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Breast

A Novel Strategy to Supercharge a Deep Inferior Epigastric Artery Perforator Flap after Port-a-Cath Removal

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Summary: Autologous breast reconstruction using the deep inferior epigastric artery perforator (DIEP) flap has become increasingly popular because of its unique advantages. However, compared with some other forms of abdominal-based autologous reconstruction, DIEP flaps are associated with an increased risk of venous congestion. Many techniques—or lifeboats—have been introduced to diagnose and treat this potentially devastating complication. In this case report, we describe a novel strategy to augment venous drainage when venous congestion is encountered. A patient presented requesting autologous reconstruction and removal of a venous access catheter that had been used for chemotherapy administration. We performed left delayed breast reconstruction using a single-perforator DIEP flap from the right hemiabdomen. The superficial inferior epigastric vein to this flap was preserved. After removal of the Port-a-Cath from the left chest, we anastomosed the superficial inferior epigastric vein to the fibrous capsular sheath that had formed around the indwelling catheter to allow additional venous drainage. Flow through this conduit was confirmed using Doppler ultrasound. There were no flap-related complications, and the patient was discharged in good condition. Further research is warranted to characterize the indications and limitations of this novel lifeboat. *(Plast Reconstr Surg Glob Open 2016;4:e1031; doi: 10.1097/GOX.0000000000001031; Published online 29 December 2016.)*

The deep inferior epigastric artery perforator (DIEP) flap has become an established option for autologous breast reconstruction because of its safety, reliability, and decreased donor-site morbidity.[1] However, a disadvantage is the increased risk of venous congestion compared with transverse rectus abdominis myocutaneous flap reconstruction.[2] To address this problem, numerous techniques have been introduced to augment venous drainage.[3] Here, we present a novel strategy to improve venous drainage during DIEP flap reconstruction utilizing a fibrous capsular tract created by the presence of an indwelling Port-a-Cath.

CLINICAL CASE

The patient is a 51-year-old female who previously underwent lumpectomy and radiation for right breast ductal carcinoma in situ. She was later diagnosed with ipsilateral invasive ductal carcinoma, for which she underwent completion mastectomy and contralateral prophylactic mastectomy. Bilateral tissue expanders were placed prepectorally. Her postoperative course was complicated by infection of the right chest requiring expander removal. After completing oncologic treatment, she presented to our institution for removal of the left expander and bilateral autologous reconstruction. She requested that a Port-a-Cath located in her left chest that had been used for chemotherapy be removed during surgery as it was no longer needed.

The patient underwent right delayed breast reconstruction with a contralateral hemiabdominal superficial inferior epigastric artery flap, left tissue expander removal, and left delayed reconstruction with a contralateral hemiabdominal DIEP flap. During DIEP flap elevation, a robust superficial inferior epigastric vein (SIEV) was noted and preserved. This flap was based on a single medial row perforator. After anastomosis to the internal mammary vessels, the SIEV became moderately engorged (Fig. 1). A decision was made to augment venous drainage by an additional anastomosis of the SIEV, which was noted to be in close proximity to the Port-a-Cath.

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The Port-a-Cath was approached through its previous healed incision. Care was taken to preserve the fibrous capsular sheath that had formed around the catheter (Fig. 2). A Valsalva maneuver was initiated during catheter removal to prevent air embolus. The SIEV was brought through a subcutaneous tunnel and was microsurgically anastomosed to the fibrous capsular sheath with a 3.0-mm venous coupler (Fig. 3; **See video, Supplemental Digital Content 1**, which displays the SIEV (left), which is microsurgically anastomosed to the fibrous capsule sheath (right) using a 3.0-mm coupler. This video is available in the "related videos" section of the full-text article on PRSGlobalOpen.com or available at ***http://links.lww.com/PRSGO/A348***). Patent flow was noted through the SIEV and sheath using hand-held Doppler.

Postoperatively, there were no complications, and the patient was discharged in good condition. At 1-month follow-up, flaps were healthy with no signs of loss.

DISCUSSION

Because of its safety, reliability, and ease of harvest, the use of abdominal tissue for autologous breast reconstruction has become the standard of care. The transverse rectus abdominis myocutaneous flap is a suitable option in many cases; however, techniques that preserve rectus abdominis integrity have gained popularity because of decreased donor-site morbidity. At our institution, we routinely employ as the primary reconstructive option muscle-sparing techniques such as DIEP and superficial inferior epigastric artery flaps.[4] However, there remain difficulties with such refined techniques, with insufficient venous output and fat necrosis being common problems.

