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Does “Two is Better Than One” Apply to Surgeons? Comparing Single-Surgeon versus Co-surgeon Bilateral Mastectomies

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Abstract

Background—Bilateral mastectomies (BM) are traditionally performed by single surgeons (SS); a co-surgeon (CS) technique, where each surgeon concurrently performs a unilateral mastectomy, offers an alternative approach. We examined differences in general surgery time (GST), overall surgery time (OST), and patient complications for BM performed by CS and SS.

Methods—Patients undergoing BM with tissue expander reconstruction (BMTR) between January 2010 and May 2014 at our center were identified through operative case logs. GST (incision to end of BM procedure), reconstruction duration (RST) (plastic surgery start to end of reconstruction) and OST (OST= GST + RST) was calculated. Patient age, presence/stage of cancer, breast weight, axillary-procedure performed, and 30-day postoperative complications were extracted from medical records. Differences in GST and OST between CS- and SS-cases were assessed with a t-test. A multivariate linear regression was fit to identify factors associated with GST.

Results—116 BMTR cases were performed [CS, n=67 (57.8%); SS, n=49 (42.2%)]. Demographic characteristics did not differ between groups. GST and OST were significantly shorter for CS-cases, 75.8 vs. 116.8 minutes, $p<0.0001$, and 255.2 vs. 278.3 minutes, $p=0.005$, respectively. Presence of a CS significantly reduces BMTR time ($\beta=-38.82$, $p<0.0001$). Breast weight ($\beta=0.0093$, $p=0.03$) and axillary dissection ($\beta=28.69$, $p=0.0003$) also impacted GST.

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Conclusions—The co-surgeon approach to BMTR reduced both GST and OST, however the degree of time-savings (35.1% and 8.3% respectively) was less than hypothesized. A larger study is warranted to better characterize time, cost, and outcomes of the CS-approach for BM.

Keywords

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

Introduction

Mastectomy operations are among the most common breast surgeries performed in the United States. Many women undergoing mastectomy undergo simultaneous contralateral prophylactic or therapeutic mastectomy with or without breast reconstruction. Rates of bilateral mastectomy (BM) have nearly tripled in the past decade, which is likely multifactorial. Research suggests enhanced imaging detection of sub-clinical disease, increased utilization of genetic testing, and better accessibility of reconstructive procedures have contributed to this trend, though the ultimate reasons are still not well understood [1–5]. A concomitant rise in the rate of mastectomy with immediate reconstruction (MIR) has also occurred, and currently 38% of all mastectomy cases performed annually in the United States involve reconstruction [1, 3, 4, 6]. At high-volume breast centers, reconstruction rates can be even higher, with over 60% of mastectomies undergoing reconstruction at our institution in recent years.

While breast reconstruction can improve aesthetic outcomes, patient satisfaction and quality of life [7, 8], MIR procedures have increased operative times and complication rates than mastectomies without reconstruction [4]. In the United States, MIR most commonly utilizes tissue-expander/implant-based methods according to the American Society of Plastic Surgery's statistics[9]. Unilateral and bilateral mastectomies with immediate tissue expander reconstruction are usually performed by a multidisciplinary team consisting of one breast surgeon and one plastic reconstructive surgeon. These surgeons perform their portions of the operation independently, with the breast surgeon performing the BMs first followed immediately by the plastic surgeon's reconstruction. The patient remains anesthetized for the entire combined procedure.

Research within other surgical subspecialties suggests that a two or 'co-surgeon' technique may effectively reduce operative times and complications associated with complex bilateral procedures, possibly leading to improved surgical outcomes [10–12]. The co-surgeon technique has yet to be described or evaluated in breast surgery and currently there are no direct comparisons between co-surgeon and single-surgeon outcomes. The aim of this present study was to identify differences in operative times and short-term surgical outcomes of BM with immediate tissue expander or implant reconstruction (BMTR) procedures performed by co-surgeons and single-surgeons at one of our primary surgical sites, in an effort to determine the potential benefit of the co-surgeon technique. We hypothesized that a co-surgeon procedure would reduce the mastectomy time by nearly half.

