

**Jarna Heikkinen**

**Breast Reconstruction in Elderly (>60 years) Women  
using Deep Inferior Epigastric Perforator Flaps (DIEP) is  
Safe and Viable: a Comparative Study**

Syventävien opintojen kirjallinen työ

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There is still debate concerning the indications for microsurgical breast reconstruction, particularly deep inferior epigastric perforator (DIEP) flap in elderly women concerning its safety. Free tissue transfer still carries the risk of perioperative morbidity and mortality in elderly patients. To clarify this issue, a comparative study was performed.

This is a retrospective cohort study including all unilateral DIEP breast reconstructions performed in a single institution. Patients were divided into two groups based on age: an elderly cohort (>60 years) and a non-elderly cohort (<60 years). Primary outcomes were complete and partial flap as well as the need for flap re-exploration. Demographic and comorbidity data were analyzed as secondary predictor variables. Secondary outcomes included surgical site occurrences, such as seroma, as well as medical complications.

A total of 214 flaps were included in this study, 177 in the non-elderly cohort and 37 flaps in the elderly one. There were no significant differences in the incidence of total or partial flap loss between the two cohorts, or flap re-exploration. Similarly, there were no differences in postoperative complications between the groups). The success rate of the non-elderly cohort was 94.6 and the success rate of the elderly cohort was 96.6 percent. Microsurgical breast reconstruction using DIEP is safe in elderly patients, and should not be denied DIEP flaps because of their age alone.

Keywords: Microsurgery; Free flap; Elderly; Reconstruction; DIEP; Complications

## **Introduction**

Breast cancer is the second most common cancer of women after non-melanotic skin cancer and the incidence of breast cancer is growing. In Finland, there are around 5100 new cases of breast cancer every year meaning 170 cases per 100 000 human years. The treatments and diagnostics of breast cancer have throughout the years vastly developed and today the 5-year survival rate is over 90%. The prevalence of breast cancer survivors living into old age is increasing.<sup>1</sup>

In western countries, the median age of patients diagnosed with breast cancer is 62-64 years.<sup>2,3</sup> Even though breast cancer is greatly a disease of elderly women, patients with advanced age are highly underrepresented in breast reconstruction patients.<sup>4</sup> This is the case even though it has been documented, that elderly women also want breast reconstruction after mastectomy, and that elderly women benefit psychosocially from breast reconstruction similarly to younger patients.<sup>5-7</sup>

Although tissue-saving techniques can be utilized in many patients, there is still a big proportion undergoing total mastectomy. To overcome the psychosocial difficulties and decrease in quality of life, various techniques for breast reconstruction have been developed.<sup>8</sup>

These include deep inferior epigastric perforator flaps (DIEP) and transverse rectus abdominus myocutaneus (TRAM) reconstructions. These breast reconstructions have a vital role in the recovery of breast cancer patients in terms of improving their quality of life after mastectomy. Surgeons' assumptions regarding the benefits of breast reconstruction in quality of life among older patients might, however, differ from the reality and breast reconstruction is often unfoundedly deemed unnecessary for older women. Because the aesthetic of breasts in older patients might not be regarded as important, reconstruction is not actively discussed and offered. Another reason for the lack of breast reconstruction in elderly patients is the perception of age as an independent risk factor for surgical complications, especially in intricate and lengthy operations like microvascular flap surgery, although the scientific evidence for this does not exist. On the contrary, it has been documented on multiple occasions, that microvascular flaps are safe for women over 60 and 65 years old.<sup>6,7,9-13</sup>

The aim of the current study was to investigate the role of age in the outcome of autologous breast reconstruction with DIEP flaps. We hypothesized that elderly women's outcomes and complication rates might be comparable to those of a younger population.

## **Materials and Methods**

This study was performed in accordance with the Declaration of Helsinki and Ethical approval was provided by the Institutional Review Board of Turku University Hospital.

This is a single-center, retrospective cohort study. We analyzed a total of 214 consecutive patients who underwent unilateral DIEP breast reconstruction at the Department of Plastic and General Surgery of Turku University Hospital, Turku, Finland between 2009 and 2018. For the purpose of this study, patients were divided into two groups based on age: the experimental group included women over 60 years of age, while the control group comprised women under 60 years old.

The inclusion criteria were age between 18 and 90 years who underwent primary unilateral breast reconstruction using DIEP flap, diagnosed with previous unilateral breast cancer, and a minimum of 6 months of follow-up. The exclusion criteria comprised bilateral breast reconstructions, secondary breast reconstructions.

