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Original article

Management of panurethral strictures

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KEYWORDS
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Complex

Abstract

Introduction: Pan-urethral stricture, involving the penile and bulbar urethra, is a common urological problem on the South Asian subcontinent. It represents a particularly difficult challenge to manage and there is a relative paucity of literature on the subject. In India, Lichen Sclerosus (LS) is the most common cause of pan-urethral stricture, followed by iatrogenic causes.2 stage surgery is not scientific in lichen sclerosus as this is a disease of genital skin. We present our experience of pan-urethral stricture repair using a single-stage, one-sided dissection, dorsal onlay repair with oral mucosa graft.

Subjects and methods: We retrospectively reviewed the records of 318 consecutive men undergoing management of pan-urethral stricture from June 1995 to December 2014. The median age was 44.6 years and the mean stricture length 14 cm. The median follow-up was 59 months. The strictures were approached through a perineal incision, limiting dissection to only one side of the urethra. The penis was invaginated to provide access to the entire length of anterior urethra in a single-stage, and two oral mucosal grafts were dorsally placed.

Results: The outcome was considered a success if the patient needed no further instrumentation, including dilation or urethrotomy. The overall success rate was 84.90%, with a success rate of 89.39% in primary urethroplasty, and 57.85% in patients who had previous failed urethroplasty. Most recurrent strictures occurred at the proximal end of the graft.

Conclusions: Repair of pan-urethral stricture in a single-stage, with one-sided dissection and dorsal onlay of oral mucosa, is a minimally invasive technique that is simple, fast, safe, effective and reproducible in the hand of any surgeon.

Introduction

Panurethral stricture disease is a process that encompasses the full length of the urethra from meatus to the proximal bulbar urethra. The incidence of panurethral strictures continues to rise, particularly in Indian and Asian countries, where the primary etiology is lichen

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sclerosis. Prevalence of iatrogenic strictures has also increased, as endoscopic instrumentation of the urethra may result in iatrogenic panurethral strictures.

Currently, there is a paucity of evidence supporting specific management options for panurethral stricture disease. Previous reports suggest the use of staged Johansson's Urethroplasty, with the use of either local flaps or buccal mucosal grafts to repair complex strictures. In this paper, we would like to present our technique of single stage buccal mucosa graft urerthroplasty for the management of panurethral disease.

Subjects and methods

Institutional research ethics board approval was obtained for this study. A retrospective review was performed of 318 consecutive patients undergoing urethroplasty for panurethral stricture disease from June 1995 to December 2014. All urethroplasties were performed by one reconstructive urologist in a Specialized Urethroplasty Center.

Inclusion criteria included patients with panurethral stricture disease, who were deemed medically fit for surgery. We included patients who presented for primary consultation as well as those patients with previous failed repair. Exclusion criteria included patients with malignant urethral lesions, patients who were unwilling or unable to undergo surgery, or incomplete patient records.

Preoperative patient evaluation included: clinical history, physical examination, urine culture, uroflowmetry, residual urine measurement, retrograde and voiding urethrography and urethroscopy using a 4.5 or 6 Fr. ureteroscope (Fig. 1).

The primary outcome measure of this study was success of surgery, defined as freedom of postoperative instrumentation or dilatation.

Surgical technique

All patients were treated using the one-stage OMG urethroplasty through a perineal incision previously described by Kulkarni et al. [1–3].

The patient is first either orally or nasally intubated. The patient is placed in simple lithotomy position, with heels carefully placed in Yellofin® stirrups (Allen Medical Systems, Acton, MA; USA) with care taken to minimize pressure on the calves to avoid peroneal nerve injury. The suprapubic, scrotal and perineal skin is shaved, disinfected using chlorhexidine, and draped.

Two teams work simultaneously at the donor and recipient site, with separate sets of instruments. The oral mucosa is harvested from both cheeks as described by Barbagli et al. [4].

