



# One-Year Experience of Same-Day Mastectomy and Breast Reconstruction Protocol

Michelle C. Specht, MD, FACS<sup>1,2</sup>, Bridget N. Kelly, BA<sup>1</sup>, Eleanor Tomczyk, MD<sup>2,3</sup>, Olivia A. Ford, MD<sup>2,3</sup>, Alexandra J. Webster, BS<sup>1</sup>, Barbara L. Smith, MD, PhD, FACS<sup>1,2</sup>, Michelle A. Gadd, MD, FACS<sup>1,2</sup>, Amy S. Colwell, MD, FACS<sup>2,3</sup>, and Eric C. Liao, MD, PhD, FACS<sup>2,3</sup>

<sup>1</sup>Division of Surgical Oncology, Massachusetts General Hospital, Boston, MA; <sup>2</sup>Harvard Medical School, Boston, MA; <sup>3</sup>Division of Plastic and Reconstructive Surgery, Massachusetts General Hospital, Boston, MA

## ABSTRACT

**Background.** The prevalence of same-day mastectomy with reconstruction has continued to increase across the United States in recent years. Prior studies have shown that same-day mastectomy with reconstruction leads to increased patient satisfaction and allows hospitals to use resources better. This study sought to evaluate the implementation of same-day mastectomy with a reconstruction recovery protocol for patients undergoing mastectomy at our institution.

**Methods.** Under an institutional review board-approved protocol, a retrospective cohort analysis compared patients who underwent mastectomy April 2016 through April 2017 with those who had mastectomy March 2020 through March 2021. Length of stay, postoperative intravenous (IV) opioid administration, safety end points, and cost were the main variables examined.

**Results.** The study compared 457 patients in 2016–2017 with 428 patients in 2020–2021. The median hospital length of stay decreased from 24.6 h in 2016–2017 to 5.5 h in 2020–2021 ( $p < 0.001$ ). The percentage of patients requiring postoperative IV opioids decreased from 69.1 % in 2016–2017 to 50 % in 2020–2021 ( $p < 0.001$ ). The rates of unplanned readmissions within 30 days after

mastectomy did not differ between the two groups, with a rate of 3.7 % in 2016–2017 and a rate of 5.1 % in 2020–2021 ( $p = 0.30$ ). Reducing the rate of overnight admissions after mastectomy by 65.8 % resulted in a cost reduction of 65.8 %.

**Conclusions.** Implementation of same-day mastectomy with a reconstruction protocol across a large academic center and two satellite sites was a safe alternative to conventional mastectomy recovery plans.

Discharging mastectomy patients on the day of surgery presents an opportunity to optimize hospital resource allocation and promote efficient patient care. Several studies have shown the safety and efficacy of same-day mastectomy and breast reconstruction when sufficient perioperative planning and postoperative recovery protocols are put in place.<sup>1–3</sup> Additionally, breast cancer patients discharged on the day of surgery have been shown to have higher patient satisfaction and a faster psychological recovery.<sup>4–10</sup> One study demonstrated that the caregiver burden for same-day mastectomy patients was not significantly higher than for mastectomy patients with a traditional recovery plan.<sup>6</sup>

In March of 2020, our institution implemented a same-day mastectomy and breast reconstruction protocol in an effort to decrease the use of hospital resources and increase the inpatient capacity while maintaining satisfactory patient care. The same-day recovery protocol, developed by a multidisciplinary team of surgical oncologists, plastic surgeons, and anesthesiologists at our institution, has been previously described.<sup>11</sup> Briefly, the same-day surgery pathway consisted of preoperative, day-of-surgery, and post-discharge requirements.

---

Michelle C. Specht and Bridget N. Kelly are co-first authors.

---

© Society of Surgical Oncology 2022

First Received: 11 February 2022

Accepted: 4 April 2022

Published Online: 11 May 2022

M. C. Specht, MD, FACS

e-mail: mspecht@mgh.harvard.edu

Preoperatively, the patients were given educational materials created by the multidisciplinary team, which included access to videos reviewing wound and drain care. Additionally, prescriptions for post-discharge medications were sent to the patients' pharmacies to be picked up before the day of surgery. These prescriptions included acetaminophen, gabapentin, lorazepam, and oxycodone, with instructions to use oxycodone only for breakthrough pain from other medications. Arrangements for visiting nurse association (VNA) services were made preoperatively and scheduled to start on postoperative day (POD) 1.

On the day of surgery, the patients had a paravertebral block (PVB) placed per Enhanced Recovery After Surgery (ERAS) protocol, were administered preoperative medications (Tylenol, gabapentin, Celebrex), and had postoperative evaluation. The patients had scheduled postoperative visits with their plastic surgery team for evaluation and drain removal.

