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Urethral Reconstruction by Full Thickness Abdominal Skin Graft – Our Experience

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Abstract

Introduction: *This study is an effort to develop an alternative to available graft sources for complex and long-segment strictures. For this to assess the outcome of harvesting a full-thickness abdominal skin graft for urethral reconstruction we conducted this study.*

Material and Method: *The study was prospective type of observational study. Data were collected between June 2019 and November 2021 from patients underwent urethroplasty using full thickness skin grafts harvested from abdominal skin.*

Result: *Total 16 patients followed up. Mean stricture length was 8 + 3.38 cm (range 5-12 cm). The aetiology [Figure 2] of urethral stricture included urethritis (6 patients), urethral trauma (7 patients), failed hypospadias repair (2 patient) and unknow (1 patient). The mean prepared graft length was 8.68 + 4.58 cm (range 7–14 cm), the mean operation time was 86.45 + 30.28 minutes (range 55 –130 minutes). Median follow-up was 24 months. 2 patients developed febrile urinary tract infections requiring oral antibiotics. 1 patient with history of urethritis developed recurrent stricture. So overall success rate is 93.75% with p value of < 0.001; that is statistically significant.*

Conclusion: *Selective use of abdominal skin grafts may be well suited for patients with long-segment urethral strictures in one or two stages when other graft sources are not available or feasible.*

Introduction:

Urethral stricture is a narrowing of the urethra due to scar tissue, which leads to obstructive voiding dysfunction with potentially serious consequences for the entire urinary tract. It produces obstructive and irritative urinary symptoms and it can ultimately impair renal function.[1]

Almost all strictures for which a cause can be identified are acquired. The largest group (45%) are iatrogenic and result from urethral manipulations (traumatic indwelling catheter, transurethral interventions, corrections of hypospadias, prostatectomy, brachytherapy). Transurethral procedures for strictures with unfavourable characteristics are not only futile but can also complicate stricture characteristics by increasing [2,3] tissue damage if they are repeated. It has been suggested that previous repeated transurethral procedures are associated with a higher failure rate of urethroplasty.[4]

Reconstruction of long-segment adult urethral stricture disease remains a difficult urological problem mainly

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due to the deficiency of available extra-genital skin for grafting. Graft tissue has been utilized successfully for urethral reconstruction from various sites including buccal mucosa, genital skin, and auricular tissue; however, each tissue source has specific drawbacks. The ideal graft source would be extragenital in origin, hairless, produce minimal postoperative mobility at the harvest site, be inconspicuous postoperatively and abundant enough in length and width to avoid multiple urethral suture lines for men with long-segment strictures.

Buccal mucosa graft (BMG) was first described for urethral [5] reconstruction by Humby in 1941. It has become an ideal urethral substitute because of ease of harvest, surgical handling characteristics, hairlessness, compatibility in a wet environment, and its early ingrowth and graft survival. Standard bulbar urethroplasties using buccal grafts should have a lifetime success rate approaching 92%. Studies have shown that the maximum graft area should be 4 cm in length and 2.5 cm in width from each cheek to minimize complications. However, the complications that have been reported from harvesting oral mucosae include pain, perioral numbness, tightness of the mouth, motor deficits, and long-term speech morbidity (lingual mucosal grafts exceeding 7 cm).[4]

In an effort to develop an alternative to available graft sources for complex and long-segment strictures we outline this study to assess the outcome of harvesting a full-thickness abdominal skin graft for urethral reconstruction.

Material and Method:

Our study was prospective type of observational study. All the patients with history and clinical examination suggestive of urethral stricture attending urology out-patient department and those coming for follow up in out-patient department at regular intervals was considered for the study. The study was conducted with informed consent from the patients. Inclusion criteria includes all patients with stricture length >2.5 cm and who need substitution urethroplasty and are willing for investigations and treatment. Exclusion criteria were patients with stricture length <2.5cm. Others were patients who weren't willing to take part in this study, patients who had perineal and groin infection, patients who had previous urethroplasties, pan anterior urethra stricture, stricture with complicating factors such as fistula, diverticula, periurethral abscess etc.

