A Safer Way to Harvest a Superthin Perforator Flap

Marco Innocenti, M.D.
Sara Calabrese, M.D.
Sara Tanini, M.D.
Gerardo Malzone, M.D.
Alessandro Innocenti, M.D.

Florence, Italy

Summary: The updated knowledge of perforasome anatomy and the evolution of microsurgical techniques have enabled surgeons to safely harvest a thin flap. Recently, the anterolateral thigh perforator flap, the current workhorse in soft-tissue reconstruction, has started to be designed and harvested on the superficial fascia, which divides the deep from the superficial fat. This allows elevation of a very thin flap tailored to the defect. Faithful to the ultrathin concept, in an attempt to make flap dissection simpler and safer, the authors describe a revisited harvesting technique of superthin anterolateral thigh perforator flap. This study presents the outlined technique performed in 16 patients with complex soft-tissue defects after trauma or tumor ablation. All of them underwent primary reconstruction using superthin anterolateral thigh perforator free flaps by superficial fascia elevation harvested according to the described surgical procedure. Complications and functional outcomes were assessed. The authors' series of anterolateral thigh perforator superthin flaps demonstrated an overall 100 percent survival rate. Of 16 anterolateral thigh perforators, 12 (75 percent) had no complications and four (25 percent) had minor complications. No major complications such as total flap loss requiring additional salvage surgery were reported. In no case was secondary debulking performed. The superthin anterolateral thigh perforator flap harvested with the described approach was used successfully in microsurgical reconstruction, providing an excellent outer skin cover tailored to the defect. The dissection procedure was safe, quick, simple, and free of major complications. With minimal donor- and recipient-site morbidity, it provided great aesthetic results, avoiding secondary operations. (*Plast. Reconstr. Surg.* 147: 466e, 2021.)
CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

In 1967, the concept of a "thin flap" was developed.[1] It was conceived by the assumption that if the subdermal plexus is undamaged, the flap should survive because of the adequate blood supply.[2] This concept along with subsequent anatomical evidence[3,4] led surgeons to believe that further thinning a flap was practically possible, up to design and harvest an ultrathin flap on a new plane of elevation, the so-called superficial fascia.[5] Faithful to the ultrathin concept, the authors applied a simpler, safer, and less time-consuming superthin anterolateral thigh perforator free flap harvesting technique. The aim of this study is to illustrate a more reliable procedure that is free of major complications, which allows for an easy dissection of a superthin anterolateral thigh perforator flap.

From the Department of Plastic and Reconstructive Microsurgery, Careggi Universital Hospital.
Received for publication March 18, 2020; accepted October 18, 2020.

DOI: 10.1097/PRS.0000000000007676

SURGICAL TECHNIQUE

Between June of 2018 and September of 2019, 16 patients underwent superthin anterolateral thigh perforator free flap reconstruction by superficial fascia elevation with the described technique. Anterolateral thigh perforator free flap harvest starts as standard when the deep fascia is included.[6–8] The medial approach allows for an easy and direct visualization of the perforators in the safe plane between perimysium and deep fascia. It is thus easy to choose the favorable perforators by intraoperative findings, opting for the most reliable ones. Once the best perforator/s is/are identified, the intramuscular dissection of the vessels is carried out until the descending branch of the lateral circumflex artery is dissected for

Disclosure: *The authors declare that they have no conflicts of interest to disclose.*

Related digital media are available in the full-text version of the article on www.PRSJournal.com.

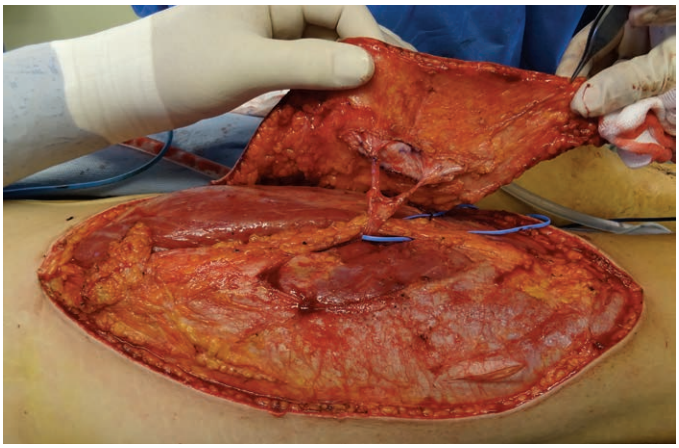

Fig. 1. A superthin anterolateral thigh perforator free flap is totally harvested with the revisited technique.

