

SURGERY

A Novel Technique of Urethroplasty Could Reduce Urethra-Related Complications in Phalloplasty With Urethral Lengthening



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ABSTRACT

Introduction: Urethral lengthening in phalloplasty could bring many postoperative complications, such as urethra fistula and stricture, which greatly affects the patient's mental health and quality of life.

Aim: To describe a novel technique of vaginal mucosal graft for prelamination urethra (VMGPU) combined with modified urethral anastomosis (MUA) for the reconstruction of a neourethra.

Methods: A retrospective study of transgender men between January 2006 and March 2021 was conducted. Patients were divided into three groups according to the surgical methods: traditional group (TG), VMGPU group (VG) and VMGPU+MUA group (VMG).

Main Outcome Measure: The main outcomes measures were demographics, surgical characteristics, complications, International Prostate Symptom Score (IPSS), Quality of Life (QOL) score, and voiding frequency conditions.

Results: Of 80 eligible transgender men (TG:n = 39, VG:n = 31, VMG:n = 10), the urethral fistula developed in 19/39 (49%) patients in TG, 8/31 (26%) in VG, and 1/10 (10%) in VMG ($P = 0.034$). The urethral stricture formed in 15/39 (38%) patients in TG, 4/31 (13%) in VG, and 1/10 (10%) in VMG ($P = 0.028$). Compared with TG, the VG got more favorable IPSS. The QOL scores showed that patients in VG or VMG were more satisfied with their postoperative status.

Clinical Implications: VMGPU combined with MUA may help reduce urethral complications for transgender men who wish to undergo phalloplasty with urethral lengthening.

Strength & Limitations: VMGPU combined with MUA focuses on reducing the urethra-related complications in the anastomotic stoma between the fixed and the penile urethra, which has not been noticed in the past. The limitations of this study are that the retrospective study design is prone to bias; the study using VMGPU+MUA technique is only in the preliminary stage, and more cases are needed to prove its effectiveness; the median follow-up in VMG was only 2 years, and longer-term follow-up results are inconclusive; the IPSS, QOL, and the voiding frequency chart were not validated in transgender men.

Conclusion: Our pilot study suggests that VMGPU combined with MUA may reduce the urethra-related complications, especially the urethral fistula in the anastomosis stoma between the fixed and the penile urethra. **Gao H, Wu D, Kong X, et al. A Novel Technique of Urethroplasty Could Reduce Urethra-Related Complications in Phalloplasty With Urethral Lengthening. Sex Med 2022;10:100571.**

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Key Words: Genital gender affirming surgery; Transgender; Phalloplasty; Urethra reconstruction; Urethral fistula; Urethral stricture

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INTRODUCTION

Genital gender affirming surgery is known to relieve gender dysphoria in transgender men significantly.¹ Standing micturition is usually the basic requirement for transgender men undergoing phalloplasty,² and at the same time, urethral lengthening is essential to achieve standing micturition.³ However, the high

incidence of urethral-related complications after urethral lengthening remains an obstacle to constructing a functional neourethra.

The urethra is divided into 3 parts after urethral lengthening,³ including the native urethra, the fixed and the penile part. There are 2 anastomosis stomas between the 3 parts that is the A anastomotic stoma between the native and the fixed urethra, and the B anastomotic stoma between the fixed and the penile urethra (Figure 1).

In previous clinical observations, we noted that the urethral fistula mainly occurred at the fixed urethra the penile shaft, and the 2 anastomotic stomas.⁴ Massie et al.⁵ used labia minora flaps to reconstruct the fixed urethra and additional localized bulbospongiosus muscles to cover the labia minora. Similarly, Al-Tamimi et al.⁶ described the effectiveness of using labia minora to construct the fixed urethra together with using the surrounding tissues to cover the A anastomotic stoma, which could reduce the urethral fistula at these sites. Our previous study⁷ also shown that using vaginal mucosa for urethral lengthening and the vaginal mucosal graft for prelamination urethra (VMGPU) may reduce the urethral fistula formation at the fixed urethra and the penile shaft. However, to our knowledge, few studies have focused on reducing the urethral complications at the B anastomotic stoma, which is still an aspect that needs attention.

