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Tunica vaginalis free graft urethroplasty: 10 years experience



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KEYWORDS

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Abstract

Objective: To evaluate the long term patient outcomes over a 10 year period among 52 patients who had tunica vaginalis (TV) for substitution urethroplasty.

Patients and methods: Between October 2005 and December 2015, a total of 52 patients had TV substitution urethroplasty. 25 cases had one stage free graft dorsal urethroplasty while 27 cases had augmented anastomoses urethroplasty. Successful criteria were: patient satisfaction, urine flow rate above 16 mL/s, patent urethrogram and no need for dilation or any instrumentation during the follow-up period.

Results: Overall success rate was 80.8%. Five cases completely failed due to severe wound sepsis and TV urethroplasty redone successfully 6–12 months later. Recurrent urethral stricture occurred in 5 cases over a period of 3–18 months. Superficial surgical site infection occurred in 7 cases. The 42 successful cases were voiding well, with an average flow rate 20 mL/s. None of the patients had any scrotal pain or discomfort in the follow-up period.

Conclusion: To the best of our knowledge this is the first long term study using this technique with encouraging results and the researchers propose that it is considered as an additional option by reconstructive genitourinary surgeons.

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Introduction

Urethral stricture disease in males is one of the most distressing urological conditions since ancient times [1]. The management of complex urethral strictures is challenging because of the urethral scarring and fibrosis of the surrounding corpus spongiosum [2].

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Initially, long strictures were managed with a two-stage repair [3]; however as the field of urethral reconstruction has developed, there has been a paradigm shift towards one-stage repair using free grafts made of skin or buccal mucosa, pedicle-based flaps or combined approaches [4,5]. For decades, many tissues have been suggested yet the tissue of choice still remains controversial [6]. Various researchers proposed the use of tunica vaginalis for substitution urethroplasty and some introduced it on the neourethra as a second layer in hypospadias repair with excellent results. Since 2005, our center has used tunica vaginalis (TV) for substitution urethroplasty and encouraging results have been achieved which we now use to suggest that TV graft can be considered as an alternative when buccal mucosa is not available or at centers where general anesthesia is not always available. Various researchers proposed the use of tunica vaginalis for substitution urethroplasty and some introduced it on the neourethra as a second layer in hypospadias repair with excellent results. In this study, we evaluated the long term patient outcomes over a 10 year period among 52 patients who had TV for substitution urethroplasty.

Patients and methods

The institutional ethics committee approved this prospective study. After obtaining fully informed written consent, a total of 52 patients were operated on by the same surgeon (H.A) from October 2005 to December 2015. Any patient who was not suitable for end-to-end urethral anastomosis was included in the study. Patients' assessment pre-operatively included a detailed clinical history, physical examination, urine culture, ascending urethrogram and micturating cystourethrogram. The patient's HIV status and blood chemistry were also determined. Patients who were HIV positive, not on HAART and had a CD4 count less than 100 were not included in the study until their immunosuppression was adequately managed. Over the 10 year period, our center conducted several urethroplasty procedures and in this study, 52 patients who met the inclusion criterion described above had substitution urethroplasty using TV grafts and none received other grafts from the same surgeon.

Surgical technique

A pre-operative parenteral antibiotic was administered to all patients. Spinal or general anesthesia was administered, and the patient placed in the lithotomy position. The urethra was mobilized through midline perineal incision and freed from underlying spongy tissue. The site of stricture was identified by passing metal urethral sound.

Twenty five cases had one stage free graft dorsal urethroplasty and 27 cases had augmented anastomoses urethroplasty. In 25 cases, dorsal urethrotomy was done at the site of the stricture up to the healthy mucosa at the proximal end. In 27 cases, dissection of the stricture (complete removal of scar tissue) was done and both ends of the urethra were spatulate. The testes were delivered through the perineal incision and the appropriate size of TV was harvested. Trimming of the cremaster fibers was then done, and the tissue was kept in saline until it was ready to be placed on the recipient site.

In the 25 cases of dorsal urethrotomy, the opened urethra was rotated 180° onto the right side. The graft (TV) is fixed and quilted to the tunica albuginea of the corporal bodies using 3/0 polyglactin absorbable running suture. The right margin of the opened urethra

was sutured to the right side of the graft. The urethra is rotated back into its original position. The left urethral margin is sutured to the left side of the patch graft and to the corporal bodies, and the grafted area is entirely covered by the urethral plate. The bulbocavernous muscles are approximated over the grafted area. A 18F silicone Foley catheter is left in place [7].

