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ORIGINAL ARTICLE – BREAST ONCOLOGY

Enhanced Recovery Minimizes Opioid Use and Hospital Stay for Patients Undergoing Mastectomy with Reconstruction

Caroline J. McGugin, MD, MSPH[1], Suzanne B. Coopey, MD[1], Barbara L. Smith, MD, PhD[1], Bridget N. Kelly, BA[1], Carson L. Brown, MS[1], Michele A. Gadd, MD[1], Kevin S. Hughes, MD[1], and Michelle C. Specht, MD[1]

Department of Surgical Oncology, Massachusetts General Hospital, Boston, MA

ABSTRACT

Background. This study examined the effects of an enhanced recovery program on inpatient opioid requirements and hospital length of stay (LOS) for mastectomy patients undergoing immediate reconstruction.

Methods. An enhanced recovery program for patients undergoing mastectomy with immediate tissue expander (TE) or implant reconstruction was evaluated by comparing a contemporary cohort of 611 patients in 2016–2018 with a historical cohort of 188 patients in 2010. Opioid use and LOS were compared over time and stratified by laterality, mastectomy type, axillary procedure, and reconstruction. Associations were assessed by uni- and multivariate analyses.

Results. In 2010, 95.2% of patients required intravenous (IV) opioids, with a last dose 15.5 h after completion of surgery, compared with 68.7% of patients in 2016–2018, with a last dose 1.8 h after surgery ($p < 0.001$). Patients prescribed gabapentin postoperatively were less likely to require inpatient IV or oral opioids ($p < 0.001$). The mean LOS decreased from 37 h in 2010 to 27.5 h in 2016–2018 without an increase in the readmission rate (6.9% vs. 4.1%; $p = 0.112$). Patients were more likely to stay more than one night if they were older ($p = 0.012$), had undergone bilateral mastectomies ($p < 0.001$) or TE reconstruction ($p = 0.012$), and had surgery in 2010 compared with 2016–2018 ($p < 0.001$). Even after adjustment for LOS, IV opioid use remained significantly associated with year of surgery ($p < 0.001$).

Conclusions. Compared with 2010, patients undergoing mastectomy with TE or implant reconstruction in 2016–2018 required less inpatient opioids and had decreased LOS. The authors attribute this to an enhanced recovery program focused on preoperative counseling, non-opioid analgesics, and improved surgical efficiencies.

Increasing numbers of patients eligible for breast-conserving therapy choose to undergo mastectomy,[1] and an estimated 40% of women who undergo mastectomy report significant postoperative pain.[2] Immediate breast reconstruction increases postoperative pain, which may continue after the immediate postoperative period.[3,4] Inadequate postoperative pain control is associated with a prolonged inpatient hospital length of stay (LOS) and is a reliable proxy for hospital resource use and cost. [5–9] With more patients undergoing mastectomy followed by immediate implant-based reconstruction, minimizing postoperative pain may reduce prolonged opioid use, hospital LOS, and hospital resources.

Several perioperative practices have been proposed to improve recovery after mastectomy. Paravertebral blocks (PVB) have been shown to improve postoperative pain control, reduce opioid consumption, and decrease LOS.[10–19] Enhanced recovery after surgery (ERAS) programs, which often include PVB together with other forms of multimodal analgesia, have been studied in patients undergoing mastectomy with reconstruction.[20] However, most studies focus on autologous reconstruction,[21,22] and

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M. C. Specht, MD
e-mail: mspecht@mgh.harvard.edu

further studies focused on minimizing opioid use by patients undergoing implant-based reconstruction are warranted.

We implemented an enhanced recovery program consisting of preoperative counseling and multimodal analgesia for patients undergoing mastectomy with immediate tissue expander (TE) or direct implant reconstruction at a single academic cancer center. We studied the program's effect on inpatient opioid use and LOS by comparing a contemporary cohort after implementation of enhanced recovery with a historical control group. Finally, we examined patient and procedural characteristics associated with higher opioid requirements and longer LOS to identify factors that can be targeted for ongoing efforts to enhance recovery.

