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Title

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Permalink

<https://escholarship.org/uc/item/2v9173z8>

Journal

Anesthesiology and pain medicine, 6(5)

ISSN

2228-7523

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Publication Date

2016-10-01

DOI

10.5812/aapm.39476

Peer reviewed

Treatment of Post-Latissimus Dorsi Flap Breast Reconstruction Pain With Continuous Paravertebral Nerve Blocks: A Retrospective Review

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Received 2016 May 12; Revised 2016 June 24; Accepted 2016 June 26.

Abstract

Objectives: The addition of a perioperative continuous paravertebral nerve block (cPVB) to a single-injection thoracic paravertebral nerve block (tPVB) has demonstrated improved analgesia in breast surgery. However, its use following isolated post-mastectomy reconstruction using a latissimus dorsi flap (LDF) has not previously been examined.

Methods: We performed a retrospective review of patients who underwent salvage breast reconstruction with a unilateral LDF by a single surgeon. Preoperatively, all patients received a single-injection tPVB with 0.5% ropivacaine. Additionally, patients had the option for catheter placement to receive a continuous 0.2% ropivacaine infusion with intermittent boluses. Infusions commenced in the recovery room and the catheters were removed on the morning of discharge. The primary endpoint was the mean pain numeric rating scale (NRS) scores for the 24-hour period beginning at 7:00 on post-operative day 1.

Results: A total of 22 patients were included in this study (11-cPVB and 11-tPVB). The mean NRS pain score of cPVB patients (3.5 (standard deviation (SD) 1.8) was lower than that of the single-injection tPVB patients (4.4 (SD 2.1), however this difference was not statistically significant ($P = 0.31$). The length of hospital stay and opioid use was not statistically different between groups.

Conclusions: Patients receiving a cPVB in addition to tPVB after LDF reconstruction experienced similar pain to those receiving tPVB alone. A larger, randomized clinical trial is warranted to fully determine the benefits of using cPVB in addition to tPVB for this procedure.

Keywords: Latissimus Dorsi Flap, Continuous Paravertebral Catheter, Breast Reconstruction

1. Background

Breast cancer affects millions annually, worldwide (1). Each year more than 35,000 women undergo mastectomy (2). The disfiguring nature of this procedure often induces physical and psychological distress and may lead to significant chronic postmastectomy pain (3-8). Breast reconstruction offers patients an option that can help them move past the trauma of cancer and loss of psychological and social wellbeing following mastectomy (9). Breast reconstruction following mastectomy has increased 21% since 2000, with over 95,000 reconstructions performed in 2013 (10).

The most prevalent form of breast reconstruction involves the use of implants (11). However, implants are not without their risks and complications related to radiation, infection and poor wound healing often result in a poor reconstructive outcome (12-15). After implant failure, patients may be offered a salvage reconstruction option with the latissimus dorsi flap (LDF) as this flap utilizes

healthy muscle with excellent and consistent vascular supply (16). However, repositioning the latissimus dorsi muscle may result in moderate-to-severe postoperative pain, sometimes leading to persistent post-surgical pain lasting months or years with incidence rates as high as 10% (17). Additionally, patients may have donor-site or shoulder morbidity associated with the procedure (18-21). As a result, it has been standard of care at our institution to offer patients a preoperative, single-injection thoracic paravertebral block (tPVB) to improve perioperative and long-term analgesia.

Recently, it has been demonstrated that the use of a continuous paravertebral block (cPVB) in addition to a single-injection tPVB has reduced the incidence of chronic postmastectomy pain (22). Additionally, numerous studies have demonstrated the benefit of both cPVB and tPVB in breast cancer and other surgery (23-28). Currently, no published data assesses the use of a cPVB following isolated breast reconstruction with a LDF.

2. Objectives

We theorized that the use of cPVB in addition to single-injection tPVB would be associated with superior analgesia in the acute postoperative period compared with tPVB alone. We executed this retrospective review to help determine if a prospective, randomized trial is warranted.