The incidence of venous congestion in DIEP reconstruction is reportedly 3% to 27%.[3] Authors have introduced a variety of methods to minimize this risk, including optimal perforator selection. Preoperatively, some advocate the use of imaging to assist in this, citing improved operative planning.[5] However, this has demonstrated nei-

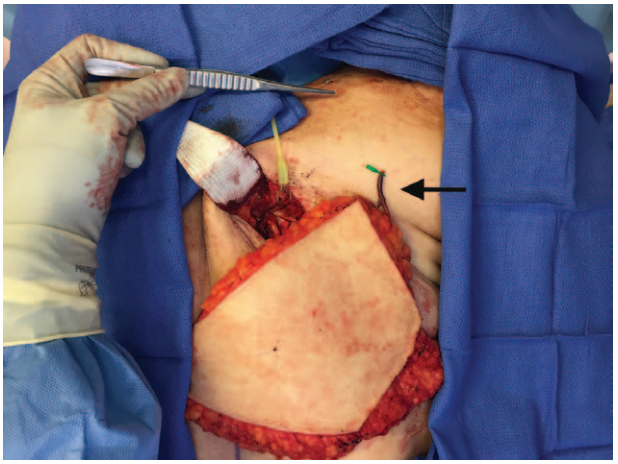


Fig. 1. After microsurgical anastomosis of the perforating vessels to the internal mammary vessels, the SIEV is noted to be tense (arrow). The venous catheter port in the patient's left chest is noted by the tip of the forceps.

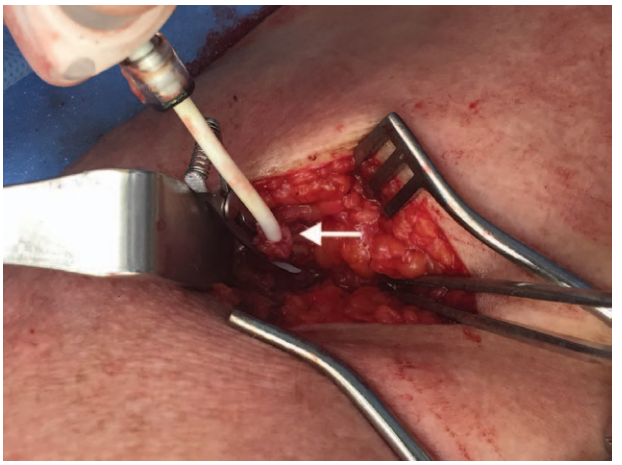
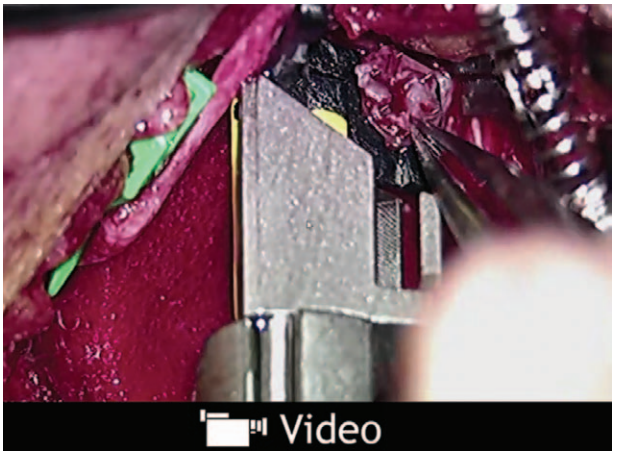


Fig. 2. The indwelling venous catheter and port are removed. Note the fibrous sheath surrounding the catheter (arrow).

Fig. 3. The SIEV (*) has been brought through a subcutaneous pocket to the level of the fibrous capsule sheath (**) after venous catheter removal.



Video Graphic 1. See video, Supplemental Digital Content 1, which displays the SIEV (*left*), which is microsurgically anastomosed to the fibrous capsule sheath (*right*) using a 3.0-mm coupler. This video is available in the "related videos" section of the full-text article on PRSGlobalOpen.com or available at ***http://links.lww.com/PRSGO/A348***.

ther improved outcomes nor a lower incidence of venous congestion, and the associated cost may be prohibitive.

