Superficial Inferior Epigastric Artery Flap Salvage Technique Using Deep Inferior Epigastric Artery Graft

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Summary: Superficial inferior epigastric artery (SIEA) flap salvage remains challenging, particularly in cases of arterial insufficiency due to vessel spasm, pedicle kinking, or thrombosis. The already small, short SIEA pedicle, in addition to its inherent tendency toward spasm, renders the SIEA flap more difficult to manage when anastomotic revision is required. Furthermore, arterial thrombosis will cause dilation of the internal mammary artery, exacerbating vessel mismatch. In our previously published experience with 145 SIEA flaps, no flap with postoperative arterial thrombosis was salvageable. Following this experience, a new salvage technique using deep inferior epigastric artery grafts has been utilized and is described here. (Plast Reconstr Surg Glob Open 2018;6:e1528; doi: 10.1097/GOX.0000000000001528; Published online 12 January 2018.)

CASE SERIES

Case 1

A 32-year-old female underwent delayed right breast reconstruction with a 1020g ipsilateral superficial inferior epigastric artery (SIEA) flap.1 Arterial pedicle length and diameter were 5 cm and 1.25 mm, respectively, with 2:1 arterial mismatch. Two hours postoperatively, a 20% drop in ViOptix (ViOptix, Inc., Fremont, Calif.) signal occurred with loss of cutaneous Doppler signal. Upon exploration, arterial thrombosis with patent venous anastomosis was noted, and arterial thrombectomy was performed. The right rectus abdominis (RA) sheath was incised longitudinally just lateral to the inferior RA, and deep inferior epigastric artery (DIEA) was harvested. A 2-cm graft was interposed between the internal mammary artery (IMA) and SIEA, decreasing mismatch to 1.5:1 and allowing the arterial pedicle to assume a less acute angle. The patient recovered well with complete flap salvage and no fat necrosis at 7-month follow-up.

Case 2

A 53-year-old female underwent delayed breast reconstruction with a right SIEA flap and left deep inferior epigastric artery perforator (DIEP) flap. The SIEA flap weight was 1031 g, and pedicle length was 5 cm with arterial diameter of 1.5 mm and recipient IMA diameter of 2.75 mm. Venous anastomosis was performed using a 3-mm coupler. The patient was discharged home on postoperative day 3 but returned on postoperative day 5 after noting right flap discoloration that started the previous night (see figure, Supplemental Digital Content 1, which displays a delayed presentation on postoperative day 5 with signs of flap ischemia, http://links.lww.com/PRSGO/A595).

She underwent exploration where both arterial and venous thromboses were identified. After minimal venous thrombectomy and irrigation, venous blood spontaneously drained. Following arterial thrombectomy, a 12-cm segment of DIEA was harvested from the left abdomen. Both arterial and venous anastomoses were revised using DIEA grafts, 6 cm in length (Fig. 1), hand-sewn with 9-0 nylon suture. Flow was confirmed with indocyanine green fluorescent imaging, and a small portion of the inferior flap was excised due to poor perfusion (see figure, Supplemental Digital Content 2, which displays intraoperative indocyanine green fluorescent imaging demonstrating good perfusion throughout majority of flap and marking of poorly perfused inferior portion of flap planned for excision, http://links.lww.com/PRSGO/A596; see figure, Supplemental Digital Content 3, which displays flap appearance at conclusion of pedicle revision, http://links.lww.com/PRSGO/A597). Eight hours postoperatively, there was a...

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progressive decline in ViOptix signal, with 30% drop over 1 hour with characteristic curve of arterial insufficiency\(^2\) and loss of cutaneous Doppler signal. Decision was made against reexploration, given previous prolonged period of flap compromise, and on postoperative day 10, flap debridement and immediate reconstruction with a pedicled latissimus dorsi myocutaneous flap was performed.

**Case 3**

A 43-year-old female underwent immediate bilateral breast reconstruction with right SIEA and left DIEP flaps. The SIEA flap weight was 823 g, and pedicle length was 6 cm with donor arterial diameter 1.5 mm and recipient IMA perforator diameter 1 mm. Two hours postoperatively, the patient had an episode of retching, and the right flap arterial signal was lost. Upon exploration, arterial Doppler signal was present on the IMA perforator and immediately distal to the anastomosis, but no signal was present as the SIEA entered the flap, consistent with spasm and insufficient inflow (Fig. 2). While leaving the flap partially perfused by the IMA perforator, the IMA was exposed with resection of the third costal cartilage. A 7 cm left DIEA graft was harvested. The IMA was anastomosed to the DIEA graft. The SIEA/IMA perforator anastomosis was divided, and the distal end of the DIEA graft was anastomosed to the SIEA, restoring flow (Fig. 3). The patient recovered uneventfully and was discharged home on postoperative day 4. No fat necrosis of the right flap has been noted at 4-month follow-up (Fig. 4).

**DISCUSSION**

Success rate of the SIEA flap has been reported over 95%,\(^1\) but known limitations of this flap include arterial spasm and insufficiency leading to thrombosis.\(^3\)\(^-\)\(^5\) SIEA flap salvage is challenging, and we formerly had no cases of successful flap salvage following arterial thromboses within our published series.\(^1\) However, cases 1 and 3 described above represent the first of such successes. Of note, in this series, patients 1 and 2 underwent spatulation of the SIEA at the time of initial arterial anastomosis, and no revision of the primary anastomosis was performed in any of the cases. Should arterial complications arise, we now advocate the use of reversed DIEA graft for pedicle revision.

Buchel et al.\(^6\) have advised that pedicle length should be double flap height to allow for anastomosis and inset, and arterial mismatch should be less than 2:1. Using DIEA graft achieves these goals by providing sufficient length to allow the pedicle to assume a less acute angle as it extends from the IMA to the superficial aspect of the flap and by correcting mismatch. Reversing the DIEA allows the most
The distal portion of the graft (segment that enters RA), where caliber is smallest, to be used for SIEA anastomosis. If venous revision is also required, the most proximal portion (segment closest to iliac origin) of the DIEA is appropriate for interposition between the IMV and thick-walled SIEV.

Other SIEA flap salvage techniques have been described, including the use of the retrograde internal mammary vessels for anastomosis. This technique is limited in that it does not increase pedicle length or correct kinking. Use of vein, rather than artery, for graft is also possible. However, we assert that matching the size of the SIEA and vein graft can be challenging, and thick-walled vessels like the SIEV are ideally suited for use of arterial graft with hand-sewn anastomosis. Our technique differs from the SADIE flap in that SADIE utilizes vein graft, and in SADIE the deep vessels are harvested prophylactically to correct mismatch, not for flap salvage.

Criticism of this technique includes violation of the rectus fascia to obtain graft. In transverse rectus abdominis myocutaneous and DIEP flap harvest, the abdominal wall weakens as muscle dissection and harvest increases, particularly in the upper abdomen. With our technique of DIEA graft harvest, however, fascia incision is limited, no muscle is sacrificed, no motor nerves are injured, and dissection is confined to the lower abdomen. Therefore, we assert that the abdominal wall morbidity from DIEA graft harvest will be minimal. Finally, although the SIEA flap in case 2 was ultimately lost despite a period of flow restoration, we largely attribute the flap failure to delayed presentation and associated alteration in flap physiology that could not be reversed.

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Fig. 4. Case 3—Flap appearance at 4-month follow-up.