasty (tubularized incised plate urethroplasty) in subjects presenting to the outpatient department of Pediatric Surgery.

MATERIALS AND METHODS

The present descriptive observational study was aimed to assess the complications associated with Snodgrass urethroplasty (tubularized incised plate urethroplasty) in subjects presenting to the outpatient Department of Pediatric surgery, Grant GMC, Mumbai. The study was conducted in the period between July 2022 to June 2024. Verbal and written informed consent was taken from the parents of all the participants before study participation.

The study included 50 male subjects with hypospadias that were fresh cases of anterior, middle, and distal hypospadias presenting at the Pediatric Surgery OPD and IPD of the Hospital. The inclusion criteria for the study were subjects in the age range of 6 months to 12 years, fresh cases, anterior, middle, and distal penile hypospadias, and subjects whose parents were willing for the study participation. The exclusion criteria for the study were subjects with a history of previous inguinoscrotal surgery including orchidopexy, hydrocele, or hernia, history of circumcision, redo cases, subjects younger than 6 months and older than 12 years, and subjects were informed consent was not available.

After the final inclusion of the study subjects based on the inclusion criteria, a detailed history was recorded for all the subjects followed by a clinical examination. This was followed by all the investigations for the fitness of general anesthesia. All subjects were managed under general anesthesia and endotracheal intubation. For all the subjects, demographic data were gathered including the name, gender, age, and address followed by detailed history recording including previous surgery history, treatment history, comorbid associated disease, and presenting complaints. Clinical examination included degree of chordee and site of the meatus. Laboratory investigations done included urine examination for sensitivity and culture, routine assessment, microscopic assessment, clotting time, bleeding time, platelet counts, total counts, differential counts, and Hb% from intravenous samples collected under strict aseptic and sterile conditions.

In clinical examination, pus was collected from the wound followed by aspiration from the swelling near the wound for collection of blood or serous fluid, examination of penile skin and wound, history, clinical examination, and assessment using anterior urethral dilator (size2/3) with local anesthetic jelly (2%). Clinical examination and history was taken particularly during micturition, testis examination for any decrease in size or position, and to compare cosmetic outcomes.

The surgery was performed under general anesthesia using Snodgrass urethroplasty (tubularized incised plate urethroplasty) under general anesthesia (Fig 3). Preoperatively, all the subjects were given intravenous ceftriaxone at 100mg/kg body weight 15 minutes before anesthesia induction The intra-surgical parameters recorded were the site of urethral opening, age of the subject at the time of surgery, width of Glanular plate, width of urethral plate, length of hospital stay, and time of operation in minutes. Operative notes were recorded concerning preoperative diagnosis, date and time, anesthesia, technique used, surgeon’s note, time needed, and adverse effects.

Intravenous ceftriaxone as 100mg/kg body weight intravenous dose was also given divided 12 hourly for 2 days postoperatively and oral cefixime 10mg/kg body weight in two divided doses for the next 8 days. Diclofenac sodium per rectally 1.5 mg/kg body weight/dose 8 hourly for 3 days, then oral paracetamol 20 mg/kg body weight/dose as and when required. The dressing was removed on the 10^{th} postoperative day and the catheter was removed on the 10^{th} postoperative day.

Early postoperative data were gathered on the 1^{st}, 2^{nd}, 3^{rd}, 5^{th}, and 8^{th} day postoperatively by clinical examination and data gathered were wound dehiscence, penile skin necrosis, hematoma formation, seroma formation, and wound infection. The subjects were further followed at 1-month, 3-month, 6-month, and 1-year intervals postoperatively and any urethrocutaneous fistula or any other complications were noted. At all the recall times, testicular atrophy, testicular ascent, urethral diverticulum, urethral stricture, meatal stenosis, and urethrocutaneous fistula were assessed and noted.

The data gathered were analyzed statistically using SPSS (Statistical Package for the Social Sciences) software version 21.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, independent t-test, Mann Whitney U test and chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

The study included 50 male subjects with hypospadias that were fresh cases of anterior, middle, and distal hypospadias. The majority of the subjects were in the age range of 1-4 with 68% (n=34) subjects followed by 22% (n=11) subjects from 5-8, and 10% (n=5) subjects respectively. 60% (n=30) of subjects were residents of rural areas and 40% (n=20) were subjects from urban residences. Proximal penile (Fig 1), mid penile, distal penile (Fig 2), subcoronal, and coronal type of hypospadias type was seen in 20% (n=10) subjects each. The most common presenting feature was cosmetic concern reported by 70% (n=35) subjects followed by a thin urinary stream in 20% (n=10) subjects, undergarment soiling in 6% (n=3) study subjects, and downward penis bending in 4% of (n=2) study subjects respectively (Table 1).