METHODS

We conducted a retrospective observational study analyzing the implementation of an enhanced recovery program, inpatient opioid use, and LOS among patients undergoing mastectomy with immediate TE or direct implant reconstruction. The ERAS protocol consisted of preoperative counseling focused on the anticipated postoperative recovery course, including use of multimodal analgesia intended to reduce opioid use and hospital stay. Gabapentin 100 mg nightly was added to the multimodal analgesia regimen that previously had consisted of preoperative PVB. We compared a contemporary cohort of patients treated between 2016 and 2018 with a historical cohort of patients treated in 2010 who did not receive this preoperative counseling or routine postoperative gabapentin. We further analyzed the 2016–2018 cohort to identify patient and procedural characteristics associated with increased inpatient opioid use and LOS. Institutional review board approval was obtained for this study.

Study Population

We examined all female mastectomy patients who had undergone immediate TE or implant reconstruction at the Massachusetts General Hospital in 2010 and 2016–2018. Patients who had surgery from 1 January 2010 through 31 December 2010 made up the historical cohort.

Beginning in 2010, all patients undergoing mastectomy with reconstruction were offered a PVB by a dedicated block service with the standardized technique previously described.[19] We compared the historical cohort of 2010 with a contemporary cohort of 2016–2018 who underwent surgery between April 2016 and May 2018. This represented the most recent patient data available by the electronic medical record after implementation of the enhanced recovery program. Patients were excluded if they had not received a PVB; had undergone mastectomy for a reason other than ductal carcinoma in situ (DCIS), invasive carcinoma, or risk reduction; had a known metastatic disease; or had undergone reoperation during the same hospital stay.

Variables and Outcomes

The primary outcomes were inpatient intravenous (IV) opioid use and LOS. 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. Postoperative oral opioid and non-opioid analgesic data were available only for the contemporary cohort.

Two methods were used to evaluate LOS: (1) time (rounded to the nearest hour) from PACU arrival to discharge and (2) number of inpatient nights. Both opioid use and LOS were compared for the two cohorts and stratified by the following variables: mastectomy laterality (unilateral vs. bilateral), mastectomy type (skin-sparing vs. nipple-sparing), axillary surgery (none vs. sentinel lymph node biopsy [SLNB] vs. axillary lymph node dissection [ALND]), reconstruction (TE vs. implant), and TE/implant location (sub-pectoral vs. pre-pectoral). All data were obtained by chart review of paper and electronic medical records.

Statistical Analysis

Independent t tests and Chi square tests were used to determine differences among continuous and categorical variables, respectively. All p values lower than 0.05 were considered statistically significant. The associations between opioid use, LOS, and cohort were further assessed by logistic regression adjusted for year of surgery (2010 vs. 2016–2018), age, laterality, mastectomy type, axillary surgery, reconstruction, and LOS. All analyses were completed using SAS v9.4 (SAS Institute Inc., Cary, NC).

RESULTS

Patient and Procedure Characteristics

Patient and procedural characteristics are stratified by cohort in Table 1. The mean age of the patients undergoing mastectomy with immediate reconstruction was slightly older in the contemporary cohort (49.9 vs. 47.1 years; $p = 0.001$). Most of the mastectomies were performed for invasive cancer, followed by DCIS and risk reduction, and the proportion performed for invasive cancer increased

TABLE 1 Patient and procedural characteristics

	Historical cohort (2010) (n = 188) n (%)	Contemporary cohort (2016–2018) (n = 611) n (%)
Mean age (years)[a]	47.1 ± 9.3	49.9 ± 10.9
Mean BMI (kg/m^2)[a]	24.7 ± 5.0	25.6 ± 5.2
Surgical indication[a]		
DCIS	59 (31.4)	102 (16.7)
Invasive carcinoma	95 (50.5)	415 (67.9)
Risk reduction	34 (18.1)	94 (15.4)
Mastectomy laterality		
Unilateral	70 (37.2)	194 (31.7)
Bilateral	118 (62.8)	417 (68.3)
Mastectomy type[a]		
Skin-sparing	138 (73.4)	162 (26.5)
Nipple-sparing	50 (26.6)	449 (73.5)
Axillary surgery		
None	36 (19.1)	98 (16.0)
SLNB	112 (59.6)	419 (68.6)
ALND	40 (21.3)	94 (15.4)
Reconstruction[a]		
TE	83 (44.1)	155 (25.4)
Direct implant	105 (55.9)	456 (74.6)
TE[5]/implant location[a]		
Sub-pectoral	188 (100)	501 (82.0)
Pre-pectoral	0 (0)	110 (18.0)

