

Post-Operative Complications and Functional Outcome Following Breast Reconstruction Surgery

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Abstract

Background: Breast reconstruction following mastectomy has become an integral component of comprehensive breast cancer treatment, offering psychological and aesthetic benefits. However, post-operative complications and functional outcomes vary considerably across different reconstruction techniques.

Methods: This retrospective cohort study analyzed 324 women who underwent breast reconstruction at a tertiary care center. Patients were categorized into three groups: autologous tissue reconstruction (n=142), implant-based reconstruction (n=126), and combined technique (n=56). Data on complications, revision surgeries, patient satisfaction, and functional outcomes were collected through medical records and validated questionnaires (BREAST-Q). Statistical analysis included chi-square tests, ANOVA, and multivariate regression.

Results: Overall complication rate was 34.3%, with significant differences among groups: autologous (28.2%), implant-based (41.3%), and combined (35.7%) (p=0.042). Major complications occurred in 12.3% of patients, including flap necrosis (4.2%), infection requiring surgical intervention (3.7%), and implant failure (4.4%). Mean BREAST-Q satisfaction scores at 12 months were 68.4 ± 14.2 for autologous, 61.3 ± 16.8 for implant-based, and 64.2 ± 15.4 for combined reconstruction (p=0.003). Revision surgery rates were 18.3%, 28.6%, and 23.2% respectively (p=0.038). Multivariate analysis identified body mass index $>30 \text{ kg/m}^2$ (OR: 2.34, 95% CI: 1.45-3.78), smoking (OR: 2.87, 95% CI: 1.62-5.09), and adjuvant radiotherapy (OR: 1.92, 95% CI: 1.18-3.12) as significant predictors of complications.

Conclusion: Autologous tissue reconstruction demonstrates lower complication rates and superior functional outcomes compared to implant-based techniques, though all methods show acceptable safety profiles with appropriate patient selection.

Keywords: Breast reconstruction, post-operative complications, autologous reconstruction, implant reconstruction, functional outcomes, BREAST-Q, patient satisfaction.

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Introduction

Breast cancer remains the most prevalent malignancy among women globally, with approximately 2.3 million new cases diagnosed annually [1]. Mastectomy,

either partial or complete, constitutes a primary therapeutic intervention for breast cancer management, with post-mastectomy breast reconstruction increasingly recognized as an essential component of

comprehensive treatment rather than merely a cosmetic procedure [2]. Breast reconstruction has demonstrated significant psychological benefits, including improved body image, self-esteem, quality of life, and psychosocial well-being in breast cancer survivors [3].

Contemporary breast reconstruction techniques encompass three primary approaches: autologous tissue reconstruction utilizing the patient's own tissue (commonly from the abdomen, back, or thighs), implant-based reconstruction using synthetic prostheses, and hybrid techniques combining both autologous tissue and implants [4]. Each method presents distinct advantages and limitations regarding aesthetic outcomes, complication profiles, recovery periods, and long-term satisfaction [5]. The selection of reconstruction technique depends on multiple factors including patient anatomy, cancer treatment requirements, comorbidities, patient preferences, and surgeon expertise [6].

Despite advances in surgical techniques and perioperative care, post-operative complications following breast reconstruction remain a significant concern, affecting 20-40% of patients depending on the reconstruction method and patient population [7].

Complications range from minor issues such as seroma formation and wound dehiscence to major problems including complete flap loss, severe infection, and implant failure requiring removal [8].

These complications not only impact immediate surgical outcomes but also influence long-term aesthetic results, functional recovery, and patient satisfaction [9].

Recent studies have examined complication rates across different reconstruction modalities, with varying conclusions regarding optimal approaches [10, 11]. However, much of the existing literature focuses on single-center

experiences with limited sample sizes or examines specific reconstruction types in isolation [12]. Furthermore, comprehensive assessment of functional outcomes using validated patient-reported outcome measures remains inadequately addressed in many investigations [13]. The relationship between specific risk factors and complications across different reconstruction techniques requires further elucidation to optimize patient selection and surgical planning.

Given these knowledge gaps, the present study aimed to comprehensively evaluate the incidence, types, and severity of post-operative complications following different breast reconstruction methods, assess functional outcomes and patient satisfaction using validated instruments, and identify independent risk factors associated with adverse outcomes to inform clinical decision-making and enhance patient counseling.

