

Paravertebral Blocks in Breast Cancer Surgery: Is There a Difference in Postoperative Pain, Nausea, and Vomiting?

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ABSTRACT

Background. The purpose of this study was to evaluate postoperative pain and postoperative nausea and vomiting (PONV) in patients with paravertebral blocks (PVB) undergoing breast cancer surgery with or without axillary staging.

Methods. An Institutional Review Board approved, retrospective chart review from January 2007 to December 2009 was performed at a single institution. Charts were reviewed for type of breast cancer surgery, axillary staging, PVB, PONV, postoperative pain score, dosages of pain medication and antiemetic medication given in the Post Anesthesia Care Unit (PACU), and during the postoperative days (POD). The study population consisted of females with a diagnosis of breast cancer undergoing breast cancer surgery, with or without axillary staging. Patients were excluded if they: had simultaneous myocutaneous tissue flap breast reconstruction, had additional surgical procedures, used continuous delivery postoperative pain medications, had a history of chronic pain, or had a history of chronic antiemetics prior to surgery. All patients received standard perioperative medications per the anesthesia department.

Results. A total of 419 patients underwent breast cancer surgery during the given time period of which 337 patients were able to be included in the study. Of these patients, 241 of the 337 patients had PVB and 96 patients did not have PVB. The mean age was 59.5 years. The mean BMI was 28.7 kg/m². Also, 45.5% of the patients who had PVB (110) had a mastectomy, while 41.1% of patients in the non-PVB cohort (39) had a mastectomy. In addition, 45 patients with

PVB had immediate tissue expander reconstruction and only 14 patients in the non-PVB group. Of patients with PVB, 53.3% (129) had a sentinel lymph node biopsy (SLN) and 33.5% (81) had full axillary dissections. Of patients in the non-PVB, 35.8% (34) had no axillary staging and 44.2% (42) underwent SLN. Also, 229 patients with PVB and 78 patients without PVB had a general anesthetic. Only 3.3% of patients with PVB and 4.2% of patients without PVB had postoperative nausea ($P = 0.746$). One patient with PVB and no patients without PVB reported emesis in the PACU ($P = 1$). There was no difference in morphine equivalents ($P = 0.234$) or in pain scores ($P = 0.521$) between the 2 groups in the PACU. There was no difference in amount of morphine equivalents given on POD0 ($P = 0.8$) or POD1 ($P = 0.079$). The reconstruction patients with PVB used less opioid analgesic on POD1 compared with the non-PVB reconstruction group ($P = 0.02$).

Conclusions. Patients undergoing breast cancer surgery who have paravertebral blocks have similar postoperative nausea and vomiting and similar postoperative pain scores compared with patients without paravertebral blocks. PVB may have an important role in decreasing postoperative pain and opioid analgesic usage in patients electing to have immediate breast reconstruction with tissue expanders.

In the United States, 1 in 8 women will develop breast cancer.¹ In 2010 it was estimated that 207,090 women in the United States will be diagnosed with breast cancer (www.cancer.gov). The majority of these women diagnosed with breast cancer will undergo some type of primary breast surgery and axillary staging for curative intent.² Multiple studies have shown that breast surgery is associated with significant postoperative pain, nausea, vomiting, and chronic pain.^{1,3,4} The cause is multifactorial, but general anesthesia is associated with a 50% incidence of nausea and vomiting among breast cancer surgery patients.¹ Paravertebral blocks

(PVB) are a type of regional anesthesia that is characterized by a blockade of several dermatomes and spinal nerves providing adequate control of pain.⁵ The proposed benefits of regional anesthesia or PVB are decreased “stress” response, improved postoperative pain control, improved postoperative pulmonary function, decreased cancer recurrence, and reduction in thrombotic events.^{2,6-9} Several studies have reported a decrease in both postoperative pain and postoperative nausea and vomiting (PONV) among patients receiving PVB. Convey et al. showed that 20% of patients with PVB required medications for PONV compared with 39% of patients with general anesthesia (GA).⁶ This group also showed a significant decrease in the amount of postoperative opioid analgesic requirements among the PVB group compared with the GA group, 25% compared with 98%, respectively.⁶ Moller and colleagues found that multilevel PVB provided good analgesia during the recovery room phase, but showed no difference after discharge from the PACU.¹⁰ A recent prospective randomized trial by Boughy et al. showed a significant decrease in postoperative pain up to 3 h among PVB patients. They did not find a difference in PONV between the 2 study groups.² PVB are associated with a 2.3–5% complication risk.^{11,12} Potential complications include inadvertent pleural puncture, epidural spread, and hypotension.^{11,12}