We evaluated our experience of a same-day recovery protocol for mastectomies in its first year across a large academic center and two satellite sites. We compared a contemporary cohort after implementation of the same-day surgery protocol with a historical control group using a subset analysis of patients in the contemporary cohort enrolled in the same-day recovery protocol. We also assessed the postoperative satisfaction of the patients who underwent mastectomy at our institution after introduction of the same-day surgery protocol. We hypothesized that an optimized same-day mastectomy with a reconstruction protocol would deliver excellent care and reduce use of hospital resources. To our knowledge, this is the largest single-institution study analyzing implementation of a same-day recovery protocol for patients undergoing mastectomy with immediate reconstruction.

## METHODS

### *Study Population*

Under an institutional review board-approved protocol, we performed a retrospective review study analyzing the implementation of a same-day surgery protocol among patients undergoing mastectomy. We reviewed consecutive female patients who underwent mastectomy at the Massachusetts General Hospital, Newton-Wellesley Hospital, or Mass General/North Shore Center for Outpatient Care from 1 April 2016 through 30 April 2017 (the historical cohort), and those who underwent mastectomy from 1 March 2020 through 31 March 2021 (the contemporary cohort). Incidentally, the implementation of the same-day surgery protocol in March 2020 coincided with the first spike in COVID-19 cases seen at our institution.

April 2016 to April 2017 was chosen for the historical cohort because it represented a period after an enhanced recovery program was implemented at our institution. Briefly, the enhanced recovery program included preoperative counseling and multimodal analgesia for patients undergoing mastectomy with immediate reconstruction at our institution.<sup>12</sup> From 2016 through 2021, PVB was routinely offered by a dedicated block service for all patients undergoing mastectomy with reconstruction using the standardized technique previously described.<sup>13</sup>

Patients undergoing mastectomy from March 2020 through March 2021 were included for analysis in the contemporary cohort. Patients deemed eligible for the same-day surgery protocol, implemented in March 2020, were enrolled. The eligibility criteria, as previously reported, specified uni- or bilateral mastectomy with immediate tissue expander or direct implant reconstruction, age younger than 75 years, an American Society of Anesthesiologists (ASA) score lower than 4, residence within 2 h of the hospital, and a strong support system.<sup>11</sup> From 1 March 2020 to 31 March 2021, 298 patients in the contemporary cohort were enrolled to the same-day recovery protocol.

Patients were excluded if they had undergone mastectomy for a reason other than invasive ductal carcinoma, ductal carcinoma in situ, or risk reduction; had known stage 4 disease; or had a concurrent contralateral breast procedure other than mastectomy, including reduction, augmentation, or lumpectomy. Patients with contralateral excisional biopsies were included.

### *Variables and Outcomes*

The primary outcomes were length of stay, intravenous (IV) opioid use, safety as measured by re-operation for complication and unplanned re-admission within 30 days, cost, and patient reported outcomes. Inpatient IV opioid use was evaluated by two methods: (1) percentage of patients requiring any postoperative IV opioid and (2) time (in hours) from post-anesthesia care unit (PACU) arrival to last IV opioid administration. Pre- and postoperative administration of acetaminophen, gabapentin, and celecoxib was collected. Postoperative administration of oral opioids in the PACU also was collected.

Two methods were used to evaluate length of stay: (1) time (in hours) from PACU arrival to discharge and (2) number of inpatient nights. Both IV opioid use and length of stay were compared between the two cohorts and stratified by the following variables: placement of PVB, mastectomy laterality (unilateral vs bilateral), mastectomy type (nipple-sparing vs skin-sparing vs total), axillary surgery (none vs sentinel lymph node biopsy [SLND] vs axillary lymph node dissection [ALND]), immediate

reconstruction (yes vs no), reconstruction type (direct implant vs tissue expander vs autologous tissue), implant/tissue expander location (sub-pectoral vs pre-pectoral), and administration of preoperative medications.

To estimate cost, a 2016 government report from the Healthcare Cost and Utilization Project, which outlined costs associated with an overnight hospital stay, was reviewed. The data published in this report were used to calculate cost associated with our same-day mastectomy recovery protocol.<sup>14</sup> To evaluate the safety of the same-day surgery protocol, re-operation during admission for mastectomy and unplanned readmission within 30 days of surgery were collected for all the patients.

#### *Patient-Reported Outcomes*

Surveys were sent to eligible mastectomy patients in the contemporary cohort at least 6 weeks after mastectomy. Each survey sent to the patients consisted of three sections: (1) patient-reported postoperative experience,<sup>15</sup> (2) BREAST-Q Satisfaction With Breast Surgeon, and (3) BREAST-Q Satisfaction with Plastic Surgeon (Memorial Sloan Kettering Cancer Center and The British Columbia 2006, all rights reserved). The surveys were sent via secure patient messaging and stored in REDCap.<sup>16,17</sup> Patients were excluded if they did not have the secure patient messaging system or if they did not speak English. The surveys were received between POD 40 and POD 432. Of 400 surveys sent, we received 144 responses, for a response rate of 36 %.

