Second free radial forearm flap for urethral reconstruction after partial flap necrosis of tube-in-tube phalloplasty with radial forearm flap: A report of two cases

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SECOND FREE RADIAL FOREARM FLAP FOR URETHRAL RECONSTRUCTION AFTER PARTIAL FLAP NECROSIS OF TUBE-IN-TUBE PHALLOPLASTY WITH RADIAL FOREARM FLAP: A REPORT OF TWO CASES

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We present a salvage procedure to reconstruct the neo-urethra after partial flap necrosis occurring in free radial forearm flap (RFF) phalloplasty for sex reassignment surgery. Two cases of tube-in-tube phalloplasty using a free sensate RFF are described in which partial flap necrosis occurred involving the complete length of the neo-urethra and a strip of the outer lining of the neo-phallus. Neo-urethra-reconstruction was performed with a second RFF from the contralateral side providing well-vascularized tissue. No flap-related complications were observed. Twelve months postoperatively, both patients were able to void while standing. A satisfactory aesthetic appearance of the neo-phallus could be preserved with an excellent tactile and erogenous sensitivity. Using this technique, we successfully salvaged the neo-urethra and reconstructed the outer lining of the neo-phallus © 2013 Wiley Periodicals, Inc. Microsurgery 34:58–63, 2014.

The free sensate radial forearm flap (RFF) is widely considered the standard technique for phalloplasty in female-to-male sex reassignment surgery. Different case series have confirmed its feasibility, reliability, and good aesthetic and functional results.[1–4] Major goals, namely the ability to urinate while standing and an appealing aesthetic appearance with protective and erogenous sensitivity, may be reached in a one-stage procedure.[5] The implantation of an erectile prosthesis for sexual intercourse is usually performed after protective sensitivity of the neo-phallus is regained 6–12 months postoperatively.

Possible complications comprise early and late anastomotic revisions due to venous, arterial, or combined thromboses, partial or total flap loss, and urological complications such as fistulas and strictures, which frequently require multiple urological revisions.[2,6–9]

Multiple designs for the RFF have been described, with the Chang- and the Gottlieb-designs being the most frequently used for tube-in-tube phalloplasty.[10,11] Modifications, such as prelamination of the urethra using split-thickness skin grafts (STSG), full-thickness skin grafts (FTSG), or vaginal mucosa grafts have been performed.[8,9,12]

We describe two cases of partial flap necrosis after free RFF-phalloplasty (Chang-design), which led to a full-length necrosis of the neo-urethra. For neo-urethra-reconstruction, we performed a second free RFF from the contralateral side in a modified Chang-design. Furthermore, we reviewed the literature for complications after RFF-phalloplasty.

CASE REPORTS

Case 1

The patient was a 30-year-old female-to-male transsexual with a heavy smoking history. The mastectomy, laparoscopic-assisted hyster- and adnexectomy were already carried out.

A simultaneous vaginectomy and free sensate RFF-phalloplasty from the left arm was performed according to the classic Chang-design. Microsurgical anastomoses were placed in the right groin with the radial artery onto the common femoral artery in an end-to-side fashion. One comitant vein and two subcutaneous veins of the flap were anastomosed end-to-end onto branches of the greater saphenous vein. Two antebrachial nerves were coapted to the ilioinguinal nerve and to one of the dorsal clitoral nerves to provide protective and erogenous sensitivity.

The initial postoperative course was uneventful. Unfractionated heparin (10,000 IU) was applied for the first 24 hours, followed by prophylactic fractionated heparin (5,000 IU). 100 mg acetylsalicylic acid was administered after postoperative day (POD) 1. Flap monitoring was assessed clinically and by handheld Doppler by trained nursing personnel every hour for the first 24 hours, then every 3 hours until POD 4, and afterwards once per nursing shift. At the end of postoperative week 2, we observed a partial flap necrosis affecting the full length of both lateral flap borders leading to a complete necrosis of the neo-urethra and of a 2 cm wide strip on the ventral outer lining of the neo-phallus (Fig. 1, left).

