# The Preexpanded Anterolateral Thigh Free Flap.

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# The Preexpanded Anterolateral Thigh Free Flap

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**Abstract:** The anterolateral thigh flap has many of the attributes of the ideal soft-tissue flap. However, a major detriment is the potential conspicuous donor site deformity, especially if skin grafted. In elective situations, preexpansion of the lateral thigh with subsequent transfer of even a wide anterolateral thigh flap can permit primary donor site closure and avoidance of a skin graft. This has been achieved successfully in 2 compliant patients, and is a reasonable solution to minimize the morbidity of this otherwise important donor site.

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The anterolateral thigh flap can be a "true" muscle perforator flap or septocutaneous flap depending on the course of the cutaneous perforators from the lateral circumflex femoral source or "mother" vessels.[1] As suggested by the Canadian system[2] for nomenclature, these could be called the $LCF_{VL}$ or LCF-s perforator flaps respectively (where VL is the vastus lateralis [the usual muscle penetrated] and "s," of course, refers to septocutaneous). Wei et al[3] have presented cogent arguments that this is the ideal soft-tissue flap, because the potential surface area is large, the pedicle can be lengthy and of large caliber, thickness can be adjustable, multiple flap tissue combinations can be either composite or conjoint, a "flow through" is possible for distal revascularization or creation of sequential flaps, and all this can be accomplished with the patient in a convenient supine position!

My ensuing "Discussion" regarding this ideal flap expressed some concern for donor site morbidity, which was underemphasized.[4] Kimata et al[5] noted that weakness and early fatigability were inherent drawbacks, probably just from the mandatory intramuscular dissection of the flap perforators. Adhesions from skin grafts needed at the donor site were also found to limit maneuverability. Zhao et al[6] added other problems with such skin grafts, including their lack of durability, growth limitation especially in children, and aesthetic concerns including abnormal pigmentation (Fig. 1). Interestingly, 40% of anterior thigh donor sites (in the extensive experience of Wei et al[3]) of 672 reported flaps required a skin graft, usually if the width of the flap exceeded 6 to 9 cm or even less if the flap extended near the knee. The sheer magnitude of these numbers makes this not an insignificant concern that deserves some attention.

Methods to minimize at least the contour deformity of the anterior thigh include restricting the dissection to a suprafascial plane.[3] The skin graft problem may be avoided altogether by the immediate interposition of a second flap, as has been done using a pedicled groin flap[6] or V-Y advancement flaps from adjacent thigh skin based on residual lateral circumflex femoral musculocutaneous perforators.[7] Post-transfer tissue expansion of residual thigh tissue has also allowed secondary removal of the skin-grafted donor defect.[8] As a corollary, if time is not of the essence, preliminary tissue expansion of the lateral thigh should also permit direct donor site closure without the need for a skin graft or the use of a second flap, which would have its own inherent morbidity.

## METHODS AND MATERIALS

Two burn patients with unstable scars recently required very large soft-tissue replacement preferentially using a cutaneous flap only. The first had immersion burns of his feet, and had previously had a preexpanded lateral arm flap to cover an Achilles tendon ulcer with primary donor site closure.[9] The other had already endured extensive burn scar revisions with multiple courses of tissue expansion. Both individuals, therefore, had an intense interest in minimizing any new deformities, and especially wanted to avoid skin grafting of any flap donor site.

The anterolateral thigh flap was selected as the ideal flap for both patients. Initially, using the method of Wei et al,[1] each proposed flap was outlined on the anterolateral thigh, centered about the pertinent musculocutaneous perforators as identified with an audible Doppler probe. A rectangular tissue expander was chosen with a length approximating that of the flap. Intraoperatively, the expander was used as a template to

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**FIGURE 1.** The obvious and nonaesthetic appearance of a skin-grafted anterolateral thigh donor site. Because fascia was removed here, adherence of the graft can understandably affect muscle performance.

mark a subcutaneous pocket at all times well lateral to the requisite perforators so that they could not be injured. A radial incision superior to this area was made, and the pocket was dissected above the fascia lata using a cervical dilator. After expander insertion, a remote valve was positioned at a site that allowed easy palpation, (eg, overlying the anterior superior iliac spine [ASIS]).

