

Does the Extent of Urethral Dissection Affect Outcomes in Urethroplasty: Circumferential Mobilisation vs Lateral Dissection Only of Urethra

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Abstract

Introduction & Objectives: Urethroplasty for anterior urethral strictures is surgically challenging with modifications described for better outcomes. We compared the outcomes of circumferential mobilisation vs lateral dissection only of urethra for patients undergoing dorsal onlay buccal mucosal graft urethroplasty. **Materials & Methods:** Between November 2018 & June 2021, all patients diagnosed with urethral stricture disease who satisfied the eligibility criteria were assigned to two groups: lateral dissection only vs circumferential mobilization of bulbar urethra after taking informed consent. Patients were evaluated with history, physical examination, ultrasound KUB, uroflowmetry and AUG + MCU. Intraoperative & postoperative parameters were compared across both the treatment groups and analysed. **Results:** Mean age of 94 patients was 48.14 ± 15.89 years with 47 assigned to each group. Post inflammatory etiology (36.2%) was most common. Demographic criteria were comparable across both the treatment groups. Strictures were seen mostly in the bulbar urethra (Mean length = 5.34 ± 1.94 cms). Mean length & width of the graft required was 7.17 ± 2.0 cms & 1.85 ± 0.25 cms respectively. 86% showed improvement at 6 months with the success in lateral dissection group slightly higher, although not statistically significant. Peak flow rates were comparable across both the groups at 3 & 6 months of follow up. **Conclusions:** One sided lateral only dissection has comparable outcomes to circumferential mobilisation in terms improved flow rates at short term follow up.

Keywords: Urethroplasty, Dorsal Onlay Urethroplasty, BMG Urethroplasty, One Sided Urethroplasty.

Introduction

Male urethra is divided into anterior urethra (penile and bulbar urethra to the level of the urogenital diaphragm) and posterior urethra (membranous and prostatic urethra) [1]. Urethral stricture disease is as ancient as the history of Mankind with notable descriptions in both Greek and Egyptian literature. Safe and effective management of urethral stricture disease has long been the goal of urologists. Visual internal urethrotomy made at either the 12 o'clock or at the 3 and 9 o'clock positions with a cold-knife urethrotome is suited for short strictures in the bulbar urethra [2]. While urethral dilatation and urethrotomy continue to be the most commonly performed procedures, they are known to fail with recurrence rate as high as 47.6%. Currently, open urethroplasty is regarded as the gold standard treatment for urethral strictures [1,2]. Stricture excision and primary re-anastomosis (EPA) has excellent long-term results for strictures <2cm while excisional augmented anastomotic urethroplasty is recommended for strictures of 2-4 cm length [2]. Various modifications have been applied to this technique, with one such significant development being the dorsal onlay graft

urethroplasty first described by Barbagli *et al.* and later improvised to muscle and nerve-sparing bulbar urethroplasty in order to preserve the bulbospongiosum muscle and its perineal innervations [3-6].

Kulkarni *et al.* [3] combined this technique with full dorsal length opening for the repair of anterior urethral strictures. They proposed that preservation of the lateral vascular supply to the urethra, the central tendon of the perineum, the bulbospongiosum muscle and its perineal innervation resulted in greater success rates (~92%) with minimal complications [3]. With the same intent/hypothesis, we aimed to compare the clinical outcomes between circumferential mobilization and lateral dissection of urethra for management of anterior urethral stricture at our center in terms of safety and efficacy.

Materials & Methods

Between, November 2018 to June 2021, all patients admitted to our department and satisfying the eligibility criteria were included in the study after obtaining informed consent. Inclusion criteria: Patients with a diagnosis of 1) Stricture of penile urethra, 2) Stricture of bulbar

urethra, 3) Post urethroplasty stricture (Anastomotic), 4) Post traumatic stricture of anterior urethra (Instrumentation & Catheterization). Exclusion criteria: Stricture previously managed with BMG urethroplasty, anterior urethral stricture with fossa navicularis involvement, stricture following hypospadias repair, stricture length < 2 cm, pelvic fracture urethral distraction defects, active urinary tract infection, post prostatectomy membranous stricture and poor general health. We aimed to compare the clinical outcomes between circumferential mobilization and lateral dissection of urethra in terms of safety and efficacy.

At the time of enrolment, patients were allotted either to circumferential mobilization group or lateral dissection group based on computer generated random number series. A detailed clinical history and a meticulous physical examination was undertaken in all enrolled patients. All patients were subjected to the routine investigations as per hospital protocol and specific investigations that included uroflowmetry, ultrasound of kidney ureter and bladder (KUB) and ascending urethrogram (AUG) with micturating cystourethrogram (MCU) to describe the site, extent and number of strictures.