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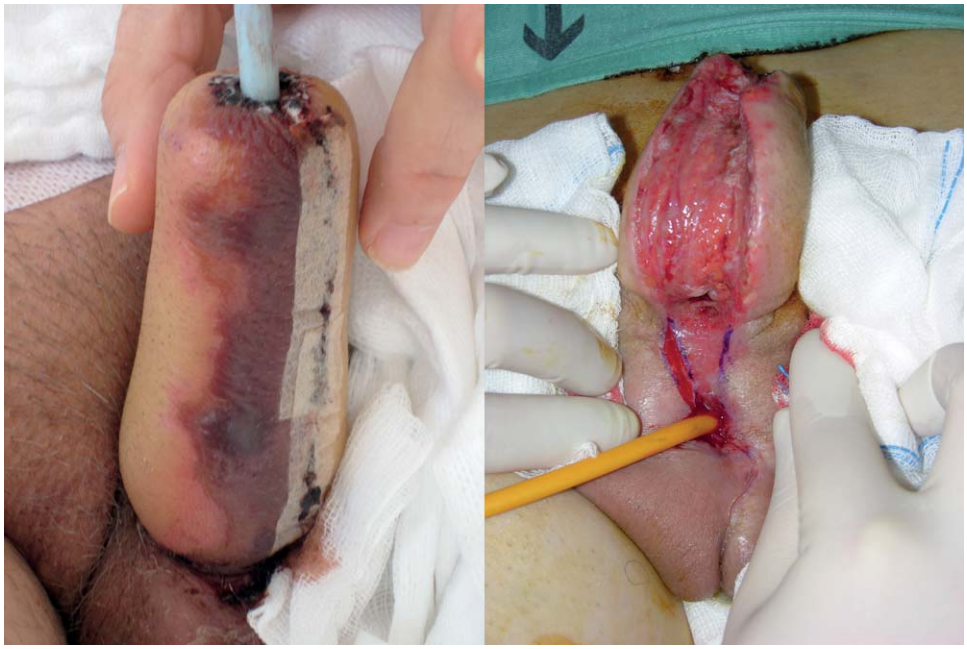

Figure 1. Left: Partial flap necrosis affecting the full length of both lateral flap borders after free RFF phalloplasty in a female-to-male transsexual patient. Right: Debridement of the necrotic areas resulting in a complete loss of the neo-urethra and a part of the ventral outer lining of the neo-phallus. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Debridement of the necrotic areas resulted in a complete resection and loss of the neo-urethra and a part of the ventral outer lining of the neo-phallus (Fig. 1, right). A second free RFF from the contralateral side was harvested as a salvage procedure to reconstruct both the neo-urethra and the necrotic part of the outer lining of the neo-phallus. A modified, shortened Chang-design was harvested from the so far intact right forearm: the part of the flap used for neo-urethra-reconstruction measured 3.5 cm × 14 cm, followed by a 0.5 cm wide, de-epithelialized strip and a shortened strip of 3 cm × 11 cm for the reconstruction of the outer lining of the neo-phallus (Fig. 2).

The neo-urethal part was wrapped around a 17 Ch foley catheter with the skin-inside and closed onto the de-epithelialized strip. After urethral reanastomosis to the lengthened pars fixa, the remaining outer lining of the initial neo-phallus was wrapped around it. The phallic part of the second flap was incorporated into the ventral outer lining in order to regain a sufficient circumference (Figs. 3 and 4). The microvascular anastomoses were performed in the intact left groin with an end-to-side anastomosis of the radial artery onto the common femoral artery. One of the comitant veins and a total of three subcutaneous veins of the flap were connected onto branches of the great saphenous vein in an end-to-end fashion. No nerve reconstruction was performed. The donor-site was

