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A decision-making algorithm for recipient vein selection in bipedicle deep inferior epigastric artery perforator flap autologous breast reconstruction

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Summary The bipedicle deep inferior epigastric artery perforator (DIEP) flap allows reliable transfer of the entire lower abdominal flap in patients who have a small pannus or require a large volume breast reconstruction. Selection of recipient vessels for the second pedicle can however, be challenging. We describe our experience with a consecutive series of twenty three bipedicle DIEP flaps with particular focus on selection of the recipient veins. We demonstrate that with judicious selection the internal mammary system can be reliably used as recipients for both pedicles with low complication rates.

Introduction

Since its introduction in 1994 the deep inferior epigastric artery perforator (DIEP) flap has become well established as the gold standard in breast reconstruction.[1] It provides a large volume of well-vascularised autologous skin and fat that is similar in consistency to the native breast while minimising the abdominal donor site morbidity.

Although there has been some controversy regarding the zones of perfusion, it is generally agreed that the entire lower abdominal flap cannot reliably survive on a unilateral vascular pedicle.[2,3] This can be problematic in candidates who require reconstruction of a large breast volume, those with a small pannus and patients with abdominal scars that may disrupt blood flow across the midline.

In 1992 Arnez and Scamp reported the reliable harvest of the entire lower abdominal flap on two pedicles.[4] While

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providing each hemi-abdomen with its own pedicle undoubtedly maximises the tissue volume and ensures reliable perfusion it raises new challenges with regard to the selection of recipient vessels for the second artery and vein. Early reports described anastomosis of the first pedicle to the internal mammary vessels while using the thoracodorsal vessels for microvascular anastomosis of the second pedicle.[5] This however, requires preparation of two recipient sites and can make optimal flap positioning difficult. An alternative strategy is to perform an inter-pedicle anastomosis so that a single set of recipient vessels could be used.[6] This is technically more challenging and both flaps are essentially reliant on a single anastomosis to the internal mammary vessels.

In 2002 Li et al. described the anastomosis of both pedicles to the internal mammary vessels using both anterograde and retrograde limbs.[7] Subsequent studies demonstrated that retrograde flow in the caudal end of the divided internal mammary artery was reduced compared to anterograde flow but remained adequate to provide flap perfusion.[8] Similarly the retrograde vein demonstrated reduced flow volume and velocity.[9] Much of the support for the concept of retrograde drainage arises from the belief that the internal mammary veins are devoid of valves. It has been the clinical experience of the authors however, that visible valves are frequently encountered during intra-operative preparation of these veins. This has been supported by a recent cadaveric study that identified multiple valves in the internal mammary veins, most frequently at the level of the third and fourth rib, which is the common site of microvascular anastomosis.[10] Using the retrograde limb of the internal mammary vessels is a very useful option as it allows both anastomoses to be performed at a single site but the variable presence of valves may indicate that retrograde venous anastomosis should not be the automatic choice in all cases. With this in mind we describe in detail our intra-operative selection of recipient veins to ensure reliable venous drainage of the second pedicle in bipedicle DIEP flaps.

Methods

Institutional research ethics board approval was obtained for this study. A retrospective chart review was performed of all patients undergoing breast reconstruction with bipedicle DIEP flaps at our centre between January 2008 and December 2012.

Patient demographics, clinical details and particulars of the surgical procedure were recorded with emphasis on the microvascular anastomosis of the second pedicle. The incidence and nature of intraoperative and postoperative complications was also recorded.

Surgical technique

Flap dissection

Procedures were carried out by two surgeon (SH and TZ) at a single institution. All patients underwent pre-operative computed tomography angiography of the abdominal wall vasculature to identify potential abdominal perforators. The largest perforators were then located with a hand-held Doppler and marked pre-operatively on both sides of the abdominal flap. The CT and Doppler served only as a guide and perforators were selected intraoperatively in all cases. The contralateral abdominal flap was raised first from lateral to medial preserving potential perforators as they were encountered. The most suitable perforator(s) were then selected by visual inspection, considering the calibre of both the artery and vein. The rectus fascia was split longitudinally to provide wide exposure of the rectus muscle and the perforators were then dissected free of the muscle to the point where they entered the underlying deep inferior epigastric vessels. A length of approximately 2 cm of pedicle was preserved cephalad to the most superiorly situated perforator as a back-up option for anastomosis. The pedicle was traced and mobilised as far as possible into the groin close to the origin from the external iliac vessel to provide a long pedicle length. The process was then repeated on the ipsilateral abdomen. We consider each hemiabdomen to be an individual flap with an independent arterial inflow and venous drainage. The deep inferior epigastric system was used on both sides as this is our pedicle of choice for autologous breast reconstruction. The hemi-abdomen with the largest perforators was deemed to be the primary flap. The entire abdominal pannus was elevated in continuity and not divided at the midline as described in other series of stacked DIEP flaps.

Internal mammary vessel preparation

Preparation of the internal mammary vessels took place concurrently using a two-team approach. The vessels were exposed behind the third rib by careful removal of the costal cartilage. Wide exposure of the vessels was achieved by removal of a portion of the intercostal muscle from the interspace to ensure adequate space for both pedicles. Approximately 1.5—2 cm of the vessels was exposed. Any perforating vessels were identified and preserved during this process. The flap was detached from the abdomen and weighed prior to transfer to the chest (Figure 1). The vessels of both pedicles were prepared under the microscope.

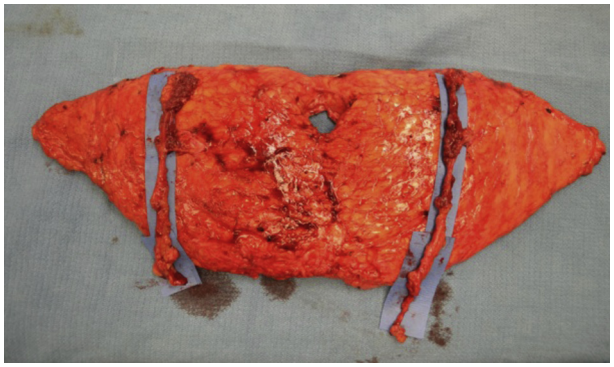

Figure 1 The bipedicle DIEP flap prior to transfer to the chest. The entire lower abdominal flap is isolated on two vascular pedicles. A narrow cuff of muscle has been harvested to incorporate three closely adjacent perforators on the left flap.