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Breast

The Effect of Axillary Lymph Node Sampling during Mastectomy on Immediate Alloplastic Breast Reconstruction Complications

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Background: Tissue expander-based immediate breast reconstruction is currently the most common technique used for postmastectomy breast reconstruction. During mastectomy, axillary lymph nodes are biopsied to stage patients. The purpose of this study is to investigate postoperative complications with respect to extent of lymph node dissection.

Methods: A retrospective review of all patients undergoing tissue expander-based immediate breast reconstruction at our institution from 2010 to 2012 was conducted. Charts were analyzed to determine the association between the absolute number of axillary lymph nodes removed and postreconstructive incidence of skin necrosis, cellulitis, seroma, and expander removal. Independent sample *t* test and linear regression were used to analyze data.

Results: In total, 282 patients with 467 reconstructions were included. Overall incidence of all postoperative complications per breast was 23.8%. Breasts in which a complication occurred had a mean of 6 nodes removed versus 4 nodes in uncomplicated breasts ($P = 0.018$). Complications were noted at a significantly higher rate in patients who underwent axillary lymph node dissection compared with sentinel lymph node biopsy ($P = 0.008$). Expander removal and seroma occurred more frequently in breasts that had a greater number of nodes removed ($P = 0.006$ and $P = 0.015$, respectively). Preoperative radiation resulted in higher incidence of cellulitis and skin necrosis. Postoperative radiation and chemotherapy did not adversely affect reconstruction.

Conclusions: Axillary lymph node removal of >4 nodes confers a greater risk of postreconstructive seroma formation and tissue expander loss in patients undergoing immediate reconstruction following mastectomy. Axillary lymph node dissection has a higher incidence of breast reconstruction complications compared with sentinel lymph node biopsy. Therefore, we encourage plastic surgeons to consider degree of lymphadenectomy when discussing reconstructive options with patients, as this may significantly impact their reconstructive outcome. *(Plast Reconstr Surg Glob Open 2019;7:e2224; doi: 10.1097/GOX.0000000000002224; Published online 16 May 2019.)*

INTRODUCTION

Breast cancer is the most common cancer in women, and the second most common cause of death from cancer among women of most ethnicities.[28] Treatment of breast cancer involves surgical therapy in the form of either breast conservation or total mastectomy. For more advanced, larger sized, or multicentric tumors, total mastectomy is the procedure of choice. Women undergoing total mastectomy are offered immediate reconstruction as this lessens the psychological impact of mastectomy and improves the overall body image. Although various options are available, immediate breast reconstruction with tissue expanders (IBR-TE) is frequently employed. This is due to the ease and speed by which it can be performed, and the positive outcome it affords patients in terms of aesthetics and psychosocial functioning.

During mastectomy, axillary lymph nodes are biopsied to stage patients. A sentinel lymph node is examined to determine metastatic spread and, if positive, the opera-

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tion is extended into a complete axillary lymph node dissection (ALND). Patients with clinically detectable nodes forgo sentinel node biopsy, and an ALND is performed during mastectomy. Although morbidity associated with lymphadenectomy is well known, no study has correlated the risk of IBR-TE complications relative to the number of lymph nodes removed during mastectomy. The purpose of our study is to investigate postoperative complications in patients undergoing IBR-TE with respect to the extent of lymph node dissection during mastectomy. Additionally, we sought to determine which comorbidities, if any, impact the incidence of postoperative complications in these patients.

METHODS

Following approval from our Institutional Review Board, we conducted a retrospective review of all patients who underwent TE-IBR from 2010 to 2012. Patient comorbidities evaluation included history of prior breast surgery or cancer, tobacco use, diabetes mellitus, hypertension, obesity, thyroid dysfunction, and autoimmune disease. Pathology reports were reviewed to determine the number of axillary lymph nodes removed during sentinel lymph node biopsy (SLNB) and ALND. Information on the stage of cancer was also obtained. Medical records were examined to determine occurrence of the following complications: cellulitis, seroma, wound dehiscence, skin necrosis, and TE failure. A deep space infection requiring explantation of the TE(s) was defined as TE failure.

Demographics between groups were compared using chi square analysis. This was also used to determine the number of nodes necessary to resect before the odds of experiencing a complication became statistically significant. Independent sample *t* test was used to determine the relationship between number of nodes removed and complication rates. Finally, multivariable linear regression was employed to examine the effect of each sequential node resected. A *P* value <0.05 was considered significant. All statistical analyses were performed at the level of the reconstruction, rather than the patient, as local factors, including the number of lymph nodes removed, would be expected to only effect the ipsilateral breast.

