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Breast

Donor-Site Morbidity After DIEAP Flap Breast Reconstruction—A 2-Year Postoperative Computed Tomography Comparison

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Background: The study was undertaken to provide a more complete picture of donor-site morbidity following the deep inferior epigastric artery perforator (DIEAP) flap harvest in breast reconstruction. Most studies evaluating this subject have been performed using ultrasonography. Computed tomography (CT) might provide valuable information.

Methods: In 14 patients who were reconstructed with a DIEAP flap, donor-site morbidity was assessed by comparing routine preoperative CT abdomen with CT abdomen performed 2 years postoperatively. The anteroposterior diameter and transverse diameter (TD) of the rectus muscle were measured bilaterally within 4 standardized zones. Diastasis recti abdominis (DRA) was measured in the same zones. The abdominal wall was assessed for hernias, bulging, and seromas.

Results: The operated rectus muscle had a significantly increased anteroposterior diameter in 2 zones and decreased TD in 1 zone compared with preoperative measurements. Comparing the operated and nonoperated rectus muscles, the former had a significantly decreased TD in 1 zone. Supraumbilical DRA was significantly decreased with surgery, whereas infraumbilical DRA was significantly increased. No new hernias or bulging were found. Two patients had seroma formation in the abdominal wall.

Conclusions: Symmetry of the 2 hemiabdomens is well preserved after DIEAP flap harvest; however, significant changes to the rectus muscles and DRA were observed. Hernia formation does not seem to be a postoperative complication of importance. The study indicates that DIEAP flaps result in limited donor-site morbidity, which for most patients does not outweigh the benefits of free perforator flap breast reconstruction. *(Plast Reconstr Surg Glob Open 2017;5:e1405; doi: 10.1097/GOX.0000000000001405; Published online 25 July 2017.)*

INTRODUCTION

The deep inferior epigastric artery perforator (DIEAP) flap is currently the first choice for both unilateral and bilateral autogenous breast reconstruction.[1] Its benefit of minimizing donor-site morbidity is ever more relevant as increasingly emphasis is put on reducing the functional and aesthetic defects at the donor-site.[2–6] Moreover, the growing trend toward bilateral breast reconstruction has made it necessary to preserve the integrity of the abdominal wall.[7] Most of the strength and stability of the abdominal wall is derived from the paired rectus abdominis muscles and the anterior and posterior rectus sheaths. The harvest of an abdominal flap implicitly violates the integrity of these structures, which may result in asymmetry, bulging, and hernia formation.[5] Several studies have shown, however, that the DIEAP flap reduces the donor-site morbidity compared with other free flaps harvested from the abdomen.[3,4,6,8] Man et al.[4] reported half the risk of abdominal bulging and hernias comparing DIEAP flaps to free transverse rectus abdominis myocutaneous flaps. Furthermore, 2 meta-analyses evaluating abdominal bulging and hernia formation demonstrated that these

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complications are reduced in DIEAP flap reconstructions compared with transverse rectus abdominis myocutaneous flap.[3,4]

With regard to the postoperative changes to the paired rectus bellies, the literature is more conflicting. Some studies have reported that the morphological and functional changes to the rectus muscles are minimal,[9,10] whereas others have reported significant differences concerning contractility[6,8,11] and structure.[12]

The aim of this study was to further assess the donor-site morbidity following the DIEAP flap breast reconstruction. We wanted to evaluate the long-term effects of the flap harvest on the abdominal wall with a focus on the rectus muscles, hernia, and diastasis recti abdominis (DRA). No previous studies have assessed if there are dimensional changes of the DRA—also called abdominal separation. We chose to use computed tomography (CT) in assessing the abdominal wall. This modality enables the scrupulous evaluation of structural components (directly or indirectly) affected. As most previous anatomical studies have been performed by the use of ultrasonography,[6,10,12] we believe that the use of CT provides complementary information to the discussion.

