Original Article

Is Advanced Age A Contraindication for Free Flap Breast Reconstruction?

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ABSTRACT

Background: Understanding the relationship between age and perioperative outcomes in free flap-based breast reconstruction, is critical. We aimed to evaluate the older age as an independent risk factor for perioperative complications following free flap-based breast reconstruction surgery.

Methods: This retrospective study utilized data from the National Surgical Quality Improvement Program (NSQIP) database from 2016 to 2022. The study included breast cancer patients who underwent free flap breast reconstruction surgery, divided into two groups: those aged ≤65 years and those aged >65 years.

Results: The study sample comprised 15,364 patients, with 1,447 (9.4%) aged >65 years. The overall complication rate was 14.1% for patients >65 years compared to 12.4% for patients ≤65 years, though this difference was not statistically significant (P=0.068). Similarly, there was no significant difference in unplanned return back to the operating room (OR: 10.7% vs. 11.3%; P=0.068) and unplanned readmission rate (6.5% vs. 5.5%; P=0.530) in patients>65 years old compared with patient<65 years old. Additionally, multivariate regression analyses showed that age >65 was not an independent risk factor for overall complication rate (adjusted odd's ratio [AOR] 1.10), unplanned return to OR (AOR 0.92), and readmission (AOR 1.14).

Conclusion: Elderly patients who underwent free flap breast reconstruction had comparable perioperative outcomes with the younger patients. The decision to proceed with this surgery should be based on a comprehensive assessment of the patient's overall health status rather than age alone. Free-flap breast reconstruction should be considered in patients at any age as long as other indications for surgery are met.

KEYWORDS
Age; Elderly; Free Flap Breast Reconstruction; Outcomes

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INTRODUCTION

Breast cancer remains the most prevalent malignancy among women in the United States, with its incidence increasing with age. As the population ages, a significant number of elderly patients face decisions regarding post-mastectomy breast reconstruction. Autologous free flap reconstruction has emerged as a preferred method due to its natural aesthetic outcomes and durability compared to implant-based

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techniques. However, the safety and efficacy of this procedure in elderly patients have been subjects of ongoing debate.

Historically, advanced age has been perceived as a contraindication for extensive surgical procedures like free flap breast reconstruction, primarily due to concerns about increased perioperative risks and comorbidities . This perception has often led to the underrepresentation of elderly patients in reconstructive surgery. Recent studies, however, challenge this notion. For instance, research indicates that free flap breast reconstruction in patients aged 70 and above can be performed safely, with complication rates comparable to those in younger cohorts. The overall complication rate in this age group was reported at 36.6%, predominantly minor wound healing issues, and no instances of flap loss were observed .

Other studies further support the safety and effectiveness of these procedures in older patients. Heikkinen et al. found no significant differences in flap loss or complication rates between patients aged 60 and above and those under 60, emphasizing that age alone should not preclude patients from undergoing autologous reconstruction. Selber et al. similarly reported equivalent outcomes in elderly patients, concluding that advanced age is not a barrier to successful reconstruction. Older patients reported equal or greater satisfaction and quality-of-life outcomes compared to younger individuals, especially when autologous flaps were used . Ludolph et al. also demonstrated high postoperative satisfaction among women over 60, with no increased rates of hernias or wound complications. However, one study identified a higher incidence of venous thromboembolism (VTE) in patients over 60 undergoing autologous reconstruction, though other major complications remained equivalent across age groups .

These findings suggest that with appropriate patient selection and perioperative management, age alone should not be a deterrent for offering free flap reconstruction to elderly patients. Patient satisfaction is a crucial aspect of post-mastectomy reconstruction. Evidence suggests that older women report satisfaction rates comparable to, if not higher than, their younger counterparts following oncoplastic surgery and breast reconstruction . This underscores the importance of not withholding reconstructive options based solely on chronological age. Despite these positive outcomes, elderly patients are less likely to be offered reconstructive surgery, possibly due to biases and misconceptions about age-related surgical risks .Addressing these disparities is essential to ensure that all patients, regardless of age, have access to reconstructive options that can significantly enhance their quality of life. In this study, we aim to evaluate whether patient age is an independent risk factor for postoperative complications following free flap breast reconstruction. By analyzing data from a large national database, we sought to provide evidence that can inform surgical decision-making and potentially expand reconstructive options for elderly breast cancer patients.