Concerning the data related to hypospadias in study subjects, meatal stenosis was seen in 20% (n=10) of subjects where coronal stenosis, sub-coronal stenosis, distal penile stenosis, mid-penile stenosis, and proximal penile stenosis were seen in 60% (n=6), 30% (n=3), 10% (n=10), 0, and 0 subjects respectively. Chordee was seen associated with 80% (n=40) of subjects. The degree of Chordee was significant and minimal in 25% (n=10) and 75% (n=30) subjects respectively. Associated disease was inguinal hernia in 60% (n=3) of study subjects and UDT (undescended testicles) in 40% (n=2) of study subjects respectively (Table 2).

The study results showed that for postoperative complications, no complication was encountered in 2% (n=1) subjects. Torsion and testicular ascent were seen in 2% (n=1) study subjects each. Urethral stricture and penile skin necrosis were seen in 6% (n=3) of subjects each. Meatal stenosis, urethrocutaneous fistula, and wound infection were seen in 10% (n=5) of study subjects each. Wound dehiscence was seen in 4% (n=2) of study subjects. Postoperative edema was seen in 30% (n=15) study subjects. Peri-catheter leak was recorded in 18% (n=9) of study subjects (Table 3).

For distribution of meatal stenosis based on the type of hypospadias, sub-coronal and proximal penile meatal stenosis was seen in 40% (n=2) and 60% (n=3) study subjects respectively. However, coronal, distal penile, and mid-penile meatal stenosis was not reported in any study subject (Table 4). Concerning fistula outcome, spontaneous healing was seen in 40% (n=2), and surgical management was done in 60% (n=3) of study subjects respectively (Table 5).

Postoperatively, the urinary stream was uniform and forward in 88% (n=44) of study subjects, was a thin jet in 6% (n=3) of study subjects, and was playing in 6% (n=3) of study subjects respectively (Table 6). In cosmetic outcomes, the results were excellent, good, fair, poor, and bad in 72% (n=36), 24% (n=12), 4% (n=2), and no study subjects respectively as depicted in Table 7.

DISCUSSION

The majority of the subjects were in the age range of 1-4 months with 68% (n=34) subjects followed by 22% (n=11) subjects from 5-8 months, and 10% (n=5) subjects respectively. 60% (n=30) of subjects were residents of rural areas and 40% (n=20) were subjects from urban residences. Proximal penile, mid penile, distal penile, subcoronal, and coronal type of hypospadias type was seen in 20% (n=10) subjects each. The most common presenting feature was cosmetic concern reported by 70% (n=35) subjects followed by thin urinary stream in 20% (n=10) subjects, undergarment soiling in 6% (n=3) study subjects, and downward penis bending in 4% (n=2) study subjects respectively. These data were similar to the studies of Kaefer M[7] in 2021 and Snodgrass P et al[8] in 2021 where authors assessed subjects with demographic data comparable to the present study.

It was seen that concerning the data related to hypospadias in study subjects, meatal stenosis was seen in 20% (n=10) subjects where coronal stenosis, sub-coronal stenosis, distal penile stenosis, mid-penile stenosis, and proximal penile stenosis was seen in 60% (n=6), 30% (n=3), 10% (n=10), 0, and 0 subjects respectively. Chordee was seen associated with 80% (n=40) subjects. The degree of Chordee was significant a1nd minimal in 25% (n=10) and 75% (n=30) subjects respectively. The associated disease was inguinal hernia in 60% (n=3) study subjects and UDT (undescended testicles) in 40% (n=2) study subjects respectively. These results were consistent with the studies of Wang C et al[9] in 2021 and Hisamatsu E et al[10] in 2021 where authors reported presenting symptoms, chordee, and associated diseases similar to the present study in their respective studies.