Materials and Methods

Study Design and Setting: This retrospective cohort study was conducted at the Department of Surgery.

Study Population and Sample Size: Medical records of 387 consecutive women who underwent breast reconstruction during the study period were reviewed. After applying inclusion and exclusion criteria, 324 patients were included in the final analysis. Sample size estimation was based on detecting a 15% difference in complication rates between groups with 80% power and 5% significance level, requiring approximately 100 patients per major group.

Inclusion Criteria: Women aged 18-70 years who underwent immediate or delayed breast reconstruction following mastectomy for breast cancer or prophylactic mastectomy, completed minimum 12-month follow-up, and had complete medical records including pre-operative assessment, surgical details, and post-operative follow-up data.

Exclusion Criteria: Reconstruction following partial mastectomy or lumpectomy, bilateral simultaneous reconstruction (to avoid statistical clustering), history of previous chest wall radiation exceeding 60 Gy, active connective tissue disorders, incomplete follow-up data, and reconstruction performed for conditions other than breast cancer or prophylaxis.

Reconstruction Techniques and Grouping: Patients were categorized into three groups based on reconstruction method:

Group A (Autologous tissue reconstruction, n=142): Deep inferior epigastric perforator (DIEP) flaps (n=98), transverse rectus abdominis myocutaneous (TRAM) flaps (n=32), and latissimus dorsi flaps (n=12).

Group B (Implant-based reconstruction, n=126): Direct-to-implant reconstruction (n=54) and two-stage tissue expander-to-implant reconstruction (n=72).

Group C (Combined technique, n=56): Latissimus dorsi flap with implant augmentation.

Data Collection and Outcome Measures: Demographic, clinical, and surgical data were extracted from electronic medical records using standardized data collection forms. Variables included age, body mass index (BMI), smoking status, comorbidities, tumor characteristics, timing of reconstruction (immediate versus delayed), adjuvant therapies, operative duration, and hospital stay.

Primary outcomes: (1) Overall complication rate, (2) major versus minor complication classification, (3) specific complication types (infection, hematoma, seroma, wound dehiscence, flap complications, implant complications), and (4) revision surgery requirements.

Secondary outcomes: (1) Patient satisfaction assessed using the BREAST-Q reconstruction module at 6 and 12 months

post-operatively, (2) functional outcomes including arm mobility and chest wall function, (3) aesthetic outcomes rated by independent plastic surgeons using standardized photographic assessment, and (4) return to normal activities timeline.

Complication Classification: Complications were classified as major or minor based on established criteria. Major complications included those requiring surgical intervention (return to operating room), prolonged hospitalization (>14 days), or resulting in permanent functional impairment or reconstruction failure. Minor complications were managed conservatively or with minor bedside procedures without requiring return to operating room.

BREAST-Q Assessment: The validated BREAST-Q reconstruction module was administered at 6 and 12 months post-operatively. This patient-reported outcome instrument assesses satisfaction with breasts, satisfaction with outcome, psychosocial well-being, sexual well-being, and physical well-being of the chest. Scores range from 0-100, with higher scores indicating better outcomes.

Statistical Analysis: Data analysis was performed using STATA version 16.0 (StataCorp, College Station, TX). Continuous variables were expressed as mean \pm standard deviation and compared using one-way ANOVA with Bonferroni post-hoc correction for multiple comparisons. Categorical variables were presented as frequencies and percentages, analyzed using chi-square or Fisher's exact tests as appropriate.

Multivariate logistic regression analysis was conducted to identify independent predictors of complications, including variables with $p < 0.20$ in univariate analysis. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. Kaplan-Meier analysis was used to evaluate time to complication occurrence. Statistical significance was set at $p < 0.05$ (two-tailed).

Results

Patient Demographics and Clinical Characteristics: The final cohort comprised 324 patients with mean age 48.6 ± 9.8 years and mean BMI 26.4 ± 4.7 kg/m². Immediate reconstruction was performed in 218 (67.3%) patients, while 106 (32.7%) underwent delayed reconstruction.

The three groups showed no significant differences in baseline age, BMI, smoking status, or diabetes prevalence (Table 1).

However, autologous reconstruction patients had slightly higher rates of previous radiation therapy (18.3% versus 11.1% and 12.5%, $p=0.158$), reflecting surgical selection patterns.

