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Original Article

The effect of a local anesthetic cocktail in a serratus anterior plane and PECS 1 block for implant-based breast reconstruction ☆

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ABSTRACT

Introduction: Enhanced recovery after surgery (ERAS) protocols have been implemented to decrease opioid use and decrease patient hospital length of stay (LOS, days). Serratus anterior plane (SAP) blocks anesthetize the T2 through T9 dermatomes of the breast and can be applied intraoperatively. The purpose of this study was to compare postoperative opioid (OME) consumption and LOS between a control group, an ERAS group, and an ERAS/local anesthetic cocktail group in patients who underwent implant-based breast reconstruction.

Methods: In this study, 142 women who underwent implant-based breast reconstruction between 2004 and 2020 were divided into Group A (46 patients), a historical cohort; Group B (73 patients), an ERAS/no-block control group; and Group C (23 patients), an ERAS/anesthetic cocktail study group. Primary outcomes of interest were postanesthesia care unit (PACU), inpatient and total hospital OME consumption, and PACU LOS.

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Results: A significant decrease was observed from Group A to C in PACU LOS (103.3 vs. 80.2 vs. 70.5; $p = 0.011$), OME use (25.1 vs. 11.4 vs. 5.7; $p < 0.0001$), and total hospital OME (120.3 vs. 95.2 vs. 35.9; $p < 0.05$). No difference was observed in inpatient OMEs between the three groups (95.2 vs. 83.8 vs. 30.8; $p = 0.212$). Despite not reaching statistical significance, Group C consumed an average of 50–60 % less opioids per patient than did Group B in PACU, inpatient, and total hospital OMEs.

Conclusion: Local anesthetic blocks are important components of ERAS protocols. Our results demonstrate that a combination regional block with a local anesthetic cocktail in an ERAS protocol can decrease opioid consumption in implant-based breast reconstruction.

Introduction

Enhanced recovery after surgery (ERAS) protocols are multimodal care pathways that rely on a multidisciplinary approach to optimize the preoperative, perioperative, and postoperative recovery following surgery.[1-3] ERAS protocols aim to improve clinical results, patient outcomes, and work toward reducing healthcare costs.[1,2,4] Since its introduction in colorectal surgery, ERAS has demonstrated decreased length of stay (LOS), decreased hospital costs, and reduced patient pain and opioid use.[1-4] Several of these outcomes are directly related to opioid-sparing multimodal analgesia regimens, as these allow patients to quickly return to baseline daily activities.[5]

As the ERAS protocols continue to evolve and expand across surgical disciplines, multiple studies on its application in breast reconstruction have been published, showing superior outcomes compared to traditional recovery after surgery (TRAS).[1,6-8] When controlling for age, smoking, preoperative radiation, one-stage versus two-stage reconstruction, and laterality, ERAS patients undergoing implant-based breast reconstruction had lesser pain ($p = 0.02$), nausea ($p = 0.01$), and shorter LOS ($p < 0.001$) than their TRAS counterparts.[7] A subsequent study on implant-based breast reconstruction also found that ERAS patients had a significantly decreased LOS without a difference in readmission or complication rates compared to TRAS patients.[6] A recent 2020 meta-analysis of ERAS protocols in breast reconstruction revealed that ERAS patients consumed 183.96 oral morphine equivalents (OMEs) on an average and the average LOS decreased by 1.58 days.[8]

Implant-based reconstruction has historically been associated with shorter operative times and decreased healthcare system costs.[9-11] As a result of the less invasive nature of implant-based reconstruction, several surgeons assume that specific protocols for pain control are not necessary. Thus, several studies have focused on ERAS pathways in autologous reconstruction. However, more recently the ERAS guidelines have improved implant-based reconstruction by decreasing opioid consumption through different protocols.[12]

Owing to these findings demonstrating positive outcomes with the use of locoregional blocks in implant-based reconstruction,[23-25] there is an increasing need for evidence regarding the effectiveness of local anesthetic cocktail blocks for postoperative outcomes within an ERAS protocol. The purpose of this study was to evaluate postoperative opioid consumption and LOS in patients receiving our local anesthetic cocktail in implant-based breast reconstruction within three groups: TRAS (historical cohort, Group A), ERAS without regional block (control group, Group B), and ERAS with a combination regional block (study group, Group C). Group A was added to demonstrate that there is a benefit of

ERAS versus TRAS, whereas Groups B and C were compared to explore whether there is a benefit to using the local anesthetic cocktail.

