


## CASE REPORT

# Successful free flap salvage upon venous congestion in bilateral breast reconstruction using a venous cross-over bypass: A case report

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Abdominal free flaps such as the muscle sparing transverse rectus abdominis myocutaneous (ms-TRAM) or deep inferior epigastric artery perforator (DIEP) flap represent the gold standard in autologous breast reconstruction. We describe a salvage procedure during bilateral free flap breast reconstruction due to insufficient venous drainage using a venous cross-over bypass. A 54-year-old woman with a thrombosis of the left subclavian port-system in the medical history was elected for simultaneous bilateral breast reconstruction with ms-TRAM and DIEP flaps. Intraoperatively, a venous congestion of the DIEP flap, which was connected to the left cranial internal mammary vessels, appeared. In the absence of sufficient ipsilateral venous recipient vessels, we performed a salvage procedure requiring a 15 cm small saphenous vein graft and presternal subcutaneous tunneling. The flap vein was anastomosed end-to-end with the contralateral caudal internal mammary vein using a coupler system. The postoperative course was uneventful and both flaps survived. We describe the cross-over venous emergency bypass as a useful tool in unexpected venous thrombosis during bilateral free flap breast reconstruction.

## 1 | INTRODUCTION

Following the establishment of the pedicled latissimus dorsi flap in 1972 and the pedicled transverse rectus abdominis myocutaneous (TRAM) flap in 1983, reconstructive breast surgery has experienced a consequent evolution. Undoubtedly, autologous breast reconstruction improves the quality of life in patients upon mastectomy (Ludolph et al., 2015).

The free TRAM flap with its muscle sparing variations is a popular method for autologous breast reconstruction. Since its introduction in 1989 the deep inferior epigastric artery perforator (DIEP) flap has become a favorable option due to its lower donor side morbidity. Mostly, the internal mammary artery and vein serve as recipient vessels due to their reliable location, large vessel diameter and high flow (Saint-Cyr, Youssef, Bae, Robb, & Chang, 2007). Current advances in microsurgery allow simultaneous bilateral breast reconstruction using free abdominal or transverse musculocutaneous gracilis flaps (Bodin et al., 2015; Momeni & Kanchwala, 2016).

Although autologous breast reconstruction has become a safe procedure in high volume centers, venous congestion remains a

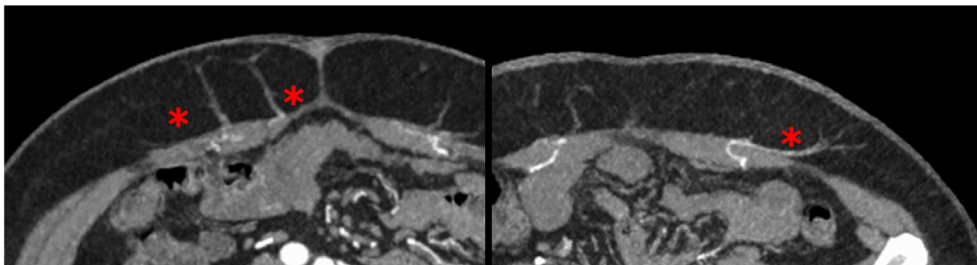
serious complication. Here, we describe a case of insufficient venous flow in the ipsilateral mammary vein and consecutive venous flap congestion in simultaneous bilateral breast reconstruction. Using a 15 cm long saphenous vein graft anastomosed to the contralateral internal mammary vein and subcutaneous presternal tunneling, we were able to provide sufficient venous drainage.

## 2 | CASE REPORT

We report on a 54-year-old woman with a history of axilla dissection and radiation therapy upon cancer of unknown primary syndrome of the right axilla. Continuative diagnostics revealed a ductal carcinoma of the right breast. The patient underwent bilateral mastectomy and chemotherapy. During chemotherapy a thrombosis of the left subclavian port-system occurred which was managed with marcumar. After accomplishing chemotherapy, the port-system was explanted and after an inconspicuous follow-up period of 5 years the patient desired to undergo autologous breast reconstruction.