We previously developed the VMGPU technique to reduce urethral complications after urethral lengthening.⁷ On this basis,

we recently developed a novel technique of modified urethral anastomosis (MUA) to specifically reduce the urethral fistula at the B anastomosis stoma. In this paper, we conducted a long-term follow up of the VMGPU technique and described the surgical details of the MUA technique. At the same time, we also shown a pilot study of VMGPU combined with MUA technique, hoping to benefit more transgender men.

METHODS

Research Design

A retrospective study was conducted between January 2006 and March 2021. The inclusion criteria were: (1) Patients have been clearly diagnosed as transgender men; (2) Phalloplasty has already been completed; (3) The pedicled mucosal flap was used for urethral lengthening and the pedicled anterolateral thigh flap was used for penis reconstruction. The exclusion criteria were that the patients underwent urethral lengthening without vaginectomy.

All patients were divided into 3 groups according to the different surgical methods: traditional group (TG), VMGPU group (VG) and VMGPU+MUA group (VMG). Demographics and main complications were recorded. We inquired the patients of the voiding frequency conditions⁸ through telephone communication. We also invited the patients to fill in

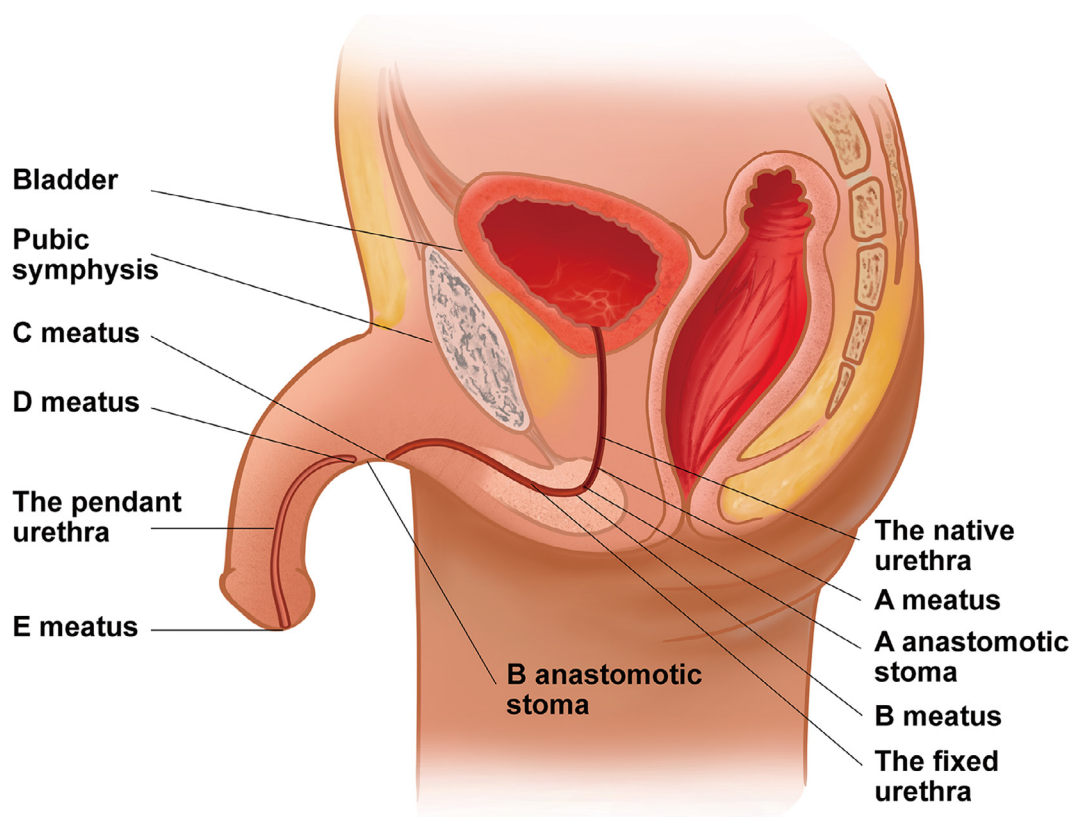


Figure 1. Overview of urethral parts in transgender men after urethral lengthening and phalloplasty.

