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Gender-Affirming Surgery

Phalloplasty Flap Salvage Using a Superficial Circumflex Iliac Artery Perforator Propeller Flap

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Background: Partial phalloplasty flap loss presents an evolving challenge, largely due to the complex demands required for both aesthetics and function. We describe our novel experience using the superficial circumflex iliac perforator (SCIP) propeller flap for neophallus salvage when skin grafting alone provides insufficient soft tissue bulk or coverage.

Methods: We retrospectively reviewed patients who underwent SCIP propeller flap reconstruction after phalloplasty partial flap loss. After suprafascial dissection, superficial circumflex iliac vessel perforator(s) were isolated toward the femoral origin. The flap was rotated 180 degrees and inset into the ventral or distal neophallus depending on the region of flap loss. If glans reconstruction was required, the flap was tubularized before inset. Division and inset were performed at a second stage, followed by subsequent glansplasty, urethral creation, and/or penile implant placement.

Results: SCIP propeller flap reconstruction was performed for four patients after one to six debridements at a mean of 6.5 (range 1.0-19.2) months following the initial phalloplasty. Three patients had lost the ventral phallus due to venous insufficiency, arterial insufficiency, and excessive postoperative swelling, respectively. The fourth patient experienced near-total loss of the glans following penile implant insertion. Division and inset was performed at an average of 7.5 (range 5.0-12.0) weeks after SCIP flap. There were no complications related to SCIP flap viability.

Conclusion: The SCIP propeller flap allows salvage of partial flap loss following phalloplasty by providing thin, pliable soft tissue bulk and skin coverage with minimal donor site morbidity, without the need for microsurgery, allowing progression with subsequent reconstructive stages. *(Plast Reconstr Surg Glob Open 2024; 12:e5522; doi: 10.1097/GOX.0000000000005522; Published online 29 January 2024.)*

INTRODUCTION

The past decade has witnessed a marked increase in gender-affirming surgery for individuals with gender dysphoria, including phalloplasty for transmasculine transgender patients.[1] Along with an increase in popularity and utilization of surgical services comes an inevitable increase in surgical complications, particularly as surgical groups worldwide gain experience. Out of all gender-affirming procedures, phalloplasty has the highest reported rate of complications, which include urethral stricture and/or fistula, infection, hematoma, delayed wound healing, donor site problems, and full or partial flap loss.[1–3] Urinary complications are the most common, although flap loss threatens the survival of the entire construct.[2] Although total flap failure is rare, partial flap loss is not infrequent; in a large systematic review, rates of partial flap loss ranged from 1.9% to 18.2%, depending on flap selection.[4]

Partial flap loss creates a challenging dilemma for the reconstructive surgeon. If not addressed adequately during initial phalloplasty construction, it can lead to significant deformity that provides neither aesthetic nor functional satisfaction to the patient. After subsequent stages, partial loss may lead to implant exposure, urethral fistula, and/or pedicle thrombosis, ultimately resulting in devastating total flap loss.[2] Thus, it is paramount to select the method of flap salvage that allows completion of all subsequent stages in reconstruction, such as glansplasty and penile implant placement, while preserving urethral function. Historically, following the stepwise principles of

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the reconstructive ladder, the most basic options for treatment of partial phalloplasty loss include healing by secondary intent or use of a skin graft.[3] Both of these options risk suboptimal function and aesthetics due to the greater propensity for healing with scar contracture and persistence of soft tissue deficits. The other end of the reconstructive spectrum carries the extreme option of starting reconstruction over with a new flap. However, this radical step may be psychologically devastating to the patient and wastes viable flap tissue, with significant additional donor site morbidity.