METHODS

This prospective clinical study included 14 women who underwent secondary unilateral breast reconstruction with a DIEAP flap. All patients had undergone mastectomy as a result of cancer. Patient details are listed in Table 1. The patients were informed about the risks and benefits and gave written consent before participation. The study was registered and published in the ClinicalTrials.gov database (ID number: NCT02563977), and the research protocol was approved by the local Ethical Committee (REK; reference no. S-07071a)

Surgical Technique

A standard DIEAP flap procedure as described by Blondeel et al.[13] was performed. Surgery was carried out at the donor and recipient site by 2 teams of plastic surgeons simultaneously. The presumed best perforator was dissected from the level of the anterior rectus fascia to the entrance of the deep inferior epigastric vessels on 1 side. The muscle dissection was performed in a longitudinal, fascia-sparing manner, and all segmental motor branches of the intercostal nerves were carefully preserved. Inevitably, some small motor nerves were disrupted during the dissection of intramuscular perforators. Such severed nerves were not repaired by microsurgical coaptation due to their size. Nine patients had 1 perforator, whereas the remaining 5 patients had 2 perforators included in the flap. Eight flaps were based on medial perforators, 4 flaps on lateral perforators, and the remaining 2 flaps had 1 perforator from each row. In all cases, the muscle was split longitudinally from the level of the perforator and as far inferiorly as necessary to divide the pedicle safely. A single myotomy was made and no rectus muscle was divided. Among the 5 flaps with 2 perforators, however, 1 dissection required 2 myotomies, and the rectus muscle was partially divided in 2 cases. If the chosen perforator(s) appeared to be satisfactory, the pedicle was transected and the flap was transferred to the recipient site. No anterior rectus fascia was harvested. Microanastomosis was performed end-to-end to the internal mammary vessels in all cases. Concurrent to the flap replacement on the thorax, the donor defect was closed by the second team of surgeons. By using the fascia-sparing technique, primary fascial closure was routinely achieved with polydioxanone (PDS 0) running suture. There was no use of synthetic or bioprosthetic mesh to reinforce the fascia. Since no fascia was removed, no tightening of the contralateral anterior rectus sheath for symmetrizing the umbilicus was performed. Upon intraoperative evaluation, 1 patient had a supraumbilical and umbilical DRA of 27 and 51 mm, respectively. A DRA plication was performed in this patient. No DRA plication was performed in any other patients. The surgeons did not perform progressive tension sutures to promote the adherence between the donor flap and the abdominal wall; however, the operating bed was jack-knifed to prevent tension. Two 18 French drains were placed in the donor-site and later removed when the production volume of each drain was less than 30 cc per day.

Table 1. Patient Details (N = 14)

Age at reconstruction (y), 53.2 (4.6) (45.3–59.5)	
Preoperative BMI (kg/m²), 25.6 (2.7) (21.1–30.3)	
Previous surgery to the abdomen, n (%)	
None, 11 (78)	
Cesarean section, 2 (14)	
Laparoscopy, 2 (14)	
Laparotomy, 0 (0)	
Smoking, n (%)	
Nonsmoker, 9 (64)	
Former smoker, 4 (28)	
Stopped smoking minimum 6 weeks before reconstruction, 1 (7)	
Adjuvant therapy, n (%)	
Chemotherapy, 12 (85)	
Radiotherapy, 12 (85)	
Hormone, 11 (78)	

Data are described as means (SD) (minimum–maximum) or number of patients (percentages).

Preoperative CT Angiography of the Abdominal Wall

Per standard protocol, all DIEAP flap patients underwent preoperative CT angiography to delineate the topography of the perforators. The scans covered the abdominal wall from the second lumbar vertebra to the pubic symphysis. They were performed in supine position, and the patient was instructed not to contract the abdominal muscles. The scans were contrast enhanced with 90 cc iomeprol (Iomeron 350 mg Iodine/ml, Bracco Imaging, Milano, Italy) and with 50 cc saline flush at a flow rate of 5.5 cc/sec.

Two Year Postoperative CT of the Abdominal Wall

The postoperative CT scans were performed as close to 2 years after the breast reconstruction as possible. Mean follow-up time was 23.5 months (range, 19–26). These scans covered more of the abdominal wall—starting from the xiphoid process to pubic symphysis. We chose to extend the postoperative scan length to be able to assess the most cranial aspects of the abdominal wall. Postoperative CT scans were noncontrast enhanced and acquired with the same image parameters as preoperative scans to achieve identical image sets. Iodine contrast media enhancement was found avoidable, due to the relatively high attenuation difference (Hounsfield units) between muscle and fat in CT scans done both with and without intravenous contrast enhancement. Furthermore, iodine contrast media enhancement is generally low in both fat and muscle tissue—especially in CT angiography scans. Hence, there is little influence on the visualization and size of the evaluated structures between the preoperative and the postoperative CT scans. Based on these aspects, there was no indication for the use of contrast enhancement on postoperative scans—potentially putting the patients at risk of its adverse effects. All scans were in the supine position, and each patient was told not to contract the abdominal muscles.

