A retrospective investigation of abdominal visceral fat, body mass index (BMI), and active smoking as risk factors for donor site wound healing complications after free DIEP flap breast reconstructions

Floyd W. Timmermans [a,b,*], Pèdrou B. Westland [a],
Stefan Hummelink [a], Joep Schreurs [a], Marijn Hameeteman [a],
Dietmar J.O. Ulrich [a], Nicholas J. Slater [a]

[a] Department of Plastic and Reconstructive Surgery, Radboud University Hospital (Radboudumc), Geert Grooteplein-Zuid 10, 6525 GA Nijmegen, The Netherlands
[b] Department of Plastic, Reconstructive and Hand Surgery, VU University Medical Centre (VUmc), De Boelelaan 1117, 1081 HV Amsterdam, The Netherlands

Summary *Background:* The deep inferior epigastric artery perforator (DIEP) flap is one of the most common techniques for breast reconstruction. Body mass index (BMI) is considered as an important predictor of donor site healing complications such as wound dehiscence. The use of computed tomography (CT) proved to be a precise and objective method to assess visceral adipose tissue. It remains unclear whether quantification of visceral fat provides more accurate predictions of abdominal wound healing complications than BMI.
Patients and Methods: A total of 97 patients with DIEP flap were retrospectively evaluated. Patients' abdominal visceral fat (AVF) was quantified on CT angiography (CTA). The patients were postoperatively assessed for abdominal wound healing complications. We analyzed for the correlations between AVF, BMI, and dehiscence and established a logistic regression model to assess the potential high-profile predictors in anatomic and patient characteristics such as weight, smoking, and diabetes.

Results: We included 97 patients, and of them, 24 patients (24.7%) had some degree of abdominal dehiscence. No significant differences were observed between the dehiscence group and the non-dehiscence group, except for smoking (p = 0.002). We found a significant correlation between AVF and BMI (R = 0.282, p = 0.005), but neither was significant in predicting donor site dehiscence. Smoking greatly increased the likelihood of developing wound dehiscence (OR = 11.4, p = < 0.001).

Conclusions: AVF and BMI were not significant predictors of abdominal wound healing complications after DIEP flap reconstruction. This study established active smoking (OR = 11.4, p = < 0.001) as the significant risk factor that contributed to the development of abdominal wound dehiscence in patients with DIEP.

Background

The deep inferior epigastric perforator (DIEP) flap has become one of the most widely used techniques used for autologous breast reconstruction following the proposal of the method by Allen in 1994.[1] The procedure has proven to be a suitable option for patients who have sufficient abdominal tissue for breast reconstruction, e.g., overweight and obese patients.[2] The most common abdominal donor site complications are skin necrosis and wound dehiscence.[3-7] In particular, obese patients who also suffer from diabetes or vascular disease and smoking patients are known to be more prone to develop postoperative complications such as dehiscence, delayed wound healing, and infection.[8-10]

This raises the question whether preoperative selection depending on the amount of body fat could lead to the development of a more precise model for predicting complications. The preoperative selection is made usually according to the body mass index (BMI). The BMI was first described by Adolphe Quetelet in 1832; this index is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2).[11] According to the World Health Organization (WHO), the different stages of BMI is defined in the following order: < 18.50–20.0 kg/m^2 as normal, 25.0–29.9 kg/m^2 as preobese, and >30.0 kg/m^2 as obese.[12] In most studies, BMI is widely used as an indicator to determine the preoperative risk. BMI is influenced by factors such as gender, general state of health, and total muscle mass, regardless of the total amount of body fat. Therefore, care should be taken when BMI is used as an indicator for scientific and clinical purposes. The advantages of using BMI are that it is user-friendly and easy to implement for clinical purposes to differentiate and categorize patients according to height and weight. However, a new insight has shown an overall discrepancy of 35.2% between BMI and the more precise dual-energy X-ray absorptiometry (DXA) in evaluating the exact amount of body fat.[13] Thus, BMI lacks the precision we need for the preoperative assessment of patients with similar BMI and variations in body fat distribution, gender, and body composition.

Morphometric measurements are three-dimensional measurements of the human anatomy which are generated with the use of computed tomography (CT) imaging. Recent studies suggest a strong correlation between morphometric measurements and postoperative complications.[14,15] In 1983, Tokunaga et al. were one of the first authors to propose the use of morphometrics as a clinical tool to more objectively determine the amount of adipose tissue.[16] In our center, a CT angiography (CTA) is always conducted for the preoperative assessment of abdominal perforators used for abdominal-based autologous flap reconstructions. This method may also prove to be useful in the preoperative assessment of adiposity and risk stratification of postoperative complications.

The purpose of this study was to generate preliminary data on the relationship between the amount of abdominal visceral fat (AVF) measured by morphometrics, BMI, and other risk factors with regard to donor site wound healing complications. If AVF is found to be a suitable predictive parameter, then morphometrics could be used as a more precise tool in patient selection and future patient-specific risk models.

Patients and methods

Patient data collection

A retrospective analysis was performed at the Radboud University Hospital between August 2012 and July 2014. Women who had undergone a preoperative CTA for DIEP flap perforator mapping were included. The preoperative CT scans were a part of the routine patient assessment and were not performed specifically for the assessment of AVF. Data regarding patient characteristics were extracted from the electronic patient records. The data included patients' age, height, weight, BMI, and abdominal visceral fat. Preoperative data comprised data on the timing of reconstruction (primary or secondary); involvement of the rectus abdominis muscle; previous or current treatment with chemotherapy, radiotherapy, or hormonal therapy; and history of smoking (within 5 years of surgery), vascular disease, and lymphedema.

All breast reconstructions were performed by two experienced microsurgeons, and patient follow-up was conducted at 1 week, 2 to 3 months, 6 months, and 12 months after surgery. Postoperative data comprised data on wound healing complications, which are defined as dehiscence and other secondary wound morbidities such as ecchymosis, skin necrosis, fat necrosis, seroma, and donor site dehiscence. Abdominal donor site wound dehiscence was defined as any degree of separation of the donor site skin suture line, which required additional treatment (wound dressings, local wound debridement, and additional surgical procedures). The post-