Ann Surg Oncol (2013) 20:1282–1286
DOI 10.1245/s10434-012-2678-7

Annals of
SURGICAL ONCOLOGY
OFFICIAL JOURNAL OF THE SOCIETY OF SURGICAL ONCOLOGY

ORIGINAL ARTICLE – BREAST ONCOLOGY

Use of Preoperative Paravertebral Block Decreases Length of Stay in Patients Undergoing Mastectomy Plus Immediate Reconstruction

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ABSTRACT

Background. A prior study in patients undergoing breast surgery with and without the use of paravertebral blocks (PVB) found no significant difference in patient length of stay (LOS). However, patients undergoing bilateral procedures and those undergoing immediate reconstructions were excluded. We sought to determine if the use of PVB in patients undergoing unilateral or bilateral mastectomy plus immediate reconstruction decreases patient LOS.

Methods. We undertook a retrospective review of patients who had mastectomies with immediate reconstructions with and without the use of preoperative PVB. Outcomes including LOS, postoperative nausea and vomiting, and time to oral narcotics were compared between groups.

Results. Mean LOS for the PVB group was 42 h. This was significantly less than the mean LOS of 47 h for the nonblock group ($p = .0015$). The significantly lower LOS for the PVB group was true for patients undergoing bilateral procedures ($p = .045$), unilateral procedures ($p = .0031$), tissue expander placement ($p = .0114$), and immediate implant placement ($p = .037$). Mean time to conversion to oral narcotics was significantly shorter in the PVB group (15 h) compared with the nonblock group (20 h) ($p < .001$). The incidence of postoperative nausea in the PVB group (42.8 %) was also significantly less than in the nonblock group (54.7 %) ($p = .031$).

Conclusions. The routine use of preoperative PVB in patients undergoing mastectomy plus immediate reconstruction significantly decreased patient LOS. In addition to improved pain control from the block itself, quicker conversion to oral narcotics because of less postoperative nausea likely contributed to a decreased LOS.

First Received: 7 April 2012;
Published Online: 14 October 2012

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An estimated 230,480 women will be diagnosed with invasive breast cancer in 2011 and an additional 57,650 will be diagnosed with ductal carcinoma in situ.[1] The majority of these breast cancers will be managed surgically by either lumpectomy or mastectomy. Evidence from large, randomized controlled trials has demonstrated that lumpectomy plus radiation is equivalent to mastectomy in terms of overall and disease-free survival.[2–4] Because of this, the National Institutes of Health issued a consensus statement in 1990, advocating breast conservation therapy (BCT) instead of mastectomy as the preferred treatment of early-stage breast cancer.[5] Consequently, the use of BCT for stage I breast cancer increased from 35 % in 1985 to 60 % in 1995, as mastectomy rates simultaneously decreased.[6]

Nationwide trends continued to show a decrease in the use of mastectomy for the treatment of breast cancer from 2000 to 2006. However, during this same time period, patients who treated their primary cancer with mastectomy increasingly decided to undergo a contralateral prophylactic mastectomy.[7] Contralateral prophylactic mastectomy rates in the United States more than doubled from 1998 to 2003, going from 4.2 to 11.0 % in breast cancer patients undergoing unilateral mastectomy.[8] Possible explanations for this increase include enhanced availability of genetic testing, preoperative use of breast MRI, and greater patient education regarding reconstruction options. A recent study

showed that immediate and early breast reconstruction rates in the Unites States have risen from 12 % in 1998 to 23 % in 2007.[9]

With more women opting for bilateral mastectomy with reconstruction, it is important to consider the impact this has on rising healthcare costs. Patients undergoing bilateral mastectomy with reconstruction have significantly higher postoperative pain than patients undergoing BCT. Most patients treated with mastectomy and reconstruction require hospitalization because of the length of surgical procedure and time under general anesthesia and for immediate postoperative pain control. The use of preoperative paravertebral blocks (PVB) in breast surgery patients can help decrease postoperative pain, a concept first introduced by Weltz and colleagues in 1995.[10] Published data on the use of PVB for breast surgery has consistently revealed a reduction in pain scores and opioid consumption.[11–16]

If breast surgery patients have improved pain control with the use of PVB, this can positively impact length of stay (LOS) as documented by Boughey.[12] However, her study and most other PVB studies excluded patients undergoing bilateral procedures and immediate reconstructions.[10–15,17] We decided to initiate a study of PVB to determine if the use of preoperative PVB in patients undergoing unilateral or bilateral mastectomy plus immediate reconstruction decreases patient LOS and to identify factors that contribute to its success.