#### *Statistical Analysis*

Independent *t* tests and chi-square tests were used to determine differences among continuous and categorical variables, respectively. Mann-Whitney *U* tests were used for continuous variables that were not normally distributed. Fisher's exact *t* tests were used for categorical variables when the expected value was less than 5. A multiple logistic regression adjusted for age, body mass index, immediate reconstruction, procedure laterality (unilateral vs bilateral), PACU arrival time (AM vs. PM), preoperative medication administration, and postoperative IV opioid administration was used to estimate the odds ratio (OR) and 95 % confidence interval (CI) for factors influencing patients scheduled for same-day mastectomy but admitted overnight. Only the 298 patients in the contemporary cohort scheduled for same-day mastectomy were included in this analysis.

All *p* values of 0.05 or lower were considered statistically significant. All analyses were completed using JASP version 0.14.1 (jasp-stats.org).

## **RESULTS**

### *Patient and Procedure Characteristics*

The study analyzed 457 consecutive mastectomies in 2016–2017 and 428 consecutive mastectomies in 2020–2021. Patient and procedural characteristics are stratified by cohort in Table 1. Race distribution did not differ between the two cohorts ( $p = 0.27$ ). The breakdown for the historical and contemporary cohorts was as follows, respectively: white (85.3 % vs 85.1 %), Hispanic (2.6 % vs 4.4 %), Asian (4.6 % vs 5.6 %), black (3.3 % vs. 2.6 %), and other/data unavailable (4.2 vs 2.3 %). The two cohorts did not differ in terms of patient characteristics, operative type, or operative indication across.

The historical cohort had a higher proportion of patients undergoing bilateral mastectomy (63.5 % vs. 50.2 %;  $p < 0.001$ ). The rate of immediate reconstruction was similar between the two cohorts (74.4 % vs 72.2 %;  $p = 0.46$ ). However, the rate of nipple-sparing mastectomy increased over time (53.4 % vs 59.8 %;  $p = 0.05$ ). The rates of SLNB increased over time ( $p = 0.02$ ), whereas the rates of ALND decreased over time ( $p = 0.02$ ). One patient in 2020–2021 underwent autologous tissue reconstruction, compared with four patients in 2016–2017. Only 8.2 % of the patients in 2016–2017 underwent pre-pectoral tissue expander or implant placement compared with 65.4 % of the patients in 2020–2021 ( $p < 0.001$ ).

### *Hospital Length of Stay*

Table 2 presents the hospital length of stay data stratified by cohort. The median length of stay decreased from 24.6 h in 2016–2017 to 5.5 h in 2020–2021 ( $p < 0.001$ ). Of the 428 patients in the contemporary cohort, 287 (67.1 %) were discharged the same day, compared with only 6 (1.3 %) patients in the historical cohort ( $p < 0.001$ ). The mean number of inpatient nights for the patients in 2016–2017 was 1.3, which decreased to 0.4 in 2020–2021 ( $p < 0.001$ ). Of the 309 patients in the contemporary cohort who had immediate reconstruction with tissue expander or direct implant, 212 (68.6 %) were discharged the same day.

The historical and contemporary cohorts displayed comparatively low rates of re-operation and re-admission within 30 days after mastectomy. Of the 428 patients in the contemporary cohort, 16 (3.7 %) had an unplanned re-operation, compared with 12 (2.6 %) of the 457 patients in the historical cohort ( $p = 0.35$ ). The rates of 30-day unplanned readmission were 5.1 % in the contemporary cohort and 3.7 % in the historical cohort ( $p = 0.30$ ).

**TABLE 1** Patient and procedural characteristics

	Historical cohort (2016–2017) ( <i>n</i> = 457) <i>n</i> (%)	Contemporary cohort (2020–2021) ( <i>n</i> = 428) <i>n</i> (%)	<i>p</i> value
Mean age: years (range)	53.5 (20–90)	53.6 (24–92)	0.99
Mean BMI: kg/m <sup>2</sup> (range)	26.3 (17.6–51.0)	26.6 (14.7–53.9)	0.55
Surgical indication			
Invasive	321 (70.2)	295 (68.9)	0.67
Ductal carcinoma in situ	72 (15.8)	81 (18.9)	0.21
Risk reduction	64 (14.0)	52 (12.2)	0.41
Nerve block			
Paravertebral block	339 (74.2)	318 (74.3)	0.97
None	118 (25.8)	110 (25.7)	
Laterality			
Unilateral	167 (36.5)	213 (49.8)	< 0.001
Bilateral	290 (63.5)	215 (50.2)	
Mastectomy type			
Nipple-sparing	244 (53.4)	256 (59.8)	0.05
Skin-sparing	112 (24.5)	61 (14.3)	< 0.001
Total	101 (22.1)	111 (25.9)	0.18
Axillary surgery			
None	87 (19.0)	75 (17.5)	0.56
SLNB	275 (60.2)	290 (67.8)	0.02
ALND	95 (20.8)	63 (14.7)	0.02
Immediate reconstruction			
Yes	340 (74.4)	309 (72.2)	0.46
No	117 (25.6)	119 (27.8)	
Reconstruction type			
Direct implant	228 (49.9)	208 (48.6)	0.70
Tissue expander	112 (24.5)	101 (23.6)	0.75
Autologous tissue	4 (0.9)	1 (0.2)	–
Implant location			
Sub-pectoral	312 (91.8)	107 (34.6)	< 0.001
Pre-pectoral	28 (8.2)	202 (65.4)	
Preoperative medications <sup>a</sup>	23 (5.0)	256 (59.8)	< 0.001