Preoperatively, urethroscopy is performed using a 4.5 or 6 Fr. Semi-rigid Ureteroscope. Methylene blue is injected into the urethra and a midline perineal incision is made. The bulbar urethra is dissected along the left lateral border from the corpora cavernosa to the bulb. The bulbospongiosus muscle and central tendon of the perineum are left intact ventrally. The bulbospongiosus muscle has 2 distinct parts. The lower two-thirds of the muscle wraps around the urethra and is necessary for effective ejaculation and expression of urine. The

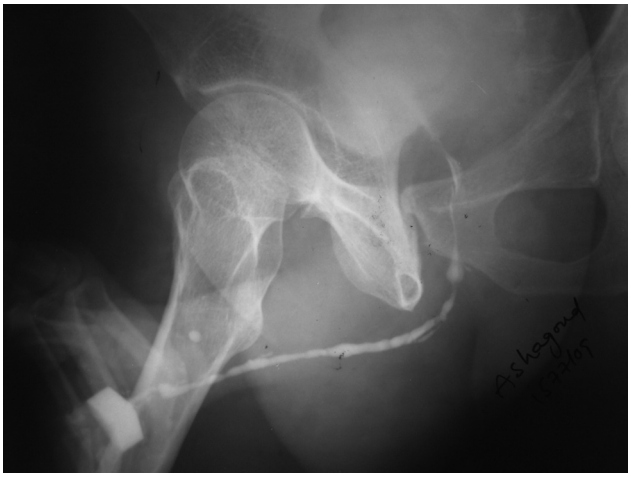

Figure 1 Urethrogram in a patient with pan-urethral stricture.

upper 1/3 of the bulbospongiosus muscle is invested more laterally and wraps around the corpora, where it becomes the bulbocavernosus muscle. Incising this aponeurosis laterally provides adequate visualization and access to the dorsal urethra without necessitating a midline incision (Fig. 2a).

The urethra is then mobilized across the midline to the contralateral attachment to the corpora cavernosa, which is left in tact. This helps to preserve the neurovascular supply to the urethra.

The penis is then invaginated into the perineum (Fig. 2b). This can be accomplished by applying steady pressure on the penis from above while sharply incising the thin fascia over the urethra. This should be continued to the glans to allow full mobilization of the urethra.

Mobilization of the urethra off the corpora cavernosa is continued from proximal to distal, ending at the coronal sulcus (Fig. 3). Once mobilization is complete, the dorsal aspect of the urethra is exposed and opened longitudinally (Fig. 4.). An additional wide dorsal meatotomy may be performed externally (Fig. 5).

The OMG are then passed into the field. The first is sutured to the dorsal apex of the meatus (Fig. 6), and then passed through to the penile urethra fixed to the corpora cavernosa over the midline. The second graft is applied to the corpora cavernosa opposing the bulbar urethra. The grafts are 1.5 cm in width, and are spread and fixed to the corpora with quilting sutures (Fig. 7).

Continuous upward traction is applied to the inverted penis to mimic stretched penile length. Grafts are placed dorsally while the penis is on stretch. This ensures adequate length of graft to prevent chordee during erection.

Once quilting of the graft is completed, the OMG margin is sutured to the urethral plate. A 14 Fr silicone urethral catheter is inserted. The urethra is rotated back to its original position and a continuous 4–0 polyglactin suture is used to approximate the urethral margin to the OMG and the corpora cavernosa on the left (Fig. 8). The separated ends of the bulbocavernosus muscle are reapproximated. At the end of the procedure, the graft is completely covered by the urethra and bulbospongiosus muscle. A 3-layer closure of perineal fat, Colles' fascia, and skin is completed in a running fashion.

