THE *OBLIQUE BRANCH TRAP* IN THE HARVEST OF THE ANTEROLATERAL THIGH MYOCUTANEOUS FLAP

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A 67-year-old man with squamous cell carcinoma underwent reconstruction with a free anterolateral thigh myocutaneous flap. Unroofing the skin perforators found that the skin perforators originated from the oblique branch of the lateral circumflex femoral artery with no connections with the descending branch. Thus, the flap was harvested based on the oblique branch, leaving the descending branch in situ. Reconstruction was completed uneventfully and he had an excellent outcome at 1-year follow-up. The anterolateral thigh myocutaneous flap was reputed to be a technically easy flap to harvest. The perforators supplying the skin were visualized and a block of muscle incorporating the perforators harvested with the descending branch of the lateral circumflex femoral artery as the pedicle of the flap. However, not infrequently with this approach, the flap thus harvested has a well-perfused muscle component, whereas the skin component was not viable. This situation is explained anatomically by the potential occurrence of an alternative pedicle that supplies the anterolateral thigh flap, called the oblique branch of the lateral circumflex femoral artery. Our case presented here was a 'classic' intraoperative finding of this potential trap and the importance of defining the anatomy before committing oneself to the harvest by unroofing all the skin perforators was emphasized. © 2012 Wiley Periodicals, Inc. Microsurgery 32:631–634, 2012.

The anterolateral thigh (ALT) is today considered the choice donor site for a variety of reconstructive needs for its unsurpassed versatility and minimal donor morbidity.[1] Harvesting the flap as a myocutaneous flap is considered technically easy, once the intermuscular septum is opened, the perforators arising from the vastus lateralis (VL) muscle supplying the skin island are selected and the descending branch of the lateral circumflex femoral artery (LCFA) identified. The VL muscle proximal and distal to the skin perforator is then transected and the composite of skin, muscle, and descending branch of the lateral circumflex femoral artery harvested enbloc as a myocutaneous flap.[2] With this approach, it is *assumed* that the perforators supplying the skin component of the flap traverse the segment of the VL muscle between the proximal and the distal muscle transections of the muscle, to join the descending branch of the lateral circumflex femoral artery. This approach is so "simple" that even in situations where the muscle is not needed, some surgeons may elect to harvest a myocutaneous flap with a small piece of VL muscle to avoid the perceived risk of intramuscular dissection needed to elevate an ALT perforator fasciocutaneous flap as well as to achieve a quicker flap harvest. Although this is a reliable way to do it in many instances, this assumption may not be corrected in all cases.[3] Not uncommonly, having used this approach to harvest the flap, the muscle is well vascularized but the

skin component is not viable. This has been attributed to "anatomical variations" that render the inclusion of the skin component not possible in some cases. The exact anatomical reasons for this remain undefined for many of the cases. Recent breakthrough in the understanding of the ALT vascular anatomy has defined the exact anatomical reason for this occurrence.[1,3] Our case presented here illustrates how the "Oblique Branch Trap" is the cause of the lost of the skin component in the harvesting the ALT myocutaneous flap and detailed how one can safeguard against it by delineating the intramuscular course of the skin perforator before committing to the harvest.

