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The Proximal Pedicled Anterolateral Thigh Flap for Lower Limb Coverage

Geoffrey G. Hallock, MD

Abstract: Although primarily considered as a versatile free-flap donor site, the anterolateral thigh can also be a source of a local muscle perforator flap. This attribute has previously been rarely considered for lower limb coverage. This small series of 3 additional cases demonstrates the usefulness of a proximal pedicled anterolateral thigh flap for medial and lateral thigh wounds. This flap can also be part of a combined flap, in particular when transferred with the vastus lateralis muscle as a local chimeric flap. The peninsular version of the anterolateral thigh local flap avoids venous congestion and is very reliable. The orthograde pedicled anterolateral thigh muscle perforator flap should be considered as another useful alternative for any upper thigh wound if a flap is essential.

Key Words: anterolateral thigh flap, local muscle perforator flap, lateral circumflex femoral—*vl* artery perforator flap

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The lateral circumflex femoral (descending branch) artery perforator flap, so called if using the Canadian nomenclature system for muscle perforator flaps where named after the intrinsic source vessel,¹ or the lateral circumflex femoral—*br*. VASTUS LATERALIS perforator flap,² which acknowledges also the muscle perforated by the inherent musculocutaneous perforators, is better known as the anterolateral thigh flap as introduced by Song et al³ as a septocutaneous flap. Most commonly, this has been used as a free-flap donor site.^{4–9} However, as with most lower-extremity muscle perforator flaps,¹⁰ these can also be advantageous for use as local flaps.

As a distal-based island flap relying on retrograde flow via distal communications of the descending branch of the lateral circumflex femoral with either the profunda femoral or superior lateral genicular artery, knee and upper leg coverage has also been possible.^{7,11,12} Arterial insufficiency has been a concern with this variant such that a free flap more often may be a preferable option.⁷ Proximal pedicled anterolateral thigh

flaps have been more reliable and successfully used for full-thickness reconstruction of the abdominal wall^{8,13} and as an island flap to reach the ischium, perineum, and scrotum.¹⁴ The V-Y advancement of local flaps from adjacent thigh skin based on residual lateral circumflex femoral musculocutaneous perforators has even been used to avoid use of skin grafts for the anterolateral thigh free-flap donor site.¹⁵ In addition, this orthograde perfused version can be used as a local flap for closure of virtually any anterior thigh defect, which has not previously been accentuated.

METHODS

Over the past 20 years, a proximal-based anterolateral thigh local flap specifically for lower-extremity defects has been used on 3 occasions. It is mandatory that this territory has not been previously violated or involved in the zone of injury. The approach then is similar to that of harvest of a free anterolateral thigh flap.

Initially, the location of the requisite musculocutaneous perforators must be identified. A line is drawn from the anterior superior iliac spine to the superolateral edge of the patella. This roughly corresponds to the location of the septum between the vastus lateralis and rectus femoris muscles. A circle with radius of 3 cm is centered at the midpoint of this line.^{9,16} Although color duplex ultrasound is highly reliable, use of a handheld audible Doppler is more pragmatic to locate perforators, most commonly in the posteroinferior quadrant of that circle.¹⁷ The most proximal pivot point possible for a local flap will be about 2 cm below the inguinal ligament and overlying the course of the femoral vessels and corresponds to the origin of the lateral circumflex vessels from the profunda femoris.¹³

The large potential territory for an anterolateral thigh local flap extends from a horizontal line at the level of the greater trochanter to just above the patella, laterally to the lateral intermuscular septum and medially to the sartorius muscle, ie, it can incorporate half the surface of the anterior thigh.¹³ Depending on the size and location of the flap in reference to the retained perforator, a proximal pedicled flap can reach 8 cm above the umbilicus, to the perineum and anus, and even to the contralateral inguinal region.¹³ The actual boundaries of the desired flap must be sufficient to cover the recipient defect and can be eccentrically placed about the chosen perforator to obtain more reach as desired. The more distal the flap, of course, the longer the pedicle leash and fewer restraints for inseting.