Concerning the postoperative complications, no complication was encountered in 2% (n=1) subjects. Torsion and testicular ascent were seen in 2% (n=1) study subjects each. Urethral stricture and penile skin necrosis were seen in 6% (n=3) of subjects each. Meatal stenosis, urethrocutaneous fistula, and wound infection were seen in 10% (n=5) of study subjects each. Wound dehiscence was seen in 4% (n=2) of study subjects. Postoperative edema was seen in 30% (n=15) study subjects. Peri-catheter leak was recorded in 18% (n=9) of study subjects. These findings were in agreement with the results of Ceccarelli PL et al[11] in 2021 and Costa E et al[12] in 2021 where authors reported similar complications after hypospadias correction as seen in the results of the present study.

The study results showed that for distribution of meatal stenosis based on the type of hypospadias, sub-coronal and proximal penile meatal stenosis was seen in 40% (n=2) and 60% (n=3) study subjects respectively. However, coronal, distal penile, and mid-penile meatal stenosis was not reported in any study subject. Concerning fistula outcome, spontaneous healing was seen in 40%

(n=2), and surgical management was done in 60% (n=3) of study subjects respectively. These results were in line with the studies of Babu R[13] in 2021 and Ali MM et al[14] in 2021 where authors reported meatal stenosis distribution based on hypospadias type similar to the present study in their respective studies.

It was seen that postoperatively, the urinary stream was uniform and forward in 88% (n=44) study subjects, was a thin jet in 6% (n=3) study subjects, and was playing in 6% (n=3) study subjects respectively (Table 6). In cosmetic outcomes, the results were excellent, good, fair, poor, and bad in 72% (n=36), 24% (n=12), 4% (n=2), and no study subjects respectively. These findings correlated with the results of Chan YY et al[15] in 2021 and Lin H et al[16] in 2021 where authors reported cosmetic outcomes and urine stream postoperatively similar to the present study.

CONCLUSIONS

Considering its limitations, the present study concludes that a properly nourished patient with good personal hygiene, optimum operative time with less intraoperative bleeding, adequate tissue for covering the neo urethra, and adequate mobilization of the graft are the bare necessities of a good surgical outcome. However, the judicious use of pre-operative and post-operative antibiotics and post-operative dressings cannot be over-emphasized in considering the outcome of Snodgrass Urethroplasty. Further future longitudinal studies with a larger sample size and longer monitoring are needed for a definitive conclusion.

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TABLES

S. No	Characteristics	Number (n=50)	Percentage (%)
1.	**Age range**		
a)	1-4	34	68
b)	5-8	11	22
c)	9-12	5	10
2.	**Residence**		
a)	Rural	30	60
b)	Urban	20	40
3.	**Hypospadias type**		
a)	Proximal penile	10	20
b)	Mid penile	10	20
c)	Distal penile	10	20
d)	Subcoronal	10	20
e)	Coronal	10	20
4.	**Presenting features**		
a)	Downward penis bending	2	4
b)	Undergarments soiling	3	6
c)	Thin urinary stream	10	20
d)	Cosmetic reasons	35	70

Table 1: Demographic data and disease data in study subjects

S. No	Associated features	Number (n=50)	Percentage (%)
1.	**Meatal stenosis**	10	20
a)	Coronal	6	60
b)	Sub Coronal	3	30
c)	Distal Penile	1	10
d)	Mid Penile	0	0
e)	Proximal Penile	0	0
2.	**Associated chordee**	40	80
3.	**Chordee degree**		
a)	Significant	10	25
b)	Minimal	30	75
4.	**Associated disease**	5	10
a)	Inguinal hernia	3	60
b)	UDT (undescended testicles)	2	40

Table 2: Hypospadias-related data in study subjects

S. No	Associated features	Number (n=50)	Percentage (%)
1.	**No complications**	1	2
2.	**Testicular ascent**	1	2
3.	**Torsion**	1	2
4.	**Urethral stricture**	3	6
5.	**Meatal stenosis**	5	10
6.	**Urethrocutaneous fistula**	5	10
7.	**Penile skin necrosis**	3	6
8.	**Wound dehiscence**	2	4
9.	**Wound infection**	5	10
10.	**Postoperative edema**	15	30
11.	**Pericatheter leak**	9	18
12.	**Total**	50	100

Table 3: Postoperative complications in the study subjects

S. No	Meatal stenosis based on Hypospadias type	Number (n=5)	Percentage (%)
1.	**Coronal**	0	0
2.	**Sub Coronal**	2	40
3.	**Distal Penile**	0	0
4.	**Mid-Penile**	0	0
5.	**Proximal Penile**	3	60