CT Systems and Further Specifications

All 28 scans were done on multidetector CT systems. The majority of the CT scans (24 of 28) were performed on a 64-row system (Light speed CT, GE Healthcare, Chicago). Four scans were performed on a 320-row CT system (Aquilion ONE, Toshiba Medical Systems, Japan) due to availability of machines. These 4 scans were performed on 4 different patients (3 preoperative scans and 1 postoperative scan). Scan parameters for the 64-row CT system were 64×0.625 mm, 120 kV, 250–750 mA, pitch 0.984, rotation time 0.5 sec, noise index 24, Adaptive Statistical Iterative Reconstruction 30%. Images were consecutively reconstructed with 2.5 mm axial, coronal, and sagittal and 1 mm axial (multiplanar reconstruction) images. Scan parameters for the 320-row CT system were 80×0.5 mm, 120 kV, 100–580 mA, rotation time 0.5 sec, SD 7.5, sure exposure 3D and Adaptive Iterative Dose Reduction 3D. Images were consecutively reconstructed with 2 mm axial, coronal, and sagittal and 1 mm axial (multiplanar reconstruction) images. Mean dose length product was 625.46 mGy-cm and mean effective dose estimated to 11.26 mSv based on conversion factor 0.018.

Standardized Zones

Four zones, named zones A–D, covering transverse sections of the abdominal wall were standardized in the study. Zone A: 5 cm cranial to the umbilicus. Zone B: umbilical level. Zone C: central zone (midway between zones B and D). Zone D: 5 cm cranial to the pubic symphysis. Figure 1 illustrates the location of each zone.

Radiological Assessment

Two full sets of measurement data were recorded separately by 2 consulting radiologists. They were blinded to the numbers recorded by their colleague and the side of surgery (although microvascular clips left behind easily revealed the operated side). Findings in each hemiabdomen were recorded according to the 4 standardized zones described and illustrated below. The following 3 anatomical features were measured bilaterally: (1) anteroposterior diameter (APD) of the rectus muscle, (2) transverse diameter (TD) of the rectus muscle, and (3) fat layer thickness (largest anteroposterior measurement). DRA was measured in the midline in each zone—from the medial fascia end of 1 rectus belly to the medial fascia end of the contralateral rectus belly. Figure 2 illustrates preoperative and postoperative measurements of APD, TD, DRA, and fat layer in all 4 zones of the same patient. Figures 3, 4 are the anterior abdominal wall of the 2 zones of greatest interest (zones B and C) in another patient. Furthermore, the radiologists meticulously assessed the abdominal wall for other signs of donor-site morbidity such as hernias, bulging, seromas, and hematomas. In some patients, the radiologists also reported skeletal metastasis, (unspecified) liver lesions, and a splenic artery aneurysm. Such findings were carefully followed up with applicatory diagnostic tests and reported to the patients and their general physicians/oncologists. All additional findings are listed in Table 2.

Statistical Analysis

Descriptive statistics are presented using means (SD) and number of patients (percentage) if not otherwise stated. Comparisons of related samples were performed with nonparametric Wilcoxon Sign Rank test, whereas Mann-Whitney *U* test was used to compare independent samples. Pearson's correlation tests were conducted to calculate the association between (1) DRA and rectus muscle changes and (2) DRA changes and BMI/age. Body mass index (BMI) is defined as the body mass (kg) divided by the square of the body height (m).

The single patient who had a DRA plication done was excluded from all analysis including DRA measurements. We accepted *P* values of less than 0.05 as statistically significant. IBM SPSS Statistics 21 (IBM, Armonk, N.Y.) was used for statistical analysis.

RESULTS

Selections of results are listed in Tables 3–6. All data are calculated using the mean of the 2 numbers recorded by each radiologist.

Rectus Muscle Changes

On postoperative CT, the operated rectus muscle had a significantly increased APD in zones B and C and decreased TD in zone D compared with preoperative measurements of the same rectus muscle (Tables 3, 4). There were no significant results comparing pre- and postoperative APD and TD of the nonoperated rectus muscle. For that reason, these data are not included in the article.