After satisfactory healing within 2 weeks, serial expansion was done weekly until each implant was overfilled near twice the vendor's suggested volume.[10] At this point, both patients were experiencing increasing discomfort in their clothing, so further expansion was ceased. Each free flap was next raised and transferred in the usual fashion, after again first identifying the correct perforators. In both patients, enough skin redundancy remained to permit primary closure of the thigh donor site.

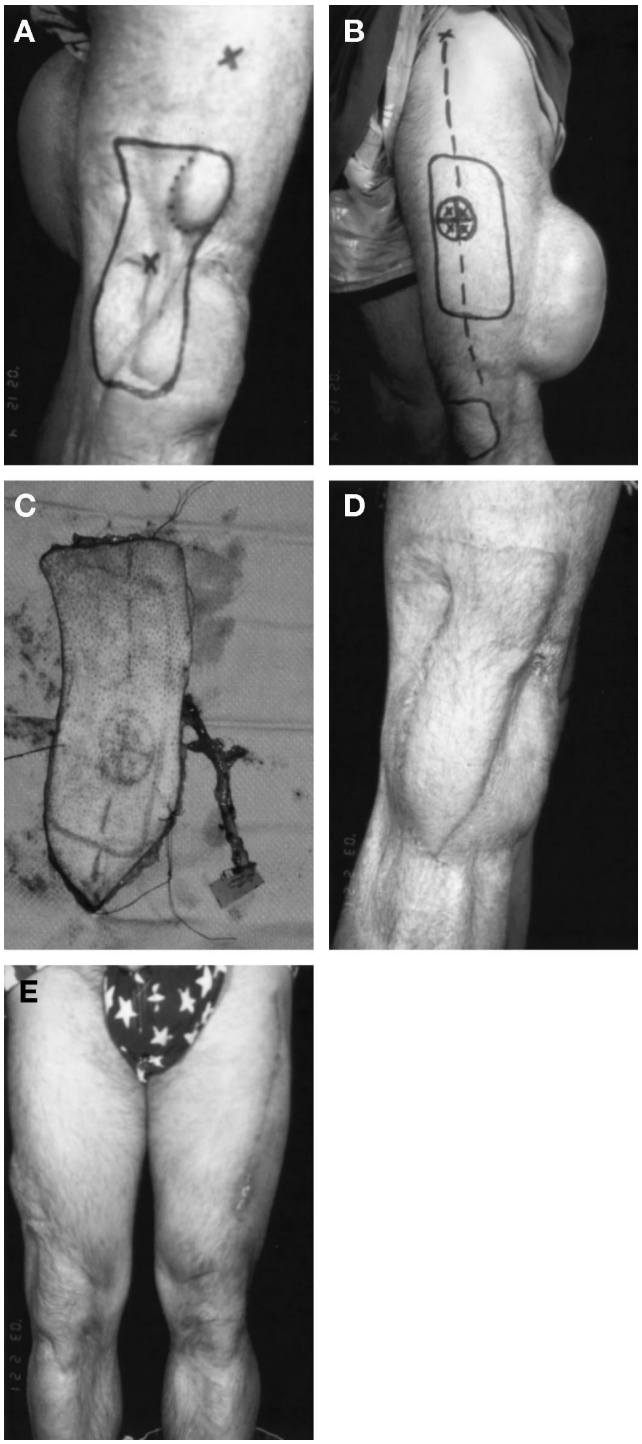


**FIGURE 2.** (**A**) Right lateral knee defect, with the hernia later to be repaired using the fascia of the $LCF_{VL}$ flap outlined by the dotted line. (**B**) The expanded left lateral thigh encroaching on the flap design that circumscribes the requisite perforators (x) as identified by an audible Doppler probe. (**C**) The free flap with the LCF pedicle in microclamps at right. (**D**) Lateral view of the healed free flap covering the right knee 6 months later. (**E**) The linear donor site scar.