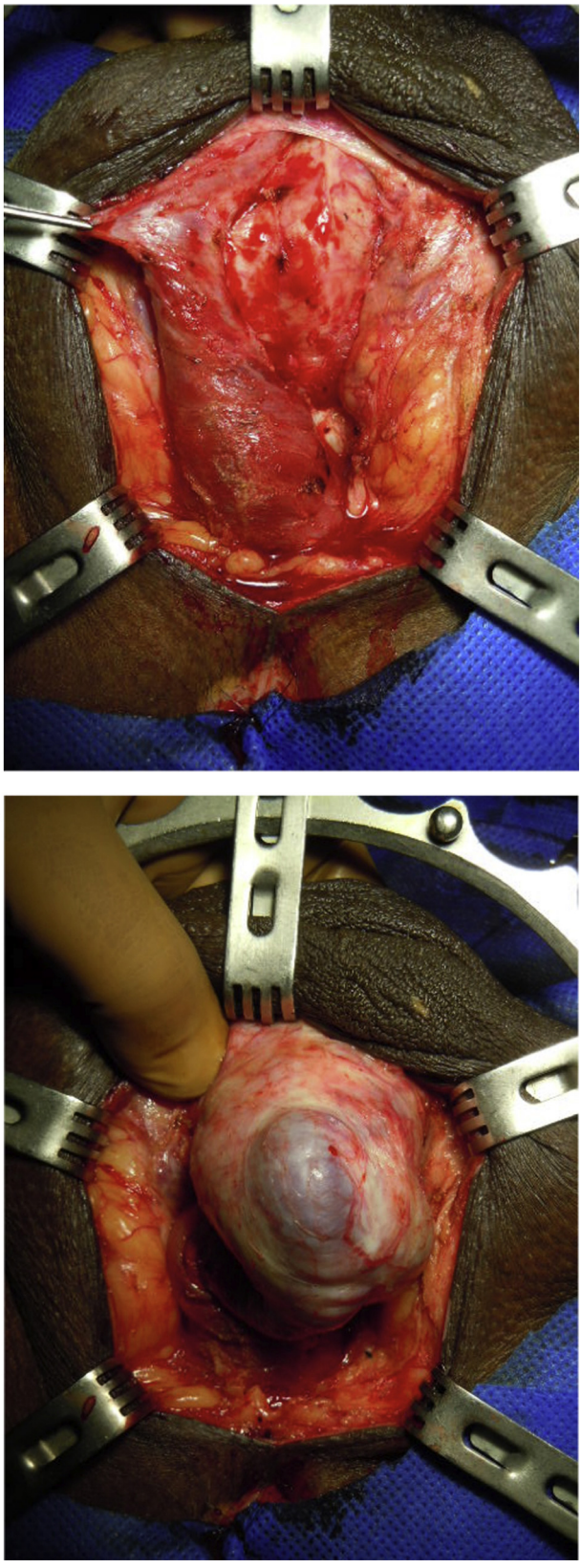

Figure 2 (a) One-sided dissection of bulbar urethra. The proximal two-thirds of the bulbospongiosus is left intact. The distal one-third of the bulbospongiosus, which attaches to the corpus cavernosum, is incised. (b) Penile invagination.

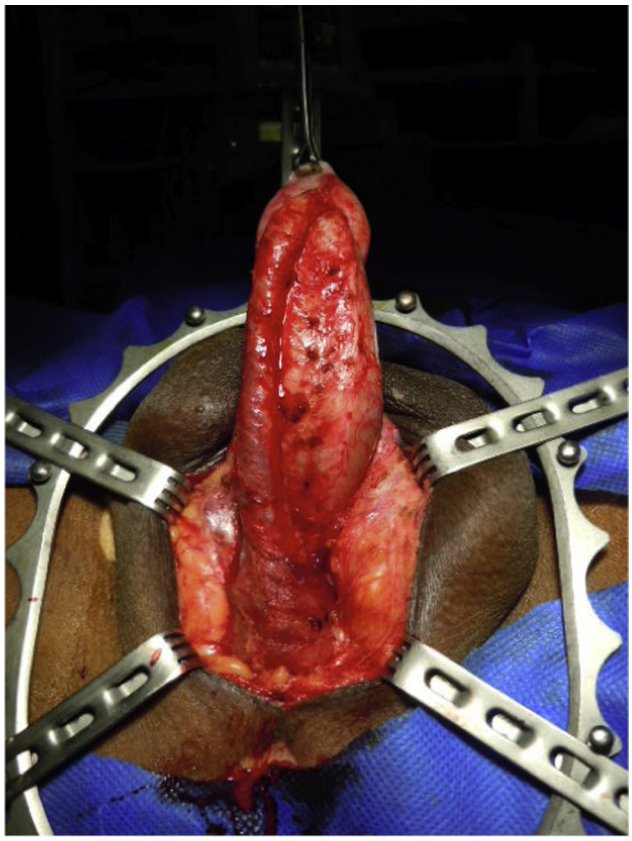

Figure 3 One-sided dissection of the entire anterior urethra.