Comparing the operated and nonoperated rectus muscles on the postoperative CT scans, the former had a significantly decreased TD in zone C (Table 5).

The nonparametric Mann-Whitney *U* tests showed no significant results comparing APD and TD changes in flaps based on either (1) 1 perforator versus 2 perforators or (2) medial row perforator versus lateral row perforator.

DRA Changes

We found a significantly decreased DRA in zone A (supraumbilical) and significantly increased DRA in zones C and D (infraumbilical). Data are listed in Table 6.

Correlation Tests

There was no statistically significant correlation between (1) DRA and rectus muscle changes or (2) DRA

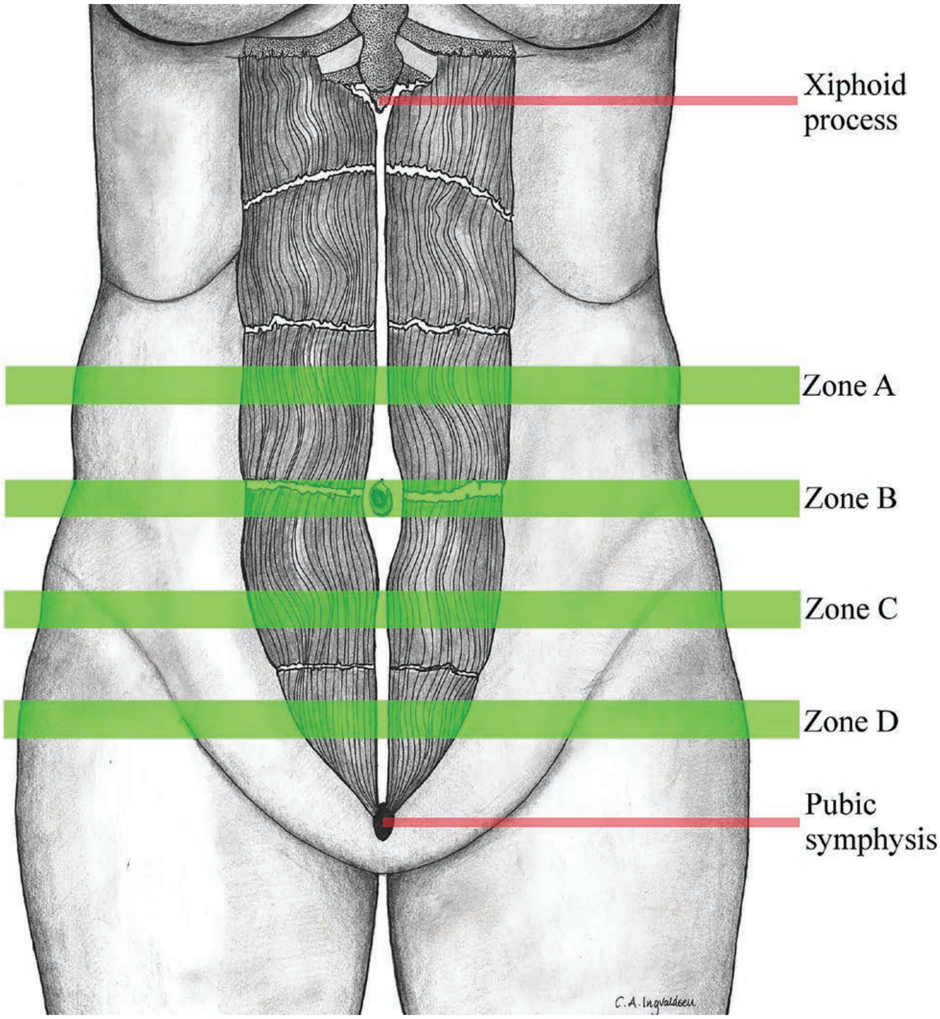

Fig. 1. Illustration of the 4 standardized zones. Zone A: 5 cm cranial to umbilicus. Zone B: umbilical level. Zone C: central zone (midway between zones B and D). Zone D: 5 cm cranial to pubic symphysis.

changes and BMI/age. BMI and age, however, were strongly correlated where older patients had a significantly lower BMI (R = -0.76; *P* value = 0.003).

Other Abdominal Wall Changes

The fat layer thickness was decreased in all zones postoperatively, being significantly thinner in zones A–C on both operated and nonoperated side. Comparing the postoperative fat layer of the 2 hemiabdomens, no significant differences were observed (Table 5).