Methods

This was an institutional review board (IRB)-approved, single-center, retrospective review of all women who underwent implant-based breast reconstruction (CPT 19357) between December 2004 and August 2020. All surgical procedures were performed by fellowship-trained academic plastic surgeons. Exclusion criteria included patients <18 years of age, patients with incomplete postanesthesia care unit (PACU) data, and/or patients in whom the specific method of local anesthesia administration could not be determined from chart review. Patient demographics, comorbidities, reconstruction timing, plane of implant placement, opioid consumption, and LOS data were gathered and analyzed.

The incorporation of an ERAS protocol for implant-based breast reconstruction at our institution began in early 2016 and the use of a local anesthetic cocktail in regional nerve blocks began in 2018. The current ERAS pathway at our institution includes a preoperative ERAS class-to discuss pre-habilitation, pre- and postoperative nutrition, and postoperative pain- and intraoperative regional block, and perioperative scheduled multimodal analgesia regimen. All patients attend the preoperative ERAS class and are provided with a postoperative binder; however, the patient's adherence to each recommendation was not recorded. The multimodal analgesia regimen consists of Gabapentin 300 mg TID for 3 days preop and 3 days postop, postoperative NSAID (Ibuprofen 600 mg Q6-8H or Naproxen 220 mg Q12H), postoperative Tylenol 1000 mg TID, and a postoperative PRN narcotic for breakthrough pain. As time progressed, a combination block consisting of PECS I, serratus anterior plane (SAP), and wide-local infiltration was incorporated into the ERAS protocol.

For the PECS 1 block, the medial pectoral nerve and lateral pectoral nerve running between the pectoralis major and minor muscles are targeted (Figure 1). This block can be carried out under ultrasound guidance or direct visualization.[13,26] The senior author uses direct visualization by identifying the lateral border of the pectoralis major muscle and the underlying pectoralis minor muscle at the level of the third rib. A blunt-tipped cannula is then advanced into this plane and the local anesthetic is infiltrated. A lack of resistance to infiltration indirectly confirms correct placement of the cannula.

For a SAP block, intercostal nerve branches from T2 through T9 are targeted in the superficial plane between the serratus anterior and the latissimus dorsi and in the plane beneath the serratus anterior muscle (Figure 2).[19] This potentiates a PECS I block by anesthetizing the antero-lateral, lateral, and postero-lateral thorax from the T2 to T9 dermatomes. When administering a SAP block, the senior author prefers to administer the block with visualization of the pectoralis minor, serratus anterior, and latissimus dorsi. Infiltration is done in the planes described above using a blunt-tipped cannula. Correct plane placement is again confirmed by the lack of resistance to infiltration.

Frequently, regional blocks, such as the transversus abdominis plane (TAP) blocks, are carried out with liposomal bupivacaine (LB) to provide superior pain control compared to plain bupivacaine; however, doubts exist as to effectiveness and economic feasibility of LBs.[27-29,40] To minimize surgical costs without sacrificing pain control, the senior author developed a local anesthetic cocktail consisting of 50–60 mL of 0.25 % bupivacaine with epinephrine, 30 mg Ketorolac, 50 mcg dexmedetomidine, and 4 mg dexamethasone (Table 1) diluted in 200 mL of 0.9 % normal saline. Notably, the use of this local

Table 1
Local anesthetic cocktail components.

Local Anesthetic Cocktail			
Medication	Concentration	Volume	Dose
Normal saline	0.9 %	200 mL	
Bupivacaine with epinephrine (Marcaine with epinephrine) 1:200,000	2.5 mg/mL	50-60 mL	
Dexamethasone (Decadron)	4 mg/mL	1 mL	4 mg
Dexmedetomidine (Precedex)	100 mcg/mL	0.5 mL	50 mcg
Ketorolac (Toradol)	30 mg/mL	1 mL	30 mg

