Perioperative Blocks for Decreasing Postoperative Narcotics in Breast Reconstruction

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Abstract

Context: High rates of mortality and chemical dependence occur following the overuse of narcotic medications, and the prescription of these medications has become a central discussion in health care. Efforts to curtail opioid prescribing include Enhanced Recovery After Surgery (ERAS) guidelines, which describe local anesthesia techniques to decrease or eliminate the need for opioids when used in a comprehensive protocol. Here, we review effective perioperative blocks for the decreased use of opioid medications post-breast reconstruction surgery.
Evidence Acquisition: A comprehensive review was conducted using keywords narcotics, opioid, surgery, breast reconstruction, pain pump, nerve block, regional anesthesia, and analgesia. Papers that described a local anesthetic option for breast reconstruction for decreasing postoperative narcotic consumption, written in English, were included.
Results: A total of 52 papers were included in this review. Local anesthetic options included single-shot nerve blocks, nerve block catheters, and local and regional anesthesia. Most papers reported equal or even superior pain control with decreased nausea and vomiting, length of hospital stay, and other outcomes.
Conclusions: Though opioid medications are currently the gold standard medication for pain management following surgery, strategies to decrease the dose or number of opioids prescribed may lead to better patient outcomes. The use of a local anesthetic technique has been shown to reduce narcotic use and improve patients' pain scores after breast reconstruction surgery.

Keywords: Breast Reconstruction, Opioid, Blocks, Non-narcotic, Regional Anesthesia

1. Context

Narcotic medications are one of the most common drugs responsible for adverse events. In fact, 47,600 opioid-related deaths were recorded in 2018 (1, 2). As prescribers, surgeons are responsible for an estimated 10% of opioid prescriptions in the United States (3, 4). While narcotics have been the mainstay for the relief of pain after a surgical procedure, recent reports have documented that physicians often write prescriptions that are excessive for a given procedure (5). In an analysis completed by the Kaiser-John Hopkins Public Health Department, it was found that 20,000 surgeons wrote over 350,000 prescriptions for pain medicine (6). Some of the surgeons were prescribing over 100 opioid pills for postoperative pain control after coronary artery bypass surgery, vastly exceeding the current guidelines of prescribing 30 pills for that procedure (6, 7). Some patients continue to take pain medicines even when their pain could have been controlled with over-the-counter pain medications with fewer side effects. The literature suggests that 6% of patients prescribed opioids after surgery were still taking these narcotics three to six months after their procedure, likely representing dependence. It has been demonstrated that extended use and dependence on narcotics increase with the number of tablets prescribed after surgery (8). These data call for a reduction in opioids being prescribed postoperatively.

Attention has been drawn to non-opioid medication strategies for postoperative pain management. Enhanced Recovery After Surgery (ERAS) guidelines state that a minimal opioid use decreases nausea, vomiting, and constipation, while also promoting early mobilization (9). The ERAS guidelines include all perioperative time points in which patient outcomes can be improved. The intra-operative

protocol includes regional anesthesia and opioid-sparing anesthesia, and the postoperative protocol includes multimodal opioid-sparing pain control. In a recent meta-analysis of the implementation of ERAS protocols during breast reconstruction surgery, it was shown that ERAS implementation in nine clinical studies decreased opioid medications by 183.96 Oral Morphine Equivalents (OME), on average. The average length of stay decreased by 1.58 days ([10]).

In this study, we reviewed the available evidence on local anesthetic techniques in reconstructive breast surgery to elucidate the ways to decrease narcotic use in breast reconstruction patients postoperatively.

2. Evidence Acquisition

A comprehensive review of the literature was completed of current local and regional block techniques in the perioperative period of breast reconstruction. Search keywords included narcotics, opioid, surgery, breast reconstruction, pain pump, nerve block, regional anesthesia, and analgesia. All experimental or observational studies written in English were included without any time restriction. Cosmetic and reductive breast surgery studies and case reports were excluded. Additionally, preclinical studies and reviews not providing original data were excluded.

All articles were screened for criteria, and data were extracted by two independent researchers (AJ, CK). Disagreements were resolved by a third researcher (SC) with a definitive decision made by the senior authors (MI, DM). After completion of full-text screening, data were extracted from each study, including sample size, analgesia utilized, the dosage of analgesia, and a summary of the results of the study. Reported outcome measures varied between the articles, making a cumulative data analysis not possible in this review.