MATERIALS AND METHODS

This retrospective cohort study utilized data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database from 2016 to 2022 to evaluate the impact of advanced age on perioperative outcomes following free flap breast reconstruction. The NSQIP database provides prospectively collected, risk-adjusted surgical outcome data from participating institutions, making it a reliable source for analyzing perioperative complications in this population.

The study included female breast cancer patients who underwent free-flap breast reconstruction surgery during the study period. Patients were identified using Current Procedural Terminology (CPT) codes for free-flap procedures and were divided into two groups based on age: those ≤65 years old and those >65 years old. Patients undergoing implant-based or pedicled flap reconstruction were excluded. The primary outcome was the 30-day postoperative complication rate, while secondary outcomes included unplanned return to the operating room (OR), unplanned hospital readmission, and length of hospital stay. To control for potential confounders, data were collected on patient comorbidities (e.g., diabetes, hypertension, smoking status), body mass index (BMI), and surgical characteristics (unilateral vs. bilateral reconstruction, immediate vs. delayed reconstruction).

For statistical analysis, descriptive statistics were used to compare baseline characteristics between the two age groups. Chi-square tests were employed for categorical variables, while ANOVA was used

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for continuous variables. Multivariate regression analyses were conducted to determine whether age >65 years was an independent risk factor for perioperative complications after adjusting for confounders. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were reported, and statistical significance was set at $P < 0.05$. All analyses were performed using Statistical Package for the Social Sciences (SPSS) version 26 statistical software (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 15,364 patients met the inclusion criteria, with 1,447 patients (9.4%) aged >65 years. Table 1, shows the frequency of comorbidities and surgical details between age groups. The overall rate of immediate breast reconstruction was (48.9%) and the rate was increased by aging from 48.4% in <50 yr age group to 57.3% in >70 age group (P=0.006). However, the rate bilateral reconstruction was decreased with aging from 40% in <50 yr age group to 21.8% in >70 age group. Table2, shows comparison of perioperative outcomes between age groups. The most reported complication was surgical site complications (9.2%) which includes surgical site infection (superficial or deep space) and wound dehiscence. However, there was no significant difference overall complication rate among the age group. In addition, there was no increase in unplanned return back to the operating room with aging.

Table 3 and 4, compares the patient and surgical characteristics and perioperative outcomes between age groups (=<65 and > 65 years old). There was no significant difference in all of the evaluate complications except surgical site infection which higher in the age> 65 group (9.2% vs. 7.7%; P=0.040). The overall 30-day complication rate was 14.1% in patients >65 years and 12.4% in patients ≤65 years; however, this difference was not statistically significant (P = 0.068). Similarly, there was no significant difference in unplanned return to the OR, which occurred in 10.7% of older patients compared to 11.3% of younger patients (P = 0.068). The unplanned readmission rate was 6.5% in patients >65 years and 5.5% in patients ≤65 years (P = 0.530), also showing no statistically significant difference. Interestingly, the mean length of hospital stay was slightly shorter in older patients (3.4 ± 4.4 days) compared to younger patients (3.6 ± 2.9 days), and this difference was statistically significant (P = 0.030).

Tables 5 and 6, demonstrate univariate and multivariate regression analyses evaluating the effect of age>65 compared with age<65 in perioperative

Table 1. Frequency of comorbidities and surgical details between age groups

Age groups(yr)	=<50	51-55	56-60	61-65	66-70	>70	*P*-value
Frequency (number and %)	7,411 (48.2%)	2,852 (18.6%)	2,327 (15.1%)	1,580 (10.3%)	901 (5.9%)	293 (1.9%)	Not applicable
Comorbidities (overall%)							
Hypertension (24.1%)	13.4%	26.1%	32.7%	40.0%	47.4%	51.5%	<0.001
Diabetes mellitus (7.1%)	4.4%	8.1%	8.7%	11.7%	12.4%	11.3%	<0.001
Smoking (5.6%)	6.5%	5.8%	5.5%	3.4%	2.4%	3.1%	<0.001
COPD* (0.4%)	0.1%	0.2%	0.8%	0.8%	0.7%	2.0%	<0.001
CHF** (0.2%)	0.1%	0.3%	0.2%	0.4%	0.6%	1.7%	<0.001
Disseminated cancer (1.2%)	1.2%	1.5%	0.9%	0.9%	1.3%	1.7%	0.064
Immunosuppressive therapy (2.0%)	1.8%	2.3%	2.1%	2.7%	2.0%	0.4%	0.106
BMI>35 (16.8%)	18.4%	16.1%	15.3%	15.4%	14.1%	14.0%	<0.001
Surgical characteristics							
Immediate reconstruction (48.9%)	48.4%	47.2%	49.9%	49.8%	51.4%	57.3%	0.006
Bilateral reconstruction (36.8%)	40.0%	37.0%	35.1%	32.2%	27.3%	21.8%	<0.001
Symmetry procedure***(5.2%)	3.9%	5.4%	5.4%	7.0%	9.1%	10.2%	<0.001