Technique: Patients were placed in dorsal lithotomy position under general anesthesia with nasal intubation. Intravenous antibiotic given at induction and the skin over the suprapubic region, scrotum and perineum was prepared and draped appropriately. Urethroscopy with a 6 Fr ureteroscope was performed at the time of surgery to confirm the findings and rule out near obliterated strictures. Buccal mucosal graft was harvested in a standard manner. Diluted Methylene blue was injected into the urethra and a midline perineal incision given. Bulbar and/or proximal urethra was dissected from the corpora cavernosa either circumferentially or only along the left side based on the type of technique assigned to the patient and size and extent of the stricture. Distal limit of stricture was identified and the dorsal surface of the urethra was incised along the midline to expose the urethral lumen. Urethrotomy extended both distally and proximally till the entire stricture length had been incised. Buccal graft was snipped to stricture length and width and apices of the graft sutured to the proximal and distal apices of the urethrotomy over a 18F Foley's catheter using Vicryl (polyglactin 910), 4-0 round body needle. The graft was stabilized using quilting sutures to underlying corpora. Colles' fascia, the perineal fat and the skin approximated and catheter left in situ for a minimum of 3 weeks. Intra operative parameters that were assessed included: type of operative technique employed, stricture length (cm), width of urethral plate (cm), blood loss (ml), operative time (minutes), length and width of graft (s) (cms), technique of hemostasis at donor site.

Peri-operative and post-operative course of intravenous antibiotics was administered for 5 days followed by oral antibiotics till catheter removal. Check dressing for the perineal suture line was done on post-operative day 3 and patients were discharged on post-operative day 5 if asymptomatic. Post catheter removal, all patients were assessed for urinary complaints/symptoms, donor and surgical site examination, and advised regular follow up as per institution protocol. Uroflowmetry, AUG, Donor site examination done at 3 months post catheter removal.

Failure was defined as need for secondary procedure in form of urethral dilatation, VIU or redo-urethroplasty during the first six month follow up period.

Statistical analysis

Sample size of 94 (47 each in lateral dissection and circumferential mobilization) was calculated on the basis of prior study results. In

order to achieve a precision of 80% power & 95% confidence interval the study required a minimum of 47 subjects in each group. Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean \pm SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven's test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/ Fisher Exact test has been applied to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for Qualitative data analysis. Fisher exact test used when cell samples are very small. A p value of <0.05 was considered statistically significant. Statistical software SPSS 18.0, and R environment ver.3.2.2 were used for the analysis of the data.

Results

A total of 94 patients were enrolled and evaluated with 47 each undergoing circumferential dissection and lateral only dissection respectively. Age of the study population ranged between 18 and 84 years ((Mean \pm SD= 48.14 \pm 15.89 years) with the highest incidence noted in 31-40 years age range. Post inflammatory strictures (36.2%) were most common followed by post traumatic strictures (31.9%). Weak stream and straining were the most common forms of presentation with only 24(25.5%) patients presenting with acute retention of urine. All patients with history of trauma had a suprapubic catheter in situ at the time of presentation. Demographic criteria were comparable across both the groups (**Table 1**). 27(28.72%) patients had undergone a prior urethral procedure either in the form of urethral dilatation, visual internal urethrotomy or anastomotic urethroplasty. 28(29.78%) patients had a positive urine culture and were given antibiotics as per standard institution protocol and were taken for surgery after repeat urine culture was negative. Stricture site, length and number were assessed intraoperatively with a 6Fr Ureteroscope (**Table 2**). Most patients had a bulbar urethral stricture measuring with a mean length of stricture measuring 5.34 \pm 1.94 cms. Pan anterior urethral stricture was seen in 8(8.51%) patients. Length of graft required ranges from minimum of 3 cms up to 12 cms while width of graft ranged from 15 mm to 25 mm. Mean length of the graft was 7.17 \pm 2.01 cms and mean width of the graft 1.85 \pm 0.25cms. Two patients required primary closure of donor site and were excluded from follow up analysis of donor site inspection.