Methods

We performed a single-center retrospective analysis of consecutive patients undergoing BMTR at our institution after obtaining ethical approval from the institutional review board at Brigham and Women's Faulkner Hospital (BWFH).

Setting

We examined the care of women undergoing BM procedures at BWFH, a Harvard-affiliated nonprofit community teaching hospital associated with both Brigham and Women's Hospital (BWH) and the Dana-Farber Cancer Institute. Approximately 1200 breast surgeries are performed at BWFH annually by BWH staff. A total of eight high-volume breast surgeons (>200 cases annually) and nine reconstructive surgeons performed the BMTR procedures in our analysis.

Cohort Selection

Through operating room (OR) caselogs we identified 187 consecutive women who underwent BM between January 2010 and June 2014 at BWFH. The operative caselogs included the following data elements: breast surgeon(s), general surgery incision start- and end-time (corresponding to the mastectomy portion of the operation), reconstructive surgery start- and end-time (if applicable), primary procedure type, reconstructive surgeon (if applicable), and reconstruction procedure (if applicable). We subsequently excluded patients who did not undergo immediate tissue expander (TE)/implant placement, and cases involving autologous reconstruction, missing operative time (OT) data and those not performed by our surgical oncology physicians. Utilization of acellular dermal matrix (ADM) during TE/implant placement did not influence eligibility. A surgical team consisting of either one or two attending breast surgeons performed the BMs and an attending plastic reconstructive surgeon performed the reconstruction. Surgical residents and/or surgical physician assistants participated in both stages of the operation.

From the final dataset of 116 patients, retrospective chart review was conducted to extract patient age, presence of cancer, tumor stage, 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), type of BM performed (nipple-sparing versus non-nipple-sparing), excised breast weight, and presence of 30-day postoperative complications. Surgical team members, including primary breast surgeon, 'co-surgeon' breast surgeon (if applicable), and reconstructive surgeon, were verified for each case. The dataset was then subdivided into co-surgeon (CS) and single-surgeon (SS) groups. The final cohort consisted of 67 CS and 49 SS-cases for analysis.

Statistical Analysis

General surgery time (GST) was calculated by subtracting the mastectomy end-time from initial incision-start time. Overall surgery time (OST) was calculated by subtracting reconstructive surgery end-time from the initial incision start-time. Bivariate analysis was performed to assess for differences between CS and SS patients undergoing BMTR. Variables included: age, presence of cancer, receipt of neoadjuvant therapy, presence of

genetic mutation, total breast weight, presence of postoperative complications, type of axillary surgery performed (if applicable), OST, GST, and reconstruction surgery duration (RST).

A multivariate linear regression model was fit to determine significant factors in GST for BMTR. Factors included use of a CS, presence of cancer, use of neoadjuvant therapy, presence of genetic mutation, breast weight, and whether ALND was performed.

The dataset was built using Microsoft Excel (2007) and analyses were performed using SAS 9.3 (Carey, NC); all tests were 2-sided, and a p-value of <0.05 was considered statistically significant. Beta and 95% confidence interval are presented for all factors.

Results

We identified 116 patients undergoing BMTR between January 1, 2010 and June 1, 2014 at one of our primary surgical sites. SSs performed 49 of these cases (TE, $n=46$; implant, $n=3$) and CSs performed the other 67 (TE, $n=62$; implant, $n=5$). Nearly three-quarters had a cancer diagnosis at the time of surgery (71%) and 21% of patients had a known BRCA1/2 mutation (Table 1).

Among the 116 BMTR procedures, 41.4% involved a SLNB and 12.9% involved an ALND. A numeric difference in the use of SLNB was observed, with an increase in SLNB among the SS cohort (51% vs 34.3%, $p=0.07$). The overall 30-day postoperative complication rate was 12.9%, with skin-necrosis representing the most common complication in both cohorts (Table 3). The incidence of complications between CSs and SSs was not statistically significant (11 CS vs 4 SS, $p=0.19$; Table 2), and there were no other statistically significant differences in the patient populations between CS and SS cohorts (Table 2).