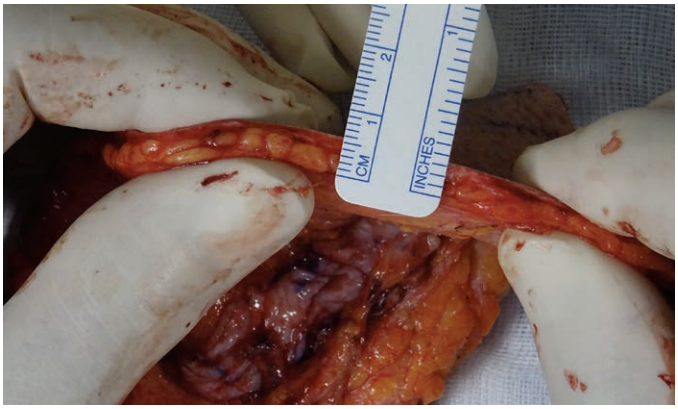

Fig. 2. Superthin anterolateral thigh perforator free flap final thickness.

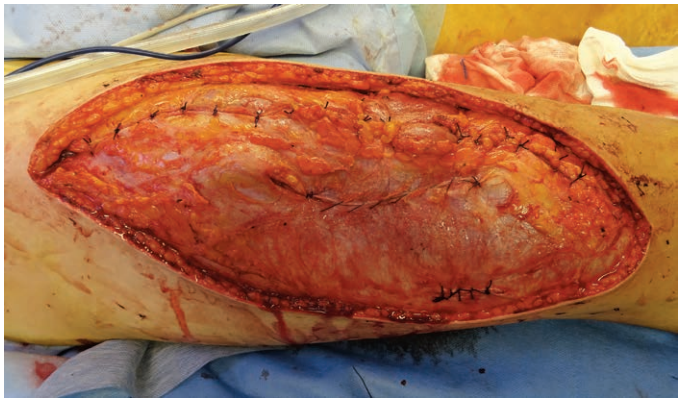

Fig. 3. At the end of the procedure, the deep fascia is repaired tension-free.

the desired length. Up to this point, the flap harvesting technique does not differ from that of a regular, full-thickness anterolateral thigh perforator free flap. At this step of the procedure, a circular deep fascia flap, approximately 2 cm wide, is centered right on the point where the perforators pierce the fascia, being first designed and then incised. In case of double perforators, the deep fascial flap design is elliptical and therefore wider. The whole fat tissue, virtually a cylinder,

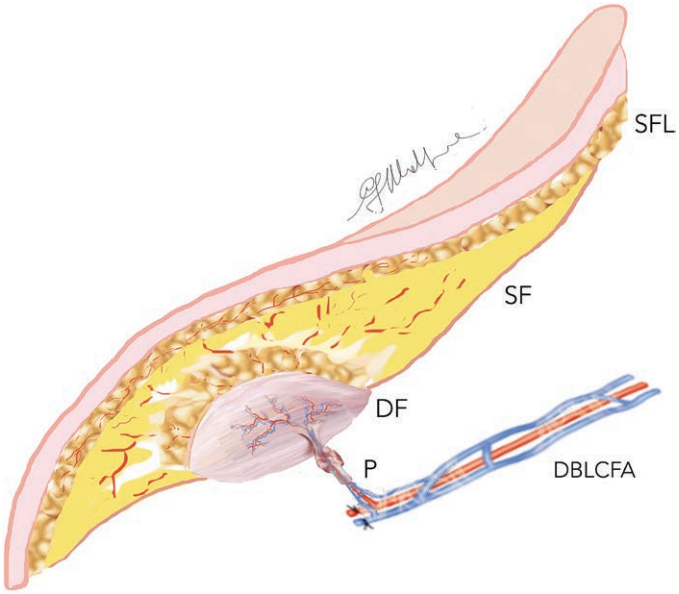

Fig. 4. Illustration of superthin anterolateral thigh perforator free flap harvested with our approach. *DBLCFA*, descending branch of the lateral circumflex femoral artery; *P*, perforator; *DP*, deep fascia; *SF*, superficial fascia of Scarpa; *SFL*, superficial fatty layer.

