Deep Inferior Epigastric Perforator Free Flaps for Use in Complicated Groin Wound Repair: A Case Report of Severe Groin Scar Contracture and Review of Pedicled and Free Flaps in Groin Wound Repair

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Abstract

The use of pedicled and free flaps for tissue transfer and coverage has become a common practice in modern plastic surgery. An area that presents considerable challenge for tissue coverage is the groin. Defects in this area are complicated by issues such as prior surgery; scar contracture; extension of the defect beyond the borders of the groin; radiation damage; high probability of infection; and involvement of vital underlying structures, the genitalia, and perineal and perianal area. Therefore, the choice of donor site and flap usage is often difficult. Multiple methods of tissue transfer closure have been reported in the literature for repair of such defects and are reviewed in the following text. Here the authors present the case of a 30-year-old Caucasian woman born with a congenital giant hairy nevus of her left lower back, buttock, posterior thigh, and flank, who underwent wide local excision and skin grafting as a newborn. After several operations, the closure broke down and was left to heal by secondary intention. She has since developed excessive scar tissue leading to pain with ambulation secondary to scar contracture involving her labia majora. In this report, the wound was repaired with a free DIEP flap with excellent result and resolution of all symptoms.

Keywords

- deep inferior epigastric perforator free flap
- breast reconstruction
- fasciocutaneous flap
- groin defect
- groin closure
- scar contracture

Introduction

The use of pedicled and free flaps for tissue transfer and coverage has become a common practice in modern plastic surgery. An area that presents considerable challenge for tissue coverage is the groin. Defects in this area are complicated by issues such as prior surgery; scar contracture; extension of the defect beyond the borders of the groin; radiation damage; high probability of infection; and involvement of vital underlying

structures, the genitalia, and perineal and perianal area.¹ Therefore, the choice of donor site and flap usage is often difficult. Multiple methods of tissue transfer closure have been reported in the literature for repair of such defects, as shown in ►Table 1. Each flap type has its own inherent risks and benefits. Free flaps have risks associated with the microvascular anastomosis, congestion leading to partial or total loss, and the added difficulty of microsurgical procedures.³ Pedicled

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Table 1 Groin defect closures: all cases resulting from a search using “groin defect” (MeSH)

No. of Cases	Size	Closure	Cause	Complications	Source
2	15 × 5 cm	ALT flap, fasciocutaneous, pedicled	Necrotizing fasciitis Pelvic fracture	<i>Clostridium difficile</i> × 1	Maxhimer et al ¹
6	10 × 9 cm–16 × 12 cm	ALT flap, fasciocutaneous, pedicled	Wide inguinal lymphadenectomy	Seroma Congestion Dehiscence Infection	Evriades et al ²
22	19 × 14 cm (mean)	ALT flap, fasciocutaneous, pedicled	Leiomyosarcoma Metastatic SCC Hidradenitis suppurativa	Dehiscence × 4 Tip necrosis × 1 Loss × 1	Lannon et al ³
2		ALT flap, myocutaneous, pedicled	Inguinal metastasis of recurrent rectal cancer		Ver Halen and Yu ⁴
4	5 × 7 cm	ALT flap, myocutaneous, pedicled	Recurrent melanoma Recurrent SCC	None	Gravvanis et al ⁵
12	171.7 cm ²	ALT flap, myocutaneous, pedicled	SCC	Seroma × 3 Hematoma × 1	Nosrati et al ⁶
54	10 × 5 cm–25 × 12 cm	ALT flap, myocutaneous, pedicled	Fungating nodal disease with extensive skin involvement	None	Friji et al ⁷
1	2 × 3 cm	DIEP flap, pedicled	Lymphatic malformation	None	Guerra et al ⁸
1		DIEP flap, pedicled	Burn scar contracture	None	Eo et al ⁹
3	10 × 8 cm (mean)	DIEP flap, pedicled	Metastatic Paget's penoscrotal carcinoma	None	Zeng et al ¹⁰
4		Gracilis flap, myocutaneous, pedicled	Bypass graft wound	None	Ducic et al ¹¹
6	7 × 19 cm	Medial thigh flap, fasciocutaneous, pedicled	Post-burn groin contracture	Tip necrosis Numbness	Turley et al ¹²
15	16 × 4 cm	Medial thigh lift	Hidradenitis suppurativa	Dehiscence × 1	Rieger et al ¹³
3		RAM flap, free		None	Kuwahara et al ¹⁴
2	Large	Tensor fascia lata flap, myocutaneous	Leiomyosarcoma Penile carcinoma		Hill et al ¹⁵
1	17 × 5 cm	Tensor fascia lata flap, myocutaneous, pedicled	MVA, trauma	None	Sen et al ¹⁶
1	20 × 10 cm	Tissue expansion by elastic tube	Trauma	Scarring	Siclován et al ¹⁷
1	9 × 20 cm	TRAM flap, pedicled	Metastatic penile carcinoma		Logan and ¹⁸
20	23 × 8 cm (mean)	VRAM flap, pedicled	Sarcoma	Infection × 3 Tip necrosis × 1 Seroma × 1 Dehiscence × 1	Parrett et al ¹⁹

