Case Report/Case Series

Auto Flow-Through Technique for Anterolateral Thigh Flaps

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IMPORTANCE The vascular supply of anterolateral thigh (ALT) free flaps is variable, and the pedicle length and ability to capture perforators to the flap may be limited by the anatomic configuration. We describe the reasoning behind performing the auto flow-through procedure, as well as the steps to carry this procedure out.

OBSERVATIONS A retrospective medical chart review was performed within our health care system database to identify patients in whom the auto flow-through technique was used during reconstruction with an ALT free flap. The auto flow-through technique was applied to 3 separate ALT free flaps to incorporate perforators from 2 separate vascular systems. This technique allowed for more robust vascularity of the flap and/or optimized pedicle length that would have otherwise necessitated vein grafts. All patients had successful ALT free flap reconstruction and went on to have good functional results.

CONCLUSIONS AND RELEVANCE The auto flow-through technique is an adaptation of the flow-through flap, which allows for capture of vascular perforators from separate sources when this configuration is present in the ALT free flap. This technique is especially useful when operating in a vessel-depleted neck or when maximizing pedicle reach is necessary. This technique allows the ALT to be used in challenging reconstruction cases regardless of the vascular branching pattern of the pedicle.

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The anterolateral thigh (ALT) flap is a well-established reconstructive option for many head and neck defects. Part of its appeal is low donor site morbidity, the ability to use a 2-team approach for reconstruction, and the large cutaneous paddle that one is able to obtain with the flap. However, there is some apprehension among reconstructive surgeons in using the flap, given the variability in pedicle and perforator systems. The auto flow-through technique allows one to incorporate separate perforators that arise from different pedicles without shortening pedicle length or necessitating isolation of additional neck vasculature. This enables the surgeon to adapt to a vessel-depleted neck or geometry that precludes a second anastomosis.

The ALT flap was first introduced in 1984 by Song et al.1 and has since gained great popularity in reconstructing defects of the head and neck. This increase in use is largely attributed to a better understanding of the variation in the vascular anatomy of the flap2 and the perforator course in supplying the overlying muscle, fascia, and skin. According to a review of 672 flaps, musculocutaneous perforators account for 87% of the flaps, whereas septocutaneous perforators occur in 13% of flaps.3 Not only has dissection of the perforators been shown to be safe, it is also essential given the anatomic variations of the pedicle. In the majority of cases, the pedicle itself comes off the descending branch of the lateral circumflex femoral artery (LCFA). The variations in the dominant pedicle, however, are as high as 16% to 32% and can complicate the harvest.4,5 The lateral circumflex femoral artery can give rise to both the transverse and oblique branches, the latter having been shown to be the predominant pedicle in 14% of cases.6 The oblique branch has been shown to come off the descending branch of the LCFA, the transverse branch, the LCFA, deep femoral artery, and the femoral artery.6

In tracing out the predominant pedicle of the ALT, Wong et al.2 describe 3 scenarios: the musculofasciocutaneous flap is supplied by the descending branch of the LCFA, the oblique branch exclusively, or contributions from both the oblique and descending branch of the LCFA. In the last scenario, 2 anastomoses can be performed if the desired skin paddle is designed over both perforators. There are situations, however, where 2 anastomoses are not feasible. One clinical scenario includes a shortage of recipient vessels in the neck, as can often be seen in salvage chemoradiation failures. Another situation that limits the ability to perform a second anastomosis is unfavorable pedicle orientation.

Anterolateral thigh flow-through flaps, which provide vascularization of an additional flap through the distal descending circumflex femoral vessels, have been described in the set-
We describe a series of cases in which an auto flow-through technique was used to incorporate perforators from dual systems for the ALT flap, thereby increasing pedicle length and flap vascularity and requiring only a single arterial and venous supply.

**Methods**

The study was approved by the institutional review board at the Cleveland Clinic. A retrospective medical chart review was
performed, which identified 3 patients in whom an auto flow-through technique was used to incorporate perforators from 2 separate systems. The patients were identified within a database maintained by the senior surgeon (M.A.F.), and all operations were performed by the senior surgeon.

The auto flow-through technique is used when perforators to the flap from both descending circumflex femoral and transverse circumflex femoral sources are encountered and capture of both sets is believed to be necessary to ensure flap viability. In the few cases in which this technique was used, both systems could not be traced proximally to a common source without sacrificing the major nutrient vessel to the rectus femoris (2 cases) or use of the proximal transverse system would have compromised needed pedicle length (1 case).

