ORIGINAL RESEARCH

One-sided Dissection with Dorsal Onlay Buccal Mucosal Graft Urethroplasty (The Kulkarni Technique): A Preliminary Experience Study in the Philippines

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Introduction: Urethroplasty is the gold standard treatment for urethral stricture disease, regardless of the reconstructive technique utilized, because of its high success rate as compared with endoscopic urethrotomy or simple dilation. Among the different urethroplasty techniques, the Kulkarni Procedure has gained wide acceptance worldwide for strictures of varying etiologies. This is the first ever local experience study to review this one-sided dissection technique aimed at preserving the lateral blood and nervous supply to the urethra thereby increasing the chances of graft survival.
Methods: A retrospective review from October 2017 – October 2021 was done. Twenty male patients were included. Their ages ranged from 24 to 75 years old (mean age 43). The patient underwent one-sided urethral dissection followed by dorsal onlay mucosal graft urethroplasty. All the surgeries were performed by a single surgeon. On follow up, outcomes were measured using a variety of tools. Incidence of postoperative complications and stricture recurrence were likewise noted.
Results: In this study, 20 patients underwent one-sided dorsal onlay BMG (buccal mucosal graft) urethroplasty (Kulkarni technique), from October 2017 to October 2021.The outcome was deemed successful if the patient no longer needed additional procedures after the initial surgery. Of the 20 patients, 18 had successful outcomes. The other 2 patients had to undergo a redo urethroplasty.
Conclusion: This technique was shown to have an overall success rate of 92% in 24 patients, with a follow-up period of 12-55 months based on Kulkarni's initial report in 2009. The results of the present study are similar wherein the overall success rate was 90% in 20 patients, but on a shorter follow up period. Despite the small sample size and short follow-up period, the results of the initial experience are very promising. As urologists gain more experience, they can achieve higher success rates in the future.

Key words: Buccal mucosal graft (BMG), Kulkarni technique

Introduction

Urethral strictures generally refer to a fibrous defect in the spongy erectile tissue of the corpus spongiosum. It can be caused by various conditions which would result in a range of manifestations, from an asymptomatic presentation to unembellished discomfort secondary to urinary retention. In the Philippines, one of the most common causes of urethral strictures is trauma secondary to motor vehicular accidents. According the Metropolitan Manila Development Authority (MMDA) Road Crash Statistics in Metro Manila, there were a total of 24,676 road crashes.[1] However, data on the specific prevalence of trauma leading to eventual stricture formation is lacking. In one local

study[2], the authors reported that posterior urethral strictures were mostly due to pelvic fracture urethral injuries, while anterior strictures were commonly due to iatrogenic injuries following endoscopic treatment.

For a long time, urethral stricture disease has been very challenging for urologists. Currently, there are various treatment approaches to this condition. Among the existing procedures, simple dilation and direct vision internal urethrotomy are more commonly used for short urethral strictures (<1 cm, soft and no previous intervention). For longer strictures, urethroplasty using either oral mucosa or penile skin is the most widely adopted technique and has shown varying success rates. Nonetheless, complications such as donor site morbidity remain a problem for those attempting to perform substitution urethroplasty.[2] This has contributed to direct vision internal urethrotomy (DVIU) as the preferred mode of treatment for stricture disease.[3]

Urethroplasty is the gold standard treatment for urethral stricture. Regardless of the reconstructive technique utilized, it has high success rates as compared with endoscopic urethrotomy or simple dilation.[4] This study used the technique that was developed by Kulkarni in 2009, wherein combined use of muscle- and nerve sparing bulbar urethroplasty followed by full length dorsal urethrotomy while preserving the lateral vascular supply to the urethra, the central tendon of the perineum, the bulbospongiosus muscle and its perineal innervation. This was shown to be very promising when it was first reported with a 92% success rate.[5] Today, the Kulkarni Technique has become standard practice for long segment strictures as well as pediatric urethral strictures wherein minimal dissection of the urethra is advisable.

The objective of the study was to examine the practicability, acceptability, safety and efficacy of using a new surgical technique for the repair of anterior urethral strictures.