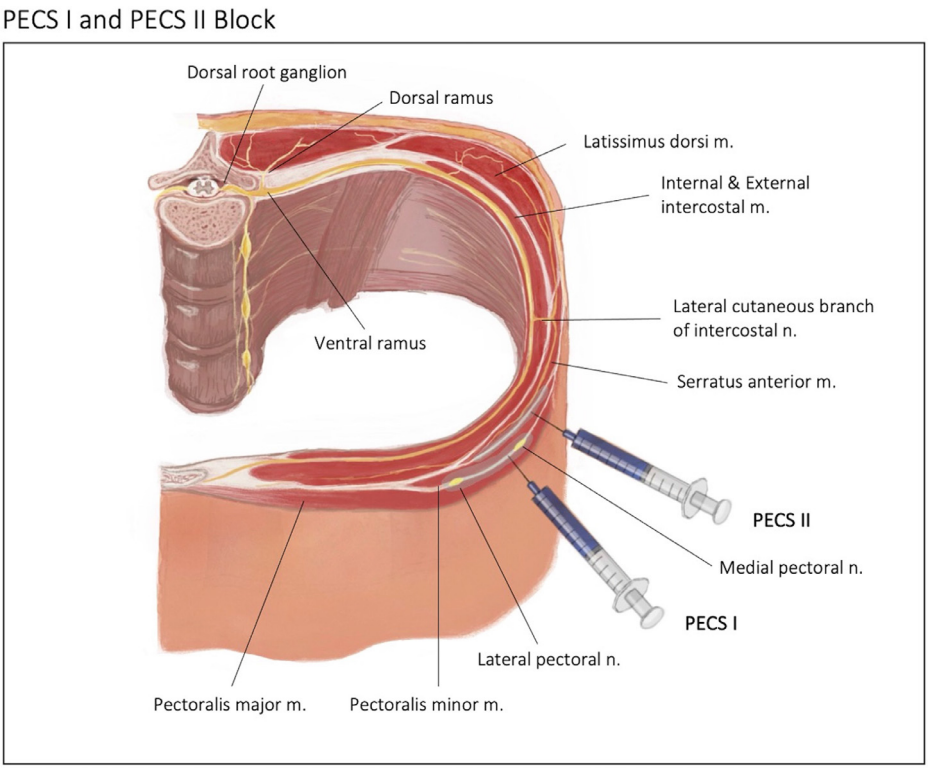

Figure 1. PECS I and PECS II block.

anesthetic cocktail costs an additional $44 per patient. Each of these ingredients has demonstrated their safety and efficacy when combined with an amide anesthetic.[30-34].

The patients were separated into three groups: patients prior to ERAS commencement (Group A, TRAS), those after ERAS not receiving a block (Group B, ERAS/no-block), and those after ERAS receiving a block (Group C, ERAS/block). Notably, one patient in Group B received wide-local infiltration with 0.25 % bupivacaine while no other patients received any locoregional block or wide-local infiltration in Group A or B. Primary outcomes of interest include PACU, inpatient, and total hospital OME consumption and PACU LOS. In this study, we broke down the postoperative opioids into PACU, inpatient, and total OMEs, with the PACU OMEs strictly being those consumed after surgery and prior to transfer to the ward and the inpatient OMEs being strictly those consumed while the patient was in the ward. Given the nature of this retrospective review, postoperative opioid use could not be accurately captured as it was not common practice at the time in question to ask and/or document the number of opioids used by the patients. Complications included seroma, hematoma, wound dehiscence, deep infection, and tissue expander rupture. These were classified into major (requiring surgical intervention) and minor (no surgical intervention) complications.

Statistical analysis

Continuous variables were analyzed using the ANOVA test. For posthoc pairwise comparisons, analysis was conducted with Tukey–Kramer HSD testing. A p-value of <0.05 was set for statistical significance. To account for the wide variance in observed OME requirements, the lowest and highest amounts of consumption were removed for each group. A total of two data points per group were removed for a total of six data points. This corresponds to the number of patients without opioid

