

Postoperative outcomes of breast reconstruction after mastectomy

A retrospective study

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Abstract

Breast reconstruction after mastectomy plays an active role in improving the quality-of-life (QoL) and alleviating the psychological trauma of breast cancer patients, and has become an indispensable part of the comprehensive treatment in breast cancer. However, compared with mastectomy alone, breast reconstruction also increase operative complications. The surgical, oncological outcomes, and cosmetic effect of breast reconstruction remains to be evaluated. Data for patients with breast cancer who underwent breast reconstruction after mastectomy from February 2009 to November 2015 in our hospital were retrospectively analyzed, with a median follow-up time of 44 months. The operating time, blood loss, drainage fluid, postoperative complications, postoperative cosmesis, oncological outcomes, and QoL were evaluated and compared between different reconstruction types. A total of 151 women were included. The flap-based group had higher complication rates of marginal necrosis of incision, while the incidence of capsular contracture was higher in immediate implant group. There was no difference in blood loss, drainage fluid, and other postoperative complications. Several independent factors were associated with increased postoperative complications included diabetic, obese, and reconstruction with flap. There was no significant difference in the disease-free survival rate and overall survival rate between different surgical groups. In terms of cosmetic effect, patients in the tissue expander group were more likely to get a satisfactory postoperative breast appearance. QoL outcomes shown that the tissue expander group has better body image and sexual enjoyment, while there was no significant difference for other QoL domains. In conclusion, different methods of breast reconstruction are safe and feasible for patients with breast cancer, tissue expander implantation following delayed implant breast reconstruction is a more effective treatment on cosmetic and QoL outcomes.

Abbreviations: BMI = body mass index, CI = confidence interval, ER = estrogen receptor, Her2 = human epidermal receptor-2, OR = odds ratio, OS = overall survival, PFS = progression-free survival, PR = progesterone receptor.

Keywords: breast reconstruction, mastectomy, postoperative outcomes

1. Introduction

Breast cancer is a common disease affecting millions of women, the incidence rate showed an upward trend, and the incidence becomes much younger recently in China. The cornerstone of breast cancer treatment is surgery. Surgical treatment for women with invasive breast cancer includes either breast-conserving

surgery or mastectomy.^[1] More patients with breast cancer are being diagnosed at early stages and the rate of breast-conserving surgery is increasing. However, a large number of patients still need total mastectomy. The absence of a breast has a great effect on the body and mind of the patients, especially for young patients. In recent years, reconstruction following mastectomy has becoming an integral part of breast cancer management, offers women an opportunity to mollify some of the emotional and aesthetic effects of this devastating disease.^[2]

The type of breast reconstruction includes autologous tissue (flap) reconstruction and implant reconstruction, or a combination of both.^[3] Breast reconstruction can be performed immediately or delayed. The timing and operate method was determined by patient preference, physical characteristics, and risk factors. The cosmetic outcome of breast reconstruction is superior to mastectomy. Literature has proven good psychosocial outcome and quality of life (QoL) in patients who underwent breast reconstruction.^[4,5] However, despite the evidence and recommendations, almost two-thirds of the mastectomies are still performed without breast reconstruction.^[6] An important reason was that patients refused additional surgery, which may have an inherent complication risk and longer recovery periods.^[7]

Autologous tissue provides the most natural and lasting outcomes, autologous reconstruction sought to provide a more aesthetic and natural alternative, and avoiding the drawbacks of early breast implants such as capsular contracture, increased risk of infection and rupture and their incompatibility with radiotherapy.^[8,9] While autologous reconstruction is the surgical

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operation for breast reconstruction, complications can occur such as necrosis of skin flap, flap shrinkage, and even calcifications. Implant-based breast reconstruction continues to be the more popular option, with advantage of no donor-site morbidity, shorter procedures.^[10] This procedure is particularly suitable for patients with a lack of autologous donor tissue. While convenient, implant-based reconstructive procedures do have their disadvantages. Postoperative complications, such as mastectomy-skin necrosis and reconstructive failure are higher.^[11]

The application of postmastectomy breast reconstruction remains controversial, how to choose the right individualized surgical procedures is still an important topic, which needs to discuss. The aim of this report is to analyze surgical outcomes, oncological safety, complications, and satisfaction of different methods of breast reconstruction after mastectomy in breast cancer patients in our hospital.

