Chapter 15
Surgical and Anatomic Considerations of Malignancies Affecting the Groin: Reconstructive Approaches to the Groin

Seyed Amirhossein Razavi, Karan A. Desai, Albert Liao, and Albert Losken

There has been an increasing demand for reconstructive surgery in acute or chronic groin wounds resulting from burn, trauma patients with oncologic defects following groin lymphadenectomy due to urogenital and lower limb malignancies and complications of infrainguinal vascular bypass surgeries [1–6]. The reconstructive surgeon has to select the optimal soft tissue coverage after considering the patient's comorbidities, postoperative quality of life, and functional outcome. In this chapter, we will review the reconstructive options regarding complex wounds in the inguinal region, a brief description of the reconstructive technique, reported outcomes, and comparison between options including use of grafts and flaps.

Primary Closure

Primary closure is always preferred when possible due to lower morbidity. Using the reconstructive ladder as a guideline, primary reconstruction is the most direct form of reconstruction and can be used in a variety of traumatic wounds and skin cancer excisions [7, 8]. Primary closure however is often not possible in wounds that are wide and have been previously irradiated.

S.A. Razavi, M.D. • K.A. Desai, M.D. • A. Liao, M.D.
A. Losken, M.D., F.A.C.S. (✉)
Division of Plastic Surgery, Department of Surgery,
Emory University Hospital Midtown, Emory University School of Medicine,
Medical Office Tower, 550 Peachtree Street, SE Suite 9000, Atlanta, GA 30308, USA
e-mail: srazavi@emory.edu; karan.desai@emory.edu; albert.liao@emory.edu; alosken@emory.edu

K.A. Delman, V.A. Master (eds.), *Malignancies of the Groin*,
https://doi.org/10.1007/978-3-319-60858-7_15

Skin Graft

Skin graft is the transfer of skin from a donor site to a recipient site. When primary closure is not possible secondary to a large defect, a skin graft may be used. In contrast to flap reconstruction, skin grafts develop their blood supply by neovascularization during the first 48–72 h after transfer. Two types of skin grafts are split-thickness and full-thickness skin grafts. Full-thickness skin grafts require more time for revascularization but have less wound contracture profile. In general, full-thickness skin grafts do not have a role in groin reconstruction secondary to the overall large size of the wounds requiring coverage. Groin wounds are most often covered by split-thickness skin grafts from the thigh, buttocks, or trunk and will subsequently heal by epithelialization [8–10]. While split-thickness skin grafts are versatile, their use is restricted in the presence of wounds with exposed vital structures such as bones, nerves, or femoral vessels. Furthermore, reconstruction of a radiated groin wound requires coverage with a well-vascularized tissue to prevent wound-healing complications. In these situations, the clinician should seek more complex methods in the reconstructive ladder such as flap reconstruction [2, 11, 12]. Skin grafts are often used if a wound has been slow to heal and otherwise has a healthy granulation bed or is a superficial defect with a well-vascularized layer subcutaneous tissue above the vessels.

Flap Reconstruction

Flap reconstruction is the transfer of skin and underlying tissue, when it is lifted from a donor site and moved to a recipient site with its blood supply. Pedicled flaps have their vascular supply connected anatomically throughout the flap transfer. Free flaps on the other hand are when vascular supply is disconnected from its donor supply during transfer and reconnected microsurgically to a new vessel at or near the recipient site. The free flaps are often used when no local or pedicle flap is available.

Flap closures are particularly useful for a wound bed with compromised tissue such as in infected or radiated wounds with exposed structures. They provide protection over exposed bones, nerves, or vessels in the wound; increase vascularization to deficient areas; decrease scar formation; and result in a tension-free closure [2, 13].

The main complication associated with flap reconstruction is the risk of vascular compromise. When feasible, pedicled flaps are always preferred over free flaps. Frequent postoperative flap checks including monitoring flap color, temperature, capillary refill, appearance, and use of tissue oximetry and external and implantable Dopplers are necessary for early diagnosis of flap vascular compromise [14–16]. Other potential complications of flap reconstruction include hematoma and seroma formation, surgical site infections, and donor site complications.