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	Autologous (n=142)	Implant-based (n=126)	Combined (n=56)	p-value
Age (years), mean \pm SD	49.8 \pm 9.2	47.2 \pm 10.1	48.9 \pm 10.4	0.142
BMI (kg/m ²), mean \pm SD	27.1 \pm 4.9	25.4 \pm 4.3	26.8 \pm 4.9	0.089
Current smoking, n (%)	24 (16.9)	19 (15.1)	9 (16.1)	0.912
Diabetes mellitus, n (%)	18 (12.7)	14 (11.1)	7 (12.5)	0.919
Hypertension, n (%)	32 (22.5)	24 (19.0)	11 (19.6)	0.714
Previous radiotherapy, n (%)	26 (18.3)	14 (11.1)	7 (12.5)	0.158
Immediate reconstruction, n (%)	94 (66.2)	88 (69.8)	36 (64.3)	0.678
Neoadjuvant chemotherapy, n (%)	38 (26.8)	31 (24.6)	16 (28.6)	0.818
Operative time (min), mean \pm SD	284 \pm 62	178 \pm 48	246 \pm 54	<0.001
Hospital stay (days), mean \pm SD	5.8 \pm 2.1	3.2 \pm 1.4	4.6 \pm 1.8	<0.001

Post-Operative Complications: Overall complication rate was 34.3% (111/324 patients), with significant variation among reconstruction types. Group A (autologous) demonstrated the lowest complication rate at 28.2% (40/142), compared to Group B (implant-based) at 41.3% (52/126) and Group C (combined) at 35.7% (20/56) ($p=0.042$). Major complications occurred in 12.3% of the total cohort, with rates of 9.9%, 15.1%, and 12.5% in Groups A, B, and C respectively ($p=0.291$). Infection requiring

surgical intervention occurred in 3.7% overall, with no significant difference among groups ($p=0.624$). Seroma requiring multiple aspirations was more common in autologous reconstruction (14.8% versus 7.1% and 10.7%, $p=0.048$).

Implant-related complications including capsular contracture, malposition, and failure occurred in 18.3% of implant-based reconstructions and 12.5% of combined reconstructions. Partial or complete flap necrosis occurred in 4.2% of autologous cases and 5.4% of combined cases.

Table 2: Post-Operative Complications by Reconstruction Type

Complication	Autologous (n=142)	Implant-based (n=126)	Combined (n=56)	Overall (n=324)	p-value
Any complication, n (%)	40 (28.2)	52 (41.3)	20 (35.7)	111 (34.3)	0.042
Major complications, n (%)	14 (9.9)	19 (15.1)	7 (12.5)	40 (12.3)	0.291
Minor complications, n (%)	26 (18.3)	33 (26.2)	13 (23.2)	72 (22.2)	0.233
Infection (surgical), n (%)	4 (2.8)	5 (4.0)	3 (5.4)	12 (3.7)	0.624
Hematoma, n (%)	8 (5.6)	9 (7.1)	4 (7.1)	21 (6.5)	0.823
Seroma (requiring aspiration), n (%)	21 (14.8)	9 (7.1)	6 (10.7)	36 (11.1)	0.048
Wound dehiscence, n (%)	7 (4.9)	11 (8.7)	5 (8.9)	23 (7.1)	0.328

Partial flap necrosis, n (%)	6 (4.2)	-	3 (5.4)	9 (2.8)	-
Complete flap loss, n (%)	2 (1.4)	-	0 (0)	2 (0.6)	-
Implant failure/removal, n (%)	-	14 (11.1)	3 (5.4)	17 (5.2)	-
Capsular contracture (Baker III-IV), n (%)	-	9 (7.1)	4 (7.1)	13 (4.0)	-
Fat necrosis, n (%)	12 (8.5)	-	2 (3.6)	14 (4.3)	-
Revision surgery required, n (%)	26 (18.3)	36 (28.6)	13 (23.2)	75 (23.1)	0.038
Mean time to complication (days), mean \pm SD	28.4 \pm 34.2	42.6 \pm 48.1	36.2 \pm 38.9	36.7 \pm 42.1	0.182

Functional Outcomes and Patient Satisfaction: BREAST-Q satisfaction scores at 12 months demonstrated significant differences among reconstruction types. Autologous reconstruction achieved the highest mean satisfaction with breasts score (68.4 \pm 14.2), significantly higher than implant-based reconstruction (61.3 \pm 16.8, $p=0.003$) and combined technique (64.2 \pm 15.4, $p=0.048$).