2. Methods

2.1. Patients

A retrospective analysis of 151 breast cancer patients who underwent breast reconstruction postmastectomy between February 2009 and November 2015 in our unit. The inclusion criteria for the present study were as follows: patients had pathology confirmed as breast cancer; patients who had undergone immediate or delayed unilateral reconstructions following mastectomy; female patients; and patients with Eastern Cooperative Oncology Group performance status of 0 or 1. The exclusion criteria for the present study were as follows: patients without available pathological data; patients who had not received standard adjuvant treatment; patients underwent bilateral reconstructions; patients with synchronous bilateral invasive breast cancer or metachronous contralateral breast cancer; and patients without follow-up records. To reduce the heterogeneity of the patient, bilateral reconstruction cases were exclude, for these cases may had synchronous bilateral invasive breast cancer. Patients were either contacted by telephone or interviewed in person at our outpatient clinic. Electronic data were collected from surgical operating notes, clinical letters, and breast care nurses records, preoperative data included patient demographics, smoking history and co-morbidities (obesity, diabetes) and tumor characteristics (largest preoperative size at imaging, location, pathological details) and any neoadjuvant treatment were recorded.

All the patients provided informed consent, which was approved by the Ethics Committee of The Affiliated Tumor Hospital of Guangxi Medical University, China. All clinical procedures were conducted in accordance with Good Clinical Practice Guidelines and any related municipal or federal regulations.

2.2. Surgical outcomes

Surgical outcome measures included the operating time, blood loss, drainage fluid, and postoperative complications (infection, marginal necrosis of incision, dehiscence of incisions, upper limb lymphedema, bleeding, nipple necrosis, seroma, capsular contracture). Risk factors for complications after breast reconstruction were analyzed.

2.3. Oncological outcomes

The follow-up period was calculated from the date of surgery to the date of either death or last follow-up. The disease-free survival (DFS), overall survival (OS), and locoregional recurrence-free

survival (LRFS) rates were calculated. The primary endpoint was DFS.

2.4. Cosmetic outcomes

The cosmetic outcome of breast reconstruction was evaluated by the surgeon and patients together as follows: Excellent, the reconstructed breast and the contralateral symmetry were of the same size, the patients were very satisfied; Good, the reconstructed breast was equal in size but slightly higher or lower than the contralateral side, there were no significant differences in clothes and patients were satisfied; Mediocre, the reconstructed breast was significantly asymmetrical with the contralateral side, and the patients were dissatisfied; Poor, the reconstructed breast was markedly deformed, the patients were extremely dissatisfied. This assessment method had been used in other literature.^[12]

2.5. Assessment of QoL

One years after therapy, the patients were invited to finish a questionnaire, consisting of the questionnaires of the EORTC QLQ-C30 (the European Organization on the Research and Treatment of Cancer Quality of Life Questionnaire Version 3.0)^[13] and QLQ-BR23 (the EORTC Breast Cancer Module).^[14] All the scales were converted linearly to a scale of 0 to 100 according to the standard scoring procedures of EORTC. Higher scores stand for better health status and functioning for the scales that evaluate the global health and functioning, higher scores conformed to more complaints and/or symptoms to evaluate the symptoms. The outcomes of mean QoL were compared between different regimens of treatment and were compared with the reference values of EORTC.

2.6. Statistical analysis

All statistical analyses were performed on SPSS 19.0 (SPSS Inc, Chicago, IL). In order to determine risk factors associated with increased postoperative complications, multivariate step-wise logistic regression was used. Categorical variables were analyzed by chi-square test and continuous variables with Student *t* test where appropriate, the mean data of multiple groups was detected by analysis of variance. Survival analysis was performed using Kaplan–Meier analysis and log-rank tests. A $P < .05$ was considered statistically significant.

3. Results

3.1. Patient characteristics

During the period reviewed, 151 patients underwent breast reconstruction following mastectomy. The median age at primary surgery was 41 years (range: 23–58). The median follow-up from index surgery was 44 months (range: 12–80). Of the 151 patients, 59 patients (39.1%) underwent autologous tissue reconstruction, 54 patients (35.7%) underwent immediate implant reconstruction and the remaining 38 (25.2%) underwent tissue expander implant following delayed implant breast reconstruction. No significant differences in age, body mass index (BMI), diabetes, smoking history, hypertension, TNM stage, pathological types, hormone receptor and human epidermal receptor-2 (Her2) status, blood loss, and postoperative drainage were found between the 3 groups. The operative time in the flap group was longer than in the others ($P = .000$), and the drainage was also more than other groups ($P = .001$). Of the 151 patients, 32

Table 1
Patient and tumor characteristics and operation details according to reconstruction type.

