Rethinking the superficial inferior epigastric artery flap in breast reconstruction: Video demonstration of a rapid, reliable harvest technique

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Abdominal-based autologous free tissue breast reconstruction has undergone significant changes over the past decade. The evolution has focused on limiting morbidity of the donor site. The transition from the transverse rectus abdominus muscle free flap to the muscle-sparing transverse rectus abdominus muscle free flap to the deep inferior epigastric artery perforator free flap has markedly improved abdominal-based autologous breast reconstruction. However, all of these flaps involve an incision through the anterior rectus fascia and potential damage of intercostal motor and sensory nerves. The superficial inferior epigastric artery flap (SIEA) reliably perfuses the ipsilateral hemiabdomen, yet does not violate the fascia or any motor nerves. As a result, the incidence of hernia, abdominal wall weakness and bulging is essentially eliminated. Nevertheless, use of the SIEA flap remains marginal. Vessel size, dissection difficulties and lack of understanding of the relevant anatomy have limited its acceptance. The present article describes a rapid, reliable and safe dissection technique with an algorithm for harvesting the SIEA flap in autologous breast reconstruction.

Key Words: Breast reconstruction; Dissection technique; Free flap; SIEA

The majority of autologous free flap breast reconstruction uses tissue from the lower anterior abdominal wall. Traditionally, this involved harvesting the entire ipsilateral or bilateral rectus abdominus muscles while incorporating them into the transverse rectus abdominus flap (TRAM flap). Recently, lower abdominal wall flap elevation has evolved from complete rectus abdominus muscle resection to limited muscle harvest and finally to perforator flap harvest. The deep inferior epigastric artery perforator (DIEP) flap is now considered to be one of the least debilitating harvest techniques routinely used in breast reconstruction. This perforator flap uses the deep inferior epigastric artery and venae comitantes to perfuse varying degrees of the lower abdominal wall skin and fat, without intentional harvest or destruction of any rectus abdominus muscle. However, a DIEP flap harvest damages the anterior rectus fascia in all cases, and intermittently transects or causes significant neuropraxia of the intercostal nerves, particularly if more than one perforator is required. In addition, the longer the vascular pedicle harvest, the longer the fascia incision, and the greater the chance of intercostal nerve damage. This can lead to increased pain, lower abdominal wall bulging and hernia development (1-4).

The superficial inferior epigastric artery (SIEA) flap uses a medially located vein – the superficial epigastric artery – and, rarely, its associated venae to reliably perfuse the ipsilateral hemiabdominal wall skin and fat. The anterior abdominal wall fascia is left intact in all cases. This technique all but eliminates the possibility of an iatrogenic anterior abdominal wall hernia. Pain is also typically decreased because the muscle, fascia and nerves to the anterior abdominal wall are left intact. Despite the potential benefits, the use of this flap has been limited in

Repenser le lambeau de l'artère épigastrique inférieure superficielle en cas de reconstruction mammaire : la démonstration vidéo d'une technique de prélèvement rapide et fiable

La reconstruction mammaire à l'aide de tissu libre autologue prélevé sur l'abdomen a connu d'importants changements depuis dix ans. L'évolution a visé à limiter la morbidité au foyer du donneur. La transition du lambeau libre prélevé sur le muscle grand droit abdominal transverse au lambeau libre épargnant ce muscle, puis au lambeau perforateur libre de l'artère épigastrique inférieure a considérablement amélioré la reconstruction mammaire autologue à l'aide de tissu prélevé sur l'abdomen. Cependant, tous ces lambeaux exigent une incision traversant la fascia droit antérieur, qui risque d'endommager les nerfs moteurs et sensoriels intercostaux. Le lambeau de l'artère épigastrique inférieure superficielle (AÉIS) assure une perfusion fiable de l'hémiabdomen ipsilatéral, sans toucher la fascia ou d'autres nerfs moteurs. Par conséquent, on prévoit une incidence nulle de hernie, de faiblesse ou de bombement de la paroi abdominale. Néanmoins, le recours au lambeau de l'AÉIS demeure marginal. La dimension des vaisseaux, les problèmes de dissection et la mauvaise compréhension de l'anatomie pertinente en ont limité l'acceptation. Le présent article décrit une technique de dissection rapide et fiable à l'aide d'un algorithme pour prélever le lambeau de l'AÉIS en cas de reconstruction mammaire autologue.

breast reconstruction when compared with the deep inferior artery-based flaps. Cited reasons for this include: that typical perfusion only supports an ipsilateral hemiabdomen (3,5-7); the SIEA vessels have been cut preoperatively in many cases due to previous Pfannenstiel incisions; and the diameter of the artery is believed to be of insufficient size to reliably complete a successful microvascular anastomosis. The highest reported rate of use of the SIEA flap versus the DIEP-based flaps has been in the 30% range (3,5,8,9). Yet, the presence of the SIEA and venae, and the SIEV of sufficient calibre has been documented in anatomical studies to be available in nearly 75% of cases (10).

