

ORIGINAL ARTICLE

## The unilateral deep inferior epigastric perforator flap: Comparing university to community hospital

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### Abstract

The deep inferior epigastric perforator (DIEP) flap is considered to be the gold standard for autologous breast reconstruction. This study evaluates the outcome of unilateral DIEP flap reconstructions, comparing university with a community hospital setting. A total of 77 unilateral DIEP flaps were performed at one university hospital and two community hospitals by the same two surgeons. Outcome parameters were: hospital stay, operating time, wound infection, wound dehiscence, fat necrosis, haematoma, (partial) flap necrosis and the need for surgical intervention. Forty-nine unilateral DIEP flaps were performed in the university hospital and 28 in the community hospitals. Baseline characteristics were equal. No significant difference was found in total complication rate, flap loss or need for surgical intervention. Although wound dehiscence occurred more often in the community hospitals, unilateral DIEP flap breast reconstructions can be performed with a comparable degree of safety and complication risk in both university and community hospital settings.

**Key Words:** Breast reconstruction, DIEP flap, microsurgery

### Introduction

Since breast reconstruction with the deep inferior epigastric perforator (DIEP) flap was first described [1], it has gained wide popularity and is considered by many to be the present-day gold standard for autologous breast reconstruction [2–6]. Only a few years ago, complicated free tissue transfers like a DIEP flap reconstruction were not likely to be performed in community hospitals and patients were often referred to a university hospital. Nowadays, an increasing number of community hospitals offer breast reconstructive operation with the microvascular DIEP flap. This development has led to an increased capacity to help a vast number of women seeking autologous reconstruction.

For a successful free flap procedure, meticulous technique and sufficient experience on the part of the surgeon are of key importance, but other factors also influence the outcome. A history of smoking, hypertension, diabetes, and radiotherapy are associated with increased complication rates [4,7,8]. Also, experience of the nursing staff, quality of the intensive care unit and availability of resident coverage have been suggested as factors that might influence the outcome of free flap operation [9].

To our knowledge, no published study to date has investigated and compared the outcome of DIEP flap breast reconstructions between community hospitals and a university hospital, although it is probably the most commonly performed free flap procedure in most parts of the world. Research has shown that, in the hands of an experienced microsurgeon, a variety of free flaps can be performed safely and efficiently in a

community hospital, but the number of DIEP flaps in that study was limited [9].

We have performed a multi-centre, retrospective cohort study on the outcome and complications of DIEP flap breast reconstructions in one university hospital and two community hospitals. The purpose of this study was to evaluate and compare different outcome parameters and complications in the two hospital settings.

A significant difference in outcome between the two settings could potentially spark a discussion about centralisation of this complicated procedure in more specialised (university) hospitals.

### Patients and methods

#### Patients and procedures

Between January 2006 and September 2008, 77 unilateral DIEP flap breast reconstructions were performed in our university hospital and two nearby community hospitals. Only unilateral DIEP flaps were included in our study, as numbers of bilateral DIEP flaps in the community hospitals were very low. All patients were operated on by the same two surgeons with extensive experience in microsurgery (RH and LN), who both operated on patients in the university and community hospitals. Immediate as well as delayed reconstructions were performed in all three hospitals. There was no specific selection for patients to be operated on in the university hospital based on previous medical history or complexity of the reconstruction.

Before the operation the DIE-perforators were marked on the abdomens of all patients using a hand-held Doppler device. During the operation zone four was always discarded and the

internal mammary vessels were used as recipient vessels. All anastomoses were made using an operating microscope. Drains were placed under the flap and in the abdominal wound. In the university hospital patients were kept on the recovery ward overnight and went to the plastic surgical ward the next morning. In the community hospitals patients spent one night in the intensive or medium care unit before going to the ward. Flap monitoring was carried out by checking Doppler signal, colour, temperature, and capillary refill every hour for the first 24 hours, every 2 hours for the next 24 hours, every 4 hours on the third day, every 6 hours on the fourth day and once daily if patients remained in hospital for more than 4 days. Patients received prophylactic low-molecular-weight heparin from the day before the operation until discharge and wore pressure stockings during and after the operation.

There was no resident coverage in the community hospitals and in these hospitals the DIEP flap is the only free flap operation being performed. There has been a great amount of experience with free flaps in the university hospital, such as in breast, head and neck and lower extremity reconstruction. This implies a greater amount of experience of scrub nurses, anaesthesiologists and nursing personnel with the procedure itself, including microsurgery and postoperative flap monitoring.