BMI, body mass index; SLNB, sentinel lymph node biopsy; ALND, axillary lymph node dissection

<sup>a</sup>Combination of at least two of the following medications preoperatively: acetaminophen, gabapentin, celecoxib

### Opioid Use

Opioid use stratified by cohort is displayed in Table 3. The percentage of patients requiring postoperative IV opioid decreased from 69.1 % in 2016–2017 to 50.0 % in 2020–2021 ( $p < 0.001$ ). The decrease in patients requiring IV opioid was consistent across most subcategories of patients. For the patients undergoing mastectomy with immediate implant-based reconstruction, postoperative IV opioid administration decreased from 74.4 % in 2016–2017 to 49.5 % in 2020–2021 ( $p < 0.001$ ). However, the

percentage of patients requiring IV opioids after mastectomy did not differ with no PVB placed ( $p = 0.96$ ), total mastectomy ( $p = 0.98$ ), no axillary surgery ( $p = 0.07$ ), or no reconstruction ( $p = 0.46$ ). The median time from arrival in the PACU to the last IV opioid dose decreased from 1.6 h in 2016–2017 to 0.8 h in 2020–2021 ( $p < 0.001$ ). The decrease in the interval to the last IV opioid dose was consistent across all included subcategories. Compared with 84.5 % of the mastectomy patients in 2016–2017 who required postoperative oral opioids in the PACU, 61.2 % of

**TABLE 2** Hospital length-of-stay (median hours  $\pm$  SD)

	Historical cohort (2016–2017) ( <i>n</i> = 457)	Contemporary cohort (2020–2021) ( <i>n</i> = 428)	<i>p</i> value
Overall	24.6 $\pm$ 14.7	5.5 $\pm$ 10.4	< 0.001
Nerve block			
Paravertebral block	24.6 $\pm$ 12.6	5.6 $\pm$ 9.5	< 0.001
None	25.0 $\pm$ 19.5	5.3 $\pm$ 12.7	< 0.001
Laterality			
Unilateral	24.2 $\pm$ 13.3	5.0 $\pm$ 10.3	< 0.001
Bilateral	24.9 $\pm$ 15.3	5.9 $\pm$ 10.5	< 0.001
Mastectomy type			
Nipple-sparing	24.2 $\pm$ 15.4	5.5 $\pm$ 9.6	< 0.001
Skin-sparing	25.3 $\pm$ 16.6	5.8 $\pm$ 11.5	< 0.001
Total	24.1 $\pm$ 11.7	5.1 $\pm$ 11.6	< 0.001
Axillary surgery			
None	26.4 $\pm$ 15.6	5.2 $\pm$ 11.0	< 0.001
Sentinel lymph node biopsy	24.2 $\pm$ 15.3	5.6 $\pm$ 10.5	< 0.001
Axillary lymph node dissection	24.7 $\pm$ 14.4	5.7 $\pm$ 9.5	< 0.001
Immediate reconstruction			
Yes	24.6 $\pm$ 12.5	5.6 $\pm$ 10.2	< 0.001
No	24.9 $\pm$ 19.8	5.1 $\pm$ 11.1	< 0.001
Reconstruction type			
Direct implant	24.0 $\pm$ 12.3	5.4 $\pm$ 9.3	< 0.001
Tissue expander	25.9 $\pm$ 12.4	5.7 $\pm$ 11.8	< 0.001
Autologous tissue	107.3 $\pm$ 31.8	N/A	N/A
Implant location			
Sub-pectoral	24.5 $\pm$ 12.6	5.8 $\pm$ 11.0	< 0.001
Pre-pectoral	24.7 $\pm$ 11.6	5.3 $\pm$ 9.7	< 0.001
Preoperative medication <sup>a</sup>	23.7 $\pm$ 8.2	5.6 $\pm$ 10.0	< 0.001

SD, standard deviation; N/A, not applicable

<sup>a</sup>Combination of at least two of the following medications preoperatively: acetaminophen, gabapentin, celecoxib

the mastectomy patients in 2020–2021 required postoperative oral opioids in the PACU ( $p < 0.001$ ).

#### Same-Day Surgery Protocol

Of the 428 mastectomy patients in 2020–2021, 298 (69.6 %) were deemed eligible for the same-day surgery protocol. Of these 298 patients, 256 (85.9 %) were discharged on the day of their mastectomy. The patients with immediate implant or tissue expander reconstruction made up the majority of patients discharged the same day (76.2 %), whereas the remaining 23.8 % of the patients did not have immediate reconstruction. Of the 150 patients with pre-pectoral implant placement, 131 (87.3 %) were discharged the same day, compared with 64 of the 80 patients with sub-pectoral implants who were discharged same-day (80 %).

