Bilateral paravertebral nerve blocks are associated with reduced opioid use and pain scores after Level 2 volume displacement oncoplastic breast surgery

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ABSTRACT

Paravertebral block (PVB) has emerged as an additional analgesic technique in breast surgery; however, it is unclear whether it benefits post-operative opioid use and pain control in women undergoing Level 2 volume displacement oncoplastic breast surgery and immediate symmetry mastopexy. Data over a 3 year period in a single institution was reviewed in those that had and had not received bilateral PVB for oncoplastic breast surgery and symmetry mastopexy. Primary outcomes included intra- and post-operative opioid use in morphine equivalents (ME) and patient reported pain scales (PS) (0-10) on a verbal numeric rating scale. Of 89 total women, 38 (43%) received bilateral PVB prior to general anesthesia (GA) and 51 (57%) received GA alone. Those who received PVB used fewer ME 0-24 hours post-operatively (12.5 vs. 6.7 ME, p<0.01) and reported less pain 0-8 hours post-operatively (8 vs. 7, p<0.05) as well as upon discharge (4 vs. 2, p<0.01) compared to GA alone. We demonstrate that PVB significantly reduces opioid use and improves immediate postoperative pain as well as pain upon hospital discharge following this type of breast operation.

BACKGROUND

In 2019, the US will experience an estimated 268,600 new cases of invasive breast cancer and suffer 42,260 breast cancer deaths (1).

Paravertebral blocks: Postoperative pain after surgical treatment of breast cancer continues to challenge patients. Use of PVB has been shown to reduce opioid administration in various breast surgical populations. Both mastectomy (2), postmastectomy autologous (3) and prosthetic (4) breast reconstruction, and reduction mammoplasty (5) with nerve blocks have reported significant improved postoperative outcomes in patient reported pain or opioid use in retrospective studies. PVB have also been shown to improve postoperative pain control and chronic persistent pain in systematic reviews of RCTs (6), though there is heterogeneity in the data available in these parameters of interest (7).

Oncoplastic sugery: Dual benefit of efficacy and excellent cosmetic result have promoted oncoplastic techniques with breast conserving lumpectomy and reduction mammoplasty for invasive breast cancer. High levels of patient satisfaction (8) are reported, along with lower seroma formation, rates of positive or close margins, compared to lumpectomy alone (9).

Study population

Characteristic Median (range)	Non-PVB (n = 51)	PVB (n = 38)
Age (years)	56 (33-83)	58 (33-83)
BMI (kg/m²)	28.9 (19.5-43.7)	28.3 (20.5-28)
Race		
White	38 (74.5 %)	29 (76.3 %)
African American	7 (10.5 %)	4 (10.5%)
Other	6 (11.8 %)	5 (12.4%)
ASA class		
I	3 (5.9 %)	1 (2.6%)
II	24 (47.1%)	25 65.8%)
III	24 (47.1%)	12 (31.6%)
Chronic Pain*		
I	38 (74.5 %)	26 (68.4 %)
II	6 (11.8 %)	7 (18.4 %)
III	7 (13.7 %)	5 (13.6%)

*defined by Parikh et al. 2016

Study groups did not differ significantly regarding age, race, body mass index, American Society of Anesthesiologists class, cancer stage, cancer laterality, chronic pain class, and preoperative daily opioid use and non-opioid pain medication use. Amount of opioids given intraoperatively did not differ between groups.

Table 1. Selected characteristics of the study population (n=89). Exclusion of patients undergoing unilateral oncoplastic procedure (original n=98). No significant differences were found between the non-PVB and PVB group (p>0.05).

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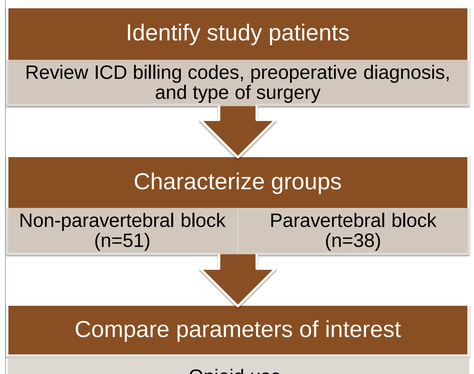
METHODS

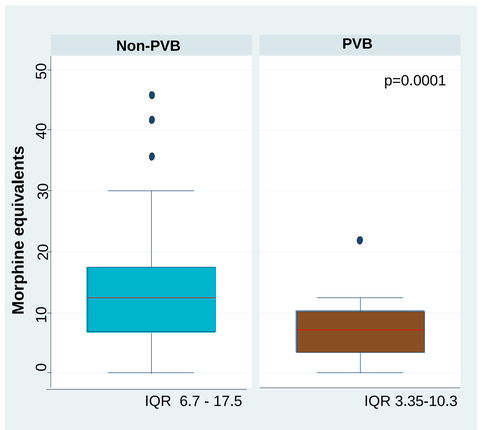


Retrospective Review
Consecutive women undergoing bilateral breast oncoplastic surgery with immediate symmetry mastopexy over a 3 year period were compared by those with and without bilateral PVB. Bilateral single-injection PVB (0.25% bupivicaine w/ epinephrine 1:200k) was performed under the supervision of 1 of 3 attending anesthesiologists, all oncoplastic procedures were completed by one surgeon.