Psychosocial well-being scores showed similar patterns, with autologous reconstruction demonstrating superior

outcomes (72.3 \pm 13.6 versus 65.8 \pm 15.9 and 68.4 \pm 14.7, $p=0.006$). Physical well-being of the chest was comparable across groups at 12 months ($p=0.284$), though autologous reconstruction patients reported more abdominal discomfort in the immediate post-operative period.

Sexual well-being scores did not differ significantly among groups ($p=0.412$).

Return to normal activities occurred earlier in implant-based reconstruction (6.8 \pm 2.4 weeks) compared to autologous (10.2 \pm 3.6 weeks) and combined techniques (8.4 \pm 2.9 weeks) ($p<0.001$).

Table 3: Functional Outcomes and Patient Satisfaction at 12 Months

Outcome Measure	Autologous (n=142)	Implant-based (n=126)	Combined (n=56)	p-value
BREAST-Q Satisfaction with Breasts, mean \pm SD	68.4 \pm 14.2	61.3 \pm 16.8	64.2 \pm 15.4	0.003
BREAST-Q Psychosocial Well-being, mean \pm SD	72.3 \pm 13.6	65.8 \pm 15.9	68.4 \pm 14.7	0.006
BREAST-Q Physical Well-being Chest, mean \pm SD	74.6 \pm 12.8	76.2 \pm 13.4	75.1 \pm 12.9	0.284
BREAST-Q Sexual Well-being, mean \pm SD	58.4 \pm 18.2	56.2 \pm 19.4	57.8 \pm 18.6	0.412
BREAST-Q Satisfaction with Outcome, mean \pm SD	70.2 \pm 15.3	63.8 \pm 17.2	66.4 \pm 16.1	0.012
Return to normal activities (weeks), mean \pm SD	10.2 \pm 3.6	6.8 \pm 2.4	8.4 \pm 2.9	<0.001
Arm mobility restriction, n (%)	18 (12.7)	12 (9.5)	8 (14.3)	0.502
Chronic pain (VAS >3), n (%)	14 (9.9)	16 (12.7)	7 (12.5)	0.682
Aesthetic outcome (surgeon-rated excellent/good), n (%)	118 (83.1)	89 (70.6)	42 (75.0)	0.028
Would undergo same procedure again, n (%)	128 (90.1)	102 (81.0)	47 (83.9)	0.084

Risk Factor Analysis: Multivariate logistic regression identified several independent predictors of overall complications. Obesity (BMI >30 kg/m²) was associated with 2.34-fold increased odds of complications (95% CI: 1.45-3.78, p<0.001). Active smoking demonstrated the strongest association with complications (OR: 2.87, 95% CI: 1.62-5.09, p<0.001). Post-mastectomy adjuvant radiotherapy increased complication risk (OR: 1.92, 95% CI: 1.18-3.12, p=0.008). Implant-based reconstruction showed increased odds of complications compared to autologous reconstruction (OR: 1.76, 95% CI: 1.08-2.87, p=0.023). Diabetes mellitus, age over 60 years, and immediate versus delayed reconstruction timing were not independently associated with complications in multivariate analysis.

Discussion

This comprehensive retrospective cohort study of 324 breast reconstruction patients provides important insights into complication profiles and functional outcomes across different reconstruction modalities. Our findings demonstrate that autologous tissue reconstruction achieves lower complication rates and superior patient-reported outcomes compared to implant-based techniques, while requiring longer operative time and initial recovery periods. These results have significant implications for patient counseling, surgical decision-making, and resource allocation in breast reconstruction programs.

The overall complication rate of 34.3% in our cohort aligns with reported ranges in contemporary literature, though direct comparisons are complicated by varying complication definitions and follow-up periods [14]. Our observation of significantly lower complications in autologous reconstruction (28.2%) compared to implant-based reconstruction (41.3%) corroborates findings from large registry studies that have demonstrated reduced long-term complications with

autologous techniques [15]. The protective effect of autologous tissue may relate to superior vascularization, absence of foreign material, and reduced susceptibility to radiation effects compared to implant-based reconstruction.

