Tunica Albuginea Urethroplasty for Panurethral Strictures

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Purpose: To assess the efficacy of tunica albuginea urethroplasty for pan urethral stricture management as an alternative approach to conventional dorsal buccal mucosal graft urethroplasty, especially in cases with unavailability of healthy buccal mucosa.

Materials and Methods: Eighty-six patients with panurethral strictures underwent tunica albuginea urethroplasty at our center with follow-ups at 6, 12, 24, and 36 months. Results were assessed by comparative analysis of pre-operative and postoperative patient's satisfaction (based on symptoms) along with retrograde urethrography, urethrosonography, and uroflowmetry. Ten patients from the successful group underwent postoperative urethroscopic examination.

Results: Counting good and fair results as successful (satisfied and not requiring revision urethroplasty), success (good + fair) rate was 95.3% at immediate postoperative and at 6 months. Results reduced to 93% at 12 months, 90.7% at 24 months, and 89.5% at the end of 36 month follow-up. Failure (poor results requiring revision urethroplasty) rate was 10.5% at the end of the 3 years of follow-up.

Conclusion: Tunica albuginea urethroplasty runs over the concept of urethral groove and the ease of procedure with adequately satisfactory results provides decent outcomes. Tunica albuginea urethroplasty gives advantage of local availability and achieving patent distensible urethra without any graft. Urethroscopy of these subjects, by direct visualization shows the area of roof formed by tunica appears well covered with urothelium, further substantiating its ability to maintain patency and distensibility of the urethra.

Keywords: urethral stricture, male urologic surgery, reconstructive surgical procedure, postoperative complications, recurrence, treatment outcome

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INTRODUCTION

Panurethral stricture is the hardest nut to crack among all strictures, as patients' miseries cannot be overlooked and moreover when treated, results are not as good as one's desire. Infection being a part and parcel of panurethral strictures, causes severe spongiofibrosis and in worst cases lichen sclerosus et atrophicus which literally eats up the entire urethra, makes the task an uphill struggle for the urologist. As panurethral strictures are very long, the only treatment modality is substitution urethroplasty with a graft or flap. It is very important to harvest a longer graft which is not always possible, especially when healthy oral mucosa is not available due to the habit of tobacco chewing and many a times the penile skin is not available due to genital infections.

We have evolved a simple and an effective alternative approach, Tunica Albuginea Urethroplasty (TAU), for treating long strictures. Based on the concept of supra-urethral or subcavernosal groove,[1]

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the urethral continuity is maintained by the tunica albuginea of corpora cavernosa presents at the urethral groove, which is capable of providing patent distensible neourethra of its own without the need of any graft or flap.[2]

MATERIALS AND METHODS

Between July 1992 and September 2006, a total of 86 patients with panurethral strictures underwent single stage TAU after pre-operative assessment on the basis of patient symptoms, contrast retrograde urethrography, urethrosonography, and uroflowmetry (possible only in patients not having suprapubic catheter at time of presentation). After urethral reconstruction, the perurethral catheter was left in situ for 6 weeks. Patients were evaluated using retrograde urethrography, urethrosonography, uroflowmetry, and patient's satisfaction, immediate postoperatively and at 6, 12, 24, and 36 months. Results were assessed by comparing pre and postoperative variables and patient's satisfaction (Table 1) (Figure 1).

Ten patients were chosen for postoperative urethroscopy to visualize the patent neo-urethra and to analyze how the tunica albuginea maintains the urethral continuity without any graft or flap. Urethroscopy was also performed in 2 patients with poor results to enable us to assess the pathogenesis of restricture.