In this study, we describe a novel application of the superficial circumflex iliac perforator (SCIP) propeller flap for reconstruction of partial neophallus loss. The SCIP flap evolved from the groin flap that McGregor and Jackson pioneered in 1972.[5] In 2004, Koshima first described coverage of limb defects with a free SCIP flap, based only on a perforator of the superficial circumflex iliac system.[6] Given the location of the SCIP flap in the abdominopelvic area, we hypothesized that this flap could serve as a regional source of soft, pliable fasciocutaneous flap tissue for neophallus salvage that provides satisfactory aesthetics while permitting preservation of urinary and sexual function.

METHODS

Patients who underwent a SCIP propeller flap for reconstruction of partial phalloplasty flap loss at The Buncke Clinic were retrospectively identified. This cohort included patients who underwent initial phalloplasty construction at outside institutions as well. Data were collected regarding patient demographics, medical and surgical history, phalloplasty operative details, area of partial flap loss, SCIP flap operative details, and postoperative course, including complications and subsequent procedures.

Surgical Technique

Preoperatively, perforators of the superficial circumflex flap pedicle are identified with use of a handheld Doppler ultrasound. A flap 7–8 centimeters wide is designed based on these vessels, located one fingerbreadth below the inguinal ligament and extending laterally past the iliac crest. The flap is then elevated suprafascially from lateral to medial until the sartorius muscle is reached, by which point one or multiple flap perforators have been identified and preserved. The sartorius fascia is then entered and dissection is continued retrograde to the superficial circumflex iliac artery (SCIA) and superficial circumflex iliac vein (SCIV) on the medial border of the sartorius muscle. The vessels are traced to the femoral system to facilitate mobilization. The lymph nodes at the medial aspect are preserved.

The phallus is prepared through excision of all remaining devitalized areas of flap loss until only viable tissue remains. In cases with partial urethral loss, the urethra is mobilized and reconstructed at the ventral base in conjunction with our urology colleagues. Temporary urinary diversion via creation of a hypospadia is useful, reserving urethral tubularization for a future stage.

Takeaways

Question: What is the best solution for soft tissue reconstruction and salvage of a phalloplasty partial flap loss?

Findings: This is a retrospective review of patients who underwent SCIP propeller flap reconstruction after phalloplasty partial flap loss. All four of the patients reviewed successfully healed after their SCIP flap reconstruction.

Meaning: The SCIP propeller flap allows for salvage of partial flap loss after phalloplasty by providing thin, pliable soft tissue bulk and skin coverage with minimal donor site morbidity, without the need for microsurgery, allowing progression with subsequent reconstructive stages.

Once the SCIP flap pedicle is isolated, the flap is rotated 180 degrees to permit more medial reach of the flap, taking the usual care to prevent pedicle kinking. Flap inset is then tailored to the specific soft tissue requirements. In cases requiring additional length, as with total glans reconstruction, the flap is tubularized on its base and inset into the distal phallus. In cases of a ventral defect, the lateral aspect of the flap is inset into the proximal portion of the phallus, and a meshed split thickness skin graft is applied over the exposed portion of the flap. If urinary diversion via hypospadia is desired, the flap may be split in a V-shaped fashion to facilitate inset around the meatus. The donor site is then closed primarily in a layered fashion.

During the second-stage procedure for division and inset, an incision around the lateral aspect of the inset propeller flap in the groin is made. The SCIA and superficial circumflex iliac vein are identified and ligated. The flap is mobilized, shaped, and inset via local tissue rearrangement as dictated by each particular area of flap loss. In cases of urethral loss, the SCIP flap can be defatted and partially tubularized to re-create the neourethra. The donor site in the groin is closed primarily.

RESULTS

From October 2015 to November 2019, a total of four patients underwent SCIP propeller flap for reconstruction of partial flap loss after anterolateral thigh (ALT; N = 2) or radial forearm free flap (RFFF; N = 2) phalloplasty. Mean patient age was 32.3 (range 18 to 58) years. Average area of flap loss was 33.3 (range 10-50) cm^2. Division and inset was performed at an average of 7.5 (range 5.0 to 12.0) weeks following SCIP flap. There were no peri- or postoperative complications related to SCIP flap loss. None of the SCIP flaps experienced venous congestion immediately after division. Two patients developed a urethral fistula and/or stricture. All patients underwent subsequent glansplasty to complete their reconstructions.

