

Tube-in-Tube Phalloplasty with Tailor-made Bilateral Superficial Circumflex Iliac Artery Perforator Flaps Using Preoperative High-resolution Ultrasound

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Summary: In phalloplasty, the radial forearm free flap is the most commonly used flap, followed by the anterolateral thigh flap. Superficial circumflex iliac artery perforator (SCIP) flaps have been used in phalloplasty, but bulkiness and unstable perfusion have precluded their common use. In this report, we present a case in which tube-in-tube phalloplasty was performed using bilateral SCIP flaps assisted by preoperative high-resolution ultrasonography. A 67-year-old man underwent resection of his penis for treatment of carcinoma. A year later, phalloplasty using bilateral SCIP flaps was planned. After mapping out the superficial circumflex iliac artery and the superficial circumflex iliac vein to their terminal portions using preoperative high-resolution ultrasonography, a 12 cm × 8 cm rectangular flap was designed on the right groin for reconstruction of the phallus, and a 10 cm × 4 cm rectangular flap was designed on the left groin for reconstruction of the urethra. Both flaps were harvested above the superficial fascia, and the thickness of both flaps was 4 mm. The Foley catheter was removed three weeks after the operation, and the patient began urinating in the standing position. No fistula or urethral stenosis had occurred as of 12 months after the reconstruction, and the patient was satisfied with the cosmesis. The use of preoperative high-resolution ultrasonography played a decisive role in ensuring the perfusion of the flap, resulting in prevention of postoperative complications such as fistula and/or urethral stenosis caused by malperfusion of the flap. (*Plast Reconstr Surg Glob Open* 2023; 11:e5280; doi: [10.1097/GOX.00000000000005280](https://doi.org/10.1097/GOX.00000000000005280); Published online 19 September 2023.)

Phalloplasty is now a common procedure, and a tube-in-tube design has become the gold standard.¹⁻⁶ The radial forearm free flap is the most commonly used flap, followed by the anterolateral thigh (ALT) flap.¹⁻⁵ Groin flaps or superficial circumflex iliac artery perforator (SCIP) flaps have been used in phalloplasty, but many issues, including bulkiness and unstable perfusion, have precluded their common use in phalloplasty.⁶ Malperfusion of the flap reconstructing the urethra directly results in devastating postoperative complications, including urethral fistula and/or stenosis. Recent technical advancements in ultrasonography devices have allowed precise imaging of the pedicle vessels of the SCIP flap,

resulting in safer flap design.⁷ In this report, we present a case in which tube-in-tube phalloplasty was performed successfully using tailor-made bilateral SCIP flaps assisted by preoperative high-resolution ultrasonography.

CASE REPORT

A 67-year-old man underwent resection of his penis for treatment of squamous cell carcinoma of the penis. A year later, the patient was referred to us for reconstruction of the penis due to his psychological discomfort and desire to urinate in a standing position. He expressed no interest in restoring erotic sensation. The patient exhibited a significant fat layer in the side of his thigh. Given these circumstances, we opted for a bilateral pedicled SCIP flap procedure for the reconstruction, rather than utilizing the radial forearm free flap or the pedicled ALT approach. The superficial branch of the superficial circumflex iliac artery (SCIA) and the superficial circumflex iliac vein (SCIV) were located and marked to their terminal portion on both groin regions using high-resolution ultrasonography (Vevo MD ultrasound device, Fujifilm

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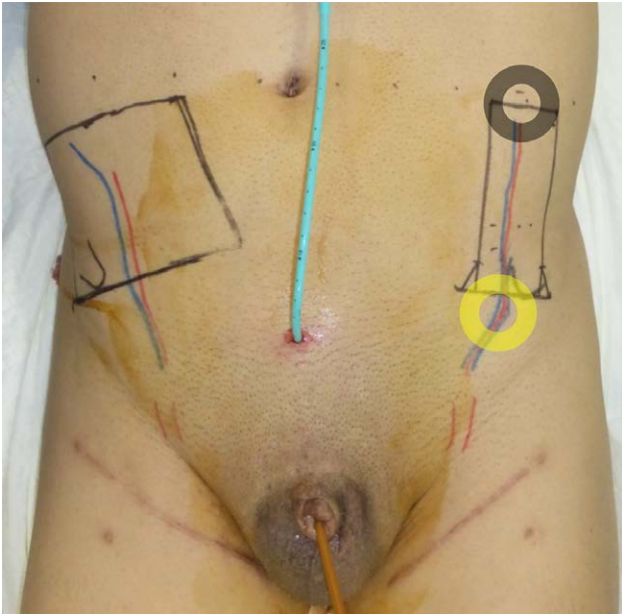