Methods

A retrospective review from October 2017 – October 2021 was done. Included were 20 male patients whose ages ranged from 24 to 75 years old (mean age 43) and who underwent the Kulkarni Technique. All surgeries were performed by a single surgeon. Pre operative patient characteristics are described in Table 1. Preoperative evaluation included clinical history, physical examination, urine culture, residual urine measurement, retrograde urethrogram +/- urethroscopy. Based on the patient database, the strictures were most commonly idiopathic or infectious in origin (35%, respectively). The mean stricture length was 6. 7cm. Of special note is one patient who had a panurethral stricture measuring 14cm. The patient population database showed that 20% (n=4) comprised of patients who had history of previous urethral instrumentation or catheterization, (e.g., TURP, TULIP, CIC). It was also noted that 30% (n=6) of the population have had previous endoscopic treatment for their urethral stricture disease in the form of either DVIU or urethral dilation.

Table 1. Patient characteristics.

Patient Characteristics	No of Patients	%
Age (Median Age 43) Range 22-75	20	100
Stricture length (range 5-14cm)		
<5cm	1	5%
5cm	5	25%
5-10cm	12	60%
>10cm	1	5%
Stricture Etiology		
Idiopathic	7	35%
Infectious	7	35%
Straddle injury	7	10%
Post instrumentation	4	15%
Previous Surgery		
None	5	25%
Suprapubic tube cystostomy	5	25%
DVIU once	4	20%
DVIU, 2x	2	10%
Multiple instrumentation	4	20%
No of Strictures		
Single	16	80%
Multiple	3	15%
Panurethral	1	5%
Pre-operative Imaging		
Urethrogram	16	80%
Urethrogram+Cystoscopy	4	20%

Note: DVIU – Direct Vision Internal Urethrotomy. Id – Idiopathic, In-Infectious, MUS – multiple urethral instrumentation, SI - Straddle Injury, PI - post instrumentation, UC - Urethrogram with Cystoscopy

Surgical Technique

After careful pre-operatively evaluation, the patients were scheduled for surgery. The patient was placed on a dorsal lithotomy making sure that the lower extremities were protected by applying compression stockings. The stirrups were adequately padded to avoid any pressure points that would predispose to nerve injuries. Proper skin preparation was done in the suprapubic region, scrotum and perineum. The oral mucosa graft harvest site was also adequately prepared using betadine solution.

Figure 1.

Sterile drapes were placed at the operative field, after which methylene blue was introduced into the urethra to delineate the fibrotic areas of the urethral mucosa. Subsequently, a midline perineal incision was made until the level of the bulbospongiosus muscle which was then retracted inferiorly. The Buck's fascia was incised and the urethra was dissected from the corpora cavernosa only along the left side starting from the distal part where it was devoid of bulbospongiosus muscle (Figure 2a). For longer strictures, the entire penis was invaginated into the perineal incision before performing one-sided dissection. The right side of the urethra remained undisturbed, still attached to the corpora cavernosa thereby preserving the lateral vascular blood supply.

The urethra was then rotated, using ventral stay sutures, and a dorsal urethrotomy was performed. (Figure2b) The incision was extended 1cm above and below the level of the stricture using Metzenbaum scissors. (Figure 3a) An oral

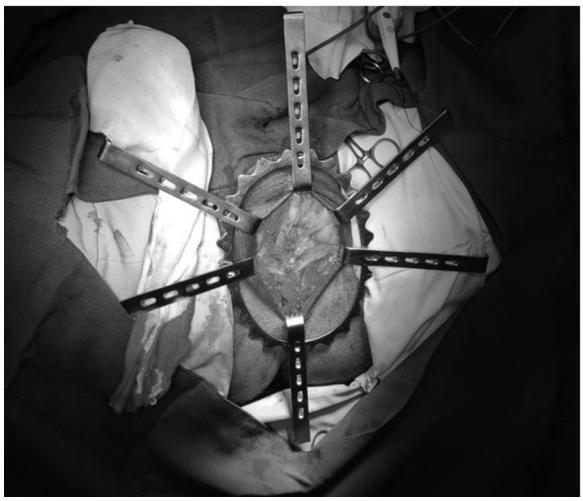

Figure 2a. The Buck's Fascia was incised and the urethra dissected from the corpora cavernosa.

