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Pectoralis Nerve (Pecs 2) Block for Breast Cancer Surgeries: A Pilot Study for an Ongoing Practice of Perioperative Surgical Home

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Abstract

Introduction: Recent studies suggest that the choice of anesthesia and analgesia can affect clinical outcomes and survival for breast cancer patients. Specifically, the use of regional anesthesia may have potential advantages in improving morbidity and mortality in this patient population. We describe our experience with the Pecs 2 block for breast cancer surgery.

Methods: Nine female patients for breast cancer surgeries underwent Pecs 2 block preoperatively, as originally described by Blanco. Intraoperatively, the patients received light to moderate sedation with opiates and a Propofol infusion. The surgeons were asked to supplement with local anesthetic infiltration depending on the patient's response to surgical incision. We recorded the amount of intraoperative and postoperative opiate use as well as patient's pain scores in the post anesthesia care unit (PACU) after surgery.

Results: All patients received their surgery under the described anesthetic management. Seven of the patients required supplemental local anesthetic infiltration by the surgeon. The total amount of fentanyl given intraoperatively ranged from 25 mcg to 150 mcg. Three patients did not require any additional opiates in the PACU. Three patients received a total of 100 mcg of fentanyl, one received a total of 0.8 mg of hydromorphone, another received 50 mcg fentanyl and 0.6 mg hydromorphone and one patient received 200 mcg fentanyl and 1.8 mg hydromorphone during recovery.

Conclusion: Perioperative Surgical Home (PSH) protocols encompass many different aspects of perioperative care including anesthetic technique. In our effort to continuously improve PSH for our breast cancer patients, we created a pathway in our hospital to incorporate regional anesthesia for breast cancer patients. Here, we demonstrated the possibility of using a regional anesthetic technique for both surgical anesthesia and postoperative analgesia.

Keywords: Perioperative surgical home (PSH); Anesthesia; Post anesthesia care unit (PACU); Analgesia

Introduction

Breast cancer is the most commonly diagnosed cancer in women in the United States regardless of race and ethnicity and the incidence is expected to follow an upward trend in the foreseeable future, along with the cancer associated mortality [1]. While ranked the second deadliest cancer in all women breast cancer has already become the number one killer in Hispanic woman despite advancement of treatments such as surgery, radiation, chemotherapy, immunotherapy, hormonal therapy [1,2]. As of today, surgical excision of the tumor remains one of the primary methods of treating breast cancer. Surgical techniques have changed dramatically over the years in response to new scientific evidence, ranging from radical mastectomy and lumpectomy to local excision with needle localization. However, improvement in anesthetic techniques for the various breast cancer surgeries has been slow. General anesthesia with an inhalational agent remains the primary technique; in fact, often the only option offered to patients for a wide variety of breast cancer surgeries.

Recent studies suggest that the choice of anesthesia and analgesia can affect immediate and long term clinical outcomes for breast cancer patients. In an extensive review published in May 2017, Hollmann et al., noted the volatile anesthetics have been implicated with carcinogenic potential while evidence points to the anti-tumor effects of Propofol. Although definitive recommendations for anesthetic technique would be premature, current experimental evidence favors Propofol infusion-based anesthetics over inhalation anesthetics for patients undergoing cancer surgery [3]. In addition, regional anesthesia, specifically thoracic epidurals and paravertebral blocks, has been regarded as an effective means of pain control and method of decreasing postoperative opioid consumption for patients undergoing mastectomies [4,5]. Peripheral nerve blocks may also potentially decrease the incidence of developing postoperative chronic pain [6,7] as well as prevent future cancer recurrence [8]. These new discoveries call for innovations in anesthesia practice and encourage more individualized perioperative management for breast cancer patients, which include selective plans for both anesthesia and analgesia.