The purpose of this study was to look at a single institutions’ experience with PVB and postoperative pain and PONV among breast cancer patients undergoing primary breast surgery with or without axillary surgery.

METHODS

An Institutional Review Board approved, retrospective chart review from January 2007 to December 2009 was performed at a single institution. Charts were reviewed for type of breast cancer surgery, axillary surgery, PVB, PONV, postoperative pain score, dosages of pain medication, and antiemetic medication given in the Post Anesthesia Care Unit (PACU), and during the postoperative days (POD). Pain scores were recorded as a numerical value from 0 to 10 with 10 being the most intense and severe pain. The postoperative opioid analgesic amount was recorded in equivalent morphine doses to standardize the opioid analgesic dosages. An opioid analgesic converter from *globalRPh.com* was used to standardize all the opioid analgesics to morphine equivalence doses. The study population consisted of females with a diagnosis of breast cancer undergoing breast cancer surgery, with or without axillary surgery. Women having immediate breast reconstruction with tissue expanders were also included in the study. Patients were excluded from the study if they had simultaneous myocutaneous tissue flap breast

reconstruction, additional surgical procedures such as mediport or radiation device implants, used continuous delivery of postoperative pain medications via epidural, on Q-pain pump, or patient-controlled access (PCA), had a history of chronic pain, or were taking chronic antiemetics or pain medication prior to surgery. All patients received standard perioperative medications per the anesthesia department. The perioperative medications were a regimen of any of the following: famotidine, ondansetron, metoclopramide, midazolam, or dexamethasone.

Paravertebral Block Technique

Several techniques for paravertebral blocks exist and may be performed with or without ultrasound guidance. The anesthesiologist performed the PVB on the patients in the cohort while the patients were in the preoperative area at least 30 minutes prior to surgery. The patients were placed in a sitting position, resting arms on a table with head and neck flexed and shoulders relaxed. The position is similar to the one taken for the placement of epidural catheters. The superior aspects of the spinous processes were marked for T1–T6. The entry sites were marked 2.5 cm lateral to the spinous process marks on the intended block side. The skin was prepared with a 2% chlorhexidine gluconate 70% isopropyl alcohol prep and aseptic technique was used throughout the procedure. A 22-gauge Tuohy needle or spinal needle was attached to extension tubing and a syringe filled with 0.25% bupivacaine. Lidocaine (1%) was used to anesthetize the skin over the entry sites. The Tuohy needle was then inserted perpendicular to the skin until it came in contact with the transverse process. Then the needle was redirected caudad or cephalad and advanced until a loss of resistance or a “pop” was felt; approximately 1–1.5 cm. Bedside ultrasound was also used by anesthesia to confirm proper placement of the needle for performing PVB. The needle was aspirated, if no blood, air, or spinal fluid was encountered then 4 ml of long-acting local anesthetic (i.e., bupivacaine) was injected at each level.

Statistics

Frequency and descriptive statistics were calculated using Fisher exact test and chi-square for categorical variables and *t* test for continuous variables. *P* values < 0.05 were considered significant.