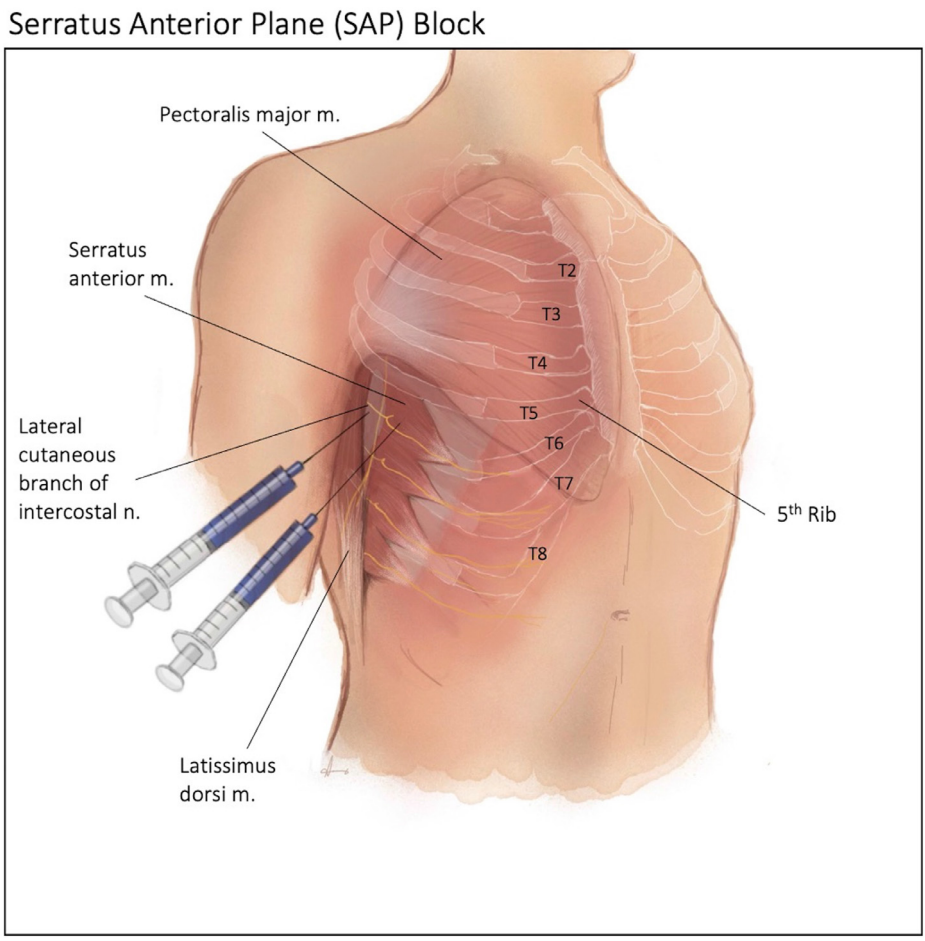

Figure 2. Serratus anterior plane (SAP) block.

consumption that were thought to be charting errors not representative of the population. The high opioid values appeared to be a charting error as some patients had several thousand OMEs consumed in a short time—an amount that generally would be considered fatal to the patient. Given our concern for the validity of these data, they were removed. Analyses were carried out before and after the removal of these outliers, with the analysis prior to removal of these outliers demonstrating a mean value of OME consumption that was significantly higher across all groups with no significant differences seen across statistical testing. Normally distributed variables are reported with mean and standard deviation. Variables that are not normally distributed are reported with the median and IQR. All statistical analyses were performed in the R Version 4.0.00 software (Vienna, Austria).

Results

Patient demographics

A total of 142 women undergoing implant-based breast reconstruction after mastectomy met the inclusion criteria, with 46 patients in Group A, 73 in Group B, and 23 in Group C (Table 2). There were no statistically significant differences in age (55.3, 52.7, and 52.6 years), BMI (27.9, 27.4, and

Table 2
Demographics: No differences were seen between demographics and medical comorbidities between the three groups (p>0.05).

	Group A (*N*=46)	Group B (*N*=73)	Group C (*N*=23)	p value
Age, years	55.3 (10.7)	52.7 (12.1)	52.6 (11.5)	0.427
BMI, kg/m^2	27.9 (5.7)	27.4 (4.5)	28.1 (5.8)	0.757
ASA	2.5 (0.6)	2.3 (0.5)	2.4 (0.5)	0.199
Tobacco	11 (22 %)	24 (32 %)	7 (28 %)	0.512
Diabetes	9 (18 %)	10 (13 %)	1 (4 %)	0.23
Hypertension	22 (45 %)	26 (35 %)	8 (32 %)	0.422
Cardiac History	6 (12 %)	6 (8 %)	2 (8 %)	0.706
Pulmonary History	5 (10 %)	9 (12 %)	1 (4 %)	0.515

28.1 kg/m^2), ASA status, smoking status, diabetes history, hypertension, cardiac history, or pulmonary history between the three groups ($p > 0.05$). Overall, the number of prepectoral tissue expanders (TE) placed per group increased from 1 to 16, or from 2.04 % to 64.0 %, from Group A to Group C. Within Group C, only nine patients had subpectoral TE placement, thus subgroup statistical analysis with regards to plane placement could not be carried out. Within Group B, 55.4 % of patients had prepectoral TE placement and 44.6 % had subpectoral TE placement (p>0.05). Regarding reconstruction timing, two delayed TEs and 25 immediate TEs were placed in Group C. The common practice at our institution is to immediately place TE except in patients who would otherwise be expected to have wound healing issues. However, there are not enough patients in the delayed TE subgroup of Group C to run a statistical analysis.