The average GST for CS-cases (75.8 min) was significantly shorter than for SS-cases (116.8 min, $p<0.0001$). The OST of CS-cases compared to SS-cases was also significantly shorter (255.2 min vs 278.3 min, $p=0.005$). However RST was significantly longer in CS-cases (139.0 minutes, SS: 123.3 minutes, $p=0.03$).

Results of the multivariate linear regression model are presented in Table 4. A significant decrease in GST was observed when BMTR was performed by CSs ($\beta=-38.82$, $p<0.0001$). Total breast weight ($\beta=0.0093$, $p=0.03$) and ALND ($\beta=28.69$, $p=0.0003$) were found to significantly impact GST. The model accounted for 52.9% of the variance in GST.

DISCUSSION

Traditionally, BMs are performed by a single breast surgeon (with or without a reconstructive surgeon). In the early 2000s, members of our breast surgical staff proposed and implemented an alternative BM-technique involving two attending surgeons. Although a two-surgeon model has been advocated in other surgical subspecialties for a small subset of cases including orthopedics [13, 14], urology [15–17], thoracics [12] and hepatobiliary surgery [11], to the best of our knowledge it has not been integrated or evaluated in a breast surgical context.

While we observed that the CS-approach significantly reduced GST and OST of BMTR procedures, we did not observe the expected 50% reduction during the mastectomy portion of the surgery. The time-savings observed in other two surgeon studies in the literature ranges from 22%–34.2%, however most of these studies involved two surgeons working together on complex operations as opposed to two surgeons independently and simultaneously performing one side of bilateral operations [11, 16, 18]. While CSs reduced our GST by 35.1%, this fell short of the reduction we expected would occur with an additional attending surgeon present. The CS-advantage was even less apparent when examining OSTs, and given the combined-nature of the BMTR procedure, OST must be significantly considered. While an average of approximately 23 minutes was saved per CS-case, the overall time-savings for BMTR procedures translated to only 8.3%. This is due to the paradoxical increase observed in RST for CS versus SS-approaches.

We are unable to definitively explain this unanticipated increase in RST during CS-procedures. Although implant-based reconstruction could take longer than TE-reconstruction depending on the surgeon, there was no significant difference in the reconstruction method utilized between the two groups (CS-implants, n=5; SS-implants, n=3). We hypothesize that the CS-approach may result in differences in flap thickness, dissection areas, and/or flap integrity given variability in breast surgeon technique, possibly requiring more time by the reconstructive surgeon to achieve symmetry. Plastic surgeons at our institution do not perform oncologic resection or flap-thinning when reconstructing BMs, and the differences in flap and dissection beds that can result when two surgeons perform a BM may result in reconstructive challenges that could increase OT. It has been suggested that the technique of using ADM with TE/implant placement can increase OT [19], and ADM is commonly used at our institution. We did not examine ADM-utilization trends in our study, and it is possible that if ADM use was unequally distributed between groups it could have contributed to the increased RST among CSs presented here. Another possible explanation for the longer RST with the CS-approach is that the presence of the CS added complexity to the BM setup which translated into a delay for the reconstruction surgeons. CS-cases require an additional OR table with a second set of sterile instruments, as well as an additional scrub technician, necessitating an additional ‘equipment-count’ at the cessation of the BM operation and potentially delaying or impeding the beginning of reconstruction. The overall impact of SS- versus CS-techniques on breast reconstruction efforts is currently unknown; research into this area could provide useful insights and possible explanations for the surprising increase in RST following BM procedures by CSs seen in our study.