As listed in Table 2, 1 patient had both an umbilical and an epigastric hernia on the postoperative CT scan. These hernias had, however, no interval change in the size of the fascial defect or the hernia sac. Signs of incarceration or strangulation were not noted, and the patient reported no discomfort. There was no radiographically apparent postoperative hernia among the remaining patients.

Two patients had ellipsoidal seromas in their abdominal wall 2 years postoperatively (Fig. 3). These patients have not had any further surgery to the abdominal wall since the DIEAP flap reconstruction. They did not report any abdominal asymmetry, pain, or discomfort related to the seromas. Therefore, no further surgical management was initiated by the plastic surgeons.

DISCUSSION

To date, only 1 study has investigated the donor-site morbidity after DIEAP flap breast reconstruction using postoperative CT. Blondeel et al.[8] scanned 12 patients 1 year postoperatively to compare the cross-sectional areas of the rectus muscles. All measurements were performed at the level of the umbilicus, which equals zone B outlined in our study. Their results demonstrated a minor change, whereby 10 of 12 patients had less than 5% atrophy on the operated side compared with the nonoperated side. Similarly, we did not detect any significant difference in APD or TD of the operated rectus belly at the umbilical level. Only the TD in zone C proved to be significantly different between operated and nonoperated side (Fig. 4). This could be an indicator of localized muscle atrophy where the pedicle has been harvested. Zone C is in fact situated right inferiorly to where the majority of dominant perforators are located.[14,15] Muscle atrophy would