The technique itself simply involves anastomosis of the proximal descending circumflex pedicle to native neck vessels and then performing a second anastomosis between the distal descending circumflex femoral vessels and the proximal transverse circumflex femoral pedicle. As a result, both systems are supplied by a single cervical source, and the reach of the transverse vessels is increased by the overall length of the descending circumflex pedicle (Figure 1 and Figure 2).

Report of a Case

A 59-year-old woman presented with a large pleomorphic adenoma extending from the hard palate to the nasal cavity. She underwent resection of her entire hard palate except the tooth-bearing alveolar arch and proximal soft palate as well as her inferior nasal septum (Figure 3). Given the preservation of critical bony support, an ALT fascia flap was selected for reconstruction.

Two perforator systems were identified during the harvest: 1 perforator emanated from the descending branch of the LCFA and 2 others branched from the transverse system. Given that the pedicle needed to reach from the facial artery and vein to the palate, a second anastomosis of the shorter transverse pedicle was not a viable option. An auto flow-through technique was therefore used to ensure robust vascularity of the flap. The descending system was anastomosed to the facial artery and vein, which were isolated using a minimal access 4-cm incision just underneath the facial notch, and a second anastomosis was performed in the oral cavity lateral to tooth #6 between the transverse circumflex femoral artery and vein and the distal descending pedicle (Figure 4). The flap remained viable and the patient’s postoperative course was uneventful. Follow-up

Figure 3. Pleomorphic Adenoma: Intraoperative and Postresection Photographs

A, Intraoperative photograph showing a large pleomorphic adenoma involving the entire palate and extending into the nasal cavity. B, Same patient after resection of the pleomorphic adenoma sacrificing the entire hard palate and inferior septum. The posterior soft palate and entire alveolar arch was preserved.

Figure 4. First and Second Anastomosis for the Auto Flow-Through

A, Intraoperative photograph showing minimal access (4-cm) incision under the facial notch used to access the facial vessels where the descending system was anastomosed. B, Photograph showing the second anastomosis (arrow) of the distal descending system to the proximal transverse system (adjacent to tooth #6), completing the auto flow-through.
The ALT flap is a well-established reconstructive option for many head and neck defects. Part of its appeal is low donor site morbidity, the ability to use a 2-team approach for reconstruction, and the large cutaneous paddle that one is able to obtain with the flap. However, there is some apprehension among reconstructive surgeons in using the flap, given the variability in pedicle and perforator systems. The auto flow-through technique allows one to use flaps based on separate perforators that arise from different pedicles. This enables the surgeon to adapt to a vessel-depleted neck or geometry that precludes a second anastomosis. We agree with Kimata et al that, when possible, the nutrient vessel to the rectus should not be sacrificed in an effort to improve pedicle length, owing to the potential sequelae of postoperative contracture of the thigh. Another added benefit of the auto flow-through technique is that pedicle length can be effectively lengthened without disrupting the blood supply to the rectus femoris, avoiding this complication.

Regarding limitations of this technique, in our very limited series, there have been few. Vessel size mismatch has not been an issue because the caliber of the descending pedicle appears to be consistently maintained through its course down the upper half to two-thirds of the vastus lateralis, which is likely the rationale for its previous use in multiple flow-through techniques.

Regarding necessity of this technique, we have reserved it for 2 indications: (1) large flaps with single or diminutive perforators from each system where we thought it would be optimal to supercharge vascular supply and (2) situations where vascular pedicle reach would have precluded reconstruction without use of vein grafts (as in the depicted case). In this situation, the large defect and corresponding large fascial flap would have been perfused by a single nondominant perforator from the descending system with marginal reach to the defect. The technique was used both to ensure robust vascularity with multiple perforators (very important in folded fascial flaps, where during inset, avoiding perforators can be challenging) and to extend flap reach.

We have considered this technique on other occasions, but after robust backflow was observed through the transverse system after anastomosis of the descending system, we believed that this was not necessary and simply ligated the transverse vessels. In other situations with plentiful vessels and easy pedicle reach, we perform separate anastomoses, which is clearly a more optimal method of insuring vascularity when amenable.

In conclusion, the auto flow-through technique can be a useful tool to circumvent limitations, which may be encountered because of variable perforator patterns in the ALT flap. It allows for increased pedicle length and increased vascularity using a single set of cervical vessels when the perforator anatomy may otherwise be prohibitive.

**REFERENCES**