

# Assessing Age as a Risk Factor for Complications in Autologous Breast Reconstruction

Radbeh Torabi, M.D.  
 Mark W. Stalder, M.D.  
 Oren Tessler, M.D., M.B.A.  
 Matthew J. Bartow, M.D.  
 Jonathan Lam, M.D.  
 Charles Patterson, M.D.  
 M. Whitten Wise, M.D.  
 Charles L. Dupin, M.D.  
 Hugo St. Hilaire, M.D.,  
 D.D.S.

New Orleans, La.



**Background:** Breast cancer is primarily a diagnosis of older women. Many patients seeking breast reconstruction are elderly women (aged 65 years or older). However, many surgeons anecdotally believe that surgery in elderly patients is inherently dangerous, or at least prone to more complications.

**Methods:** The authors conducted a retrospective cohort study composed of chart review of all deep inferior epigastric perforator flap breast reconstruction patients at a single institution divided into an elderly cohort (65 years or older) and a nonelderly cohort (younger than 65 years). Cohort was the primary predictor variable. Demographic and comorbidity data were secondary predictor variables. Primary outcomes were complete flap loss, partial flap loss, or need for flap reexploration. Secondary outcomes such as wound healing problems, seroma, and others were also assessed.

**Results:** There were 285 flaps in the nonelderly cohort and 54 flaps in the elderly cohort. The elderly cohort had higher rates of diabetes, hypertension, and hyperlipidemia. Chi-square analysis showed no significant differences in primary outcomes between the two cohorts. Breast wound dehiscence was significantly higher in the elderly cohort ( $p < 0.01$ ). On logistic regression, being elderly was seen as a significant risk factor for complete flap loss (OR, 10.92; 95 percent CI, 0.97 to 122.67;  $p = 0.05$ ). The overall success rate for the nonelderly cohort was 99.6 percent, whereas the success rate for the nonelderly cohort was 96.3 percent.

**Conclusions:** Elderly women desire breast reconstruction. Free flap breast reconstruction is a viable and safe procedure in these patients. (*Plast. Reconstr. Surg.* 142: 840e, 2018.)

**CLINICAL QUESTION/LEVEL OF EVIDENCE:** Risk, II.

The elderly population, defined as individuals older than 65 years, continues to increase appreciably not just in the United States but also worldwide. This segment alone currently represents 8.5 percent of the total global population and is projected to include over 850 million women by the year 2050.<sup>1</sup> With advances in medical care and technology, many women are appreciating greater longevity; however, this segment also experiences the highest rates of breast cancer. As survival rates increase, more consideration should be focused toward breast reconstruction after mastectomy for affected individuals.<sup>2-4</sup>

Breast reconstruction following mastectomy has been shown to improve self-esteem and quality of life in the younger population. Despite the increasing size of the aging population, there remains a paucity of literature regarding the benefits of breast reconstruction in the elderly. Small analyses have shown that the benefits of breast reconstruction are, in large part, indiscriminate of age and seem to suggest that reconstruction should be more frequently and appropriately offered.<sup>2,3,5,6</sup>

The reasons behind not offering breast reconstruction following mastectomy are often unfounded. Surgeons' tendencies to not offer

From the Division of Plastic and Reconstructive Surgery, Louisiana State University Health Sciences Center.

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reconstruction may lie in certain unsubstantiated bias such as that reconstruction is deemed unnecessary, that aesthetic importance is diminished in the elderly, or that the elderly simply do not want reconstruction, all of which have been refuted in the literature.<sup>2,7,8</sup> In addition, many surgeons are reluctant to offer reconstruction based simply on age alone because of its perceived effects on morbidity and mortality.

Whereas the debate on age and its effects on surgical outcomes persists, more studies are revealing age as an independent risk factor.<sup>9-11</sup> Diabetes, coronary artery disease, hypertension, and other pathologic conditions are quantitative diagnoses that can contribute to perioperative risk stratification, whereas other factors such as physiologic reserve and frailty are more difficult to define.<sup>12,13</sup> It is obvious that elderly patients with severe comorbidities are at higher risk for postoperative complications and mortality and therefore should refrain from undergoing elective surgery. However, it is the healthy elderly patients that clinically appear well but respond poorly to external stresses that are more difficult to delineate. Age is simply another factor that must be taken within the context of the whole when considering reconstructive options.<sup>14</sup> Heidekrueger et al. recently demonstrated that there is no increased risk of complications in microsurgical reconstruction in patients older than 80 years; however, the majority of the reported procedures were for head and neck or lower extremity reconstruction.<sup>15</sup> Laporta et al. also demonstrated no increased risk of complications in those older than 70 years undergoing various methods of breast reconstruction, including free flap reconstruction.<sup>16</sup> Although these data are encouraging, the decreased number of free flap reconstructions in elderly patients deserves further investigation. Furthermore, these studies use age cutoffs to assess risk profiles in age cohorts without logistic regression models. In this study, we present our experience performing free flap breast reconstruction and attempt to identify risk factors for complications, including age, comorbidities, indication for reconstruction, timing of reconstruction, and treatments received before or after reconstruction, using the chi-square test and multivariable logistic regression models.