BMI Body Mass Index, *DCIS* ductal carcinoma in situ, *SLNB* sentinel lymph node biopsy, *ALND* axillary lymph node dissection, *TE* tissue expander

[a]$p < 0.05$

over time ($p < 0.001$). More than 60% of the mastectomies performed were bilateral during both periods. The contemporary cohort had a larger proportion of patients undergoing SLNB (68.6% vs. 59.6%) and a smaller proportion undergoing ALND (15.4% vs. 21.3%), but this difference was not significant ($p = 0.062$). The rates of nipple-sparing mastectomy (NSM) increased over time (73.5% vs. 26.6%; $p < 0.001$), as did direct implant reconstruction (74.6% vs. 55.9%; $p < 0.001$). No patients underwent pre-pectoral TE or implant placement in 2010, whereas 18% of the patients did in 2016–2018.

Opioid Use

Opioid use stratified by cohort is displayed in Table 2. The percentage of patients requiring any postoperative IV opioid decreased from 95.2% in 2010 to 68.7% in 2016–2018 ($p < 0.001$). Compared with 2010, significantly fewer patients in 2016–2018 required IV opioids whether undergoing unilateral ($p < 0.001$) or bilateral mastectomy ($p < 0.001$), skin-sparing mastectomy (SSM; $p < 0.001$), NSM ($p < 0.001$), no axillary surgery ($p = 0.014$), SLNB ($p < 0.001$), ALND ($p = 0.001$), TE reconstruction ($p < 0.001$), or direct implant reconstruction ($p < 0.001$) (Fig. 1a).

In both 2010 and 2016–2018, more patients with TE reconstruction ($p = 0.005$) required IV opioids than those with direct implant reconstruction ($p = 0.012$). In 2016–2018, more patients with bilateral procedures ($p = 0.012$), NSM ($p = 0.016$), and ALND ($p = 0.018$) required IV opioids than those with unilateral procedures, SSM, no axillary surgery, or SLNB, respectively. There was no difference in the percentage of patients requiring IV opioids after sub-pectoral or pre-pectoral TE or implant placement ($p = 0.442$). In the multivariate analysis, surgery performed in 2010 (odds ratio [OR], 6.75; 95% confidence interval [CI] 3.24–14.09; $p < 0.001$), TE reconstruction (OR, 1.80; 95% CI 1.18–2.74; $p = 0.006$), and younger age (OR, 0.98; 95% CI 0.96–0.99; $p = 0.024$) were significantly associated with postoperative IV opioid requirement.

TABLE 2 Postoperative intravenous (IV) opioid use

	Percentage requiring IV opioids			Time to last IV opioid dose (h)		
	Historical cohort (2010) *n* (%)	Contemporary cohort (2016–2018) *n* (%)	*p* Value	Historical cohort (2010) *n* (%)	Contemporary cohort (2016–2018) *n* (%)	*p* Value
Overall	179 (95.2)	420 (68.7)	< 0.001	15.5 (8.7)	1.8 (3.6)	< 0.001
Laterality						
Unilateral	66 (94.3)	120 (61.9)	< 0.001	14.5 (8.3)	1.0 (1.5)	< 0.001
Bilateral	113 (95.8)	300 (71.9)	< 0.001	16.1 (9.0)	2.2 (4.2)	< 0.001
Mastectomy type						
Skin-sparing	130 (94.2)	112 (69.1)	< 0.001	15.6 (9.3)	2.2 (5.4)	< 0.001
Nipple-sparing	49 (98.0)	308 (88.2)	< 0.001	15.3 (7.0)	1.6 (2.7)	< 0.001
Axillary surgery						
None	34 (94.4)	74 (75.5)	0.014	17.7 (11.7)	2.0 (3.1)	< 0.001
SLNB	105 (93.7)	273 (65.1)	< 0.001	14.9 (8.0)	1.7 (3.9)	< 0.001
ALND	40 (100)	73 (77.6)	0.001	15.5 (7.4)	1.8 (2.7)	< 0.001
Reconstruction						
TE	104 (99.0)	119 (82.1)	< 0.001	16.8 (8.0)	2.6 (5.6)	< 0.001
Direct implant	75 (90.3)	301 (66.0)	< 0.001	14.0 (9.4)	1.5 (2.6)	< 0.001
TE[3]/implant location						
Sub-pectoral	179 (95.2)	341 (68.1)	< 0.001	15.5 (8.7)	1.8 (3.6)	< 0.001
Pre-pectoral	0 (0)	79 (71.9)	N/A	N/A	1.7 (3.8)	N/A

