A NEW CLASSIFICATION SYSTEM FOR MUSCLE AND NERVE PRESERVATION IN DIEP FLAP BREAST RECONSTRUCTION

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The main advantage of deep inferior epigastric perforator (DIEP) flap breast reconstruction is muscle preservation. Perforating vessels, however, display anatomic variability and intraoperative decisions must balance flap perfusion with muscle or nerve sacrifice. Studies that aggregate DIEP flap reconstruction may not accurately reflect the degree of rectus preservation. At Beth Israel Deaconess Medical Center from 2004–2009, 446 DIEP flaps were performed for breast reconstruction. Flaps were divided into three categories: DIEP-1, no muscle or nerve sacrifice (126 flaps); DIEP-2, segmental nerve sacrifice and minimal muscle sacrifice (244 flaps); DIEP-3, perforator harvest from both the medial and lateral row, segmental nerve sacrifice and central muscle sacrifice (76 flaps). Although the rate of abdominal bulge was similar among groups, fat necrosis was significantly higher in DIEP-1 when compared with DIEP-3 flaps (19.8% vs. 9.2%, $P = 0.049$). We describe a DIEP flap classification system and operative techniques to minimize muscle and nerve sacrifice. ©2010 Wiley-Liss, Inc. Microsurgery 30:85–90, 2010.

INTRODUCTION

The evolution of abdominal-based breast reconstruction has focused on increasing the aesthetic outcome and decreasing the associated morbidity. Since the advent of the transverse rectus abdominis myocutaneous (TRAM) flap,[1] modifications have developed minimizing donor site morbidity. As techniques developed, such as the free TRAM flap, muscle sparing free TRAM flap, deep inferior epigastric perforator (DIEP) flap, and superficial inferior epigastric artery (SIEA) flap, there has been an increasing shift towards rectus muscle preservation.[2–14]

However, the advantages of a DIEP flap reconstruction over a muscle sparing free TRAM is controversial.[7,10,15,16] Differences in donor site morbidity are hard to quantify as there is no consensus for the evaluation of postoperative abdominal wall function.[6,10,15,17–19] Classification systems have developed for free TRAM reconstruction as it became clear that the harvest techniques represented different degrees of muscle sacrifice. Nahabedian in 2002 described the following classification system: MS-0, full muscle width sacrifice; MS-1, preservation of the lateral segment; MS-2, preservation of a lateral and medial segment; and MS-3, preservation of the entire muscle (DIEP).[7]

As experience increases in DIEP flap reconstruction, it becomes quickly apparent that harvest techniques differ significantly based on the perforator anatomy. Within the MS-3 classification of a DIEP flap, there can be significant differences in muscle and nerve preservation. Flaps with a large, single perforator can be easily harvested with no nerve or muscle sacrifice. However, flaps requiring multiple perforators from both the medial and lateral row represent the other end of the spectrum with sacrifice of segmental nerves and the central muscle. Although no muscle is taken with the flap itself, this may functionally be no different from a muscle sparing (MS-2) free TRAM flap.

Recent papers by Rozen et al. have described the segmental nerve anatomy of the rectus muscle and found two discrete types of nerves.[20,21] Type 1 nerves are small and innervate small strips of muscle; sacrifice of these nerves has no functional sequelae. Type 2 nerves are large, located at the arcuate line, and are functionally important as they innervate the entire width of the muscle. In addition, type 2 nerves penetrate the muscle more medial than the lateral row perforators placing them at risk during vessel harvest. Clearly, sacrifice of a type 2 nerve could denervate large segments of the rectus muscle, resulting in abdominal wall complications.

With this new understanding of the segmental nerve anatomy, it becomes apparent that not all DIEP flaps are the same. This may contribute to difficulties in comparison and evaluation, as the aggregate DIEP flap experience and data may not accurately represent subtle differences. As a MS-0 free TRAM and a MS-2 free TRAM have important differences, the DIEP flap experience begets a classification system. We describe a classification system with emphasis on operative techniques for maximal preservation. An algorithm is also presented for abdominal based flap selection based on perforator anatomy.

METHODS

Patient Population

All abdominal microsurgical breast reconstruction at Beth Israel Deaconess Medical Center from January 2004

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