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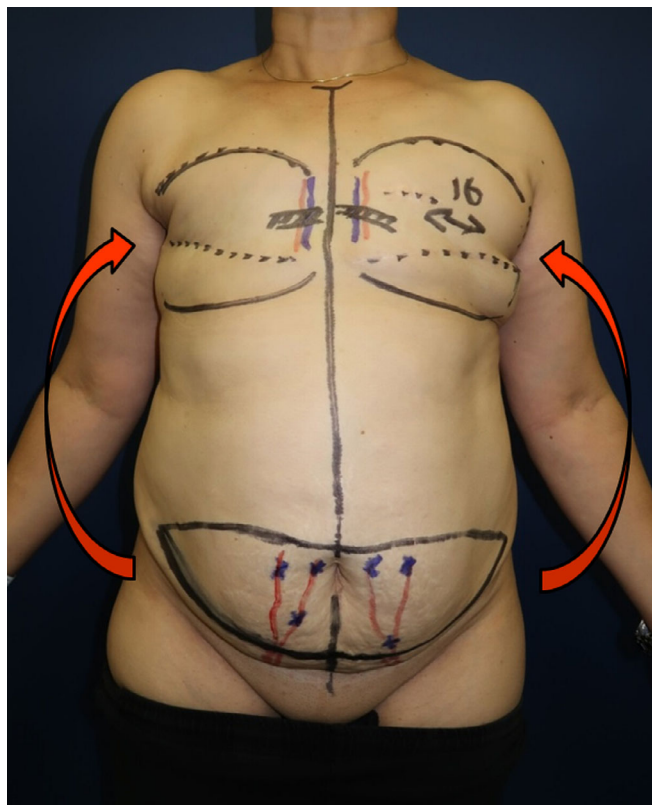
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**FIGURE 1** Computed tomography angiography of the abdomen revealing sufficient perforator vessels originating from the inferior epigastric vessels (labeled with stars)

A preoperative thrombophilia screening was performed without any anomalies. A computed tomography angiography revealed sufficient perforator vessels originating from the inferior epigastric vessels (Figure 1). A muscle sparing (ms2) TRAM and DIEP flap were planned for breast reconstruction (Figure 2). After partial resection of the fourth rib, the internal mammary vessels (IMV) were dissected demonstrating a sufficient caliber and blood flow. Complete flap dissection was performed immediately before transplantation. After ligation of the inferior epigastric vessels, the flap was flushed with heparinized saline solution and the anastomosis performed. First, the DIEP flap was anastomosed to the left cranial IMVs. The venous anastomosis was performed with a Synovis 3.0-mm vein coupler (Synovis Micro Companies Alliance, Birmingham, AL, USA) and the arterial anastomosis was hand-sewn. After releasing the clamps the DIEP flap demonstrated a sufficient perfusion. Then the ms2-TRAM flap was