Abbreviations: ALT, anterolateral thigh; DIEP, deep inferior epigastric perforator; MeSH, Medical Subject Headings; MVA, motor vehicle accident; RAM, rectus abdominis myocutaneous; SCC, squamous cell carcinoma; TRAM, transverse rectus abdominis musculocutaneous; VRAM, vertical rectus abdominis musculocutaneous.

Note: Results from Medline and plastic-surgery-related journals not listed in Medline.

flaps risk twisting or avulsion of the vascular supply and have a range limited to the length of the vascular pedicle.^{1,3} Of note, the vast majority of flap closures to the groin have been done with a pedicled flap, with the anterolateral thigh (ALT) flap being the most common. Free flaps are rare in the literature for complex groin closures, and no reports of a free deep inferior epigastric perforator (DIEP) flap for groin closure have been published. Here the authors review the advantages and disadvantages of the most common flaps used in closure of a complex groin wound as represented by a review of 105 cases in the current literature and present a case of a scar contracture of the groin repaired by release and tissue transfer of a DIEP free flap.

Musculocutaneous flaps have reliable vascular supply allowing adequate delivery of nutrients and removal of wastes

and contamination. This makes them the one of the best choice for areas set to undergo radiation or wounds with a high probability of infection.²⁰ As seen in ► **Table 1**, there have been three myocutaneous flap types reported for groin repair, all of them as local flaps. The most common type is the rectus abdominis myocutaneous (RAM) flap with 24 reported cases. This method provides a larger flap for tissue coverage, and primary closure of the donor site is usually not a problem.¹⁸ In addition, cosmetic result is good as one can often achieve an easily hidden scar. The disadvantages of musculocutaneous flaps are inherent in their design and often result in deficits in function of the abdominal core muscles and an increased risk of hernia formation.^{3,7,8,14} Tensor fascia lata flaps have been reported in several cases. This flap is often chosen due to its wide arc. It also provides a viable option if a concomitant

abdominal fascia defect or urethral injury is present.^{15,16,20} Tensor fascia lata flaps have fallen out of favor, though, due to poor blood supply and high rate of infection when used for groin wound repair.^{15,16}

Fasciocutaneous flaps are useful for their large length-to-width ratios, less bulky nature, ability to preserve donor site function, and the inherent decrease in morbidity associated with muscle harvest.²⁰ The pedicled ALT flap is the most reported closure method used in groin defects with 102 cases found in the literature. ALT flap is a desirable choice due to low associated morbidity, proximity to the groin, long length of the vascular pedicle, and little effect on function.^{1,3,7} Donor site morbidity is higher in these flaps if the defect is more than 9 cm in width. In this case, primary closure may not be possible, which can lead to the need for split-thickness skin grafting that carries the risks of more scarring, contracture, and infection.⁷