Postoperative pain management and length of stay

The mean total hospital OME consumption across the three groups was significantly lower for Group C compared to the other groups (Group A: 120.3, Group B: 95.2, and Group C: 35.9; $p = 0.05$; Table 3, Figure 3). However, no difference was observed in total hospital OME use between Group B and Group C ($p = 0.169$; Table 4). Regarding the inpatient postoperative phase, despite consuming 50-60 % less opioids than the patients in Group 2, no statistically significant difference was noted between the three groups (Group A: 95.2, Group B: 83.8, and Group C: 30.8; $p = 0.212$).

The mean PACU OME consumption across the three groups was significantly different and decreased from Group A to Group C (Group A: 25.1, Group B:11.4, and Group C: 5.7; p≤0.0001). Posthoc testing revealed a statistically significant decrease in PACU OME use between Group A and Group C (p <0.0001) and between Group A and Group B ($p < 0.0001$). No difference was noted between PACU OME consumption between the two ERAS groups (p = 0.24).

The mean PACU LOS significantly decreased as the ERAS protocol was incorporated and evolved (Group A: 103.3, Group B: 80.2, and Group C: 70.5 min; $p = 0.011$). Significant differences in LOS were seen between Group A and Group C ($p = 0.024$) and between Group A and Group B ($p = 0.032$), but not between Group B and Group C ($p = 0.682$). The mean hospital LOS for Group A was 1.29 days

Table 3
Oral Morphine Equivalents and Length of Stay: As our institutions' ERAS protocol evolved, we saw a decrease in the consumption of total PACU OMEs and total hospital OMEs and the PACU LOS from Group A to Group C ($p < 0.05$).

	Group A (*N*=46)	Group B (*N*=73)	Group C (*N*=23)	*p*-value
		Mean (SD, SEM)		
PACU OMEs	25.1 (18.3, 2.7)	11.4 (13.3, 1.6)	5.1 (8.9, 1.9)	<0.0001*
Post-Op Inpatient OMEs	95.2 (84.5, 24.27)	83.8 (164.6, 19.3)	30.8 (33.3, 6.94)	0.212
Total Hospital OMEs	120.3 (88.6, 13.1)	95.2 (171.4, 20.1)	35.9 (35.9, 7.9)	0.05*
PACU LOS (min)	103.3 (60.3, 8.9)	80.2 (43.1, 5.0)	70.5 (37.0, 7.7)	0.011*

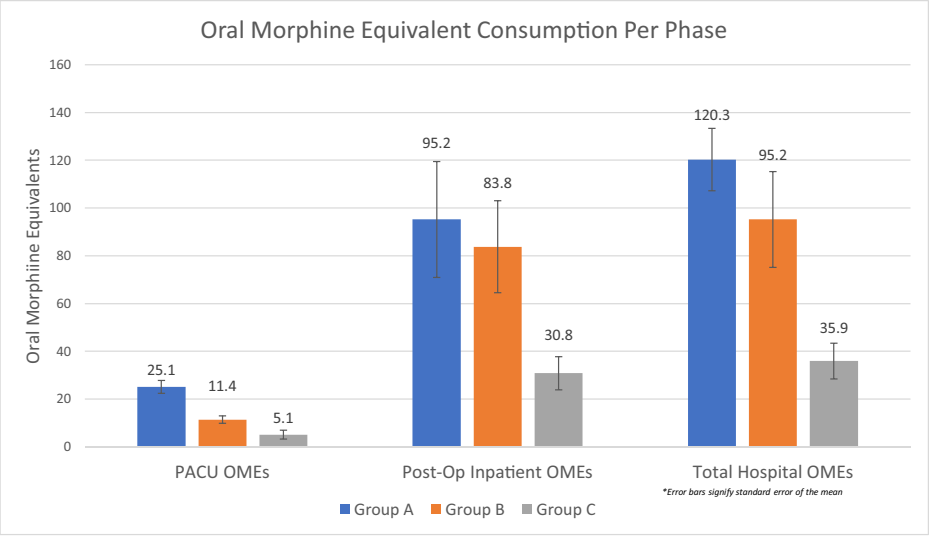

Figure 3. Average oral morphine equivalent consumption per phase.