Operative procedure involved TAU for anterior urethral strictures, in which edges of dorsal urethrotomy were sutured to the edges of the urethral groove.[3] Hence, roof of the neourethra was formed by the tunica albuginea of the corpora cavernosa. In cases where prostato-membranous urethral distraction defect was also present, the strictured membranous urethra was completely excised and prostatic urethra was anastomosed to the bulbar urethra in a U shape with 3 stitches (at 3, 6 and 9 o'clock position), namely U-shaped prostatobulbar anastomosis (USPBA).[4]

Figure 1. Pre-operation; Multiple Penile urethral strictures Postoperation; wide patent urethra after Tunica Albuginea Urethroplasty

RESULTS

The mean age of the participants was 44 years (range, 18 to 60 years) and two-third of the patients belonged to young middle-aged group (20 to 45 years). Traumatic followed by iatrogenic post catheterization strictures were the most common type of strictures (Table 2). Almost all of the panurethral strictures were either caused by inflammation or had inflammation as a co-existing factor.

Of 86 patients, 62 (72%) had a suprapubic

Table 1. Postoperative Result Assessment Criteria

	Good	Fair	Poor
Retrograde urethrography	Good caliber	Partial narrowing at stricture site	Persistent stricture
Urethro-sonography	Patent and distensible lumen	Patent lumen with decreased distensibility	Stricture present
Uroflowmetry	Qmax >20 mL/s	Qmax 15 to 20 mL/s	Qmax <15 mL/s
Patient's satisfaction	Satisfactory voiding, no instrumentation needed	Satisfactory voiding, but Required ≤ 1 dilatation per year	Not satisfied, not voiding or voiding with thin stream, needed multiple dilatations or repeat surgery

Table 2. Site and Etiology of Stricture

	Penile + Bulbar	Penobulbar + Membranous
Traumatic	36	18
Iatrogenic	16	02
Inflammatory	07	02
Idiopathic	03	02
Total [86]	62	24

catheter in situ for complete urinary retention. Seventy-five patients (87%) had some form of intervention (urethrotomy, dilatation, or urethroplasty) before referring to us. The mean length of the stricture was 12.5 cm (range, 8.0 to 16.5 cm). Based on our standard criteria, results were divided as successful (good + fair; satisfied with no or minimal intervention, and not require revision urethroplasty) and failure (poor; requiring revision urethroplasty). Immediate postoperatively and at 6 months follow-up, success rate was 95.3% (75 + 7 = 82), which reduced to 93.0% (74 + 6 = 80) at 12 months, 90.7% (72 + 6 = 78) at 24 months, and 89.5% (72 + 5 = 77) at the end of 36 month follow-up with overall failure rate of 10.5% after 36 months from the procedure (Table 3). Three patients with lichen sclerosus developed urethrocutaneous fistula. Such patients ultimately required 2-stage urethroplasty for final correction of the stricture.

Ten patients from the successful group (6 good results and 4 fair results), who underwent urethroscopy, allowed us to visualize the neourethra formed by tunica albuginea of corpora cavernosa. It was observed that the roof of the neourethra formed by tunica albuginea of corpora cavernosa was smoothly covered by the re-grown urothelium along with a patent and distensible lumen. In the fair result group, there was a patent, distensible lumen, but the mucosa was rough at places. In some cases, there was a tendency of formation of some flimsy adhesions, which were broken with a single dilatation, leaving behind a rough mucosa. Two poor result patients, on urethroscopy, displayed an initial patent neourethra, followed by gradual narrowing and ultimately ending at a distal collapsed lumen (Figure 2). Continued inflammation and excessive surrounding spongiofibrosis ultimately led to restricture formation. Urethroscopic findings of good, fair, and poor results are summarized in Table 4.

DISCUSSION

Procedures like penile 'Q' flap have been mentioned to provide longer substitution material; however, the procedure is extremely labor-intensive and is among the most difficult and tedious procedures in reconstructive urology.[5] Understandably, other flap techniques are also not the easiest to master, because despite being technically very sound, if not done well, will ultimately result in poorer outcome.[6] On the contrary, buccal mucosa graft procedures, which have been very successful in medium-sized strictures, are not very feasible because of the length of stricture in this case.[7] Reports suggest that even in dorsal onlay grafting, buccal mucosal and penile skin grafts have shown similar results, while both proving superior to flap techniques. Therefore, it is not the type of graft rather than the site of graft which is finally responsible for the success of the procedure.[6] Probably, it is the tunica albuginea present at the urethral groove which is ultimately responsible for maintaining the continuity of neourethra even if the graft is not taken up. Hence, tunica albuginea is the best substitution material available in the nearest