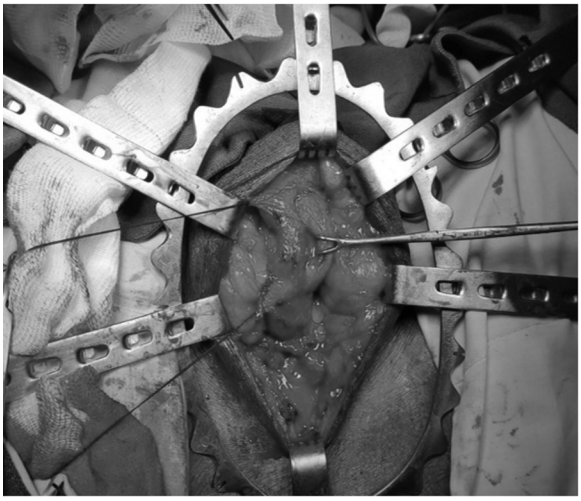

Figure 2b. Urethra is then rotated, using ventral stay sutures, and a dorsal urethrotomy is performed.

mucosal graft was harvested and trimmed to an appropriate size according to the length and width of the urethrotomy. After defatting the graft, it was spread and anchored over the tunica albuginea of the corpora cavernosa. (Figure 3b) In addition, vicryl 5-0 was used to perform three rows of quilting sutures to further fix the graft unto the recipient bed, The urethra was then closed over a Fr 14 silicone catheter which was left in place for 4 weeks. (Figure 4) Layer by layer closure was then done. Post operatively, patients were able to ambulate and subsequently discharged on the 2nd to 3rd postoperative day. All patients received appropriate antibiotics until removal of the catheter at 4 weeks post op.

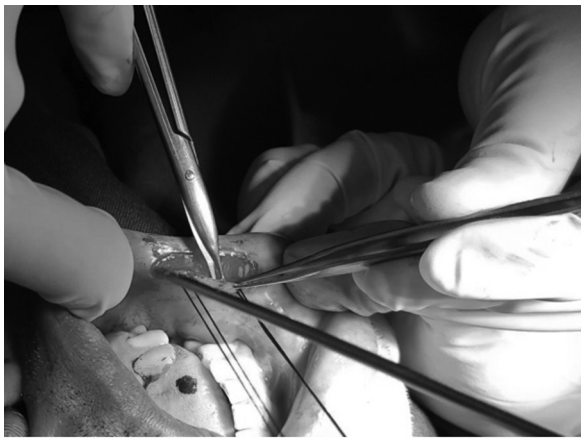

Figure 3a. The incision is extended 1cm above and below the level of the stricture.

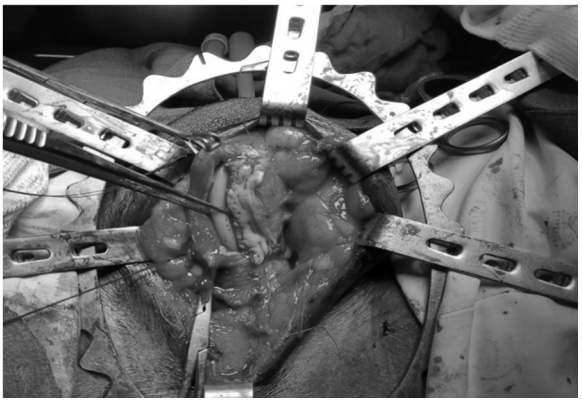

Figure 3b. Graft is spread and quilted to the corpora cavernosa.

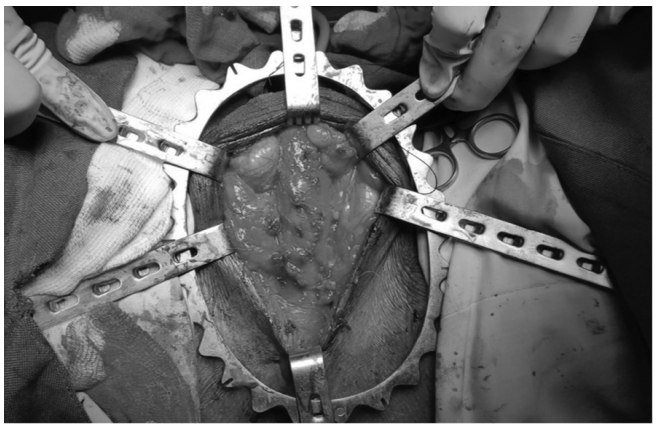

Figure 4. Urethra is closed over a Fr 14 silicone catheter.