Case 1

A 22-year-old transmasculine patient presented for penile implant placement 17 months after undergoing free left ALT phalloplasty at an outside institution. Implant placement was complicated by ischemic

change of the glans of the neophallus, requiring penile implant removal the following day. Despite early implant removal, the patient developed full-thickness necrosis of the distal end of the phallus involving roughly 70% of the glans and the distal urethra. This was thought to be secondary to injury to the dominant ALT flap perforator with penile implant placement (Fig. 1). The patient underwent initial debridement 1.5 months after implant removal to permit tissue demarcation, followed 1 week later by additional debridement totaling 10 cm^2 and reconstruction of the distal phallus with a left SCIP propeller flap (Figs. 2 and 3). Due to complete glans loss, the SCIP flap was tubularized at the time of inset to re-create a complete outer tube. The patient returned for division and inset 5 weeks later (Fig. 4A). He healed uneventfully and underwent glansplasty and additional soft tissue sculpting approximately 8 months after SCIP flap (Fig. 4B, C). Finally, the patient underwent successful urethral lengthening to the tip of the phallus approximately 17 months after the SCIP flap operation. The patient has had no further complications and has healed well.

Fig. 1. CT scan after penile implant removal, showing abrupt termination of the pedicle at the level of the glans.

Case 2

An 18-year-old transmasculine patient presented 6 weeks after undergoing left RFFF phalloplasty complicated by recurrent venous thrombosis at an outside institution. Hypercoagulability testing subsequently revealed that the patient was a heterozygote for the factor V Leiden mutation, and he was placed on long-term anticoagulation. Despite immediate operative decompression and creation of an arteriovenous fistula, the patient had developed partial flap loss of the ventral aspect of the phallus, including neourethral exposure. He underwent six surgical debridements, resulting in a final defect size of 50 cm^2 (Fig. 5). A SCIP propeller flap from the left groin was performed 20 days after presentation for soft tissue coverage of the ventral phallus, corresponding to 3.2 months from the time of phalloplasty (Fig. 6). Based on the ventral defect, tubularization of the SCIP flap was not required. The proximal flap inset allowed for creation of a diverting hypospadia, allowing for future tubularization and pars pendulans urethral creation. The flap was divided and inset 12 weeks postoperatively (Fig. 7). The patient developed a recurrent pars fixa urethral fistula refractory to multiple urethroplasties, and ultimately underwent a perineal urethrostomy. Glansplasty was performed 16.4 months from the time of SCIP flap. Final appearance at approximately 3 years after SCIP flap is shown in Figure 8. The patient has now been cleared for penile implant surgery.

Case 3

A 58-year-old transmasculine patient underwent left RFFF phalloplasty, which was complicated by arterial insufficiency secondary to thrombosis. Despite immediate exploration with embolectomy and creation of an

