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Autologous free tissue breast reconstruction using the internal mammary perforators as recipient vessels

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Received 8 January 2003; accepted 29 May 2003

KEYWORDS

DIEP; Internal mammary artery; Perforator; Breast reconstruction

Summary Perforator flaps have become popular for autologous free tissue breast reconstruction because they reduce the donor site morbidity. It is possible to apply the this principle to the recipient site.

We present our experience of using the perforating vessels from the internal mammary artery and vein as recipient vessels for autologous free tissue breast reconstruction flaps in 21 out of 54 consecutive cases (39%). We discuss the technique and its advantages.

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Donor site morbidity has steadily reduced in autologous breast reconstruction with the evolution from pedicled transverse rectus abdominis myocutaneous (TRAM) flap, to free TRAM flap, to free deep inferior epigastric perforator (DIEP) and to superficial inferior epigastric perforator (SIEP) flaps. The recipient vessels for these free flaps are usually either branches of the thoracodorsal axis or the internal mammary vessels. Access to the internal mammary vessels requires the removal of a section of costal cartilage. If perforating arteries and veins of the internal mammary vessels could be used as recipient vessels it would negate the need to remove a section of costal cartilage. We attempted to use these perforating

branches of the internal mammary vessels as recipient vessels for microanastomoses in autologous free tissue breast reconstruction.

Patients

A total of 21 patients had the perforating branches of the internal mammary vessels used as the recipient vessels out of 54 consecutive patients undergoing autologous free tissue breast reconstructions, performed by two different surgeons in two hospitals. Surgeon A (AGBP) found internal mammary perforators suitable for recipient vessels in 10 out of 16 consecutive DIEP flap breast reconstructions. Surgeon B (EL) found internal mammary perforators suitable for recipient vessels in 11 out of 38 consecutive autologous breast reconstructions using

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DIEP flaps, superior gluteal artery perforator (SGAP) flaps and SIEP flaps. The cases were both immediate and delayed reconstructions.

Method

The dissection of the recipient site proceeds as standard for preparation of the internal mammary vessels for anastomosis. Sometimes perforating vessels of the internal mammary artery and vein are seen at the second or third intercostal spaces. Any perforators superficial to the pectoralis major muscle were looked for at the time of mastectomy (Fig. 1) for immediate breast reconstruction or when elevating the mastectomy flaps in delayed reconstruction. Perforating vessels are deemed suitable to be used as recipient vessels if they are greater than 1.5 mm in diameter and there is free arterial blood flow upon release of the arterial micro clamp. If there are no suitable perforators superficial to pectoralis major, the muscle is split along its fibres at the level of the third costal cartilage and elevated cranially looking for perforators in the second intercostal space, and elevated caudally looking for perforators in the third intercostal space (Fig. 2). Dissection of the perforating vessels through pectoralis major increases the length available for microanastomosis. In the event of no suitable perforators being found superficial or deep to pectoralis major, the internal mammary vessels are prepared after excision of a section of the third costal cartilage.

Results

In surgeon A's group, perforators suitable for

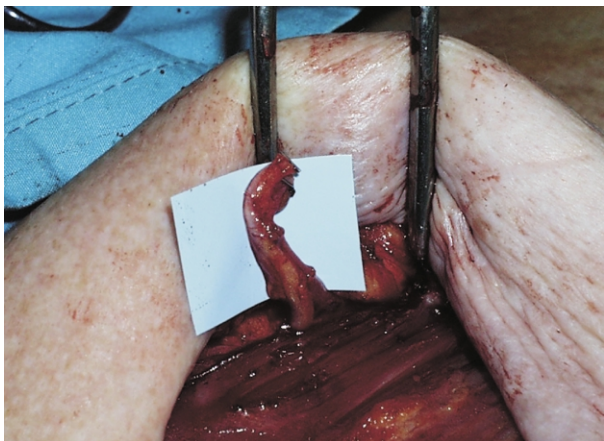


Fig. 1 3 mm diameter perforator superficial to pectoralis major.