Characteristic	Total (n = 151)	Flap (n = 59)	Immediate implant (n = 54)	Tissue expander (n = 38)	P
Age, y, mean ± SD	41.0 ± 5.6	43.2 ± 6.5	41.2 ± 5.4	38.7 ± 4.8	.124
BMI, kg/m ² , mean ± SD	21.2 ± 2.1	21.0 ± 2.1	21.3 ± 2.2	21.2 ± 2.1	.672
Diabetes, %	18(11.9)	9(15.3)	6(11.1)	3(7.9)	.515
Smoking history, %	2(1.3)	0(0.0)	1(1.9)	1(2.6)	.496
Hypertension, %	16(10.6)	5(8.5)	6(11.1)	5(13.1)	.756
Stage, %					.082
0	12(7.9)	9(15.3)	1(1.9)	2(5.3)	
I	28(18.5)	5(8.5)	15(27.8)	8(21.1)	
II	88(58.3)	39(66.1)	29(53.7)	20(52.6)	
III	21(13.9)	6(10.2)	8(14.8)	7(18.4)	
IV	2(1.3)	0(0.0)	1(1.7)	1(2.6)	
Histology, %					.658
Ductal carcinoma in situ	12(7.9)	9(15.3)	1(2.6)	2(5.3)	
Ductal carcinoma	124(82.1)	44(74.6)	47(87.0)	33(86.8)	
Lobular carcinoma	6(4.0)	3(5.1)	2(3.7)	1(2.6)	
Other	9(6.0)	3(5.1)	4(7.4)	2(5.3)	
ER+, %	113(74.8)	42(71.2)	45(83.3)	26(68.4)	.190
PR+, %	90(59.6)	29(49.2)	36(66.7)	25(65.8)	.111
Her2+, %	67(44.4)	21(35.6)	28(51.9)	18(47.4)	.201
Other treatment, %					
Neoadjuvant chemotherapy	32(21.2)	11(18.6)	9(16.7)	12(31.6)	.188
Adjuvant chemotherapy	108(71.5)	42(71.2)	38(70.1)	28(73.7)	.939
Endocrine therapy	119(78.8)	44(74.6)	46(85.2)	29(76.3)	.352
Radiotherapy	57(37.7)	20(33.9)	9(16.7)	28(73.7)	.000
Operation time (mean), min	209 ± 19.4	286 ± 23.5	165 ± 15.6	153 ± 17.1	.000
Blood loss (mean), mL	61 ± 13.2	73 ± 12.5	56 ± 8.0	50 ± 16.9	.214
Drainage (mean), mL	342 ± 20.1	380 ± 21.6	320 ± 18.9	316 ± 20.5	.001

BMI=body mass index, ER=estrogen receptor, Her2=human epidermal receptor-2, PR=progesterone receptor. Data are presented as mean ± SD or number (%).

received neoadjuvant chemotherapy, 57 underwent radiotherapy, 108 adjuvant chemotherapy, and 119 endocrine therapy. Patient and tumor characteristics were summarized in Table 1.

3.2. Complications and risk factors

Total complication rate was 26.5%, there was no operative mortality. The patients were divided into 3 groups based on the type of reconstruction. There were significantly more complications after flap-based reconstruction than any other type of reconstruction (P=.028). There was increased marginal necrosis of incision (25.4%) after flap-based reconstruction (P=.000). There was increased capsular contracture (16.7%) after immediate implant reconstruction (P=.005). We found no

significant differences in the rate of infection, dehiscence of incisions, upper limb lymphedema, bleeding, nipple necrosis, and seroma in different groups (Table 2). We evaluated whether these complications result in delay to adjuvant treatment, results shown that no significant differences in the time from surgery to subsequent treatment between patients with and without complications. Several independent factors were associated with increased postoperative complications, such as obese (odds ratio [OR] 1.76, confidence interval [CI] 1.28–2.69, P=.025), diabetic (OR 1.28, CI 1.06–1.55, P=.043). Flap-based reconstruction was also a risk factor for postoperative complications (OR 1.58, CI 1.32–2.75, P=.032). The results are shown in Table 3.