SLNB sentinel lymph node biopsy, *ALND* axillary lymph node dissection, *TE* tissue expander, *N/A* not available

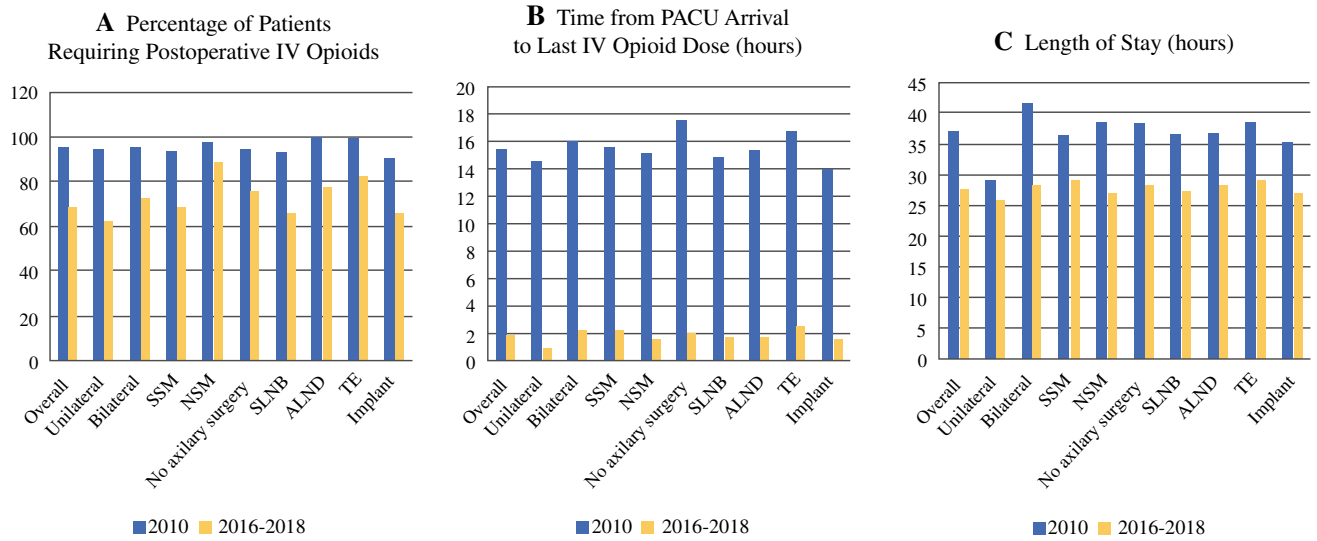

FIG. 1 Opioid use and hospital length of stay by year

The mean time from arrival in the PACU to the last IV opioid dose decreased from 15.5 h in 2010 to 1.8 h in 2016–2018 ($p < 0.001$). This interval decreased whether the patients had unilateral ($p < 0.001$) or bilateral mastectomies ($p < 0.001$), NSM ($p < 0.001$), SSM ($p < 0.001$), no axillary surgery ($p < 0.001$), SLNB ($p < 0.001$), ALND ($p < 0.001$), TE reconstruction ($p < 0.001$), or direct implant reconstruction ($p < 0.001$)

(Fig. 1b). The patients with TE reconstruction required IV opioids longer than those who had direct implant reconstruction in both 2010 ($p = 0.031$) and 2016–2018 ($p = 0.002$). In addition, the patients who underwent bilateral mastectomies in 2016–2018 received IV opioids longer than those who underwent unilateral mastectomies ($p < 0.001$).