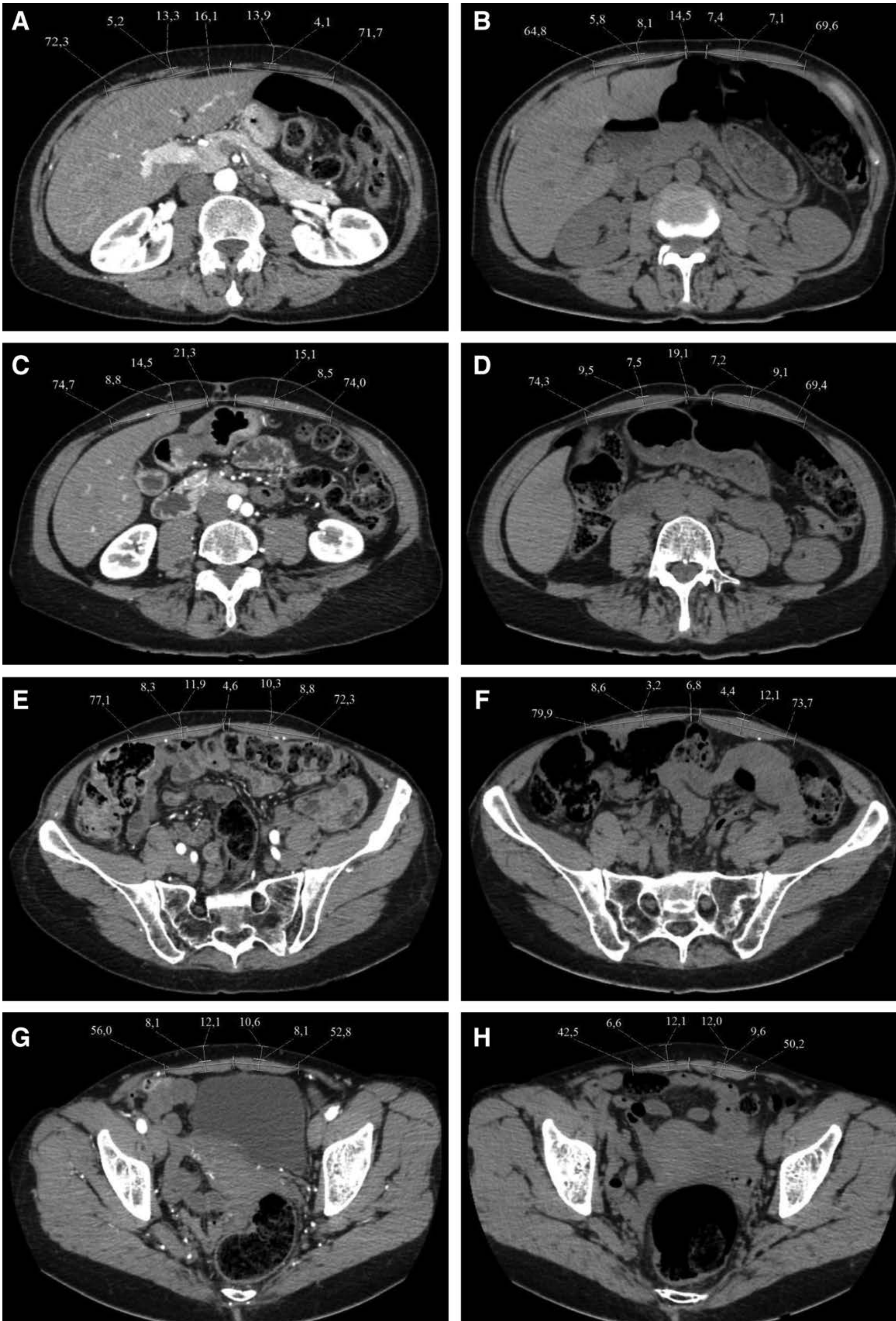

Fig. 2. Preoperative (left) and postoperative (right) measurements of all 4 zones. Left being the operated side. Measurements in millimeters. A and B) Zone A. C and D) Zone B. E and F) Zone C. Note the increased postoperative APD on the operated side. G and H) Zone D.

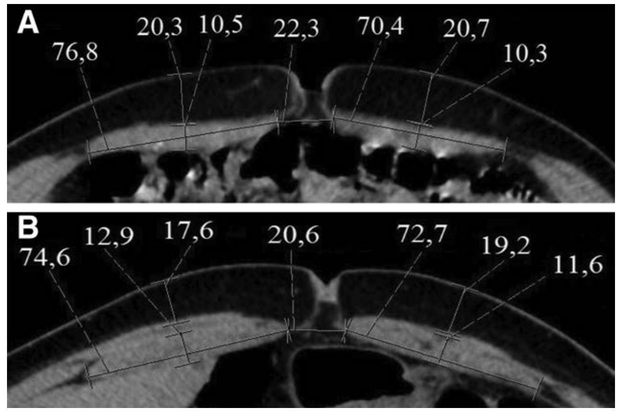

Fig. 3. Preoperative (A) and postoperative (B) measurements in Zone B. Right being the operated side. Measurements in millimeters. Note: (1) the increased postoperative APD on the operated side and (2) the seroma covering most of the anterior surface of the operated muscle belly.

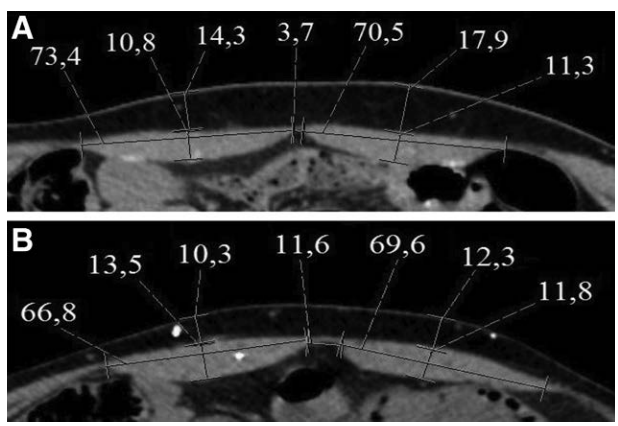

Fig. 4. Preoperative (A) and postoperative (B) measurements in Zone C. Right being the operated side. Measurements in millimeters. Note: (1) the increased postoperative APD on the operated side, (2) the smaller TD on operated side versus nonoperated side, and (3) the increased postoperative DRA.

Table 2. Additional Findings on Postoperative CT Scan (N = 14)

Additional Finding	N	Applicatory Diagnostic Testing	Comment
Seroma	2	None	No surgery/aspiration needed
Hernia	1	None	Two hernias (epigastric and umbilical) on same patient. Unchanged from preoperative CT
Liver lesion	2	Ultrasound with contrast	Both hemangiomas
Splenic artery aneurysm	1	CT with contrast	No surgery needed
Skeletal metastasis	1	CT-guided biopsy	Reported to oncologist

develop inferior to the perforator location when injury to the nerve and muscle happens due to pedicle dissection progression. Despite this finding, all remaining data listed in Table 5 indicate otherwise well-preserved symmetry of the paired rectus muscles. When comparing the operated rectus belly on postoperative scans to the same rectus belly on preoperative scans, the former had a significantly increased APD in zones B and C (Figs. 2–4). No similar significant change is seen on the nonoperated side. The increased APD might be secondary to impaired venous/lymphatic drainage and scar formation caused by the intramuscular perforator dissection. Venous stasis is thought to occur when the deep inferior epigastric vein, a rather large caliber vessel, is separated from the muscle belly.