Demographic data were obtained from patient charts including patients' age, BMI, comorbidities, the indication for the mastectomy, smoking status, use of herbal supplements, history of radiation, and chemotherapy before and after mastectomy. Intraoperative details such as the duration of operation, the weight of the flap, the amount of blood loss, surgical technique, number, and location of perforators, were also collected. All flaps were monitored postoperatively with a Licox microcatheter to measure the oxygen tension and temperature of the flap. Flaps with low scores with Licox catheter were immediately assessed by the surgeon and re-explored in order to save the reconstruction.

Primary outcome measures of the study were complete flap loss, partial flap loss, and the need for re-exploration. Secondary outcomes included surgical site occurrences, postoperative infection or wound dehiscence, fat necrosis, hemorrhage, seroma, and medical complications such as venous thromboembolism or cardiac complications.

#### *Statistical analysis*

Continuous parametric and nonparametric data are reported as mean  $\pm$  standard deviation (SD), while discrete data with percentage. Statistically, significance was set whether two-sided *P* value was  $\leq 0.05$  on a 95% confidence interval. Comparisons between the study groups were carried out using Student's t-test for continuous variables and Chi-square or Fisher's exact test for discrete variables, according to the nature of the data. Normality assumptions were assessed with

histograms, Skewness, Kurtosis, and Kolmogorov/Smirnov tests. All the statistical analyses were conducted using SPSS statistical software (IBM SPSS Statistics, version 28, Armonk, NY, U.S.A).

## Results

Altogether 154 breast reconstructions using DIEP or free TRAM flaps were performed during the study period; 37 flaps in the elderly cohort and 177 flaps in the non-elderly cohort. All reconstructions were late reconstructions. The average age of the entire study population was 50.7 years and comorbidities were present in 48.6 % of patients.

The mean age in the elderly cohort was  $62.24 \pm 2.63$  years and  $48.30 \pm 6.53$  years in the non-elderly cohort. The mean BMI was significantly higher in the non-elderly cohort ( $21.65 \pm 0.75$  vs  $26.85 \pm 2.40$  respectively,  $p < 0.001$ ). However, there was no significant difference in the prevalence of obesity ( $BMI > 30 \text{ kg/m}^2$ ) between the groups (8.1% in the elderly group and 9.0% in the non-elderly group,  $p = 0.856$ ). There was no significant difference in the total amount of comorbidities between the cohorts ( $1.51 \pm 1.21$  in the elderly cohort and  $1.46 \pm 1.23$  in the non-elderly cohort,  $p = 0.594$ ). Hypertension was slightly but not significantly more common in the elderly cohort (21.6% in the elderly cohort and 12.4% in the non-elderly cohort,  $p = 0.143$ ) as well as depression (24.3% in the elderly cohort vs 20.0% in the non-elderly cohort,  $p = 0.556$ ). Diabetes was slightly more prevalent in the non-elderly cohort (0% in the elderly cohort vs 2.3% in the non-elderly cohort,  $p = 0.356$ ). The number of smokers was quite similar in the cohorts (13.5% in the elderly cohort vs 14.12 in the non-elderly cohort,  $p = 0.880$ ). The demographics of the patients are presented in Table 1.

No statistically significant differences regarding perioperative parameters were found (Table 2). The average operation time in the elderly cohort was  $404.29 \pm 100.82$  minutes and  $402.18 \pm 100.46$  minutes in the non-elderly cohort,  $p = 0.928$ . There were no significant differences in flap weight, blood loss, or the number of perforators between the cohorts.

There was no significant difference in complete flap loss between the two cohorts (5.4% in the elderly cohort vs 3.4% in the non-elderly cohort,  $p = 0.629$ ) nor in partial flap loss (0.0% vs 4.7% respectively,  $p = 0.216$ ). Furthermore, there was no significant difference in the need for re-exploration between the cohorts (8.1% in the elderly cohort vs. 10.1% in the non-elderly cohort,