between the deep and the superficial fascia is dissected up to the superficial fascia. After identifying the superficial fascia–like structure between the superficial loose areolar fat and the deep denser, septate fibrofatty lobules,[5] the superthin anterolateral thigh perforator flap can be quickly elevated on the superficial fascia plane until the fascia flap and the surrounding block of fat tissue previously dissected is reached (Figs. 1 and 2). The anterolateral thigh perforator flap is then incised at its anterolateral side. After the harvest of the flap, the deep fascia can be easily repaired with minimal donor-site morbidity (Figs. 3 and 4). [**See Video (online)**, which demonstrates a superthin anterolateral thigh perforator free flap harvesting technique. All the steps of the surgical procedure are shown and described.]

RESULTS

The mean length of follow-up was 12.5 months (range, 6 to 18 months). All the anterolateral thigh perforator flaps were elevated with at least one viable perforator with this approach. Our series of anterolateral thigh perforator superthin flaps demonstrated an overall 100 percent survival rate, with no reported total loss of the skin paddle. Of 16 anterolateral thigh perforator flaps, 12 (75 percent) had no complications. In four cases (25 percent), minor complications are reported, all of which were managed conservatively. Secondary debulking was never performed. Aesthetic and functional outcomes were highly satisfactory. Muscle hernia was clinically noted in no cases.

DISCUSSION

One of the paradigms of plastic surgery is to reconstruct soft tissues "like with like." In general, this concept is applied to aesthetics, referring mostly to skin color, thickness, and texture. Nevertheless, the same concept can be applied to function, given that functional tasks require a tissue as similar as possible to the native one. In other words, in most of the cases, the best appearance corresponds to the best function. The anterolateral thigh flap, in all its variants,[9–15] is an interesting example of the evolution of the above-mentioned concepts according to the progress of knowledge and technology. The ultimate advance in anterolateral thigh perforator flap use, because of the well-established understanding of the vascular anatomy of the perforasome,[16] was the development of the ultrathin anterolateral thigh perforator flap. Hong and Chung and others described a new way to design and harvest perforator flaps, bringing attention to the superficial fascia plane.[5–19] In our opinion, the elegant way to harvest ultrathin flaps described by Hong and Chung should be used only by experienced microsurgeons, given the difficulty in visualizing and dissecting the perforator/s while proceeding

in the fat tissue over the superficialis fascia. We started with the assumption that, unless a perforator-to-perforator flap is planned, the deep fascia must be divided in any case to dissect the perforator and the descending branch of the lateral circumflex femoral artery. The medial subfascial approach—and thus an early incision of the fascia—allows for a comprehensive view of the vascular network, increasing the accuracy in flap design and making the choice of the best perforator more reliable. At this point, a deep fascia flap may be drawn and incised around the chosen perforator(s) at a safe distance from it/them, with a similar incision of the fat tissue until the fascia superficialis is reached. Now, the flap is harvested over the fascia superficialis with no risk to harm the perforator, which is protected by a block of fat tissue. In our opinion, the morbidity at the donor site is comparable to that resulting from a totally suprafascial approach. In all of our cases, indeed, a satisfactory repair of the fascia and the overlying deep fat was achieved at the end of the procedure, preventing potential muscular disorders and providing a soft and well-vascularized recipient bed for a skin graft, if needed. No secondary debulking was reported in our series of cases.

CONCLUSIONS

The described approach manages to turn a technique that is technically demanding and potentially prone to pitfalls into a safer and more prudent procedure. In a microsurgical world where talented surgeons conceptualize and then perform brilliant procedures with their skilled hands, starting from the "pure skin perforator"[20] concept to a possible future of using capillary-based perforator flaps, this approach offers this anterolateral thigh perforator flap harvesting procedure as valid alternative in an effort to optimize performance and maximize patient outcomes.