3. Methods

After local institutional review board (University of California, San Diego) approval, we retrospectively examined the electronic medical record of patients who underwent a post-mastectomy salvage breast reconstruction with a unilateral myocutaneous LDF with a single surgeon (AMW) at the University of California, San Diego between 2013 and 2015. The flap reconstruction was done at a separate operation from the initial mastectomy. To ensure that each patient's pain was associated with the LDF reconstruction and not the concomitant pain from a mastectomy and a reconstruction, we included only patients who did not have their reconstruction at the time of their mastectomy.

On the day of surgery, preoperatively, all patients received a single-injection of 15mL 0.5% ropivacaine with epinephrine under an ultrasound-guidance protocol previously described. For patients receiving a cPVB, a catheter was inserted immediately after initial single-injection tPVB, using a previously described ultrasound-guided protocol (29). In the operating room, all subjects received a general anesthetic, with induction using intravenous (IV) propofol that was continued with inhaled volatile anesthetic and nitrous oxide in oxygen. For patients with a cPVB, a continuous perineural infusion of 0.2% ropivacaine (basal infusion rate 6 - 8 mL/hour, "bolus" 4 mL, "lock-out" 30 - 60 min) was initiated in the postoperative anesthesia care unit (PACU) and continued until morning of discharge. Furthermore, all subjects were provided opioid pain medication and acetaminophen for analgesia. Subjects who had received a cPVB in addition to single-injection tPVB were designated as the treatment group; while subjects who only received a single-injection tPVB were designated as the control group.

Our hypothesis was that patients who received a cPVB would have lower pain scores than the control group in the acute postoperative period following LDF breast reconstruction. We assessed patient's pain for a 24 hour period, starting on postoperative day (POD) #1 at 7:00am. This time frame was utilized to allow for washout from the single-injection tPVB and measure the effect of the continuous postoperative infusion. Pain was recorded by nursing staff using the 0 - 10 Likert numeric rating scale

(NRS) for pain (0 = none/no pain, 10 = worst pain imaginable). Our primary outcome measure was the difference in the mean NRS scores for each group during the designated 24 hour postoperative period. Secondary endpoints examined included opioid pain and antiemetic medication usage during the same period. Opioid medication was converted to oral morphine equivalents per kilogram (mEq/kg). Antiemetic medications included ondansetron, metoclopramide, and promethazine. Additionally, length of hospital admission and occurrence of adverse events during any portion of hospitalization were recorded.

3.1. Statistical Analysis

We used all patients undergoing salvage reconstruction with a LDF reconstruction given that this was a retrospective review designed to help determine if a future randomized, controlled trial is warranted (and, if so, to help power the clinical trial). For normally distributed data, comparisons were tested using the t-test, while for nonparametric data the Mann-Whitney test was used. Chi square or Fisher's exact test were used for categorical data. A $P < 0.05$ was considered significant. Statistical analysis was carried out in R 3.2.3.

4. Results

During the 2 year period of the retrospective study, 22 patients underwent LDF breast reconstruction (Table 1). There were 11 patients in the treatment group and 11 patients in the control group. The mean age of patients demonstrated no statistically significant difference between groups.

4.1. NRS Pain Scores

The mean 24 hour postoperative period NRS pain score for treatment group was lower (3.5 (standard deviation (SD) 1.8)) than that of the control group (4.4 (SD 2.1)), however this difference was not statistically significant ($P = 0.31$).

4.2. Morphine Equivalents

The mean total morphine equivalents per kg taken during the 24 hour postoperative period were similar between groups. The treatment group used 0.3 mEq/kg (SD 0.3) compared to 0.3 mEq/kg (SD 0.2) for the control group, $P = 0.81$.

Table 1. Patient Characteristics and Outcomes^a

	CPVB (n = 11)	TPVB (n = 11)	P Value
Age, y	55 (11)	54 (9)	0.94
Morphine (PO equivalents/kg)	0.3 (0.3)	0.3 (0.2)	0.81
Antiemetic Medication Usage	0.7 (0.8)	0.6 (1.2)	0.84
Mean NRS 24-hour postop pain score	3.5 (1.8)	4.4 (2.1)	0.31
Length of stay, d	2.7 (0.5)	2.5 (0.7)	0.29

Abbreviations: CPVB, continuous paravertebral block in addition to tPVB; TPVB, single-shot thoracic paravertebral block; NRS, numeric rating scale.