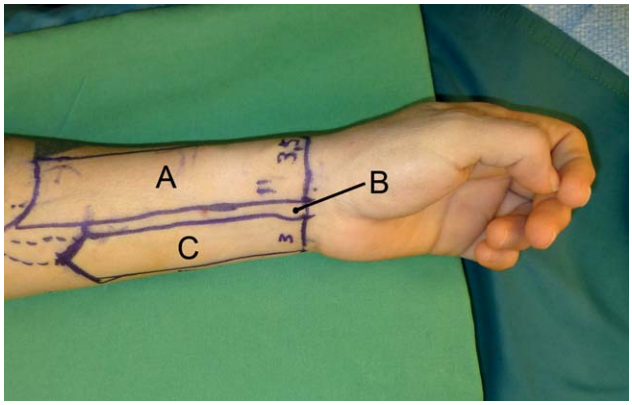

Figure 2. Modified, shortened Chang-design with 3.5 cm × 14 cm for reconstruction of the neo-urethra (A), a 0.5 cm wide and de-epithelialized strip (B), and 3 cm × 11 cm for the reconstruction of the outer lining of the neo-phallus (C). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

covered with FTSG. A summarizing illustration of the surgical technique is given in Figure 5.

Postoperatively, the same pharmacological and flap screening protocol was applied as for the first RFF. The postoperative courses were uneventful. No flap-related complications occurred.

After discharge, clinical examinations took place at the outpatient clinics 1, 3, 6, and 12 months postoperatively. Twelve months postoperatively, the patient rated his impression of the appearance of the neo-phallus as

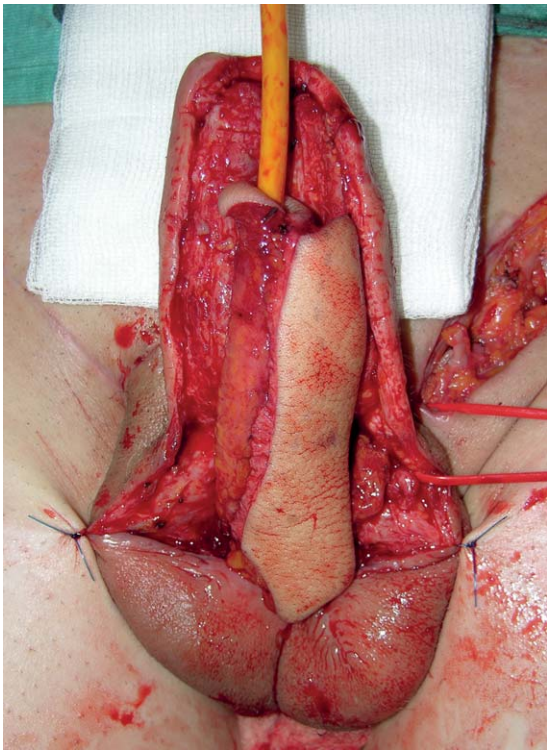

Figure 3. Re-anastomosis of the neo-urethra and incorporation of the flap into the remaining neo-phallus, partially reconstructing the ventral outer lining. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Figure 4. Immediate postoperative picture showing the newly incorporated second flap on the ventral side of the neo-phallus. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

excellent on a subjective scale (poor, sufficient, good, and excellent) (Fig. 6, top left and middle left). Tactile and erogenous sensitivity was also rated as excellent.

Urethrography carried out by the urologists showed a stricture at the urethral anastomosis 4 months postoperatively which required an open urethroplasty. Two months later, another urethroplasty was necessary due to recurrent stricture. Twelve months postoperatively, the patient was able to urinate while standing (Fig. 6, bottom left).

No donor-site complications were recorded. The patient regained full range of motion of the wrist with unimpaired strength. No nerve-related complications were encountered.

Case 2

The patient was a 48-year-old female-to-male transsexual with an osteogenesis imperfecta, arterial hypertension, and a heavy smoking history with chronic obstructive pulmonary disease. In this case, vaginectomy had been performed in a previous procedure combined with adnexectomy and hysterectomy.

We performed the free sensate RFF-phalloplasty from the right side using the Chang-design. The microsurgical anastomoses were performed in the right groin: the radial artery onto the common femoral artery in an end-to-side fashion, and three venous end-to-end anastomoses of the flap onto branches of the greater saphenous vein. Both antebrachial nerves were coapted to the ilioinguinal and to one of the dorsal clitoral nerves respectively.

The same pharmacological and flap monitoring protocol was followed as for case 1.