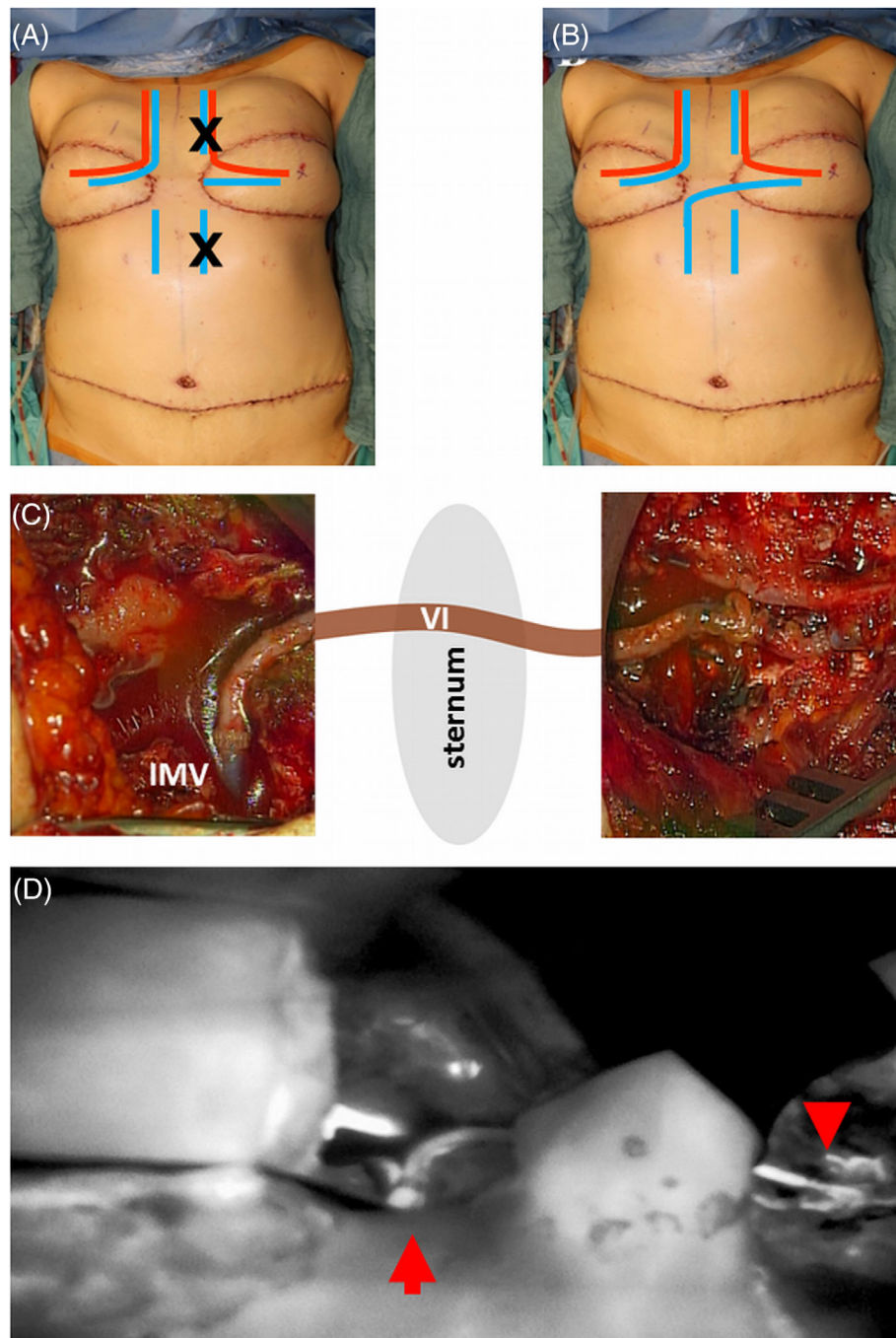
connected to the right IMVs in the same manner. After finishing the anastomosis for the ms-TRAM flap, a venous congestion occurred in the DIEP-flap requiring revision. A venous thrombosis was found and the anastomosis renewed with a 2.5-mm vein coupler. Initial blood flow was good but after several minutes a venous thrombosis occurred again. We decided to revise the anastomosis using the caudal internal mammary vein. The venous anastomosis was hand-sewn using Ethilon 8-0. However, a venous thrombosis appeared again. On the basis of the left port vein thrombosis in the medical history we decided to perform the venous anastomosis with the right side caudal internal mammary vein. A small saphenous vein graft of 15 cm length was gathered, a subcutaneous presternal tunnel created and end-to-end anastomosis performed using two 2.5 mm vein couplers. Thereafter, a sufficient venous flow was evident and flap perfusion was excellent (Figure 3). As previously described, laser-assisted angiography was performed, indicating well-perfused free flaps (Buehrer, Taeger, Ludolph, Horch, & Beier, 2016; Ludolph et al., 2016). Postoperative prophylactic anticoagulation was performed with enoxaparin (40 mg 1-0-1, subcutaneously) and the patient was discharged from hospital after 10 days. No further complications were noted in the follow-up period (Figure 4).



**FIGURE 2** Preoperative planning demonstrating breast reconstruction with a muscle sparing transverse rectus abdominis myocutaneous flap for the right side and a deep inferior epigastric artery perforator flap for the left side

### 3 | DISCUSSION

Multiple risk factors, such as radiotherapy, tamoxifen therapy and/or obesity, associated with flap thrombosis are discussed in the literature (Berry et al., 2010; Lee & Mun, 2016; McAllister, Teo, Chin, Makubate, & Alexander Munnoch, 2016; Parikh, Odom, Yu, Colditz, & Myckatyn, 2017). Although there might be a bias concerning the patient related risk factors (including radiotherapy and overweight [body mass index: 28.19 kg/m<sup>2</sup>]), we consider the left subclavian port-system thrombosis in the medical history as the primary reason for venous congestion. Venous insufficiency is the major reason for flap loss in unilateral as well as bilateral breast reconstruction (Rao, Parikh, Goldstein, & Nahabedian, 2010; Tran, Buchel, & Convery, 2007). Although a known thrombophilia and/or a subclavian vein thrombosis represent a relative contraindication, we selected this patient for autologous breast reconstruction using abdominal free flaps. The preoperatively performed thrombophilia screening with its inconspicuous results led to the assumption that the left subclavian port-system thrombosis might be a result of the hypercoagulable condition during chemotherapy (Haddad & Greeno, 2006). Despite an inconspicuous interval of 5 years, an additional duplex sonography