There are many different local flap options for groin reconstruction, including gracilis muscle flap (medial femoral circumflex system), sartorius muscle flap

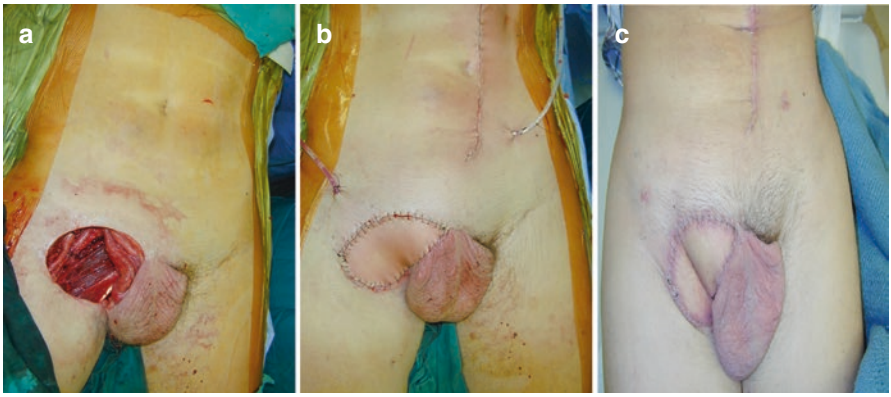

Fig. 15.1 Rectus myocutaneous flap reconstruction of right groin oncologic defect with exposed vessels. (**a**) Pre-reconstruction, (**b**) post-reconstruction, (**c**) first follow-up in the plastic surgery clinic

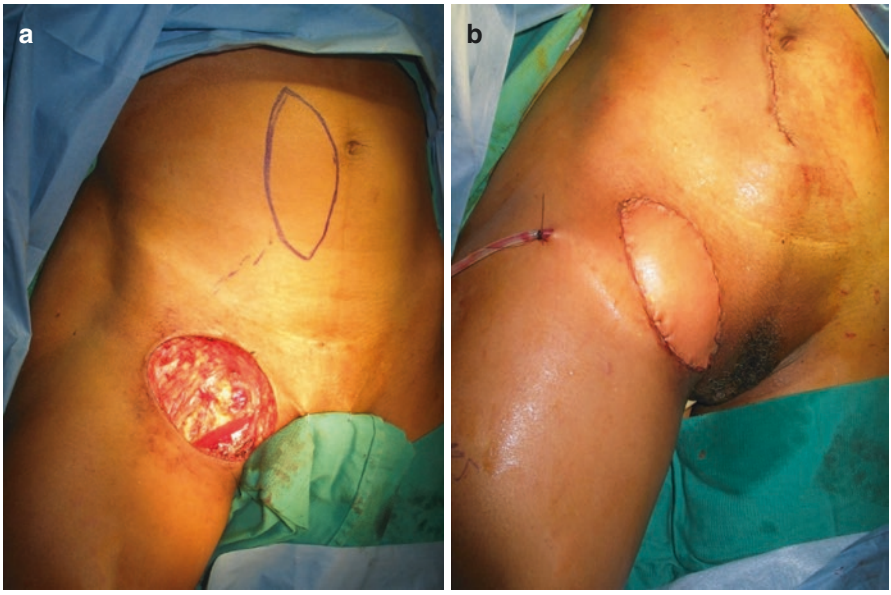

Fig. 15.2 Another example of rectus myocutaneous flap reconstruction. (**a**) Pre-reconstruction, (**b**) post-reconstruction

(superficial circumflex iliac artery from the superficial femoral artery), omental flap (right omental artery from the right gastroepiploic artery), tensor fascia lata flap (ascending branch of lateral femoral circumflex artery), anterolateral thigh flap (descending branch of lateral femoral circumflex artery), rectus abdominis flap (deep inferior epigastric artery), and rectus femoris flap (descending branch of lateral femoral circumflex artery) (Figs. 15.1 and 15.2).

Regional muscle flaps such as the gracilis muscle flap and the sartorius muscle flap are usually useful for reconstruction of small groin defects [17–19]. Sartorius flaps and pedicled gracilis flaps are safe and durable reconstructions for locally infected or exposed vascular grafts and infected groin wound of <10 cm. However, as these flaps consist only of muscle, a skin graft is often needed over the flap for skin coverage in the event of a skin deficit. In their retrospective review of 244 flaps used for complex groin wound reconstruction, Fischer et al. suggested the use of prophylactic sartorius muscle flap for smaller, low-risk wounds, reserving rectus femoris flap for larger, more complex wounds and anterolateral thigh for wounds with larger cutaneous defect [20].