Table 4
Oral Morphine Equivalents and Length of Stay: No statistically significant differences were observed between the two ERAS groups in OME consumption or LOS ($p>0.05$). Despite this, Group C consumed less than half the amount of opioids throughout the hospital stay than did the Group B.

	Group B ($N=73$)	Group C ($N=23$)	p-value
	Mean (SD, SEM)		
PACU OMEs	11.4 (13.3, 1.6)	5.1 (8.9, 1.9)	0.24
Post-Op Inpatient OMEs	83.8 (164.6, 19.3)	30.8 (33.3, 6.94)	0.212
Total Hospital OMEs	95.2 (171.4, 20.1)	35.9 (35.9, 7.9)	0.169
PACU LOS (min)	80.2 (43.1, 5.0)	70.5 (37.0, 7.7)	0.682

and 1.36 days for Groups B and C. No differences were found between median hospital LOS between the three groups (Group A: 1, 1-2; Group B: 1, 1-2; and Group C: 1, 1-2; $p = 0.762$).

Complications

No differences were seen between the three groups regarding frequency of complications or their classification as major or minor events ($p > 0.05$). There were no differences in the rate of returns to the ED, readmissions, or unplanned reoperations ($p>0.05$; Table 5).

Discussion

Pain management is a crucial part of plastic surgery practice as uncontrolled pain negatively impacts postoperative patient outcomes and patient satisfaction. Additionally, uncontrolled pain can lead to increased morbidity, even in healthy patients.[35] Multimodal analgesia protocols, ERAS protocols, were formed to provide desirable and appropriate responses to preoperative habilitation, perioperative non-opioid analgesia, intraoperative local anesthesia, and postoperative early mobilization and feeding.[3]

Literature on surgical ERAS protocols began emerging in the field of plastic surgery around 2014 as a guide for abdominal wall reconstruction, and eventually expanded to include microvascular and

Table 5
Complications: Major complications were those that required operative intervention. No significant differences were observed between major complications, minor complications, return to ED, readmission, or unplanned reoperation between the three groups ($p>0.05$).

	Group A (N=46)	Group B (N=73)	Group C (N=23)	p-value
Major Complications	8 (16 %)	17 (23 %)	7 (28 %)	0.481
Seroma	2 (4&)	3 (4 %)	0 (0 %)	0.593
Hematoma	0 (0 %)	0 (0 %)	1 (4 %)	0.082
Wound Dehiscence	2 (4 %)	3 (4 %)	1 (4 %)	0.999
Deep Infection	5 (10 %)	10 (13 %)	4 (16 %)	0.761
Tissue Expander Rupture	0 (0 %)	0 (0 %)	0 (0 %)	N/A
Minor Complications	18 (37 %)	34 (45 %)	13 (52 %)	0.417
Seroma	3 (6 %)	15 (20 %)	6 (24 %)	0.061
Hematoma	2 (10 %)	6 (8 %)	0 (0 %)	0.272
Wound Dehiscence	5 (10 %)	14 (19 %)	6 (24 %)	0.267
Superficial Infection	11 (22 %)	14 (19 %)	4 (16 %)	0.779
Tissue Expander Leak	0 (0 %)	0 (0 %)	0 (0 %)	N/A
Return to ED	3 (6 %)	4 (5 %)	1 (4 %)	0.929
Readmission	6 (12 %)	14 (19 %)	6 (24 %)	0.418
Unplanned Reoperation	0.2 (0.53)	0.13 (0.38)	0.2 (0.41)	0.634

implant-based breast reconstruction.[3,36] In 2015, a retrospective cohort analysis of patients who received microvascular breast reconstruction revealed that ERAS protocols decreased hospital LOS, morphine requirements, and time to ambulation without affecting postoperative complications.[37] Later in 2017, Dumestre et al. published their ERAS protocol for patients undergoing implant-based breast reconstruction. Their protocol focused on a standardized perioperative education course with multimodal analgesia, including wide-local infiltration of local anesthetic, which resulted in patients consuming fewer opioids and having a shorter hospital LOS.[7] Afonso et al. published more supporting evidence highlighting the effectiveness of ERAS protocols in microvascular breast reconstruction, where they also showed a decrease in opioid usage and hospital LOS when using TAP blocks within an ERAS protocol for autologous breast reconstruction.[38] These articles demonstrate the advantage of ERAS protocols in breast reconstruction; however, there is an additional need to investigate the effectiveness of local anesthetic blocks in a comprehensive ERAS protocol.