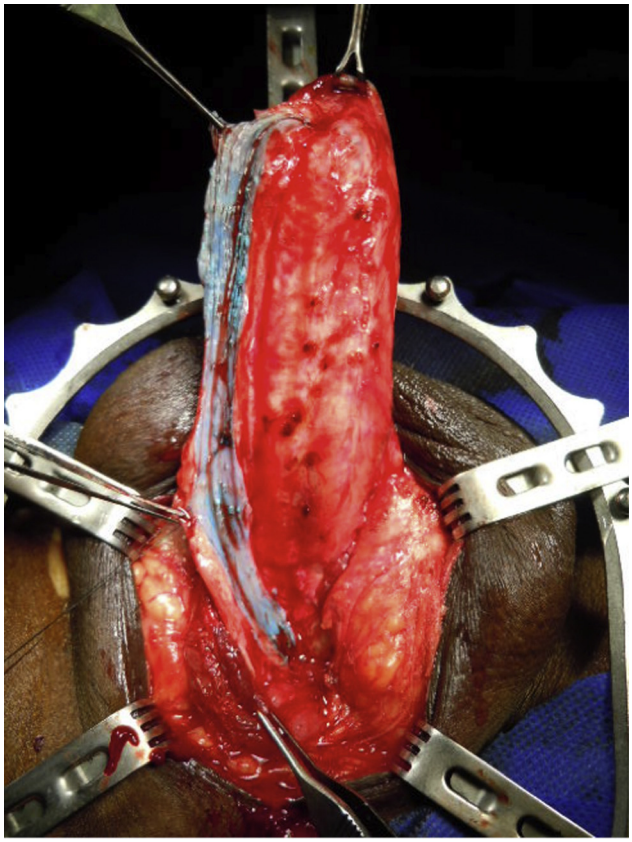

Figure 4 Urethra opened along dorsal aspect longitudinally.