## PATIENTS AND METHODS

### Study Design/Sample

This study was a retrospective cohort study. On institutional review board approval, a retrospective

hospital chart review was conducted of all deep inferior epigastric perforator (DIEP) free flap breast reconstructions performed at a single institution between January 1, 2009, and August 30, 2013. All patients in the study had a minimum 3 months of follow-up, with an average of 16 months. Patients were separated into two cohorts: patients younger than 65 years and patients aged 65 years and older.

### Study Variables

#### Predictors

The primary study predictor variable was whether the patient was in the elderly cohort or not. Secondary predictor variables were demographic and clinical measures of the patient that may possibly modify the correlation of age with primary and secondary outcome measures. Secondary predictor variables included age, body mass index, smoking status, hypertension, hyperlipidemia, and diabetes mellitus.

#### Outcomes

The primary outcome measures were complete flap loss, partial flap loss, and need for take-back of flap. Secondary outcome measures were arterial or venous anastomosis problems; hematoma, seroma, operable fat necrosis, or dehiscence of the breast wound; and hematoma, seroma, infection, abdominal skin necrosis, operable fat necrosis, or dehiscence of the abdominal site all grouped into one variable, "abdominal wound complications." Medical complications were assessed as outcome measures, including cardiac complications, venous thromboembolism (deep venous thrombosis or pulmonary embolism), pneumonia, and renal failure.

### Statistical Analysis

Deidentified data were entered into a statistical database for analysis (IBM SPSS Version 23; IBM Corp., Armonk, N.Y.). General demographic data between all elderly and nonelderly patients were compared with descriptive statistics. The *t* test was performed for scale variables and the chi-square test was performed for categorical variables. In this phase of analysis, flaps were counted individually, keeping in mind that patients may have undergone bilateral DIEP flap reconstruction. Logistic regression was performed to compare the frequency of postoperative complications between the two cohorts. Flaps were analyzed individually unless analyzing abdominal wound complications, where patients were counted individually instead.

**RESULTS**

A total of 339 free DIEP flaps were performed in 208 patients. The average age of the study population was 52.18 ± 8.26 years, and the average body mass index was 30.86 ± 6.44 kg/m<sup>2</sup>. The comorbidities with the highest prevalence in the study population were hypertension (*n* = 153), hyperlipidemia (*n* = 67), and diabetes mellitus (*n* = 51).

There were 285 flaps in the nonelderly cohort and 54 flaps in the elderly cohort. The average age of the nonelderly cohort was 49.42 ± 8.62 years, and the average age of the elderly cohort was 66.74 ± 2.32 years (*p* = 0.01). One hundred fifteen nonelderly flap patients (40.35 percent) and 38 elderly flap patients (70.37 percent) had hypertension (*p* < 0.01). Forty nonelderly flap patients (14.04 percent) and 27 elderly flap patients (50.00 percent) had hyperlipidemia (*p* = 0.01). Thirty-eight nonelderly flap patients (13.33 percent) and 13 elderly flap patients (24.07 percent) had diabetes (*p* = 0.04). These were the only three comorbidities and preoperative conditions with a significant difference between the two cohorts (Table 1). Two hundred five immediate flaps (69.0 percent) were performed in the younger group and 31 immediate flaps (73.8 percent) were performed in the elderly group.

Regarding flap complications, the two patient cohorts had very similar rates of partial flap loss, incidence of take-backs, arterial problems, and

venous problems. No statistically significant difference emerged in the analysis of these complications (Table 2). However, a difference between the two cohorts emerged when analyzing recipient-site complications. The two patient cohorts had significantly different rates of breast wound dehiscence (8.42 percent versus 25.92 percent; *p* < 0.01). This was the only statistically significant difference between rates of recipient-site complications (Table 3). In comparing the rate of donor-site complications in the abdominal area, no statistically significant difference was found between the two cohorts (Table 4).