At first follow up, three patients had graft site discomfort (cheek). Uroflowmetry showed satisfactory improvement in 86% of patients at first follow up which was sustained at 6 months postoperatively. Patients in lateral mobilization group had slightly better uroflowmetry results but the difference between the groups was not statistically significant (**Table 3**). Failure of surgery, which was predefined as need for any additional procedures, was seen in five cases of lateral mobilization and nine cases of circumferential dissection of urethra. This difference was not statistically significant (p=0.216, Fisher Exact Test) (**Figure 1**). All patients who were declared failure were initially managed with urethral dilatation. Five patients who were initially managed with dilatation later went on to undergo various other procedures like VIU, Redo BMG Urethroplasty and Perineal Urethrostomy (**Table 4**).

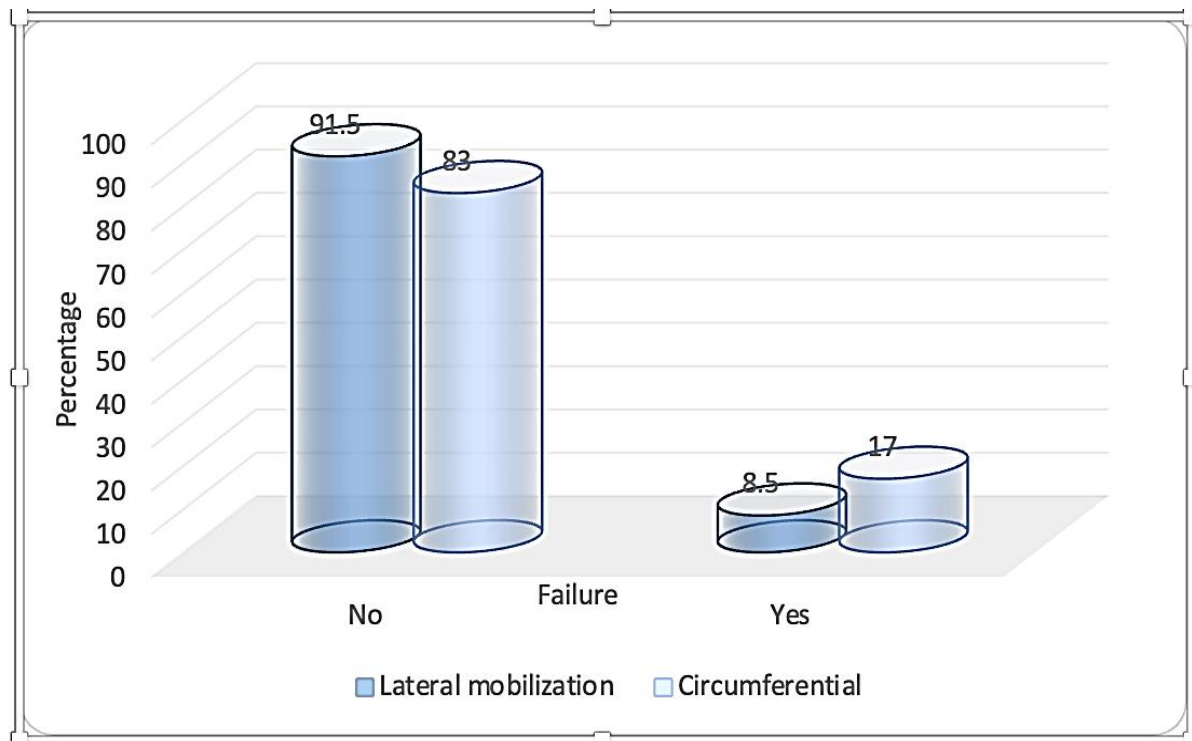


Figure 1: Success vs failure rate depiction across both the treatment groups(n=94)

Table 1: Demographic criteria across the study of population (n=94) *

Variables	Lateral mobilization N=47 (Mean ± SD)	Circumferential N=47 (Mean ± SD)	Total N=94 (Mean ± SD)	P value
Age in years	47.51±15.65	48.77±16.27	48.14±15.89	1.00
Etiology				
Post traumatic	14(29.8%)	16(34%)	30(31.9%)	0.658
Post catheterization	7(14.9%)	7(14.9%)	14(14.9%)	1.000
Post Surgical	10(21.3%)	7(14.9%)	17(18.1%)	0.421
Post inflammatory	17(36.2%)	17(36.2%)	34(36.2%)	1.000
Prior procedure				
Urethral Dilatation	6(12.8%)	9(19.1%)	15(16%)	0.398
Suprapubic cystostomy	4(8.5%)	7(14.9%)	11(11.7%)	0.336
Visual Internal Urethrotomy	5(10.6%)	4(8.5%)	9(9.6%)	1.000
Anastomotic Urethroplasty	2(4.3%)	1(2.1%)	3(3.2%)	1.000