In the 27 cases of dissection, the stricture and the urethral scar were completely removed. The distal and proximal ends of the urethra were fully spatulated along the dorsal surface and 2 mL of fibrin glue are injected over the urethra. The TV graft inserted using augmented roof strips anastomosis by suturing of the distal and proximal urethral edges to the apices of the graft. The distal urethra is pulled down and the proximal urethra is pulled up to cover the graft. Distal and proximal urethral edges are sutured together along the midline as an end-to-end anastomosis. Two mL of fibrin glue are injected over the urethra to prevent urinary leakage. At the end of the procedure, a size 18F silicone catheter (if it was available) was inserted and fixed to the suprapubic catheter (with the balloon not inflated). In instances where a silicone catheter was not available, a size 18F nasogastric tube was substituted and left in situ for 2–4 weeks. A detailed description of this technique can be reviewed in the author's previous article [7].

Post-operatively, patients were given parenteral antibiotic and non-steroidal anti-inflammatories for 5 days. A pericatheter urethrogram was done before removal of the catheter.

Post-operative evaluation was done by assessing patient satisfaction, performing a urethrogram, and observing and timing the flow rate (volume of urine flow per given time) using a stop watch (because flowmetry was not available).

Follow-up was done at 2, 4, 6 and 12 months and annually thereafter. Successful criteria were: patient satisfaction assessed objectively by use of a validated questionnaire, urine flow rate above 16 mL/s, patent urethrogram, and no need for dilation or any instrumentation during the follow-up period. Successful outcome meant that a patient had to meet all of the criteria for success. In the subsequent follow-up visits, patients had a urine flow rate assessment and answered a questionnaire to determine their satisfaction.

Statistical analysis

We have used the Chi² test for analysis of qualitative variables. The Anova Test and K-S Test (to check the normal distribution) have been used in the study of quantitative variables. The mean and standard deviation (SD) were used to report continuous normally distributed variables. All statistical analysis were performed using 'Statistical Package for Social Sciences' software, 17.0 version (SPSS Inc., Chicago, IL, USA).

Results

The 52 patient participants' median (range) values of each of their variables were as follows: patient age 46,3 (22–79) years, follow up 58 (6–120) months with only 3 patients with less than 1 year of follow up, intra-operative stricture length 67 (35–120) mm, operating time 86 (80–140) min and post-operative maximum urinary flow rate 20 (17–24) mL/s. An example of a pre and post-operative cystourethrogram is shown in Figs. 1 and 2, respectively. Patient



Figure 1 Pre-operative cystourethrogram showing multiple strictures.



Figure 2 Post-operative urethrogram showing patent urethra.

Table 1 Etiology and site of stricture (N = 52).

Etiology of stricture	n	Site of stricture	n
Inflammatory	25 (15 HIV+)	Penile urethra	17
Lichen sclerosis	3	Bulbar urethra	15
Trauma	15	Bulbopenile	12
Idiopathic	9	Multiple strictures	8

characteristics in this study are shown in (Table 1). At the end of the follow-up period, 10/52 cases were considered to be a failure and the overall success rate was 80.8%.

5 cases completely failed due to severe wound sepsis and the TV urethroplasty was redone successfully 6–12 months later (Grade III). Recurrent urethral strictures occurred in 5 cases over a period of 3–18 months and management by dilatation and internal urethrotomy done in 2 and 3 cases, respectively (Grade IIIb). Superficial surgical site infection (which did not affect the anastomotic site) occurred in 7 cases which responded well to parental antibiotics and daily wound dressings (Grade II) see Table 2. Follow-up patient satisfaction was determined by answering a questionnaire post-operative PROM at a median of 129 days that showed excellent correlation between voiding symptoms scores maximum flow rates ($r = -0.69$), supported by parallel improvements in the EQ-5D visual analogue and time trade-off scores demonstrated criterion validity. Cronbach's alpha was 0.71 for the overall score. None of the patients in this study had any scrotal pain or discomfort in the follow-up period.

Table 2 TV graft free graft urethroplasty complication gradings: annual of surgery guidelines.