Perioperative Surgical Home (PSH) was recently introduced and implemented into the field of perioperative medicine which encompasses a multimodal approach to improve a long-term healthcare outcome that matters to the patient the most: Disability free survival. For cancer patients, techniques that decrease cancer recurrence which often originates in the perioperative period, is more relevant as it will directly impact their disability free survival. In our hospital, we have implemented a PSH practice for several different surgical services [9,10] and in this case series, we delineated our effort to incorporate regional nerve blocks with monitored anesthesia care for our breast

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cancer surgeries. The regional block, called the pectoralis nerve block (Pecs 1 and Pecs 2), was developed by Blanco et al. [11] and provides an effective way to control postoperative pain after breast surgery. Here, we describe our experience with the Pecs 2 block for breast cancer surgeries and postoperative analgesia as a continuum. The goal was to minimize the immunosuppressive effect of inhalation agents and long lasting opioid medication while providing effective anesthesia and analgesia for surgery and postoperative pain.

Case Series

Nine breast cancer patients undergoing lumpectomies and simple mastectomies were included in this series. Their ages ranged from 42 to 83 with an average BMI of 29.78 (19.55-48.10). In Table 1, patients received a preoperative single-injection Pecs 2 block followed by moderate to deep sedation with Propofol infusions intraoperatively.

In the operating room, monitored anesthesia care was provided with Propofol infusions and additional fentanyl boluses as indicated. Each patient was spontaneously breathing with 6-8 L/min of oxygen via face mask or 50-60% fiO^2. In our series of patients, the total amount of fentanyl given intraoperatively ranged from 25 mcg to 200 mcg. At the completion of surgery, patients were transferred to the post-anesthesia care unit (PACU) where numeric pain scale was used to assessed pain and given additional pain medication as needed. Four patients did not require any additional opioid medications in the PACU. Three patients received a total of 100 mcg of fentanyl, one patient received a total of 0.8 mg of hydromorphone and one patient received 50 mcg fentanyl and 0.6 mg hydromorphone. (Table 2). Depth of anesthesia monitor was not used in this case series study.

Characteristics	Range
Patients	9
Age	57.7 (42-83)
BMI	29.78 (19.55-48.10)
ASA	3
Female	9
Avg. score	<4

Table 1: Characteristics of breast cancer surgery patients.

Age	Local infiltration by surgeon	PACU pain score	Intraoperative opiate use	Total PACU opiate use
69	10 ml 0.5% bupivacaine 10 ml 1% lidocaine	0	Fentanyl 25 mcg	None
42	12 ml 0.5% bupivacaine 12 ml 1% lidocaine	0-4 (+6)	Fentanyl 150 mcg	Hydromorphone 0.8 mg
53	3 ml 0.5% bupivacaine 3 ml 1% lidocaine	0-5	Fentanyl 100 mcg	Fentanyl 100 mcg
59	2.5 ml 0.5% bupivacaine 2.5 ml 1% lidocaine	0-5	Fentanyl 25 mcg	None
66	None	0-8	Fentanyl 100 mcg	Fentanyl 100 mcg
76	None	0-5	Fentanyl 50 mcg	Fentanyl 100 mcg
49	10 ml 0.5% bupivacaine	3-4	Fentanyl 100 mcg	None
50	2 ml 0.5% bupivacaine 2 ml 1% lidocaine	6-10	Fentanyl 100 mcg	Fentanyl 200 mcg Hydromorphone 1.8 mg
83	30 ml 0.25% bupivacaine	0-10	Fentanyl 50 mcg	Fentanyl 50 mcg Hydromorphone 0.6 mg

Table 2: Intraoperative and postoperative anesthesia management.

Ultrasound technique

The patient is placed in supine position with the ipsilateral arm abducted and the elbow flexed. The infraclavicular area is cleaned with chlorhexidine. A linear, 13-6 MHz ultrasound probe (Sonosite, Bothell, WA, USA) is placed immediately inferior to the clavicle in the sagittal plane at approximately the anterior axillary line. The first rib that should be seen is the 2nd rib, at which point the probe is moved inferiorly until ribs 3 and 4 are visualized. The acromiothoracic artery/lateral border of the pectoralis minor muscle may be identified.