Table 2
Comparison of postoperative complication between different breast reconstruction groups.

Parameter	Flap (n = 59)	Immediate implant (n = 54)	Tissue expander (n = 38)	P
Total complications	20(33.9)	15(27.8)	5(13.2)	.028
Infection	2(3.4)	2(3.7)	1(2.6)	.960
Marginal necrosis of incision	15(25.4)	3(5.6)	0(0.0)	.000
Dehiscence of incisions	5(8.5)	8(14.8)	2(5.3)	.286
Upper limb lymphedema	8(13.6)	6(11.1)	5(13.2)	.919
Bleeding	1(1.7)	1(1.9)	0(0.0)	.709
Nipple necrosis	3(5.1)	1(1.9)	0(0.0)	.283
Seroma	7(11.9)	5(9.3)	4(10.5)	.904
Capsular contracture	0(0.0)	9(16.7)	3(7.9)	.005

Table 3
Multivariate logistic regression for risk factors associated with postoperative complications.

Factor	Odds ratio	95% CI	P
Age > 40	1.02	0.83–1.22	.478
Smoker	NA		
Hypertension	1.18	0.76–1.54	.264
Alcohol abuse	NA		
Diabetic	1.28	1.06–1.55	.043
Chemotherapy	1.04	0.72–1.43	.355
Obese	1.76	1.28–2.69	.025
Type of reconstruction			
Flap	1.58	1.32–2.75	.032
Immediate implant	1.13	0.84–1.36	.607
Tissue expander	1.07	0.92–1.16	.829

CI = confidence interval, NA = no analysis.

Table 4
Oncologic outcomes in different breast reconstruction groups.

Patient group	Total no.	Locoregional recurrence no. (%)	Distant metastasis no. (%)	Any recurrence no. (%)	Expire no. (%)
Flap	59	4 (6.8)	3 (5.1)	9 (15.3)	1 (1.7)
Immediate implant	54	2 (3.7)	2 (3.7)	5 (9.3)	2 (3.7)
Tissue expander	38	5 (13.2)	2 (5.3)	7 (18.4)	1 (2.6)

3.3. Oncologic outcomes

In the flap-based reconstruction group, 4 patients had locoregional recurrence, 3 patients had distant metastasis. In the immediate implant reconstruction group, 2 patients had locoregional recurrence, 2 patients had distant metastasis (Table 4). In the tissue expander group, 5 patients had locoregional recurrence, 2 patients had distant metastasis. There was no

significant difference in DFS (log-rank $P = .358$) (Fig. 1) and OS (log-rank $P = .738$) (Fig. 2).

3.4. Cosmetic result

Comparing cosmetic outcomes between the 3 groups (Table 5), we found a better outcome (excellent or good) in the tissue expander group compared with the others (tissue expander vs flap vs immediate implant = 76.3% vs 62.7% vs 46.3%).

3.5. QoL outcomes

For the questionnaires of EORTC QLQ-C30, patients in the of tissue expander group had better cognitive function and role function, patients who received reconstruction based on flap had much better global QoL and emotional function, and patients who received immediate implant reconstruction had better scores on social and physical functions. However, as shown in Table 6, the differences were quite subtle and not statistically significant.

Based on the questionnaires of EORTC QLQ BR23, the immediate implant group of patients reported significantly worse breast symptoms, and those in the tissue expander group had much better sexual enjoyment and body image, which were statistically difference ($P < .05$). There was no significant difference for other QoL domains, as shown in Table 7.

4. Discussion

With the innovation of breast surgery, patients have more choices for the surgical approach than ever before. The number of patients who underwent breast reconstruction following mastectomy has increased in recent years, this is likely due to in part to advances in breast reconstruction, particularly tissue expander surgery. However, concerns remain regarding oncologic outcomes, surgical complications, and the National Comprehensive Cancer Network recommends breast reconstruction following mastectomy only for selected patients treated by experienced multidisciplinary teams.^[15]

Since breast reconstruction is more complex than conventional breast cancer surgery, patients may be concerned that the resulting surgical complications may increase. As seen in our study, the total complication rate was only 26.5%, which is