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The medial border of the flap is first elevated at a subcutaneous or subfascial level. The latter is the easiest, quickest, and safest way to insure visualization of perforators as they arise in the septum between the rectus femoris and vastus lateralis muscles, or more commonly through the latter. It is best to include 2 perforators, if possible, as a lifeboat in case of inadvertent injury or to allow turbocharging if 1 perforator cannot completely nourish the entire flap.^{4,7} Once adequate perforators are identified, the opposite boundary of the flap may then be incised and elevated rapidly.

If an island flap is not necessary, a proximal skin pedicle can be preserved, which better insures venous outflow and can be sensate if the lateral femoral cutaneous nerve of the thigh is included.⁴ An intramuscular dissection of the perforators, as usually required, proceeds back to the descending branch, with care to preserve any motor branches. Proximal dissection of the vascular supply to the flap can cease once a tension-free transfer is possible. The local flap is then inset. Donor site closure will require a skin graft if width of the flap exceeds about 8 cm.⁸

RESULTS

A proximal pedicled anterolateral thigh flap was used on 3 occasions. Two peninsular flaps for coverage of a medial and a lateral thigh wound, respectively, had no complications. An island chimeric flap transferred with the vastus lateralis muscle for hip coverage suffered venous congestion of the skin flap, requiring leech therapy for resolution. Compression by a tight tunnel used for flap transposition may have been an important risk factor.

Case 1: Lateral Thigh Wound

A 33-year-old man sustained an open fracture of the proximal left femur in a motorcycle accident, with extensive

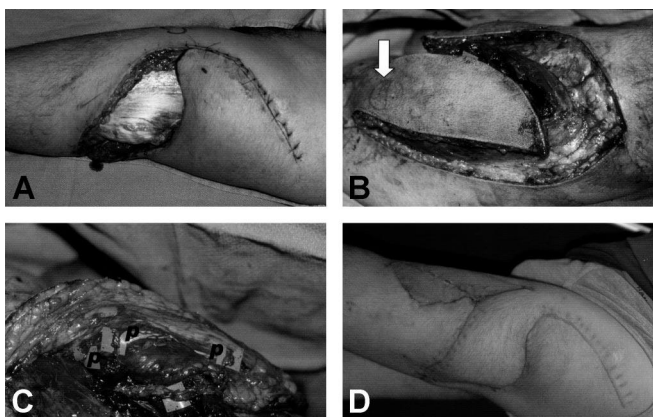


FIGURE 1. A, Deep gouge of the lateral left thigh exposing the fascia lata, with the more proximal open femur fracture tenuously covered with buttock tissues; B, elevated local anterolateral thigh flap, with a perforator that had been marked preoperatively (arrow) after identification using an audible Doppler; C, elevated flap, with microgrid under 3 perforators that were included; D, final healed wound. Note skin graft was necessary at the anterior thigh donor site.

lateral thigh-tissue loss (Fig. 1). This was closed with a 10-cm × 20-cm proximal pedicled peninsular anterolateral thigh flap rotated laterally. The flap was based on 3 perforators. The donor site required a skin graft. The patient is now fully ambulatory.

Case 2: Medial Thigh Wound

This 48-year-old roadside laborer was struck by a motor vehicle, sustaining an avulsion of the anteromedial right thigh without bone or vascular injury (Fig. 2). Demarcation of the wound resulted in skin loss of the distal anterior and anteromedial thigh. Both the vastus medialis and sartorius muscles had also been totally devascularized, and the superficial femoral vessels became exposed by their removal. Fortunately, enough skin at least to the midportion of the anterolateral thigh remained to allow elevation of an 8-cm × 15-cm peninsular flap based on a single large perforator that reached to protect the vessels at risk. The remaining open

