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Bilateral Mastectomies—Can a Co-surgeon Technique Offer Improvements over the Single-Surgeon Method?

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Abstract

Purpose—Bilateral mastectomy (BM) is traditionally performed using a single surgeon (SS) technique (SST); a co-surgeon (CS) technique (CST), where each attending surgeon concurrently performs a unilateral mastectomy, offers an alternative approach. We sought to compare the CST and SST for BM with respect to operative times and complications.

Methods—Patients undergoing BM without reconstruction at our institution between 2005–2015 were identified using operative caselogs and stratified into CS- and SS-cohorts. Operative time (OT; incision to closure) was calculated. Patient age, cancer presence/stage, hormone receptor/BRCA status, breast weight, axillary procedure, and 30-day complications were extracted. Differences in OT, complications, and demographics between cohorts were assessed with t-tests and chi-square tests. A multivariate linear regression model was fit to identify factors independently associated with OT.

Results—Overall, 109 BM cases were identified (CS, n=58 [53.2%]; SS, n=51 [46.8%]). Average duration was significantly shorter for the CST by 33 minutes (21.6% reduction; CS: 120 minutes versus SS: 153 minutes, $p<0.001$), with no difference in complication rates ($p=0.65$). Demographic characteristics did not differ between cohorts except for total breast weight (TBW) (CS: 1878g versus SS: 1452g, $p<0.05$). Adjusting for TBW, CST resulted in a 27.8% reduction in OT (44-minutes savings, $p<0.001$) compared to SST.

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Compliance with Ethical Standards

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study formal consent is not required.

Data availability: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conclusions—The CST significantly reduces OT for BM procedures compared to the SST without increasing complication rates. While time-savings was < 50% and may not be ideal for every patient, the CST offers an alternative BM approach potentially best-suited for large TBW patients and those undergoing axillary procedures.

Keywords

Breast Surgery; Bilateral Mastectomy; Breast reconstruction; Co-surgeon; Operative Time

INTRODUCTION

Bilateral mastectomy (BM) operations are increasingly being performed across the United States with rates tripling over the last decade [1,2]. While some BMs are performed for bilateral disease, many BMs involve a therapeutic mastectomy coupled with a contralateral prophylactic mastectomy. With recent rates of these procedures on the rise, BMs have become an increasingly important operation for breast surgeons, and techniques aimed at improving operative efficiency without sacrificing patient outcomes are in demand [1,3]. The traditional surgical approach for BM operations involves a single surgeon removing both breasts in succession. Recently, our group suggested the co-surgeon technique (CST) as an alternative method for performing BMs, in which two attending surgeons simultaneously perform one side of the operation. While the CST has been suggested within other surgical subspecialties as a way of effectively reducing operative times and complications and potentially improving outcomes associated with lengthy or complex bilateral procedures, our study was the first to investigate the CST in breast surgery, specifically in cases of BM followed by immediate tissue-expander reconstruction (BMTR) [4–9]. While subsequent research has suggested this approach offers improved operative efficiency for breast reconstruction procedures, further investigation into the role of the CST in reconstruction-free mastectomies has yet to be published [10,11]. Here, we sought to examine the role of the CST in operations in which no immediate reconstruction was performed, to specifically determine if this approach can afford comparable improvements in operative durations without concurrently increasing complication rate, similar to the results observed in the BMTR cohort.

METHODS

We performed a single-center retrospective analysis of consecutive patients undergoing BM without immediate reconstruction at our institution after receiving approval from the institutional review board at Brigham and Women's Faulkner Hospital (BWFH).

Setting

We examined BM without immediate reconstruction procedures in women at BWFH, a Harvard-affiliated nonprofit community teaching hospital associated with Brigham and Women's Hospital (BWH) and the Dana-Farber Cancer Institute. Approximately 1,200 breast surgeries are performed at BWFH annually by BWH staff. A total of 11 high-volume breast surgeons (those performing 150 breast surgeries annually) performed the BM procedures without immediate reconstruction in our analysis.

Cohort selection

Utilizing ICD-9 codes for BM procedures, we searched billing records to identify patients undergoing BM without reconstruction between June 2005 and October 2015 at BWFH, and subsequently utilized operating room case logs to obtain the following data: breast surgeon(s), surgery start (incision) time, and surgery end time. We additionally searched BWFH tumor registry for patients undergoing bilateral mastectomy operations during this same time-period. Patients who had immediate breast reconstruction, aborted breast reconstruction, or incision closure by plastic surgeons were not included in this cohort. A total of 109 women made up the final cohort. In all cases, the surgical team consisted of either one or two attending breast surgeons performing the BMs; surgical fellow, surgical resident, and/or surgical physician assistant participation was not examined and did not warrant exclusion from our study.