3. Results

A total of 243 publications were found. A total of 39 peer-reviewed articles were included in this review. Local anesthetic options that had been published included single-shot nerve blocks, nerve block catheters, and local and regional anesthesia. Most papers reported equal or even superior pain control with decreased nausea and vomiting, length of hospital stay, and various other outcomes.

3.1. Regional Anesthesia

Regional anesthesia can be very useful for analgesia after breast surgery. The main advantages are improved patient pain scores and decreased opioid consumption ([11-18]).

Often, shorter hospital stays and decreased postoperative nausea and vomiting are associated with regional anesthesia for pain control with breast surgery ([12-14], [18]). Several regional nerve blocks were described with common techniques, including paravertebral, pectoralis, and erector spinae blocks. For donor site pain management in autologous reconstruction, the transverse abdominis plane block can be used ([17], [19-21]). Nerve blockade can occur via a single dose of an anesthetic; additionally, a catheter can be placed at the location of the single-shot block to allow for continuous anesthetic for extended analgesia ([15], [20], [22]).

3.2. Paravertebral Block

Paravertebral Block (PVB) targets the nerve roots that provide sensation to the chest wall at its most proximal point, just outside the epidural space, thus providing unilateral pain control of a narrow band of dermatomes slightly above and below the level of injection along the thoracic spine. This block may require several injection sites to completely cover the surgical area for unilateral breast reconstruction. It is performed by an anesthesiologist typically on the awake, upright patient preoperatively ([23]). The PVB can be done as a primary anesthetic technique to ensure a completely anesthetized surgical field for breast and axillary surgery and/or postsurgical pain control ([11]). It likely provides the greatest benefit to patients undergoing mastectomy with immediate reconstruction, which is typically a high-pain surgery. Research suggests innumerable benefits to the patient similar to other regional techniques, such as reduced postoperative complications and hospital stays, improved analgesia up to 72 hours, decreased postoperative nausea and vomiting, and reduced pain medication requirement ([12-14]).

In a recent systemic review, Jacobs et al. concluded that paravertebral blocks can reduce postoperative pain scores, analgesic consumption, and postoperative nausea and vomiting. The authors also found a reduction in the length of stay in patients receiving PVB, as well as a pain advantage of multiple injections over a single injection. Patients with PVB catheters had better pain scores up to POD5 and showed improved functional outcomes. Also, the severity of chronic pain symptoms reduced ([15]).

3.3. Transverse Abdominis Plane Block

The Transverse Abdominis Plane (TAP) block is useful in controlling abdominal pain after autologous reconstruction. This nerve block entails anesthetizing T6-L1 anterior rami, and subsequently, the anterior abdominal wall ([24]). The single-injection TAP block has been reported to be safe and decrease the amounts of opioids used postoperatively

(16-18). In a retrospective analysis by Wheble et al., the hospital stay, morphine requirement, and amounts of anti-nausea medications were all found to decrease when TAP blocks were used in autologous breast reconstruction (18). Hivelin et al. also reported lower morphine requirements and lower cumulative morphine use in patients receiving modified TAP blocks than in the control group (16). Lastly, Momeni et al. reported that when patients received TAP blocks, only 4 out of 46 patients (9%) required a Patient Controlled Analgesia (PCA) infusion (25).

Zhong et al. published studies assessing TAP catheter use in microsurgical breast reconstruction. In the first study of 45 patients, the authors reported a 16 mg decrease in IV morphine equivalents in the TAP catheter group compared to controls. In the second double-blinded study, 93 patients received a TAP catheter with bupivacaine or saline. The decrease in average morphine consumption was 10 mg IV morphine equivalents when compared to saline controls. There were no complications related to TAP catheter placement (19, 20). Jablonka et al. compared the single-dose TAP nerve block with infusion TAP catheter after abdominal-based microsurgery breast reconstruction and found that the infusion group had shorter LOS, with no difference in major complications between the groups (17).

Additionally, the duration of these nerve blocks can improve with the use of Liposomal Bupivacaine (LB). Several studies have compared the effectiveness of bupivacaine hydrochloride versus LB in TAP blocks (26, 27). Gatherwright et al. compared patients who had TAP blocks with LB versus those who had a bupivacaine pain pump and found that the LB TAP group used significantly fewer narcotics both intravenously and in total postoperatively (0.08 mg/kg/day in the LB group vs. 0.16 mg/kg/day in the bupivacaine group). The LB group of patients was mobile at an earlier time point postoperatively compared to the bupivacaine group (21.43 hours vs. 36 hours), which was a significant difference (26).