Sara Calabrese, M.D.
Department of Plastic and Reconstructive Microsurgery
Careggi Universital Hospital
Largo Palagi 1
Florence 50139, Italy
calabresesaramed@gmail.com
Instagram: saracalabrese_29

REFERENCES

1. Colson P, Houot R, Gangolphe M, et al. Use of thinned flaps (flap-grafts) in reparative hand surgery (in French). *Ann Chir Plast.* 1967;12:298–310.
2. Thomas CV. Thin flaps. *Plast Reconstr Surg.* 1980;65:747–752.
3. Imanishi N, Nakajima H, Minabe T, Aiso S. Angiographic study of the subdermal plexus: A preliminary report. *Scand J Plast Reconstr Surg Hand Surg.* 2000;34:113–116.
4. Hyakusoku H, Ogawa R. The subdermal vascular network flaps—the concept of the 'super-thin flap.' In: Blondeel PN, Hallock GG, Morris SF, Neligan PC, eds. *Perforator Flaps.* St. Louis: Quality Medical; 2006:1002–1007.
5. Hong JP, Chung IW. The superficial fascia as a new plane of elevation for anterolateral thigh flaps. *Ann Plast Surg.* 2013;70:192–195.
6. Wei FC, Jain V, Celik N, Chen HC, Chuang DC, Lin CH. Have we found an ideal soft-tissue flap? An experience with 672 anterolateral thigh flaps. *Plast Reconstr Surg.* 2002;109:2219–2226; discussion 2227–2230.
7. Celik N, Wei FC. Technical tips in perforator flap harvest. *Clin Plast Surg.* 2003;30:469–472.
8. Celik N, Wei FC, Lin CH, et al. Technique and strategy in anterolateral thigh perforator flap surgery, based on an analysis of 15 complete and partial failures in 439 cases. *Plast Reconstr Surg.* 2002;109:2211–2216; discussion 2217–2218.
9. Song YG, Chen GZ, Song YL. The free thigh flap: A new free flap concept based on the septocutaneous artery. *Br J Plast Surg.* 1984;37:149–159.
10. Lin DT, Coppit GL, Burkey BB. Use of the anterolateral thigh flap for reconstruction of the head and neck. *Curr Opin Otolaryngol Head Neck Surg.* 2004;12:300–304.
11. Xu ZF, Duan WY, Tan XX, Sun CF. Reconstruction of complex total parotidectomy defect with a chimeric anterolateral thigh perforator flap and vascularized motor branch of femoral nerve grafting. *J Oral Maxillofac Surg.* 2015;73:2448.e1–2448.e7.
12. Chong LSH, Tjahjono R, Eviston TJ, Clark JR. Dual chimeric innervated vastus lateralis free flap for single stage blink and midface reanimation. *Head Neck* 2017;39:1894–1896.
13. Tursun R, Marwan H, Green JM III, Alotaibi F, LeDoux A. Combined anterolateral thigh and tensor fasciae latae flaps: An option for reconstruction of large head and neck defects. *J Oral Maxillofac Surg.* 2017;75:1743–1751.
14. Lucattelli E, Delcroix L, Baldrighi C, Tanini S, Innocenti M. Quadriceps tendon reconstruction using a fascia lata included in a reverse-flow anterolateral thigh flap. *Microsurgery* 2019;39:642–646.
15. Ozkan O, Ozkan O, Derin AT, et al. True functional reconstruction of total or subtotal glossectomy defects using a chimeric anterolateral thigh flap with both sensorial and motor innervation. *Ann Plast Surg.* 2015;74:557–564.
16. Saint-Cyr M, Wong C, Schaverien M, Mojallal A, Rohrich RJ. The perforasome theory: Vascular anatomy and clinical implications. *Plast Reconstr Surg.* 2009;124:1529–1544.
17. Hong JP, Choi DH, Suh H, et al. A new plane of elevation: The superficial fascial plane for perforator flap elevation. *J Reconstr Microsurg.* 2014;30:491–496.
18. Kim KN, Hong JP, Park CR, Yoon CS. Modification of the elevation plane and defatting technique to create a thin thoracodorsal artery perforator flap. *J Reconstr Microsurg.* 2016;32:142–146.
19. Goh TL, Park SW, Cho JY, Choi JW, Hong JP. The search for the ideal thin skin flap: Superficial circumflex iliac artery perforator flap. A review of 210 cases. *Plast Reconstr Surg.* 2015;135:592–601.
20. Narushima M, Yamasoba T, Iida T, et al. Pure skin perforator flaps: The anatomical vascularity of the superthin flap. *Plast Reconstr Surg.* 2018;142:351e–360e.