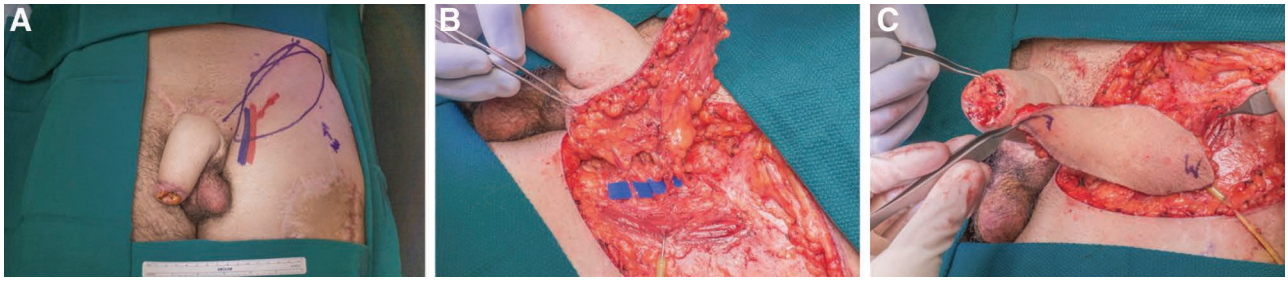

Fig. 2. SCIP flap design and elevation. A, Flap design based on the superficial circumflex iliac vessels. B, Two perforators off the superficial branch of the superficial circumflex iliac artery were identified and preserved. C, Flap rotated 180 degrees, demonstrating rotation of the medial and lateral borders.

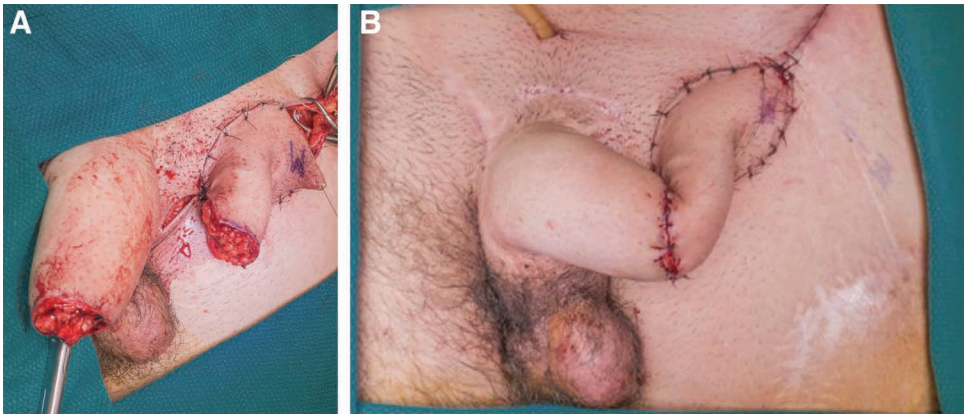

Fig. 3. SCIP flap inset. A, SCIP propeller flap rotated and tubularized in preparation for inset into the distal phallus. Note that the medial (M) flap now lays laterally and has been rotated 180 degrees. B, Flap inset into the distal phallus at the end of the procedure, with the donor site closed primarily.

Fig. 4. SCIP flap division and glansplasty. A, Phallus connected to tubularized SCIP propeller flap at the time of division and inset. B, Phallus at the time of glansplasty, approximately 6 months following division and inset. C, Immediately following glansplasty and additional soft tissue sculpting.

arteriovenous fistula within the forearm flap, the patient developed ventral partial flap loss. Hypercoagulability testing subsequently revealed antiphospholipid syndrome and long-term anticoagulation commenced. He underwent three excisional debridements with a final defect size of 50 cm^2. Approximately 1 month from the time of phalloplasty, the patient underwent SCIP propeller flap from the left groin for coverage of the partial loss of the ventral phalloplasty. Division and inset was performed 6.4 weeks postoperatively. The patient developed a urethral fistula and a mild proximal stricture, both of which were remedied with urethroplasty and adjacent tissue transfer. The remainder of his postoperative course was uneventful. Glansplasty was performed 16.4 months after SCIP flap. Finally, approximately 7 years after SCIP flap was performed, the patient underwent successful semirigid penile and testicular implants.

Case 4

A 30-year-old transmasculine patient underwent pedicled left single-tube ALT phalloplasty, complicated by marked postoperative swelling requiring bedside decompression. He developed an area of ventral soft tissue loss secondary to venous congestion. After one excisional debridement, the patient underwent a right SCIP propeller flap to the ventral phallus 2.7 weeks after phalloplasty. This was followed by division and inset 6.7 weeks later.

