



# Lateral Approach to the Popliteal Artery for Free Tissue Transfer to the Lower Extremity

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**Summary:** Free tissue transfer to the proximal leg and knee requires appropriate recipient vessel selection. The popliteal vessels have historically been unpopular choices, due to their remote location often necessitating vein grafts, and need for prone positioning. In this report, we describe a lateral approach to the above-knee popliteal vessels, which was utilized for 2 cases of free tissue transfer to the lower extremity. Neither prone positioning nor vein grafts were needed. The lateral approach to the above-knee popliteal vessels and their branches is a viable option for the otherwise recipient vessel-depleted lower extremity. (*Plast Reconstr Surg Glob Open* 2016;4:e675; doi: 10.1097/GOX.0000000000000664; Published online 6 April 2016.)

Free flaps are commonly used for the reconstruction of distal lower extremity wounds resulting from diverse etiologies including trauma, amputation coverage, tumor extirpation, radiation wounds, infection, and prior orthopedic intervention.<sup>1,2</sup> Although free flaps are technically complex and demanding, surgeon experience with microsurgical technique increases the likelihood of success. Additionally, selection of appropriate recipient vessels in the lower extremity is important in obtaining successful outcome from the free tissue transfer.<sup>3,4</sup>

The ideal recipient vessel for lower extremity free flaps should be near the wound but outside the zone of injury, most commonly proximal to the wound.<sup>5</sup> In cases of proximal leg and knee injuries where local tissue transfer is not possible, free tissue transfer to the site is necessary. However, there is ongoing debate regarding which recipient vessel

should be used for these locations. Different authors have advocated for the use of popliteal, medial sural, descending geniculate artery, lateral femoral circumflex, and medial superior geniculate artery in these reconstructions.<sup>2,6-8</sup> Historically, the popliteal artery has not been a popular recipient vessel, owing to its deep course and necessity of placing the patient in the prone position. In this series, we report on the successful outcomes of free tissue transfer to the lower extremities using a lateral approach to the popliteal vessels.

## PATIENTS AND METHODS

We performed lower extremity free tissue transfer in 2 patients using the above-knee popliteal vessels as recipients accessed via a lateral approach. Patient hospital and clinic charts were reviewed and outcome documented. Both patients underwent standard preoperative medical optimization and vascular assessment with angiography.

## Surgical Technique

With the patient placed supine on the operating table and lower extremity extended, a 10-cm line is marked on the distal lateral thigh between the iliotibial band and the biceps femoris tendon. An incision is made sharply and carried down through the subcutaneous tissue. The iliotibial band is retracted anteriorly, the biceps femoris tendon retracted posteriorly, and

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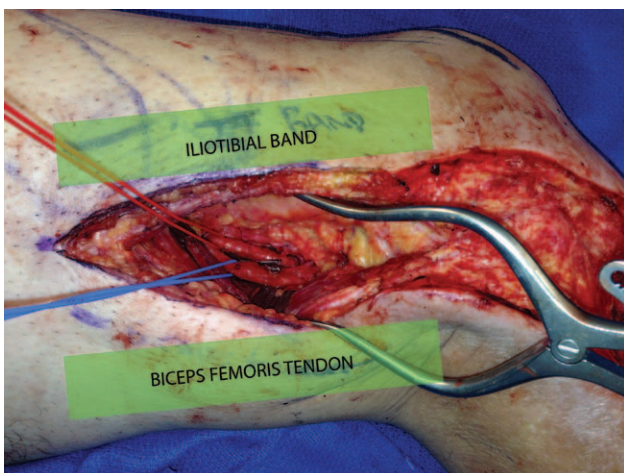
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dissection continues in the plane between the vastus lateralis and biceps femoris. Dissection proceeds until the sciatic nerve is encountered, which is identified and protected, and delicately retracted posteriorly. Further dissection will next reveal the popliteal vein and artery (Fig. 1). The vessels are circumferentially dissected to allow for adequate control if they are to be selected as microsurgical recipient vessels in an end-to-side fashion. It is our preference, however, to identify and select one of the many branches originating from the popliteal vessels for microanastomosis. By selecting a side branch as a recipient vessel, the recipient vessel is effectively lengthened, and it allows the surgeon to perform an end-to-end anastomosis. Preparation of the recipient vessels is performed using loupe magnification, and the anastomosis is performed using the surgical microscope. Adequate visualization and microscope positioning are accomplished by bumping the patient into a partial lateral position on a beanbag and “airplaning” the operating table away from the surgeon.

## CASE REPORTS

### Case 1

A 51-year-old man presented with a chronic proximal anterolateral right leg wound after resection of the proximal two thirds of his fibula and radiation therapy for Ewing sarcoma 18 years before. His wound was precipitated by a minor trauma 1 year before presentation, resulting in a continuously draining sinus tract. He underwent wound exploration and debridement, which resulted in a large (30×7cm) anterolateral leg defect with exposed bone.