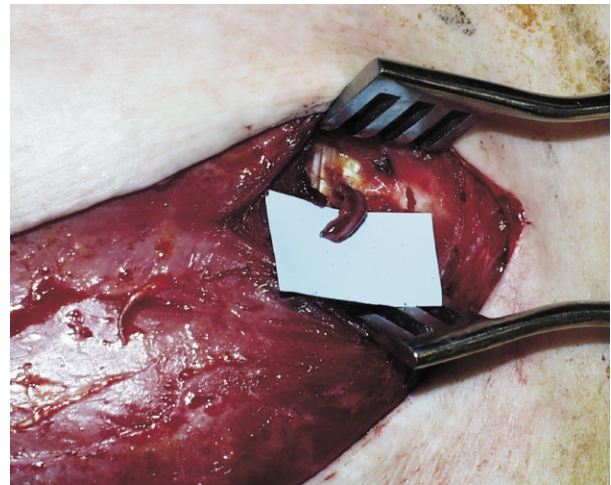


Fig. 2 2 mm diameter perforator deep to pectoralis major.

microanastomosis were found in 10 out of the 16 cases (63%). Four of these 10 cases were delayed reconstructions, one having received radiotherapy after her mastectomy. The average flap weight was 505 g, ranging from 344 to 572 g. In one case, we were able to anastomose the deep inferior epigastric (DIE) perforator directly to the internal mammary perforator. In all cases shorter lengths of DIE vessels were required. There were no partial or complete flap losses. Two flaps required re-exploration for venous congestion. In one case at exploration after 72 h, it was found that the DIE perforator vein was insufficient to drain the flap. The preserved superficial inferior epigastric (SIE) vein was grossly distended and, therefore, anastomosed to the ipsilateral tunnelled cephalic vein. In retrospect the venous drainage of this flap was predominantly via the SIE vein, which was of large calibre. The other case of venous congestion required re-exploration the same night. Thrombus obliterated the venous anastomosis. The DIE vein was re-anastomosed to the internal mammary perforating vein. The original problem was probably a poor microanastomosis (Fig. 3).

In surgeon B's group, perforators suitable for microanastomosis were found in 11 out of the 38 cases (29%). Seven of these 11 cases were delayed reconstructions, three having received radiotherapy after their mastectomy. The average flap weight was 680 g, ranging from 340 to 820 g. There were no partial or complete flap losses but two flaps required re-exploration for venous anastomotic problems the same night. One patient needed re-exploration at day 5 for an arterial anastomotic blockage; in this case it was noteworthy that there was a sizeable mismatch of arterial diameters.

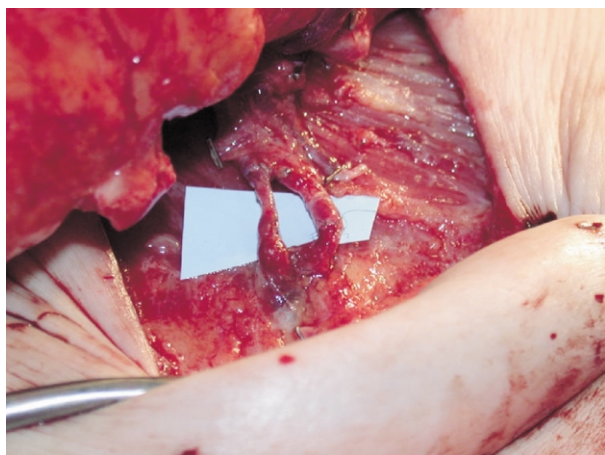


Fig. 3 Microanastomoses of DIE vessels to internal mammary perforator vessels.