In Table 4, multiple logistic regression of the 298 patients scheduled for same-day mastectomy showed that bilateral procedure was the only variable significantly associated with unexpected overnight admission (OR, 2.362; 95 % CI, 1.110–5.027;  $p = 0.026$ ). Within 30 days after mastectomy, 14 (4.7 %) of the 298 patients scheduled for same-day surgery required re-operation, and 16 (5.4 %) of the 298 patients required readmission.

#### Patient-Reported Outcome Measures

Patient-reported measures of experience are shown in Fig. 1. Of the 144 patients who completed the survey, 81 % felt “excellent or good” about the plan to go home, 84 % felt “excellent or good” about how to care for themselves once home, 86 % felt “excellent or good” about how to care for their drain, 83 % felt “excellent or good” about

**TABLE 3** Postoperative intravenous (IV) opioid use

	Requiring IV opioids <i>n</i> (%)			Time to last IV opioid dose (median hours $\pm$ SD)		
	Historical cohort (2016–2017) ( <i>n</i> = 457)	Contemporary cohort (2020–2021) ( <i>n</i> = 428)	<i>p</i> value	Historical cohort (2016–2017) ( <i>n</i> = 457)	Contemporary cohort (2020–2021) ( <i>n</i> = 428)	<i>p</i> value
Overall	316 (69.1)	214 (50.0)	< 0.001	1.6 $\pm$ 8.0	0.8 $\pm$ 3.4	< 0.001
Nerve block						
Paravertebral block	252 (74.3)	154 (48.4)	< 0.001	1.7 $\pm$ 8.6	0.9 $\pm$ 3.8	< 0.001
None	64 (54.2)	60 (54.5)	0.96	1.3 $\pm$ 4.8	0.8 $\pm$ 2.1	< 0.001
Laterality						
Unilateral	102 (61.1)	81 (38.0)	< 0.001	1.3 $\pm$ 1.9	0.8 $\pm$ 1.8	< 0.001
Bilateral	214 (73.8)	133 (61.9)	< 0.01	1.7 $\pm$ 9.5	0.9 $\pm$ 4.0	< 0.001
Mastectomy type						
Nipple-sparing	180 (74.7)	122 (48.2)	< 0.001	1.6 $\pm$ 9.5	0.9 $\pm$ 4.4	< 0.001
Skin-sparing	80 (75.5)	44 (54.3)	< 0.01	2.1 $\pm$ 6.4	0.8 $\pm$ 0.9	< 0.001
Total	57 (50.9)	48 (51.0)	0.98	1.1 $\pm$ 2.7	0.8 $\pm$ 0.9	< 0.01
Axillary surgery						
None	63 (72.4)	44 (58.7)	0.07	1.3 $\pm$ 3.3	0.8 $\pm$ 2.6	< 0.01
SLNB	183 (66.3)	145 (50.0)	< 0.001	1.6 $\pm$ 9.8	0.8 $\pm$ 3.7	< 0.001
ALND	71 (74.0)	25 (40.0)	< 0.001	1.9 $\pm$ 4.9	0.8 $\pm$ 3.2	< 0.001
Immediate reconstruction						
Yes	253 (74.4)	153 (49.5)	< 0.001	1.7 $\pm$ 8.6	0.9 $\pm$ 3.9	< 0.001
No	63 (53.8)	61 (51.3)	0.69	1.2 $\pm$ 4.7	0.8 $\pm$ 0.9	< 0.001
Reconstruction type						
Direct implant	159 (69.7)	98 (47.1)	< 0.001	1.5 $\pm$ 9.0	0.8 $\pm$ 3.5	< 0.001
Tissue expander	94 (83.9)	55 (54.5)	< 0.001	2.1 $\pm$ 7.7	1.0 $\pm$ 4.6	< 0.001
Autologous tissue	4 (100.0)	0 (0.0)	N/A	13.8 $\pm$ 11.5	N/A	N/A
Implant location						
Sub-pectoral	232 (74.4)	57 (53.3)	< 0.001	1.7 $\pm$ 8.8	0.8 $\pm$ 4.3	< 0.001
Pre-pectoral	21 (75.0)	96 (47.5)	< 0.01	2.1 $\pm$ 6.6	1.0 $\pm$ 3.7	< 0.01
Preoperative medication <sup>a</sup>	15 (65.2)	119 (46.5)	0.09	1.2 $\pm$ 0.8	0.9 $\pm$ 3.3	0.29

SD, standard deviation; SLNB, sentinel lymph node biopsy; ALND, axillary lymph node dissection; N/A, not applicable

<sup>a</sup>Combination of at least two of the following medications preoperatively: acetaminophen, gabapentin, celecoxib

how to care for their incision, and 91 % felt “excellent or good” about who to contact for support or for any issues. When asked about satisfaction with the breast surgeon, the score for the patients discharged same day (93.9) did not differ from the score for the patients who stayed overnight (94.2) ( $p = 0.74$ ). The rates of satisfaction with the plastic surgeon also did not differ between the mastectomy with reconstruction patients discharged the same day and the patients who stayed overnight ( $p = 0.30$ ).