**Fig. 1.** Intraoperative photograph depicting the lateral approach to the above-knee popliteal vessels. The incision is made between the IT band anteriorly and the tendon of the biceps femoris posteriorly. The popliteal vein is tagged with the blue vessel loop, and the popliteal artery is tagged with the red vessel loop.

Treatments with hyperbaric oxygen therapy, wound vac, and intravenous antibiotics were completed with minimal improvement to the site. The patient underwent free tissue transfer using an anterolateral thigh (ALT) fasciocutaneous perforator flap, with end-to-end microanastomosis to a branch off of the popliteal artery and 2 veins using the lateral approach (Fig. 2).

### Case 2

A 19-year-old man presented with a chronic nonhealing left below-the-knee amputation stump. His left leg was amputated below the knee after ischemic complications during an episode of *Staph aureus* sepsis 4 years before. He was found to have unstable stump soft tissue coverage with skin graft and heterotopic bone formation. The patient underwent excision of unstable scar and soft tissue, excision of heterotopic bone, and stump resurfacing with a free ALT fasciocutaneous perforator flap. His flap was anastomosed to branches of the popliteal vessels in end-to-end fashion using a lateral approach. A skin graft was placed medially, as the total area resurfaced was 20×30 cm (Fig. 3).

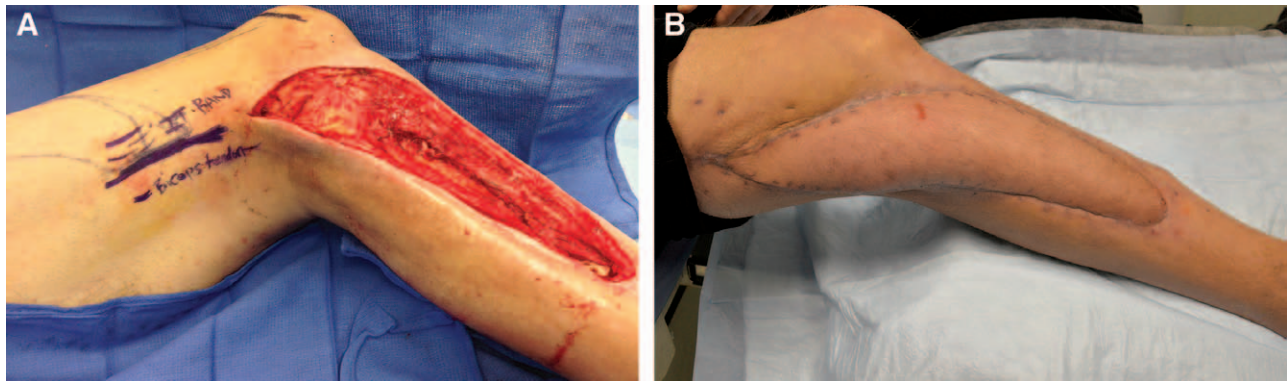
## RESULTS

Both patients underwent successful transfer of large ALT fasciocutaneous perforator flaps to branches of the above-knee popliteal artery. The anterior and posterior tibial vessels were not available recipients in either patient 1 or 2. Additionally, proximal medial recipient vessels such as medial genicular and descending geniculate were too remote from the laterally located wounds. Patient 1 had a large anterolateral leg defect with diffuse radiation fibrotic changes. Patient 2 had a diffusely scarred and indurated below-the-knee amputation stump after multiple revisions. Patient 1 underwent successful dangling protocol starting 2 weeks postoperatively. The patient became fully weight bearing and ambulating at 1 month postoperatively. At 6 months postoperatively, he remains healed and ambulating over a mile a day. Patient 2 underwent revision of his flap 5 months postoperatively to excise the medial skin graft and advance the flap. He was fitted for a new prosthesis and able to ambulate.