*Chronic obstructive pulmonary disease (COPD); ** Congestive heart failure (CHF); *** patients who underwent simultaneous contralateral symmetry procedure during unilateral breast reconstruction (e.g. contralateral breast reduction/mastopexy)

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Table 2. Comparison of perioperative outcomes between age groups

Age groups	=<50	51-55	56-60	61-65	66-70	>70	*P*-value
Postoperative complications							
Surgical site infection (SSI)* (7.8%)	7.7%	7.6%	7.4%	8.1%	10.2%	8.5%	0.123
Wound dehiscence (2.0%)	2.0%	2.1%	1.8%	1.6%	1.9%	2.0%	0.900
Urinary tract infection (0.5%)	0.4%	0.5%	0.5%	0.4%	1.0%	0.7%	0.247
Pneumonia (0.4%)	0.4%	0.2%	0.4%	0.5%	0.2%	0.7%	0.604
Myocardial infarct (0.1%)	0.1%	0.0%	0.1%	0.1%	0.1%	0.7%	0.015
Postop bleeding (6.3%)	6.4%	6.2%	6.25	5.7%	7.1%	5.3%	0.737
Deep vein thrombosis-DVT (0.6%)	0.6%	0.3%	0.7%	0.8%	1.2%	0.3%	0.031
Pulmonary embolism-PE (0.7%)	0.7%	0.6%	0.7%	0.7%	0.9%	1.0%	0.880
Venous thromboembolism**- (1.1%)	1.1%	0.8%	1.2%	1.3%	1.9%	1.0%	0.202
Overall Wound complications*** (9.2%)	9.1%	9.1%	8.8%	9.2%	11.2%	9.6%	0.432
Overall complication rate (12.6%)	12.6%	12.2%	12.4%	11.8%	15.4%	13.0%	0.157
Mean length of stay (day)	3.6+/-2.9	3.5+/-3.8	3.6+/-1.8	3.6+/-2.2	3.4+/-5.3	3.5+/-2.1	0.001
Unplanned return to OR (11.2%)	10.9%	12.5%	10.7%	11.1%	12.0%	7.2%	0.044
Unplanned readmission[3](5.6%)	5.9%	5.2%	4.8%	5.5%	7.4%	5.8%	0.068

*SSI: including superficial, deep and deep organ space infection ** Venous thromboembolism (VTE): DVT and/or PE *** Overall wound complications including surgical site infection (SSI) and or wound dehiscence # Unplanned readmission within 30 days

Table 3. Frequency of comorbidities and surgical details between age groups (=<65 and > 65 years old)

Age groups(yr)	=<65	>65	*P*-value
Frequency (number and %)	13,917 (90.6%)	1,447 (9.4%)	Not applicable
Comorbidities			
Hypertension	21.7%	47.8%	<0.001
Diabetes mellitus	6.5%	16.8%	<0.001
Smoking	5.9%	2.4 %	<0.001
COPD	0.3%	1.0%	<0.001
CHF	0.2%	0.7%	0.379
Disseminated cancer	1.2%	1.5%	0.472
Immunosuppressive therapy	2.1%	1.5%	0.144
BMI>35 (16.8%)	17.2%	13.5%	<0.001
Surgical characteristics			
Immediate (48.9%)	48.6%	51.6%	0.034
Bilateral (36.8%)	37.9%	26.7%	<0.001
Symmetry procedure (5.2%	4.8%	9.1%	<0.001

outcomes. In the multivariate regression analysis (Table 6), after adjusting for comorbidities, BMI, and surgical characteristics, age >65 years was not identified as an independent predictor of perioperative complications. Specifically, for overall complication rate, the AOR was 1.10 (95% CI: 0.94 - 1.30; $P = 0.242$). For unplanned return to the OR, the AOR was 0.92 (95% CI: 0.77 - 1.10; $P = 0.369$), and for unplanned readmission, the AOR was 1.14 (95% CI: 0.91 - 1.44; $P = 0.255$).