**FIGURE 3** Venous congestion in the deep inferior epigastric artery perforator (DIEP) flap (A). Intraoperative trouble shooting using a venous interponat (VI) and the contralateral caudal internal mammary vein (IMV) (B and C). View through the operation microscope and schematic illustration. The VI connects the right caudal IMV with the left DIEP flap (C). Laser-assisted indocyanine green angiography demonstrating excellent venous flow and flap perfusion. The VI, connected to the right caudal IMV, is marked by red bold bars (D)

could have provided guidance to altered flow conditions. In this context a further preoperative assessment of alternative recipient vessels would have been possible. Although manifold recipient vessels for autologous breast reconstruction are described in the literature, the subclavian port-system thrombosis and axilla dissection permitted the use of the ipsilateral thoracodorsal, cephalic, external jugular, lateral thoracic and circumflex scapular veins (Casey, Rebecca, Smith, Craft, & Buchel, 2007; Santanelli Di Pompeo, Longo, Sorotos, Pagnoni, & Laporta, 2015). In this case the contralateral caudal internal mammary vein has been the most obvious recipient vessel. After creating a

subcutaneous presternal tunnel and harvesting a small saphenous vein graft we were able to reconstitute the venous drainage of the DIEP flap. As an ultima ratio the creation of an arteriovenous loop prior free flap surgery remains a further salvage procedure (Arkudas et al., 2018). The IMVs are preferred for autologous breast reconstruction due to their high flow rate (Saint-Cyr et al., 2007). In the pertinent literature the caudal internal mammary vein is described as a reliable recipient vessel for breast reconstruction, especially when the cranial vein is not available (Venturi, Poh, Chevray, & Hanasono, 2011). Furthermore, some authors prefer the caudal and cranial internal mammary vein in



**FIGURE 4** The postoperative course remained uneventful and the patient presented 1 year postoperative in our clinic

order to supercharge the venous drainage (Al-Dhamin, Bissell, Prasad, & Morris, 2014; La Padula et al., 2016). Regarding the use of the contralateral IMVs in simultaneous breast reconstruction several case reports exist with auspicious results (Kosutic & Lambe, 2018; Lee, Varon, & Halvorson, 2017). In this context, not only anatomical variants causing vessel depletion but also patients after coronary bypass surgery using the left mammary artery are possible candidates for the contralateral caudal IMVs. Taken together, a subclavian port-system thrombosis in the patient history can be associated with a risk of venous congestion in autologous breast reconstruction. In this regard a rigorous preoperative assessment including a thrombophilia screening and/or duplex sonography is indispensable. However, in case of venous congestion of the internal mammary and/or subclavian vein, it is important to bear in mind alternative recipient vessels. To date this is the first case report describing a successful salvage procedure using a venous cross-over bypass to the contralateral caudal mammary vein due to insufficient venous flow of the ipsilateral internal mammary vein.

#### CONFLICT OF INTEREST

None.

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#### REFERENCES

- Al-Dhamin, A., Bissell, M. B., Prasad, V., & Morris, S. F. (2014). The use of retrograde limb of internal mammary vein in autologous breast reconstruction with DIEAP flap: Anatomical and clinical study. *Annals of Plastic Surgery*, 72(3), 281–284.
- Arkudas, A., Horch, R. E., Regus, S., Meyer, A., Lang, W., Schmitz, M., ... Beier, J. P. (2018). Retrospective cohort study of