Table 3. Results of urethroplasty at different follow-up periods

Results	6 Months	12 Months	24 Months	36 Months
Good	75 (87.2%)	74 (86.0%)	72 (83.7%)	72 (83.7%)
Fair	07 (8.1%)	06 (7.0%)	06 (7.0%)	05 (5.8%)
Poor	04 (4.7%)	06 (7.0%)	08 (9.3%)	09 (10.5%)

Table 4. Urethroscopic Findings

	Good	Fair	Poor
Urethroscopy	Wide patent distensible lumen, regular mucosa	Patent lumen with decreased distensibility, some mucosal irregularities	Distal obliterated lumen, not possible to negotiate scope further

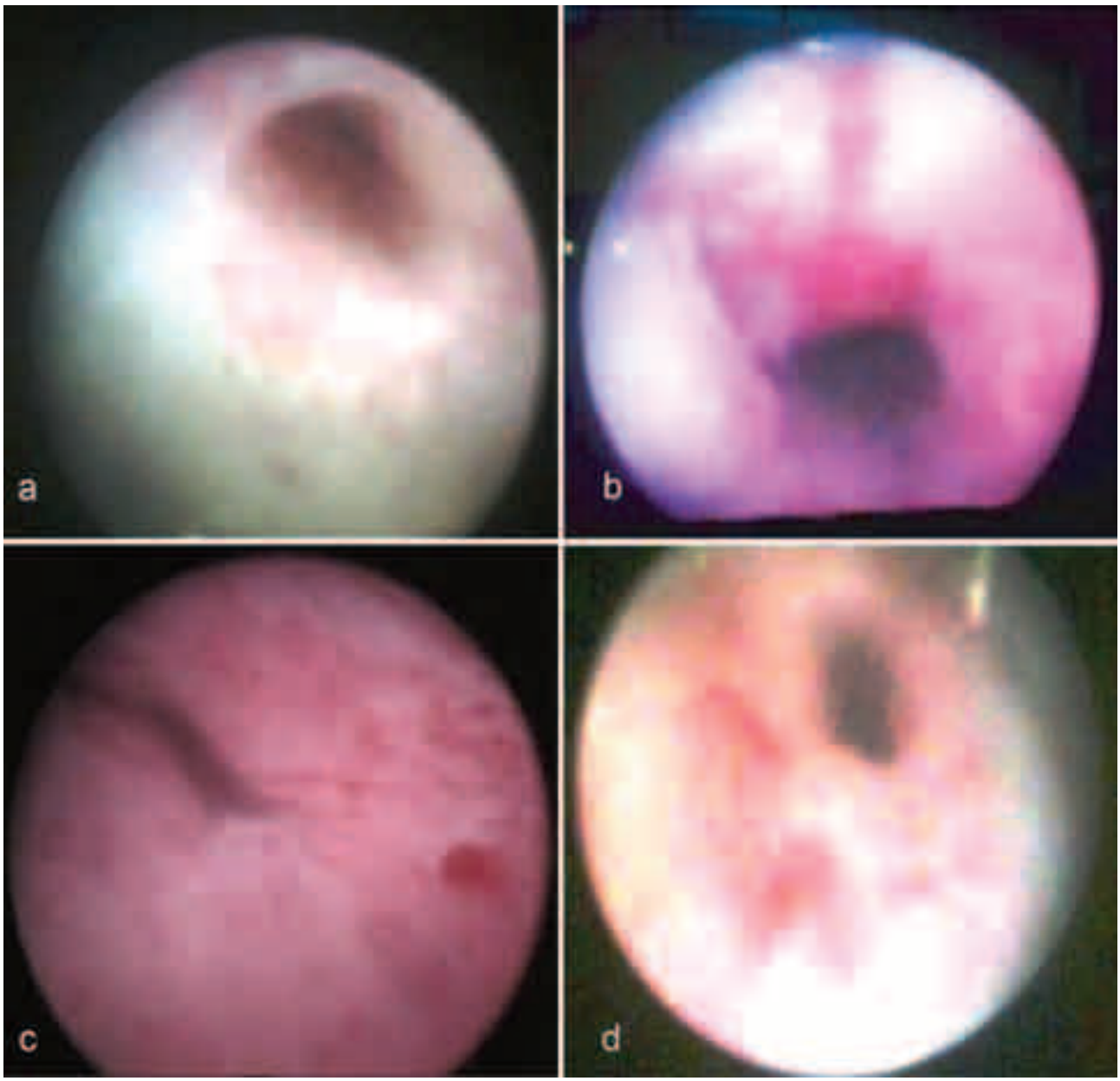

Figure 2. (a) Good result; Showing patent distensible roof of neourethra formed by tunica albuginea of corpora cavernosa with smooth mucosal lining **(b)** Fair result; Showing patent lumen with some mucosal irregularities **(c)** Poor result; Showing diffused fibrotic narrowing with collapsed lumen **(d)** Poor result; Showing circumferential scarring proximal to wide neourethra

vicinity of the urethra.[8]

Tunica albuginea urethroplasty gives certain advantages in the prospect of urethroplasty. Procedure is simple and less time consuming, as no graft or flap is harvested or applied. Tunica albuginea is the locally available connective tissue which is very durable, also very distensible. Procedure is possible in subjects where healthy buccal mucosa is not available due to habit of tobacco chewing, also in very long strictures where very long substitutes are difficult to harvest.

U-shaped prostatobulbar anastomosis is done for panurethral strictures with prostato-membranous distraction defect along with TAU for penile and bulbar stricture part. U-shaped prostatobulbar anastomosis is advantageous as it avoids ring anastomosis (only 3 stitches are taken); hence, avoiding risk of ring stricture formation, which has been found to be the cause of restricture after urethroplasty in some studies.[9] Also, it

maintains the blood supply of the urethra by avoiding round the clock stitches, because near the apex of the prostate the neurovascular bundle divides into two parts: a larger anterior part and a smaller posterior part. The anterior part crosses the membranous urethra, then the bulb of the penis at the 1 and 11 o'clock positions, and finally enters the corpora cavernosa. The posterior part crosses the membranous urethra more posteriorly to enter the bulb of the penis.