### Cost

By reducing the rate of overnight admissions after mastectomy, from 98.7 % in 2016–2017 to 32.9 % in 2020–2021, the implementation of the same-day surgery pathway decreased the cost of care by 65.8 %. If cost per day is approximately \$2543, we can approximate the inpatient cost per hour to be \$106.<sup>14</sup> In 2016–2017, the average length of stay was 29.3 h, which translates to a mean cost of \$3106 per mastectomy patient. In 2020–2021, the average length of stay dropped to 10.9 h, which translates to a mean cost of \$1155 per mastectomy patient,

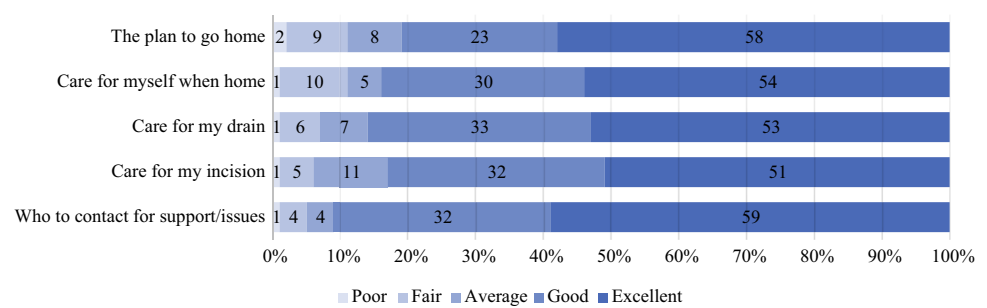


**TABLE 4** Multiple logistic regression of patients with unexpected overnight admission

Variable	Outcome: unexpected overnight stay (n = 42)		
	OR <sup>a</sup>	95 % CI	p value
Age >50 years	1.212	0.595–2.470	0.596
BMI >30 kg/m <sup>2</sup>	0.826	0.418–1.631	0.582
Immediate reconstruction	1.500	0.605–3.720	0.381
Bilateral procedure (ref: unilateral)	2.362	1.110–5.027	0.026
PM arrival to PACU (ref: AM)	0.861	0.437–1.697	0.666
Preoperative medication <sup>a</sup>	0.964	0.483–1.921	0.916
Required postoperative IV opioid	1.431	0.706–2.900	0.320

OR, odds ratio; CI, confidence interval; BMI, body mass index; PACU, post-anesthesia care unit; IV, intravenous

<sup>a</sup>Combination of at least two of the following medications preoperatively: acetaminophen, gabapentin, celecoxib

**FIG. 1** Results from the survey of voluntary patient-reported experience

reducing costs by approximately \$1951 per patient. In 2016–2017, 400 patients undergoing mastectomy each with a hospital stay of 29.3 hours would cost an estimated total of \$1,242,400. In 2020–2021 after implementation of a same-day recovery mastectomy protocol, 400 patients undergoing mastectomy each with a hospital stay of 10.9 h would cost an estimated total of \$462,000, for a net savings of \$780,400 during 1 year.

## DISCUSSION

In March of 2020, our institution enacted a COVID-19 emergency response plan, which in conjunction with a state mandate to delay elective surgeries greatly limited the surgical capacities of our institution. Implementation of the streamlined same-day recovery protocol coincided with this first surge of COVID-19 patients at our institution. Careful allocation of hospital resources and use of inpatient beds became essential during this time. Same-day mastectomy recovery protocols also have been shown to have comparable or decreased rates of wound infections, serious complications, and rehospitalization rates compared with overnight admissions.<sup>2–10</sup> To our knowledge, this is the largest single-institution study analyzing implementation of a same-day recovery protocol for patients undergoing mastectomy with immediate reconstruction.

Prior systematic reviews and retrospective database studies have shown that same-day mastectomy with immediate reconstruction can be safely and effectively performed in some settings.<sup>2,3,7,18</sup> A 2020 single-institution retrospective study examined rates of same-day discharge before and after implementation of an ERAS protocol for patients undergoing mastectomy with or without reconstruction. Of the 140 patients in the post-ERAS cohort, 58.6 % were discharged the same day. Of the patients discharged the same day, 74.4 % were administered long-acting liposomal bupivacaine during the procedure.<sup>19</sup> We omitted liposomal bupivacaine from our same-day recovery protocol due to cost and feasibility, opting instead for pain control with preoperative administration of acetaminophen, gabapentin, and celecoxib. Additional single-institution studies of same-day recovery protocols implemented for patients undergoing mastectomy with reconstruction have been limited by small cohorts.<sup>20–22</sup>

Administration of post-operative IV opioid administration dropped 24.9 % after implementation of our same-day recovery protocol for patients undergoing mastectomy with immediate implant-based reconstruction. Patients in the contemporary cohort were converted to oral opioids sooner in the PACU than the historical cohort regardless of reconstruction status. The goals of our protocol included reduction of postoperative pain through management with

non-opioid medications and decreased opioid administration in the PACU, which together would allow for streamlined patient discharge.