METHODS

Institutional review board approval was obtained for this study. Patients who underwent PVB prior to unilateral or bilateral mastectomy with immediate tissue expander or implant reconstruction at the Massachusetts General Hospital in 2010 were identified from a prospectively maintained regional block database. All patients who underwent similar procedures without PVB in 2008 were also identified. Review of electronic and paper medical records was performed, and outcomes were compared between the PVB group and the nonblock group.

The use of preoperative PVB began at our institution in 2008, and by 2010 all patients undergoing mastectomy plus immediate reconstruction were offered a PVB. A total of 24 patients had PVB in 2008 compared with 190 patients who had PVB in 2010. The 24 patients who received PVB in 2008 were excluded from this study. We chose to look at the 2010 calendar year because by that time a dedicated block service had been established and the technique had become standardized among providers.

Patients in the PVB group had their unilateral and bilateral PVB placed preoperatively. All PVB were placed by a dedicated block service, including an experienced attending anesthesiologist and a resident. Blocks were performed with patients in the prone position and with full cardiovascular monitoring, including noninvasive blood pressure, pulse oximetry, and EKG. Supplemental oxygen was provided. Patients were sedated with 1–2 mg of Versed and 50–100 mcg of fentanyl. All PVB were placed under ultrasound guidance using a 5–15 MHz linear array transducer and a 22-gauge Pajunk facet tipped block needle. The majority of blocks involved a single injection of approximately 15 cc of 0.5 % bupivacaine with epinephrine 1:400,000 on 1 side or bilaterally at the T3 level (Fig. 1). Block efficacy was evaluated by changes in temperature and pinprick sensation. Technical failures were not excluded from this study. A routine chest x-ray was not performed after block placement.

All PVB patients underwent general anesthesia and surgery as scheduled. Intraoperatively, all patients (with 1 exception) received antiemetics at the discretion of the anesthesia team. Antiemetics included 1 or a combination of the following medications: ondansetron, haloperidol, metoclopramide, dexamethasone, and/or scopolamine. In addition, patients received small amounts of dilaudid and/or fentanyl intraoperatively.

All patients were admitted for at least 1 inpatient night stay. Patients were considered ready for discharge when they were tolerating oral intake, ambulating independently, and their pain was controlled without the use of

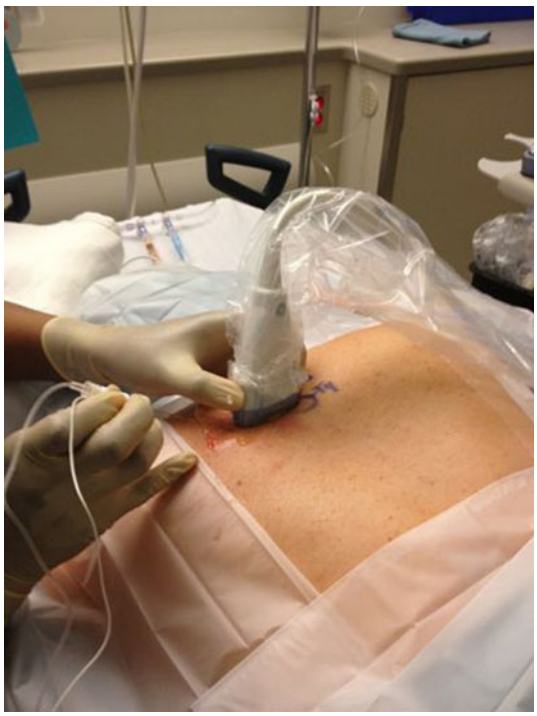

FIG. 1 Ultrasound-guided paravertebral block placement

intravenous narcotics. The LOS, postoperative nausea and vomiting, and time to conversion to oral narcotics were determined by chart review. The LOS was counted from the beginning of the surgical procedure to the time of discharge and was rounded to the nearest hour. A patient was deemed to have nausea if antiemetics were administered postoperatively. A patient was considered to have vomiting if an episode of vomiting was documented in her intake and output records. Time to conversion to oral narcotics was defined as the time from end of surgery to the time when a patient received her last dose of intravenous narcotics.

The PVB group and the nonblock group were analyzed separately then compared. Additional analyses of LOS based on laterality of procedure and type of reconstruction were also performed. Continuous variables were evaluated using *t* test, while categorical variables were evaluated using chi-square or Fisher exact test. The *p* values less than .05 were considered statistically significant. Statistical analyses were performed using The R Project for Statistical Computing.