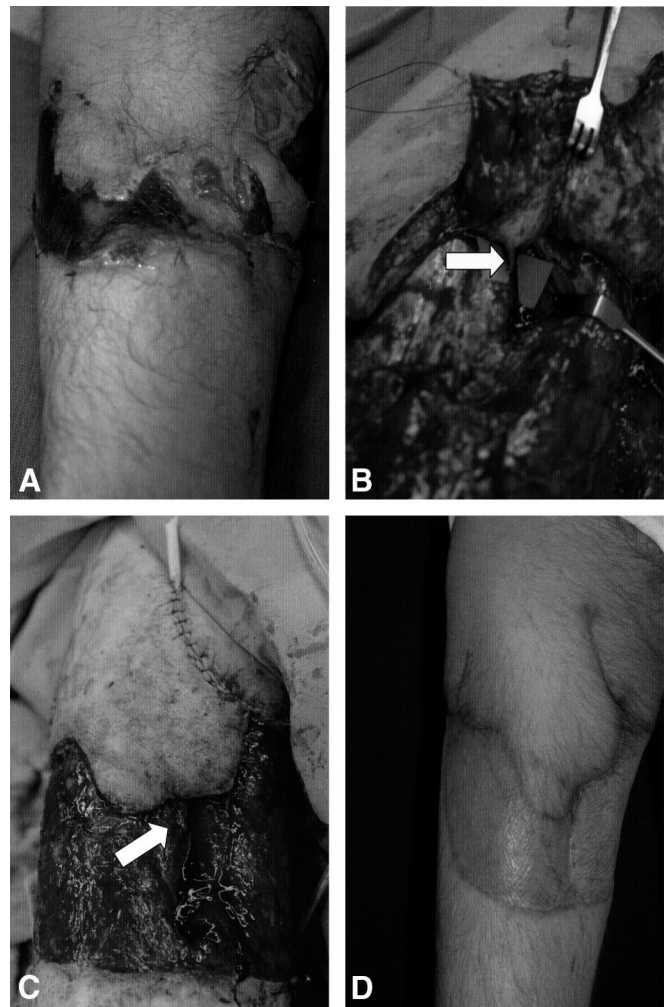


FIGURE 2. A, Necrotic residue after right thigh avulsion; B, single perforator (arrow) found in remaining midportion of the anterolateral thigh; C, flap rotated to cover exposed superficial femoral vessels (arrow); D, healed flap over medial thigh, and skin-grafted residual defect.

wounds required skin grafting. In spite of significant muscle injury at the time of the accident, the patient was ambulating independently 6 months later.

Case 3: Chimeric Anterolateral Thigh and Vastus Lateralis Muscle Local Flap

Following drainage of a chronic trochanteric bursitis in this 83-year-old man, the wound dehiscd with granulations over the mobile right greater trochanter at the base of the wound, precluding skin grafting (Fig. 3). A chimeric flap¹⁸ consisting of a 4-cm × 10-cm anterolateral thigh muscle perforator flap and a vastus lateralis muscle flap was raised, joined together only by their common proximal vascular origin from the descending branch of the lateral circumflex femoral vessels. Each component of the flap was independently inset, with the muscle filling the void above and padding the greater trochanter, and the perforator flap used for tension-free skin closure. Venous congestion of the skin

flap ensued and required leech therapy for 5 days prior to resolution. The wound otherwise healed without sequela.

DISCUSSION

The anterolateral thigh muscle perforator flap is an “ideal” donor site for a cutaneous flap whether as a local flap or free flap because of its reliability and large potential size.^{9,16} Further augmentation is possible if combined with the anteromedial thigh¹ or tensor fascia lata skin territories.^{4,8} The vastus lateralis, rectus femoris, and tensor fascia lata muscles can also be combined to form composite or chimeric flaps if bulk or the attributes of muscle are also desirable (Fig. 3).^{4,9}

