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Breast

Risk Factors for Complications in Expander-Based Breast Reconstruction: Multivariate Analysis in Asian Patients

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Background: There have been many studies examining risk factors for complications in expander-based breast reconstruction after mastectomy, and some patient factors have been identified as risk factors. However, most of the previous studies were based on Caucasian patients.

Methods: Asian patients who had a tissue expander placed for immediate breast reconstruction between January 2006 and December 2015 (363 patients and 371 expanders) were analyzed retrospectively. Univariate and multivariate analyses were performed to elucidate risk factors for complications.

Results: The rate of skin necrosis was significantly higher in nipple-sparing mastectomy than in other types of mastectomies (12 patients among 107 patients, $P = 0.001$). The weight of the resected specimen was significantly higher in the group with complications than in the group without complications (444 g compared with 363 g, $P = 0.027$). Other factors (age, body mass index, smoking, expander type, preoperative chemotherapy, axillary dissection) had no significant effect on complications. Multivariate analysis with a logistic regression showed that a large breast (over 500 g) was the only significant risk factor for complications, with an odds ratio of 3.20 and a 95% confidence interval of 1.33–7.54 ($P = 0.010$).

Conclusion: In this series of Asian patients, breast size, rather than body mass index, is the most important predictor for complications in expander-based breast reconstruction. *(Plast Reconstr Surg Glob Open 2017;5:e1563; doi: 10.1097/GOX.0000000000001563; Published online 20 November 2017.)*

INTRODUCTION

Two-stage, tissue expander-based reconstruction has been the most common type of breast reconstruction.[1] Although the surgical procedures in expander-based breast reconstruction are fairly simple, such procedures result in a wide variety of complications such as infection, hematoma, and expander rupture. There have been many studies examining risk factors for complications in expander-based breast reconstruction, and some patient factors (obesity, smoking, large breast size, and so on) have been identified as risk factors.[2,3] However, most of the previous studies reported statistical analyses based on Caucasian patients[1–4]; there have been few studies based on Asian patients. Asian patients show physiological and lifestyle-related physical differences from Caucasian patients, such as lower rates of smoking and obesity.[5] Differences in patient characteristics may lead to different risk factors for complications. In this study, we performed univariate and multivariate analyses to elucidate risk factors for complications in expander-based breast reconstruction for Asian patients.

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METHODS

Patients

All female patients who had a tissue expander placed for immediate breast reconstruction between January 2006 and December 2015 (363 patients and 371 expanders) at our institution were analyzed retrospectively. All the patients were Asian.

Operative Technique

Mastectomy types included total mastectomy with skin resection, skin-sparing mastectomy with nipple re-

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section, and nipple-sparing mastectomy. Expander types were both smooth (PMT Corporation, Chanhassen, Minn.) and textured (Allergan Inc., Irvine, Calif.). Expanders were placed in a submuscular pocket. The expanders were filled 30% of full expansion at the time of surgery. Antibiotic irrigation was not performed. Acellular dermal matrix was not used. One or 2 closed suction drains were placed. Drains were removed when their output was less than or equal to 30 mL/d. Prophylactic antibiotics (cefazolin, 2 g/d) were continued until removal of the final drain. Postoperative expansion was started 2–3 weeks after surgery.

Statistical Analysis

All analyses were performed using JMP 12 (SAS Institute Inc., Cary, N.C.). Data are expressed as means ± SDs. Univariate analysis with continuous variables was performed with Student's *t* test. Univariate analysis with categorical variables was performed with the chi-square test. Multivariate analysis was performed with a logistic regression. Values of $P < 0.05$ were considered significant.

RESULTS

Seven oncologic surgeons and 4 plastic surgeons were involved in the cases. There was no significant difference in the rate of complications between the surgeons. Eighty-seven patients underwent adjuvant chemotherapy, and 15 patients underwent radiation postoperatively. These postoperative treatments were started 1–2 months after surgery. Forty-two patients (11.6%) suffered from complications that required surgical intervention. The most common complication was skin necrosis (18 patients), followed by expander rupture (11 patients), hematoma (7 patients), infection (4 patients), and expander exposure (2 patients; Table 1).