Logistic regression findings are summarized in Figure 5. In the models, elderly patients were more likely to develop complete flap loss (OR, 10.92; 95 percent CI, 0.97 to 122.67; *p* = 0.05). The models also demonstrated that elderly patients were more likely to develop breast wound dehiscence (OR, 3.81; 95 percent CI 1.87 to 7.97). The models did not demonstrate any increased risk of abdominal wound complications in the elderly cohort (Table 5).

Statistical analysis was performed to identify correlation between comorbidities and timing of surgery (immediate versus delayed), and breast wound dehiscence and complete flap loss. Flaps had a higher incidence of breast wound dehiscence in patients with hypertension (16.3 percent versus 6.5 percent; *p* = 0.005), diabetes mellitus

**Table 1. Demographic Characteristics for Breasts and by Elderly or Nonelderly Cohort**

	All Breasts (%)	Cohort		<i>p</i>
		Elderly (%)	Nonelderly (%)	
No.	339	54 (15.93)	285 (84.07)	
Mean age ± SD, yr	52.18 ± 8.26	66.74 ± 2.32	49.42 ± 8.26	<0.001*
Mean BMI ± SD, kg/m <sup>2</sup>	30.86 ± 6.44	29.96 ± 6.09	31.03 ± 6.50	0.37
Smoker	51 (15.04)	5 (9.26)	46 (16.14)	0.22
Hypertension	153 (45.13)	38 (70.37)	115 (40.35)	<0.01*
Hyperlipidemia	67 (19.76)	27 (50.00)	40 (14.04)	<0.01*
Diabetes mellitus	51 (15.04)	13 (24.07)	38 (13.33)	0.04*

BMI, body mass index.

\*Statistically significant.

**Table 2. Flap Complications for Breasts and by Elderly or Nonelderly Cohort**

	All Breasts (%)	Cohort		<i>p</i>
		Elderly (%)	Nonelderly (%)	
No.	339	54 (15.93)	285 (84.07)	
Flap loss				
Partial	11 (3.24)	1 (1.85)	10 (35.10)	1.00
Complete	3 (0.88)	2 (3.70)	1 (0.35)	0.07
Take-back	11 (3.24)	2 (3.70)	9 (3.16)	0.69
Anastomosis problems				
Arterial	2 (0.60)	1 (1.85)	1 (0.35)	0.29
Venous	10 (2.95)	2 (3.70)	8 (2.81)	0.66

**Table 3. Recipient-Site Complications for Breasts and by Elderly or Nonelderly Cohort**

	All Breasts (%)	Cohort		<i>p</i>
		Elderly (%)	Nonelderly (%)	
No.	339	54 (15.93)	285 (84.07)	
Breast wound dehiscence	38 (11.21)	14 (25.93)	24 (8.42)	<0.01*
Hematoma	20 (5.90)	1 (1.85)	19 (6.67)	0.22
Seroma	2 (0.59)	0 (0.00)	2 (0.70)	1.00
Breast infection	18 (5.31)	2 (3.70)	16 (5.61)	0.75
Fat necrosis	36 (10.62)	5 (9.26)	31 (10.88)	1.00

\*Statistically significant.

**Table 4. Abdominal-Site Complications for Patients and by Elderly or Nonelderly Cohort**

	All Patients (%)	Cohort		<i>p</i>
		Elderly (%)	Nonelderly (%)	
No.	208	34 (16.35)	174 (83.65)	
Abdominal wound complication	22 (10.58)	3 (8.82)	19 (10.92)	1.00

**Table 5. Logistic Regression Model for Complications and Correlation of Being in the Elderly Cohort**

	OR	95% CI	<i>p</i>
Flap complications			
Partial flap loss	—	—	0.55
Complete flap loss	10.92	0.97–122.67	0.05*
Take-back	—	—	0.86
Arterial anastomosis problem	—	—	0.18
Venous anastomosis problem	—	—	0.96
Recipient-site complications			
Breast wound dehiscence	3.81	1.82–7.97	<0.01*
Hematoma	—	—	0.08
Seroma	—	—	0.58
Breast infection	—	—	0.39
Fat necrosis	—	—	0.81
Abdominal-site complications			
Abdominal wound complication	—	—	0.72

\*Statistically significant.

(15.7 percent versus 4.5 percent; *p* = 0.007), and hyperlipidemia (17.9 percent versus 9.2 percent; *p* = 0.049). There was no correlation between comorbidities and complete flap loss.

Assessment of medical complications in the postoperative period demonstrated no reported cardiac complication, pneumonia, renal failure, or pulmonary embolism. Deep venous thrombosis occurred in one patient in the nonelderly cohort and one patient in the elderly cohort. Statistical analysis demonstrated no significance in the rate of deep venous thrombosis between the two groups (*p* = 0.196).