From the final dataset of 109 patients, retrospective chart review was conducted to extract the following demographic data: patient age at operation, presence of cancer, hormone receptor status (estrogen receptor [ER], progesterone receptor [PR], human epidermal growth factor receptor 2 [HER2]), use of neoadjuvant therapy, presence of genetic mutation (BRCA1/2), type of axillary surgery performed (sentinel lymph node biopsy [SLNB], axillary lymph node dissection [ALND], none), excised breast weight, and presence of 30-day postoperative complications. Cases were noted to include a SLNB even if the biopsy was attempted but no lymph nodes were found as long as the incision was made. The following postoperative complications were searched for by manual retrospective review of electronic medical records/chart: abscess, cellulitis, deep vein thrombosis, hematoma (non-operative and operative), skin ischemia, pulmonary embolism, skin necrosis, surgical site infection, venous thromboembolism, and wound dehiscence. Tumor stage was obtained from BWFH's tumor registry for each case. Surgical team members, including primary and co-surgeon (if applicable), were verified for each case. The dataset was then subdivided into co-surgeon (CS) and single-surgeon (SS) groups. The final cohort consisted of 58 CS and 51 SS cases for analysis.

Statistical analysis

Operative time (OT) was calculated as the time between incision and end of the procedure. Bivariate analysis was performed to assess for differences between the CS and SS cohorts. Variables included age, presence of cancer at the time of operation, use of neoadjuvant therapy, presence of genetic mutations, total breast weight (TBW), presence of postoperative complications, type of axillary surgery performed (if applicable), and operative time.

A multivariate linear regression model was fit to examine factors associated with operative time for BMs without immediate reconstructions. Factors included use of a CS, presence of cancer, use of neoadjuvant therapy, presence of genetic mutation, breast weight, and type of axillary surgery performed (if applicable).

The dataset was built using Microsoft Excel (2011), and analyses performed using Stata 14.1 (StataCorp, College Station, TX). Student's t-test was used to calculate p values and a p

value of $<.05$ was considered statistically significant. Beta and 95% confidence intervals are presented.

RESULTS

We identified 109 patients undergoing BMs without immediate reconstruction between June 1, 2005 and October 31, 2015 at BWFH. CSs performed 58 of these cases and SSs performed the remaining 51. Amongst the entire cohort, BMs were performed most often in the setting of a cancer diagnosis (94.8% of CS and 94.1% of SS operations were performed in the setting of either unilateral or bilateral breast cancer). Stage I disease was found most frequently in both the CS (29.3%) and SS (41.2%) groups (Table 1). Among the 109 procedures, 48.6% included a SLNB and 30% included an ALND; there was no statistically significant difference found in number of axillary procedures between the CS and SS cohorts (Table 2). TBW was the only statistically significant difference in the demographic characteristics between cohorts (CS: 1878g versus SS 1452g, $p < 0.05$, Table 2). The overall 30-day postoperative complication rate was 16.5% ($n=18$). There were no statistically significant differences in the number of complications between CS and SS groups ($p=0.65$). The most common complication in the CS group was cellulitis ($n=5$), whereas cellulitis ($n=3$) and hematoma ($n=3$) were the most common in the SS group. Although cohorts were screened for additional postoperative complications including deep vein thrombosis, skin ischemia, and pulmonary embolism, there were no cases of these in the study period therefore, are not presented in Table 3.

The average OT for CS cases (120 minutes) was significantly shorter than for SS cases (153 min, $p < 0.01$), demonstrating a time-savings for the CS group of 33 minutes on average compared to the SS group (Table 3). Results of the multivariate linear regression model are presented in Table 4. A significant decrease in BM duration was observed when the procedure was performed by CSs ($\beta = -44.10$, $p < 0.001$). TBW ($\beta = 0.01$, $p < 0.001$); the addition of unilateral and bilateral SLNB (unilateral $\beta = 23$ $p < 0.01$; bilateral $\beta = 52.48$, $p < 0.05$) and ALND (unilateral $\beta = 34.22$, $p < 0.01$; bilateral $\beta = 89.16$ $p < 0.05$) also significantly impacted operative time. The model accounted for 39% of variability in BM duration ($R^2 = 0.3910$).

