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Imaging of the superficial inferior epigastric vascular anatomy and preoperative planning for the SIEA flap using MDCTA

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Received 3 December 2009; accepted 4 March 2010

KEYWORDS

Abdominal wall;
Angiography;
MDCT;
Superficial inferior
epigastric artery (SIEA)
flap;
Superficial inferior
epigastric artery (SIEA);
Superficial inferior
epigastric vein (SIEV)

Summary The superficial inferior epigastric artery (SIEA) flap consists of skin and subcutaneous fat with limited donor-site morbidity and has the potential to be very versatile – either as a thin flap without excessive fat tissue or as a voluminous flap for breast reconstruction. However, anatomical inter-individual variability often makes the choice of a free SIEA flap difficult.

Imaging of small-calibre vessels is possible with the multi-detector-row computed tomography angiography (MDCTA) and to obtain the characteristics of the superficial inferior epigastric vascular anatomy, we investigated the superficial inferior epigastric system using MDCTA.

Methods: We investigated 17 patients who had abdominal wall MDCTA in preparation for a free flap procedure using either the deep inferior epigastric perforator (DIEP), SIEA or the groin flap. The visibility and anatomical characteristics including the branching pattern, the diameter, course of travel and layers were noted.

Results: The SIEA was visible in 64.7% and, of these, 36.4% had a common trunk formation with the superficial circumflex iliac artery (SCIA), while 63.6% arose independently. The measured diameters were SIEA 1.6 ± 0.4 mm, SCIA 1.4 ± 0.4 mm, deep circumflex iliac artery (DCIA) 2.4 ± 0.4 mm, DIEA 2.9 ± 0.4 mm and superficial inferior epigastric vein (SIEV) 3.1 ± 0.5 mm. The SIEA consistently coursed lateral to and deeper than the SIEV and also lateral to the DIEA.

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Conclusion: MDCTA provided detailed three-dimensional information of the superficial inferior epigastric vascular system including the course and size of the SIEA. The information on vascular anatomy obtained with the MDCTA is valuable in the preoperative planning of the free SIEA flap and should be performed routinely.

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Background

Successful free tissue transfer depends on many factors such as the vascular supply of the donor site, the suitability of the recipient vessel, the expertise of the microvascular procedure and flap circulation. In recent years, the advancement of imaging with multi-detector-row computed tomography angiography (MDCTA) or magnetic resonance angiography (MRA) has allowed for preoperative determination of vessels most suitable for flap vascular supply.^{1–3} These images provide three-dimensional information on the course of the target vessels leading to a significant reduction in surgical time and a safer flap elevation.^{4,5} Recently, many studies using MDCTA for preoperative imaging addressed the course of the vascular pedicles perforating the muscle and fascia. Meanwhile, the ideal donor for a free tissue transfer should offer optimal volume and texture with limited donor-site morbidity. The free superficial inferior epigastric artery (SIEA) flap is based on a superficial artery of the abdominal wall and can be harvested without the excision of the rectus fascia or muscle and thus has limited donor-site morbidity compared to the rectus abdominis musculocutaneous flap or the deep inferior

epigastric perforator flap (Figure 1). Despite these advantages, the SIEA flap has often not been the choice for many surgeons because of its unreliability; the inter-individual anatomical variations^{6–10} or the SIEA diameter sometimes being too small for microanastomosis.^{11–13} Previous studies have investigated the anatomy of the SIEA system with cadaver dissections^{8–10,14} or intra-operative laser-induced fluorescence videoangiography.^{6,7} The SIEA arises from the femoral artery 2–3 cm below the inguinal ligament and courses superior and lateral before turning superiorly midway between the pubic tubercle and the anterior iliac spine to perforate Scarpa's fascia just above the inguinal ligament. Its calibre is reported to be 0.4–2.6 mm with several anatomical variations with regard to its origin in the femoral artery and course in relation to the superficial circumflex iliac artery.¹⁰ Although the SIEA is accompanied by small-calibre concomitant veins, the major venous drainage route is the superficial inferior epigastric vein (SIEV), which runs apart from the SIEA.¹⁵ Therefore, preoperative information about not only the existence and the size of the SIEA but also the spatial relationship between the SIEA and the SIEV is very important for SIEA flap elevation. Investigation of the SIEA anatomy using MDCTA adds significantly to preoperative knowledge as it can depict the exact depth and course of travel of the vessel in the subcutaneous tissue and allows a three-dimensional look at the vascular system. If the branching pattern, course and diameter of the SIEA, along with its relation to the course of the SIEV, can be obtained preoperatively, this will allow the surgeon to plan a reconstruction using the SIEA flap with more liberty and with predictability.

Materials and methods

Patients

MDCTA was performed on the abdominal wall of 17 patients (10 male, seven female) undergoing reconstruction using one of the following; the deep inferior epigastric perforator (DIEP), the SIEA or the groin flap at Tokyo Women's Medical University between November 2008 and April 2009 to examine the vasculature of the abdominal wall. Our study was compliant with the protocol approved by the institutional review board. Patients ranged in age from 33 to 75 years (mean: 53.8 years). Normal renal function was confirmed prior to studies.

Image acquisition

Studies were performed on the Aquilion64 scanner (Toshiba Medical, Japan). The patients were placed in a supine position and it was ensured that no items of clothing deformed the contour of their abdomen. An intravenous catheter was placed in their antecubital vein, and this was connected to a power

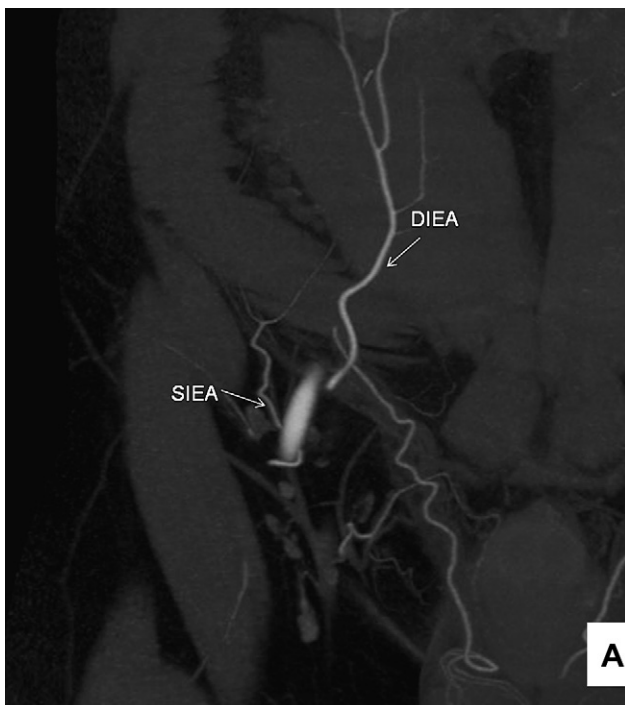


Figure 1 The superficial inferior epigastric artery for the superficial inferior epigastric artery flap and the deep inferior epigastric artery for the rectus abdominis musculocutaneous flap or the deep inferior epigastric perforator flap.

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