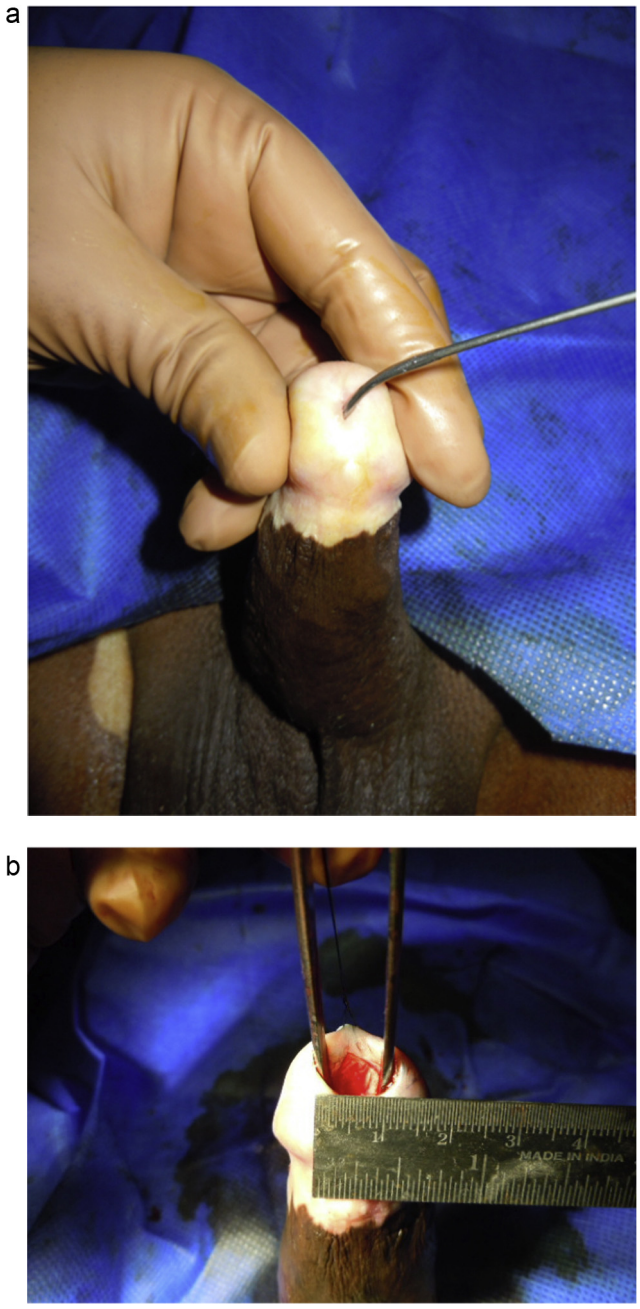

Figure 5 (a) Initial Meatus. (b) After dorsal meatotomy.

The catheter is maintained for 4 weeks.

Postoperative care and follow-up criteria

Patients are ambulated on postoperative day 1 and kept in hospital until postoperative day 2. They receive a single dose of broad-spectrum IV antibiotics, and are then transitioned to oral antibiotics from day 2 until catheter discharge.

We do not routinely performed pericatheter urethrogram prior to removal of foley catheter. We do employ this investigation for cases of redo urethroplasty; pericatheter RUG is performed at 4 weeks postoperatively, and catheter is removed if there is no evidence of contrast extravasation.

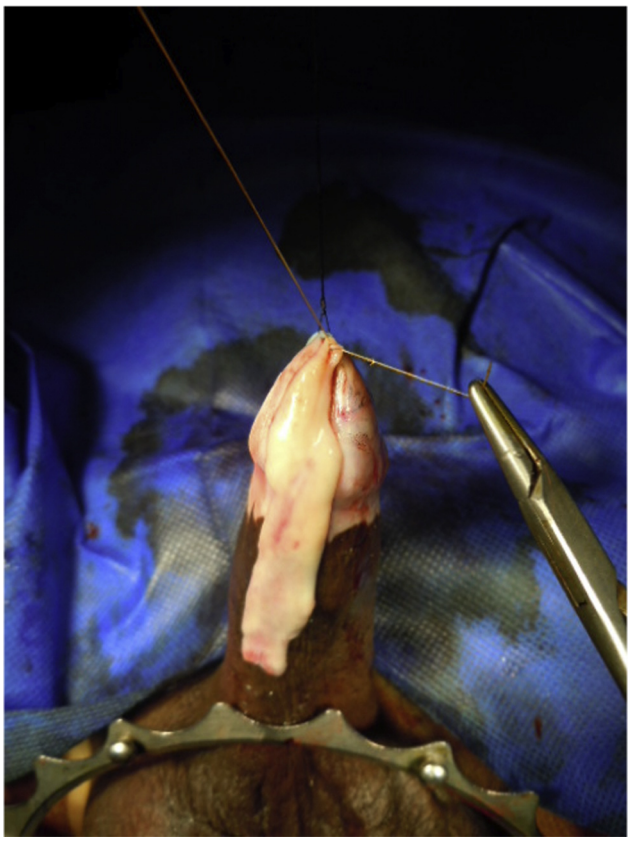

Figure 6 Securing the graft at the apex of meatus.

Patients are followed at 3, 6, and 9 months postoperatively, and then annually thereafter. We recommend use of uroflometry at these time intervals, and any time there is clinical indication. A clinical history of subjective decrease flow should be investigated by uroflometry; a flow rate less than 12 ml/s should promptly secondary investigations including a repeat retrograde urethrography and urethrocystoscopy.