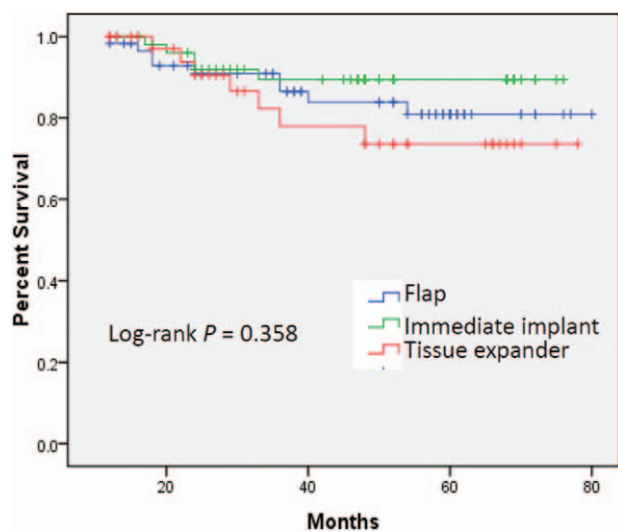


Figure 1. Comparison of disease-free survival (DFS) between different breast reconstruction groups.

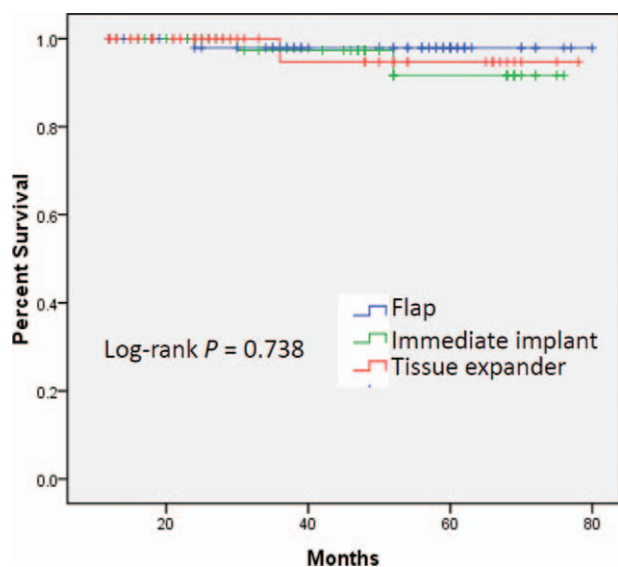


Figure 2. Comparison of overall survival (OS) between different breast reconstruction groups.

Table 5
Comparison of cosmetic effect between different breast reconstruction groups.

Parameter	Flap (n=59)	Immediate implant (n=54)	Tissue expander (n=38)	P
Excellent	6 (10.2)	4 (7.4)	4 (10.5)	.839
Good	31 (52.5)	21 (38.9)	25 (65.8)	.026
Mediocre	20 (33.9)	22 (40.7)	7 (18.4)	.076
Poor	2 (3.4)	7 (12.9)	2 (5.3)	.127

Table 6
QoL of patients according to the QLQ-C30 questionnaire.

Functioning scales	Flap (n = 59)		Immediate implant (n = 54)		Tissue expander (n = 38)		P
	Mean	SD	Mean	SD	Mean	SD	
Global QoL	66.2	22.9	65.3	16.8	63.3	16.2	.126
Physical function	82.3	18.4	85.7	19.6	82.6	18.0	.160
Role function	81.5	17.2	81.0	21.1	83.2	20.1	.209
Emotional function	85.8	21.5	81.4	20.8	82.5	19.3	.958
Cognitive function	84.6	21.9	84.3	22.6	85.1	20.2	.813
Social function	86.7	15.7	88.9	17.4	86.5	18.5	.422

QoL = quality-of-life.

comparable to previous series of oncoplastic breast surgery.^[7,16] The incidence of marginal necrosis of incision was increased in flap-based reconstruction group, compare with immediate implant or tissue expander reconstruction. In addition, the incidence of capsular contracture was increased in immediate implant reconstruction group, compare with other groups. Other complications had no significant difference. Although these are minor complications from surgical perspective, their duration may affect patients' QoL and subsequent treatment. The operation time and drainage were statistically different, and were increased in flap-based reconstruction group, we hold the opinion that which is because of the operation itself, because all the operations were done in the same department, and the technical skills of the surgical teams were at the same level. We evaluated whether these complications result in delay to adjuvant treatment, results shown that no significant differences in the time from surgery to subsequent treatment between patients with and without complications. The main reason maybe the complications were mild and less influential. It is suggested that breast reconstruction is a safe and reliable operation from surgical perspective. Several independent factors were associated with increased operative complications such as obese and diabetic patients with these risk factors do not recommend complex breast reconstruction surgery.