The mean age of all patients was 49.3 ± 9.6 years, and there was no significant difference between the groups with and without complications. The mean body mass index (BMI) of all patients was 22.2 ± 3.5 kg/m^2, and there was no significant difference between the groups with and without complications. Mastectomy type (skin resection, skin sparing, or nipple sparing) did not affect the rate of complications. However, the rate of skin necrosis was significantly higher in the group of nipple-sparing mastectomy patients (4/192 in total mastectomy with skin resection, 2/71 in skin-sparing mastectomy, and 12/107 in nipple-sparing mastectomy, $P = 0.001$). The history of smoking was recorded in 196 patients, and 14 patients (7.1%) were active smokers. Smoking did not affect the rate of complications. Expander type (smooth or textured) did not affect the rate of complications. However, ruptured expanders were all smooth expanders ($P = 0.051$). Preoperative chemotherapy and axillary dissection had no significant effect on complications (Table 2). The weight of the resected specimen was significantly higher in the group with complications than in the group without complications (444 g compared with 363 g, $P = 0.027$; Fig. 1). Five patients had preoperative radiation, and 1 of these 5 patients suffered from expander rupture. Two patients had a history of diabetes, and 1 of those 2 patients suffered from skin necrosis. However, the number of the patients with preoperative radiation or diabetes was too small for statistical analysis to detect the influence of those factors on complications.

Multivariate analysis with a logistic regression showed that a large breast (over 500 g) was the only significant risk factor for complications, with an odds ratio of 3.20 and a 95% confidence interval of 1.33–7.54 ($P = 0.010$; Table 3). In the larger breast group, the majority of complications involved skin necrosis (n = 7; 54%), but expander rupture (n = 3), infection (n = 2), and hematoma (n = 1) were also seen.

Table 1. List of Complications

Complication	Number (%)
Skin necrosis	18 (5.0)
Expander rupture	11 (3.0)
Hematoma	7 (1.9)
Infection	4 (1.1)
Expander exposure	2 (0.6)

Table 2. Influence of Each Factor on Complications

Factor	Complication (–)	Complication (+)	*P*
Smoking (–)	159	23	0.859
Smoking (+)	12	2	
Smooth expander	244	34	0.339
Textured expander	85	8	
Preoperative chemotherapy (–)	268	38	0.148
Preoperative chemotherapy (+)	61	4	
Axillary dissection (–)	222	27	0.793
Axillary dissection (+)	105	14	

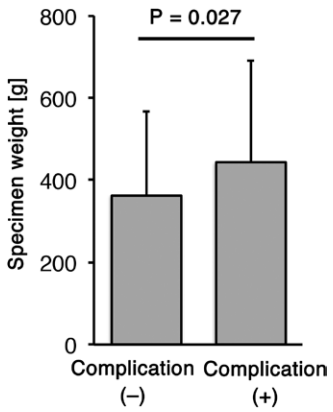

Fig. 1. Weight of the resected specimen in the groups with and without complications.

Table 3. Multivariate Analysis of Risk Factors for Complications

Variable	OR	95% CI	*P*
Elderly (age > 65 y)	0.999	0.222–3.22	0.999
Obesity (BMI > 25)	0.558	0.186–1.52	0.262
Nipple-sparing	1.98	0.940–4.13	0.072
Preoperative chemotherapy	0.360	0.093–1.13	0.081
Axillary dissection	1.32	0.524–3.17	0.539
Large breast (> 500 g)	3.20	1.33–7.54	0.010

OR, odds ratio.

DISCUSSION

The complication rate was 11.6% in our study, comparable with those of previous studies.[1–5] Skin necrosis was the most common complication in our institution. The rate of nipple-sparing mastectomy is generally high at our institution, and this may have led to the high rate of skin necrosis among complications. Skin necrosis including nipple loss is a major complication in nipple-sparing mastectomy.[6,7] In our study, too, the rate of skin necrosis was significantly higher in nipple-sparing mastectomy than in other types of mastectomy. A previous study reported that there was a statistically significant difference in the rate of observed skin necrosis between surgical oncologists.[8] We believe that nipple-sparing mastectomy is effective for selected patients. However, nipple-sparing mastectomy should be performed by experienced oncologists, and careful attention should be paid to skin necrosis.