RESULTS

Our cohort included a total of 282 females with 467 reconstructions. Of the 467 reconstructions included in the study, 221 underwent mastectomy with SLNB and 55 underwent mastectomy with ALND. As expected, the average number of lymph nodes removed was greater for those receiving ALND than those treated with SLNB (19.5 versus 4.38, $P < 0.001$; Table 1). Patients with a higher stage of breast cancer were more likely to undergo a complete ALND ($P < 0.001$), which is again expected given current treatment guidelines. There was no significant difference in frequency of cellulitis, seroma, wound dehiscence, or skin necrosis between patients who underwent mastectomy with SLNB versus mastectomy with ALND (Table 2). TE removal occurred in 9.5% patients who had an SLNB compared with 27.2% patients who had a complete ALND with mastectomy ($P = 0.001$; Table 2). The average age of patients who had a complication was 51.5 years (±9.67) versus 49.9 years (±10.4) for those who did not have a complication ($P = 0.133$).

Overall, our rate of postoperative complications per reconstruction was 23.8%. As shown in Table 2, reconstruction following ALND was associated with higher complication rate (36.4%) than both SLNB (24.9%) and no node removed (18.8%, $P = 0.023$). Furthermore, reconstructions that experienced any of the studied complications on average had more lymph nodes removed than those that did not experience one of these complications (6.18 versus 4.03 nodes, respectively, $P = 0.018$). When investigating each specific complication, the number of nodes removed was found to correlate with experiencing increased rates of both seroma and TE removal (Table 3). On average, reconstructions complicated by seroma had 4.59 nodes removed. Reconstructions that did not result in seroma had an average of 2.62 nodes removed ($P = 0.015$). TE loss occurred in patients who had an average of 8.12 nodes removed, whereas those that did not develop a deep space infection mandating TE explantation had an average of 4.04 nodes removed ($P = 0.006$).

Utilizing multivariate logistic regression analysis, we found that each node taken conferred an odds ratio of 1.07 ($P = 0.005$) for TE removal and 1.042 ($P < 0.001$) for any combination of complications (Table 4).

Further analysis was performed to determine if there was a cutoff, above which the odds of experiencing a complication increased significantly, and a risk burden for each node removed. Our results indicate that if more than 12 nodes were removed from the breast the odds of experiencing any complication increase by 1.95 times ($P = 0.025$) (Table 5). When analyzing specific complications, the resection of more than 2 nodes increased the odds of experiencing TE removal by 1.85 times, whereas removal of more than 19 nodes increased the odds of experiencing cellulitis by 2.84 ($P = 0.05$ and 0.0028),

Table 1. Number of Nodes Removed in SLNB versus ALND

	Mastectomy + SLNB (n = 221)	Mastectomy + ALND (n = 55)	*P*
No. nodes removed	4.38 (3.79)	19.5 (7.13)	<0.001

Value expressed as mean (SD).

Table 2. Number and Type of Complication in Patients Undergoing SLNB versus ALND

	Patients (n = 282)			
	Breasts undergoing IBR+TE (n = 467)			
	Mastectomy + SLNB (n = 221)	Mastectomy + ALND (n = 55)	Mastectomy alone (n = 191)	*P*
Cellulitis	25 (11.3)	10 (18.2)	15 (7.85)	0.079
Seroma	12 (5.43)	1 (1.82)	13 (6.81)	0.368
Dehiscence	16 (7.24)	7 (12.7)	10 (5.24)	0.150
Skin necrosis	16 (7.24)	5 (9.1)	13 (6.81)	0.834
TE removal	21 (9.5)	15 (27.2)	15 (7.85)	0.001
Any complication	55 (24.9)	20 (36.4)	36 (18.8)	0.023

Value expressed as number of breasts (percentage).

Table 3. Comparison of Number of Nodes Removed for Each Complication

	Cellulitis	Seroma	Dehiscence	Skin Necrosis	TE Removal	Any Complication
No. nodes removed in breast with this complication	4.23 (6.33)	4.59 (6.81)	5.82 (8.03)	5.62 (8.01)	8.12 (9.86)	6.18 (8.85)
No. nodes removed in breasts without this complication	6.5 (8.88)	2.62 (3.58)	4.38 (6.56)	4.39 (6.56)	4.04 (6.06)	4.03 (6.03)
P	0.086	0.015	0.232	0.302	0.006	0.018

Value expressed as mean (SD).

Table 4. Logistic Regression for Development of Any Combination of Complications and TE Removal

Result	OR (95% CI)	*P*
Any complication	1.042 (1.012–1.071)	0.005
TE removal	1.070 (1.034–1.108)	<0.001

OR, odds ratio.

respectively. There were no statistically significant differences between groups in terms of comorbidities and incidence of complications (Table 6).

Last, we evaluated the implications of preoperative and postoperative radiation and chemotherapy on reconstructive outcomes. Preoperative radiation resulted in greater risk of developing cellulitis and skin necrosis ($P = 0.043$). Postoperative radiation and chemotherapy did not significantly increase risk of any complication.