p=0.937). Overall, there was a trend of more complications in the non-elderly cohort, yet no statistical significance was found (61.8% in the non-elderly cohort vs. 45.9% in the elderly cohort p=0.074). There were no significant differences in the rates of any singular complications between the cohorts. The non-elderly cohort had slightly but not significantly higher incidences of superficial wound infection (2.7% in the elderly cohort vs 11.3% in the non-elderly cohort, p=0.110), wound dehiscence (5.4% vs 7.4% respectively, p=0.669), fat necrosis (0% vs 4.5% respectively, p=0.187), hemorrhage (29.7% vs 45.2% respectively, p=0.083), deep wound infection (0% vs 0.6% respectively, p=0.647) and hematoma (5.4% vs 6.8% respectively, p=0.753). Seroma was slightly more common in the elderly cohort (5.7% in the elderly cohort vs 4.0% in the non-elderly cohort, p=0.653). The only significant difference between the two cohorts was seen in the late re-operation rate (re-operation > 30 days postoperatively) as late re-operations were significantly more common in the non-elderly cohort (14.4% in the elderly and 32.9% in the non-elderly cohort, p=0.028). Also, the incidence of early re-operations (re-operation <30 days postoperatively) was slightly higher in the non-elderly cohort (13.5% vs 21.3% respectively, p=0.497). Primary and secondary outcomes are shown in Table 3.

On logistic regression, being elderly was seen not as a significant risk factor for complete flap loss (OR 1.0, 95% C.I 0.93-1.1; p=0.591). The overall success rate for the elderly cohort was 94.6 percent, whereas the success rate for the non-elderly cohort was 96.6 percent.

## **Discussion**

In our study, the risk for total or partial flap loss, the risk for re-exploration, or the risk for complications did not increase with older age. Our results support the previous studies on this matter and suggest that age over 60 is not a significant risk factor for autologous breast reconstruction. On the contrary, late re-operations were more common in the non-elderly cohort. It has been reported in the literature that breast reconstruction significantly increases the psychosocial and sexual well-being of patients, and this effect does not diminish with age.<sup>10</sup> Body image is equally important to older women and mastectomy usually has a significant impact on self-perception.<sup>5</sup> The absence of a breast is a constant reminder of cancer even if the disease itself has been successfully cured. In Bowman and al. study women over 60 years old were highly satisfied with the results of breast reconstruction.<sup>7</sup> In a study by Santosa et al. elderly women had even better outcomes in psychosocial well-being as well as sexual well-being after breast reconstruction surgery than non-elderly women.<sup>6</sup>

Even though many of the patients who undergo breast surgery for cancer are 60 years of age or older, they present a minority among patients who undergo breast reconstruction. One reason for the underrepresentation of elderly women in autologous breast reconstructions is the belief of age being an independent risk factor for microvascular surgery. Also, comorbidities such as cardiovascular disease are more common in the elderly population, and this is most likely one reason why breast reconstruction is not as widely offered to older patients.

However, in previous studies assessing the safety of autologous breast reconstruction on elderly patients, the procedure has mostly been considered to be safe for patients older than 60 years old. In a chart review performed by Torabi et al., there was significantly more complete flap loss and wound dehiscence in patients older than 65 years, but overall, the procedure seemed safe for elderly patients with a success rate of 96.3 percent in the cohort of patients over 65 years old (vs. 99.6% percent in the non-elderly cohort). It is worth noticing that in the population of this study comorbidities such as hypertension, hyperlipidemia and diabetes were significantly more common in the elderly cohort which could be a more important reason for the difference than age itself.<sup>9</sup> In Santosa et al. study age did not increase the risk of complications in autologous breast reconstruction.<sup>6</sup> In a 2015 study by Butz et al. age over 65 was a risk factor for thromboembolism in autologous breast reconstruction, but in this study as well comorbidities were significantly more frequent in the elderly cohort.<sup>14</sup> In 2021, Cordova et al. published a multicentric study that evaluated 194 patients over 65 years of age. This study found that flap survival was similar in different age groups, but patients older than 75 years with an ASA score of 3 or more had a higher risk of complications. It is worth noticing, that the overall flap survival rate in the study was lower than generally reported in flap surgery, which could indicate a greater risk for flap loss in patients over 65.<sup>12</sup>

Studies on other types of microvascular flaps have been conducted and the results tend to be much similar to breast reconstruction – age should not be an exclusion criterion for flap surgery.<sup>15–18</sup> A meta-analysis on many different types of microvascular interventions in elderly patients found that systemic complications were significantly higher in elderly patients but there were no differences in flap survival rates and surgical complications between young and elderly patients.<sup>19</sup> Our results are consistent with the previous findings and suggest that age alone does not increase perioperative risks in breast reconstruction surgery.