Starting from POD 11, a partial flap necrosis appeared, affecting the areas of the lateral flap borders. The debridement resulted in a complete loss of the neo-urethra.

We decided to apply an identical approach to reconstruct the neo-phallus and the neo-urethra.

The same modified, shortened Chang-designed RFF was harvested on the contralateral left forearm. The flap dimensions were identical to the ones described in case 1 (Fig. 2). The anastomoses were carried out in the intact left groin: an end-to-side anastomosis of the radial artery onto the common femoral artery, one of the comitant veins and a total of three subcutaneous veins of the flap onto branches of the great saphenous vein in an end-to-end fashion. No nerve reconstruction was performed. The postoperative course was uneventful. No flap-related complications occurred.

Due to a filiform stricture at the urethral anastomosis, the patient underwent open urethroplasty 10 months

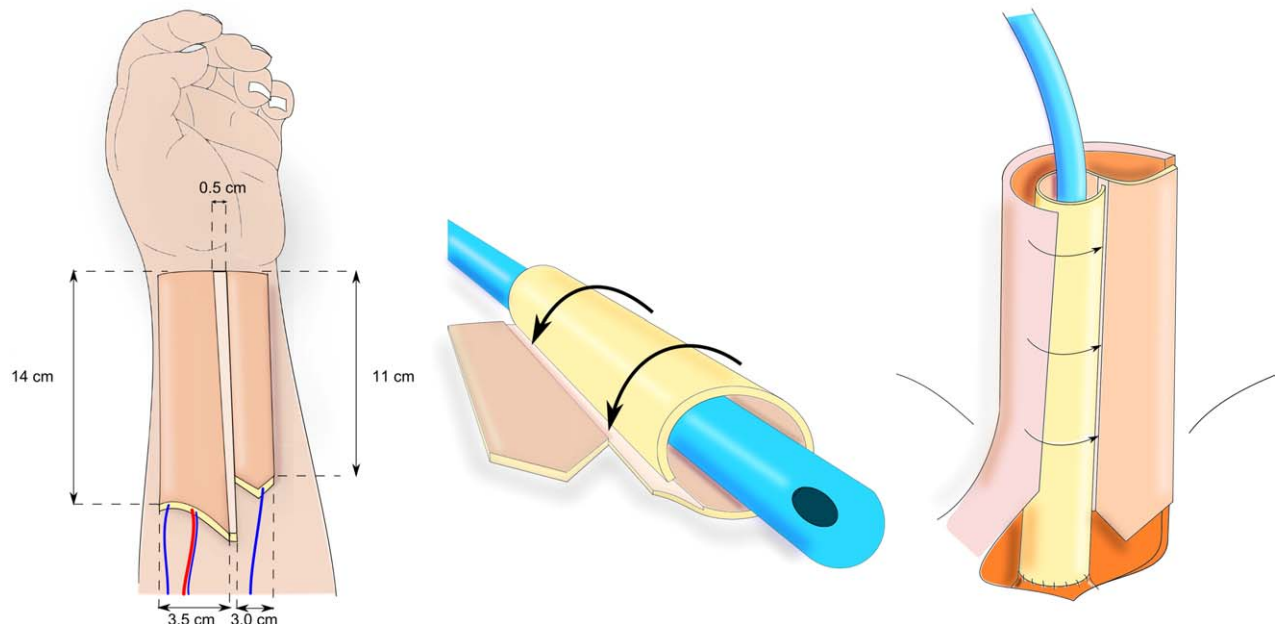

Figure 5. Summarizing illustration of the surgical technique. Left: Dimensions of the modified, shortened Chang-design RFF. Middle: Formation of the neo-urethra by wrapping the flap with the skin-inside around a foley catheter and suturing onto the de-epithelialized flap part. Right: Insertion of the flap into the remaining portion of the initial RFF and re-anastomosis of the neo-urethra. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

postoperatively. Twelve months postoperatively, the patient was able to urinate while standing. The appearance of the neo-phallus was subjectively rated as good, and the patient reported on an excellent tactile and erogenous sensitivity (Fig. 6, right column). No donor-site complications were recorded.