Many of the patients treated at our institution are from across the country and the world. We enlist the help of local urologists for follow up, and rely on emails and phone calls in the event of postoperative complications or failures. Patients are instructed to follow up with their referring urologist to undergo the recommended follow up regime. In the case of recurrence of the stricture, referring urologists are encouraged to telephone or email the clinic for further management decisions. These modes of communication have significantly reduced the travel time for patients, and reduced the burden of care.

Results

A total of 318 patients were included for analysis. Mean patient age was 44.6 years (range 20–76). The overall median follow-up was 59 months (range 6.4–192). Etiology of the stricture were as follows: LS 184 patients (57.9%), non-LS (including catheter related, idiopathic, iatrogenic, failed hypospadias, and trauma) 134 patients (42.1%).

The mean stricture length was 14 cm, with a range of 10–19 cm. Of 318 patients, 283 (88.99%) had no previous urethral surgery, and 35 (11.01%) had a previous failed urethroplasty.

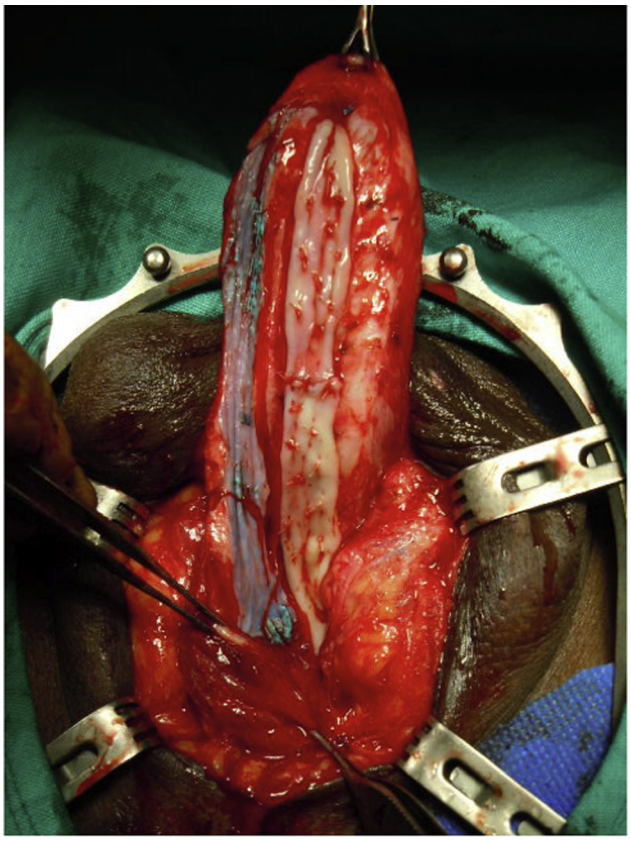

Figure 7 Grafts spread and fixed dorsally. One graft opposite the penile urethra, and one graft opposite the bulbar urethra.