Fig. 1. A 12 cm × 8 cm rectangular flap was designed on the right groin for reconstruction of the phallus, and a 10 cm × 4 cm rectangular flap was designed on the left groin for reconstruction of the urethra. The superficial branch of the SCIA and the SCIV were located and marked from their proximal portion (yellow circle) to their terminal portion (black circle) on both groin regions using high-resolution ultrasonography.

Visual Sonics, Amsterdam, Netherlands) as reported in our previous report.⁷ A 12 cm × 8 cm rectangular flap was designed on the right groin for reconstruction of the phallus, and a 10 cm × 4 cm rectangular flap was designed on the left groin for reconstruction of the urethra (Figs. 1 and 2). Both flaps were harvested above the superficial fascia, and the thickness of both flaps was 4 mm. The pedicles were dissected to their origin, the femoral vessels, which resulted in a 6-cm length in both flaps. At this point, flap perfusion was confirmed using indocyanine green angiography. Both pedicled SCIP flaps were relocated to the genital region through a subcutaneous tunnel. The 10 cm × 4 cm rectangular flap was wrapped around an 18 FR Foley catheter with the skin facing the catheter. The urethral anastomosis was made between the urethral flap and the remaining urethra in a spatulated fashion with interrupted resorbable monofilament sutures, and the other SCIP flap was wrapped around the neourethra (Fig. 3). A glans was created with a small skin flap and a full-thickness skin graft. Both donor sites could be closed directly without much tension because the urethral SCIP flap was a very narrow flap. Urinary catheterization was performed for urinary diversion. Both flaps survived completely, with no healing issues, and there were no donor-site complications. The patient began urinating via the Foley catheter 2 weeks after the reconstruction. Three weeks after the operation, the Foley catheter was removed, and the patient began urinating in the standing position. No fistula or urethral stenosis had occurred as of 12 months after the reconstruction, and the patient was satisfied with the cosmesis (Fig. 4).