DISCUSSION

Partial flap necrosis is reported to occur in 7–11% of phalloplasty cases.[1–3] The largest series published by Doornaert et al. showed a rate of 7.2% (23 out of 316 cases) with a higher incidence in smokers, patients who insisted on large-sized neo-phalluses, and after anastomotic revision. In 15 out of these 23 patients (63%), debridement and secondary closure or skin grafting was necessary.[2] Partial flap necrosis frequently affects the radial and ulnar flap borders, which are both directly involved in the formation of the neo-urethra in the Chang-design. This may lead to a necrotic or exposed neo-urethra and consequently to urethral dysfunction. Possible contributing factors to partial flap necrosis in a tube-in-tube setting are the flap width and the need for double bending of the flap. Additionally, postoperative flap-swelling may cause venous congestion. In the presented cases, additional risk factors which may have contributed to the occurrence of the partial flap necrosis are a heavy smoking history in both cases, as well as an osteogenesis imperfecta and arterial hypertension in the second case. In the first case, the simultaneously performed vaginectomy led to an increased operation time and blood loss, which might have further increased the risks. This led us to modify our approach by performing vaginectomy together with hysterectomy and adnexectomy. The partial flap necrosis resulted in a complete loss of the neo-urethra and a partial loss of the outer lining of the neo-phallus on the ventral side. A second free RFF in a modified, shortened Chang-design provided well-vascularized tissue for reconstruction of both elements. Instead of a second free flap for immediate neo-urethra-reconstruction, a tubed skin graft could be used, although the risk for urethral strictures due to graft contracture may be increased compared to vascularized tissue. Moreover, the decreased circumference due to partial loss of the outer lining and the loss of flap volume is not addressed. If no immediate neo-urethra-reconstruction is considered, a primary urethrostomy has to be performed. To our knowledge, no data concerning the specific problem of total loss of the neo-urethra and its treatment after RFF-phalloplasty in sex reassignment surgery is available in the literature. Harrison initially described the usage of the free RFF for urethral reconstruction in hypospadia.[13] Dabernig et al. presented a series of nine patients who underwent urethral reconstruction and in some cases simultaneous glans penis reconstruction with a tubed RFF: three patients after subcutaneous penectomy for penile cancer and six patients after failure of primary urethra-construction in

Figure 6. Result 12 months postoperatively. Left: Patient 1. Right: Patient 2. Top: View of the dorsum penis. Middle: View of the ventral side with the incorporated second flap. Bottom: Micturition in standing position. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

phalloplasty for sex reassignment surgery. Of these six phalloplasties, three were bilateral groin flaps and three abdominal flaps. The indication was recurrent strictures after multiple corrective procedures. All patients had satisfactory skin envelope of the neo-phallus. Two patients suffered strictures at the site of urethral anastomosis, requiring revision procedures with local flaps. At 6 months, all patients were able to urinate while standing.[14] In order to prevent partial flap necrosis in RFF-phalloplasty, alternatives to the Chang-design may be considered. As a modification to the Chang-design, in which the neo-urethra is constructed with the ulnar part of the flap, the Gottlieb-design may be chosen, in which the neo-urethra is constructed with the central part of the flap.[11] The flap width and the need for double-bending of the flap, however, are not altered. Additionally, most patients do not accept an additional scar on the dorsal, most visible part of the neo-phallus. Another possibility to reduce the necessary flap width and double-bending consists of neo-urethra-prelamination with STSG, FTSG, or vaginal mucosa.[3,8,9,12] The partial flap necrosis rate of prelaminated neo-urethra varies in most case series. A significantly lower rate in partial flap necrosis, however, does not clearly appear in the literature review. Küntscher and Hartmann reported no occurrence in 15 cases of RFF phalloplasties with prelaminated urethra (FTSG).[9] In contrast, Schaff and Papadopulos presented a large case series of phalloplasties with prelaminated urethra (vaginal mucosa or STSG) with a partial flap necrosis-rate of 16% (5 out of 31 cases) in free fibular flaps and 16.6% (1 out of 6 cases) in free RFF.[8] Fang et al. compared the traditional tube-in-tube flap and the free RFF with a prelaminated urethra (vaginal mucosa). Partial flap necrosis occurred in 6 out of 28 patients (21%) in the traditional flap group, while none was found in the 28 patients of the prelaminated group.[3] In a recent study, Song et al. reported on 3 partial flap necrosis (15.8%) of their 19 free osteocutaneous RFF with prelaminated urethra (FTSG).[12]