All data were obtained from the electronic medical record. Primary outcome variables included postoperative opioid use and patient reported PS (0-10). All opioids were converted to ME. PS were collected by nursing staff every 4 hours. Secondary outcome variables included time to first postoperative analgesic (TTFA) and pain score upon hospital discharge.

Statistical analysis: Tests for statistical differences between groups were performed using x^2 for categorical variables and Wilcoxon rank-sum tests for continuous variables due to deviation of normality. Two-sided hypothesis tests and 5% level of significance were set a priori to detect statistical significance. To achieve a power $(1 - \beta) = 0.8$ to detect a 1.5 point difference in PS between groups at 0-12 and 12-24 hrs, with an $\alpha = 0.05$, at least 22 subjects in each group was required. A separate logistic regression incorporating PVB and 0-24 hours ME was calculated to predict pain scores at discharge. All analyses were performed using STATA v. 15 (College Station, TX).

RESULTS: Opioid Use



Post-Op	Non-PVB	PVB	P value
0-12* hours	7.5 (0-36.7)	5.5 (0 – 16.7)	< 0.05
12-24* hours	5 (0 – 22.3)	2.5 (0 - 5.2)	< 0.01
0-24* hours	12.5 (0 – 45.9)	6.7 (0 -21.9)	=0.0001

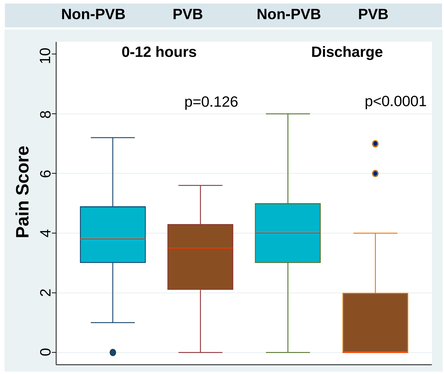
Table 2. Median (range) postoperative ME by time. Statistically significance noted with asterisk.

Figure 1. Total ME used 0-24 hours after Level 2 volume displacement oncoplastic surgery by type of anesthesia received. Box plots show the 25th, 50th, and 75th percentile.

After oncoplastic surgery, patients non-PVB group used significantly more ME than the PVB group (12.5 vs 6.7 ME, p<0.01).

Intraoperative ME administration (26.7 vs. 28.5 ME, p=0.970), TTFA (72 vs. 97 minutes, p=0.760), and number of non-narcotic pain medication administration did not differ between groups. Procedure duration defined by start and end time in the operating room, was shorter by an average of 26 minutes in the non-PVB vs. PVB group (232 vs. 258, p<0.05).

RESULTS: Pain Scores



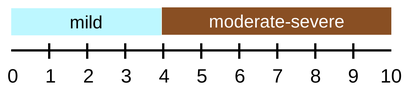
Post-Op	Non-PVB	PVB	P value
0-4* hours	5 (0-9.6)	3.2 (0-6.2)	<0.001
4-8 hours	3 (0-6.5)	3.4 (0-6.3)	0.315
8-12* hours	2.7 (0-8)	2.5 (0-8)	<0.01
12-24 hours	3.5 (0.5 – 7.5)	3.5 (0-7)	0.465
Discharge *	4 (0-8)	2 (0 -7)	<0.0001

Figure 2. PS at 0-12 hours and at discharge from hospital after Level 2 volume displacement oncoplastic surgery by type of anesthesia received.. Box plots show the 25th, 50th, and 75th percentile.

Table 3. Mean (range) postoperative PS by time. Statistically significance noted with asterisk.

PS at 0-12 hours were not significantly different at 2.7 vs. 2.5 for the non-PVB vs. PVB group (p=0.126). PS prior to discharge from hospital was significantly different at 4 vs. 2 for the non-PVB vs. PVB group (p<0.01).

PS were classified as mild (0-4) and moderate-severe (5-10) for comparison by odds ratio (OR).



Overall 0-24 hours post-op: Patients in the non-PVB group were 3.89 more likely to experience moderate-severe pain compared to PVB group (OR = 3.89 and 95% confidence interval [CI] 1.07, 21.59). Multivariate analysis significantly predicted that PVB led to, on average, lower pain scores by 1.9 points as compared to GA alone.

At discharge: Patients receiving >10 ME in the first 24 hours after surgery are 7.1 times more likely to experience moderate-severe pain at discharge when compared to patients who receive <10 ME (OR = 7.1, 95% CI 1.97, 25.5).

CONCLUSIONS

This novel study investigating PVB in women undergoing Level 2 volume displacement oncoplastic breast surgery shows that PVB significantly reduces postoperative opioid use (by 5.3 ME in 24 hours) and pain upon hospital discharge (by 2 points). Women who did not receive PVB more likely to report moderate-severe pain. It corroborates with existing literature regarding PVB improving post-operative pain control in patients undergoing surgical treatment for breast cancer. There were no PVB-related complications noted in this retrospective cohort study. With this clinically significant benefit of superior immediate analgesia and decreased opioid use, data supports the addition of PVB with GA in optimal anesthetic protocol in oncoplastic breast surgery.

FUTURE DIRECTIONS

Additional effects of PVB in perioperative care including patient oriented outcomes of length of stay and post-operative nausea and vomiting may be value to assess for this procedure. Prospective investigation of PVB for cost-effectiveness, patient-satisfaction, and at-home opioid usage would further strengthen evidence-based practice.

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