RESULTS

A total of 190 patients underwent preoperative PVB prior to mastectomy with immediate reconstruction in 2010. Mean patient age was 47 years (range, 19–72). Mean body mass index (BMI) was 24.8 kg/m^2 (range, 17.3–53.4). Mastectomy was performed for cancer in 160 (84.2 %) patients and for prophylaxis in 30 patients (15.8 %). Axillary staging at the time of mastectomy included 112 sentinel lymph node biopsies (SLNB) (58.9 %), 41 axillary lymph node dissections (ALND) (21.6 %), and no axillary surgery in 37 (19.5 %). There were 118 patients (62.1 %) who underwent bilateral mastectomy with reconstruction, while 72 patients (37.9 %) had unilateral procedures. Tissue expanders were placed in 105 patients (55.3 %), and immediate implants were placed in 84 (44.2 %). There was 1 patient (0.5 %) who elected to have no reconstruction.

The PVB group was compared with 154 patients who underwent mastectomy and immediate reconstruction without the use of PVB in 2008 (Table 1). Patient age, BMI, indication for surgery, and laterality of procedure were similar between groups. However, there were significantly more tissue expanders than immediate implants placed ($p = .048$) and significantly more ALND performed ($p < .001$) in the PVB group. This was important to note because the axilla, which receives sensory innervation from both cervical and upper thoracic nerve roots, may not have complete sensory blockade with the PVB.

Mean LOS for the PVB group was 42 h (range, 17–101). This was significantly less than the mean LOS of 47 h (range 19–102) for the nonblock group ($p = .0015$). The significantly lower LOS for the PVB group was true for patients undergoing bilateral procedures ($p = .045$), unilateral procedures ($p = .0031$), tissue expander placement ($p = .0114$), and immediate implant placement ($p = .037$) (Table 2). While the mean number of hospital nights for the PVB group (1.77 nights, ±0.60) and the nonblock group (1.95 nights, ±0.69) were similar, the difference was statistically significant ($p = .0078$). Only 23.4 % (36 of 154) of patients in the nonblock group stayed only 1 night compared with 32.1 % (61 of 190) of the PVB group.

TABLE 1 Comparison of PVB group to nonblock group

	PVB group ($n = 190$)	Nonblock group ($n = 154$)	*p* value
Age (years), mean (range)	47 (19–72)	48 (29–76)	.52
BMI (kg/m^2), mean (range)	24.8 (17.3–53.4)	25.2 (17.8–40.5)	.45
Indication for surgery			
Cancer	160 (84.2 %)	128 (83.1 %)	.78
Prophylactic	30 (15.8 %)	26 (16.9 %)	
Laterality of procedure			
Unilateral	72 (37.9 %)	58 (37.7 %)	.96
Bilateral	118 (62.1 %)	96 (62.3 %)	
Reconstruction type			
Expanders	105 (55.3 %)	69 (44.8 %)	.048
Implant	84 (44.2 %)	85 (55.2 %)	
None	1 (0.5 %)	0 (0.0 %)	
Axillary surgery type			
ALND	41 (21.6 %)	11 (7.1 %)	<.001
SLNB	112 (58.9 %)	113 (73.4 %)	
None	37 (19.5 %)	30 (19.5 %)	

PVB paravertebral block, *BMI* body mass index, *ALND* axillary lymph node dissection, *SLNB* sentinel lymph node biopsy

The mean time from completion of surgery to conversion to oral narcotics was significantly shorter in the PVB group (15 h; range, 0–64) compared with the nonblock group (20 h; range, 0–63) ($p < .001$). The incidence of postoperative nausea in the PVB group (42.8 %) was significantly less than in the nonblock group (54.7 %) ($p = .031$), while there was no significant difference in the incidence of vomiting between groups (16.9 vs 22.7 %, $p = .24$). Technical block failures occurred in 14 patients (7.4 %) who underwent PVB. There were no major adverse events (nerve damage, pneumothorax, or vascular puncture) from PVB placement.

DISCUSSION

Our study is the first to show that the routine use of preoperative PVB in patients undergoing mastectomy plus

TABLE 2 Length of stay based on procedure type comparing PVB group to nonblock group

Mean LOS (hrs ± SD)	Type of procedure				
	All types	Bilaterals	Unilaterals	Tissue expanders	Implants
PVB group	42 (±14)	47 (±13)	33 (±11)	43 (±15)	41 (±13)
Nonblock group	47 (±16)	51 (±14)	41 (±17)	49 (±16)	46 (±16)
p value	.0015	.045	.0031	.011	.037

LOS length of stay, *hrs* hours, *SD* standard deviation, *PVB* paravertebral block

immediate tissue expander or implant reconstruction significantly decreased patient LOS. This was seen in patients undergoing both unilateral and bilateral procedures. In contrast, when Boughey and colleagues performed a prospective, randomized trial of PVB versus no PVB in patients undergoing lumpectomy plus SLNB or ALND, mastectomy alone, mastectomy plus SLNB or ALND, and ALND alone, they found no significant difference in LOS.[11] However, patients undergoing bilateral procedures or immediate reconstructions were excluded from participation. Interestingly, this is a patient population in whom PVB may have the most benefit as they have higher pain levels and an overall longer LOS compared with patients undergoing BCT or mastectomy without reconstruction.