IPSS⁸ and QOL scores⁹ through electronic questionnaires to assess the postoperative outcomes.

The Traditional Procedure for Urethra Reconstruction

Previous studies^{10–12} demonstrated that phalloplasty with urethral lengthening could lead to well-documented urethral complications. In order to minimize bias caused by other surgical factors, we only selected patients in the TG with pedicled mucosal flaps for urethral lengthening, pedicled anterolateral thigh flaps for penile reconstruction, and tube-within-tube design for pendulous urethra.

The VMGPU Procedure for Urethra Reconstruction

The VMGPU technique was developed to reduce urethral complications after urethral lengthening and the detailed surgical protocol has been reported.⁷ Briefly in the first-stage operation the pedicled mucosal flap was used to form the fixed urethra for urethral lengthening (Figure 2A). The free vaginal mucosa wrapped around a drainage tube (10 mm in diameter) was placed within the anterolateral thigh flap (Figure 2B). In the second-stage operation about 6 months later, the anterolateral thigh flap with

prelamination urethra was excised to reconstruct the penis. At the same time, the prelamination urethra was anastomosed with the fixed urethra.

The MUA Procedure for Urethra Reconstruction

In the clinical application of VMGPU technique, we found that the incidence of urethral fistula at the B anastomosis stoma formed by direct anastomosis during the second-stage operation was still high. Therefore, we developed the MUA technique on the basis of the VMGPU technique to specifically prevent the occurrence of urethral fistula at the B anastomosis. The first-stage operation was consistent with VMGPU. In the second-stage operation for phalloplasty, the flap should be incised 2cm away from the perineal end of the prelamination urethra (Figure 3A and 3B). The 2cm wide piece of skin, which we called “skin bridge,” could be used as a double pedicled flap in the third-stage operation. Subsequently, the flap was raised and transposed to the pubic region, leaving the “skin bridge” between the C and D meatus (Figure 2C and Figure 3C). After this operation, the fixed urethra was used for urination, and the pendulous urethra was supported by a catheter. The patients were instructed to irrigate the penile urethra with saline from D to E meatus twice a day themselves.