The DIEP flap has been used extensively in the reconstruction of the breast and is beginning to be used more widely in other areas of the body. The use of the DIEP flap in the reconstruction of groin defects has only been reported in five cases, none of which were a free flap. The DIEP flap has good-sized perforators and a long vascular pedicle for arc length for doing a pedicled flap or using in microsurgical anastomosis.⁸ The DIEP flap has an aesthetically pleasing final donor site scar placement, essentially a tummy tuck, and a quicker recovery than other more invasive flaps,^{9,10} such as the RAM flap. Another important benefit of the DIEP flap is the lack functional deficit seen with myocutaneous flaps.^{8,10} Here the authors present a case of a DIEP free flap for the repair and reconstruction of a severe groin scar contracture with impact on the patients' activities of daily living.

Case

Patient Background

This patient is a 30-year-old Caucasian woman born with a congenital giant hairy nevus of her left lower back, buttock, posterior thigh, and flank, who underwent wide local excision and skin grafting as a newborn with a revision procedure in 1997 to her left posterior thigh and groin. The revision closure

broke down and was left to heal by secondary intention. Though the patient is married, with two healthy children, and has a successful career, she reports significant pain and morbidity associated with the scarring from her multiple surgeries. She complains of pain with prolonged standing, walking, and hip abduction due to scar tissue contracture. On examination she has a matured, well-healed skin graft encompassing her entire left buttock and circumferentially around her upper left thigh and extending cephalad to the lower abdomen (→ Fig. 1). A strong band of scar contracture within the left inguinal and groin region is present, which is noted to be pulling the left external labia laterally and anal verge superiorly with significant distortion of the appearance of both structures.

Because of the patient's multiple surgeries on the left thigh and significant scar tissue formation over the vastus muscles, a pedicled ALT flap for scar revision was ruled out. As a practice, this center has moved from transverse rectus abdominis musculocutaneous (TRAM) flaps for breast reconstruction to DIEP free flaps and has become proficient at the harvest and microvascular anastomosis of such flaps. Because of the adjacent location and amount of tissue available, a DIEP flap was picked as a viable option for repair of the patient's problem. An ipsilateral pedicled DIEP flap was not an option due to excessive scar tissue; therefore, use of contralateral free DIEP flap was planned. After extensive discussion with the patient, plans were made for scar tissue release from the labia followed with a DIEP flap to replace the scar tissue and prevent future contracture to the area.

Method

Literature review was accomplished through a MeSH (Medical Subject Headings) query of the PubMed database for "groin defect" as well as review of Medline and plastic surgery journals not associated with PubMed. Results of this search yielded a return of 19 studies representing 159 individual flaps. These reports ranged from case reports to large studies involving more than 50 flaps.

For this patient, prior to surgery, computed tomographic (CT) angiogram and Doppler studies of the abdomen were

Fig. 1 Preoperative photographs in frontal and lateral view showing extent of scar and contracture of the labia.

Fig. 2 CTA of the abdomen revealing adequately sized medial row perforator. CTA, computed tomographic angiogram.

obtained and the patient was nutritionally optimized. On review of the imaging, healthy deep inferior epigastric artery (DIEA) perforators were noted bilaterally. The contralateral medial row was chosen preoperatively due to their healthy size (**►Fig. 2**). The flaps were elevated in standard fashion using the standard DIEP flap incision and then elevated from lateral to medial until the medial row perforators on the right side were identified. The rectus fascia was then opened and the rectus muscle perforators carefully dissected in a muscle sparing fashion. Once adequate pedicle length was obtained, dissection was started from the left lateral border and continued medially. Extensive scar tissue was noted on the left hemi-abdomen in zone 4 and excluded the use of an ipsilateral DIEP flap. This scar tissue made the left dissection difficult and would have presented difficulty tunneling the flap as the normal fascial plains were distorted. The authors continued with their plan for contralateral DIEP free flap for tissue coverage.

The DIEP flap was elevated on three perforators with very good blood flow by intraoperative Doppler examination (**►Fig. 3**). The authors then proceeded to remove zone 4 and kept half of zone 2 and all of zones 1 and 3. Attention was then

Fig. 3 Intraoperative photograph showing abdominal DIEP artery dissection elevated by the clamp. Rectus abdominus and split fascia are seen below at the site of dissection.

