

Comparison of Snodgrass Tubularised Incised Plate Urethroplasty and Duckett Onlay Transverse Preputial Patch Urethroplasty for Correction of Penile Hypospadias

Mandar Vaidya¹, Suyog Shetye² and Jyotsna Kulkarni^{3*}

¹Associate Professor, Department of Surgery, Dr. Vasanttrao Pawar Medical College, Hospital and Research Centre, Nashik - 422003, Maharashtra, India

²Former PG Resident, Department of Surgery, Dr. Vasanttrao Pawar Medical College, Hospital and Research Centre, Nashik - 422003, Maharashtra, India

³Assistant Professor, Department of Surgery, Dr. Vasanttrao Pawar Medical College, Hospital and Research Centre, Nashik - 422003, Maharashtra, India; jyobkulkarni@gmail.com

Abstract

Introduction: Hypospadias is defined as a condition where the urethra opens on the ventral aspect of the penis. It is commonly associated with penile curvature, usually ventral and is one of the most common genital birth defects in males. Hypospadias can be treated with numerous different surgical approaches numbering upto 200, and historically has been treated with procedures like Trans-Verse Island Flap (TVIF) on lay, Tubularised Incised-Plate (TIP), vertical preputial island flap, tubularised preputial flap, vertical preputial flap with double skin island etc. Present study was conducted to compare Snodgrass Tubularised Incised Plate Urethroplasty (TIP procedure) and Duckett Onlay Transverse Preputial Patch Urethroplasty for penile hypospadias correction. **Material and Methods:** Male patients between the age of 2-14 years who underwent correction of penile hypospadias by either of the two techniques viz. TIP (procedure) Urethroplasty and Duckett Onlay Transverse Preputial Patch Urethroplasty were included in the present prospective observational study after written informed consent. **Results:** The study was carried out with 40 patients and sorted into two groups, i.e. Snodgrass (S) and Duckett (D) group with 20 patients each. No difference was observed among study groups with regards to incidence of individual complications like urethrocutaneous fistula, stricture, or wound infection ($p>0.05$). However, total complication rate was marginally higher (55%) in Snodgrass' procedure as compared to Duckett's procedure (35%). All the cases of stricture (10%) and wound dehiscence (5%) were reported in Snodgrass group.

Keywords: Snodgrass Urethroplasty, Duckett Onlay, Transverse Preputial, Patch Urethroplasty, Penile, Hypospadias, Ventral Penile Curvature

1. Introduction

Hypospadias is a congenital abnormality in which the urethra opens on ventral aspect of the penis. It is commonly associated with chordee (ventral penile curvature) and is the second most common genital birth defect in males after cryptorchidism. The incidence of hypospadias is one in 200 live male births. Hence, hypospadias correction is a common surgical procedure performed by pediatric urologists^{1,2}.

Hypospadias is classified based on location of the urethral meatus into distal, midshaft or proximal hypospadias. The surgical correction of hypospadias aims to achieve a straight penis with a slit-shaped meatus of adequate calibre at the glans apex, a conical constructed glans, either a circumcised appearance of the penis or if the parents opt for preputial reconstruction, a circumferential foreskin which is retractable and an acceptable cosmetic outcome objectively³.

*Author for correspondence

Hypospadias has been treated with numerous different surgical approaches numbering up to 200^{4,5} with procedures like Trans-Verse Island Flap (TVIF) onlay⁷, Tubularised Incised-Plate (TIP)⁶ vertical preputial island flap⁸ tubularised preputial flap⁹, vertical preputial flap with double skin island¹⁰ etc.

Selection of optimal technique for hypospadias correction is challenging since numerous factors are to be considered. Along with severity of chordee, optimal tissue for urethral reconstruction, urethral plate quality and surgeons' experience and preference, the initial meatal location influences the urethroplasty technique and the prognosis of hypospadias repair¹¹. Also, the need for glanuloplasty and preputioplasty needs deliberation¹².

Originally introduced for distal hypospadias correction, TVIF onlay⁷ a variation of tubularised preputial flap, first described by Standoli *et al.* (1979)¹³ and Duckett *et al.* (1980)⁸, and TIP, described by Snodgrass *et al.* (1994)⁶, have extended their effectiveness to proximal hypospadias^{14,15}.

Numerous studies have compared the surgical outcomes between these two techniques for hypospadias treatment with erratic results. This study was conducted for better comparison of the surgical outcomes between Snodgrass TIP (procedure) Urethroplasty and Duckett Onlay Transverse Preputial Patch Urethroplasty for correction of penile hypospadias.