Table 4: Distribution of meatal stenosis based on the type of hypospadias

S. No	Fistula outcomes	Number (n=5)	Percentage (%)
1.	**Spontaneous Healing**	2	40
2.	**Operative**	3	60
3.	**Total**	**5**	**100**

Table 5: Assessment of fistula outcome in study subjects

S. No	Urinary stream	Number (n=5)	Percentage (%)
1.	**Uniform and forward**	44	88
2.	**Thin Jet**	3	6
3.	**Splaying**	3	6
4.	**Total**	**50**	**100**

Table 6: Urinary stream postoperatively in study subjects

S. No	Cosmetic outcome	Number (n=5)	Percentage (%)
1.	Excellent	36	72
2.	Good	12	24
3.	Fair	2	4
4.	Bad	0	0
5.	**Total**	**50**	**100**

Table 7: Cosmetic outcomes in study subjects

Fig 1: Proximal hypospadias

Fig 2: Distal Hypospadias

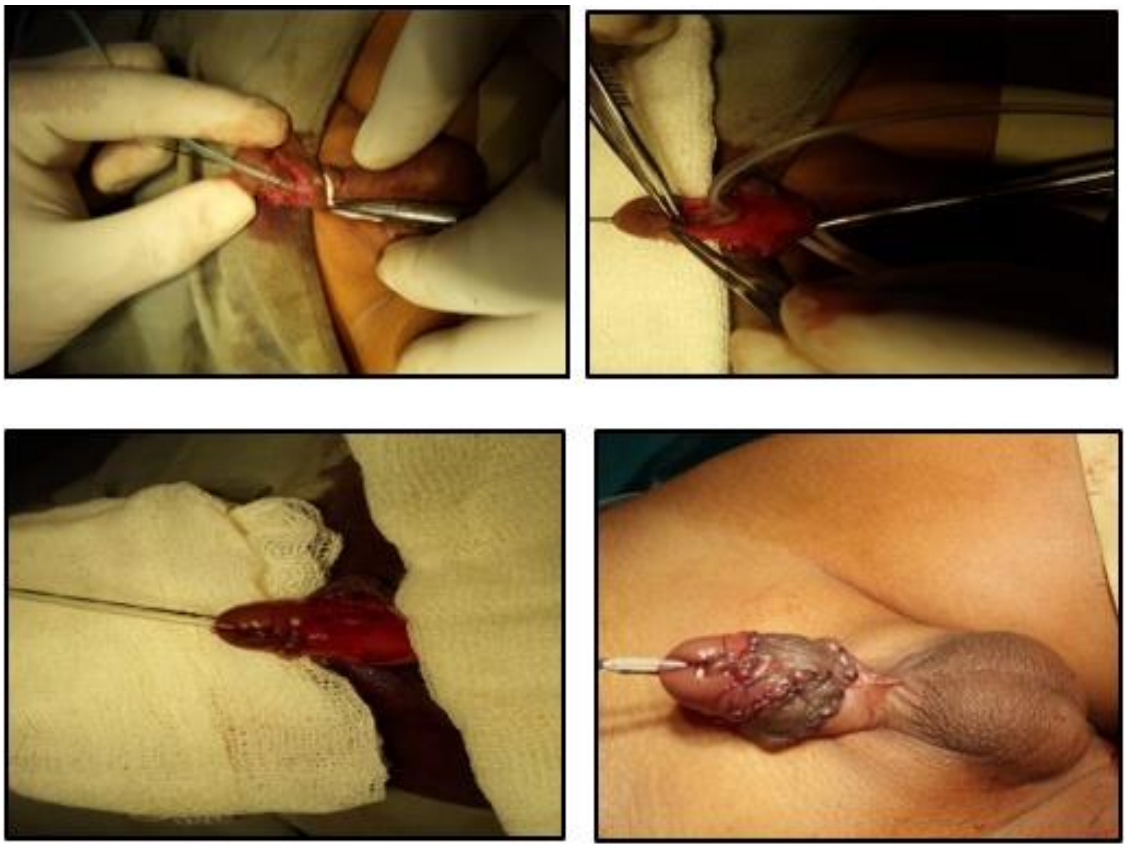

Fig 3: Intraoperative view of Snodgrass procedure