^aData is reported as means or n (standard deviation).

4.3. Adverse Events/Length of Stay

No patients in either group suffered any perioperative adverse events, including hypotension or catheter-related problems. Antiemetic medication utilization was similar between groups, 0.7 times (SD 0.8) for the treatment group versus to 0.6 times (SD 1.2) for controls, $P = 0.84$. Furthermore, the treatment group did not experience a longer hospitalization. Treatment group patients (2.7 days (SD 0.5)) stayed in the hospital for nearly the same amount of time following their procedure compared to control patients (2.5 days (SD 0.7)), $P = 0.29$.

5. Discussion

Our study demonstrates that the addition of a cPVB in addition to tPVB did not provide a statistically significant benefit in controlling pain in patients undergoing salvage LDF breast reconstruction. With both the growing increase in breast cancer survival and use of breast reconstruction (11), more patients in the future will likely present with complications related to breast reconstruction. The LDF has been often used in plastic surgery for many years given its reliable muscle and blood supply. As a result, it can be expected more women may become suitable candidates for LDF breast reconstruction. Given the pain and other morbidity associated with the LDF (17-21), it is imperative that we examine ways to minimize immediate and long-term sequelae associated with the procedure.

It has been previously demonstrated at our institution that the addition of a cPVB to a single-injection tPVB improves pain one year postoperatively in mastectomy patients (22). After the results of that trial, we began offering cPVB to patients undergoing latissimus dorsi flap reconstruction as an adjunct to standard postoperative care (tPVB). After incorporating the technique for 2 years in patients receiving latissimus dorsi flap breast reconstruction, we thought it important to examine its effects. Keeping in mind the small sample size, the addition of a cPVB

did not provide a benefit to patients in the postoperative period. As this study was not randomized, patients opting to select cPVB may be more likely to anticipate experiencing higher postoperative pain levels than the control group. Additionally, since all patients underwent prior mastectomy, their baseline pain levels are likely to be significantly different. As a result, in a future randomized trial, the effect of cPVB may be significantly different.

While the current healthcare climate puts a significant emphasis on controlling costs and minimizing length of inpatient stays, balancing a patient's long-term physical and psychological well-being are critical to optimal patient care. Given the high rates of chronic postmastectomy pain (8), we must further evaluate if pain during follow-up reconstructive procedures contribute to this phenomenon. Additionally, we must fully assess if methods leading to faster inpatient discharges correlate with improved long term patient outcomes. While our data does not show an improvement in immediate pain control with cPVB, a future clinical trial is warranted to fully determine if the continuous catheter is beneficial and if it provides additional long term benefits.

This study has several limitations. First, the sample size of this study, while sufficient to make a conclusion regarding a small subset of patients at this institution, would be bolstered by a larger sample size. A larger, randomized controlled study could provide more conclusive results and data (activities of daily living (ADLs), time to return to work, long term morbidity) to determine whether the difference in NRS translates to meaningful long-term outcomes (30). Additionally, as is the case for all retrospective studies, there is a possibility that the results could be biased due to unknown confounding variables.

5.1. Conclusion

Patients receiving a cPVB in addition to single-injection tPVB did not have lower pain scores after salvage latissimus dorsi flap breast reconstruction. While not statistically significant, we feel confident that a larger, randomized con-

trial is warranted that could further evaluate acute and chronic pain benefits of a cPVB in salvage breast reconstruction.

Footnotes

Authors' Contribution: Jonathan T. Unkart designed study and wrote the manuscript. Jennifer A. Padwal abstracted the data and wrote the manuscript. Brian M. Ilfeld and Anne M. Wallace analyzed the data and contributed to the manuscript.

Funding/Support: Funded by the Departments of Surgery and Anesthesiology at University of California, San Diego, USA.

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