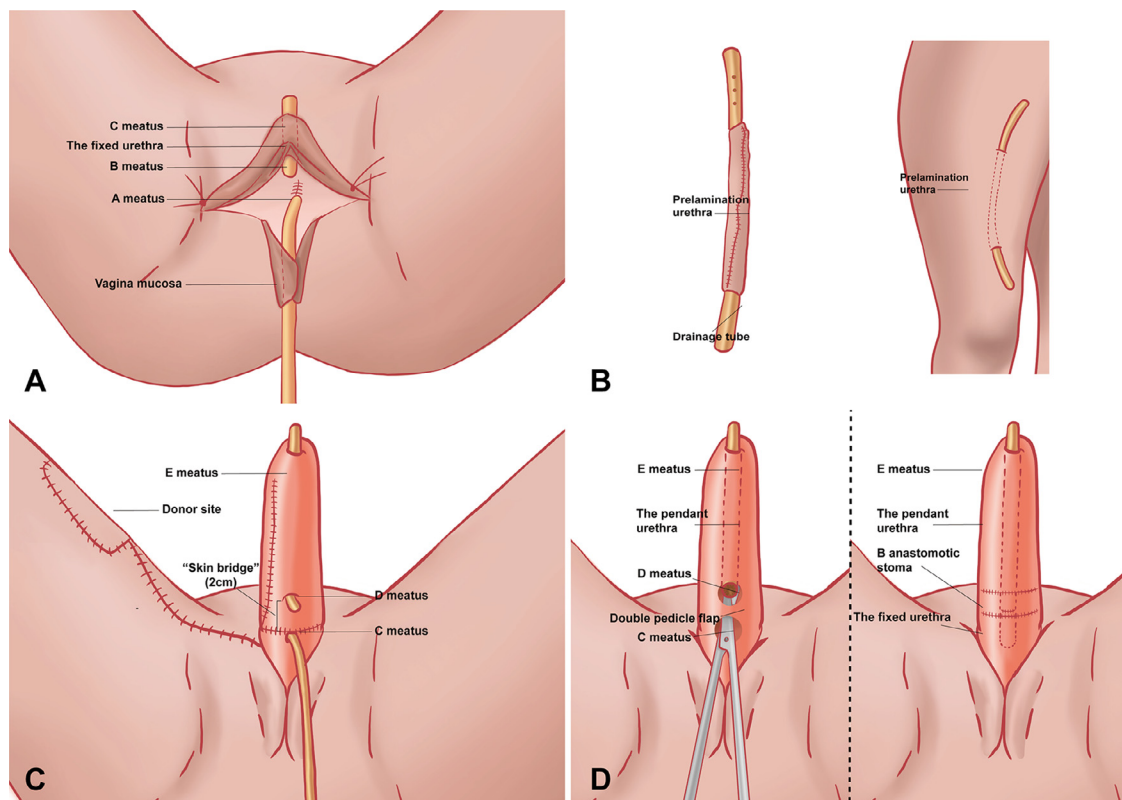


Figure 2. (A) The pedicled mucosal flap was used for urethral lengthening. (B) The free vaginal mucosa was sutured and placed within the anterolateral thigh flap to form the prelamination urethra. (C) The penis was reconstructed and the “skin bridge” was retained. (D) The “skin bridge” was mobilized to form a double pedicled flap; anastomosis under the coverage of the double pedicle flap.

