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Preoperative planning of deep inferior epigastric artery perforator flap reconstruction with multislice-CT angiography: imaging findings and initial experience

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Summary *Background*: Autologous breast reconstruction with abdominal tissue is one of the best options after mastectomy. Reconstruction with deep inferior epigastric perforator (DIEAP) flaps requires a precise location and preoperative evaluation of perforating vessels. The objective of this report is to demonstrate the usefulness of multislice-CT (MSCT) angiography for preoperative planning in patients undergoing DIEAP flap reconstruction.
Methods: Six consecutive women were considered for breast reconstruction with DIEAP flaps after previous mastectomy for breast cancer. Preoperative MSCT angiography was performed to localise the arterial perforators. Axial images, multiplanar reconstructions (MPR) and 3D volume-rendered images were analysed. Findings were correlated with surgery. Initial experience and imaging findings will be described.
Results: Accurate identification of the main perforators was achieved in all six patients with a very satisfactory concordance between MSCT angiography and surgical findings. No unreported vessels were found. Location, course, anatomical variations and relations of the superficial inferior epigastric artery were reported. The very small perforators, were equally evaluated and described.
Conclusions: Preoperative evaluation of perforator arteries with MSCT angiography is feasible in patients undergoing breast reconstruction. This technique provides a noninvasive global approach of the vascular anatomy and the entire anterior

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abdominal wall. However, more patients need to be evaluated in order to clarify the potential aspects pointed in this report.

It is estimated that more than 211 000 women will be diagnosed with breast cancer in 2005 in the United States. One woman in eight either has or will develop breast cancer in her lifetime.[1] Therapeutic options for breast cancer include tumorectomy, mastectomy, chemotherapy and/or radiotheraphy according to the stage at the time of diagnosis. More than one-third of women with early-stage breast cancer were treated with mastectomy in 2001,[4] even if there is professional consensus that most women with early-stage breast cancer are good candidates for breast-conserving surgery (BCS).[2,3] Surgeons may recommend mastectomy for different reasons including clinical contraindication for BCS, such as multicentric or multifocal disease, and the poor cosmetics that would result from removal of a large tumour. Patients might prefer mastectomy to BCS because of concerns about recurrence of disease, recovery from surgery, or side effects of radiation treatment.[5]

After mastectomy, reconstructive breast surgery is an optimal option for patients concerned about aesthetics. Among breast conserving surgical options, autologous breast reconstruction with abdominal tissue is one of the best options after mastectomy because of the match in quality and texture, the easily hidden scar, and the additional abdominal aesthetic benefit for the patient. The pedicled transverse rectus abdominis myocutaneous (TRAM) flap became the gold standard for breast reconstruction in the 1980s.[6] Free TRAM flap improved the results (compared with other reconstructive options) due to a better vascularisation of the flap and less donor site morbidity. Nevertheless, part of the muscle was sacrificed resulting in a risk of abdominal bulging, hernias, abdominal wall weakness, and asymmetries. In an effort to decrease donor site morbidity,[7] the deep inferior epigastric artery perforator (DIEAP) flap has recently emerged as a refinement of the free TRAM flap.[7] The DIEAP flap not only provides the advantages of the free TRAM flap, but also decreases post-operative pain and recovery period, since the rectus abdominis muscle and fascia are protected. Abdominal asymmetries, hernias, and bulging are also minimised.[8–10] However, the use of DIEAP flap for breast reconstruction is technically more demanding, as dissection of single perforator vessels, due mainly to their irregular anatomical distribution, is usually a more time-consuming procedure. For this reason, individual precise preoperative location and evaluation of perforating vessels is highly desirable. Among last generation angiographic diagnostic techniques, multislice-CT (MSCT) has emerged as an outstanding noninvasive operator independent option.

The objective of this report is to show the usefulness of MSCT angiography for preoperative planning for DIEAP flaps. Initial experience and imaging findings will be described.

Patients and methods

Between June and October 2005, six consecutive women aged 51, 41, 40, 54, 57 and 48 years old (patients A–F, respectively) were considered for free microvascular flap breast reconstruction after previous mastectomy for breast cancer. Immediate breast reconstruction was performed in four patients (A–D) and in one of them (patient B), bilateral breast reconstruction was required. In patients E and F, delayed breast reconstruction was performed after 8 years and 5 months, respectively. After written informed consent was obtained from all patients, a preoperative MSCT angiography was performed for surgical planning using a four-row multi-detector CT scanner (Somatom Volumen Zoom; Siemens, Erlangen, Germany). Scan parameters are summarised in Table 1. MSCT angiography was performed following a target injection of 150 ml of iodixanol contrast medium (270 mg of iodine per ml) (Visipaque® 270; Amersham Health, Little Chalfont, England) at a flow rate of 4 ml/s. No oral contrast medium was given. Axial images were processed and reformatted into MPR, maximum intensity projections (MIP) and 3D-volume rendered (VR) reconstructions, using a commercially available software (Inspace, Leonardo, Siemens). Location of arterial perforators, their origin, course, and anatomical variations were evaluated.

Arterial perforators with the widest diameters (parameter evaluated in the MIP reconstruction) and with a predicted easy dissection were reported and marked in each patient (Fig. 1). According to Giunta et al.,[11] an arterial perforator with a