A retrospective review by Ducic and colleagues for the use of extended dissection gracilis flap in high-risk patients with complex groin wounds requiring more coverage than a standard gracilis flap concluded that the extended dissection gracilis flap has greater arc of rotation and no restriction on postoperative ambulation or thigh abduction [21]. First described by Hason et al. [22] in the extended dissection gracilis flap technique, after the identification of the pedicle, the muscle is divided proximally, and pedicle dissection continues deeper to the adductor longus muscle, the perforators, and the vascular network and can be extended all the way to the profunda femoris artery.

There does not appear to be a consensus first choice flap option for large (>10 cm) groin defects; however, anterolateral thigh (ALT) flap (both as a pedicled and free flap) and vertical rectus abdominis myocutaneous flap are considered highly versatile and reliable for this type of defect [3, 7, 23]. In their retrospective review, Lannon et al. determined that the pedicled ALT flap should be the flap of choice for large groin defects. There are several techniques to preserve flap viability, including suprafascial flap harvesting, extended harvesting of fascia, utilization of the fascia to protect the pedicle, coharvest with the vastus lateralis, and preservation of large lateral rectus femoris perforators [23].

A retrospective review by LoGiudice et al. looking at 39 patients who underwent reconstruction with ALT flap and rectus abdominis flap demonstrated shorter time to healing and lower rate of delayed postoperative complications in the ALT group. Incisional hernias were of particular concern in rectus abdominis flap patients [4]. Aslim et al. [3] reported their use of ALT flap and vertical rectus abdominis musculocutaneous (VRAM) flap for large groin defects, both resulting in consistent results with little morbidity. Additionally, both flaps have the benefit of having donor sites that can be closed primarily reducing donor site morbidity.

A review of 50 patients, who underwent VRAM (63%) and extended RAM (37%) flaps by Parrett et al., showed reliable coverage of irradiated thigh and groin oncologic wounds. Extended RAM was used for contralateral and more distal defects. Parret reported significantly improved results when performing immediate compared to delayed reconstruction [5].

Comparing vertical and oblique RAM flaps in 71 patients, Combs and colleagues reported similar complication rates between the two reconstruction techniques. They concluded that an oblique RAM flap is a safe alternative to VRAM with advantages including greater arc of rotation, thinner skin paddle, less bulk, and limited fascial harvest [24].

Alkon et al. [25] reviewed their experience with rectus femoris muscle flaps as an effective and reliable mean for complex groin wound reconstruction. This flap is harvested through a mid-anterior incision extending over the distal two-thirds of the thigh, with muscle elevated on its pedicle and transposed into the groin wound defect. They reported no flap losses and no donor site complications in the 37 rectus femoris flaps performed between 1999 and 2003. Reoperation was required in four patients, one for flap readvancement and three for prosthetic vascular graft removal.

A cost analysis study by Chatterjee and colleagues comparing sartorius ($n = 234$) versus rectus femoris ($n = 62$) flap in the treatment of the infected vascular groin graft wounds notes that the rectus femoris flap is the more cost-effective option with less major complication profile [26].

In conclusion, evaluation for complex groin wound reconstruction starts with considering patients' comorbidities, postoperative quality of life, and functional outcome and going through the reconstructive ladder. The reconstructive surgeon should always consider primary reconstruction and skin grafting as first options and then move to more complex reconstruction options such as pedicled and free flaps.

The gracilis and sartorius flaps are useful options for reconstruction of smaller, low-risk groin wounds (<10 cm), while anterolateral thigh flap and vertical rectus abdominis myocutaneous flap are reliable options for reconstruction of larger groin defects.

References

1. Horch R, Stark GB. Prosthetic vascular graft infection--defect covering with delayed vertical rectus abdominis muscular flap (VRAM) and rectus femoris flap. Vasa. 1994;23:52–6.
2. Murthy V, Gopinath KS. Reconstruction of groin defects following radical inguinal lymphadenectomy: an evidence based review. Indian J Surg Oncol. 2012;3:130–8.
3. Aslim EJ, Rasheed MZ, Lin F, Ong YS, Tan BK. Use of the anterolateral thigh and vertical rectus abdominis musculocutaneous flaps as utility flaps in reconstructing large groin defects. Arch Plast Surg. 2014;41:556–61.
4. LoGiudice JA, Haberman K, Sanger JR. The anterolateral thigh flap for groin and lower abdominal defects: a better alternative to the rectus abdominis flap. Plast Reconstr Surg. 2014;133:162–8.
5. Parrett BM, Winograd JM, Garfein ES, Lee WP, Hornicek FJ, et al. The vertical and extended rectus abdominis myocutaneous flap for irradiated thigh and groin defects. Plast Reconstr Surg. 2008;122:171–7.
6. Perez-Burkhardt JL, Gonzalez-Fajardo JA, Carpintero LA, Mateo AM. Sartorius myoplasty for the treatment of infected groins with vascular grafts. J Cardiovasc Surg (Torino). 1995;36:581–5.
7. Larson JD, Altman AM, Bentz ML, Larson DL. Pressure ulcers and perineal reconstruction. Plast Reconstr Surg. 2014;133:39e–48e.
8. Simman R. Wound closure and the reconstructive ladder in plastic surgery. J Am Col Certif Wound Spec. 2009;1:6–11.
9. Ratner D. Skin grafting. Semin Cutan Med Surg. 2003;22:295–305.
10. Ogawa R, Hyakusoku H, Ono S. Useful tips for successful skin grafting. J Nippon Med Sch. 2007;74:386–92.
11. Fujioka M. Surgical Reconstruction of Radiation Injuries. Adv Wound Care (New Rochelle). 2014;3:25–37.