Preoperative investigations include urine culture and sensitivity (C/S), uroflowmetry, retrograde urethrogram (RGU), micturating cysto-urethrogram (MCU) and urethrocystoscopy. If urine C/S revealed any organism they were treated accordingly to make the urine sterile before procedure. Uroflowmetry done to document the flow rate and use for reference for follow-up. RGU and MCU done to delineate the pathology of anterior and membranous urethra and to know the condition of urinary bladder and posterior urethra. On uretrocystoscopy stricture appears as circumferential scar. Any additional area of scar near stricture may be detected by urethrocystoscopy.

The extent of the urethral stricture was evaluated preoperatively with cystoscopy and retrograde urethrogram. The area of abdominal wall to be harvested was demarcated and discussed with the patient preoperatively.

For one or two-staged long segment urethral reconstructive procedures involving the mid or proximal bulbar urethra, the patient was placed in the low lithotomy position. Otherwise, those with stricture confined to the penile urethra and distal bulbar urethra were placed in the supine position. A bougie-à-boule sound is then used to identify the anatomically distal most aspect of the stricture. The urethra is incised along its anterolateral edge throughout the length of the stricture. The full extent of the urethrotomy is then measured in preparation for graft harvest. Alternatively, in men undergoing the first of a two-staged procedure for long segment stricture disease, stricture segment of urethra opened through the full thickness of the penile skin and urethra. The mucosa from the proximal urethrotomy site is then sutured to the overlying penile, scrotal, or perineal skin, depending on stricture length, with interrupted 5-0 vicryl sutures. All nonviable corpus spongiosum and urethral mucosa or tissue excised.

Graft harvest of the abdominal wall involves excision of the skin of the right or left lower quadrant of the abdomen at the level of the anterior superior iliac crest. An area of hairless skin is identified and chosen in a location which is anatomically positioned so that the patient's belt line will eventually conceal the wound. Principally, the graft length was planned to be 38% longer than the measured stricture length because of the expected contracture rate.[4] A full thickness skin graft is harvested to the level of the subcutaneous tissue [figure 1]. Once the graft is sharply excised, the deep dermal tissue of the harvest site is closed with

interrupted 3-0 vicryl sutures followed by a 4-0 vicryl subcuticular skin closure. The graft is then prepared by sharp dissection over its dermal edge until transparent.

For single-stage procedures, the epithelial side of the graft is sutured to the remaining mucosa of the urethral plate with 5-0 vicryl suture [figure 2]. In the first of a two-staged procedure, graft fixation to the dartos fascia is accomplished by suturing the graft to the urethral plate medially and the penile skin laterally.

A 16F catheter is left in place. All men undergoing the first of a two-staged procedure had a catheter placed for 5 days postoperatively in conjunction with a moisturized bolster dressing. All other patients undergoing a single procedure for repair had catheter drainage for three weeks postoperatively.

The patients were followed for voiding difficulties, with uroflowmetry being conducted postoperatively during the 4th week, 8th week and then every 3 months. In cases with serious voiding complaints or low uroflowmetry profiles, the patients were evaluated immediately using cystoscope combined with fluoroscopic imaging. The procedure was considered a failure if there was any need for surgical intervention or a need for more than one Foley catheterization.

Result:

Our data were collected between June 2019 and November 2021 from 16 patients. Median patient age was 32 + 7.67 years (range 22-55 years). Mean stricture length was 8 + 3.38 cm (range 5-12 cm). A total of 4 urethral strictures were located in the penile region, 10 strictures were located in the bulbar region, and 2 strictures were located in the penile and bulbar region [figure 3].

The aetiology [Figure 4] of urethral stricture included urethritis (6 patients), urethral trauma (7 patients), failed hypospadias repair (2 patient) and unknow (1 patient).

The mean prepared graft length was 8.68 + 4.58 cm (range 7–14 cm), the mean operation time was 86.45 + 30.28 minutes (range 55 –130 minutes).