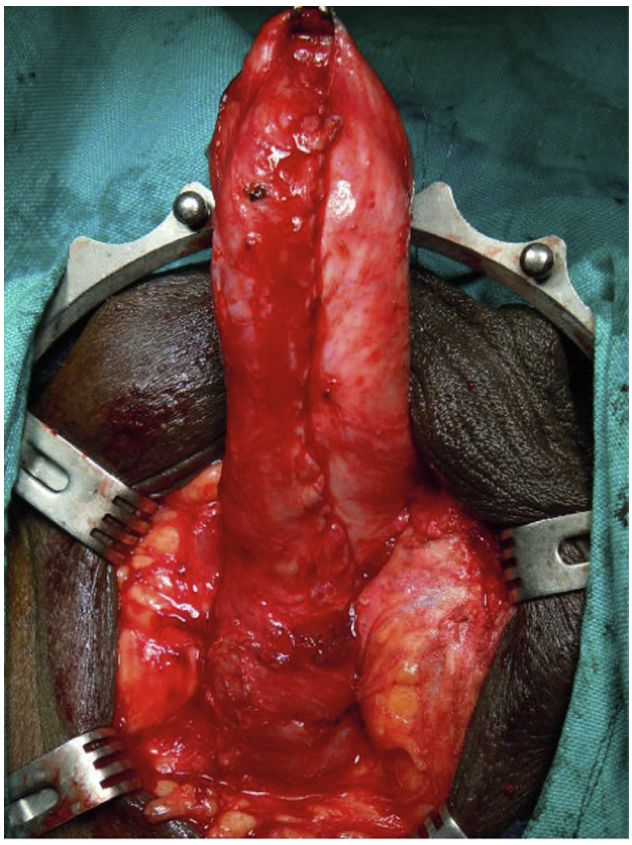

Figure 8 Urethra rotated back into position over the grafts.

Out of the 318 patients, 270 (84.90%) were successful and 48 (15.10%) failures. Of the 283 patients who had no prior surgery, 244 (89.39%) were successful and 39 (11.61%) failed. In the group of 35 re-do urethroplasty patients, 20 (57.85%) had a successful outcome and 15 (42.15%) failed.

Of the 48 patients with recurrent strictures, no patient had a full-length recurrence. When a stricture recurred, it was at the proximal end of the graft, the junction of two grafts, or the meatus. These generally manifest as a non-obliterative fibrous ring [5].

Stricture recurrence was managed with interval dilations, repeat urthroplasty, meatotomy, and perineal urethrostomy. At our center, repeat urethroplasty after previous failed panurethral repair at proximal bulbar urethra is managed by ventral OMG patch urethroplasty.

We also analyzed a subset of patients who presented with a history of retention with indwelling suprapubic catheters. Of the 318 patients, 49 of those had obliterative strictures. The success rate of our single stage urethroplasty in this patient population was 57.1%. On detailed analysis it was noted that 60.3% of obliterative strictures were due to iatrogenic etiology.

Discussion

Panurethral strictures by definition involve the whole anterior urethra and form a complex subset of urethral stricture disease. Lichen sclerosus remains a primary etiology for panurethral stricture disease, particularly in the Asian subcontinent. Recently, however, there has been a trend in etiology, favoring more iatrogenic panurethral strictures. Prolonged catheterization or traumatic catheterization result in panurethral stricture secondary to inflammation and ischemia of the urethra. Another proposed mechanism includes local allergic reaction to the catheter or lubricant used at time of placement. Endoscopic instrumentation of the urethra, particularly with transurethral resection of the prostate, can also lead to urethral trauma and ischemia, resulting in stricture formation. Aside from technical considerations (obvious catheter trauma or complicated procedures), it remains difficult to identify those at higher risk for pan-urethral stricture.

In order to differentiate between the 2 most common etiologies, it is helpful to inspect the meatus. Panurethral strictures secondary to lichen sclerosus almost always involve the meatus. In iatrogenic and catheter induced strictures, the meatus is often spared.

Historically, two-stage urethroplasty was favored for the management of panurethral strictures. The Johanson's two-stage technique, first described in 1953, involves buried epithelium (originally local skin, which later evolved to autologous graft) based on the Denis-Browne principle [6]. Upon review of the literature, several institutions have experimented with other tissue transfer techniques, including fasciocutaneous skin flap with or without simultaneous use of buccal mucosa graft [7,8], or tunica albuginea [9]. There has been long standing view of using two-stage urethroplasty for Panurethral strictures. Our primary concern with the two-stage Johanson's technique is that it relies on genital skin for the neourethra. As was shown in our series, more than 50% of panurethral

strictures are secondary to lichen sclerosus. Any two-stage procedure with genital skin will have a high risk of recurrence secondary to incorporation of diseased skin in urethra. It is for this reason that we developed a single-stage urethroplasty for panurethral stricture.