With more patients choosing bilateral mastectomies with immediate reconstruction, we thought it was important to consider the benefits of PVB in this population.[8,9] Undergoing longer bouts of general anesthesia and technically more involved procedures predisposes these patients to postoperative nausea, vomiting, and surgical site pain. Knowing that PVB has provided other breast surgery patients with improved pain control, we set out to prove its usefulness in this cohort of patients.[11–17] Because our study was retrospective, pain scores at standardized time intervals were not reliably recorded. Instead of pain scores, we calculated time to conversion to oral narcotics without the use of rescue intravenous narcotics as a measure of pain control. This was useful because conversion to oral narcotics was also 1 of our criteria for patient discharge. We found that time to conversion to oral narcotics was significantly shorter in the PVB group, occurring 5 h sooner. While no other study has specifically commented on time to conversion to oral narcotics, most have documented significantly lower pain scores with PVB.[12–15,17] The reported duration of pain relief provided by PVB in breast surgery patients has ranged from 1–2 h (time in PACU) to up to 12 h postoperatively, as measured by pain scores.[12–15,17] In addition, opioid consumption in the postoperative PACU setting has consistently been lower in PVB patients compared with patients with no PVB.[13,17] Few studies have addressed opioid consumption after discharge from the PACU, and when they have, results have been conflicting.[13,4,17]

Previous studies of PVB without general anesthesia for breast surgery have all documented improved rates of postoperative nausea and vomiting (PONV).[14,18,19] Comparing the incidence of PONV between patients receiving PVB plus general anesthesia versus general anesthesia alone has proven less reliable.[11,13] When patients were given a prophylactic antiemetic regimen of promethazine, dexamethasone, and ondansetron, Boughey's group found no significant difference in PONV rates.[11] When Kairaluoma and colleagues omitted prophylactic antiemetics for all patients in both their general anesthesia alone group and their general anesthesia plus PVB group, they found that patients undergoing PVB had significantly less PONV.[13] In our study, all but 1 patient received prophylactic antiemetics. We found that patients in the PVB group had significantly less nausea compared with the nonblock group, but there was no significant difference in the incidence of vomiting. The use of PVB may decrease postoperative nausea by allowing for a reduction in intraoperative and postoperative narcotic usage. Additional studies using a standardized antiemetic regimen in both groups would need to be performed in order to verify results for this patient population.

In our study, we found a wide discrepancy between time to conversion to oral narcotics and time to patient discharge in both the PVB group and the nonblock group. In fact, this mean time difference was 27 h for both groups. This highlights that even though breast surgery patients may have adequate pain control using an oral narcotic regimen (and therefore meet 1 criterion for hospital discharge), this may not be enough to encourage a timely discharge. Other factors including patient anxiety and expectation of LOS may contribute to an extended hospital stay. Educating breast surgery patients, as well as nursing staff and house staff, as to the expected postoperative course in the setting of a PVB may further decrease LOS in this population. The creation of a standardized, preoperative antiemetic regimen and a standardized, postoperative order set, which includes criteria for oral and intravenous narcotics, anti-anxiety medications, and patient activity, has the potential to aid in this process. Future studies of PVB in breast surgery patients after implementation of standardized order sets will need to be performed to see if this reduces LOS even

further. Additionally, a cost analysis to document whether a significant decrease in LOS with PVB amounts to a significant cost savings for the hospital will be forthcoming. While a 5 h reduction in mean patient LOS may sound negligible, in a large high-volume center with occupancy rates often near maximum capacity, timely discharges could lessen overall hospital costs.

Our study is limited by its retrospective nature. Pain scores were not recorded at regular time intervals after discharge from the PACU, which limited comparison between the 2 groups. Patients also did not receive standardized antiemetic and narcotic regimens. Furthermore, we did not take into account the impact of ALND on the efficacy of PVB. The latter is something we hope to address in a future study comparing the efficacy of PVB alone versus PVB plus cervical block in patients undergoing mastectomy plus ALND with immediate reconstruction. Regardless of its limitations, there are several important strengths of this study, including the large number of patients in each group and the fact that this was the first study to look at the effect of PVB in patients undergoing unilateral and bilateral mastectomy with immediate reconstruction.

In conclusion, we found that the routine use of preoperative PVB in patients undergoing unilateral or bilateral mastectomy plus immediate tissue expander or implant reconstruction significantly decreased patient LOS. In addition to improved pain control from the block itself, quicker conversion to oral narcotics because of less postoperative nausea likely contributed to a decreased LOS.

ACKNOWLEDGMENT The authors would like to thank Eric Coopey MCS for his assistance with the statistical analysis portion of this study.

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