DISCUSSION

The present study is the first to investigate the impact of an additional attending surgeon on the overall OT and the short-term postoperative complications associated with BM procedures without immediate reconstruction, in an effort to compare the CST to the single-surgeon technique (SST). The main findings are that the CST affords a reduction in OT without increasing complication rates for BM procedures. The degree of time savings for CS procedures in the unadjusted regression was approximately 33 minutes, which increased to 44 minutes corresponding to a 27.8% reduction ($p < 0.001$) when adjusting for TBW on multivariate linear regression analysis. Although the addition of a second surgeon did not proportionally reduce OT (i.e., did not afford a 50% time-savings) and may not ultimately prove cost-effective for all situations, certain patient scenarios (namely those patients with

large TBW and those undergoing axillary nodal procedures,) were afforded a greater time benefit and the CST may be worth considering in these cases.

Our results expand upon our initial work in which the CST was originally proposed [9]. In our original cohort of 116 patients undergoing BM with immediate reconstruction, we found a 41-minute time-savings for the mastectomy portion of the procedure when done with the CST, representing a 35.1% reduction over the SST. Here, time-savings was similar, representing an adjusted overall time savings of 44 minutes, or a reduction of 27.8% in a cohort of 109 patients undergoing BM without any reconstruction. Taken together, it appears consistent that the presence of a second surgeon may be able to reduce the duration of BM procedures by close to one-third. This degree of time-savings appears similar to that associated with application of the CST within other surgical subspecialties [4,8,12,13].

The benefit of the CST appeared to increase with the type and extent of nodal procedure performed, with ALND affording a greater impact on time than SLNB, and bilateral procedures within both categories offering a greater impact on time than their unilateral counterparts (Table 4). These results are not surprising, and not only echo but further elaborate upon our prior work on this topic and suggest a cohort of patients in which the CST may be best suited.

Other considerations for cases best-suited for the CST include surgeon and concomitant operating room block time availability, as well as patient comfort with involving two-surgeons in their care. At our institution, there are multiple breast surgeons sharing clinic and operative space making it relatively easy to find a second surgeon to operate with at any given time, however one could imagine this coordination to be challenging in a smaller practice or one with more constraints on operative room utilization. Patients must also be comfortable with the CST in order for it to succeed, and while we have found that most patients are open to and even pleased by having two surgeons involved in their care, some patients will certainly prefer to remain with a single-surgeon approach. At our institution, the second co-surgeon usually meets the patient prior to the procedure in the preoperative holding area and not as an additional preoperative consultation.

Time-savings in the operative setting are important not only for patient outcomes, given the long accepted association between longer surgical duration and morbidity, but also with respect to operating room utilization, as operating room time is expensive [14–17]. While we have observed that the CST appears to improve operative time compared to the SST, we have also noticed that it requires additional resources that must not be overlooked when considering the financial incentives of this procedure, such as additional surgical and nursing staff and additional surgical setup. One of the potential benefits reduced operative time is a reduction in complications, a connection which has been well cited in the surgical literature [16,18,19]. Ultimately, however, we have found no significant difference in complication rates between the SST and CST cohorts in our analyses. It is possible that this is related to the relatively small study sizes involved and the infrequency of overall complications associated with these cases, but ultimately, a larger study is warranted to determine the final impact of the CST on patient outcomes. As was noted in a recent study investigating the role of the CST in bilateral microsurgical breast reconstructions, the financial impact of the CST

on the healthcare system needs further consideration and further research into these varying financial tradeoffs are required to better understand the potential cost-effectiveness of the CST compared to the traditional SST [11].

Other benefits, as well as drawbacks, of this alternative method of BM are still unknown. Reduced work/stress for the primary surgeon, perceived improved safety/reduced complication rates, and perceived improved outcomes were cited as reasons to use two surgeons in Scheer et al's survey of neurosurgeons performing spinal deformity surgery [20]. We are currently attempting to ascertain the utilization patterns, perceived benefits, and barriers to implementation of the CST in the wider breast surgery community with a survey we administered to the members of the American Society of Breast Surgeons designed to investigate nationwide BM practice-patterns.

There are strengths and limitations to this study. It was performed in a retrospective fashion, and only includes cases of BM performed at a single institution. In order to obtain a statistically significant sample size, the study period spans a large number of years, during which the rates for both BM procedures and nodal procedures fluctuated. We did not include patient comorbidities as part of our analysis, such as BMI or Charlson/Deyo score, for example, that could have potentially influenced operative times and/or complications. Other factors, such as influence of other providers on overall operative time (i.e., residents, fellows, surgical PAs), are also not accounted for here as we did not specifically examine their participation during data collection. While there was no surgical PA or fellow involvement during our study period, residents (mostly PGY1 or 2) may have taken part in some of these cases as an assistant. While a prior study examining the influence of resident participation on mastectomy operations concluded resident-participation usually increases mean operative time for a variety of mastectomy procedures, there was no statistically significant difference found between attending-alone and attending-with-resident bilateral mastectomy cases performed without reconstruction [21]. Overall, with the incidence of BM procedures on the rise, further investigation into the CST, and into the influence of other providers on the single-surgeon vs CST operative times and outcomes, is warranted.