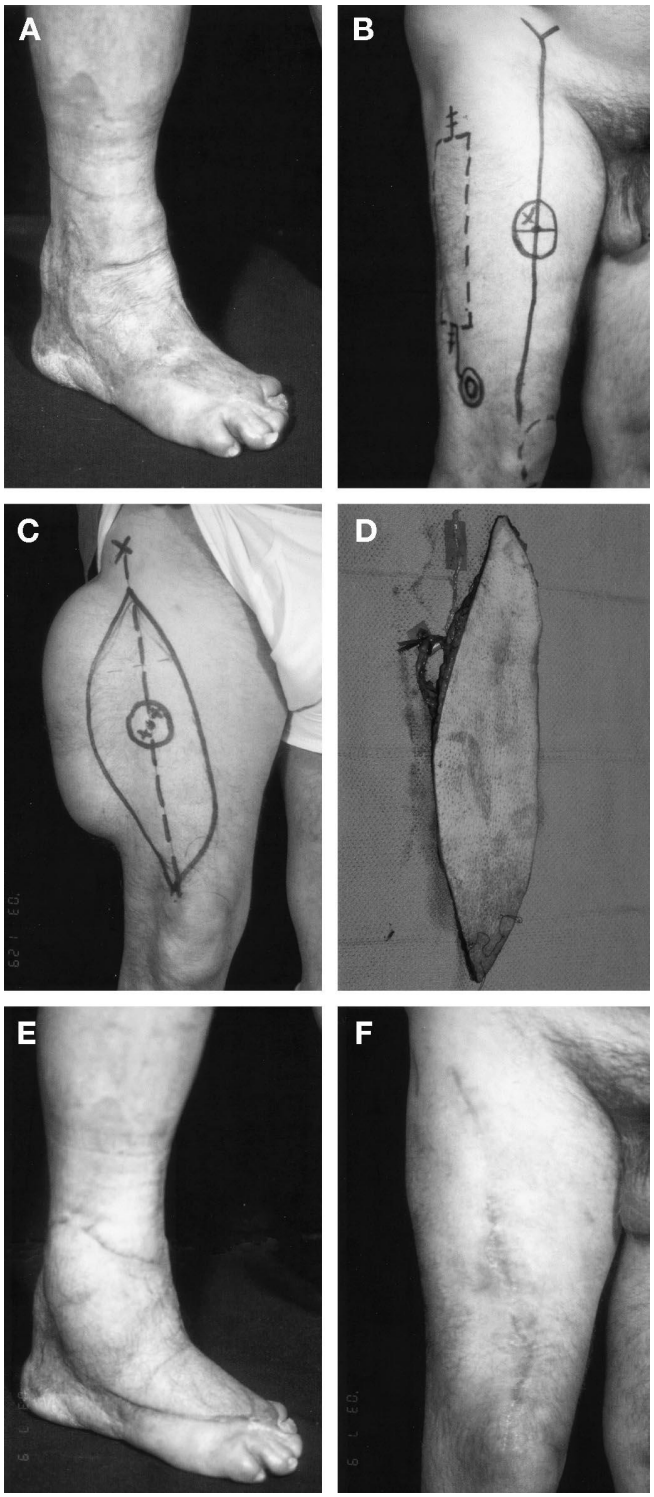


**FIGURE 3.** (**A**) Unstable, densely adherent skin grafts on the dorsum of the right foot. (**B**) A major perforator of the anterolateral thigh marked by an "x," with the design of the expander pocket (dotted lines) kept well lateral for its protection. Note that the valve was ultimately placed superiorly by the ASIS. (**C**) After completion of expansion, the lateral aspect of the proposed free flap was also expanded. (**D**) The huge free flap with the LCF pedicle in microclamps at the upper left. (**E**) Mobile soft-tissue replacement of the dorsum of the right foot (**F**) and concomitant linear closure of the right thigh donor site without the need for a skin graft as seen 5 months later.