Over the past 10 years, our use of the SIEA flap has progressed from a rare event to more than 35% of all abdominal wall-based autologous breast reconstructions performed at our institution. The change in harvest technique and the algorithm for selection are described below with video documentation of the technique.

LOWER ABDOMINAL WALL-BASED AUTOLOGOUS TISSUE HARVEST ALGORITHM

The algorithm for deciding whether to use a SIEA flap is based on the following considerations. First, if the breast reconstruction will require more volume than a hemiabdomen, we defer to a DIEP flap. The second consideration is both the absolute vessel size of the SIEA at the level of the femoral artery and the size mismatch ratio between the internal mammary artery and SIEA. If the SIEA is <1 mm or the vessel mismatch is >2:1, we defer to a DIEP flap. The third consideration is the length of the pedicle. To provide enough length for an anastomosis to the internal mammary vessels and flap inset, the length of the

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Figure 1) Lower abdominal wall-based autologous tissue harvest algorithm. DIEA Deep inferior epigastric artery; DIEP Deep Inferior epigastric artery perforator; SIEA Superficial inferior epigastric artery

pedicle needs to reach from its subcutaneous position to the depth of the recipient vessels. Our rule of thumb is that the pedicle length should be twice the thickness of the flap. The final consideration is to confirm that the SIEA vessels do, in fact, adequately perfuse the required amount of abdominal tissue. To achieve this, the dominant DIEP perforator(s) are rapidly isolated and temporarily clamped after dissection of the desired SIEA vessels. If perfusion is sufficient, the clamps are removed, perforators clipped and the SIEA vessels harvested (Figure 1).

SIEA HARVEST TECHNIQUE

The markings for a standard free TRAM or DIEP are made. The inferior margin of the flap is placed at the lowest point on the abdomen that still allows closure of the abdominal wall skin after flap harvest and a harvest of the DIEP flap if needed. Lowering the inferior incision is important because the SIEA vessels decrease in diameter and move to a subdermal location as the vessels move more cephalad. Difficulty in locating the vessels and the potential to damage these vessels, therefore, increases as they move cephalad.

The inferior incision is made just through the skin using a scalpel. Electrocautery is then used to extend the incision completely through the dermis. At this point, darkening in the colour of the subcutaneous fat is sought, indicating where the underlying vessels are. A combination of blunt dissection using the tip of a nonactivated cautery pencil and coagulation of residual tissue bands allows exposure of the vessels. During the dissection, vertical retraction of the overlying skin and fat is performed with fish hook retractors and towel rolls placed just below the inguinal region (See online video at www.pulsus.com). The 90° tension created between the overlying tissue and the flap vessels is of significant importance if pedicle dissection is to be safely performed using electrocautery. Tension on the loose areolar tissue between the vessel and the adjacent adipose tissue creates a plane for easy dissection. The effectiveness and safety of cautery dissection is only realized when there is sufficient tension of tissue being coagulated that the tissue is cut and separates immediately on being touched with an activated electrocautery pencil.

Dissection continues on the superior side of the vessels and subsequently along the medial and lateral aspects, only enough to allow easy visualization. Care must be taken to preserve all small vessels lateral to the medial vein. Frequently, these represent branches from the main SIEA that increase perfusion to the flap. The SIEA and venae are dissected to the level of the first appearing lymph node, which we now consider to be an important and reliable landmark. This lymph node consistently marks the level where the artery and venae separate. At this level, the artery makes almost a 90° turn deep toward the femoral artery, while the venae typically join one another and travel inferior following a similar course to the femoral vein or a more horizontal course to the saphenous vein. The medial vein is dissected out until it joins the saphenous or femoral veins. In the minority of cases, the venae join this medial vein forming a single dominant vein. While this provides excellent venous drainage to the entire flap, the increased diameter frequently makes this vessel unusable for an anastomosis to the internal mammary veins. If a single joined vein does not exist or cannot be used, then the medial vein is preferentially chosen. Rarely (<5% of our cases) will the venae be used alone for the venous drainage of the flap. However, before committing to one system, microvascular clamps are placed on each venous system sequentially and the flap evaluated for congestion.

The vessels are dissected to a level flush with the femorals where they are clipped once the diameter is believed to be adequate. The final decision regarding the adequacy of the artery size is only made at this level. It is important to place the clips flush to incorporate the largest diameter of the SIEA and to obtain the maximum possible pedicle length.

CONCLUSION

Overall, the SIEA can be considered a first-line choice for abdominal based-breast reconstruction. The main advantage of the SIEA flap over the DIEP flap is its suprafascial dissection, eliminating the potential for abdominal wall hernias and bulges. In our hands, the harvesting technique described above has significantly increased the rate at which the SIEA flap is used at our institution and decreased the time and complications associated with the harvest.

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