Oncological safety is an important factor for patients to consider whether to undergo breast reconstruction. The local recurrence rate and distant recurrence rate was 7.3% and 4.6%, respectively, in our series, at a median follow-up of 44 months. The recurrence rate is within the range reported in many series of mastectomy treatment for breast cancer patients.^[17,18] There were no significant differences in OS, DFS, and LRFs between different groups. In preoperative conversation, some of patients choose to forgo autogenous flap reconstruction for fear that it

will make detection of recurrent breast cancer difficult. Some patients worry that implants or tissue expander may cause breast cancer. There have been a few matched case-control studies have reported no difference in oncologic outcomes between different types of breast reconstruction, oncologic outcomes was mainly related to the biological characteristics and stages of tumor.^[19,20] In the present study, multivariate analysis show that the independent factors of prognosis were tumor stage, estrogen receptor/progesterone receptor status, and Her2 status. Our results coincide with those of other matched case-control studies,^[5,21] suggesting that breast reconstruction is an oncologically safe procedure, whether it is autogenous tissue reconstruction, implant reconstruction, immediate breast reconstruction or delayed reconstruction.

The goal of breast reconstruction was to improve patients' QoL after mastectomy, and patients' satisfaction with breast symmetry is most important.^[22,23] Achieving symmetry during breast reconstruction is also the most important goal for breast surgeons. The shape and volume of breasts differing in every person, the implants or tissue flap cannot meet the unique circumstances and needs of each patient. While bilateral breast symmetry is important, surgeons mainly choose the appropriate surgical method based on contralateral side. For a general size of the breast, we believe that autologous tissue transplantation is a more ideal method for breast reconstruction in term of tissue volume, size and softness, while implant styles are limited in matching the exact shape of the contralateral side. Previous studies have shown that volume is a more critical factor to patient satisfaction,^[24] implants can provide a similar volume, which may confer a stable feeling of symmetry and great satisfaction on the patient when wearing a brassier. However, in our study, the patient satisfaction scores were generally higher in the tissue expander group, it can establish more appropriate breast volume

Table 7
QoL of patients according to the QLQ-BR23 questionnaire.

Functioning scales	Flap(n = 59)		Immediate implant(n = 54)		Tissue expander(n = 38)		P
	Mean	SD	Mean	SD	Mean	SD	
Body image	72.0	23.9	75.2	21.7	81.3	25.2	<.001
Sexual functioning	22.3	15.4	23.7	16.3	25.1	15.6	.521
Sexual enjoyment	35.2	16.1	43.5	15.0	50.8	19.4	<.001
Future perspective	65.6	18.5	68.1	24.8	75.5	20.3	.286
Arm symptoms	21.5	11.7	15.1	13.9	18.7	16.0	.109
Breast symptoms	15.4	12.5	22.6	15.6	12.8	13.2	<.001
Systemic therapy side effects	12.0	8.9	12.5	8.2	13.4	10.3	.833

QoL = quality-of-life.

and have low incidence of capsular contracture. Compare with immediate implant reconstruction, a better cosmetic outcome was found in the autologous flap reconstruction group, more natural shape and softness make it more advantageous; meanwhile, there is no capsular contracture in the long term. It is undeniable that reconstruction is probably from an outcome perspective most important for consideration on improvement on self-esteem and QoL, our results shown that the global QoL of the patients in different groups was generally high. This suggests that different ways of breast reconstruction do not have influence on global QoL. However, patients in the tissue expander group reported significantly better body image and sexual enjoyment, probably because this group has a better cosmetic outcome therefore improves self-esteem.

Our study has a few limitations. It was a retrospective study; therefore, selection bias may be an issue. Although all tested factors were matched successfully, the sample size was smaller. The patients' pathological types were different, which may have an impact on the prognostic results, but the difference was small and not statistically. In addition, the follow-up duration was also relatively short for comparing long-term outcomes.

In conclusion, breast reconstruction following mastectomy could be a feasible surgical treatment option for breast cancer, tissue expander implantation following delayed implant breast reconstruction is a more effective treatment in terms of cosmetic and QoL outcomes, but the appropriate surgical procedures should be chosen according to the patient's actual situation. In future studies, a larger study population with a long-term follow-up is needed to more accurately determine oncologic outcomes.

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