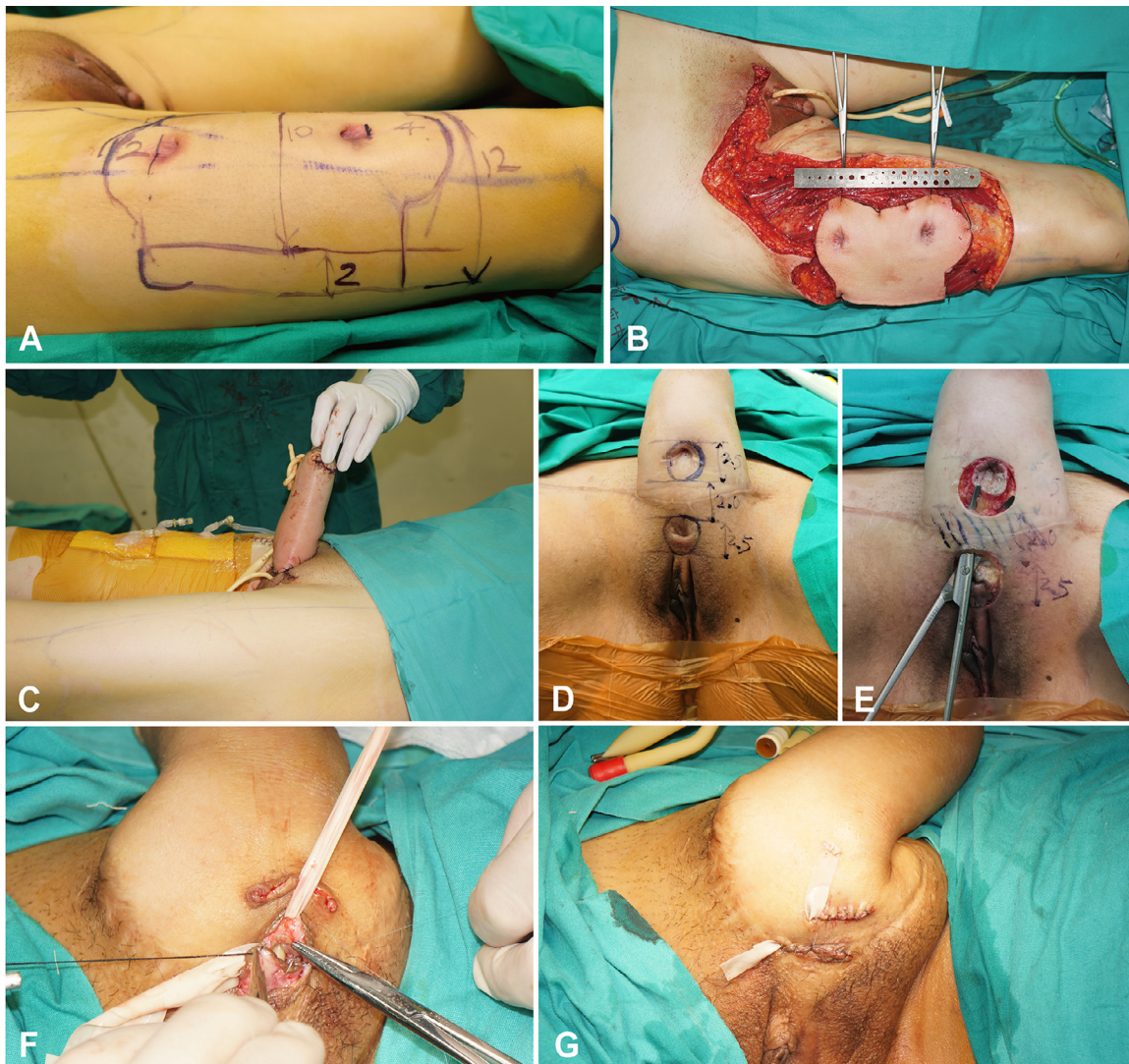


Figure 3. (A) The design of the flap in the second-stage operation. (B) The flap was incised 2 cm away from the perineal end of the prelamination urethra. (C) The flap was raised and transposed to the pubic region, leaving the “skin bridge” between the C and D meatus. (D) The excess scar tissues around C and D meatus were marked and ready for resection. (E) The “skin bridge” was mobilized at the subcutaneous level by blunt dissection to form a double pedicle flap. (F) The double pedicle flap was pulled up with a rubber sheet, and the C and D meatus were subcutaneously sutured under the double pedicle flap. (G) The double pedicle flap was sutured intermittently with the skin of C and D meatus, respectively.

Gradually, the reconstructed penis and the scar around “skin bridge” softened when the adequate blood circulation was established. At this point (usually 6 months after the second-stage operation), we could start implementing the third-stage operation. Firstly, the excess scar tissues around C and D meatus were marked and resection (Figure 3D), and the 2 meatus were slightly dissociated to reduce the tension (Figure 3E). Secondly, the “skin bridge” was mobilized at the subcutaneous level by blunt dissection to form a double pedicle flap (Figure 2C and Figure 3E). Thirdly, the double pedicle flap was pulled up with a rubber sheet, and the C and D meatus were subcutaneously sutured under the double pedicle flap (Figure 3F). Then, the double pedicle flap was sutured intermittently with the skin of C

and D meatus, respectively (Figure 3G). After such an operation, we could cover the urethral anastomosis with a double pedicle flap with rich blood supply (Figure 2D), thereby promoting the healing of the anastomosis and reducing urethral fistula.

Statistical Analysis

Mean \pm SD was used to present the normally distributed continuous variables. The median and range were used to present the skewed continuous variables. The one-way Anova test was applied to compare continuous variables. The Fisher’s exact test was applied to compare categorical variables. Statistical significance was held at $P < .05$.

RESULTS

Patient Demographics

In Table 1, 80 patients were identified in the study: 39 patients in TG, 31 in VG, and 10 in VMG. Patients in the 3 groups were well matched in terms of the age at the time of procedure, body mass index, smoking status, and median operation frequency. The median follow-up was 8 years in TG, 5 in VG, and 2 in VMG.