Liposomal bupivacaine (Exparel®) is widely used in local blocks due to block duration up to 3 days when used as a TAP block.[27,28] By blocking sodium channels, bupivacaine inhibits the formation and propagation of action potentials from noxious stimuli.[28,39] The addition of unilamellar liposomes to bupivacaine allows for sustained drug delivery while avoiding toxicity due to higher plasma drug levels. One systematic review indicated that LB may represent a safer alternative to more invasive pain management systems.[28] Although promising, there is no clear consensus on its efficacy, with conflicting data suggesting that patients receiving LB in autologous breast reconstruction did not differ significantly from those receiving plain bupivacaine in opioid consumption, pain scores, LOS, and patient satisfaction.[29] Additionally, local anesthetic cocktail, composed of readily available medications, has previously been demonstrated to provide excellent pain control and superior cost benefits when compared to LB TAP blocks.[39]

In addition to TAP blocks for regional anesthesia in autologous breast reconstruction, various blocks have been used in implant-based breast reconstruction. These include any combination of PECS (pectoralis) I/II, SAP, and intercostal nerve blocks, in addition to wide-local infiltration. In our study, we aimed to show the utility of our local anesthetic cocktail for PECS I and SAP blocks, followed by wide-local infiltration with regards to opioid usage and LOS.

Popular regional blocks used in breast reconstruction include the TAP, pectoralis I/II, and intercostal nerve blocks.[13-16] A TAP block can be administered via ultrasound guidance or direct visualization by locating the triangle of petit and or by marking a point 8 cm above the ASIS and inserting the needle between the transverse abdominis and internal abdominal oblique muscles, allowing for placement of anesthetic from the T10-L1 dermatomes.[13,17] A PEC I block is administered in the plane between the pectoralis major and minor muscles and at the level of the 3rd rib to anesthetize the medial and

lateral pectoral nerves.[13,14] A PEC II block technique includes a second injection in addition to the PEC I block between the pectoralis minor and serratus anterior muscles, anesthetizing the long thoracic nerve and part of the intercostal nerves T2 to T4 (Figure 1).[13,14] Intercostal nerve blocks are a series of injections at the inferior rib margin of the 3rd, 4th, 5th, and 6th ribs where they intersect the anterior axillary line, thereby targeting the respective intercostal nerves.[18] Lastly, the SAP block, has changed the impact of anesthesia for implant-based reconstruction by targeting the T2 through T9 thoracic intercostal nerves as they travel ventral and dorsal, thus providing anesthesia to the anterolateral, lateral, and posterolateral thorax (Figure 2).[19-21] Thus, the use of SAP blocks alone or in combination with other blocks can provide anesthesia to multiple dermatomes.

In breast surgery, the local SAP block has demonstrated promise in minimizing postoperative opioid use and adverse opioid effects, while providing a predictable zone of anesthesia.[22,23] A prospective RCT examining SAP block and opioid consumption in 40 breast reduction patients found that 24-hour opioid consumption was significantly higher ($p < 0.001$) in the TRAS group and analgesic requirements were significantly lower ($p < 0.028$) in the SAP block.[23] Two additional studies that combined the PEC I and SAP block in an ERAS protocol for breast reconstruction further demonstrated the effectiveness of SAP block and the importance of local anesthetic blocks in a comprehensive ERAS protocol. During a prospective cohort study from 2016 to 2019, an ERAS protocol implemented for patients who underwent latissimus dorsi flap breast reconstruction revealed that an adjunct of PEC I and SAP block decreased hospital LOS (6.5 h vs. 58.5 h; $p = 0.003$) and cost ($5,666.80 vs. $8890.25; $p = 0.003$), and expedited discharge within 24 h (60 % same day vs. 9 % same day; $p < 0.0001$) compared to a pre-ERAS protocol.[24] In August 2021, Straughan et al. found that the administration of the PEC I and SAP blocks under ultrasound guidance for breast surgeries within an ERAS protocol resulted in similar trends to that in the study mentioned earlier.[25] Patients in the ERAS group required lesser amounts of opioids (100.3 OME vs. 332.3 OME; $p < 0.001$), anti-emetic medication (16.3 mg promethazine/patient vs. 664 mg; $p < 0.001$), and antispasmodic medications (31.2 mg cyclobenzaprine/patient vs. 401.3 mg; $p < 0.001$) compared to the pre-ERAS group.[25] These results suggest that local anesthetic blocks are an important component of ERAS protocols for breast reconstruction surgeries in improving patient outcomes and decreasing the cost of postoperative care.