RESULTS

A total of 419 patients underwent primary breast cancer surgery during the given time period, of which 337 patients were able to be included in the study. There were 82

TABLE 1 Demographic information

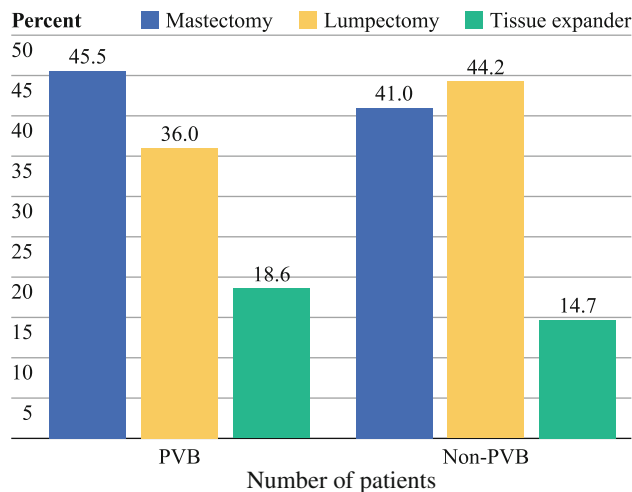
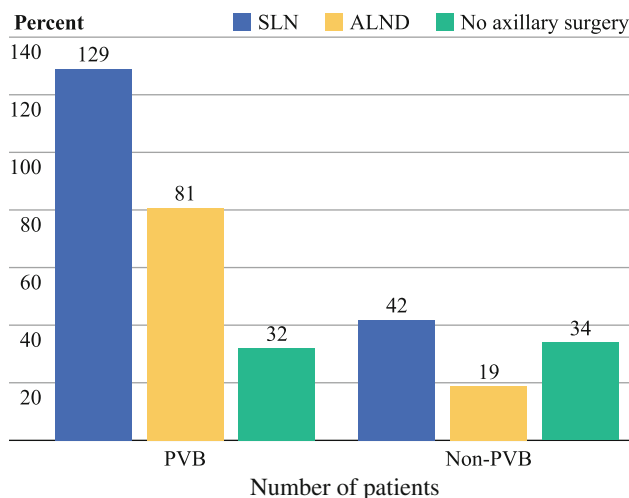
	PVB	Non-PVB
Mean age	58.1	60.02
Mean BMI	29.1	28.5
Race (%)		
White	86.9	80
Black	12.4	18.3
Other	<1	<1
ASA class	2	2

patients who did not meet initial inclusion criteria and were excluded from the study. Of the 337 patients, 71.8% ($n = 242$) had PVB and 28.2% ($n = 95$) did not have PVB. The mean age of study participants was 59.5 years. The mean BMI was 28.7 kg/m². Table 1 shows the breakdown of demographic information between the PVB group and the non-PVB group. There were no statistical differences between the two groups. Of the patients receiving PVB, no adverse outcomes (inadvertent pleural puncture, epidural spread, or hypotension) were recorded.

Figure 1 shows the breakdown by percentage for the different types of surgeries in each cohort. Of patients in the PVB cohort 45.5% ($n = 110$) had a mastectomy and 36% ($n = 87$) had a lumpectomy. The distribution of lumpectomy (44.2%) and mastectomy (41.1%) was similar for the non-PVB cohort. There was a statistically significant association between surgery type and PVB (P value < 0.0001). Also, 73.8% of all mastectomy patients and 67.4% of patients with lumpectomies had a PVB. Significantly, more patients with tissue expander reconstruction (76.3%) had PVB. Thus, patients having less extensive breast surgery were less likely to undergo PVB at our institution.

There was a statistically significant association between axillary surgery and PVB (P value < 0.0001). Specifically, 75.4% of all patients receiving SLN had a PVB and 81% of patients with full axillary dissection (ALND) had a PVB. Also, 86.8% of patients with PVB ($n = 210$) and 64.2% of patients without PVB ($n = 61$) had axillary surgery. Figure 2 depicts the breakdown of axillary surgery for each cohort. Of patients with PVB, 53.3% ($n = 129$) had a sentinel lymph node biopsy (SLN), and 33.5% (81) had ALND. Of patients without PVB, 35.8% ($n = 34$) had no axillary staging, and 44.2% (42) underwent SLN. Only 20% ($n = 19$) of patients in the non-PVB cohort had ALND.