Postoperative Outcomes

In Table 2, there were no statistical differences in the necrosis of the flap in phalloplasty among the 3 surgical techniques ($P = .839$). In the patients diagnosed with urethral fistula [TG: 19/39 (49%), VG: 8/31 (26%), VMG: 1/10 (10%); $P = .034$], some fistulas could close spontaneously [TG: 3/19 (16%), VG: 3/8 (38%), VMG: 1/1 (100%)], and others needed extra surgery

to cure it [TG: 16/19 (84%), VG: 5/8 (62%), VMG: 0/1 (0%)]. The incidence of urethral fistula formation between VMG and TG was found to be statistically significant. As for the patients diagnosed with urethral stricture [TG: 15/39 (38%), VG: 4/31 (13%), VMG: 1/10 (10%); $P = .028$], some urethral stricture could be treated conservatively [TG: 8/15 (53%), VG: 2/4 (50%), VMG: 0/1 (0%)], and others needed extra urethroplasty [TG: 7/15 (47%), VG: 2/4 (50%), VMG: 1/1 (100%)]. The incidence of urethral stricture between VG and TG was found to be statistically significant.

The IPSS in VMG was lower than that in TG, which was verified to be statistically significant by comparison in pairs. Moreover, the patients in VG and VMG were more satisfied with their urination conditions than in TG according to the QOL scores. The postoperative voiding frequency (Day frequency, Night frequency, and Functional bladder capacity) was basically the same across the 3 groups.

Table 1. Demographics

Variable	TG	VG	VMG	P Value
Number of patients	39	31	10	
Median age (range, years)	25 (18–40)	26 (19–40)	24 (19–30)	.753
Median follow-up (range, years)	8 (4–15)	5 (1–11)	2 (1–4)	—
Number of Smokers	10/39 (26%)	6/31 (19%)	2/10 (20%)	.868
Mean \pm SD Body Mass Index (kg/m ²)	23.2 \pm 2.7	23.6 \pm 2.6	22.8 \pm 2.8	.680
Median operation frequency (range)	3 (1–5)	3 (2–5)	3 (3–4)	.287

TG = Traditional group; VG = vaginal mucosal graft for prelamination urethra group.

VMG = vaginal mucosal graft for prelamination urethra combined with modified urethral anastomosis group.

* $P < .05$

Table 2. Evaluation of postoperative outcomes

Variable	TG	VG	VMG	P Value
Flap-related complication				
Partial flap loss	12/39 (31%)	11/31 (35%)	3/10 (30%)	.839
Urethra-related complications				
Urethra fistulas	19/39 (49%)	8/31 (26%)	1/10 [†] (10%)	.034 [‡]
Fistulas closing spontaneously	3/19 (16%)	3/8 (38%)	1/1 (100%)	—
Fistulas require urethroplasty	16/19 (84%)	5/8 (62%)	0/1 (0%)	—
Urethra strictures	15/39 (38%)	4/31* (13%)	1/10 (10%)	.028 [‡]
Strictures treated conservatively	8/15 (53%)	2/4 (50%)	0/1 (0%)	—
Strictures require urethroplasty	7/15 (47%)	2/4 (50%)	1/1 (100%)	—
Fistulas and strictures	8/39 (21%)	2/31 (6%)	0/10 (0%)	—
IPSS (range)	9 (2–28)	6 (0–23)	5 [†] (0–16)	.035 [‡]
QOL (range)	3 (1–5)	2* (1–4)	2 [†] (1–3)	.013 [‡]
Frequency voiding chart				
Median Day frequency (range)	7 (4–10)	8 (3–9)	7 (4–11)	.770
Median Night frequency (range)	2 (1–3)	2 (1–3)	1 (0–3)	.059
Median Functional bladder capacity (range, ml)	420 (220–790)	400 (220–720)	400 (250–670)	.820

TG = Traditional group; VG = vaginal mucosal graft for prelamination urethra group; VMG = vaginal mucosal graft for prelamination urethra combined with modified urethral anastomosis group; IPSS = International Prostate Symptom Score; QOL = Quality of Life.