In the multivariate linear regression model, we found the CS-approach significantly predicts for a shorter GST whereas increased total breast weight and the addition of ALND significantly increased GST. These results are not surprising, as ALND adds complexity to the operation and large total breast weight implies more dissection is required, and the addition of an additional surgeon was hypothesized as a means of reducing OT given the ability to work on both sides simultaneously.

The association between longer surgical duration and morbidity has been long accepted, with recent research supporting the direct association between OTs and surgical

complications ranging from surgical site infections, venous thromboembolisms (VTE), and even mastectomy flap necrosis [20–23]. However surgical durations for breast cases are not as lengthy as many other oncologic resections, and even those with reconstruction demonstrate relatively few complications compared with other surgeries. Multiple patient and surgical factors impact complication rates, and although reduced OTs were seen with CS-cases in our study, complication rates between CS and SS cohorts did not significantly differ (Table 2). This finding is largely due to the fact that ultimately OST was only reduced by 23 minutes, which is a relatively small degree of time-savings and one that we would not expect to reduce complication rates. Larger studies are warranted to better understand what degree of time-savings may translate into reduced complications for breast cancer operations.

Although reductions in OT have the potential for increased OR efficiency and subsequent cost-savings, we did not perform cost-analysis in our study. The cost of OR time depends on many factors including the procedure performed, whether fixed overhead costs and/or physician fees are included in the calculation and the opportunity costs associated with including a second surgeon during bilateral procedures [24–26]. The costs of additional personnel and equipment required during co-surgeon cases may potentially counter the cost-savings from reduced OTs, and co-surgeons participating in CS-BMTR cases are prevented from performing other tasks which may generate larger revenue. A more in-depth investigation including all of these factors would be necessary to determine the true costs of CS- versus SS-BMTR procedures, which is beyond the scope of our present analysis.

Our study is subject to several limitations. It was performed retrospectively and although we attempted to account for patient and surgical variation in our model, we were not able to eliminate all elements of variability. For example, we were unable to control for variations in surgeons' operating speeds and while most surgeons participated in both SS- and CS-cases, we did not control the proportion of cases each surgeon performed. Because we chose to examine the role that CSs play during BMs in patients undergoing BMTR procedures, we were faced with the challenge of distinguishing the effects of the CS's role on both the BM and reconstructive portions of procedures. A prospective study designed to investigate the role of CSs on BM techniques in patients forgoing immediate reconstruction may provide a more straightforward dataset for analysis, and these results could then be used to design future studies examining the role of CSs in MIR operations. Finally, we did not examine patient or reconstructive surgeon preferences with respect to the CS- versus SS-approaches, which could provide insight into the benefit of the CS-method. If the CS-technique consistently negatively impacts breast reconstruction efforts, this approach may not be ideal for BM with reconstruction procedures. Long-term surgical outcomes including cosmetic challenges and patient and surgeon satisfaction with the ultimate reconstruction should be investigated in future studies. Asymmetrical mastectomy flaps can contribute to long-term contour irregularities that may require fat-grafting or the use of different implant sizes at final reconstruction to accommodate differences resulting from the initial BM procedure, and these outcomes may be just, if not more, challenging than short-term complications to overcome. Research into these areas is warranted to better understand the role that CS-operations may play for future breast surgical procedures.

Despite these limitations this is the first study to our knowledge characterizing the use of a CS-approach in BMTR, an area that warrants additional research given the recent uptrend in BM procedures in the United States. A prospective study designed to further investigate the CS-technique for BM operations with and without reconstruction is being developed at our institution, with the ultimate goal of determining ways in which BM operations can be improved. We hope to better determine how cost, operative duration, and patient and surgical outcomes are influenced when one versus two breast surgeons perform BMs, and to assess the ways in which this novel approach impacts reconstructive efforts and outcomes.

Conclusion

The CS-technique is an alternative method for performing BMs. It offers a reduction in the overall surgery time and in the mastectomy portion of BMTR procedures, however a paradoxical increase in reconstructive surgery time was observed and overall time-savings was less than hypothesized in our analysis. A larger study is warranted to better characterize time, cost, and outcomes of the CS-approach for BMs.