Results

In this study, 20 patients underwent one-sided dorsal onlay BMG urethroplasty (Kulkarni technique), from 2017 to 2021. Each patient was carefully followed up after the procedure. Documentation was done at 3 months, 12months, and 18 months, post operatively. All post operative consultation and follow up were done by the primary surgeon. Patients were given instructions before discharge and was reached thru phone 2-3 days before their scheduled date. During the first follow up, all patients underwent physical examination, which also included doing diagnostic modalities such as retrograde urethrogram, and uroflowmetry. IPSS scoring was also obtained from each patient. Cystourethroscopy was performed for patients with bothersome symptoms suggesting stricture recurrence or for those with Qmax<15 ml/sec.

With respect to the operative time, the median time to completion of the procedure was 2.5 hours (range 1.5-4 hours). Within this time frame, the mean blood loss noted was 250cc (range 150-400). Intraoperatively, there were varying degrees of spongiofibrosis. It was noted that the patients who underwent previous endoscopic treatment were the ones with more severe spongiofibrosis. One patient was also noted intraoperatively to have multiple false tracts. Another patient was also noted to have multiple strictures.

In this study, success was defined as not having the need for further procedures after the initial surgery. Any case wherein the patient is required to perform chronic intermittent catheterization or dilatation after the urethroplasty, is recorded as a failure. Based on the initial follow up of 4-6 weeks IPSS, uroflowmetry, cystourethroscopy and retrograde urethrogram, the authors noted a 95% success rate and 5% failure rate. There was stricture recurrence in one patient. Another patient had stricture recurrence on the 3rd month as documented by a retrograde urethrogram and urethroscopy. There was no stricture recurrence with the other patients as of their last scheduled follow up.

The failed case is a 55-year-old male with single stricture at the penile urethra 8cm in length (L2S2bE2) (Appendix 1) the etiology of the stricture was idiopathic. On follow-up, the patient had a surgical site infection (SSI) due to poor postoperative wound care which caused the dehiscence of the post op site. He developed a scrotal abscess which required drainage. After

4 weeks, the patient developed moderate lower urinary tract symptoms. Stricture recurrence was documented thru a repeat retrograde urethrogram.

Another documented recurrence is a 43-year-old male, with genitourinary tuberculosis noted with a single stricture at the distal bulbar area 5cm in length (L2S1bE4). Three months post operatively, patient followed up and recurrence was documented thru cystoscopy and retrograde urethrogram. Patient was non-compliant with the TB treatment regimen. He tested positive again for genitourinary tuberculosis at the time of recurrence.

It is also worth mentioning that most of patients underwent surgery in 2020-21. As such, only their short-term follow-up data can be reported in this study. (Table 2)

Table 2. Post operative patient outcomes (Short term follow up).

Outcomes	Follow-up Period	Follow-up Period
IPSS	4 -6 weeks	3months
Mild (0-7)	13 (65%)	10 (50%)
Moderate (8-19)	7 (35%)	9 (45%)
Severe (20-35)	-	-
Urolflowmetry (Qmax)		
<10ml/sec	-	
10-15ml/sec	-	1 (5%)
>15ml/sec	20 (100%)	18 (95%)
Cystourethroscopy Findings		
Normal caliber	19 (95%)	4 (20%)
Stricture recurrence	1 (5%)	2 (10 %)
No cystoscopy	-	13 (65%)
Retrograde Urethrogram		
Normal	19 (95%)	18 (90%)
Stricture recurrence	1 (5%)	2 (10%)
None	-	

Definitions: ml-milliters, Qmax- Maximum Urinary Flow

Note: 1 patient is still at 4 weeks post op, and there were patients who were lost to follow up

Table 3. Post operative patient outcomes on (Long term follow up).

Outcomes	Follow-up Period	Follow-up Period
IPSS	12 months	18 months
Mild (0-7)	4 (20%)	3 (15%)
Moderate (8-19)	5 (25%)	5 (25%)
Severe (20-35)		
Urolflowmetry (Qmax)		
<10ml/sec	-	-
10-15ml/sec	-	-
>15ml/sec	-	-
Cystourethroscopy Findings		
Normal calibre	-	-
Stricture recurrence	-	-
Lost to follow up	-	-
Retrograde Urethrogram		
Normal	-	-
-Stricture recurrence	-	-
None	-	-

Definitions: ml-milliters, Qmax- Maximum Urinary Flow

Note: 1 patient is still at 4 weeks post op, and there were patients who were lost to follow up