Fig. 4 Intraoperative photograph showing left groin scar dissection with a red vessel loop highlighting the SIEV and SIEA with dissection carried down to the femoral artery deeply, the anal verge inferiorly, the labia majora medially, and the DIEP flap shown superiorly.

turned to the groin, and an incision was made below the left inguinal ligament over the femoral artery. The dissection was carried down to the level of the femoral artery, then superiorly to the level of the inguinal ligament where the authors identified the superficial inferior epigastric artery and vein from their takeoff from the femoral artery and vein (**►Fig. 4**). The flap was divided from the right pelvis after appropriate heparin dosing and brought into the left groin. End-to-end anastomosis was performed to the superficial inferior epigastric artery in the standard hand-sewn fashion. Significant and encouraging healthy bleeding from the venous system of the flap was noted after arterial anastomosis. The flap's venous system was then anastomosed to the superficial inferior epigastric vein (SIEV) with a 2.5 Synovis coupler (Synovis Microsystems; Birmingham, Alabama, United States). The flap was then inset by opening the scar right at the verge of the labia and releasing it, which left a deficit of 20 cm long $\times$ 14 cm wide curving into a tip right at the anal verge. The authors proceeded then to release the labia completely, put it back to its normal anatomical orientation, sutured the flap into position, and closed the initial DIEP incision in the standard fashion (**►Fig. 5**). The patient was admitted to the hospital and underwent the standard postoperative care for a DIEP flap. She had an uneventful hospital stay, recovered without complications, and was discharged on postoperative day 5.

Follow-up

At 3-month follow-up, there have been no complications and the patient is looking to undergo selective liposuction to further contour the flap. She reports a significant improvement in pain and thigh abduction. No anal dysfunction or labial distortion is noted on leg movement. The flap has healed well with no complications of infection or poor wound healing.

Fig. 5 Pre- and postoperative comparison photographs in the frontal view after flap inset and healing. Adequate separation of the labia from the medial thigh has been achieved and the patient is satisfied with her improvement in pain and thigh abduction. No labial distortion or anal dysfunction is noted.

Discussion

Review of the literature shows the pedicled ALT to be an excellent option for closure of complex groin wounds. For this patient, this was not an option due to the history of prior surgery and extensive scarring of her ipsilateral thigh. Pedicled DIEP flap was not able to be performed due to the extensive scarring preventing ipsilateral flap mobilization and the significant amount of healthy tissue replaced with scar tissue. Therefore, the right DIEP flap was lifted and reanastomosed to the SIEA and vena concomitant with good result. The large tissue transfer provided adequate coverage and the free nature of the flap allowed for excellent placement to reach the most posterior extent of the defect near the anal verge. The healthy size of the perforators of the DIEP flap and their anastomotic partners provided excellent blood flow to the flap preventing necrosis or infection. Over the last 3 months the patient has had no surgical complications and reports a significant decrease in pain and an increase in her overall mobility. Her abdominal incision has healed well and she is pleased with the cosmetic result.

The use of a DIEP free flap is dependent on the patient having enough abdominal tissue to support tissue donation and primary closure and the availability of vessels near the area of injury for anastomosis. The SIEA off the femoral artery provides an excellent blood supply for a free DIEP flap with minimal dissection needed. As with the RAM flap, if associated abdominal injury is present, a DIEP flap may not be a

viable option. Despite this injury, if the injury is only associated with part of the abdomen, as in this patient, the contralateral DIEP free flap remains an option for closure. An added benefit over the pedicled ALT flap is the low likelihood of STSG for donor site closure decreasing morbidity and risk of infection.

Conclusion

Use of the free DIEP flap is becoming common for breast reconstruction after mastectomy. The authors propose that its use for tissue defects in other areas is a novel and viable option. The long pedicle length, low donor site morbidity, and ease of dissection to reach the SIEA and vena concomitant suggest that the DIEP free flap is an excellent option for tissue transfer and closure complex groin defects.

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Conflict of Interest

None.

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