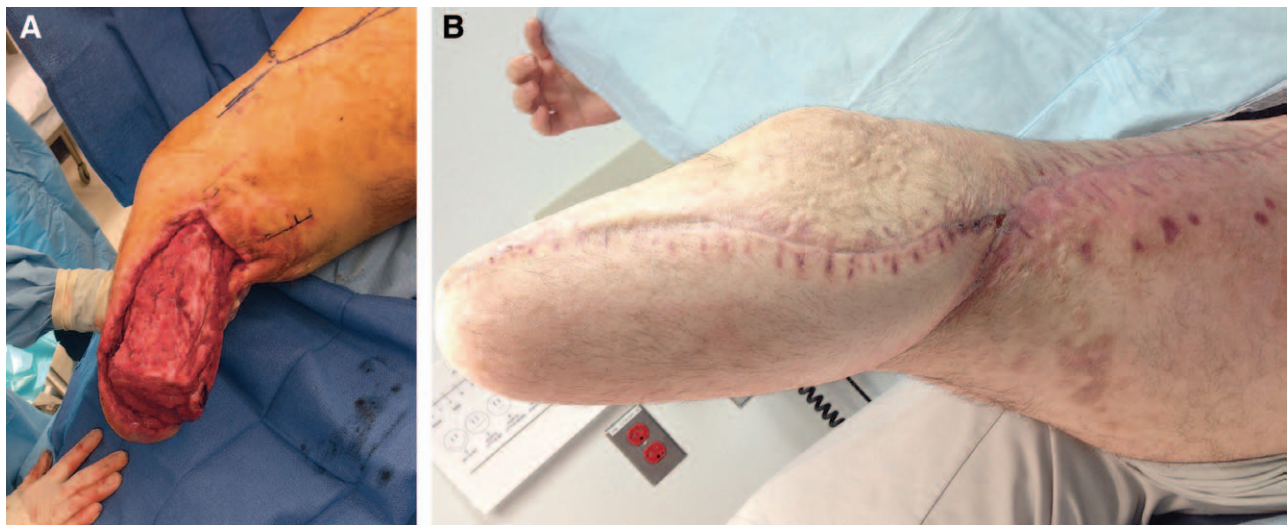
## DISCUSSION

In this series, we successfully performed free tissue transfer with anastomoses to branches off the above-knee popliteal vessels using a lateral approach. To the best of our knowledge, the lateral approach to popliteal vessels for free tissue transfer has not been previously published; however, the lateral approach has been previously described for arterial bypass in limb salvage, particularly in cases of prior scarring or open wounds precluding a medial approach.<sup>9,10</sup>

The popliteal vessels are rarely first choice recipients for free tissue transfer to proximal leg and knee



**Fig. 2.** The patient from case 1 with right lateral leg defect in the setting of irradiation. A, The markings demonstrating the lateral approach to the above-knee popliteal recipient vessels; B, flap fully healed at 3 months postoperatively.



**Fig. 3.** The patient from case 2 with a left traumatic below knee amputation and inadequate soft-tissue coverage posterolaterally; A, after debridement of unstable scar and skin graft; B, flap fully healed at 3 months postoperatively.

wounds due primarily to difficulty with exposure.<sup>5</sup> Traditionally, the popliteal vessels are accessed via a posterior approach.<sup>11</sup> When the posterior approach to the popliteal vessels is used, vein grafts may be necessary owing to their often remote location from the wound.<sup>5,7,12</sup> Vein grafts add to the microsurgical complexity of the case and may increase thrombosis risk given the multiple anastomoses and varying vessel caliber.<sup>7</sup>

Although the depth of the vessel posteriorly can make microsurgery challenging, Hoballah et al<sup>9</sup> found that via a lateral dissection the popliteal vessels were only 2–3 cm deep. Additionally, by identifying one of the many branches arising from the popliteal vessels above the knee, the recipient vessels are effectively lengthened, and a flap with a long pedicle such as the ALT had no difficulty reaching the recipient through the lateral access incision. No vein grafts were needed in our series.

The below-knee popliteal vessels are also accessible via a lateral approach but not without potential for significantly more morbidity. In the most commonly described dissection, the proximal quarter of fibula is removed and the insertion of the biceps femoris killed.<sup>10</sup> Bone cuts are often made blindly, placing the deeper peroneal and popliteal vessels at risk of injury. The less commonly employed fibula preserving lateral approach to the below knee popliteal artery still places the common peroneal nerve in jeopardy from direct injury or compression as it courses around the fibular neck.<sup>13</sup>

The medial genicular, saphenous artery, and descending genicular arteries have been described in the literature for use in microsurgical reconstruction around the knee.<sup>2,8</sup> Although these are reliably present vessels, their location makes lateral leg defects difficult to cover without the use of interpolating vein grafts.

The advantages of the lateral above-knee popliteal artery approach include its reliable anatomy and ease of dissection during which the patient can remain supine. Visibility during the microsurgical anastomosis can be enhanced with beanbag aided lateral positioning. When combined with an ALT flap, a 2-team approach can be utilized, and use of the ipsilateral thigh for flap donor site aids in post-operative recovery by limiting surgery to 1 extremity. In both of our cases, end-to-end anastomoses were performed with branches off the popliteal vessels; however, if suitable branches are not found, a more difficult end-to-side anastomoses could be performed to the popliteal artery itself.

### CONCLUSIONS

Choosing the appropriate recipient vessel in lower extremity free tissue transfer is vital to a successful reconstruction. In patients with limited recipient vessels, a lateral approach to the above-knee popliteal vessels offers a viable option and may preclude the need for vein grafting or prone positioning.

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