3.4. Fascial Plane Block

Fascial plane blocks after breast surgery have increased in popularity due to their efficacy, relative ease of performance, and low complication rate (28-31). The PECS I block was originally described by Blanco et al. in 2011, as a means to block the medial and lateral pectoral nerves, which innervates pectoralis major and minor, for pain management after breast implant or tissue expander surgeries (28). The following year, Blanco et al. introduced the modified PECS (PECS II) block, which included an additional injection of pectoralis minor and serratus anterior at the level of the fourth rib on the anterior axillary line

to block the intercostobrachial, intercostals, and long thoracic nerves, providing complete analgesia to the breast (29). Siddeshwara et al. compared the efficacy of PECS II and thoracic paravertebral blocks and showed that the PECS II had a longer duration of action, lower morphine consumption, and better dynamic and resting pain scores (30). Similar to the second block of PECS II is the serratus anterior block, which is performed between serratus anterior and latissimus dorsi at the mid to posterior axillary line at the level of the fifth rib. Finally, the erector spinae plane block (ESB), first described by Forero in 2016, is performed by depositing the anesthetic deep into the erector spinae muscle at the tip of the vertebral transverse process. The ESB exerts its effects at the ventral and dorsal rami of spinal nerves, as well as the paravertebral and epidural spaces, providing visceral and somatic analgesia (31). It is an effective modality for providing analgesia after breast surgery (32, 33). The clinical effectiveness of ESB is subject to volumes and concentrations of anesthetics and, therefore, has shown to be less favorable than the PECS II block for chest wall anesthetic coverage (33). Interestingly, there has been one study of epidural catheter use without general anesthesia during DIEP surgery, leading to faster immediate postoperative recovery (34).

3.5. Local Infiltration

Local infiltration of anesthetics can be used to obtain anesthesia to decrease postoperative pain and opioid consumption (35). Abdelsattar et al. first published an abstract of their success using local infiltration of the breast pocket before tissue expander (TE) placement for oncologic reconstruction (36). The authors described using a blunt tip needle to inject diluted LB into the pectoralis major muscle and serratus anterior fascia circumferentially along the breast footprint. Shortly after that, they published a comparative study of local infiltration of LB of the breast pocket versus PVB in patients receiving an immediate TE for reconstruction (37). The advantage was the decreased operative time, as the local infiltration group's average time to incision was 15 minutes shorter than that in the PVB group. Additionally, multivariable analysis showed that there was a significantly lower opioid use in the recovery room for patients with local infiltration than for the PVB group [9.4 morphine equivalents vs. 24.8 morphine equivalents] (37).

3.6. Local Infusion Catheter

Several studies have reported that the use of a Local Infusion Catheter (LIC) reduces reliance on postoperative narcotics (38-47). Bupivacaine and ropivacaine are the two most commonly reported anesthetics used in LIC, and ropivacaine is frequently chosen over bupivacaine due to its

lower cardiotoxic profile (22). The LIC has been recently reported in implant-based reconstruction (40, 48). Specifically, Strazisat et al. reported 9.8 mg of opioid piritramide during the first 24 hours in the group that received LIC in the breast pocket, compared to 29.4 in patients who did not receive LIC. This difference was significant. They also noted that patients' alertness was significantly higher by observer assessment of alertness/sedation scale six hours after surgery (48). Chaundhry et al. used an elastomeric pump in the subpectoral pocket in subpectoral implant reconstruction and reported significantly lower 24-hour Visual Analog Scale (VAS) pain scores [0.28 for the pump group vs. 1.84 for the control group] (40).

