JPRS Journal of Plastic and Reconstructive Surgery
https://doi.org/10.53045/jprs.2021-0011
https://j-prs.jp/index.html

Case Report

Scrotal Reconstruction Using a Free Ulnar Forearm Flap: A Case Report

Sho Yamakawa and Kenji Hayashida

Division of Plastic and Reconstructive Surgery, Faculty of Medicine, Shimane University, Shimane, Japan

Abstract

Scrotal defects requiring reconstruction may occur after trauma, cancer, or infection. To maintain good testicular function, the ideal scrotal temperature should be slightly lower than the abdominal temperature. However, large local flaps that are enough to cover the testes cannot be used in all patients. A 74-year-old man presented with scrotal and perineal tissue defects after undergoing debridement for Fournier's gangrene due to rectal carcinoma-induced perforation. The scrotal skin defect was reconstructed using a 22 × 10-cm-free ulnar forearm flap. The postoperative course was uneventful, and at the 14-month follow-up examination, the scrotal skin was found to be thin and pliable. Moreover, the donor site on the left forearm was in an acceptable state and no hand dysfunction due to contracture was observed. Based on our observations, we recommend that the free ulnar forearm flap might be an effective option for scrotal reconstruction, causing little donor site morbidity.

Keywords

scrotal reconstruction, free ulnar forearm flap, fournier's gangrene, free testosterone

J Plast Recontr Surg 2022; 1(1): 26-30
https://doi.org/10.53045/jprs.2021-0011

Background

Apart from its role in spermatogenesis, the testis is an endocrine organ that secretes testosterone. The position of the testes is altered by the contraction and relaxation of the cremaster muscle in response to ambient temperature and/or body temperature[1]. Therefore, the scrotal skin must be adequately pliable to allow this movement. As skin grafting can cause postoperative contractures leading to adhesion of the testes to the abdominal wall, it is inappropriate for reconstruction of the scrotal sac. Although scrotal reconstructions using large local flaps are most preferred, their use may not be generally feasible. Lovie et al.[2] reported the use of an ulnar forearm flap (UFF) in 1984, 2 years after the use of the radial forearm flap (RFF) was reported[3]. Both flaps are effective when thin and pliable flaps are required in cases such as head and neck reconstruction procedures; however, RFFs have been used predominantly used for decades[4]. Recently, UFFs have gained popularity as they have various advantages due to their anatomical features[5,6]. We present the case of a patient in whom a scrotal tissue defect was reconstructed using a UFF. To the best of our knowledge, this is the first report describing scrotal reconstruction using a UFF.

Case Presentation

A 74-year-old right-handed man was referred to our department and presented with scrotal and perineal tissue defects after undergoing debridement for Fournier's gangrene because of rectal carcinoma-induced perforation. He underwent radical surgery for rectal carcinoma with a reconstruction of the pelvic floor and perineum (**Figure 1**). We successfully reconstructed the pelvic floor and perineum using a left gracilis myocutaneous flap transfer. We selected a UFF for the following scrotal reconstructive surgery because a local flap could not be used, as both inguinal regions and the inside center of the right thigh had been deeply incised and extensively dissected for drainage. The preoperative Allen's test was normal. Additionally, using ultrasonography, we confirmed that a sizable perforator originated from the ulnar artery in the middle of the left forearm. On computed tomographic angiography, we detected several vessels that branched off from the profunda femoris artery and veins as

Corresponding author: Sho Yamakawa, yamakawashoright@yahoo.co.jp
Received: July 18, 2021, Accepted: August 23, 2021
Copyright © 2022 The Japan Society of Plastic and Reconstructive Surgery
This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Figure 1. Preoperative image of the scrotal and perineal defects. Large incisions were made in the right thigh and both inguinal regions.

Figure 2. The anastomotic vessels of the flap were selected based on preoperative CT angiography findings. Arrows indicate the blood vessels branching off from the profunda femoris artery or vein. CT, computed tomography

potential recipient vessels (**Figure 2**).