Previous studies as well as our results imply that age alone should not be considered an exclusion criterion when assessing the eligibility for surgery. The overall health status varies greatly between elderly patients and should be assessed individually. Healthy and fit patients should be offered necessary surgery, regardless of age.

DIEP has become the golden standard of autologous breast reconstructions. Deep epigastric inferior perforator flaps consist of skin and subcutaneous tissue from the lower abdomen with the deep epigastric inferior perforator artery. The flap is cut from the lower abdomen and moved to the chest. An important benefit of the technique is the natural texture and esthetic of the reconstructed breast. The color of DIEP flaps usually matches the color of the chest and usually, the technique gives the possibility to a good graft volume. With DIEP flaps the abdominal muscles are left intact which helps to decrease the risk of abdominal hernia. Autologous breast reconstructions are technically demanding, and operation times are long but ultimately autologous reconstructions can be easier for the patients since implants usually require re-operation 10-15 years after the reconstruction.

Kuykendall et al. documented higher patient satisfaction with DIEP flaps than with implant-based reconstruction especially in elderly patients.<sup>20</sup> Similarly, Walton in a literature review studying six papers recommends autologous breast reconstruction for elderly patients with better outcomes than implant-based reconstructions, given that the patient selection is thoroughly made.<sup>21</sup>

Many comorbidities such as diabetes, hypertension, and vascular disease are more frequent in the elderly population, and these comorbidities increase perioperative morbidity.<sup>22-24</sup> Therefore, elderly patients, in general, are more prone to surgical and anesthetic complications. General frailty and nutritional status might be more difficult to assess but they are characteristics that are more common in the elderly population and increase operative risks.<sup>25,26</sup> However, there are healthy elderly patients, and if reconstruction is safe in these individuals, and they significantly profit from it, the operation should be adequately offered.

In our study population, there were no statistical differences in the rates of any comorbidities between the elderly and non-elderly cohort, and the mean BMI was higher in the non-elderly cohort. This indicates that the selection criteria for the patients in the elderly cohort have been as strict regarding comorbidities as in the non-elderly cohort, and perhaps even more rigorous regarding BMI. In Turku University Hospital autologous breast reconstruction surgery is offered generally only to patients with BMI under 30 because of the perioperative risks obesity causes. Therefore, there were no patients with a BMI clearly over 30 in either of the cohorts, 19 patients

had a BMI just above 30. There was no significant difference in the rate of patients with BMI over 30 between the cohorts.

In our analysis older age did not increase the risk of complications. On the contrary, there was a tendency for a lower risk of complications in the elderly cohort. It is unlikely that older age itself would protect from surgical complications and it seems more likely that this phenomenon is explained by differences in patient selection criteria between younger and older patients. The only significant difference found between the cohorts was higher BMI in the non-elderly cohort, yet there was no difference in the prevalence of obesity (BMI>30) between the cohorts. Obesity has been shown to be a risk factor for breast reconstruction.<sup>23,24,27</sup> Correlation between higher BMI and surgical complications in breast reconstruction in non-obese patients should be further studied. The rate of late re-operations was significantly higher in the non-elderly cohort. Most late re-operations were esthetical fix-ups due to patients' dissatisfaction with the symmetry, volume, or shape of the outcome. It can be speculated that the reason for older women going through less late re-operations could be that they were more satisfied with the outcome of the surgery. On the other hand, as older women are not as easily offered breast reconstruction surgery in the first place, it could be that the same phenomenon recurs after the surgery and older women could be less likely to be offered improvement surgery on the flap. The average follow-up time did not differ significantly between the cohorts.

As life expectancy increases, the incidence of breast cancer keeps getting higher. The oncological treatments for breast cancer have developed and as most breast cancer nowadays can be curatively treated, the focus shifts to preserving the quality of life of breast cancer survivors. Our findings suggest that age over 60 does not increase the risks for breast reconstructive surgery with DIEP flaps. Thus, elderly women should be counseled for microsurgical breast reconstruction and not excluded because of age alone.

In this study, the average follow-up time of the patients was 74.5 months, and the follow-up times ranged from a minimum of 6 months up to over 10 years. Because of the strong public healthcare in Finland, patients also often seek medical attention from public health care providers. Thus, the patient charts used to collect the data for this study can be considered representative.

In most previous papers studying the relationship between age and operative risks, older patients have more comorbidities. This complicates the assessment of the role of age as an individual risk factor. In our study, there was no significant difference in morbidity between the cohorts.