4. Conclusions

This review highlights some local anesthetic techniques that can be used in conjunction with a narcotic-reducing protocol to decrease the amounts of opioids consumed after breast reconstruction surgery. The narcotic use/misuse is a complex issue that requires surgeons to provide adequate pain control to patients postoperatively while minimizing their contribution to the opioid epidemic. Many factors come into play in choosing a pain control regimen for patients. The first consideration is the general painfulness of the surgery and, therefore, the requirement for pain medications postoperatively. Gassman et al. used the Visual Analog Scale (VAS), pain medication, and patient-controlled analgesia (PCA) attempts to compare immediate postoperative pain control of patients receiving abdominal-based flap reconstruction and implant-based reconstruction. They found that the total narcotic use and PCA use were higher in the implant-based group in bilateral and unilateral surgeries (49). In a study by the same institution using the same pain control assessment methods, the authors looked at specific implant-based reconstruction factors and their effect on pain. They found that the Tissue Expander (TE) size and initial fill volume increased narcotic use. They also found that two-staged TE reconstruction was more painful than single-stage direct-to-implant reconstruction (50). Regimens should be adjusted depending on the procedure. Additionally, to account for the donor site or a wider area of analgesia, a combination of discussed blocks may also be employed.

Patient selection is an important tool to ensure successful pain management during and after breast reconstruction. Patient factors play important roles in surgical experience. A study by Marcusa et al. utilized the Truven Health MarketScan Research Database to characterize opioid use in opioid-naive women who underwent immediate breast reconstruction (51). In their study, they found that patients' psychiatric comorbidities, such as depression and anxiety, and the type of procedure led to prolonged fills of opioid medications. Patients with a diagnosis of depression within one year before the surgery showed to have significantly higher OME per day than had patients with no preexisting psychiatric diagnosis (74.2 mg vs. 58.3 mg; P < 0.01). Patients with depression filled higher doses, and patients with anxiety filled for longer periods (51). These psychiatric comorbidities, therefore, are important to consider when prescribing opioids for individual patients, as physical pain may not be a reason for the continued filling of medications. Additionally, patient expectations should be clearly defined before proceeding with surgery.

In this review, we presented a multitude of examples in which local and regional anesthetic techniques were used to decrease patient pain and narcotic consumption after surgery. Perioperative blocks and catheters also have been shown to decrease postoperative nausea, vomiting, and length of stay in patients post-breast reconstruction surgery. Interestingly, it has also been reported that local anesthesia may decrease the recurrence and metastasis of breast cancer, seemingly due to natural killer cell activity (52, 53). When comparing the cost-effectiveness of nerve blocks, Shah et al. found that cost savings in bilateral reconstructions with the intercostal nerve block amounted to $2873.14 per patient and cost savings for unilateral reconstructions with the intercostal nerve block equaled $1532.34 per patient (54). Miranda et al. compared LB intercostal nerve blocks and bupivacaine blocks in implant-based reconstruction and found a significant increase in outpatient surgeries, as well as a 12% margin of saving for the LB group (55).

There are also negative reports of blocks, indicating that the blocks did not show a decrease in postoperative nausea, vomiting, or pain medication consumption (21, 56, 57). On inspection of the methods of these studies, it was found that the blocks were added to existing pain protocols consisting of narcotics and other medications, and the protocol did not change with the addition of a block (21, 56, 57). Without a pre-determined protocol that adheres to ERAS or another formalized set of guidelines, it is easy for surgeons to fall into what they know – narcotics. As such, these papers, which lack an established protocol to decrease opioid narcotic use after surgery, do not provide an accurate comparison of surgeries with and without a block. Additionally, these papers reported no difference in pain scores and Quality Recovery Scores (21, 56, 57). We have learned from the ERAS protocols that the decreasing narcotic use to improve outcomes for patients must be a multifactorial approach (9). This brings attention to non-narcotic pain medications that can be used intravenously

or orally. Examples include IV ketorolac and tramadol, and PO diclofenac and muscle relaxants (58-61). Lastly, complications due to blocks per se may cause extended hospital stays. For example, paravertebral blocks can be technically challenging for unexperienced anesthesiologists. Even with ultrasound guidance, one can cause accidental neuraxial injection, trauma to the neurovascular bundle along the near rib, and even pneumothorax (62, 63).

This comprehensive review has some limitations. The utilization of other postoperative narcotics, including sedatives was rarely taken into account in most studies. Also, the reported outcome measures varied between the articles, making a cumulative data analysis impossible. However, we believe that this study still contributes to the literature by reviewing potential alternatives to opioid therapy and their comparative results. Regional and local blocks are important additions to postoperative pain management to enhance recovery while decreasing the amounts of opioids consumed. If widely implemented, blocks could be one piece of the puzzle to decrease the amounts of opioids prescribed in the United States and help address the opioid epidemic that the medical community and the country at large are currently facing.

Footnotes

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