12. Payne WG, Walusimbi MS, Blue ML, Mosiello G, Wright TE, et al. Radiated groin wounds: pitfalls in reconstruction. Am Surg. 2003;69:994–7.
13. Schoeman BJ. The tensor fascia lata myocutaneous flap in reconstruction of inguinal skin defects after radical lymphadenectomy. S Afr J Surg. 1995;33:175–8.
14. Lin SJ, Nguyen MD, Chen C, Colakoglu S, Curtis MS, et al. Tissue oximetry monitoring in microsurgical breast reconstruction decreases flap loss and improves rate of flap salvage. Plast Reconstr Surg. 2011;127:1080–5.
15. Lohman RF, Langevin CJ, Bozkurt M, Kundu N, Djohan R. A prospective analysis of free flap monitoring techniques: physical examination, external Doppler, implantable Doppler, and tissue oximetry. J Reconstr Microsurg. 2013;29:51–6.
16. Sinna R, Boloorchi A, Mahajan AL, Qassemyar Q, Robbe M. What should define a "perforator flap"? Plast Reconstr Surg. 2010;126:2258–63.
17. Maser B, Vedder N, Rodriguez D, Johansen K. Sartorius myoplasty for infected vascular grafts in the groin. Safe, durable, and effective. Arch Surg. 1997;132:522–5. discussion 525-526
18. Chen SH, Hentz VR, Wei FC, Chen YR. Short gracilis myocutaneous flaps for vulvoperineal and inguinal reconstruction. Plast Reconstr Surg. 1995;95:372–7.
19. Shih PK, Cheng HT, Wu CI, Chang SC, Chen HC, et al. Management of infected groin wounds after vascular surgery. Surg Infect (Larchmt). 2013;14:325–30.
20. Fischer JP, Mirzabeigi MN, Sieber BA, Nelson JA, Wu LC, et al. Outcome analysis of 244 consecutive flaps for managing complex groin wounds. J Plast Reconstr Aesthet Surg. 2013;66:1396–404.
21. Ducic I, Dayan JH, Attinger CE, Curry P. Complex perineal and groin wound reconstruction using the extended dissection technique of the gracilis flap. Plast Reconstr Surg. 2008;122:472–8.
22. Hasen KV, Gallegos ML, Dumanian GA. Extended approach to the vascular pedicle of the gracilis muscle flap: anatomical and clinical study. Plast Reconstr Surg. 2003;111:2203–8.
23. Lannon DA, Ross GL, Addison PD, Novak CB, Lipa JE, et al. Versatility of the proximally pedicled anterolateral thigh flap and its use in complex abdominal and pelvic reconstruction. Plast Reconstr Surg. 2011;127:677–88.
24. Combs PD, Sousa JD, Louie O, Said HK, Neligan PC, et al. Comparison of vertical and oblique rectus abdominis myocutaneous flaps for pelvic, perineal, and groin reconstruction. Plast Reconstr Surg. 2014;134:315–23.
25. Alkon JD, Smith A, Losee JE, Illig KA, Green RM, et al. Management of complex groin wounds: preferred use of the rectus femoris muscle flap. Plast Reconstr Surg. 2005;115:776–83. discussion 784–75
26. Chatterjee A, Kosowski T, Pyfer B, Fisher CS, Tchou JC, et al. A cost-utility analysis comparing the sartorius versus the rectus femoris flap in the treatment of the infected vascular groin graft wound. Plast Reconstr Surg. 2015;135:1707–14.