Univariate and multivariate analyses in our study showed that a large breast was associated with an increased risk of complications while BMI did not affect complications. The most common complication in large breasts was skin necrosis. The effects of breast size on complications have been reported in previous studies.[9–11] Duggal et al.[9] reported that women with complications had a greater mean mastectomy weight than women without complications (744 g compared with 620 g), a finding comparable with our results. Wang et al.[10] found that larger breast mass (over 352 g) was associated with an increased risk of superficial nipple necrosis. Kato et al.[11] reported that larger expander size (over 400 cc) was identified as a risk factor for infection. Our previous study showed that the weight of the resected specimen had a strong correlation with total drainage after expander-based breast reconstruction.[12] For reconstruction of a large breast, a larger area must be dissected and hence the operation time tends to be longer, which results in complications. We believe that patients with large breasts, irrespective of obesity, should be informed they may have a higher risk of complications.

The rate of infection was 1.1% in our study, and this rate was lower than that in previous studies.[2,11,13] Olsen et al.[14] reported that suboptimal prophylactic antibiotic dosing was a risk factor for surgical-site infection after major breast operation. At our institution, prophylactic antibiotics (cefazolin, 2 g/d) are continued until drain removal. This extended use of prophylactic antibiotics may result in the low rate of infection at our institution. However, a recent study concluded that prolonged antibiotics use did not have a statistically significant effect on reducing surgical-site infection or implant loss.[15] More prospective randomized controlled trials are needed to determine whether prolonged prophylactic antibiotics are truly beneficial in breast reconstruction.

The rate of expander rupture (3.0%) was high in our study, and ruptured expanders were all smooth expanders although there was no significant difference. In the cases of expander rupture, the expanders were unable to be expanded and were replaced with new expanders. A smooth expander is connected to the injection port with a tube, while a textured expander has the injection port integrated. The tube between the smooth expander and the injection port can be ruptured intraoperatively. However, Yanko-Arzi et al.[4] reported that integrated-port expanders are associated with more complications including expander rupture than the distant port. Multicenter studies with more patients are needed to elucidate the effects of expander type on complications.

Racial and ethnic differences in breast cancer survival have been reported.[16] In that report, Asians were found to be less likely to die from breast cancer than whites, and BMI was an important mediator. Regarding breast reconstruction, Asian patients are statistically less likely than Caucasians to undergo breast reconstruction.[17,18] Lower BMI[5,11,19,20] in Asian patients undergoing breast reconstruction is well documented in the literature. Chang et al.[5] examined risk factors for complications after expander-based breast reconstruction in a Taiwanese population and concluded that BMI over 24 kg/m^2, not the standard definition of obesity (BMI over 30 kg/m^2) may be a more suitable cutoff point for risk in Asian patients. In a multivariate analysis in our study, we set the cutoff point for obesity at BMI of 25 kg/m^2 according to the definition of obesity in our country.[21] Sixty-four patients had BMI over 25 kg/m^2 and were regarded as obese in our study. However, a large breast was the only risk factor for complications; obesity was not a risk factor. Obese patients tend to have large breasts, and obesity can be a confounding variable of large breasts in statistical analysis. Our multivariate analysis excluded this confounding effect. Interestingly, in previous studies reporting obesity or higher BMI as a risk factor for complications, breast size was not included as a variable.[3,8] Our results suggest that breast size, rather than BMI, is the most important predictor for complications in expander-based breast reconstruction.

The main limitation of this study is the selection bias for breast reconstruction. In our institution, all the patients who wish breast reconstruction are offered a consultation with a plastic surgeon preoperatively. The selection bias is made either by an oncologic surgeon or a plastic surgeon. Some patient factors, such as preoperative radiation[2] and diabetes,[11] have been known to be associated with an increased risk of complications. Patients with these factors may have been discouraged from undergoing breast reconstruction. The low prevalence rate of preoperative radiation or diabetes in this study may be the cause of the inadequate statistical power to detect the importance of these factors. Multicenter studies with more Asian patients are needed in the future.

CONCLUSIONS

Univariate and multivariate analyses were performed to elucidate risk factors for complications in expander-based breast reconstruction for Asian patients. In this series of Asian patients, breast size, rather than BMI, is the most important predictor for complications in expander-based breast reconstruction.

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