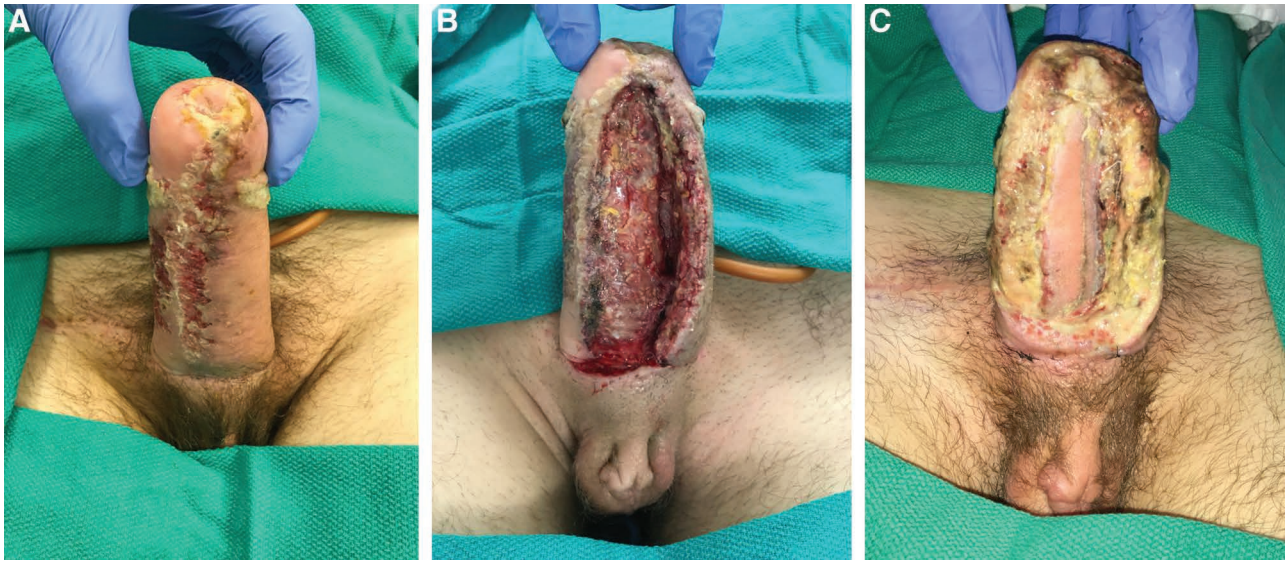

Fig. 5. Ventral phallus soft tissue loss (A) and progression of defect size with surgical debridements (B, C). Note the remaining intact skin paddle in the urethral portion centrally.

Fig. 6. SCIP flap design, elevation, and inset. A, Final ventral soft tissue defect of phallus with exposed urethra, and SCIP propeller flap design in the left groin. B, SCIP flap elevated with phallus prepared for flap inset. C, Lateral aspect of SCIP flap inset into proximal phallus, with meshed split-thickness skin graft over the exposed portion of the flap.