As with any muscle perforator flap, the intramuscular dissection of the vascular pedicle can be tedious.¹⁶ Although the anterolateral thigh flap was originally described by Song et al³ to be based on direct septocutaneous perforators, more than 80% of the time musculocutaneous perforators are the essential source of flap vascularization.^{4,9,16} These are almost always present and found to be absent in only 0.89% of hundreds of cases from the large Taiwan experience.⁴ The musculocutaneous perforators do not always proceed directly to the septum between the vastus lateralis and rectus femoris muscles and may take a more longitudinal course, sometimes through the entire length of the muscle, and may then arise from a different source vessel.¹⁹ Donor-site morbidity may include muscle weakness and lower limb fatigability directly related to the required intramuscular dissection and disruption but also due to skin-graft adhesions that limit muscle maneuverability.^{8,20} If skin grafted, the nonesthetic donor site may not be acceptable, especially for women (Fig. 1).²¹

Although the major experience to date with the anterolateral thigh flap has been use as a free flap,^{4,9} this same donor site can be used as a local flap without the need for microsurgical expertise. Distal-based flaps have been used for knee and lower leg coverage.^{7,11,12} Proximal pedicled flaps with orthograde perfusion are more reliable. These can reach as an island flap even cephalad to the umbilicus.¹³ The peninsular flap version avoids venous congestion and is an ideal choice for thigh defects medial or lateral to the anterolateral thigh donor site (Figs. 1, 2). Just as with free flaps,^{4,9} combined composite or chimeric flaps¹⁸ composed of every known donor tissue from the anterior thigh may also be possible options for this very versatile local anterolateral thigh muscle perforator flap. The latter as an option should not be overlooked if soft-tissue coverage is essential for any thigh wound not involving the anterolateral thigh itself.

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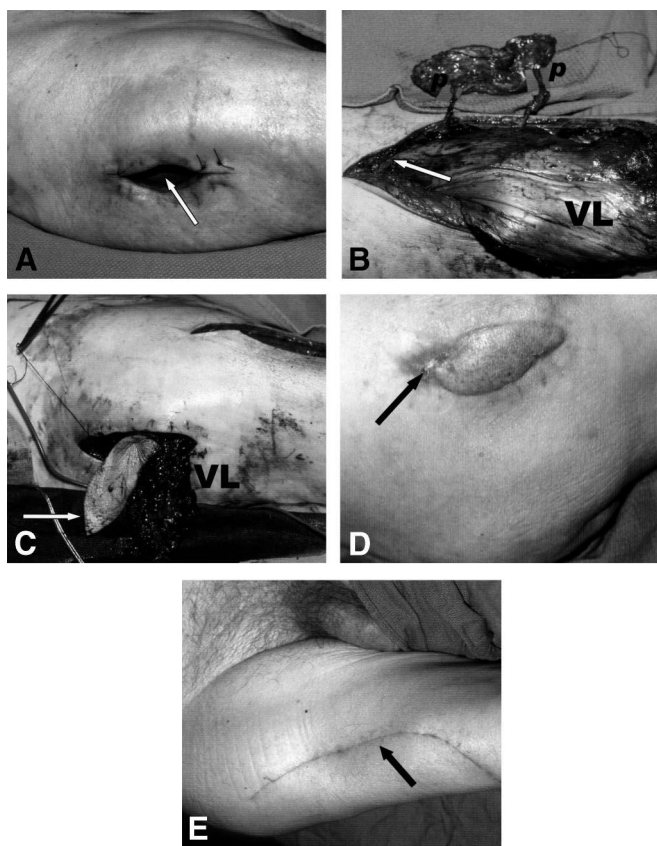


FIGURE 3. A, Dehiscd right hip wound after 2 prior attempts at direct closure, with exposed greater trochanter (arrow); B, chimeric proximal pedicled [arrow] island flap consisting of both the vastus lateralis muscle (VL) and anterolateral thigh flap (above) based on 2 perforators (p) seen entering the deep fascia on the flap undersurface; C, the chimeric flap brought into the right hip wound via a subcutaneous tunnel, prior to independent component inseting. (VL, vastus lateralis muscle; arrow, anterolateral thigh flap). D, Healed right hip wound (arrow); E, direct closure of the right anterior thigh donor site left a residual linear scar (arrow).

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