Overall and across all subdivisions of patient and procedural characteristics, the length of stay for the mastectomy patients in the contemporary cohort was significantly shorter than the length of stay for those in the historical cohort. Reduced rates of overnight admissions and decreased length of stay led to comparable reductions in cost, approximately \$780,400 in 1 year. Of the 428 patients who underwent mastectomy between 1 March 2020 and 31 March 2021, 67.1 % were discharged on the day of mastectomy. In the last year, the rate of patients undergoing outpatient mastectomy at our institution was much lower than the national average of outpatient mastectomies.<sup>9,18</sup>

Although the same-day mastectomy recovery protocol reduced the length of stay, postoperative IV opioid administration, and cost, it was important that we maintained quality patient care. Evaluation of patient satisfaction in our contemporary cohort with validated BREAST-Q questionnaires demonstrated no difference in satisfaction with the breast surgeon ( $p = 0.74$ ) or plastic surgeon ( $p = 0.30$ ) between the patients discharged the same day and those who stayed overnight.

Our preoperative education included information regarding PVB for reduced postoperative nausea and vomiting, reduced time to conversion to oral opioid medications, and decreased length of stay.<sup>11</sup> The results of 80 % to 90 % of patients reporting that they felt “good or excellent” about their postoperative plans and care demonstrated effective communication from the care team through the pre- and postoperative experience. Because these are the results from the earliest implementation of the same-day mastectomy recovery protocol, there is room for improvement with regard to patient satisfaction.

Our study was limited by its retrospective design. Although our historical and contemporary cohorts were similar, there were several significant differences in procedural characteristics. Procedural laterality differed significantly, with more unilateral cases in the contemporary cohort, likely due to the Massachusetts state restrictions on elective surgeries during the COVID-19 pandemic. Increases in nipple-sparing mastectomies and pre-pectoral implant placement were observed in our contemporary cohort. An increase in nipple-sparing mastectomies has been observed at both our institution and nationwide.<sup>23</sup> In 2020, Sobti et al.<sup>24</sup> showed a decrease in capsular contracture and revision rates after muscle-sparing pre-pectoral implant placement, leading to increased pre-pectoral implant placement at our institution. We find that the pre-pectoral approach is less morbid and amenable to the same-day protocol. With regard to the higher rates of

SLNB than ALND in our contemporary cohort, a study examining axillary management between 2006 and 2014 showed significant declining rates of ALND over time.<sup>25</sup>

## CONCLUSIONS

Although reduction of resource utilization was one of our goals, we also were able to minimize patient exposure to COVID-19 through decreased time in the hospital and increased postoperative telehealth services, which spared patients another required trip to the hospital. The inclusion of nearly all consecutive mastectomies performed at our institution from 1 March 2020 to 31 March 2021, with acceptably low rates of re-operation and 30-day readmission, demonstrates that the same-day mastectomy with reconstruction protocol is a safe alternative to conventional mastectomy recovery plans.

## DECLARATIONS

**CONFLICT OF INTEREST** Disclosure Eric Liao has consulting agreements with entities that manufacture acellular dermal matrices used in breast reconstruction, but these consulting relationships in no way influenced this research. No payment was received from these entities with regard to this work. The entities include Abbvie Inc, Musculoskeletal Transplant Foundation, and Integra. There are no conflicts of interest.

## REFERENCES

1. Panda N, Solsky I, Haynes AB. Redefining shared decision-making in the digital era. *Eur J Surg Oncol.* 2019;45(12):2287–8. <https://doi.org/10.1016/j.ejso.2019.07.025>.
2. Cordeiro E, Jackson T, Cil T. Same-day breast cancer surgery is safe: an analysis of short-term outcomes using NSQIP data. *Ann Surg Oncol.* 2016;23(8):2480–6. <https://doi.org/10.1245/s10434-016-5128-0>.
3. Cordeiro E, Zhong T, Jackson T, Cil T. The safety of same-day breast reconstructive surgery: an analysis of short-term outcomes. *Am J Surg.* 2017;214(3):495–500. <https://doi.org/10.1016/j.amjsurg.2016.11.015>.
4. Margolese RG, Lasry JCM. Ambulatory surgery for breast cancer patients. *Ann Surg Oncol.* 2000;7(3):181–7. <https://doi.org/10.1007/BF02523651>.
5. Seltzer MH. Partial mastectomy and limited axillary dissection performed as a same day surgical procedure in the treatment of breast cancer. *Int Surg.* 1995;80(1):79–81.
6. Athey N, Gillam D, Sinha P, et al. Day-case breast cancer axillary surgery. *Ann R Coll Surg Engl.* 2005;87(2):96–8.
7. Marla S, Stallard S. Systematic review of day surgery for breast cancer. *Int J Surg.* 2009;7(4):318–23. <https://doi.org/10.1016/j.ijso.2009.04.015>.
8. Weber WP, Barry M, Junqueira MJ, et al. Initial experiences with a multidisciplinary approach to decreasing the length of hospital stay for patients undergoing unilateral mastectomy. *Eur J Surg Oncol.* 2011;37(11):944–9. <https://doi.org/10.1016/j.ejso.2011.08.001>.
9. Bian J, Halpern MT. Trends in outpatient breast cancer surgery among Medicare fee-for-service patients in the United States from 1993 to 2002. *Chin J Cancer.* 2011;30(3):197–203. <https://doi.org/10.5732/cjc.010.10345>.
10. Case C, Johantgen M, Steiner C. Outpatient mastectomy: clinical payer, and geographic influences. *Health Serv Res.* 2001;36(5):869–84.