CASE REPORT

A 67-year-old man with a T4N1M0 squamous cell carcinoma of involving the retromolar trigone and tongue underwent wide excision and radical neck dissection. This left a soft tissue defect of the buccal mucosa, soft palate, floor of mouth, and half the tongue. Reconstruction with a 15 cm × 8 cm ALT myocutaneous flap was planned. Intraoperative finding was as shown in Figure 1. This looked like a deceptively favorable situation for our purpose: 1) a large and long descending branch of the LCFA is present and 2) a sizable perforator supplying the skin was also present, ensuring good skin circulation. Flap harvest could be expediently completed by transecting the VL proximally and distally. This was classic set-up of what is known as the *Oblique Branch Trap*. The skin perforator was unroofed retrogradely, by division of that portion of the VL muscle covering the vessel, from its subfascial location to its source vessel, to define its course. In this case, the perforator was noted to run cephalically (instead of the expected transverse course across the VL muscle to join the descending branch) to originate
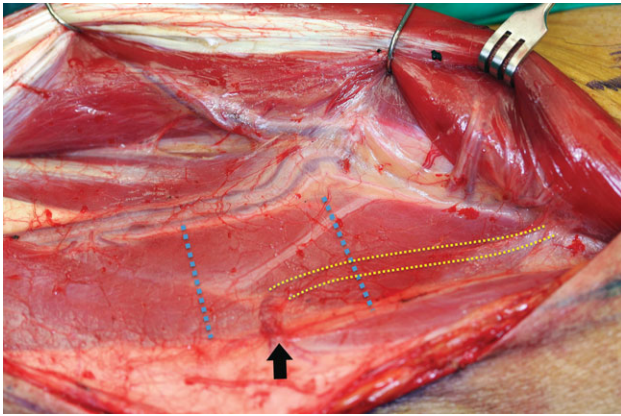
Figure 1. The intraoperative photograph of the left leg shows a deceptively favorable situation for the harvest of an ALT myocutaneous flap, with a large descending branch as the flap pedicle and a large perforator (arrow) to supply the skin component, seemingly arising from the descending branch. This is the oblique branch trap that one must be aware of. Harvesting the flap using conventional teaching by transecting the VL along the blue dotted line wound inevitably result in transection of the oblique branch (yellow dotted line), which in this case is the sole supply to the skin flap (This is an image of the left thigh, to orientate, the right side is cephalic, and the left side is caudal). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]
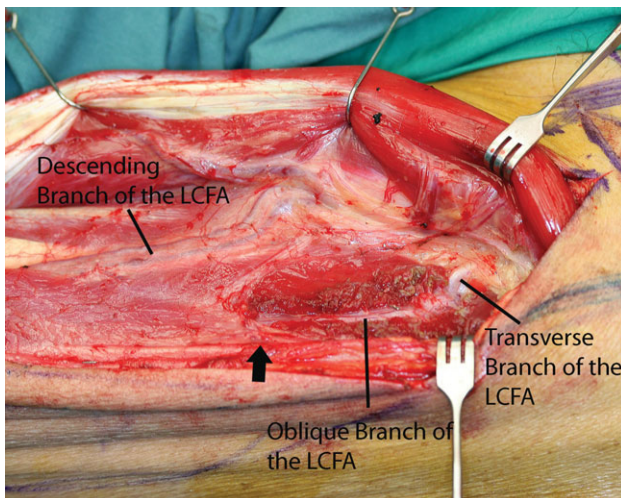

Figure 2. By unroofing the perforator (arrow) before committing to the harvest, it was demonstrated that perforator in fact arises from the oblique branch, which in turn originated from the transverse branch of the lateral circumflex femoral artery. Routine unroofing of the selected perforators to be used to vascularize the skin flap is strongly recommended to safeguard against the oblique branch trap in harvesting an ALT myocutaneous flap (This is an image of the left thigh, to orientate, the right side is cephalic, and the left side is caudal). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

from the oblique branch of the LCFA, which in turn originated from the transverse branch of the LCFA. It would be immediately evident, looking at the anatomy at this

Figure 3. The patient at 1-year follow up. The flap has mucosalized well and mobility of the tongue was excellent. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

stages (Fig. 2), that the oblique branch would inevitably be transected if the ALT myocutaneous flap was to be harvested using the conventional approach, with the descending branch as the flap pedicle. This constituted the *Oblique Branch Trap*. As the skin component was the priority in the reconstructive needs in this case and not much bulk is need, the flap was harvested as an ALT perforator flap with the oblique branch as the pedicle. Reconstruction was completely uneventful and he was discharged on the 12th postoperative day. At 1-year review, he was doing well with good quality speech and mobility of the remnant tongue (Fig. 3).