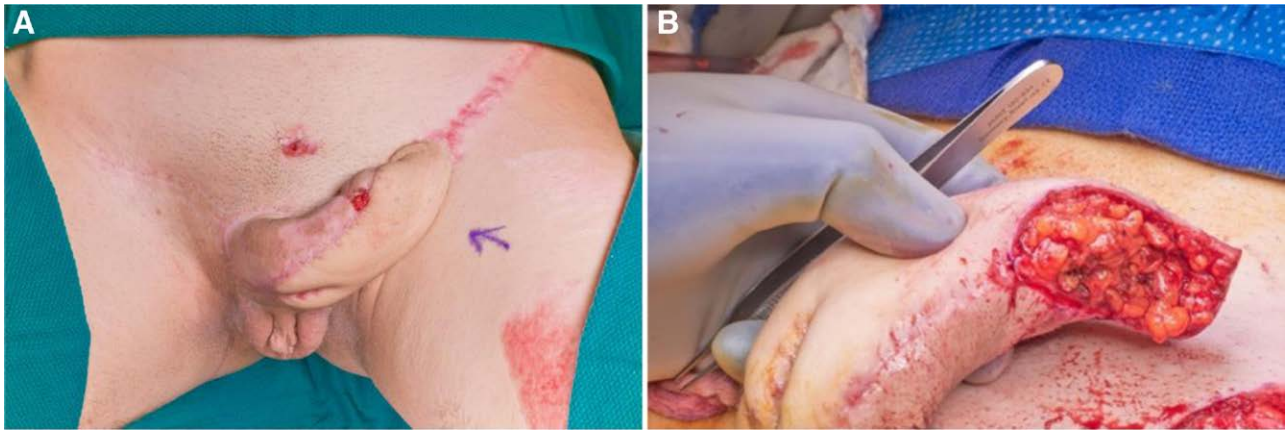

Fig. 7. Phallus-flap construct at the time of division and inset (A), and 12 weeks after SCIP flap (B). The flap was divided at the level of the groin and soft tissue was subsequently sculpted. The donor site was closed primarily.

He healed uneventfully and eventually underwent staged urethroplasty, in addition to glansplasty and testicular and penile implant insertion.

DISCUSSION

We describe a novel technique of neophallus salvage with a pedicled SCIP propeller flap following partial flap loss in

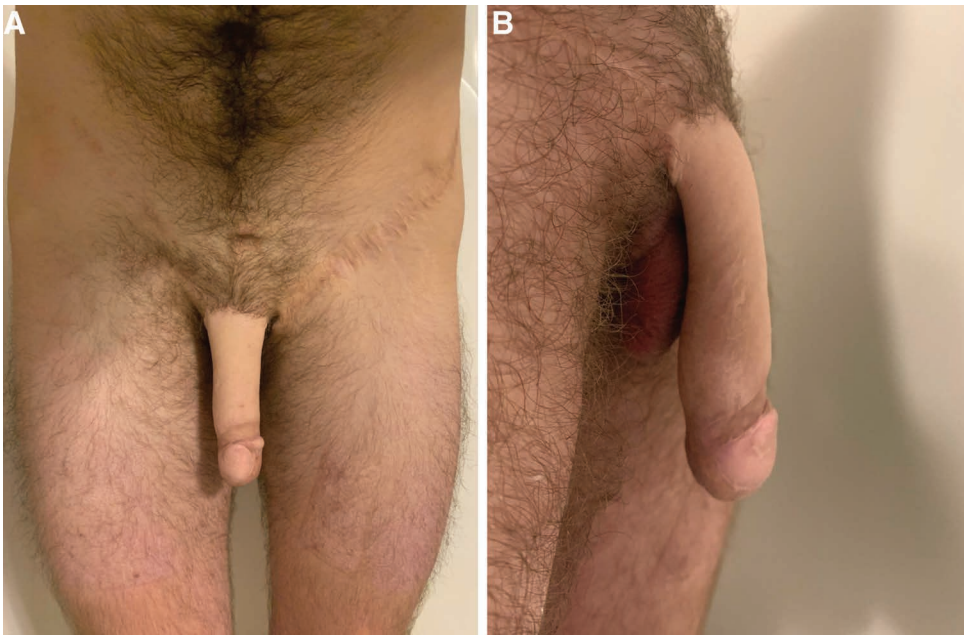

Fig. 8. Final appearance of the phallus approximately 3 years after salvage with SCIP propeller flap and subsequent glansplasty in both the (A) frontal and (B) lateral views.

four transgender patients. As outlined in the seminal article by Koshima et al, the SCIP flap has several advantages, particularly in comparison to the traditional groin flap.[6] The SCIP flap consists of thin and pliable soft tissue, due to its elevation in a suprafascial plane, and can be further thinned in the initial stage without significant threat of impaired vascularity. Unlike a groin flap, which is dependent on a pedicle vessel that runs subfascially or in the deep fat, the SCIP flap is based on more superficial perforators that are less susceptible to damage with resection of fatty tissue. Lymph nodes at the medial aspect of the SCIP flap are preserved because the dissection is limited to the suprafascial plane, thus lowering the risk of postoperative lower extremity lymphedema. In addition, in contrast to the RFFF and ALT flap that are commonly used in phalloplasty, the SCIP flap has an inconspicuous donor site in the inguinal crease; visibility is further minimized with primary linear closure.