[10] Thus, avoiding stitches at dorsal aspect of anastomosis, ie, from 10 to 2 O'clock position, there are less risk of compromise of blood supply to the urethra and thereafter, ischemia and fibrosis, and most importantly, less chances of impotence postoperatively after USPBA.[4] As there has already been a lot of fibrosis and precarious blood in complex strictures, this technique gives a wider anastomosis and avoids compromise of already precarious vascular supply in complex strictures. The fiber composition of tunica albuginea of corpora cavernosa and spongiosum are the same in histology, composing of inner circular layer from which radiates intercavernosal and spongiosal pillars to augment septum to provide essential support avoiding excess fibrosis, thereby abating stricture.

It has been further confirmed by urethroscopy that tunica albuginea and perineal membrane can maintain urethral patency and distensibility, and area of roof where no graft is placed appears to be covered with urothelium in most of the subjects. Tunica albuginea is itself sufficient to allow re-growth of urothelium and give patent distensible lumen. However, ultimate proof of urothelium covering over tunica will be the urethroscopic biopsy, wherein it is not wise to traumatize the urethra of a good result satisfied patient just for the sake of histological evidence of success of the procedure. Treatment modalities for urethral strictures are continuously evolving day by day with ongoing research. Our prior 15-year experience of TAU and USPBA treating urethral stricture has been satisfactory for strictures of various etiology and site, proving its value in curing most difficult panurethral strictures.

CONCLUSION

We concluded that this approach is, hence, surely a useful, easy, and effective tool in the armamentarium of urologists, especially for patients who want to avoid cosmetic deformities caused by penile skin grafts and not having healthy oral mucosa owing to the habit of tobacco chewing.

CONFLICT OF INTEREST

None declared.

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