*Chi-square/ Fisher Exact test has been applied to find the significance of study parameters on categorical scale between two or more groups

Table 2: Comparison of Intraoperative characteristics across the study population (n=94) *

Intra operative Variables	Lateral mobilization (n=47)	Circumferential (n=47)	Total (n=94)	P value
Stricture site				
Stricture at anastomotic site	2(4.3%)	1(2.1%)	3(3.2%)	1.000
Penile Urethral stricture	5(10.6%)	11(23.4%)	16(17%)	0.100
Bulbar Urethral Stricture	17(36.2%)	10(21.3%)	27(28.7%)	0.111
Multiple	23(48.9%)	25(53.2%)	48(51.1%)	0.680
Stricture length (cms)				
➤ <6	29(61.7%)	28(59.6%)	57(60.6%)	1.000
➤ 6-10	18(38.3%)	18(38.3%)	36(38.3%)	
➤ >10	0(0%)	1(2.1%)	1(1.1%)	
Bleeding(ml)				
➤ <60	18(38.3%)	9(19.1%)	27(28.7%)	0.067+
➤ 60-120	29(61.7%)	37(78.7%)	66(70.2%)	
➤ >120	0(0%)	1(2.1%)	1(1.1%)	
Duration of surgery (minutes)				
➤ <80	12(25.5%)	18(38.3%)	30(31.9%)	0.139
➤ 80-100	14(29.8%)	17(36.2%)	31(33%)	
➤ >100	21(44.7%)	12(25.5%)	33(35.1%)	
Length of graft (cms)				

➤ <7	34(72.3%)	26(55.3%)	60(63.8%)	0.115
➤ 7-10	13(27.7%)	18(38.3%)	31(33%)	
➤ >10	0(0%)	3(6.4%)	3(3.2%)	
Width of graft (cms)				
➤ 1.5	17(36.2%)	13(27.7%)	30(31.9%)	0.222
➤ 2	30(63.8%)	32(68.1%)	62(66%)	
➤ 2.5	0(0%)	2(4.3%)	2(2.1%)	

*Chi-square/ Fisher Exact test has been applied to find the significance of study parameters on categorical scale between two or more groups

Table 3: Post-operative findings at first follow up and Peak flow rate assessment at 3 and 6 month follow up across both the treatment groups (n=94) *

First follow up	Lateral mobilization (n=47)	Circumferential (n=47)	Total (n=94)	P value
Surgical site Examination Normal	44(93.6%)	45(95.7%)	89(94.7%)	1.000
Donor site examination Normal	46(97.9%)	45(95.7%)	91(96.8%)	1.000
Normal Ascending Urethrogram	41(87.2%)	44(93.6%)	85(90.4%)	0.486
Peak flow rate (Qmax) (ml/s) at first follow up				0.931
<18	6(12.8%)	8(17%)	14(14.9%)	
18-25	30(63.8%)	29(61.7%)	59(62.8%)	
>25	11(23.4%)	10(21.3%)	21(22.3%)	
Total	47(100%)	47(100%)	94(100%)	
Peak flow rate (Qmax)(ml/s) at 6 months follow up				0.534
<18	4(8.5%)	5(10.6%)	9(9.6%)	
18-25	36(76.6%)	28(59.6%)	64(68.1%)	
>25	7(14.9%)	14(29.8%)	21(22.3%)	
Total	47(100%)	47(100%)	94(100%)	

*Chi-square/ Fisher Exact test has been applied to find the significance of study parameters on categorical scale between two or more groups.

Table 4: Number and Type of Secondary procedures required in patients who underwent urethroplasty across both treatment groups (n=94)

Type of secondary procedure	Lateral mobilization	Circumferential	Total
Number	43(91.5%)	37(78.7%)	80(85.1%)
Urethral Dilatation	2(4.3%)	7(14.9%)	9(9.6%)
Perineal Urethrostomy	1(2.1%)	2(4.3%)	3(3.2%)
Redo Buccal Mucosal Graft Urethroplasty	1(2.1%)	0(0%)	1(1.1%)
Visual Internal Urethrotomy	0(0%)	1(2.1%)	1(1.1%)
Total	47(100%)	47(100%)	94(100%)