Thirty-five days after the reconstruction of the pelvic floor and perineum, a scrotal reconstructive surgery was performed. The flap dimensions were 22 × 10 cm, which was large enough to encase the testicles. The flap was horizontally centered on the line connecting the pisiform bone and the volar aspect of the epicondyle (**Figure 3**, top left). After applying a tourniquet, an incision was made on the radial side of the flap and a continuous dissection was performed in the suprafascial plane up to the ulnar side of the flexor digitorum superficialis tendons. The fascia was incised at this point, and the dissection was resumed in the subfascial plane to reach the neurovascular bundle underneath the flexor digitorum superficialis tendon. In the proximal forearm, the flexor carpi ulnaris and flexor digitorum superficialis muscles were separated to expose the vascular bundles and allow for further dissection of the vascular pedicle. A sizable perforator and several small septocutaneous perforators arising from the ulnar artery were identified during pedicle dissection. After ligating the distal end of the ulnar artery and concomitant veins, the pedicle was dissected from the accompanying ulnar nerve along its length. After making an incision along the flap's ulnar side, it was elevated in the distal-to-proximal direction, and the harvesting procedure was completed (**Figure 3**, top right). A medial antebrachial vein was placed at the proximal end of the flap. Subsequently, we elevated the 8-cm-long vascular pedicled skin flap (**Figure 3**, middle left and right). The secondary defect was closed with a full-thickness skin graft (FTSG) from the left thigh. After wrapping the testis with the flap, using a microscope, the ulnar artery's proximal end and the flap's larger concomitant vein were anastomosed to the medial circumflex femoral artery and veins, respectively. Moreover, the cutaneous vein was anastomosed to a branch of the great saphenous vein (**Figure 3**, bottom). The total operation time was 5 h and 30 min.

The postoperative course was uneventful, and complete survival of the UFF used in the scrotum and the FTSG to the donor site was achieved. Blood-free testosterone levels increased from 3.7 pg/mL before scrotal reconstruction to 6.1 pg/mL at 2 months postoperatively (normal range, 4.5-13.8 pg/mL for Japanese men in their 70s)[7]. At the 14-month follow-up examination, the scrotum skin was thin and pliable (**Figure 4**, top). Moreover, the donor site on the left forearm was soft and inconspicuous and no numbness in the hands or restriction of the range of motion (extension, 62°; flexion, 78°; ulnar deviation, 34°; and radial deviation, 17°) of the wrist was present (**Figure 4**, bottom left and right).

Discussion and Conclusions

Scrotal defects requiring reconstruction may occur after scrotal/perineal trauma, cancer, or infections, including Fournier's gangrene[8]. Split-thickness skin graft (STSG) is the most commonly selected option for reconstructing large scrotal defects[8]. Despite its convenience, STSG has several disadvantages. First, a skin graft may not adapt well at a site with poor granulation tissue. Second, scar contractures can cause scrotal adhesions to the abdominal wall, which can restrict the cremasteric muscle activity, leading to testicular temperature dysregulation. The ideal scrotal temperature is 2.2℃ lower than the abdominal temperature; a scrotal temperature 1℃-1.5℃ higher than the normal scrotal temperature is reported to adversely affect spermatogenesis[9]. Third, compared with other flap types, STSGs are less resistant to external forces[10]; therefore, we prioritized flap reconstruction. Pedicled superficial circumflex iliac perforator flaps, anterolateral thigh (ALT) flaps, and profunda artery perforator (PAP) flaps, which are either used standalone or in combination, seemed appropriate[11,12]; however, in our case, a left gracilis flap had already been utilized for the pelvic floor and perineal skin reconstruction. Moreover, both inguinal regions and the inside center of the right thigh had been deeply incised and extensively dissected for drainage. Therefore, only the right PAP flap was available; however, for a