In accordance with our data, Lee et al.[10] assessed the rectus muscle using ultrasonography and concluded that the resting muscle thickness (APD) was significantly increased at 1 month postoperatively ($P = 0.01$). They measured APD

Table 3. Anteroposterior Diameter of Operated Rectus Muscle (N=14)

	Zone A		Zone B		Zone C		Zone D	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Minimum	4.0	6.0	8.0	8.0	7.0	8.5	5.0	5.0
Maximum	11.5	11.5	11.0	13.5	12.5	14.5	13.0	15.5
Mean	8.5	9.1	9.3	10.0	10.2	11.2	9.7	9.3
SD	1.9	1.7	1.5	1.4	1.7	2.0	2.3	2.6
*P**	0.508†		0.044†		0.038†		0.207†	

All data in millimeters. Significance was taken at $p < 0.05$.
**P* values comparing preoperative and postoperative measurements within each zone.
†Values are statistically significant.

Table 4. Transverse Diameter of Operated Rectus Muscle (N=14)

	Zone A		Zone B		Zone C		Zone D	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Minimum	59.5	49.5	51.0	49.0	56.0	51.5	23.0	22.0
Maximum	94.5	82.0	82.5	80.5	82.5	83.5	63.5	54.5
Mean	69.5	67.1	66.0	64.7	68.6	65.7	47.9	44.5
SD	10.0	9.6	9.4	7.7	7.9	9.1	9.8	8.6
*P**	0.116†		0.363†		0.064†		0.035†	

All data in millimeters. Significance was taken at $p < 0.05$.
**P* values comparing preoperative and postoperative measurements within each zone.
†Values are statistically significant.

Table 5. Comparison of Operated and Nonoperated Side on Postoperative CT Scan (N=14)

	Zone A						Zone B					
	APD		TD		Fat Layer		APD		TD		Fat Layer	
Side*	OS	NOS	OS	NOS	OS	NOS	OS	NOS	OS	NOS	OS	NOS
Mean	9.1	8.9	67.1	69.6	18.4	18.4	10.0	9.9	64.7	65.1	18.0	18.6
P value†	0.398		0.140		0.776		0.673		0.60		0.422	
	Zone C						**Zone D**					
Side*	OS	NOS	OS	NOS	OS	NOS	OS	NOS	OS	NOS	OS	NOS
Mean	11.2	11.1	65.7	70.4	13.9	13.4	9.3	9.6	44.5	46.2	20.9	20.8
P value†	0.906		0.048†		0.293		0.636		0.208		0.969	

All data in millimeters. Significance was taken at $p < 0.05$.
*Side: OS, operated side; NOS, nonoperated side.
†*P* values comparing postoperative measurements of operated and nonoperated side within each zone.
‡Values are statistically significant.

Table 6. Diastasis Recti Abdominis (N=13)

	Zone A		Zone B		Zone C		Zone D	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Minimum	7.5	4.0	19.5	15.0	0.0	0.0	0.0	0.0
Maximum	38.0	32.5	41.5	36.5	20.0	23.0	10.5	16.5
Mean	23.0	19.5	29.0	27.5	8.2	11.8	1.8	5.3
SD	8.6	8.6	7.8	7.4	5.7	7.1	3.4	5.6
**P* value	0.036†		0.382†		0.030†		0.032†	

All data in millimeters. Significance was taken at $p < 0.05$.
**P* values comparing preoperative and postoperative measurements within each zone.
†Values are statistically significant.

of the rectus belly at 1 standardized point (using bony landmarks) almost equivalent to our zone C. The authors of the study also speculate whether this can be attributed to a postoperative edema of the muscle caused by damage of local blood flow and lymphatic drainage. Contrary to our data, the same study reports that the increased APD was resolved at 1 year follow-up ($P = 0.54$), suggesting a more transient muscle edema as the cause. Whether or not the operated rectus belly suffers from chronic edema and/or scar formation are subjects of further research. Magnetic resonance imaging would be more preferable in addressing these issues. Magnetic resonance elastography and ultrasound elastography are other usable alternatives.