Discussion

Management of urethral strictures has always been a difficult task. Open urethroplasty remains the gold standard of management for treating urethral strictures despite dilatations and internal urethrotomy being routinely performed [3-6]. EAU guidelines strongly recommend augmentation urethroplasty by either a single-stage or staged approach taking into consideration previous interventions and stricture characteristics. SIU recommends EPA in longer (> 2-4 cm) strictures, in proximal bulbar strictures due to favorable tissue characteristics, in contrast with distal bulbar and penile strictures [SIU: B]. However, for long (> 2 cm) & distal bulbar strictures, SIU suggests augmentation surgery if a tension-free anastomotic repair is not feasible [7]. Of the various urethroplasties being performed, dorsal onlay urethroplasty is performed for proximal, middle or distal bulbar strictures or cases of stenotic lumens with near-obliterative bulbar strictures [8]. In the originally described technique of dorsal onlay graft urethroplasty, the urethra is mobilised from the corpora cavernosa circumferentially so as to expose the dorsal surface adequately. This enables to spread the graft before fixing it over the underlying albuginea. However the circumferential mobilisation may injure the small branches of perineal nerves that innervate the bulbospongiosum muscle. The injury is most likely during dissection of the central tendon of the

perineum, or when the bulbospongiosum muscle is fully divided along the midline [3,9,10].

Moreover, it is described that the vascularity between the corpus spongiosum and the tunica albuginea is compromised with circumferential mobilisation. Also the vascular connections between the superficial perineal tissues and urethra is compromised bilaterally with circumferential dissection [3]. This is of particular consequence in those who have undergone prior urethroplasty.

In order to overcome this vascular compromise which would subsequently have an effect on the erectile function, Kulkarni *et al.* in 2009 [3] proposed and described one-sided anterior urethroplasty with lateral only mobilization of the urethra. They advocated that such a urethroplasty would result in preservation of the one-sided vascular supply to the urethra and its entire muscular and neurogenic support [3,5,11]. Their study demonstrated a 92% success rate as compared to their previous studies with circumferential dissection where the success rates ranged between 77.3% to 83.5%.

Our study results were comparable with 91.5% success rate in the lateral mobilization group as compared to 83% success in the circumferential dissection group. Ours is the only study to have prospectively compared the two groups head to head till this date.

In our series, highest incidence of stricture was noted in the 31-40 years probably because they are exposed to outdoor work and the increased incidence of road traffic accidents in this age group.

The older age group (61-70 years) also had a higher incidence owing to the popularity of transurethral procedures such as TURP, TURBT etc. Although this was the general trend, no age was immune to urethral strictures which is in concordance with previous studies [11,12].

Most of the strictures were post inflammatory. This is largely consistent with many contemporary series from Asian subcontinent [13]. Post traumatic strictures (31.9%) are on the rise which is an unfortunate price of modernization. As regards to symptomatology, our series is comparable to Dr Barbagli series and Dr Kulkarni series [12,13]. Roughly half the patients included in study had complaints of decreased libido or erectile deficiency.

Intra operative parameters like duration of surgery, site and length of stricture, length and width of buccal mucosa graft used were similar in both the groups. AUG done in post-operative period showed no abnormality in 78% of patients, which correlated poorly with failure eventually. Which led us to believe the value of post-operative AUG in presence of uroflowmetry may be exaggerated in some older literature.

Although number of failures were more for the circumferential mobilization of urethra group compared to lateral mobilization of urethra group (9 vs. 5), this number was not statistically significant ($p=0.216$). All failed patients were initially managed with urethral dilatation with 1/3rd undergoing subsequent procedure (Table 4).

Limitations

Whilst our outcomes were successful in terms of voiding, we did not assess the erectile function post operatively across both the treatment groups. Considering the fact that the perineal nerves supplying the bulbospongiosum is spared in lateral only mobilization group, erectile function is maintained in those with preserved erectile function. Since more than half of our patients had erectile dysfunction we did not assess this component. Moreover, larger cohorts with long term collection of data is required for further validation of our results.

Conclusions

Lateral mobilisation of urethra is a feasible option in patients undergoing dorsal onlay buccal mucosal graft urethroplasty. The short-term outcomes are comparable to the conventional circumferential mobilization of urethra in urethral stricture management.

Declarations

Ethics approval

Ethics approval and consent to participate obtained from the Institutional ethics Committee.

Ethical committee Name: Ramaiah Medical College Ethical committee, Approval number:MSRMC/EC/JA-04/180-21

Informed & written consent

Informed & written consent obtained to publish data

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

The authors declare that they have no competing interests.

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None

Authors' contributions

MT: Designed the work, Acquisition Analysis and Interpretation of data, and Drafted the manuscript

YPM: Data acquisition, Analysis of Data and Drafted the manuscript

PM: Conception, Design of the work Draft revision

All authors have read and approved the manuscript.

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