11. Specht M, Sobti N, Rosado N, et al. High-efficiency same-day approach to breast reconstruction during the COVID-19 crisis. *Breast Cancer Res Treat*. 2020;182(3):679–88. <https://doi.org/10.1007/s10549-020-05739-7>.
12. McGugin CJ, Coopey SB, Smith BL, et al. Enhanced recovery minimizes opioid use and hospital stay for patients undergoing mastectomy with reconstruction. *Ann Surg Oncol*. 2019;26(11):3464–71. <https://doi.org/10.1245/s10434-019-07710-3>.
13. Coopey SB, Specht MC, Warren L, et al. Use of preoperative paravertebral block decreases length of stay in patients undergoing mastectomy plus immediate reconstruction. *Ann Surg Oncol*. 2013;20(4):1282–6. <https://doi.org/10.1245/s10434-012-678-7>.
14. Statistical Brief #246. Healthcare Cost and Utilization Project (HCUP). December 2018. Agency for Healthcare Research and Quality, Rockville, MD. [www.hcup-us.ahrq.gov/reports/statbrief/sb246-Geographic-Variation-Hospital-Stays.jsp](http://www.hcup-us.ahrq.gov/reports/statbrief/sb246-Geographic-Variation-Hospital-Stays.jsp).
15. Keehn AR, Olson DW, Dort JC, et al. Same-day surgery for mastectomy patients in Alberta: a perioperative care pathway and quality improvement initiative. *Ann Surg Oncol*. 2019;26(10):3354–60. <https://doi.org/10.1245/s10434-019-07568-5>.
16. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap): a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377–81. <https://doi.org/10.1016/j.jbi.2008.08.010>.
17. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software partners. *J Biomed Inform*. 2019. <https://doi.org/10.1016/j.jbi.2019.103208>.
18. Kruper L, Xu XX, Henderson K, et al. Utilization of mastectomy and reconstruction in the outpatient setting. *Ann Surg Oncol*. 2013;20(3):828–35. <https://doi.org/10.1245/s10434-012-2661-3>.
19. Jogerst K, Thomas O, Kosiorek HE, et al. Same-day discharge after mastectomy: breast cancer surgery in the era of ERAS®. *Ann Surg Oncol*. 2020;27(9):3436–45. <https://doi.org/10.1245/s10434-020-08386-w>.
20. Hammond JB, Thomas O, Jogerst K, et al. Same-day discharge is safe and effective after implant-based breast reconstruction. *Ann Plast Surg*. 2021;87(2):144–9.
21. Dumestre DO, Webb CE, Temple-Oberle C. Improved recovery experience achieved for women undergoing implant-based breast reconstruction using an Enhanced Recovery after Surgery model. *Plast Reconstr Surg*. 2017;139(3):550–9.
22. Chiu C, Aleshi P, Esserman LJ, et al. Improved analgesia and reduced postoperative nausea and vomiting after implementation of an enhanced recovery after surgery (ERAS) pathway for total mastectomy. *BMC Anesthesiol*. 2018;18(1):41. <https://doi.org/10.1186/s12871-018-0505-9>.
23. Wong SM, Chun YS, Sagara Y, et al. National patterns of breast reconstruction and nipple-sparing mastectomy for breast cancer, 2005–2015. *Ann Surg Oncol*. 2019;26(10):3194–203. <https://doi.org/10.1245/s10434-019-07554-x>.
24. Sobti N, Weitzman RE, Nealon KP, et al. Evaluation of capsular contracture following immediate prepectoral versus subpectoral direct-to-implant breast reconstruction. *Sci Rep*. 2020;10(1):1137. <https://doi.org/10.1038/s41598-020-58094-4>.
25. Weiss A, Lin H, Babiera G, Bedrosian I, et al. Evolution in practice patterns of axillary management following mastectomy in patients with 1–2 positive sentinel nodes. *Breast Cancer Res Treat*. 2019;176(2):435–44. <https://doi.org/10.1007/s10549-019-05243-7>.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.