Median follow-up was 24 months. 2 of the 16 patients underwent two-staged procedures with successful graft uptake. In the other 14 men, strictures were closed in one stage with a long segment graft. The uroflowmetry parameters of the successful cases were the mean maximum flow rate (Q_{max}) of

Fig.-1: *Harvesting FTSG from left groin*

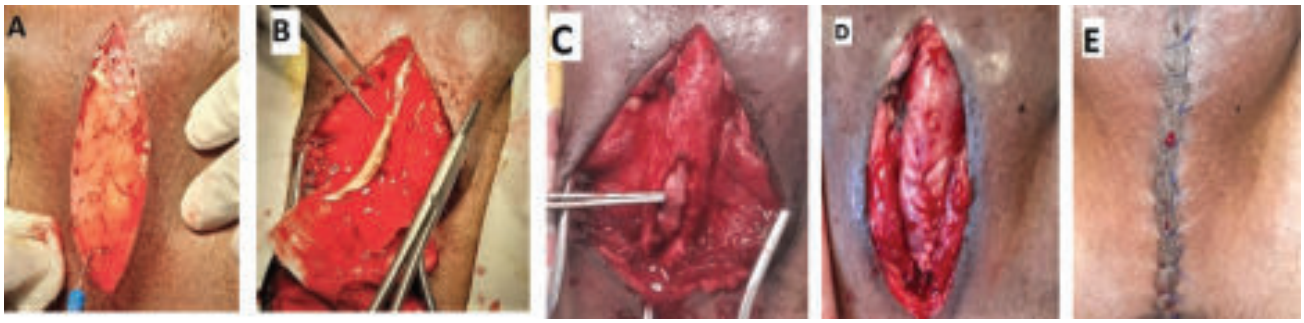

Figure 2: *Substitution urethroplasty using FTSG for bulbar urethral stricture*

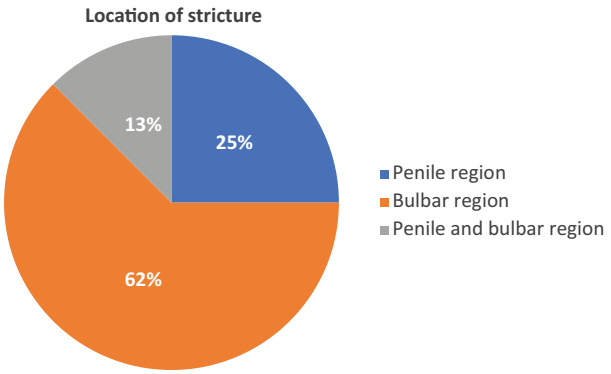

Figure 3: *Stricture location*

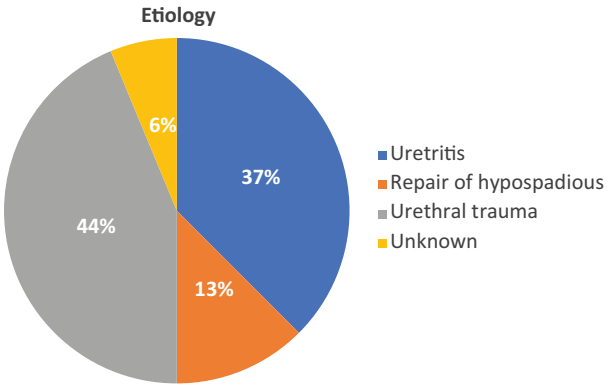

Figure 4: *Aetiology of patient underwent urethroplasty with skin.*

19.30 ± 5.32 mL/s and an average flow rate of 13.3 ± 2.52 mL/s; the voided volumes were 310 ± 140 mL.

All abdominal skin harvest sites healed well without complication. Two patients developed febrile urinary tract infections requiring oral antibiotics. One patient with history of urethritis developed recurrent stricture. So overall success rate is 93.75% with p value of < 0.001; that is statistically significant. The findings are summarized in table 1.

Table I: *Result Summary*

Variables (n=16)	values
Age (mean+SD, range)	32 + 7.67; 22 -55 year
Stricture length (mean+SD, range)	8 + 3.38 cm, 5-12 cm
Prepared graft length (mean+SD, range)	8.68 + 4.58 cm, 7–14 cm
Operation time (mean+SD, range)	86.45 + 30.28 min., 55 –130 min.
One stage procedure	14 (87.5%)
Two stage procedure	2 (12.5%)
Q_{max} (mean + SD)	19.30 ± 5.32 mL
average flow rate (mean + SD)	13.3 ± 2.52 mL/s
voided volumes (mean + SD)	310 ± 140 mL
Postoperative UTI	2 (12.5%)
Recurrence	1 (6.25%)
Success	15 (93.75%)

Discussion

Long-segment stricture management is difficult because of the extensive scarring and the paucity of the available graft tissue. Buccal mucosal harvesting is the most common graft procedure for urethral reconstruction, but it may be limited by the amount of graft tissue available for extensive strictures.[6] Studies have shown that the maximum graft area should be 4 cm in length and 2.5 cm in width from each cheek to minimize complications.[4] However, the complications that have been reported from harvesting oral mucosae include pain, perioral numbness, tightness of the mouth, motor deficits, and long-term speech morbidity (lingual mucosal grafts exceeding 7 cm).