Development of Kulkarni technique

Dr. Kulkarni performed urethrectomy for bladder cancer using penile invagination during his training in UK. Panurethral strictures were mainly treated by 2 stage procedures until 1990s. Dorsal onlay buccal graft urethroplasty was popularized by Barbagli in 1996. Dr. Kulkarni performed dorsal onlay buccal graft urethroplasty for panurethral strictures in India. Penile urethra was approached through circumcision incision and bulbar urethra through perineal incision. The penoscrotal junction would be a watershed area with technical difficulty. Dr. Kulkarni applied the penile invagination technique and performed dorsal onlay buccal graft urethroplasty for panurethral incision through perineum. By invagination, the full anterior urethra was now visualized as a single unit. The concept of meatotomy with graft insertion from meatus till proximal bulb was now possible through a single incision in perineum. Initially the urethra was mobilized circumferentially. Barbagli and Kulkarni published the techniques of muscle sparing bulbar urethroplasty [2]. The one side dissection technique was then amalgamated with Kulkarni technique further refining it. Today the technique consists of single stage, penile invagination, one side dissection, dorsal onlay buccal graft urethroplasty. This approach is widely followed across reconstructive urology units.

This approach also opened up the avenue of treating penile urethral strictures without incision on penis. As of today, many centers perform penile urethroplasty with penile invagination.

Dubey et al. reported on their experience comparing the one-stage Kulkarni technique and two-stage repairs for panurethral strictures secondary to lichen-sclerosus [10]. They concluded that one-stage procedures had better success, and while staged procedures could be successful, they were fraught with technical difficulties and multiple revisions. [10] The Johanson staged repair has long fallen out of favor as first-line therapy. It can still be employed to salvage the most complex urethral strictures [11].

A very recent multi-center study from high volume urethroplasty units concluded that single stage buccal graft urethroplasty was more successful than 2 stage procedures. Flaps have higher complication rates as compared to one stage urethroplasty [12].

Fasciocutaneous flaps are also technically demanding and require plastic surgery training. Furthermore, because a majority of panurethral strictures are secondary to LS – a genital skin disease – it is of utmost importance that the same diseased skin not be incorporated into the repair, as suggested in a large retrospective review of patients who underwent circular fasciocutaneous flap [13].

The one-stage Kulkarni technique offers several key advantages. The perineal approach avoids a penile incision and suture line, minimizing the risk of urethrocutaneous fistula. Penile cosmesis is excellent, with no hypospadiac metaus, and reduce incidence of chordee. Functionally, this technique preserves the bulbospongiosus muscle, urethral neurovascular supply, and the central tendon of the perineum. This portends less vascular compromise, superior muscular support of the urethra, decreased post micturition dribbling, and preservation of ejaculatory function [1,2,14].

In our series, the success rates for primary and re-do urethroplasty were significantly different. This likely reflects the severity of the disease process, and fibrosis after the previous failed repair.

Recurrences after panurethral stricture repair often occur at either the meatus, the junction of the two buccal mucosa grafts, or at the proximal anastomosis. We attempt to minimize meatal recurrence by performing a wide dorsal meatotomy. At our institution, recurrences at the meatus are managed with ventral meatotomy. Recurrence at the junction of the two grafts is first treated by one attempt at urethrotomy/dilation, followed by dorsal inlay buccal mucosa graft (Asopa Technique). Proximal recurrence is similarly treated with one attempt of urethrotomy/dilation, followed by ventral onlay buccal mucosa graft urethroplasty.

We attempt to adhere to a strict follow up regimen for patients undergoing panurethral urethroplasty. Patients are followed at 3, 6, 9, and 12 months, and annually thereafter with clinical history, physical exam, and uroflometry. If they are unwilling or unable to travel, we ask the primary urologist to perform the follow up. Clinical history is paramount to our decision to proceed with further investigation. Diminished flow on uroflometry is further investigated with retrograde urethrogram and cystoscopy. Low flows (Qmax 10–13 ml/s) may be attributed to stricture recurrence, BPH, or bladder hypotonicity. We attempt to avoid over investigation in patients who report good flow and improvement in symptoms.

Conclusion

Panurethral stricture disease is a complex process. The Kulkarni Technique for panurethral urethroplasty is a minimally invasive, with excellent postoperative outcomes, improved cosmesis, and excellent functional outcomes.

Conflicts of interest

No conflicts of interest declared.

Source of funding

None declared.

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