DISCUSSION

The oblique branch of the LCFA was described by Wong et al.[3] The oblique branch is present in the ALT in 34% of cases and when it is present, it may take over the blood supply to the skin of the ALT from the descending branch of the LCFA (Fig. 4). Not infrequently, the ALT skin is supplied by perforators arising exclusively from the oblique branch of the LCFA.[4] This case highlights the relevance of this branch in the harvest of an ALT myocutaneous flap. To safeguard against the "oblique branch trap," it is strongly recommended that when harvesting the ALT myocutaneous flap, the skin perforators supplying the skin
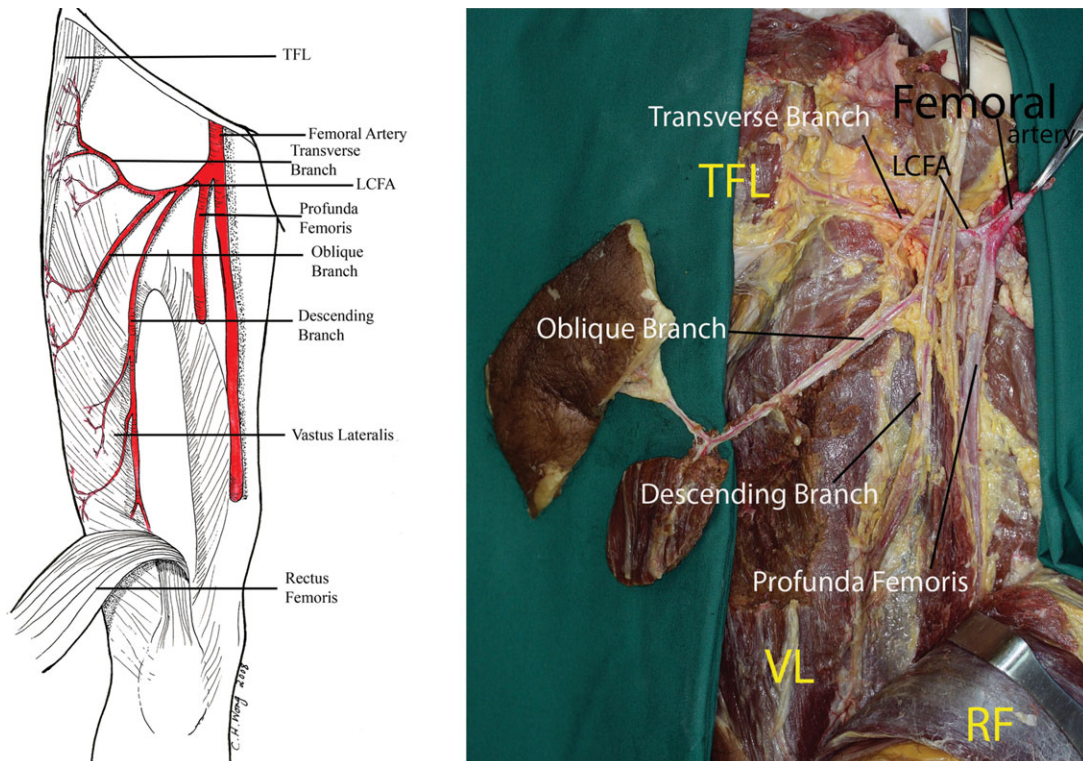
Figure 4. The oblique branch of the LCFA is a variably present (34%) vascular pedicle in the ALT that when present has a profound implication on the harvest of the ALT perforator or myocutaneous flaps. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

component should be *routinely* unroofed to define the exact anatomy before committing to the harvest.[1] If, as is most commonly the case, that the skin vessel arises from the descending branch and the oblique branch is absent, harvest can be completed as usual. In cases where the descending and oblique branches are present, so long as a sizable perforator supplying the skin arises from the descending branch, the oblique branch and its contributions can be ligated and myocutaneous flap harvested based on the descending branch.[1] As noted, the descending branch is the preferred flap pedicle when a choice is available as it is usually larger and longer than the oblique branch.[3] In rarer situations where the skin is supplied exclusively by the oblique branch, this pedicle would need to be included to ensure skin island survival. The flap can either be a myocutaneous flap or (as with our case presented here) if the muscle is not really needed, the flap can be harvested as a perforator-based fasciocutaneous flap based on the oblique branch. The oblique branch has been shown to be equally reliable as the flap pedicle as the descending branch although the surgeon has to be comfortable with microsurgical anastamosis of smaller vessels as the former is usually about 1 mm in diameter.[3] In a situation where a large portion or even the entire VL is needed and the skin is supplied by the oblique branch, two options are available. First, if the skin is need as well, both the descending and the oblique branch can be included with the flap by tracing proximally to a point where they converge, usually at the LCFA itself or the oblique branch may arise from the descending branch.[3] Second, only the muscle is harvested as a VL muscle flap based on the descending branch.[5]

The "chimeric" ALT skin and VL muscle flap are, in many ways, superior to the conventional ALT myocutenous flap as presented here. Their benefit is mainly that the skin and muscle component can be inset independent of each other, either to increase the area that can be covered or to optimize soft tissue coverage in difficult wounds.[6] However, the chimeric ALT is technically more demanding, requiring meticulous intramuscular dissection and precise selection of perforators supplying the skin as well as the muscle components. For selected defects, where the bulk of the muscle is needed to obliterate dead space, and do not require precise inset of the muscle component to optimize soft tissue coverage, the ALT myocutaneous design, with the skin and muscle harvested enbloc, as used in this case, is an acceptable alternative.

Finally, much has been noted about the anatomical variations of the ALT flap, which have resulted in much confusion and no clinically usable or consistent

classifications.[7–11] The "missing-link" in earlier descriptions is the failure to recognize that in a significant proportion of patients, an oblique branch of the LCFA may be present. Based on current understanding, the anatomical variations of the ALT can simply be classified as 1) *variation in the skin vessel supplying the ALT*, either musculocutaneous (87%) vs. septocutaneous (13%)[2] and 2) pedicle of the flap, either the descending or the oblique branches of the LCFA[3].

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