*Statistical significance between VG and TG.

[†]Statistical significance between VMG and TG.

[‡] $P < .05$.

DISCUSSIONS

It has been a broad consensus that urethral reconstruction is the most difficult part in phalloplasty, because of the high incidence of urethra-related complications such as fistula and stricture. It has been reported in literatures that the incidence of urethral fistulas and urethral stricture in previous phalloplasty ranges from 25% to 58% and 17% to 75% respectively.^{13–16}

Aiming at reducing the urinary tract complications, we developed the VMGPU technique. In clinical practice, we gradually found that VMGPU alone cannot significantly reduce urethral fistula at B anastomosis stomas. Based on this reality, we optimized the VMGPU as a 3-stages procedure for urethra reconstruction, that is, VMGPU+MUA. In our previous phalloplasty, the incidence of urethral fistula was 19 of 39 (48.72%). After technical modification, the incidence of urethral fistula declined to 25.80% and 10% in VG and VMG respectively.

The difference of MUA technique lies in 2 aspects, one is that the second-stage operation is changed to the third-stage operation, and the other is that the anastomosis method of the B anastomosis is innovated. We speculate that the reasons that MUA technique could make up for the imperfections of VMGPU are listed as 2 aspects: (1) After the second-stage operation, the D meatus on the reconstructed penis is only supplied by the flap pedicle, which is often in a state of poor blood supply. If the C meatus and the D meatus are directly anastomosed at this time, it is easy to cause delayed healing of the anastomosis, which will lead to urethral fistula. Therefore, we changed the direct anastomosis in the second-stage operation to the third-stage delayed anastomosis to provide sufficient vascularization time for the surrounding tissues of the anastomosis. (2) During the third-stage operation, we modified the procedure of anastomosis. We anastomosed C meatus and D meatus firstly, and then covered the B anastomotic stoma with a double pedicled flap. We hypothesized that covering the anastomosis with an additional flap with adequate blood supply would be more beneficial for anastomotic healing than interrupted suture alone.

Another severe urethral complication after phalloplasty is urethral stricture.¹⁷ Lumen et al.¹⁸ described the fact that urethral stricture usually occurs at the anastomotic stoma and distal urethra from that. This was also confirmed by our data, 8 of 19 (42%) of patients diagnosed with urethral fistula in TG were associated with urethral stricture. Therefore, we speculate that the MUA technique may reduce the incidence of urethral stricture caused by scar hyperplasia by improving the healing quality of the anastomotic stoma. In addition, urethral high tension caused by urethral stricture often leads to urethral fistula formation.¹¹ For this reason, the reduction in the

incidence of urethral stricture in patients with the MUA technique may also be one of the factors for the reduction in the incidence of urinary fistula.

Here, we would like to share some other details: (1) The width of the “skin bridge” is generally about 2 cm, which will not hinder the formation of a tension-free urethral anastomosis in MUA. (2) We usually think that a 6 months interval between each stage is preferable.^{19,20} (3) Statistics shows that the median number of surgeries in all groups is 3. Therefore, although the MUA technique changed the 2-stage operation to the 3-stage operation, it did not increase the total number of operations, which may own to the MUA technique could reduce additional operations for subsequent complications.

CONCLUSIONS

The 5-year median follow-up results showed that VMGPU technique could reduce urethral complications. On this basis, the preliminary study of MUA technique showed that its operation of B anastomotic stoma may reduce urethral complications to a greater extent. At present, the study of VMGPU + MUA is still in the small sample stage. We need to learn from it and expand the sample size to prove its effectiveness, so that the VMGPU+MUA technique could potentially become a surgery option for more clinicians and patients.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study formal consent is not required.

INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study.

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STATEMENT OF AUTHORSHIP

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