### Measures

All patient-specific data were collected from hospital and out-patient records by the first author (RW). Information was obtained regarding demographics and potential risk factors: age; timing of reconstruction (immediate or delayed); hypertension (any patient diagnosed with hypertension or treated with anti-hypertensive drugs at time of reconstruction); diabetes (regardless of type or treatment); smoking (active or in the past); abdominal scarring due to laparotomy (laparoscopy scars were not taken into account); and a history of radiotherapy or chemotherapy before time of reconstruction. Data about flap weight and ischaemia time were often not consistently documented and were therefore not taken into consideration, since evaluating them would not be reliable.

Outcome parameters of our study were operating room time, length of hospital stay, and the following complications: wound infection, wound dehiscence, fat necrosis, haematoma, and partial or total flap necrosis. Furthermore, the need for surgical treatment of complications was evaluated. A minimum follow-up period of 3 months was maintained to facilitate an adequate observation of any postoperative complications.

### Statistical analysis

Analytical evaluation of patient data and the comparison of outcome parameters were carried out by means of the Fisher's exact test and the independent *t*-test. A *p*-value of less than 0.05 was considered statistically significant. SPSS version 15.0.0 for Windows® software (SPSS inc., Chicago, IL) was used for the statistical analysis.

## Results

### Patient characteristics and risk factors

A total of 77 women underwent a unilateral DIEP flap procedure, of which 49 (64%) were performed in the university hospital and 28 (36%) in the two community hospitals. The mean age of these

patients at the time of operation in the university hospital was 48.8 years (range 26–70) and 49.4 years (range 35–71) in the community hospitals ( $p = 0.73$ ). Eighteen per cent of the patients in the university hospital setting had an immediate reconstruction compared with 14% in the community hospital setting ( $p = 0.73$ ). None of the baseline patient characteristics were significantly different between the two groups, a detailed description of which is presented in Table I. However, there seemed to be a trend towards more cases of hypertension among patients in the university hospital than among patients in the community hospitals (25% and 11%, respectively) ( $p = 0.23$ ), as well as a trend towards more smokers/former smokers in the community hospital setting than in the university hospital setting (32% and 18%, respectively) ( $p = 0.26$ ).

### Outcome and complications

Mean total operating time was 7 hours 29 minutes in the university hospital (range 3 hours 59 minutes–13 hours 1 minute) and in the community hospitals it was 6 hours 25 minutes (range 4 hours 16 minutes–8 hours 24 minutes) ( $p = 0.002$ ). Mean length of hospital stay was 6.2 days in the university hospital (range 3–14) and 6.8 days in the community hospitals (range 5–14) ( $p = 0.20$ ).

Detailed information about outcome is shown in Table II. Fifteen postoperative complications (31%) occurred in the university hospital setting, compared with 13 (43%) in the community hospital setting, but this difference was not statistically significant ( $p = 0.33$ ). Twenty-seven per cent of patients in the university hospital required one or more operations to treat these complications, compared with 21% in the community hospitals ( $p = 0.79$ ). Wound dehiscence was more common in the community hospital setting than in the university hospital setting (36% and 6%, respectively) ( $p = 0.001$ ). Partial flap loss occurred in three cases (6%) in the university hospital and in two cases (7%) in the community hospitals ( $p = 1.00$ ). There were two occurrences of total flap loss (4%) in the university setting and none in the community setting ( $p = 0.53$ ). The cumulative rate of flap loss (total flap loss plus partial flap loss) was 10% in the university hospitals and 7% in the community hospitals ( $p = 1.00$ ). Fat necrosis was present in five patients (10%) in the university setting and in two patients (7%) in the community setting ( $p = 0.53$ ).

## Discussion

The purpose of our study was to compare outcome and postoperative complications of DIEP flap breast reconstruction between a university hospital setting and a community hospital setting. In our population, baseline patient characteristics of the two groups showed no significant differences. However, we found two significant differences in outcome parameters.

First, total operating time of a unilateral DIEP flap procedure was longer in the university hospital than in the community hospitals (7 hours 29 minutes compared with 6 hours 25 minutes) ( $p = 0.002$ ). These figures correspond to those found in previous reports on an early series of DIEP flaps [8], although in centres with extensive experience with this procedure operative time can be reduced to a great extent [6]. Factors that potentially contribute to a longer operative time in the university hospital are training of consultant plastic surgeons who are less

Table I. Patient characteristics of 77 patients who had unilateral DIEP flap breast reconstruction.