The use of a penile fascio-cutaneous circular skin flap has been described for stricture lengths of up to 24 cm, with a 16% stricture rate at 5 years. The patients can experience several complications, such as penile scarring, penile skin necrosis, and a significant loss of penile sensation.[8] Mundy et al. reported on the use of scrotal skin tube grafts, with a rate of stenosis of 5% per year after 4 years, thus limiting its use.[9] Intestinal graft sources have also been described for substitution urethroplasties; for example, Xu et al. reported success in 85.7% of the patients with long-segment urethral strictures using colonic mucosae.[10] However, this technique is not feasible because of the complicated techniques required for the laparotomy and colon resection. In addition, the use of intestinal submucosae for bulbar urethroplasties has been shown to have a 76% success rate, but there was a 100% failure rate for strictures exceeding 4 cm.[7]

FTSG is an alternative tissue for urethroplasty and has previously been reported using postauricular skin, with a success rate of 89% at 22 months; however, FTSG can lead to cosmetically unappealing scarring.[11]

In the present study, our aim was to describe a novel technique using full-thickness skin grafting from hairless area of abdominal skin for patients with long-segment urethral strictures. In our study group, the mean stricture length was 8 + 3.38 cm (range 5-12 cm).

The patient aetiologies varied, including urethritis (6 patients), urethral trauma (7 patients), failed hypospadias repair (2 patient) and unknow (1 patient).

FTSG is an attractive graft source with the potential to harvest a long-segment, continuous graft. Meeks et al. reported successful urethroplasties using abdominal skin grafting, with a recurrence rate of 19%.[5]

The treatment strategies used in these urethral stricture cases were discussed with a highly experienced plastic surgeon to planning the urethroplasty operations. The main point of this discussion was to determine the most appropriate FTSG region instead of the oral mucosa. The most important indication of the success of the FTSG is to maintain a scarless and viable stricture bed. Therefore, the meticulous dissection of the stricture scar to reach the viable tissue is of vital importance. Another point in reconstructive surgeries is to predict the contraction rate of the graft. For example, Stephenson et al. reported that significant contractions in human FTSGs were found approximately 38% of the time.[4] In our cases, this possible contraction rate was added to the stricture length prior to planning the graft length.

We prefer the abdominal skin for the graft harvesting regions. The advantages of this tissue are that the ability to harvest hairless segments up to 24 cm, and the limited graft site morbidity observed in this series. Furthermore, the abundant length and width of the abdominal skin graft allows for harvest of a single graft segment as compared to buccal mucosa or penile skin grafts which require multiple harvest sites and suture lines between grafts within an anastomosis for long-segment stricture defects. An FTSG is harvested without the subcutaneous areolar tissue. By maintaining a thick dermis, the harvested tissue continues to behave as a full-thickness graft.

The success rate was high with only one recurrence. In the successful cases, no complications were seen, including hair growth from the graft, glans dehiscence. Except 2 cases suffered from urinary tract infections. Additionally, no infections, wound dehiscence, or patient complaints were observed in the primary graft source area.

Using cystoscopy during urethroplasty and then for the follow-up examinations plays an important role in this procedure. This is because these patients have a history of long-term cystostomy catheters owing to their urethral strictures, which can cause bladder stone formation. Moreover, by using a cystoscope, the distal urethra can be clearly identified, and the stricture can be measured easily.

Limitation

This study does have several limitations. For example, the cohort size was limited, and future long-term analyses will yield important data regarding FTSGs for urethral reconstruction.

Conclusion

We describe a technique for full-thickness abdominal skin graft use in long-segment urethral stricture reconstruction. When harvested from hairless regions, these grafts have acceptable success rates with few complications at early follow-up. Selective use of abdominal skin grafts may be well suited for patients with long-segment urethral strictures in one or two stages when other graft sources are not available or feasible. The technique we describe is not meant to replace standard techniques of buccal or genital skin grafts but is a supplemental technique to consider when approaching a complicated patient with few ideal graft sources.

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