The majority of patients included in the study had a general anesthetic; 95% ($n = 229$) of patients in the PVB cohort and 81.1% ($n = 77$) of patients in the non-PVB cohort had a general anesthetic. Only 3.3% of patients with PVB and 4.2% of patients without PVB had postoperative nausea ($P = 0.746$). One patient in the entire study

**FIG. 1** Percentage of different surgeries for PVB and non-PVB cohorts**FIG. 2** The different axillary surgeries for both PVB and non-PVB cohorts

population was reported to have emesis in the PACU, and this patient belonged to the PVB cohort ($P = 1$). When patients receiving IV sedation and local anesthesia were removed from the analysis, there was still no difference in PONV between the 2 cohorts. All patients received a pre-operative and intraoperative regimen of medications for nausea. The medications given were similar, and there were no significant differences in the dosages given between the 2 cohorts.

There was no difference in morphine equivalents ($P = 0.234$) or in pain scores ($P = 0.521$) between the 2 groups in the PACU. Of patients in the PVB group, 60% ($n = 145$) required pain medication in the PACU, and of patients in the non-PVB cohort 55.8% ($n = 53$) required pain medication in the PACU. There was no statistical difference in amount of morphine equivalents given on POD0

TABLE 2 Average postoperative morphine equivalent dosage for the PVB and non-PVB groups

	PVB (mean mg/day)	Non-PVB (mean mg/day)	<i>P</i> value (<i>P</i> < 0.05)
RR (<i>n</i> = 145,53)	6.52	7.5	0.234
POD 0 (<i>n</i> = 211,84)	5.7	6.02	0.8
POD 1 (<i>n</i> = 129,33)	14.81	21.2	0.079
POD 2 (<i>n</i> = 28,5)	10.57	18	0.244

TABLE 3 Average postoperative morphine equivalent dosage for tissue expander reconstruction patients

	PVB (mg/day)	Non-PVB (mg/day)	<i>P</i> value (<i>P</i> < 0.05)
RR (<i>n</i> = 34,12)	6.95	9.42	0.153
POD 0 (<i>n</i> = 38,11)	8.97	8.36	0.869
POD 1 (<i>n</i> = 37,10)	25.3	42.8	0.02

(*P* = 0.8) between the 2 groups. However, on POD1 patients receiving PVB trended toward less morphine equivalent use compared with patients without a PVB (*P* = 0.079). Table 2 depicts the mean milligrams of morphine equivalents used by each cohort for each POD recorded. A subset analysis of patients undergoing immediate tissue expander reconstruction showed that reconstruction patients receiving PVB had a significantly lower morphine equivalent usage (25.3 mg) on POD1 compared with patients who had reconstruction but no PVB (42.8 mg) with a *P* value of 0.02. Table 3 displays the mean morphine equivalent usage in milligrams for each study group on each recorded POD.

The average pain score in the PACU and on all postoperative days was not significant between the 2 cohorts. The mean pain score on POD1 for the PVB group was 1.83, and the mean pain score for the non-PVB group was 1.89 with a *P* value of 0.898.

Patients receiving PVB had a longer length of surgery and a longer length of stay. The average length of surgery for the PVB cohort was 135 min compared with 116 min for the non-PVB group (*P* = 0.05). The mean length of stay for the PVB group was 0.83 and 0.58 days for the non-PVB group (*P* = 0.04). When mastectomy and immediate reconstruction patients were excluded, the length of stay between the PVB and non-PVB groups were similar: 46.7% (*n* = 113) of patients in the PVB group and 65.3% (*n* = 62) of patients in the non-PVB group were discharged home on POD0.

DISCUSSION

The demographic data between the 2 cohorts was similar with respect to age, BMI, race, and ASA class. Almost all

patients in the study received general anesthesia and had their surgery performed by 1 of the 2 breast surgeons involved in the study. The PVBs were performed by a small group of anesthesiologists who used the same technique.

The study showed no difference in PONV between the PVB and non-PVB groups. This finding is consistent with multiple published reports looking at PVB and PONV.² The majority of breast cancer patients undergoing surgery received a preoperative and intraoperative regimen of antiemetics to prevent or decrease postoperative nausea and vomiting. Breast cancer surgery is associated with a very high rate of nausea and vomiting.¹ This knowledge has led to consistent dosing of perioperative antiemetics by our anesthesia team and is likely responsible for the lack of difference in PONV between the 2 cohorts.