## DISCUSSION

Although never proven (though anecdotally believed), there is the assumption that surgery in elderly patients is inherently dangerous or prone to increased rates of complications. In 2013, Elia et al. demonstrated that intensive care unit and hospital mortality rates increased exponentially in their patient cohort older than 65 years and that increasing age was an independent risk factor for in-hospital death irrespective of surgical procedure. However, these authors did concede that the prevalence of comorbidities increased with increasing age, and that numerous studies exist conflicting with their findings that elderly patients are at increased surgical risk.<sup>17</sup> Conversely, the literature is full of numerous studies demonstrating that hospital outcomes are dictated more by severity of comorbidities.<sup>18–21</sup> Therefore, it can be hypothesized that the complications of surgery in elderly patients comes from a combination of increasing age and increased pathologic states in these patients because of comorbidities; therefore, age alone should not be seen as a deterrent to surgery.

The median age at diagnosis of breast cancer is 62 years, with 41 percent of new diagnoses occurring in patients who are aged 65 years or older.<sup>22–24</sup> With this information, breast surgeons and plastic surgeons are faced with an intriguing discussion: Do elderly women desire breast reconstruction and, if so, is this a generally safe endeavor with reliable outcomes? What has been described in the literature previously is that elderly patients are less likely than younger patients to undergo breast reconstruction.<sup>6,25</sup> However, what is unfortunate is that, also in the literature, it has been demonstrated that (1) elderly women still have a significant investment in their self-image, comparable to that of younger women; (2) mastectomy significantly diminishes their physical self-perception and self-esteem; and (3) their decision to seek postmastectomy breast reconstruction stems latterly from concerns for their appearance.<sup>26–28</sup>



Therefore, we as plastic surgeons must be prepared to consult elderly patients before their mastectomies, so that we can plan reconstructions in a fashion similar to that for younger patients.

A more pertinent concern regarding reconstructive surgery is that many skin changes have been documented in elderly patients, such as dermal atrophy, decreased cell replacement, and decreased elastic fibers.<sup>29</sup> Similar to the anecdotal fear of surgery in elderly patients, wound healing in the elderly has been considered defective; however, no strong evidence has been provided in support of this notion. In 2015, Karamanos et al.<sup>28</sup> published perhaps the most rigorous review of wound healing in elderly plastic surgery patients. Their findings showed that age does not significantly impair wound healing in plastic surgery patients. This study demonstrated these findings in their entire population and in a subgroup of patients specifically who underwent breast reconstruction. However, in their study, the authors did not clarify whether the “breast reconstruction patients” underwent tissue expander placement, implant placement, pedicle flap, or free flap—most likely, they underwent a combination of all these procedures. Therefore, the investigation of the effect of age on the healing of elderly autologous breast reconstruction patients (specifically, in particular free flap procedures) is warranted.

Autologous breast reconstruction remains an appealing choice for women after mastectomy with free flaps such as the DIEP flap, which is widely used for its impressive volume, well-known path to dissection of donor perforators, and matching skin tone. However, free tissue transfers are the most technically challenging and lengthy breast reconstruction operations. In this study, delineation of the correlation of surgical outcomes of DIEP free flap tissue reconstruction of the breast in elderly and nonelderly patients was attempted.

As expected, our experience demonstrates a higher prevalence of medical comorbidities among the older patient population, with a significantly higher percentage of patients with hypertension and hyperlipidemia. There were no significant differences in other parameters assessed, including smoking, indication for surgery, and timing of surgery in relation to mastectomy and other treatment modalities received before or after reconstruction. The incidence of complications between elderly and nonelderly cohorts was similar except for rates of complete flap loss and breast wound dehiscence. Complete flap loss was noted in two elderly cohort patients (3.7 percent) compared with one nonelderly

cohort patient (0.4 percent). Our analysis shows that when using age 65 years as a cutoff, there is a trend toward significance ( $p = 0.07$ ); however, using a logistic regression model, the risk of complete flap loss is significantly increased with age ( $p = 0.05$ ). This is contrary to recently published data demonstrating similar complication risk in elderly patients undergoing free flap reconstruction.<sup>15,16</sup> This increased risk needs to be discussed with patients during preoperative evaluation of elderly patients seeking free-flap breast reconstruction; however, the overall success rate for the nonelderly cohort is 99.6 percent and the success rate of the nonelderly cohort is 96.3 percent.