Grade	Definition
Grade 1	Urethrorrhagia, scrotal swelling, temporary numbness or dysesthesia to the perineum. We did not experience any of the above.
Grade 2	Superficial surgical site infection (which did not affect the anastomotic site) occurred in 7 cases which responded well to parental antibiotics and daily wound dressings
Grade 3	5 cases completely failed due to severe wound sepsis and the TV urethroplasty was redone
Grade 3b	5 cases of recurrent stricture over a period of 3–18 months and management by dilatation and internal urethrotomy done in 2 and 3 cases respectively
Grade 4	No life threatening complications
Grade 5	No deaths

Discussion

Although end-to-end anastomosis remains the method of choice in short segment urethral stricture (2–3 cm), patients with long segment and multiple stricture particularly in the penile urethra require substitution urethroplasty with either genital or extra-genital graft material [7].

Materials such as lingual mucosa, bladder mucosa and bowel mucosa have been used with success by various surgeons and can result in complications as they required a laparotomy or an oral procedure [8,9]. Use of skin grafts in substitution urethroplasty causes a lot of complications due to hair follicles which might end up growing and forming stones in the urethra.

Memmelaar was the first to report the use of bladder mucosa for urethral reconstruction [10]. Following initial enthusiasm with this substitute, there were reports of problems with harvesting tissue for substitution and meatal exuberance [11].

Humby was the first to describe the use of buccal mucosa for urethral substitution as early as 1941, but it was only in the early 1990s that buccal mucosa was rediscovered for this indication. El-Kasaby et al. [12] had the first reported use of buccal mucosa in urethroplasty for adults [12].

Various factors have contributed to the acknowledgement of buccal mucosa grafts as an ideal substitute for the urethra. These factors include easy accessibility and manual handling, resistance to infection, compatibility with a wet environment, a thick epithelium, and a thin lamina propria [13].

A percentage of 51 patients with buccal mucosa grafts had donor site pain that was worse than expected, 26% had perioral numbness lasting more than 6 months [14]. Kero et al. [15] reported that oral mucosa is an important reservoir for the human papillomavirus and urologists using buccal mucosa grafts needed to consider other newer graft tissue techniques [15].

Calado et al. [16] evaluated tunica vaginalis as substitution for buccal mucosa using an animal model, which showed patent and functional urethra as evidenced by radiographic and histological analysis [16]. Foinquino et al. [17] reported their initial experience in 11 patients using TV dorsal graft urethroplasty with encouraging results [17].



Figure 3 Dorsal placement of tunica vaginalis graft.

Barbagli et al. [13], commenting on this article, emphasized that “this article confirmed that buried strip of TV becomes an epithelialized tube which confirm and expend the ingenious Duplay’s principle: each strip of autologous epithelial tissue has the potential to be used for urethral regeneration”. This is an important message for people involved in tissue engineering studies (p. 531) [17].

The TV graft is much easier to harvest than other materials because it can be harvested through the same incision using regional anesthesia. Therefore, there is no need for another wound, general anesthesia, and additional morbidity.

The tissue is abundant and suitable for any length of stricture (see Fig. 3).

In our experience using tunica vaginalis free graft in substitution urethroplasty, the tissue is easy to mobilize and can fit anywhere along the urethra giving much more flexibility pedicel graft techniques cannot easily offer. TV graft has significantly reduced operative time which helps to prevent complications for the prolonged high lithotomy position [7].

Economically, the TV graft is suitable for developing countries where many of the surgeons use spinal anesthesia because general anesthetic agents are in short supply. Additionally, access to tissue engineering (TEBM) with its high cost may not be available.

Since October 2005, we have been using TV free grafts as substitution for long segment urethral stricture, with encouraging long term results. Comparative studies with existing urethral substitution tissues are needed.

Conclusions

Over a 10 year period, Tunica vaginalis free graft urethroplasty has been used in the author’s department with encouraging results. This technique is easy, safe, and not time consuming. Comparative studies with existing urethral substitution procedures are needed for best practices by reconstructive genitourinary surgeons. To the best of our knowledge, this is the first long term study using tunica vaginalis free graft urethroplasty.

Conflict of interest

There is no conflict of interest.

Ethical committee approval

This study was approved by Mpilo Central Hospital Institutional Ethics Committee.

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There was no source of funding.

Authors’ Contributions

Hassan Ashmawy; performed the surgical operations, manuscript writing, submission and revision.

Praise Magama; manuscript editing.

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