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Table 4. Comparison of perioperative outcomes between age groups (=<65 and > 65 years old)

Age groups(yr)	=<65	>65	*P*-value
Postoperative complications			
Surgical site infection*	7.7%	9.2%	0.040
Wound dehiscence	2.0%	1.9%	0.945
Urinary tract infection	0.4%	0.8%	0.088
Pneumonia	0.4%	0.3%	0.773
Myocardial infarct	0.1%	0.2%	0.092
Postop bleeding	6.2%	6.7%	0.507
Deep vein thrombosis-DVT	0.6%	0.8%	0.245
Pulmonary embolism-PE	0.7%	0.9%	0.297
Venous thromboembolism- VTE **	1.1%	1.5%	0.135
Overall Wound complications***	9.1%	10.3%	0.138
Overall complication rate	12.4%	14.1%	0.068
Mean length of stay (day)	3.6 +/- 2.9	3.4+/- 4.4	0.030
Unplanned return to OR	11.3%	10.7%	0.530
Unplanned readmission	5.5%	6.5%	0.133

*SSI: including superficial, deep and deep organ space infection ** Venous thromboembolism (VTE): including DVT and/or PE #There was only one patient with Acute renal failure, 4 patients with CVA and 10 patients with MI

Table 5. Univariate regression analysis evaluating the effect of age>65 compared with age<65 in perioperative outcomes

Variable	Odds Ratio	95% Confidence Interval	*P*-value
Postop complications			
Wound complications			
I-Superficial surgical site infection	1.30	1.05 – 1.61	0.017
II-Deep surgical site infection	1.28	0.81 -2.03	0.288
III-Organ space surgical site infection	0.77	0.43 – 1.35	0.355
IV-Wound delicense	0.99	0.67 – 1.46	0.945
Surgical site complication rate	1.15	9.96 – 1.37	0.138
Pneumonia	0.87	0.35 – 2.19	0.773
Venous thromboembolism (VTE)	1.41	0.90- 2.21	0.137
-DVT	1.43	0.78 -2.63	0.248
- PE	1.36	0.76 – 2.44	0.299
Urinary tract infection (UTI)	1.74	0.91 -3.31	0.092
Blood transfusion	1.08	0.87 – 1.34	0.507
Sepsis	1.23	0.69 – 2.20	0.488
Myocardial infarction	2.89	0.79 – 10.51	0.107
Total complication rate	1.16	0.99- 1.35	0.068
Unplanned return to OR	0.95	0.79 – 1.13	0.530
Unplanned readmission	1.19	0.95 – 1.48	0.134

DISCUSSION

The findings of this study indicate that advanced age is not an independent risk factor for postoperative complications following free flap breast reconstruction. Despite initial concerns that elderly patients may experience higher morbidity due to preexisting comorbidities and age-related physiological changes, our analysis demonstrates comparable perioperative outcomes

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Table 6. Multivariate regression analysis evaluating the effect of age>65 compared with age<65 in perioperative outcomes

Variable	Adjusted Odds Ratio	95% Confidence Interval	*P*-value
Postop complications			
Wound complications			
I-Superficial surgical site infection	1.30	1.04 -1.62	0.023
II-Deep surgical site infection	1.33	0.83 – 2.15	0.232
III-Organ space surgical site infection	0.75	0.42 – 1.33	0.323
IV-Wound delicense	0.92	0.62 – 1.39	0.702
Overall surgical site complication rate	1.12	0.93 – 1.35	0.225
Pneumonia	0.93	0.36 – 2.37	0.877
Venous thromboembolism (VTE)	1.29	0.81 – 2.05	0.288
-DVT	1.27	0.68 – 2.39	0.453
- PE	1.22	0.67 – 2.23	0.516
Urinary tract infection (UTI)	1.75	0.90 – 3.40	0.100
Blood transfusion	0.98	0.78 – 1.23	0.855
Sepsis	1.19	0.65 – 2.17	0.569
Myocardial infarction	2.80	0.72 – 10.87	0.136
Total complication rate	1.10	0.94 – 1.30	0.242
Unplanned return to OR	0.92	0.77 – 1.10	0.369
Unplanned readmission	1.14	0.91 – 1.44	0.255

*Included factors were BMI, comorbidities (hypertension, DM, smoking, CHF and COPD) and surgical characteristics (Immediate vs. delayed reconstruction and unilateral vs. bilateral reconstruction)

between patients >65 years old and their younger counterparts. These results align with existing literature suggesting that, when carefully selected, older patients can safely undergo free flap breast reconstruction with outcomes similar to younger individuals.