The literature review of urological complication shows a high incidence of strictures and fistulas. The benefits of urethra prelamination have not been clearly demonstrated. Fang et al. reported strictures in 14% (4 out of 28 cases) and urethrocutaneous fistulas in 79% (22 out of 28 cases) of patients after the classic tube-in-tube design. With prelaminated urethra, strictures occurred in 11% (3 out of 28 cases) and urethrocutaneous fistulas in 57% (16 out of 28 cases). All the fistulas occurred at the junction between the pars fixa and the pars pendulans of the neo-urethra and no fistulas were observed in vaginal mucosa prefabricated penile neo-urethra.[3] With the classic tube-in-tube free RFF, Doornaert et al. reported on urological complications in 40% of their patients (127 out of 316 cases). Fistulas were detected in 25% (80 out of 316 cases), strictures in 6% (20 out of 316 cases), and a combination of both in 8.5% (27 out of 316 cases). Spontaneous healing occurred in 66% (53 out of 80 cases) of the fistulas, while 42.5% (54 out of 127 cases) of the patients with urological problems needed further surgical procedures to obtain urethral function.[2] Küntscher and Hartmann found an incidence of 53% out 15 cases for fistulas at the urethra-anastomosis in their series of free RFF with a FTSG-prelaminated urethra.[9] Using a FTSG for prelamination of a osteocutaneous-free RFF in 19 phalloplasties, Song et al. observed one fistula (5.3%), five strictures (26.3%) and a

combination of both in nine cases (47.4%) when suturing the urethral anastomosis in a multilayer fashion including perineal muscle flaps to bolster the anastomosis.[12] In a series of 31 free sensate osteofasciocutaneous fibula flaps and 6 RFF with prelaminated urethras, Schaff and Papadopulos presented 32.4% out of 37 cases involving urethral strictures and 16.2% (6 out of 37 cases) involving fistulas. Five out of the six fistulas originated at the connection site of the lengthened urethra to the prelaminated urethra.[8] In both our cases, urological complications occurred leading to open urethroplasties. Twelve months postoperatively, both patients were able to urinate through a competent neo-urethra while standing. We do not think that the occurrence of urological complications is related to the salvage-procedure but rather reflects the generally high incidence in phalloplasties.

Donor-site morbidity after the RFF harvesting is considered a major drawback. Incomplete graft-take after donor site coverage with STSG or FTSG, functional impairment, prolonged swelling of the hand and sustained paresthesia in the hand, and neuroma formation have all been described.[15–17] Moreover, the scar on the forearm is frequently perceived as a stigma for transsexuals. In the presented cases, no donor-site complications or morbidities were encountered. The bilateral scars were not perceived as a major problem by either patient.

Summarizing, in two cases of complete loss of the neo-urethra after total phalloplasty using a free sensate RFF in the Chang-design, we successfully salvaged the neo-urethra and reconstructed the outer lining of the neo-phallus using a second RFF. Twelve months postoperatively, both patients were able to urinate while standing. The aesthetic appearances were rated excellent and good, respectively. Sensitivity was not impaired, as both patients reported an excellent tactile and erogenous sensitivity. In our experience, the presented technique is a valuable alternative to primary urethrostomy in such cases.

It is clear that additional techniques for eliminating or at least mitigating partial flap necrosis as a major drawback of the standard tube-in-tube phalloplasty are needed. We propose the primary usage of a flap-in-flap technique, e.g. the combination of a free or pedicled sensate anterolateral thigh flap for neo-phallic construction and a free RFF or a pedicled groin flap for neo-urethral construction. Since only few reports on flap-in-flap approaches are presently available,[18,19] the feasibility and safety of such a technique needs further assessment.