Discussion

The Kulkarni Technique was developed, in part, as an effort to spare the bulbospongiosus muscle and the central tendon of the perineum, thereby preserving branches of the perineal nerves during surgery. Perineal nerves innervate the bulbospongiosum, which mainly acts to facilitate urination, erection and ejaculation based on its compressive action.[6]

The earlier techniques for urethroplasty which involved circumferential mobilization of the urethra disrupts the vascular connections between the corpus spongiosum and the tunica albuginea, including the lateral vascular connections between the urethra and superficial perineal tissues bilaterally.[7] This technique had an overall success rate of 82% with a mean length of follow up 42.9 months. Moreover, this technique is versatile and reproducible with acceptable results.[8]

This technique was modified by Kulkarni, since an extensive disruption in the vascular supply would contribute to failure of urethroplasty especially in patients who have undergone previous urethral surgery and in patients with extensive spongiofibrosis. Although authors had to consider different factors that would influence the outcome of success (e.g smoking, obesity, stricture etiology, prior urethroplasty, stricture length, etc.), their data show that this emerging urethroplasty technique is versatile and practical with high success rates.

Based on Kulkarni's initial report in 2009, this technique was shown to have an overall success rate of 92% in 24 patients, with a follow-up period of 12-55 months. The results of the present study are similar wherein the overall success rate was 90% in 20 patients, but on a shorter follow up period.

The limitations of this study include a relatively small study population for now, and some patients were eventually lost to follow up due to several factors, mainly due to the COVID-19 pandemic wherein most of them are not confident in doing face-to-face consults. Another limitation was rendered by the lack of data in some patients within the 12 to 18 months follow up period.

Future studies should include a larger population size and longer follow-up schedules.

Conclusion

This technique was shown to have an overall success rate of 92% in 24 patients, with a follow-up period of 12-55 months based on Kulkarni's initial report in 2009. The results of the present study were similar wherein the overall success rate was 90% in 20 patients, but on a shorter follow up period.

Despite the small sample size and short follow-up period, the results of the authors initial experience are very promising. As they gain more experience, they can achieve higher success rates in the future.

TURNS LSE Anterior Urethral Stricture Classification System

L – Length*	
1	< 2cm
2	≥ 2cm & < 7cm
3	≥ 7 cm
S – Urethra Segment	
1	**Bulbar Urethra**
1a	Bulbar Urethral Stricture. Cannot Involve the Distal Bulbar Urethra (note: XXX on figure)
1b	Bulbar Urethral Stricture. Must involve the Distal Bulbar Urethra
2	**Penile Urethra**
2a	Stricture involves both bulbar and penile urethral segments. Cannot involve fossa/meatus.
2b	Stricture involves only the penile urethra. Cannot involve fossa/meatus or bulbar urethra
2c	Stricture involves both penile and fossa/meatus. Cannot involve bulbar urethra.
2d	Meatal/Fossa Navicularis stricture. Cannot involve the penile or bulbar urethra.
3	Stricture must involve meatus/fossa navicularis, penile urethra and bulbar urethra (3-segment stricture).**
S – Modifiers	
x	Portion(s) of the Stricture with Obliterated Lumen (e.g. S1ax, S2ax)
m	Separate strictures involving two or more distinct areas of the anterior urethra (managed with separate urethroplasty techniques). (e.g. Sm1a2a; note: list segments from proximal to distal)
p	Extension of stricture into posterior urethra (non-PFUDD; e.g. S1ap), or isolated non-PFUDD posterior urethral stricture (e.g. Sp)
E – Etiology * **	
1	External Trauma (e.g. known straddle injury)
2	Idiopathic/Unknown Etiology
3	Iatrogenic
3a	Internal Trauma (e.g. post TURP/TURBT stricture)
3b	Recurrent Urethral Stricture in Prior Urethroplasty Segment (excluding hypospadias repairs (E5))
3c	Radiation Induced Urethral Stricture
4	Infectious/Inflammatory (e.g. post-gonococcal)
5	Stricture in Segment of Prior Hypospadias Repair
6	Lichen Sclerosus

* Total length of all clinically significant (i.e. requiring intervention) strictured urethral segments. For Sm strictures, list all lengths from proximal to distal (e.g. L1,2 S1a2a)

** If separate strictures are noted to involve all three segments, use S3 if managed with single surgical technique and Sm modifier if managed with separate surgical techniques.

*** If multiple etiologies suspected/known, stage with highest numbered etiology.

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