Another preventative method relies on surgeon judgment. During flap elevation, the surgeon must decide if a selected perforator is sufficient. Experience is key, but surgeons can also use additional intraoperative information, such as whether a ligated SIEV is engorged, to guide their decision making. Nevertheless, even experienced surgeons will encounter cases of inadequate venous drainage. When this occurs, alternate techniques to augment venous drainage—sometimes referred to as lifeboats—must be employed.

The first step after venous congestion is identified is to evaluate the anastomosis, pedicle, and flap for a mechanical issue. When conservative maneuvers fail, mechanical augmentation of venous flow may be required. Oftentimes, the flap will have an additional deep vein or SIEV available. The ability to perform an additional venous anastomosis often depends on the presence of a suitable recipient vein.

The use of both internal mammary veins or the distal internal mammary vein stump in a retrograde fashion has been advocated.[6] An additional strategy is to anastomose the SIEV and the deep inferior epigastric vein or vena comitantes, effectively turbocharging the flap, to more efficiently drain the superficial and deep venous systems together.[7] In cases of a dominant superficial venous system or a deficiency of internal mammary drainage, the SIEV can be anastomosed to an alternate recipient target within the cephalic or external jugular systems.[8,9] If no alternate recipient is available, leech therapy and decompression of the venous system using temporary venous catheters have been reported.[10]

Here, we report for the first time utilizing the fibrous capsule that characteristically forms around a long-standing indwelling venous catheter to supercharge and facilitate augmented venous drainage in DIEP flap reconstruction. We preserved the fibrous capsular sheath surrounding the Port-a-Cath after removal, so that it could serve as a conduit for the SIEV to drain into the subclavian venous circulation. Although this report serves as a proof of concept for the use of this technique, further research is necessary to better characterize its indications and limitations. For example, it is not known whether venous flow through a fibrous capsule is maintained for the long-term or if thrombosis occurs. However, augmented venous drainage is probably only necessary during the initial 2 to 3 weeks postoperatively while the flap revascularizes. Once this process is complete, an accessory drainage system may no longer be needed. An additional limitation is that this option is useful only when removal of the venous access device will not impede further cancer treatment. Catheter removal must, therefore, be discussed preoperatively with the patient (and ideally her oncologist).

CONCLUSIONS

We report for the first time the use of the fibrous capsular sheath that formed around an indwelling venous catheter to augment venous drainage in DIEP flap reconstruction. Further research is necessary to characterize the indications and limitations of this novel technique.

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REFERENCES

1. Gill PS, Hunt JP, Guerra AB, et al. A 10-year retrospective review of 758 DIEP flaps for breast reconstruction. *Plast Reconstr Surg.* 2004;113:1153–1160.
2. Blondeel PN, Arnstein M, Verstraete K, et al. Venous congestion and blood flow in free transverse rectus abdominis myocutaneous and deep inferior epigastric perforator flaps. *Plast Reconstr Surg.* 2000;106:1295–1299.
3. Galanis C, Nguyen P, Koh J, et al. Microvascular lifeboats: a stepwise approach to intraoperative venous congestion in DIEP flap breast reconstruction. *Plast Reconstr Surg.* 2014;134:20–27.
4. Park JE, Shenaq DS, Silva AK, et al. Breast reconstruction with SIEA flaps: A single-institution experience with 145 free flaps. *Plast Reconstr Surg.* 2016;137:1682–1689.
5. Rosson GD, Williams CG, Fishman EK, et al. 3D CT angiography of abdominal wall vascular perforators to plan DIEAP flaps. *Microsurgery* 2007;27:641–646.
6. Kerr-Valentic MA, Gottlieb LJ, Agarwal JP. The retrograde limb of the internal mammary vein: an additional outflow option in DIEP flap breast reconstruction. *Plast Reconstr Surg.* 2009;124:717–721.
7. Tseng CY, Lang PO, Cipriani NA, et al. Pedicle preservation technique for arterial and venous turbocharging of free DIEP and muscle-sparing TRAM flaps. *Plast Reconstr Surg.* 2007;120:851–854.
8. Niranjan NS, Khandwala AR, Mackenzie DM. Venous augmentation of the free TRAM flap. *Br J Plast Surg.* 2001;54:335–337.
9. Mehrara BJ, Santoro T, Smith A, et al. Alternative venous outflow vessels in microvascular breast reconstruction. *Plast Reconstr Surg.* 2003;112:448–455.
10. Caplin DA, Nathan CR, Couper SG. Salvage of TRAM flaps with compromised venous outflow. *Plast Reconstr Surg.* 2000;106:400–401.