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Synopsis

We describe a co-surgeon (CS) approach for bilateral mastectomies, in which two breast surgeons concurrently perform one unilateral mastectomy. Operative duration and complications were compared between CS- and single-surgeon approaches; overall and general surgery times were reduced with the CS-approach.

Table 1

Stage Data for Patients

Stage	Frequency (%)
0	18 (15.5%)
1	28 (24.2%)
2	23 (19.8%)
3	13 (11.2%)
4	0 (0%)
BRCA genetic mutation	24 (20.7%)
No cancer or genetic mutation present	10 (8.6%)

Table 2

Descriptive Statistics

	Procedures performed by Co-Surgeons (n=67)	Procedures performed by Single Surgeon (n=49)	P-value
Age [Mean (Std)]	43.2 years (9.8)	41.3 years (9.6)	0.29
Presence of Cancer			
Unilateral	47 (70.2%)	32 (65.3%)	0.18
Bilateral	0	3 (6.1%)	
None	20 (29.9%)	14 (28.6%)	
Neoadjuvant Therapy	15 (22.4%)	7 (14.3%)	0.27
Genetic cases	24 (35.8%)	16 (32.6%)	0.72
Breast Weight (sum) [Median (range)]	804.0 (559–1,128)	767.0 (568–1,080)	0.88
Breast Weight (sum)			
< 500 g	14 (20.9%)	10 (20.4%)	0.88
500–1499 g	43 (64.2%)	30 (61.2%)	
> 1500 g	10 (14.9%)	9 (18.4%)	
Post-op Complications	11 (16.4%)	4 (8.2%)	0.19
Sentinel Lymph Node Biopsy (SLNB)	23 (34.3%)	25 (51.0%)	0.07
Axillary Lymph Node Dissection (ALND)	9 (13.4%)	6 (12.2%)	0.85
Nipple-Sparing Mastectomies	12 (17.9%)	10 (20.4%)	0.73
Overall Surgery Time [Mean (Std)]	255.2 min (44.9)	278.3 min (40.1)	0.005
General Surgery Time [Mean (Std)]	75.8 min (22.0)	116.8 min (29.0)	<0.0001
Reconstruction Surgery Time [Mean (Std)]	139.0 min (39.8)	123.3 min (34.0)	0.03

Table 3

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

30 Day Post-Op Complication List	Frequency in Cosurgeon Cases	Frequency in Single Surgeon Cases	Frequency in Total Cohort (CS +SS)
Hematoma	1	1	2
Infection	2	0	2
Skin Ischemia *	2	0	2
Skin Necrosis	5	3	8
Deep Vein Thrombosis (DVT)	1	0	1
Total Number (%)	11 (16.4%)	4 (8.2%)	15 (12.9%)

* Required topical treatment/non-surgical management during observed timeframe

Table 4

Regression model using General Surgery Time as outcome variable*

	β	95% CI	P-value
Procedure Performed by Co-surgeons	-38.82	-47.88, -29.76	<0.0001
Age	0.09	-0.40, 0.57	0.72
<i>Presence of Cancer</i>			
Unilateral	4.79	-9.41, 19.01	0.51
Bilateral	0.88	-31.27, 33.02	0.96
None	Ref.	Ref.	Ref.
Neoadjuvant Therapy	-2.75	-16.27, 10.77	0.69
Genetic cases	0.84	-9.77, 11.45	0.87
Breast Weight (g, sum)	0.0093	0.00093, 0.018	0.03
Sentinel Lymph Node Biopsy (SLNB)	11.00	-0.63, 22.63	0.06
Axillary Lymph Node Dissection (ALND)	28.69	13.54, 43.85	0.0003
Nipple Sparing Mastectomies	10.97	-1.20, 23.14	0.08

* Data are given as regression coefficients (β) and 95% confidence limits. Ref indicates the reference category. R^2 is 0.5293