2. Aim and Objectives

1. Compare the final outcomes after surgery for Snodgrass' Procedure and Duckett's Procedure.
2. Assess the complications associated with each procedure.
3. Measure the failure rate and associated re-dos for each procedure.

3. Material and Methods

Male patients between the ages of 2-14 years who underwent correction of penile hypospadias by either of the two techniques viz. Snodgrass' or Duckett's procedure were included in the present prospective observational study after written informed consent.

The total sample size was 40. Twenty patients were allotted in two groups:

Group TIP: The patients undergoing Snodgrass Tubularised Incised Plate Urethroplasty (TIP procedure).

Group Duckett: The patients undergoing Duckett Onlay Transverse Preputial Patch Urethroplasty.

Inclusion Criteria: Male patients with hypospadias in the age group of 2-14 years.

Exclusion Criteria:

1. Hypospadias with chordee.
2. Redo Surgeries.
3. Defect distal to coronal hypospadias.
4. Patient refusal to participate in the study.

4. Results

Mean age was comparable between the two study groups ($p=0.72$). Mean age was 47.6 months in Duckett's groups as compared to 48.7 months in Snodgrass group.

Out of the total 40 cases, position of the meatus was distal in 30% cases while it was mid-shaft and proximal in 52.5% and 17.5% cases respectively (Table 1).

Table 1. Distribution of meatal position among study groups

Meatal Position	Group		Total
	Duckett's	TIP	
Distal	1 5.0%	11 55.0%	12 30.0%
Mid shaft	14 70.0%	7 35.0%	21 52.5%
Proximal	5 25.0%	2 10.0%	7 17.5%
Total	20 100.0%	20 100.0%	40 100.0%
p- value - 0.025			

No difference was observed among study groups with regard to incidence of individual complications like urethra-cutaneous fistula, stricture or wound infection ($p>0.05$). But, overall complication rate was higher (55%) in TIP's procedure as compared to Duckett's procedure (35%). All the cases of stricture (n-2) and wound dehiscence (n-1) were reported in TIP group (Table 2).

Complication rate was higher among cases of proximal repair (3/5 cases of Duckett's and 2/2 cases of TIP) and mid-shaft repair (4/14 cases of Duckett's and 7/7 cases of TIP) as compared to distal repair (0/1 cases of Duckett's and 2/11 cases of TIP). The difference was significant among study groups in cases of mid shaft repair (Table 3).

Table 2. Distribution of complications among study groups

Complications	Group		Total	p- value
	Duckett's	TIP		
Urethrocutaneous Fistula	7 35.0%	8 40.0%	15 37.5%	1.00
Stricture	0 0.0%	2 10.0%	2 5.0%	1.00
Wound Dehiscence	0 0.0%	1 5.0%	1 2.5%	1.00
Total	7 35.0%	11 55.0%	18 45.0%	0.34

Table 3. Distribution of type of complications as per meatal site

Complications	Group		Total	P- value
	Duckett's	TIP		
Distal (n-12)	0 0.0%	2 18.2%	2 16.7%	1.00
Mid shaft (n-21)	4 28.6%	7 100.0%	11 52.4%	<0.05
Proximal (n-7)	3 60.0%	2 100.0%	5 71.4%	1.00
Total	7 35.0%	11 55.0%	18 45.0%	0.34

Urethrocutaneous fistula was the only complication associated with proximal repair in both groups (3/5 and 2/2 cases in Duckett's and Snodgrass repair).

Urethrocutaneous fistula was seen in 3 cases out of 14 undergoing mid shaft Duckett's repair (21.4%). While incidence of fistula, stricture and wound dehiscence was 1, 2 and 1 cases out of 7 cases of mid shaft Snodgrass repair (14.3%, 28.6% and 14.3%).

Urethrocutaneous fistula was the only complication associated with distal repair in both groups (1/1 and 5/11 (45.5%) cases in Duckett's and Snodgrass repair).

Re-operation rate was 45% in cases undergoing TIP procedure as compared to 25% among cases of Duckett's repair (p=0.32) (Table 4).