In the multivariable analysis, surgery performed in 2010 (OR, 60.02; 95% CI 34.93–103.12; $p < 0.001$), bilateral procedures (OR, 1.63; 95% CI 1.10–2.41; $p = 0.014$), younger age (OR, 0.98; 95% CI 0.96–0.99; $p = 0.021$), and LOS (OR, 1.02; 95% CI 1.01–1.04; $p < 0.001$) were significantly associated with receiving an IV opioid dose more than 2 h after arriving in the PACU.

LOS

Table 3 presents LOS stratified by cohort. The mean LOS decreased over time, from 37 h in 2010 to 27.5 h in 2016–2018 ($p < 0.001$). This translates to mean number of inpatient nights, which decreased from 1.8 in 2010 to 1.2 in 2016–2018 ($p < 0.001$). Compared with 2010, the patients in 2016–2018 had a shorter LOS whether they had unilateral ($p = 0.012$) or bilateral mastectomies ($p < 0.001$), SSM ($p < 0.001$), NSM ($p < 0.001$), no axillary surgery ($p < 0.001$), SLNB ($p < 0.001$), ALND ($p < 0.001$), TE reconstruction ($p < 0.001$), or direct implant reconstruction ($p < 0.001$) (Fig. 1c).

The 30-day readmissions did not increase despite a decrease in LOS. In fact, a trend toward decreased 30-day readmissions was observed, but it was not statistically significant (6.9% in 2010 vs. 4.1% in 2016–2018; $p = 0.112$).

The range of LOS remained relatively stable over time (13–97 h in 2010 vs. 16–95 h in 2016–2018). However, fewer patients stayed at the higher end of that range in 2016–2018, as demonstrated by the change in median LOS over time (40 h in 2010 vs. 25 h in 2016–2018). The difference in LOS between the patients who underwent bilateral versus unilateral mastectomies in 2010 was 12.5 h (41.7 vs. 29.2 h; $p < 0.001$), whereas the difference in LOS in 2016–2018 was only 2.1 h (28.2 vs. 26.1 h; $p = 0.017$).

In the multivariable analysis, the odds of a hospital stay longer than one night was significantly associated with having surgery in 2010 (OR, 10.91; 95% CI 6.91–17.21; $p < 0.001$), bilateral procedures (OR, 4.49; 95% CI 2.83–7.13; $p < 0.001$), SSM (OR, 1.53; 95% CI 1.01–2.31; $p = 0.044$), TE reconstruction (OR, 1.65; 95% CI 1.12–2.42; $p = 0.011$), and older age (OR, 1.02; 95% CI 1.00–1.04; $p = 0.019$).

Characteristics of Opioid Use in the Contemporary Cohort

The variables associated with inpatient IV and oral opioid use in the contemporary 2016–2018 cohort are displayed in Table 4. Younger patients ($p < 0.001$) and those who underwent bilateral mastectomies ($p < 0.001$) for risk reduction ($p = 0.035$) were more likely to require

TABLE 3 Hospital length of stay (h)

	Historical cohort (2010) *n* (%)	Contemporary cohort (2016–2018) *n* (%)	*p* Value
Overall (mean ± SD)	37.0 ± 14.0	27.5 ± 10.1	< 0.001
Laterality			
Unilateral	29.2 (10.6)	26.1 (8.0)	0.012
Bilateral	41.7 (13.7)	28.2 (10.9)	< 0.001
Mastectomy type			
Skin-sparing	36.4 (14.5)	29.1 (10.9)	< 0.001
Nipple-sparing	38.8 (12.3)	27.0 (9.8)	< 0.001
Axillary surgery			
None	38.2 (17.8)	28.2 (9.9)	< 0.001
SLNB	36.7 (11.9)	27.2 (10.0)	< 0.001
ALND	36.8 (15.7)	28.4 (11.0)	< 0.001
Reconstruction			
TE	38.4 (14.6)	29.0 (11.0)	< 0.001
Direct implant	35.3 (13.1)	27.0 (9.8)	< 0.001
TE[3]/implant location			
Sub-pectoral	37.0 (14.0)	27.4 (10.0)	< 0.001
Pre-pectoral	N/A	28.2 (10.5)	N/A