There was no statistically significant difference in morphine equivalent use in the recovery room or on POD1. However, the patients in the PVB group did show a trend to less morphine equivalent use on POD1. The lack of significant difference may be due to the significantly larger portion of tissue expander reconstruction and the higher rates of axillary surgery among the PVB cohort. One interesting finding on subset analysis of postoperative morphine equivalent use was that patients with tissue expander reconstruction who received a PVB used significantly less opioid analgesic than patients with tissue expander reconstruction and no PVB. This finding suggests that PVB may have an important role in decreasing postoperative pain and decreasing opioid analgesic use among breast cancer patients choosing to have immediate tissue expander reconstruction. This finding requires further investigation to the role of PVB in breast cancer reconstruction surgery.

Postoperative pain scores were not significantly different between the 2 cohorts. This is a significant finding considering that the majority of patients in the PVB cohort had mastectomies, tissue expander reconstruction, and either SLN or ALND. Patients in the non-PVB cohort mostly had lumpectomies as their primary breast surgery, and a large percentage of patients in this cohort had no axillary surgery. Patients in the PVB group were more likely to have more involved surgeries compared with the non-PVB group and yet had no differences in reported postoperative pain scores. The lack of difference in pain scores may indicate a benefit of pain control from the PVBs. However, a future study using a larger control group and a preset pain medication regimen may give a more accurate depiction of the role of PVB in postoperative pain control.

Significantly more patients with mastectomies, lumpectomies, tissue expander reconstruction, and axillary surgery had PVBs. The PVB cohort had longer surgery

lengths and increased length of stay compared with the non-PVB cohort. The increased length of surgery is likely attributed to the more complex breast surgery and increased axillary surgery among the PVB group. The significance of the difference in length of stay between the 2 cohorts is difficult to assess. Many factors affect when a patient is ready for discharge including timing of surgery during the day. Patients who have surgery later in the afternoon may be more likely to be admitted overnight than their counterparts who had surgery in the morning, thus affecting the length of stay. We did not account for what time of day patients were having surgery, and this may have impacted our findings of increased length of stay for patients with PVB. When lumpectomies for each cohort were evaluated, the length of surgery and stay was similar between the 2 groups.

This study does have several limitations. First, the study design is a retrospective chart review. Not all the charts had consistently recorded the postoperative pain scores and the timing or frequency of the pain scores varied greatly. It was also difficult to identify the relationship of the pain score and administration of pain medication. Some pain scores may have been high because they were taken just prior to the administration of pain medication, and other scores may have been low because they were recorded just after the administration of pain medications. There was no standard postoperative pain medication regimen. Patients received different types of opioid analgesic. The dosages of each opioid analgesic were converted to an equivalent morphine dose. Another limitation was the use of NSAIDs and the role they play in post operative pain control. Some of the patients did receive postoperative NSAIDs, and this was not evaluated for its role in pain control among the cohorts. Another limitation of the study was the adequacy of the PVB. There was no record in the charts indicating whether the blocks were successful or not. The anesthesia group states that they test to confirm block adequacy, but do not record it in the chart. The literature states that block failure rate is approximately 9–15%.^{6,9} To better understand the impact of PVB on postoperative pain control, one must know the success rate of the blocks. If the percentage of unsuccessful PVB was high, then it may have impacted the outcomes and may explain why there is little to no difference in postoperative pain between the PVB group and the non-PVB group. A final and significant limitation of this study is the significantly different types of breast

and axillary surgeries performed in each cohort. A future study looking at a more appropriate control group matched for similarities among the primary breast surgery and axillary surgery would help to determine the true benefit of PVB among breast cancer surgery.

In conclusion, this study demonstrates that PVB can be easily and safely administered for postoperative pain control after breast surgery. Despite the limitations of this study, there is support for PVB in postoperative pain control particularly in patients undergoing immediate breast reconstruction.

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