Logistic regression analysis demonstrated an odds ratio of 10.92 for complete flap loss; however, the take-back rate was similar between the two groups. In the elderly group, one of the two complete flap losses was not taken back because it was deemed unsalvageable because of signs of severe congestion and edema, with minimal bleeding on puncture with a needle. The other was noted to have arterial thrombosis at the time of take-back. The one salvaged flap in the elderly group demonstrated venous thrombosis at the time of take-back. In the younger patient group, the only complete flap loss was noted to have arterial thrombosis at the time of take-back, whereas all eight of the salvaged flaps demonstrated venous thrombosis. This suggests that when there is a problem with vascular flow, flaps in the elderly group may be less likely to be salvaged.

Although there is an increased risk of flap loss with age, patients 65 years and older can be advised that free flap reconstruction carries an acceptable risk profile when benefits of the procedure are considered. One caveat to this statistic is that an observer must admit that the level of significance is evident in the logistic regression for flap loss. Importantly, however, although there may be an increased risk of flap loss with age, patients 65 years and older can be advised that free flap reconstruction carries an acceptable risk profile when benefits of the procedure are considered. The elderly group included mostly flaps performed in patients younger than 70 years, with six flaps performed in patients aged 70 to 75 years. Expanding free flap reconstructive efforts to include more patients older than 70 years will allow the assessment of risks in this patient population. The relative decrease in the number of free flaps performed in this age group may be attributable to surgeon and/or patient preference of reconstructive options.

The significantly higher percentage of breast wound dehiscence (24.1 percent versus 8.4 percent) needs further study. Although the majority of the breast wound dehiscence was managed with local wound care and addressed during the second stage of reconstruction, this may be a source of anxiety and decreased comfort experienced by the patient. Further studies could help to identify and address the source of wound healing problems within this population, including nutritional status, which has been shown to correlate with increased wound healing problems in surgical patients. Interestingly, despite the large increase in breast wound dehiscence between the two groups, there was no significant difference with regard to complications associated with abdominal wound healing. Our results demonstrate a significant risk of breast wound dehiscence in free flaps performed in patients with hypertension, diabetes mellitus, and hyperlipidemia. The elderly patients in the study were more likely to have medical comorbidities. Although the results demonstrate that elderly patients carry a higher risk of breast wound dehiscence, these data suggest that medical comorbidities do increase the risk of breast wound dehiscence as well.

Voineskos et al.<sup>29</sup> voice the fact that it is more likely that increased complications in elderly autologous reconstruction breast patients may be attributable to their increased number of comorbidities rather than to age itself. Given that there was a significant difference between the comorbidities of the elderly and nonelderly cohorts, assessment of demographics (age, body mass index) and comorbidities as independent risk factors for postoperative complications was performed. Hypertension was an independent risk factor for developing mastectomy skin loss, breast wound dehiscence, and abdominal wound problems. Diabetes was an independent risk factor for developing mastectomy skin loss. Hyperlipidemia was an independent risk factor for developing seroma, breast wound dehiscence, breast-site infection, and partial flap loss. These findings further reinforce the importance of the assessment of patient health status rather than age alone before offering a reconstructive procedure following mastectomy. The findings of this study reiterate the initial points elucidated: age may play a role in DIEP flap complication rates; however, a more conglomerate mechanism of patient age synergistic with patient comorbidities is likely at work.

There was no significant increase in risk of medical complications in the elderly cohort,

despite an increase in medical comorbidities. Assessing length of stay, readmission rates, and return to full function as outcome measures will be addressed in future studies. This will be important in identifying risks of performing autologous breast reconstruction in the elderly population, which can help better guide patient expectations regarding autologous reconstruction.

## CONCLUSIONS

A significant portion of breast cancer diagnoses and subsequent mastectomies occur in elderly patients. These patients desire breast reconstruction at similar rates found in nonelderly patients. Elderly mastectomy patients should be offered all breast reconstruction options available. What has been demonstrated in this study is that DIEP flap breast reconstruction in elderly patients is safe and has generally good outcomes, but that it is wise to be prepared for increased complications in this patient group. This study suggests that although age may discourage some surgeons from choosing a lengthy procedure such as DIEP flap autologous breast reconstruction, the cause of increased rates of postoperative complications in these elderly surgical patients may be attributable to the numerous comorbidities and medical conditions they inherently possess secondary to their advanced age; however, age is an independent risk factor for complete flap loss and breast wound dehiscence.

*Oren Tessler, M.D., M.B.A.*

Division of Plastic and Reconstructive Surgery  
Louisiana State University School of Medicine  
1542 Tulane Avenue, Room 758A  
New Orleans, La. 70112  
o\_tessler@hotmail.com

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