Discussion

The DIEP or TRAM free flap is recognised as the gold standard autologous breast reconstruction. Branches of the thoracodorsal axis and the internal mammary vessels are the most commonly used recipient vessels. Banic et al. have shown that the choice of recipient vessels has no effect on flap complication rates.¹ The advantages of using the internal mammary vessels over branches of the thoracodorsal axis, as recipient vessels are that they are of a good calibre match to the DIE vessels; they are usually uninvolved in oncological breast surgery, they are more accessible for microsurgery.

They allow easier positioning of the flap more medially, using the ipsilateral DIE vessels and ensures the best vascularised portion of the DIEP flap is placed medially. Their use avoids potential avulsion injury and shoulder stiffness secondary to shoulder immobilisation.

The disadvantages of the internal mammary vessels are that exposure requires excision of a section of costal cartilage. Contour defects relating to the missing costal cartilage have been described, and is a difficult problem in this very conspicuous cosmetic site. Schwabegger reported five significant contour defects out of 36 cases² although Majumder and Batchelor³ avoided any contour defects in their series of 27 cases by careful placement of subcutaneous tissue of the TRAM flap over the defect. Pain and pneumothorax have been described. Usage of internal mammary vessels removes a potential donor vessel for coronary artery bypass graft surgery if required in the future.

Perforator flaps have been increasingly used to reduce the morbidity of autologous breast reconstructions. The evolution of pedicled TRAM flaps to

free TRAM flaps to DIEP flaps has led to the steady reduction in donor site morbidity. Other flaps such as the SGAP flap and the SIEA flap can also produce a breast without the morbidity associated with dissecting perforators through the rectus muscle.

Logically the same principle can be applied to recipient vessels. The use of perforator vessels as recipients for a DIEP flap was reported by Gazzetti in 2001⁴ and has been discussed by Hamdi⁵ and ourselves.⁶⁻⁸ Hamdi felt that approximately one in 10 cases had perforators of suitable calibre for use as recipient vessels for anastomosis to the flap. We have found that perforators of the internal mammary vessels are of appropriate size for use as recipient vessels in over a third of cases. Interestingly, half our patients had delayed reconstructions, where the perforators were preserved in spite of having mastectomies.

We used the second and third intercostal perforators when their diameter exceeded 1.5 mm in diameter and there was good arterial flow upon release of the arterial clamp. Use of these as recipient vessels obviated the need for the excision of a section of costal cartilage and preserved the continuity of the internal mammary vessels for future CABG surgery. With careful selection, we have managed to use the internal mammary perforators as recipient vessels in 39% (21 out of 54 cases) of the autologous free tissue transfer breast reconstructions in this consecutive series, with no partial or complete flap losses.

References

1. Banic A, Boeckx W, Greulich M, Guelickx P, Marchi A, Rigotti G, Tschopp H. Late results of breast reconstruction with free TRAM flaps: a prospective multicentric study. *Plast Reconstr Surg* 1995;**95**(7):1195–204.
2. Schwabegger AH, Gschnitzer C, Ninkovic MM. Contour deformity at the internal mammary recipient site. *Br J Plast Surg* 1999;**52**(8):674.
3. Majumder S, Batchelor AG. Internal mammary vessels as recipients for free TRAM breast reconstruction: aesthetic and functional considerations. *Br J Plast Surg* 1999;**52**(4):286–9.
4. Guzzetti T, Thione A. Successful breast reconstruction with a perforator to deep inferior epigastric perforator flap. *Ann Plast Surg* 2001;**46**(6):641–3.
5. Hamdi M. Fourth Perforator Flap Course. Canniesburn, 2000.
6. Haywood RM, Raurell A, Perks AG. *DIEP to internal mammary perforator breast reconstruction*. Adelaide: Royal Australasian College of Surgeons Annual Scientific Congress; 2002. May.
7. Phillips J, Sassoon EM, Logan AM. The next phase: perforator to perforator flaps in breast reconstruction. Presentation at The Royal Society of Medicine, 2001.
8. Sassoon EM, Logan AM, O'Neill T. A first year of perforator flaps. The Norwich experience. Presentation at the Gent Perforator Flap Course, 2001.