Although a SCIP flap in the strictest sense does not require dissection of the SCIA system to the femoral artery, as is done in a groin flap, this technique increases flap mobility through increased pedicle length, thus minimizing torsion per unit length with the 180 degree pedicle rotation.[7] Furthermore, the pedicle skeletonization does not need to be as extensive as is required in free tissue transfer and microsurgical anastomosis, but must only be sufficient enough to prevent kinking and spasm of the pedicle. This additional dissection can be done expeditiously and does not add a significant amount of time to the flap harvest.

Our SCIP flap design is typically based on perforators of the superficial branch of the SCIA, although the flap can be based on perforators of either the superficial or deep branch. Koshima et al have previously shown that one dominant perforator off of either the superficial or deep branch is sufficient to sustain a large groin flap.[8] Anatomical studies have similarly demonstrated relatively large perforasomes for each major perforator, with a mean surface area of 178.6 cm^2 for the superficial pattern perforasome and 156.2 cm^2 for the deep pattern perforasome.[9] In most cases, we base the SCIP flap on a single dominant perforator; however, if a second perforator is robust and does not impede the 180 degree rotation, we preserve and include this in the flap design, if possible.

Although this flap has proven to be a durable reconstructive option in prior alternative contexts, the SCIP flap is also useful in staged reconstruction following partial neophallus loss that allows subsequent revision including urethroplasty and glansplasty, as we have shown. Besides its first described use for coverage of lower limb defects,[6] the free SCIP flap has also been described for coverage of defects of the head and neck[10,11] and the upper limbs.[12,13] Pedicled SCIP flaps have been used for coverage of abdominopelvic defects, including penoscrotal defects.[7,14] In their review of 72 SCIP propeller flaps for locoregional defect coverage, Boissière et al describe two instances of complete flap necrosis from venous insufficiency (2.8%), in addition to six occurrences of arteriovenous insufficiency that resolved with pedicle detorsion (8.3%) and one instance of venous congestion that resolved with leeching (1.4%).[14] These complications highlight the importance of freeing the pedicle with complete dissection to the femoral system when used in a propeller fashion.

In the context of phalloplasty for gender dysphoria, the SCIP flap is not as widely described. Several authors have published on use of the groin flap not only for penoscrotal defects, but also for phalloplasty in transgender patients.[15,16] However, the groin flap has lost favor as microsurgical techniques have gained popularity.[4] Koshima et al described bilateral SCIP flaps for a

single-stage phalloplasty, using one SCIP flap to create the neourethra and the other for the penile shaft, in a patient who wished to avoid the forearm donor site morbidity of the RFFF phalloplasty.[8] Koshima et al conclude their case report by predicting that, given its location and favorable qualities, the SCIP flap will be developed into additional "sophisticated" procedures for the transgender patient, as we have done in this case series.

In terms of study limitations, one could argue that the exclusion of patient reported outcome measures (PROMs) is a limitation of this study. Although PROMs may be more relevant to the index gender-affirming operation, rather than a salvage operation as these SCIP flaps were, PROMs are an essential tool in better understanding gender-affirming care and will be considered for inclusion in future studies of this nature. Additionally, rather than using the gold-standard two step method for measuring gender, our study determined gender based on patient self-reporting.

In conclusion, we show that in four challenging cases of partial neophallus loss, the SCIP propeller flap can be used for salvage with good aesthetic and functional results. Despite the requirement for second-stage division and inset, we believe that the benefits far outweigh this inconvenience, allowing recruitment of sizable pliable soft tissue, avoiding the need for microsurgical anastomosis, and maintaining the viable parts of the initial reconstruction.

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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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IRB approval was not required for this case series.

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