SLNB sentinel lymph node biopsy, *ALND* axillary lymph node dissection, *TE* tissue expander, *N/A* not available

inpatient IV and oral opioids. The patients prescribed gabapentin postoperatively were less likely to require IV opioids ($p < 0.001$). Of the patients prescribed gabapentin postoperatively, 31.1% required only oral opioids, and 24.6% did not require any opioids. In the multivariable analysis of the contemporary cohort, postoperative gabapentin order and unilateral procedure were associated with decreased postoperative IV opioid requirement.

DISCUSSION

After implementation of an enhanced recovery program, the postoperative IV opioid requirement for patients undergoing mastectomy with implant-based reconstruction decreased 26%. On the average, patients were converted to oral pain control 14 h sooner, and LOS was decreased by 10 h. Even after adjustment for patient and procedural characteristics, year of surgery remained significantly associated with opioid use and LOS. All patients received a PVB, suggesting that the differences observed in opioid use and LOS over time were linked to other aspects of enhanced recovery, including preoperative counseling and non-opioid analgesics such as gabapentin.

Similar to previous studies, this study demonstrated that postoperative pain control after mastectomy with reconstruction was associated with LOS.[5–7] Several studies have examined optimization of pain control for patients undergoing mastectomy with reconstruction,[17,20] and many studies have shown that PVB reduces opioid consumption and LOS.[10–13,18,23] All the patients in our study had a PVB, which allowed us to identify additional measures, including gabapentin and lorazepam, that could improve recovery.

TABLE 4 Characteristics of inpatient opioid requirements in the contemporary cohort (2016–2018)

	Requires IV + oral opioids (n = 384)	Requires IV opioid only (n = 36) n (%)	Requires oral opioid only (n = 143) n (%)	Requires no opioids (n = 48) n (%)	p value
Mean age (years)	48.7 ± 10.9	54.6 ± 11.6	51.0 ± 9.5	53.5 ± 12.4	< 0.001
Mean BMI (kg/m^2)	25.8 ± 5.0	23.4 ± 3.7	25.7 ± 5.6	25.6 ± 6.3	0.058
Indication					
DCIS[2]	54 (52.9)	7 (6.9)	35 (34.3)	6 (5.9)	0.035
Invasive carcinoma	261 (62.9)	91 (21.9)	261 (62.9)	38 (9.1)	
Risk reduction	69 (73.4)	4 (4.2)	17 (18.0)	4 (4.2)	
Laterality					
Unilateral	101 (52.1)	19 (9.8)	45 (23.2)	29 (14.9)	< 0.001
Bilateral	283 (67.9)	17 (4.1)	98 (23.5)	19 (4.6)	
Mastectomy type					
Skin-sparing	101 (62.3)	11 (6.8)	36 (22.2)	14 (8.6)	0.893
Nipple-sparing	283 (72.6)	25 (5.6)	107 (27.4)	34 (7.6)	
Axillary surgery					
None	67 (68.4)	7 (7.1)	19 (19.4)	5 (5.1)	0.137
SLNB	252 (60.1)	21 (5.0)	107 (25.5)	39 (9.3)	
ALND	65 (69.1)	8 (8.5)	17 (18.1)	4 (4.3)	
Reconstruction					
TE	111 (71.6)	8 (5.2)	29 (18.7)	7 (4.5)	0.054
Direct implant	273 (59.9)	28 (6.1)	114 (25.0)	41 (9.0)	
TE/implant location					
Sub-pectoral	312 (62.3)	29 (5.8)	118 (23.5)	42 (8.4)	0.751
Pre-pectoral	72 (65.4)	7 (6.4)	25 (22.7)	6 (5.4)	
Opioid alternatives					
Gabapentin	21 (34.4)	6 (9.8)	19 (31.1)	15 (24.6)	< 0.001
Lorazepam	187 (66.6)	20 (7.1)	61 (21.7)	13 (4.6)	
Gabapentin + lorazepam	148 (66.7)	8 (3.6)	49 (22.0)	17 (7.6)	
Mean LOS (h)	28.2 ± 10.7	25.5 ± 8.7	27.4 ± 10.0	24.3 ± 5.3	0.050