	University hospital (n = 49)		Community hospital (n = 28)		p-value
	n	%	n	%	
Mean age in years (SD; range)	48.8 (7.9; 26–70)		49.4 (8.1; 35–71)		0.73
Immediate reconstruction	9	18	4	14	0.76
Hypertension	12	25	3	11	0.23
Diabetes	2	4	1	4	1.00
Smoker/former smoker	9	18	9	32	0.26
Abdominal scar	5	10	4	14	0.72
Radiotherapy	16	33	7	25	0.61
Chemotherapy	16	33	12	43	0.46

SD = standard deviation.

experienced in microsurgery and the fact that part of the operation was carried out by residents.

Secondly, a higher number of wound dehiscence was found in the community hospitals compared with the university hospital (36% and 6%, respectively) ( $p = 0.001$ ). Although no significant differences were found in patient characteristics to which this finding can be attributed, there was a trend towards more smokers or previous smokers in the community hospital setting, which could be an explanation for the difference in complications related to wound healing. Fisher's exact test pointed out that 33% of smokers/former smokers in the total population developed a wound dehiscence as compared with 12% of non-smokers. However, this finding, too, was not statistically significant ( $p = 0.07$ ). In all hospitals, smokers were told to quit or minimise smoking, but some continued to smoke. One can propose that smokers should be counselled to stop smoking or the reconstruction be cancelled if they adhere to smoking.

Flap necrosis did not significantly differ between university and community hospitals. The largest follow-up study for complications of DIEP flaps reports a partial flap necrosis rate of 2.5% and total flap necrosis rate of 0.5% [4]. These numbers are lower than the numbers we found in our population. However, the authors report 14% fat necrosis and most of their patients had an immediate reconstruction, whereas only ~17% of our patients had an immediate reconstruction. This difference may be explained by the possibility that a percentage of partial flap necrosis was mistakenly reported as fat necrosis in the abovementioned study. Especially in DIEP flap reconstruction after subcutaneous mastectomy, when most

of the flap is buried and only a small skin paddle remains, it is more difficult to distinguish between fat necrosis and partial flap necrosis.

No differences were found between the two groups in the need for surgical treatment of complications, and our figures compare to those reported in the literature [8]. There was, nonetheless, a large number of patients that required one or more operations, apart from additional elective procedures such as reconstruction of the nipple-areola complex or scar revision. It must be pointed out, however, that most of these operations were minor procedures, for example, evacuation of a haematoma or debridement and closure of a small wound dehiscence.

We did not observe a difference between the two hospital settings in postoperative risk of the most serious of complications in DIEP flap surgery: (partial) flap loss and fat necrosis. Another notable finding is the fact that the need for surgical treatment for any complication did not differ among the hospitals. In other words, when compared with the university setting, patients in the community hospital setting did not have an increased risk of complications, nor did they have to undergo a greater amount of additional operation.

Some limitations of this study are the retrospective nature of our series and a relatively small patient population. Furthermore, we were dependent on the documentation of different physicians involved in the follow-up of patients, so inter-observer variability cannot be ruled out. Also, data about flap weight and ischaemia time was often incomplete. A prospective trial involving a larger population would be of value for further determining whether or not differences exist between university and community hospital settings.

Table II. Outcome of 77 unilateral DIEP flaps.

	University hospital (n = 49)		Community hospital (n = 28)		p-value
	n	%	n	%	
Total complications	15	31	12	43	0.33
Wound infection	2	4	0		0.53
Wound dehiscence	3	6	10	36	0.001
Haematoma	3	6	0		0.30
Fat necrosis	2	4	0		0.53
Flap necrosis	5	10	2	7	1.00
Partial flap necrosis	3	6	2	7	1.00
Total flap necrosis	2	4	0		0.53
Surgical intervention	13	27	7	21	0.79

Our study provides insight into complication rates in both university and community hospitals, by taking account of the influence of hospital setting specific factors in addition to the skill and experience of the microsurgeon. It appears that unilateral DIEP flap breast reconstructions can be performed in a community hospital setting with the same degree of safety as in a (specialised) university hospital setting. We feel that the minimum hospital-specific requirements necessary are: an experienced surgeon; an operating microscope; and a recovery or nursing ward equipped with enough staff to facilitate frequent flap monitoring. In addition, (nursing) staff should be trained to recognise flap failure, using protocols in which indicators of flap health, such as colour, capillary refill, temperature, and Doppler signal are combined. Also the facility to promptly return to the operating theatre in the event of a complication, such as arterial or venous thrombosis, is an important requirement. DIEP flap operation continues to be a difficult and time-consuming operation and should be performed by a surgeon who has extensive experience in carrying out this procedure, but the hospital setting in which he or she performs this type of breast reconstruction seems to be of little importance if certain minimum requirements are met.

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