One of the most notable findings was the lack of significant difference in overall complication rates, unplanned return to the OR, and hospital readmission rates between the two age groups. These results suggest that, contrary to traditional assumptions, chronological age alone should not be a contraindication for complex reconstructive procedures. The slightly shorter hospital stay observed in elderly patients (P = 0.030) may reflect differences in postoperative care strategies, discharge planning, or patient selection criteria in this population. It is possible that older patients were discharged sooner due to enhanced preoperative optimization, lower activity levels postoperatively, or fewer post-discharge care barriers.

Additionally, multivariate regression analysis confirmed that age >65 was not an independent predictor of perioperative complications. Instead, factors such as BMI, comorbidities, and surgical characteristics were more strongly associated with adverse outcomes. This reinforces the need for comprehensive preoperative risk assessment that focuses on physiological resilience rather than age alone. Plastic surgeons should consider a patient's functional status, comorbid burden, and surgical risk profile rather than relying on age as an exclusion criterion for free flap reconstruction.

These findings are supported by a growing body of literature. Selber et al. demonstrated equivalent complication rates in patients ≥65 compared to younger cohorts, and emphasized that free flap breast reconstruction is safe and feasible in older patients. Similarly, Heikkinen et al. found no significant differences in flap loss, complication rates, or reoperation rates between patients ≥60 and younger individuals, concluding that age alone should not disqualify patients from autologous reconstruction [5]. Older women had postoperative outcomes and patient-reported satisfaction scores equal to or greater than their younger counterparts [6]. Older patients had high satisfaction and quality-of-life metrics, supporting the inclusion of older women in reconstructive discussions [7]. Chicco et al. and Dejean et al. further reinforced these findings, highlighting the safety and acceptability of free flap procedures in septuagenarian cohorts, .

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While Torabi et al. noted a slightly increased risk of wound dehiscence and flap loss in elderly patients, the absolute rates remained low, underscoring that well-optimized older patient can undergo these procedures with minimal added risk [2]. Additionally, Masoomi et al. reported a higher incidence of venous thromboembolism in older patients, though they found no significant differences in other major complications such as surgical site infection or mortality[8].

Additionally, this study's findings have important clinical and ethical implications. The underutilization of reconstructive surgery in elderly breast cancer patients is well-documented and may stem from biases among both patients and providers. Some surgeons may hesitate to offer free flap reconstruction to older patients due to concerns about prolonged operative times and potential complications. However, our data and those from other institutions suggest that these concerns may be overestimated, and that elderly patients should not be systematically excluded from reconstructive options. Shared decision-making between surgeons and patients should emphasize individualized risk assessment rather than broad exclusion based on age. Furthermore, this study contributes to growing evidence supporting equitable access to breast reconstruction across all age groups. Given the psychosocial and quality-of-life benefits associated with free flap procedures, efforts should be made to ensure that elderly patients are counseled about all available reconstructive options. In addition to surgical feasibility, discussions should incorporate patient preferences, long-term functional outcomes, and realistic expectations regarding recovery.

Despite the strengths of this study, including a large sample size and robust statistical analysis, there are several limitations. First, as a retrospective study utilizing the NSQIP database, the findings are dependent on the accuracy of recorded data. The database does not capture long-term complications beyond the 30-day postoperative period, which may limit the ability to assess late-onset surgical morbidity. Additionally, certain factors that could influence postoperative outcomes, such as frailty scores, social support, and adjuvant cancer treatments (chemotherapy and radiation timing), were not available in the dataset. Another limitation is selection bias. It is possible that elderly patients who underwent free flap reconstruction represent a healthier, more surgically fit subset, as patients with significant comorbidities may not have been offered surgery in the first place. Future studies incorporating frailty indices and long-term follow-up data would provide further insight into the safety and efficacy of these procedures in older populations.

CONCLUSION

Free flap breast reconstruction can be safely performed in patients over 65 years old, with comparable perioperative outcomes to younger patients. The findings challenge the notion that advanced age should be a contraindication for autologous breast reconstruction. Instead, surgical candidacy should be determined based on overall health status, functional capacity, and patient preferences rather than chronological age. Future research should explore long-term outcomes, quality of life metrics, and patient-reported satisfaction in older populations to further guide reconstructive decision-making.

ETHICAL APPROVAL

This study was presented as a poster at the American Society for Reconstructive Microsurgery Annual Meeting, January 16-21, 2025 at Hilton Wailoloa Village Resort, Waikoloa, Hawaii., USA.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests.

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