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The anterolateral thigh – Vastus lateralis conjoint flap for complex defects of the lower limb

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Summary *Introduction:* Complex and extensive lower limb defects remain difficult reconstructive problems. Conventional flaps may not be large enough or lack the versatility that allows precise tissue positioning to optimally cover the wound. The anterolateral thigh–vastus lateralis conjoint flap provides a superior reconstructive solution for these difficult wounds.
Methods and materials: From Jan 2010 to June 2011, seven patients were reconstructed with the anterolateral thigh–vastus lateralis conjoint flap. Three cases were traumatic degloving injury of the lower limb, three were open fractures of the tibia with extensive soft-tissue loss and one was a large soft-tissue defect as a result of necrotising fasciitis. The skin island and muscle component were raised with independent pedicles to allow complete freedom in the inset of each flap based on a common pedicle. The descending and oblique branches of the lateral circumflex femoral artery were used as the pedicle of the conjoint flap in four and three cases, respectively.
Results: The mean size of the skin flap was 355 cm^2 (range: 312–420 cm^2) and the volume of the muscle flap was 210 cm^3 (range: 42–360 cm^3). All flaps survived completely and no infective complications were noted in our patients. The skin and muscle component were widely separated to expand the area of coverage. In cases where specific areas of the wound were severely traumatised with significant tissue loss, the muscle component can be precisely positioned to obliterate the dead space and to optimise soft-tissue coverage of the wound.
Conclusion: The anterolateral thigh–vastus lateralis conjoint flap is superior to conventional flaps available for coverage of extensive defects of the lower limb. It can cover far greater area as well as providing the versatility needed to optimise soft-tissue coverage.

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Introduction

Extensive lower limb defects are challenging reconstructive problems.[1] These defects, with a large vertical as well as transverse dimensions, make coverage difficult even with the largest conventional free flap, occasionally necessitating two free flaps.[2] Furthermore, within the defect, in the lower third of the leg where soft tissues are usually deficient, there are areas in particular need for greater volume of vascularised tissue to provide optimal soft-tissue coverage and to obliterate dead space. Failure to do this would predispose the area to infective complications such as abscess formation and osteomyelitis.[3,4]

The anterolateral thigh flap, with is versatility and low donor-site morbidity, is increasingly becoming the flap of choice for coverage of a variety of lower limb defects.[4–7] However, for reconstruction of defects of greater dimensions, anterolateral thigh skin flap may not be sufficient as the transverse dimension that can be reliably harvested is usually <12—14 cm.[8] The anterolateral thigh myocutaneous flap harvested in a traditional manner with the muscle as a carrier of blood vessels that supply the skin cannot solve the problem of inadequate dimension due to inherent limitation of movement and mobility between the muscle and the skin paddle.

The design of an anterolateral thigh—vastus lateralis conjoint (ALT-VL(c)) flap is able to provide both skin and muscle components independently based on different vascular branches from the same pedicle source vessel. It helps increase the surface area available for coverage of defects of greater dimensions. The relative independence of the skin paddle and vastus lateralis also allows more precise positioning of both two components to optimise their use for coverage defect, soft-tissue volume replacement as well as for dead space obliteration.[9,10] This article reports our experience with its application in reconstruction of complex lower limb defects. It also highlights the clinical significance of the anatomy of the anterolateral thigh flap recently known.[11]

Materials and methods

From January 2010 to June 2011, seven patients with complex lower limb defects were reconstructed with the ALT-VL(c) flap. Three cases were traumatic degloving injury of the lower limb, three were open fractures of the tibia with extensive soft-tissue loss and one was a large soft-tissue defect as a result of necrotising fasciitis.

Surgical technique

The anterolateral thigh flap was raised as previously described[8] with modifications specific to harvesting the ALT-VL(c) flap highlighted here. The dimensions of the skin island required based on the defect size is marked centred on the skin vessel as located by the hand-held Doppler. The medial incision is made and the skin flap elevated to the intermuscular septum between the rectus femoris and the vastus lateralis. The skin vessels that will supply the flap are identified and the rectus femoris is then lifted off the vastus lateralis muscle. The descending branch and the oblique branch (if present) of the lateral circumflex femoral artery are then identified.[11] The skin flap is raised either as a perforator flap by intra-muscular dissection to its pedicle or as a septocutaneous vessel based flap. This can be either at the descending or at the oblique branches of the lateral circumflex femoral artery. When possible, two skin vessels are included to supply the skin as in many of these cases the size of the skin flap needed is usually very large. The pedicle distal to the origin of the distal-most skin vessel is then isolated and mobilised for a distance of 1—2 cm. The vastus lateralis supplied by this, the same source vessel, is then harvested. The dimension of the muscle is determined by the defect requirements. A significant-sized muscle flap can reliably be harvested based either on the descending or on oblique branches of the lateral circumflex femoral artery. The ALT-VL(c) flap should be handled with care during harvesting and insetting, taking note not to exert undue tension on the skin vessels as well as avoiding the muscle from dangling off its pedicle. Microanastomoses should only be performed after the skin and muscle flap have at least been partially inset into the defect with all vessels supplying the components of the flap lying in a favourable, tension-free position. We prefer end-to-side arterial anastomoses[12] and perform two venous anastomoses whenever possible for lower limb cases. This is, however, a matter of preference as no evidence exists that two venous anastomoses are superior to a single anastomosis and it is certainly reliable in situations where a second vein is not available.

Results

All flaps survived completely. The mean size of the skin flap was 355 cm^2 (range: 312—420 cm^2) and the volume of the muscle flap was 210 cm^3 (range: 42—360 cm^3). Four flaps were harvested with the descending branch as its pedicle and three with the oblique branch as its pedicle. Split-thickness skin grafts were used over the transferred vastus lateralis. All wounds healed uneventfully with no long-term infective complications.

Illustrative cases

The following cases illustrate the versatility of the ALT-VL(c) flap in covering extensive defects by widely separating the skin and muscle components (case 1) and its ability to optimise soft-tissue coverage in complex three-dimensional defects (case 2). In case 2, the entire ALT-VL(c) flap was harvested based on the oblique branch of the lateral circumflex femoral artery alone (leaving the descending branch *in situ*), demonstrating the reliability as well as the capacity of this pedicle to nourish a large volume of soft tissue.

Case 1

A 42-year-old man presented with a degloving defect over his left leg and foot. His Achilles tendon, the entire calcaneum as well as the distal tibia were exposed