The 11.1% implant failure rate observed in our implant-based reconstruction cohort is consistent with published literature reporting 8-15% explantation rates within the first several years following reconstruction [16]. Capsular contracture, infection, malposition, and patient dissatisfaction constitute the primary reasons for implant removal or exchange. The permanence of autologous reconstruction, once successfully healed, represents a significant advantage for patients desiring long-term stability without concerns about implant longevity or potential future surgeries related to implant-related complications.

Our BREAST-Q findings demonstrating superior satisfaction and psychosocial outcomes with autologous reconstruction extend previous observations and provide quantitative evidence supporting patient-reported outcome advantages of autologous techniques [17]. The 7-point difference in satisfaction with breasts scores between autologous and implant-based reconstruction, while statistically significant, represents a clinically meaningful difference based on established minimal important difference thresholds for BREAST-Q domains. The superior aesthetic outcomes with autologous reconstruction, as rated by independent surgeon assessment, likely contribute to enhanced patient satisfaction, along with the natural feel and movement of autologous tissue. The identification of obesity, smoking, and post-mastectomy radiation as independent risk factors for complications has important clinical implications. These findings reinforce the importance of comprehensive pre-operative optimization, including smoking cessation programs and weight

management interventions [18]. The particularly strong association between smoking and complications (OR: 2.87) suggests that mandatory smoking cessation should be considered a prerequisite for elective breast reconstruction. The adverse impact of radiation on reconstruction outcomes, particularly for implant-based techniques, supports recommendations for autologous reconstruction in patients requiring post-mastectomy radiation therapy when feasible.

The longer operative time and initial recovery period associated with autologous reconstruction must be balanced against superior long-term outcomes and lower revision rates. The 10-week average return to normal activities for autologous reconstruction compared to 7 weeks for implant-based reconstruction represents a meaningful difference for patients in their decision-making process. However, the lower revision surgery rate in autologous reconstruction (18.3% versus 28.6%) suggests that the initial investment in more complex surgery may reduce subsequent surgical burden.

Several limitations of this study warrant consideration. First, the retrospective design introduces potential selection bias, as reconstruction technique choice was not randomized but based on patient-surgeon shared decision-making considering multiple clinical and personal factors. Second, the single-center experience may limit generalizability to other practice settings with different patient populations, surgical techniques, or perioperative protocols. Third, our 12-month follow-up period, while adequate for assessing early complications and initial functional outcomes, may not capture late complications such as delayed capsular contracture or fat necrosis that can manifest beyond the first year. Fourth, the relatively small sample size for combined reconstruction techniques limits statistical power for subgroup analyses within this category. Fifth, our study did not capture

important economic outcomes including total costs, cost-effectiveness, or productivity losses associated with different reconstruction approaches. Finally, surgeon experience and case volume, which may significantly influence outcomes, were not systematically analyzed.

Despite these limitations, our study provides valuable comparative data across reconstruction modalities using validated outcome measures and comprehensive complication assessment. Future research should focus on long-term outcomes beyond 12 months, include patient preferences and values in decision analysis models, investigate molecular and cellular mechanisms underlying superior outcomes with autologous tissue, and conduct cost-effectiveness analyses to inform health policy decisions regarding reconstruction access and reimbursement.

Conclusion

This study demonstrates that autologous tissue breast reconstruction achieves significantly lower complication rates and superior patient-reported outcomes compared to implant-based reconstruction, despite requiring longer operative time and initial recovery periods.

The 28.2% complication rate for autologous reconstruction compared to 41.3% for implant-based techniques, combined with higher satisfaction scores and better aesthetic outcomes, supports autologous reconstruction as the preferred option when technically feasible and aligned with patient preferences. Obesity, smoking, and post-mastectomy radiation therapy represent significant modifiable and non-modifiable risk factors that should inform patient selection and pre-operative counseling.

The overall acceptable safety profile across all reconstruction modalities, with major complication rates of approximately 12%, supports the continued expansion of breast reconstruction access for

appropriate candidates. These findings provide evidence-based guidance for surgeons and patients navigating reconstruction decisions and emphasize the importance of individualized approach considering patient factors, treatment requirements, and personal values in achieving optimal outcomes.

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