- combined approach for trunk reconstruction using arteriovenous loops and free flaps. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, 71(3), 394–401.
- Berry, T., Brooks, S., Sydow, N., Djohan, R., Nutter, B., Lyons, J., & Dietz, J. (2010). Complication rates of radiation on tissue expander and autologous tissue breast reconstruction. *Annals of Surgical Oncology*, 17 (Suppl. 3), 202–210.
- Bodin, F., Schohn, T., Dissaux, C., Baratte, A., Fiquet, C., & Bruant-Rodier, C. (2015). Bilateral simultaneous breast reconstruction with transverse musculocutaneous gracilis flaps. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, 68(1), e1–e6.
- Buehrer, G., Taeger, C. D., Ludolph, I., Horch, R. E., & Beier, J. P. (2016). Intraoperative flap design using ICG monitoring of a conjoined fabricated anterolateral thigh/tensor fasciae latae perforator flap in a case of extensive soft tissue reconstruction at the lower extremity. *Microsurgery*, 36(8), 684–688.
- Casey, W. J., 3rd, Rebecca, A. M., Smith, A. A., Craft, R. O., & Buchel, E. W. (2007). The cephalic and external jugular veins: Important alternative recipient vessels in left-sided microvascular breast reconstruction. *Microsurgery*, 27(5), 465–469.
- Haddad, T. C., & Greeno, E. W. (2006). Chemotherapy-induced thrombosis. *Thrombosis Research*, 118(5), 555–568.
- Kosutic, D., & Lambe, G. F. (2018). The use of single recipient internal mammary vessels for bilateral DIEP flap breast reconstruction in a recipient-vessel-depleted patient. *Microsurgery*, 38(1), 120–121.
- La Padula, S., Hersant, B., Noel, W., Niddam, J., Hermeziu, O., Bouhassira, J., ... Meningaud, J. P. (2016). Use of the retrograde limb of the internal mammary vein to avoid venous congestion in DIEP flap breast reconstruction: Further evidences of a reliable and time-sparing procedure. *Microsurgery*, 36(6), 447–452.
- Lee, J. H., Varon, D. E., & Halvorson, E. G. (2017). Unilateral internal mammary recipient vessels for bilateral DIEP flap breast reconstruction. *Plastic and Reconstructive Surgery - Global Open*, 5(6), e1359.
- Lee, K. T., & Mun, G. H. (2016). Effects of obesity on postoperative complications after breast reconstruction using free muscle-sparing transverse rectus abdominis myocutaneous, deep inferior epigastric perforator, and superficial inferior epigastric artery flap: A systematic review and meta-analysis. *Annals of Plastic Surgery*, 76(5), 576–584.
- Ludolph, I., Arkudas, A., Schmitz, M., Boos, A. M., Taeger, C. D., Rother, U., ... Beier, J. P. (2016). Cracking the perfusion code?: Laser-assisted indocyanine green angiography and combined laser Doppler spectrophotometry for intraoperative evaluation of tissue perfusion in autologous breast reconstruction with DIEP or ms-TRAM flaps. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, 69(10), 1382–1388.
- Ludolph, I., Horch, R. E., Harlander, M., Arkudas, A., Bach, A. D., Kneser, U., ... Beier, J. P. (2015). Is there a rationale for autologous breast reconstruction in older patients? A retrospective single center analysis of quality of life, complications and comorbidities after DIEP or ms-TRAM flap using the BREAST-Q. *The Breast Journal*, 21(6), 588–595.
- McAllister, P., Teo, I., Chin, K., Makubate, B., & Alexander Munnoch, D. (2016). Bilateral breast reconstruction with abdominal free flaps: A single centre, single surgeon retrospective review of 55 consecutive patients. *Plastic Surgery International*, 2016, 6085624.
- Momeni, A., & Kanchwala, S. K. (2016). Improved pocket control in immediate microsurgical breast reconstruction with simultaneous implant placement through the use of mesh. *Microsurgery*, 38, 450–457. <https://doi.org/10.1002/micr.30123>
- Parikh, R. P., Odom, E. B., Yu, L., Colditz, G. A., & Myckatyn, T. M. (2017). Complications and thromboembolic events associated with tamoxifen therapy in patients with breast cancer undergoing microvascular breast reconstruction: A systematic review and meta-analysis. *Breast Cancer Research and Treatment*, 163(1), 1–10.
- Rao, S. S., Parikh, P. M., Goldstein, J. A., & Nahabedian, M. Y. (2010). Unilateral failures in bilateral microvascular breast reconstruction. *Plastic and Reconstructive Surgery*, 126(1), 17–25.
- Saint-Cyr, M., Youssef, A., Bae, H. W., Robb, G. L., & Chang, D. W. (2007). Changing trends in recipient vessel selection for microvascular autologous breast reconstruction: An analysis of 1483 consecutive cases. *Plastic and Reconstructive Surgery*, 119(7), 1993–2000.
- Santaneli Di Pompeo, F., Longo, B., Sorotos, M., Pagnoni, M., & Laporta, R. (2015). The axillary versus internal mammary recipient vessel sites for

- breast reconstruction with DIEP flaps: A retrospective study of 256 consecutive cases. *Microsurgery*, 35(1), 34–38.
- Tran, N. V., Buchel, E. W., & Convery, P. A. (2007). Microvascular complications of DIEP flaps [Discussion 1406–1398]. *Plastic and Reconstructive Surgery*, 119(5), 1397–1405.
- Venturi, M. L., Poh, M. M., Chevray, P. M., & Hanasono, M. M. (2011). Comparison of flow rates in the antegrade and retrograde internal mammary vein for free flap breast reconstruction. *Microsurgery*, 31(8), 596–602.

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