This study investigates the use of our local anesthetic cocktail PECS 1 and SAP blocks, followed by wide-local infiltration within an ERAS protocol for implant-based reconstruction. Our results demonstrate that the incorporation of our local anesthetic cocktail into an ERAS protocol can decrease opioid consumption in implant-based breast reconstruction. A statistically significant decrease was observed in OMEs from Group A to Group C in all outcomes except in the inpatient postoperative OMEs. No statistically significant difference was detected in inpatient OME, PACU OME, or total hospital OMEs between either ERAS groups. Despite not reaching statistical significance, the group that received the local anesthetic cocktail regional blocks (Group C) used less than half the number of opioids used in the ERAS only group. In addition, as demonstrated in Table 3, with the standard deviation, the patients who received the local anesthetic cocktail in Group C had a smaller variability in OME consumption among the entire group.

Our study demonstrates relevant factors that influence clinical outcomes of patients: opioid usage and LOS. Statistical significance depends on multiple statistical factors, such as sample size, that may or may not benefit the patient and does not necessarily constitute clinical significance. Our data show a clinically significant decrease in opioid use with the local anesthetic cocktail in implant-based breast reconstruction, particularly when used in an ERAS pathway; however, the difference was not statistically significant. Given the relatively small size of the ERAS/block group versus the ERAS/no-block group, and the large discrepancies in OME values between the two groups, it is plausible to suggest that statistical differences were not observed owing to sample size, rather than a true lack of difference.

Limitations of the current study include the small sample size and retrospective nature of the study. Although retrospective studies have an important role in research and play a large role in shaping clinical outcomes, the data are dependent on the clinical database with a multitude of unrecognized confounders. Although the postoperative OME usage and hospital LOS differences are encouraging, data from Group B were collected from various surgeons. Additionally, our study did not

specifically analyze OME usage according to implant plane (e.g., prepectoral, total submuscular, or dual plane). Statistical analysis on opioid consumption was not conducted on the plane of placement, as Group A did not have enough patients with prepectoral placement and Group C did not have enough patients with subpectoral placement to conduct a meaningful statistical analysis. However, this is a confounder as muscular elevation would be more painful. Future research should be aimed at a prospective analysis with a larger sample size and different techniques, including specific implant planes.

Conclusion

The incorporation of local anesthetic blocks is an important component of ERAS protocols for implant-based breast reconstruction. Our results demonstrate that the incorporation of a combination PECS I/SAP block with a local anesthetic cocktail into an ERAS protocol can decrease opioid consumption in implant-based breast reconstruction.

Conflicts of interest

None declared.

Authorship Role, Participation, and Acknowledgments

1) Nicholas F. Lombana, MD contributed substantially to conception and design, acquisition of data, analysis, and interpretation of findings, drafting the article and revising it critically for important intellectual content, and final approval of the version to be published.
2) Courtney Beard, MD contributed substantially to conception and design, acquisition of data, analysis, and interpretation of findings, drafting the article and revising it critically for important intellectual content, and final approval of the version to be published.
3) Ishan H. Mehta, MD contributed substantially to conception and design, acquisition of data, analysis, and interpretation of findings, drafting the article and revising it critically for important intellectual content, and final approval of the version to be published.
4) Reuben A. Falola, MD contributed substantially to conception and design, acquisition of data, analysis, and interpretation of findings, drafting the article and revising it critically for important intellectual content, and final approval of the version to be published.
5) Peter Park, BS contributed substantially to conception and design, acquisition of data, analysis, and interpretation of findings, drafting the article and revising it critically for important intellectual content, and final approval of the version to be published.
6) Andrew M. Altman, MD contributed substantially to conception and design, acquisition of data, analysis, and interpretation of findings, drafting the article and revising it critically for important intellectual content, and final approval of the version to be published.
7) Michel Hector Saint-Cyr, MD contributed substantially to conception and design, acquisition of data, analysis, and interpretation of findings, drafting the article and revising it critically for important intellectual content, and final approval of the version to be published.

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