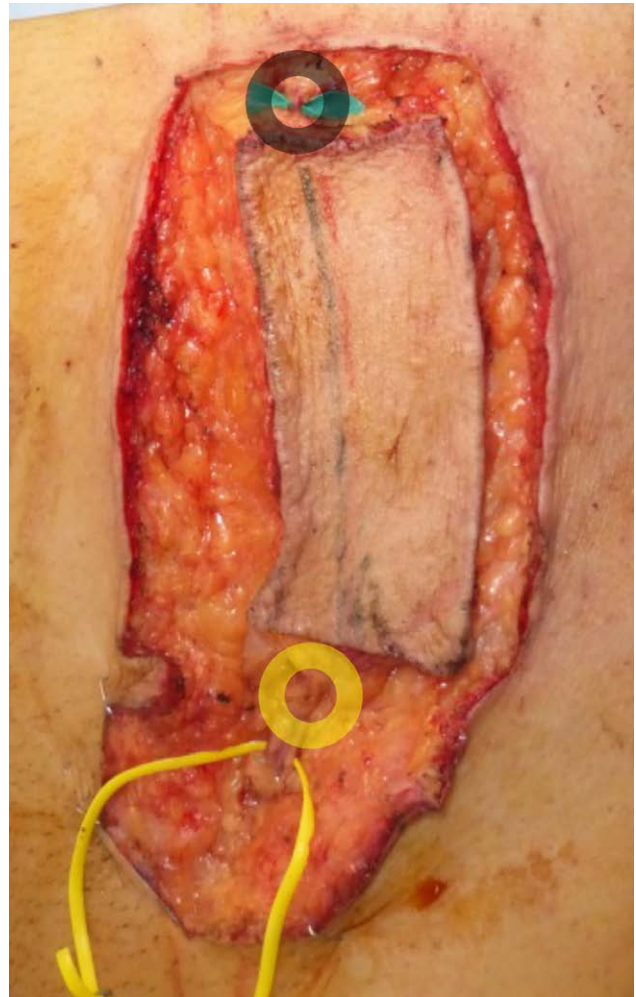


Fig. 2. Intraoperative photograph demonstrating the same vessel patterns as observed with preoperative ultrasonography.

DISCUSSION

Since Chang reported its first use in 1984, the tube-in-tube radial forearm free flap has been the gold standard for phalloplasty.¹ Nonetheless, this procedure involves partially harvesting skin from the forearm, including its cutaneous nerves, which can lead to complications at the donor site. These complications might encompass diminished sensation and strength, unsatisfactory aesthetic results, and lymphedema, which are major downsides of this approach.⁸⁻¹⁰ Pedicled or free ALT flaps have been used to achieve lower donor-site morbidity, but bulkiness of the flap has been problematic, especially for the reconstruction of the urethra.⁵ Use of the SCIP flap for phalloplasty has been reported, which allows even lower donor-site morbidity than the ALT flap.⁶ One of the advantages of the SCIP flap over the radial forearm free flap or the ALT flap is that skin grafting of the donor site is not necessary. However, the following issues have precluded its wide use in phalloplasty. First, its unstable perfusion, especially in the flap used for reconstruction of the urethra, has often resulted in postoperative complications such as fistula or stricture. Second, the



Fig. 3. Both pedicled SCIP flaps were relocated to the genital region through a subcutaneous tunnel, and the 10 cm × 4 cm rectangular flap was wrapped around an 18 FR Foley catheter with the skin facing the catheter. The other SCIP flap was wrapped around the neourethra.



Fig. 4. No fistula or urethral stenosis had occurred as of 12 months after the reconstruction, and the patient was satisfied with the cosmesis.

bulkiness of the flap is an issue, especially when bilateral flaps are used: the diameter of the reconstructed penis tends to be slightly larger than four times that of the flap thickness. This issue goes hand-in-hand with the first issue because, to ensure its perfusion, surgeons tend to avoid harvesting a thin flap. Third, the short pedicle of the flap jeopardizes flap perfusion after inset. In this case report, a high-resolution ultrasound system was used preoperatively to mitigate these challenges.

The high-resolution ultrasound system used in this case provides frequencies as high as 48 MHz and resolution as fine as 50 μ m, which allow for precise imaging of the terminal portions of the SCIA and the SCIV.⁷ Because of this high resolution, both vessels can be visualized preoperatively to their terminal portions (Fig. 1), allowing precise flap design, taking the following points into account: (1) because the vessels' depths were identified preoperatively, thin flaps could be safely procured by elevating the flaps above the superficial fascia; (2) the courses of the SCIA and the SCIV were clearly marked, so a flap with a small width (10 cm × 4 cm) could be designed, including both vessels within the flap, which was then used to make the neourethra (Fig. 2). This plays a decisive role in ensuring the flap's perfusion and preventing postoperative complications such as fistula and/or urethral stenosis caused by malperfusion of the flap. (3) Because the SCIA and the SCIV could be seen to their terminal branches, the skin paddles could be designed cephalad, resulting in longer pedicles (8 cm), allowing for safe flap inset. Flap perfusion was confirmed after its elevation using indocyanine green angiography, which can be used to detect not only ischemia, but also congestion of a flap.¹¹

No effort was made to restore erogenous sensitivity in this case because psychological satisfaction and voiding while standing were the patient's requests. However, the intercostal nerve within the SCIP flap can be coapted to one of the dorsal penile nerves or one of the dorsal clitoral nerves when applying this method to transgender men.

Tube-in-tube phalloplasty after cancer resection using precisely designed bilateral pedicled SCIP flaps assisted by preoperative high-resolution ultrasonography is feasible and advantageous.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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