DISCUSSION

To our knowledge, this is the first study to quantify the number of lymph nodes removed during mastectomy that lead to specific IBR-TE complications. First, we confirmed that ALND increases the risk of developing postreconstructive complications compared with SLNB or no node dissection. We subsequently calculated this risk and demonstrated that greater than 4 nodes removed results in a significantly higher chance of seroma development and TE loss. Additionally, we found that the removal of as few as 2 additional nodes can increase the risk of developing any postoperative complication. Furthermore, we have shown that each node removed during axillary dissection confers a 4% risk of developing any complication.

Current guidelines from the National Comprehensive Cancer Network dictate that patients with stage I, IIA, IIB, or IIIA (T3N1M0) with 4 or greater axillary lymph nodes positive for metastatic disease receive postoperative radiation therapy.[3,4] The present study demonstrates that patients with greater than 4 axillary nodes removed have a significantly higher risk of developing a reconstructive complication, especially seroma or TE loss. Other studies have corroborated our findings. In the Z0011 trial, SLNB followed by completion of axillary dissection resulted in greater incidence of wound infections, seroma, and parasthesias compared with SLNB alone.[1] Additionally, lymphedema was reported in a significantly greater number of patients who underwent SLNB+ALND.[1] Although the Z0011 only enrolled patients undergoing breast conservation therapy, similar results have been demonstrated in patients who have mastectomy. In a retrospective study performed over a 10-year period, the reconstructive complication rate among patients who underwent mastectomy with ALND was 31% compared with 10% in those who did not have ALND.[2] Controlling for risk factors including smoking, obesity, tumor stage, and history of chemother-

Table 5. Number of Nodes Removed and Chance of Developing a Complication

	No. Breasts with 0–12 Nodes Removed	No. Breasts with >12 Nodes Removed	OR	*P*
Any complication	91	20	1.954	0.025
No complication	320	36		
	No. breasts with 0–2 nodes removed	No. breasts with >2 nodes removed	OR	*P*
TE removal	22	28	1.845	0.04
No TE removal	245	169		
	No. breasts with 0–19 nodes removed	No. breasts with >19 removed	OR	*P*
Cellulitis	44	6	2.835	0.028
No cellulitis	395	19		

OR, odds ratio.

Table 6. Incidence of Complication with Respect to Comorbidities

	Cellulitis	Seroma	Skin Necrosis	TE Removal	Dehiscence	Any Combination of Complications
History of cancer (n = 65)	10	4	6	6	6	17
Prior breast surgery (n = 53)	11	7	5	5	5	20
Obesity (n = 48)	11	5	8	11	4	22
Diabetes mellitus (n = 30)	6	2	1	3	1	6
Hypertension (n = 74)	12	2	7	12	4	20
Thyroid dysfunction (n = 57)	7	4	3	4	2	13
Autoimmune disease (n = 21)	3	1	0	3	3	6
Tobacco use (n = 91)	14	8	16	15	5	33

apy and radiation, the risk of major reconstructive complications was 3 times greater with ALND, with infection being the most common postoperative complication.[2]

Combining these previous studies with our results can help plastic surgeons better prognosticate reconstructive results for their patients. It is of utmost importance that the reconstructive surgeon maintains a heightened awareness of the extent of lymph node dissection, as this can impact results and lead to patient morbidity. Because we have quantified a specific threshold of node removal associated with certain postoperative morbidities, that is, have demonstrated that even removal of 2 or 4 additional nodes can result in seroma formation or TE removal, respectively, surgeons can employ expectant management and ensure that the patient is aware of their own risk profile. Furthermore, we hope that our results will heighten the awareness of surgical oncologists toward the consequences of performing an ALND. Further investigation into this procedure would help to evaluate the risk–benefit ratio of this procedure and determine whether it is necessary in prolonging disease-free survival compared with alternative modalities, such as SLNB with radiation, or a limited axillary dissection.

Our study is limited by the fact that it is retrospective in nature with limited numbers. The lack of power may have prevented us from reaching statistical significance for all complications investigated. Furthermore, our study included reconstructions performed by a number of plastic surgeons. Variability in operative experience and technique may influence incidence of postoperative complications. In addition, we were unable to study all possible confounding factors, including differences in volume of breast tissue resected, mastectomy flap thickness, and number of incision sites, single versus double. Further investigation of these factors is encouraged as these may significantly alter reconstructive outcomes.

CONCLUSIONS

We have demonstrated that the risk of postoperative IBR-TE complications increases with more extensive lymph node dissection, and that each lymph node removed during mastectomy can increase the risk of developing any complication by 4%. Our study has shown that more than 4 lymph nodes removed during ALND can adversely impact reconstructive outcomes. Specifically, it may lead to seroma formation or, even worse, TE loss. Therefore, we suggest that reconstructive surgeons consider the extent of lymph node resection when risk stratifying their patients, and that surgical oncologists employ judicious use of axillary lymphadenectomy to reduce reconstructive morbidity. Additional research into the benefits of ALND may help determine its role in promoting disease free survival, and whether this outweighs the morbidity associated with this procedure.

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