Although some of our data indicate morphological changes to the rectus bellies postoperatively—possibly representing localized atrophy (reduced TD) and/or chronic edema (increased APD) on the operated side—they do not tell anything about rectus muscle function. This issue has not been sufficiently addressed in our study. Futter et al.[9] used an isokinetic dynamometer to compare DIEAP flap patients and no surgery controls reporting insignificant differences (although there was a trend of reconstructed patients having lower eccentric and isometric abdominal flexion strength). Bottero et al.[11] showed an analogous muscle function reduction through their electromyographic analysis comparing the operated and nonoperated rectus muscles. At 15 months follow-up, the mean activity of the operated muscle was 70% of the nonoperated muscle. We believe that the morphological changes documented in our study, in concert with such postoperative muscle function studies, indicate that DIEAP flap harvest causes some muscle morbidity. The changes documented, however, are probably not limiting the patient in terms of activities of daily living and regular exercise.

Despite not performing a plication of the linea alba during the abdominoplasty, the DIEAP flap procedure seems to cause several significant changes to the DRA. As listed in Table 6, there are significant changes in 3 of 4 zones.

In zone A, the DRA is decreased in size (Fig. 2). As mentioned, only 1 patient had a DRA plication done who was subsequently excluded for the analysis. The authors hypothesize, therefore, that the decreased DRA might be caused by the longitudinal tension generated when closing the abdominal defect: To achieve an adequate closure, the upper abdominal panniculus is undermined and mobilized several centimeters caudally. Due to the ellipsoidal shape of the donor defect, the tension is greater in the midline compared with the lateral corners. Consequently, the closure might cause the upper abdominal tissue to be pulled both caudally and medially and the supraumbilical DRA is thought to tighten. In contrast, the DRA in zones C and D increased significantly (Fig. 4). Initially, we believed that the decreased TD of the operated rectus belly in the same zones was a plausible explanation of these DRA changes. There was, nevertheless, no statistically significant correlation between the structural changes of operated rectus muscle and DRA. The results of our correlation tests make muscle atrophy through iatrogenic denervation less likely the cause of increased infraumbilical DRA. Due to the relatively low sample size of the study, such hypothesis should however not be totally ruled out (type II errors).

Alternatively, one can imagine that there is less support in the myoaponeurotic system in the lower abdomen and that zones C and D cover areas that are more susceptible to abdominal wall laxity. We believe that a number of factors contribute in increasing the infraumbilical DRA as this is where the abdominal wall integrity is violated the most. The statistical tests performed simply do not yield a single, conceivable cause.

When assessing these DRA measurements, one needs to keep in mind whether the radiographically measurable changes are of any clinical significance. DRA is described as a weakening of the linea alba, which can contribute in bulging of the abdominal wall.[16–18] There is, however, a lack of agreement on when diastasis is pathologic, and there is no universal agreement about the definition.[16] It is known to be a prevalent condition, especially postpartum,[19,20] and is regularly evaluated and treated by general and plastic surgeons.[21] Importantly, a DRA is not a true hernia and is not associated with a risk of strangulation.[22] Blondeel et al.[8] have demonstrated that despite having abdominal bulging after the flap harvest, none of the patients experienced subjective complaints. Based on these publications and personal clinical experience, we do not believe that DRA changes play a major role in donor-site morbidity and abdominal wall functioning. We suggest, however, that plastic surgeons should tell patients that a DIEAP flap reconstruction might cause DRA changes and possibly shifts to abdominal contour. In addition, if repair is to be undertaken, abdominal wall protrusion (and not the DRA itself) should be the prime indicator.[17] During the preoperative consultation, one should also add the positive fact that no hernias or bulging were observed on the postoperative CT scans. This also counts for the dehisced anterior sheath repaired and the traumatized muscle. Hernia formation does not seem be a frequent postoperative complication of DIEAP flaps, which must be seen as a great advantage comparing the outcomes of other abdominally based perforator flaps.[3,4,6,8]

In summary, the study does demonstrate significant changes to the donor-site. In our opinion, however, these changes could be seen as minimal and of minor clinical relevance. The study does, in other words, indicate that DIEAP flaps result in limited donor-site morbidity, which for most patients does not outweigh the benefits of free perforator flap breast reconstruction.

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