CONCLUSION

A CST for performing BM operations appears to reduce overall operative time without significantly increasing postoperative complications compared to the traditional SST. While time-savings is not directly proportional (i.e., addition of a second surgeon does not halve the operative time), benefits appear to be greater in those with larger TBWs and those requiring nodal procedures, suggesting a unique patient-cohort where the CST may be best suited. This cosurgeon model is worth further exploration as it may offer additional benefits beyond time-savings, making it an appealing alternative operative approach for certain patients.

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Table 1

Stage Data for Patients

Stage	Co-surgeon cases <i>N</i> (%)	Single-surgeon cases <i>N</i> (%)	Frequency in total cohort (Co-surgeon + Single surgeon) <i>N</i> (%)
0	8 (13.8%)	5 (9.8%)	13 (11.9%)
1	17 (29.3%)	21 (41.2%)	38 (34.8%)
2	16 (27.6%)	11 (21.55%)	27 (24.8%)
3	10 (17.2%)	11 (21.55%)	21 (19.3%)
4	4 (6.9%)	0	4 (3.7%)
Not Applicable/Prophylactic operation	3 (5.2%)	3 (5.9%)	6 (5.5%)

Table 2

Descriptive Statistics

	BMs performed by Co-surgeons (n = 58)	BMs performed by Single surgeons (n = 51)	P value
Age (mean [SD]), years	55.6 (12.4)	55.1 (11.3)	0.81
Presence of cancer			0.99
Unilateral	48 (82.7%)	42 (82.3%)	
Bilateral	7 (12.1%)	6 (11.8%)	
None (bilateral prophylactic)	3 (5.2%)	3 (5.9%)	
BRCA1/2 genetic cases	9 (15.5%)	9 (17.6%)	0.57
Neoadjuvant therapy	13 (22.4%)	5 (15.7%)	0.37
Average total breast weight (sum, g)	1878	1452	<0.05*
Cases with postoperative complications	11 (19.0%)	7 (13.7%)	0.65
Sentinel lymph node biopsy	28 (48.3%)	25 (49.0%)	0.64
Unilateral	25	20	
Bilateral	3	5	
Axillary node dissection	21 (36.2%)	12 (23.5%)	0.20
Unilateral	19	12	
Bilateral	2	0	
Mean operating time (min)	120	153	<0.001*

BM bilateral mastectomy, *g* grams, *min* minutes, *SD* standard deviation

Table 3

Short-term Surgical Outcomes: 30-Day Postoperative Complication List by CS and SS cases

Complication type	# of complications in co-surgeon cases	# of complications in single-surgeon cases	# of complications in total cohort (CS+SS)
Abscess	2	0	2
Cellulitis	5	3	8
Hematoma	4	3	7
Skin necrosis	1	0	1
Surgical site infection	0	1	1
Wound dehiscence	1	0	1
Total number of patient cases with at least one of the above complications	11 * (19.0%)	7 (13.7%)	18 (16.5%)

CS co-surgeon, *SS* single surgeon

* One case in the CS cohort had 3 complications (hematoma, wound dehiscence, and bilateral abscesses). In this instance, the total number of patient cases with postoperative complications differs from the total number of complications listed. Alternatively, in the SS cohort, each complication listed represents a unique patient case.

Table 4

Regression Model using Operative Time as Outcome Variable

		β	95% confidence interval	P value
Procedure performed by co-surgeons		-44.10	-59.53, -28.67	<0.001
Age		0.07	-0.80, 0.94	0.87
Neoadjuvant therapy		3.00	-19.45, 25.46	0.79
Genetic cases		8.89	-12.28, 30.06	0.41
Breast weight (g, sum)		0.01	0.01, 0.02	<0.001
Presence of cancer	Unilateral	29.64	-12.52, 71.79	0.17
	Bilateral	22.66	-34.44, 79.77	0.43
Sentinel lymph node biopsy	Unilateral	23.00	5.84, 40.13	<0.01
	Bilateral	52.48	8.65, 96.31	<0.05
Axillary lymph node dissection	Unilateral	34.22	14.21, 54.23	<0.01
	Bilateral	89.16	21.88, 156.43	<0.05

* Data are given as regression coefficients (β) and 95% confidence limits. $R^2=0.3910$.