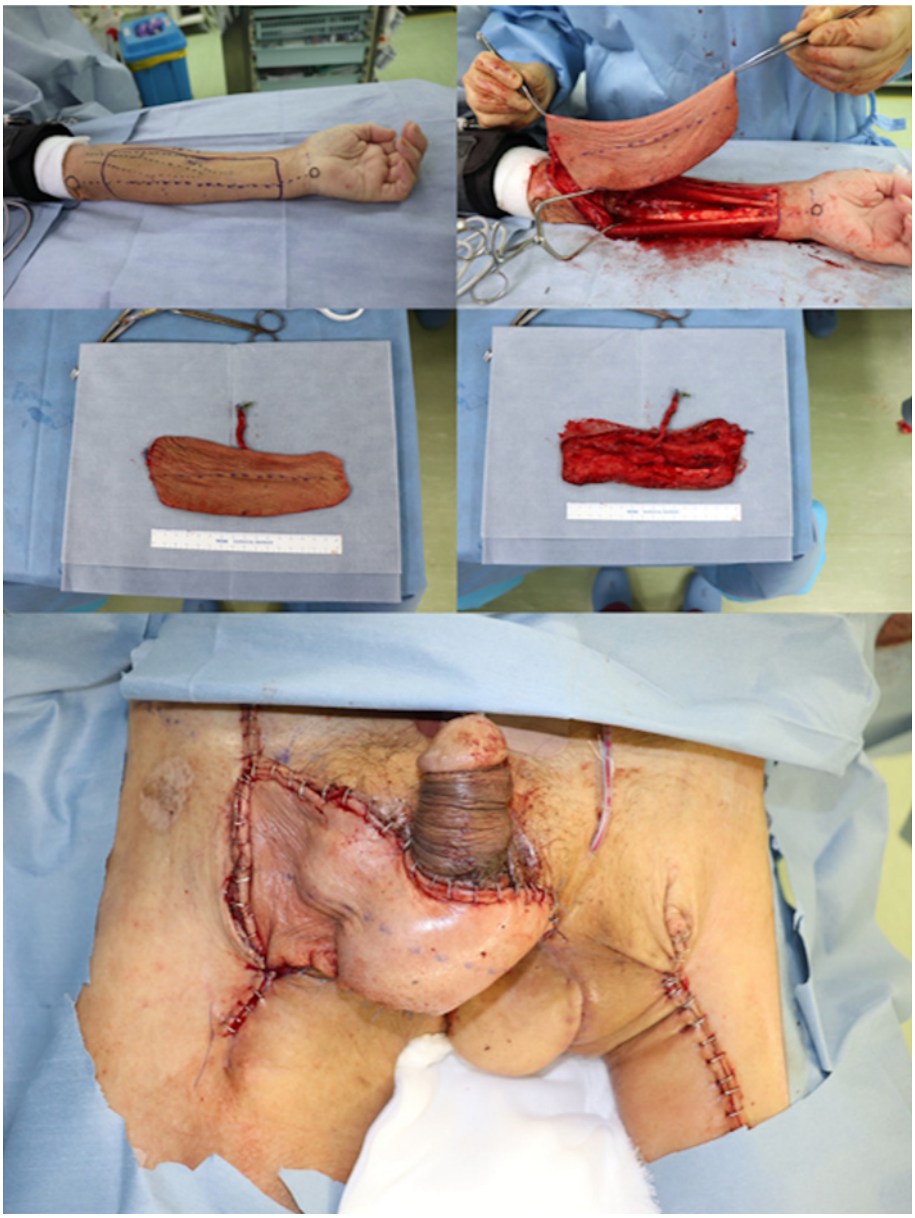

Figure 3. An ulnar forearm flap was selected for reconstruction of the scrotal skin defect. The flap design is shown (top left). Intraoperative images demonstrating the thinness of the elevated flap are shown (top right, middle left, and right). A picture of the reconstructed scrotum immediately after surgery is shown (bottom).

thin and pliable scrotal reconstruction, PAP flaps, having an average thickness of approximately 26 mm, are reportedly inadequate as opposed to UAPFFs, having an average thickness of approximately 3 mm[13]. Consequently, we decided to perform a free forearm flap reconstruction.

Herein, we selected a UFF, which has an operating time comparable to that of an RFF. Since our patient was relatively old, we aimed to shorten the operation time. This approach allowed us to obtain a large, thin, and pliable flap. Since the ulnar nerve runs deep within the neurovascular bundle, this flap only involved a mild risk of developing an ulnar nerve injury. Moreover, sacrificing the ulnar artery has minimal effect on the blood flow in the hands. Several studies have reported that the blood flow in the hands is predominantly influenced by the radial artery[6]. From an esthetic perspective, flap harvest from the ulnar side has the advantage of its inconspicuous location. Moreover, skin grafting to the defect after UFF harvest is mainly applied to the muscle berry, as tendon exposure is lesser on the ulnar side than on the radial side[4]. Conversely, in RFF donor sites, in addition to its conspicuous location, skin grafting is mainly applied to the paratenon. Therefore, skin grafting to the UFF donor site could be well suitable if it is an FTSG, thus maintaining a good UFF donor site condition, both functionally and esthetically. Nevertheless, UFF use has some limitations. First, as UFFs are perforator flaps, flap elevation in UFFs requires more attention than that in RFFs. However, in contrast to ALT flaps, UFFs are septocutaneous perforator flaps, and consequently, they are relatively easy to elevate. Second, the concomitant veins tend to have small diameters. Moreover, the basilic vein, which corresponds to the cephalic vein in the RFF, does not pass through the flap

Figure 4. Images obtained 14 months postoperatively showing soft and pliable skin of the reconstructed scrotum (top), inconspicuous donor site, and absence of numbness or restriction of hand movement (bottom left and right).

site in many cases. Regarding this issue, Hakim suggested including the antebrachial vein within the flap, which is available in 70% of patients[14].