The major limitations of our study are the retrospective nature of the study and the limited number of patients. This may lead to type II error in some of the outcome comparisons; for example, the incidence of partial flap loss may suffer from this limitation. However, being more frequent in the younger group, this limitation does not question our main results and conclusions. The mean age of the elderly cohort was  $62.24 \pm 2.63$  years and the oldest patient of the cohort was 68 years old. Thus, the results of our study do not represent patients much older than the mean age of the cohort and the safety of breast reconstruction in patients in their late 60s and 70s should be further investigated. Elderly patients, in general, have more comorbidity than younger patients. Further studies should be conducted to detect, which comorbidities are associated with complications in breast reconstructive surgery.

### **Conclusions**

Elderly women want breast reconstruction and benefit from it similarly to younger patients. Our results confirm what has been shown in previous studies— free flap reconstruction is a viable and safe option for elderly patients. When selecting patients for DIEP surgery the entire health status should be considered, not only the age.

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**Table 1.** Demographics of patients at the time of the study.

	<i>Elderly group (n=37)</i>	<i>Non-elderly group (n=177)</i>	<i>p-value</i>
Age (mean $\pm$ SD)	62.24 $\pm$ 2.63	48.30 $\pm$ 6.53	<0.001
Mean BMI (kg/m <sup>2</sup> )	21.65 $\pm$ 0.75	26.85 $\pm$ 2.40	<0.001
Any comorbidity	1.51 $\pm$ 1.21	1.46 $\pm$ 1.23	0.594
Obesity (BMI >30 kg/m <sup>2</sup> )	3 (8.1%)	16 (9.0%)	0.856
Any comorbidity	21 (58.3%)	82 (46.9%)	0.210
Diabetics	0	4 (2.3%)	0.356
Hypercholesterolemia	3 (8.1%)	10 (5.6%)	0.475
Depression	9 (24.3%)	35 (20.0%)	0.556
Hypertension	8 (21.6%)	22 (12.4%)	0.143
Smokers	5 (13.5%)	25 (14.12%)	0.880
Herbal supplement	1	14	0.259
Follow-up (months)	64.49 $\pm$ 36.74	75.54 $\pm$ 37.71	0.375

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**Table 2.** Comparison of peri-operative parameters in the two groups of patients.

	<i>Elderly group (n=37)</i>	<i>Non-elderly group (n=177)</i>	<i>p- value</i>
Operative time (min, mean $\pm$ SD)	404.29 $\pm$ 100.82	402.18 $\pm$ 100.46	0.928
Flap weight harvested (g, mean $\pm$ SD)	905.07 $\pm$ 329.93	887.57 $\pm$ 302.83	0.848
Flap weight after adjustment (g, mean $\pm$ SD)	739.31 $\pm$ 177.93	713.73 $\pm$ 214.50	0.554
Blood loss (ml, mean $\pm$ SD)	521.52 $\pm$ 219.24	473.14 $\pm$ 189.87	0.275
Number of perforators	2.60 $\pm$ 1.00	2.65 $\pm$ 0.788	0.758
Immediate symmetrization	12 (32.4%)	40 (23.1%)	0.234
Flap re-exploration	3 (8.1%)	18 (10.1%)	0.937

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**Table 3.** Postoperative complications < 30 days.

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	<i>Elderly group (n=37)</i>	<i>Non-elderly group (n=177)</i>	<i>P-value</i>
<b>Total flap loss</b>	2 (5.4%)	6 (1.1%)	0.629
Partial flap loss	0 (0.0%)	8 (4.7%)	0.216
Complications (surgical site occurrence)	17 (45.9%)	107 (61.8%)	0.074
Superficial wound infection	1 (2.7%)	20 (11.3%)	0.110
Wound dehiscence	2 (5.4%)	13 (7.4%)	0.669
Fat necrosis	0 (0.0%)	8 (4.5%)	0.187
Hemorrhage (need for transfusion)	11 (29.7%)	80 (45.2%)	0.083
Seroma	2 (5.7%)	7 (4.0%)	0.653
Deep wound infection	0 (0.0%)	1 (0.6%)	0.647
Hematoma	2 (5.4%)	12 (6.8%)	0.753
Re-operation (<30 days)	5 (13.5%)	37 (21.3%)	0.497
Re-operation (>30 days)	5 (14.3%)	56 (32.9%)	0.028

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