REFERENCES

1. Baumeister S, Sohn M, Domke C, Exner K. Phallusbildung beim Frau-zu-Mann Transsexuellen: Erfahrung in 259 Fällen. Handchir Mikrochir Plast Chir 2011;43:215–221.
2. Doornaert M, Hoebeke P, Ceulemans P, T'Sjoen G, Heylens G, Monstrey S. Penile reconstruction with the radial forearm flap: An update. Handchir Mikrochir Plast Chir 2011;43:208–214.
3. Fang RH, Lin JT, Ma S. Phalloplasty for female transsexuals with sensate free forearm flap. Microsurgery 1994;15:349–352.
4. Garaffa G, Christopher NA, Ralph DJ. Total phallic reconstruction in female-to-male transsexuals. Eur Urol 2010;57:715–722.
5. Hage JJ, De Graaf FH. Addressing the ideal requirements by free flap phalloplasty: Some reflections on refinements of technique. Microsurgery 1993;14:592–598.
6. Fang RH, Kao YS, Ma S, Lin JT. Phalloplasty in female-to-male transsexuals using free radial osteocutaneous flap: A series of 22 cases. Br J Plast Surg 1999;52:217–222.
7. Monstrey S, Hoebeke P, Selvaggi G, Ceulemans P, Van Landuyt K, Blondeel P, Hamdi M, Roche N, Weyers S, De Cuypere G. Penile reconstruction: Is the radial forearm flap really the standard technique? Plast Reconstr Surg 2009;124:510–518.
8. Schaff J, Papadopulos NA. A new protocol for complete phalloplasty with free sensate and prelaminated osteofasciocutaneous flaps: Experience in 37 patients. Microsurgery 2009;29:413–419.
9. Küntscher MV, Hartmann B. Die Radialisphalloplastik mit präformierter Harnröhre—ein Erfahrungsbericht der letzten 6 Jahre. Handchir Mikrochir Plast Chir 2011;43:222–226.
10. Chang TS, Hwang WY. Forearm flap in one-stage reconstruction of the penis. Plast Reconstr Surg 1984;74:251–258.
11. Gottlieb LJ, Levine LA. A new design for the radial forearm free-flap phallic construction. Plast Reconstr Surg 1993;92:276–283; discussion 284.
12. Song C, Wong M, Wong CH, Ong YS. Modifications of the radial forearm flap phalloplasty for female-to-male gender reassignment. J Reconstr Microsurg 2011;27:115–120.
13. Harrison DH. Reconstruction of the urethra for hypospadiac cripples by microvascular free flap transfers. Br J Plast Surg 1986;39:408–413.
14. Dabernig J, Shelley OP, Cuccia G, Schaff J. Urethral reconstruction using the radial forearm free flap: Experience in oncologic cases and gender reassignment. Eur Urol 2007;52:547–553.
15. Selvaggi G, Monstrey S, Hoebeke P, Ceulemans P, Van Landuyt K, Hamdi M, Cameron B, Blondeel P. Donor-site morbidity of the radial forearm free flap after 125 phalloplasties in gender identity disorder. Plast Reconstr Surg 2006;118:1171–1177.
16. Sinclair CF, Gleysteen JP, Zimmermann TM, Wax MK, Givi B, Schneider D, Rosenthal EL. Assessment of donor site morbidity for free radial forearm osteocutaneous flaps. Microsurgery 2012;32:255–260.
17. Murray RC, Gordin EA, Saigal K, Leventhal D, Krein H, Heffelfinger RN. Reconstruction of the radial forearm free flap donor site using integra artificial dermis. Microsurgery 2011;31:104–108.
18. Vesely J, Hyza P, Ranno R, Cigna E, Monni N, Stupka I, Justan I, Dvorak Z, Novak P, Ranno S. New technique of total phalloplasty with reinnervated latissimus dorsi myocutaneous free flap in female-to-male transsexuals. Ann Plast Surg 2007;58:544–550.
19. Koshima I, Nanba Y, Nagai A, Nakatsuka M, Sato T, Kuroda S. Penile reconstruction with bilateral superficial circumflex iliac artery perforator (SCIP) flaps. J Reconstr Microsurg 2006;22:137–142.