5. Discussion

In recent times, more emphasis is placed on to the preservation of the urethral plate¹⁰. The urethral

Table 4. Distribution of re-operation rates among study groups

Re-operation Rate	Group		Total
	Duckett's	TIP	
Yes	5 25.0%	9 45.0%	14 35.0%
No	15 75.0%	11 55.0%	26 65.0%
Total	20 100.0%	20 100.0%	40 100.0%
p- value - 0.32			

plate in hypospadias patients has several elements present normally in urethral spongiosum¹¹. It is rich in neurovascular supply and has good muscular backing. These factors render the urethral plate suitable for hypospadias repair. Duckett's Onlay Patch and Snodgrass TIP procedure, both utilize urethral plate for neourethra formation with agreeable results.

Braga *et al.* (2005)¹ observed slightly higher complication rates in TIP (60%) when compared to Duckett's procedures (45%), similar to this study.

Xu *et al.* (1980)⁸ observed overall complication rate in the Duckett's Onlay group as 21.5% (20/93) and as 18.1% (15/83) in the TIP group (p=0.569). The commonest complication was urethrocutaneous fistula, occurring in 10.8% (10/93) of the Duckett's group and in 9.6% (8/83) of the TIP group.

The study by Sujjantararat *et al.* (2010)² showed overall rate of complication as 30.9% (13/42) in the Duckett's Onlay group and 23.5% (8/34) in TIP group (p=0.305), and urethrocutaneous fistula rate was 23.8% (10/42) in the Duckett's group compared to 14.7% (5/34) in the TIP group (p=0.393).

On analysis of the correlation between meatus position and overall complications, complication rate was higher among cases of proximal repair (3/5 cases of Duckett's and 2/2 cases of TIP) and mid-shaft repair (4/14 cases of Duckett's and 7/7 cases of TIP) as compared to distal repair (0/1 cases of Duckett's and 2/11 cases of TIP). It was evident that in either group with distal meatal position, complications were minimal and hence both techniques can be equally applied in distal hypospadias repair. For proximal and mid shaft hypospadias, this study shows Duckett's onlay has lower complication rate (36.8) when compared to Snodgrass procedure (100%).

The rate of complication for TIP in distal hypospadias repair is low. Snodgrass et al experienced complications in 10/148 (7%) patients of distal hypospadias repair¹². Retik and Borer experienced complications in only 1/31 (3%) patients of distal hypospadias repair¹³. Sugarman *et al.*, experienced complications in 2/32 (6.25%) patients¹⁴ where in distal hypospadias was present in 25 out of the 32 boys.

However, complication rate after TIP procedure for proximal and mid-shaft hypospadias repair ranges from 31% to 60%²⁻⁷. Sujjantararat *et al.*, (2010)² in their study, noted that there were no complications in both TIP and Duckett's group with distal hypospadias but in proximal hypospadias, TIP procedure resulted in a higher complication rate (37.5%) compared to Duckett's Onlay repair (30%). Snodgrass and Lorenzo experienced overall complication rate of 33% for TIP procedure in 33 patients with proximal and mid-shaft hypospadias¹⁵. Complication rate was 60% as reported by Braga *et al.*, in these cases¹⁶.

The predominance of fistulas proposes that a "long TIP" neourethra in proximal and mid-shaft repair generates increased flow resistance compared to a "short TIP" neourethra for distal repair. This is governed by Poiseuille's law which tells us that the pressure differential created in a tube is directly proportional to its length and inversely to the radius. Thus, even though the TIP neourethra be stricture-free, its length-to-calibre ratio might act as resistance in comparison to the onlay neourethra just distal to the native meatus, leading to a proximal fistula in the region of the original proximal hypospadiac meatus.

Since the patients in this series with proximal hypospadias is less than ten in either group, we could expect that with more patient numbers, the complication rate would reduce even further, as the surgeon gained experience. Nevertheless, our study demonstrates that TIP procedure in proximal hypospadias is not as good as in proximal and mid-shaft hypospadias. Hence, TIP procedure being relatively simple should be recommended for distal hypospadias repair while Duckett's Onlay Patch repair is to be preferred for proximal and mid shaft hypospadias.

6. Conclusion

Hypospadias repair by Duckett's Onlay Transverse Preputial Patch Urethroplasty or Snodgrass Tubularised Incised Plate (TIP) Urethroplasty procedure has almost

similar complication rates. Urethrocutaneous fistula is the commonest complication associated with both surgeries while stricture was associated with TIP procedure only.

TIP procedure tends to have higher overall complication rate for proximal and mid shaft hypospadias repair. However, TIP procedure is a relatively simple technique in comparison to Duckett's Onlay repair and should be preferred for distal hypospadias repair whereas Duckett's Onlay repair is to be preferred for proximal and mid shaft hypospadias repair.

7. References

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