Fourteen months postoperatively, the patient showed favorable recovery. His blood-free testosterone levels, which reflect testicular function, returned to normal, suggesting that functional scrotal reconstruction had been successful. Although the harvested UFF was the largest ever reported in the literature[15], the forearm donor site was painless and inconspicuous and no contracture-induced range of motion restriction or sensory disturbances in the hand were observed. This case suggested that the UFF use for scrotal reconstruction might be an ideal option with negligible donor site morbidity.

Acknowledgments: We would like to thank Editage (www.editage.com) for English language editing.

Author Contributions: SY collected the patient data, performed the literature search, and wrote the majority of the manuscript. KH was the leader of this case, made the intraoperative decision, directed the clinical management of the case, and shaped the final conclusions. All authors have read and approved the final manuscript.

Conflicts of Interest: There are no conflicts of interest.

Ethics: This work was a retrospective case report. For this type of study, the requirement for ethics approval is waived by the Medical Ethics Committee of Shimane University Hospital. Written informed consent was obtained from the patient to participate in this study. Written informed consent was obtained from the patient for publication of this case re-

port and accompanying images. A copy of the written consent is available for review by the Editor of this journal.

References

1. Lie G, Hutson JM. The role of cremaster muscle in testicular descent in humans and animal models. Pediatr Surg Int. 2011 Dec; 27(12):1255−65.
2. Lovie MJ, Duncan GM, Glasson DW. The ulnar artery forearm free flap. Br J Plast Surg. 1984 Oct;37(4):486−92.
3. Song R, Gao Y, Song Y, et al. The forearm flap. Clin Plast Surg. 1982 Jan;9(1):21−6.
4. Hakim SG, Trenkle T, Sieg P, et al. Ulnar artery-based free forearm flap: review of specific anatomic features in 322 cases and related literature. Head Neck. 2014 Aug;36(8):1224−9.
5. Haerle M, Häfner H-M, Dietz K, et al. Vascular dominance in the forearm. Plast Reconstr Surg. 2003 May;111(6):1891−8.
6. Yu P, Chang EI, Selber JC, et al. Perforator patterns of the ulnar artery perforator flap. Plast Reconstr Surg. 2012 Jan;129(1):213−20.
7. Iwamoto T, Yanase T, Koh E, et al. [Reference ranges of serum total and free testosterone in Japanese male adults]. Nihon Hinyokika Gakkai Zasshi. 2004 Sep;95(6):751−60. Japanese.
8. Lucas JW, Lester KM, Chen A, et al. Scrotal reconstruction and testicular prosthetics. Transl Androl Urol. 2017 Aug;6(4):710−21.
9. Hamerezaee M, Dehghan SF, Golbabaei F, et al. Assessment of semen quality among workers exposed to heat stress: a cross-sectional study in a steel industry. Saf Health Work. 2018 Jun;9 (2):232−5.
10. Ferreira PC, Reis JC, Amarante JM, et al. Fournier's gangrene: a review of 43 reconstructive cases. Plast Reconstr Surg. 2007 Jan; 119(1):175−84.
11. Scaglioni MF, Fakin RM, Barth AA, et al. Bilateral pedicle anterolateral thigh (ALT) flap combined with bilateral sartorius muscle flap for reconstruction of extensive perineoscrotal and medial thigh defect because of Fournier's gangrene. Microsurgery. 2017 Sep;37(6):669−73.
12. Scaglioni MF, Chen Y-C, Yang JC-S. Posteromedial thigh (PMT) propeller flap for perineoscrotal reconstruction: a case report. Microsurgery. 2015 Oct;35(7):569−72.
13. Largo RD, Chu CK, Chang EI, et al. Perforator mapping of the profunda artery perforator flap: anatomy and clinical experience. Plast Reconstr Surg. 2020 Nov;146(5):1135−45.
14. Hakim SG. Median antebrachial vein for drainage of the ulnar free forearm flap. Br J Oral Maxillofac Surg. 2014 Nov;52(9):864−5.
15. Antony AK, Hootnick JL, Antony AK. Ulnar forearm free flaps in head and neck reconstruction: systematic review of the literature and a case report. Microsurgery. 2014 Jan;34(1):68−75.