## RESULTS

Two patients successfully had lateral thigh tissue expansion before the microsurgical transfer of an anterolateral thigh ($LCF_{VL}$) free flap. Only the most lateral part of the flap itself was ever expanded, with no expansion under the site of the perforators to the flap. Both flaps survived without compromise. The major benefit of this preexpansion was closure of the thigh donor site without a skin graft, although the area about the knee in 1 patient required a delayed closure after resolution of edema. In addition, the capsule of the remaining expanded thigh was advanced where possible to close the fascial defect left because both flaps were harvested at a subfascial plane.

### Patient 1

A 57-year-old contractor sustained an electrical injury with his right lateral knee the point of exit. After debridement, a lateral gastrocnemius muscle flap was used initially to maintain joint integrity. He was constantly bothered by herniation of the quadriceps muscle through a small defect in the fascia lata, the hypertrophic scarring spanning the lateral knee, and the nonaesthetic skin-grafted cavity in this area (Fig. 2.).

A 680-mL rectangular CUI (McGhan Medical, Santa Barbara, CA) 6 × 10-cm tissue expander was placed parallel to the desired flap design in the lateral left thigh. During a 9-month period, 1239 mL was instilled. A 9 × 22-cm flap was then transferred without incident to the right knee area. Direct donor site closure of the left thigh was possible.

### Patient 2

Twenty-five years ago both feet in this now 58-year-old man sustained molten steel immersion burns that required skin grafts. He since has had periodic graft ulcerations because of their dense adherence to the bone and tendons on the dorsum of his foot (Fig. 3). To remove the entire unstable grafted region, a very large cutaneous flap was required. He emphatically wanted no more skin grafts.

A 7 × 20-cm, 650-mL rectangular Versafil CUI (McGhan Medical) tissue expander was placed in the lateral right thigh via a radial incision superior to the expander pocket that paralleled the design of the flap. A high-profile remote valve was put in a prominent position near the ASIS. During a 6-month period, 1433 mL was instilled. A 12 × 23-cm flap was then transferred without incident to cover the

right foot. Direct donor site closure was possible except near the knee for fear of causing excessive tension. Once edema resolved, this too could be closed directly under local anesthesia.



## DISCUSSION

If the luxury of time is available, and the patient will submit to 2 operative procedures, preexpansion of the anterolateral thigh region can permit direct closure of the donor site after flap transfer. This extra step is 1 way to avoid the stigmata and morbidity inherent with a thigh skin graft, which is a major detriment of this donor site.[5,6,11] This is consistent with pretransfer expansion of other cutaneous free flap donor sites (eg, scapular,[12–14] parascapular,[15] radial forearm,[16,17] and lateral arm[18]) in which a similar goal has already been achieved. If desirable, pretransfer tissue expansion can also augment flap size, create a thin flap, or alter flap contour.[12,19]

In a sense, preexpansion of the anterolateral thigh has already been accomplished by others. For example, Pribaz et al[20] prefabricated thigh flaps with implantation of the LCF pedicle directly over the expander, with eventual direct donor site closure. In these 2 cases as reported, the same results can be achieved by routine elevation of the $LCF_{VL}$ muscle perforator flap alone. Horch et al[21] placed the expander *under* the fascia lata, but to preexpand TFL flaps. They also could obtain direct thigh closure, which corroborates the validity of this approach.

Because the size, course, and even exact location of perforators to the $LCF_{VL}$ flap can be uncertain with nonoperative methodologies,[1] preexpansion of this flap was limited here to avoid a donor site skin graft, although the most lateral part of both flaps did have some expansion. Expansion of the entire anterolateral flap territory could jeopardize the requisite perforators as a result of the trauma of pocket creation, even if done with endoscopic guidance.[22] Other potential adverse sequelae that must be dealt with specific to preexpansion include fibrosis about the pedicle,[13] overthinning and even frank tissue necrosis, interference with flap design resulting from the surgical incisions used for expander implantation, and infection at any time that could abort the entire process.[16] Of course, this is a 2-stage procedure, and the patient must be compliant over a lengthy period with frequent office visits for gradual expansion. The benefit of no skin graft residue of the anterior thigh may be well worth these risks, if feasible.

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