IV intravenous, *BMI* body mass index (kg/m^2), *DCIS* uctal carcinoma in situ, *SLNB* sentinel lymph node biopsy, *ALND* axillary lymph node dissection, *TE* tissue expander, *LOS* length of hospital stay

These additional measures have often been incorporated into ERAS programs. A meta-analysis of ERAS in breast reconstruction patients demonstrated less opioid use and reduced LOS without an increase in complications.[21] However, only one study in this meta-analysis included patients undergoing implant-based reconstruction.[24] Our study aimed to identify perioperative measures in addition to PVB that can further streamline recovery for patients with implant-based reconstruction.

This study identified several factors associated with postoperative opioid use and LOS. First, TE reconstruction was associated with increased opioid requirement and longer LOS. This likely was multifactorial. Reconstruction with TEs may be more painful than direct implant reconstruction, and the decision to place TEs may be based on patient factors, such as skin flap compromise, which can have an impact on recovery.

Second, although the enhanced recovery program had a greater impact on reducing opioid use by patients undergoing unilateral procedures, it had a greater impact on reducing LOS for patients undergoing bilateral procedures. This suggests that although patients undergoing bilateral procedures may require more opioids than those undergoing unilateral procedures, ERAS can optimize recovery for bilateral mastectomy patients so that their LOS is comparable with the recovery of those having unilateral mastectomies.

Finally, whereas younger age was associated with IV opioid requirement and a longer conversion to oral pain control, older age was associated with increased LOS. Older patients may stay longer in the hospital due to additional comorbidities or lack of a support system rather than pain control.

The results from our subgroup analysis of opioid use within the contemporary 2016–2018 cohort indicated that even with an enhanced recovery program, younger patients undergoing bilateral mastectomies for risk reduction were more likely to require postoperative opioids and have an increased LOS. Notably, although this increase in LOS was statistically significant, it was minimal. Further studies on minimizing opioid use and LOS in this patient population are warranted. Until then, understanding that this patient population and those requiring TE reconstruction are more likely to require postoperative opioids and have a minimally increased LOS can be used to guide preoperative counseling.

This study was limited by its retrospective nature. Because the data were obtained by chart review, oral opioid and opioid-alternative analgesic data were available only for the contemporary 2016–2018 cohort. Although we included gabapentin in the subgroup analysis, we were unable to include it in the overall model. It also is important to note that IV opioids were used as a surrogate for pain control because pain was not directly assessed in this study.

Another possible limitation was the inclusion of patients who had pre-pectoral TE or implant placement in 2016–2018. Because we did not identify a difference in opioid use or LOS between the sub-pectoral and pre-pectoral TE/implant location groups in the 2016–2018 cohort, we thought that including these patients was less likely to confound the overall results. Although we were able to show an association between gabapentin and postoperative opioid use, many elements that make up the enhanced recovery program, including preoperative counseling and improved operative efficiencies, are challenging to measure retrospectively. By adjusting for patient and procedural factors, our results suggest that implementation of an enhanced recovery program accounts for the decreases in opioid use and LOS observed over time.

Finally, health care provider awareness regarding the risk of opioid addiction and efforts to facilitate early discharge have led to overall trends in decreased opioid use and LOS over time and also may have contributed to the decrease in opioid use and LOS observed in our study.

CONCLUSION

Compared with the 2010 historical cohort, the patients undergoing mastectomy with TE or implant reconstruction in the contemporary 2016–2018 cohort were 26% less likely to require IV opioids and had a significantly decreased LOS. Even after adjustment for increasing rates of NSM and direct implant reconstruction over time, opioid use and LOS still were associated with year of surgery. We attribute these improvements to preoperative counseling, multimodal analgesia, and surgical efficiencies.

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DISCLOSURE All authors declare that they have no conflict of interest.

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