Local infiltration of the skin is performed at the superior end of the ultrasound probe. A 4 inch, 21-gauge regional block needle (Pajunk sonotap) is advanced in the superior-to-inferior or inferior-to-superior direction in-plane with the probe until the needle tip makes contact with the 3rd or 4th rib. Once contact has been achieved, the needle is pulled back slightly, and a total of 20 mL of 0.35% or 0.5% ropivacaine is injected with the aim of local anesthetic spread either below the serratus anterior muscle or between serratus anterior and pectoralis minor muscles.

Subsequently, the needle is pulled back until the needle tip is positioned between the pectoralis major and minor muscles. A total of 10 ml of 0.35% or 0.5% ropivacaine is injected into this space with visualization of separation of the muscles.

Results and Discussion

While the thoracic epidural and paravertebral block can achieve satisfactory anesthesia and analgesia for breast surgery, they have multiple potential disadvantages: technical difficulty; contraindications with anticoagulation and bleeding risk; risk of vascular injection, pneumothorax, dural puncture with neuraxial spread and subsequent hypotension and increased cost associated with elevated level of care [12]. On the contrary, the pectoralis block is a novel regional block that is easier to perform while incurring less potential complications and providing reliable, effective analgesia following breast cancer surgeries [13,14]. In fact, a prospective randomized trial performed by Kulhari et al., concluded that the Pecs 2 block worked better for decreasing opioid consumption and achieving pain control in the postoperative period after mastectomy compared to the paravertebral block [15]. While the Pecs block has proven its value for postoperative analgesia, we have demonstrated here that it may be equally effective for surgical anesthesia, and subsequent pain management following surgery.

For the set of patients described in this study, we were able to successfully use the Pecs 2 block as the primary intraoperative anesthetic technique supplemented with a low- to moderate-dose propofol infusion for sedation without any complications. The average pain scores of these patients were mild to moderate for the duration of their stay in the PACU. In addition, we were able to administer minimal to moderate doses of opioids intraoperatively and postoperatively in the PACU. This opioid-sparing effect, in addition contributing to the ability to avoid general anesthesia, provides additional benefits for patients who are undergoing cancer surgery and dealing with recovery. These benefits range from a decrease in the risk of immediate postoperative complications such as postoperative nausea and vomiting (PONV), over-sedation, and emergence delirium to potential long-term survival benefits associated with a decrease in cancer recurrence and prevention of chronic pain syndromes.

A unique contribution of regional anesthesia that has been widely studied is the role it plays in the potential reduction of cancer recurrence. This has been hypothesized to occur due to several factors, including

the attenuation of the systemic stress response to surgical trauma thereby providing protective anti-inflammatory effects, decreasing the amount of volatile anesthetics needed for surgery, and minimizing consumption of perioperative opioids [16]. Volatile anesthetics and opioids have been associated with suppression of the immune system which would allow residual neoplastic cells to proliferate after tumor resection thus leading to cancer recurrence [17,18]. While current evidence is somewhat sparse and ongoing prospective randomized controlled trials are investigating this phenomenon, a retrospective analysis by Exadaktylos et al., has shown that the use of paravertebral nerve blocks for breast cancer surgery reduced the risk of cancer recurrence by four-fold in long-term follow-up [19]. This would need further exploration through future research on the pectoralis blocks and this effect on morbidity and mortality after breast cancer surgery.

Another less appreciated benefit of regional nerve block for breast surgery is its effectiveness in reducing phantom breast pain, inter-costobrachial neuralgia and other chronic pain syndromes, which are not uncommon after breast cancer surgery. In fact, following surgery, a significant number up to 60% of patients can develop chronic pain [20]. Although the cause of long-term pain is multifactorial, patients with severe acute postoperative pain are more likely to develop chronic pain [21,22] and significant reduced quality of life [23]. It is hypothesized that traumatic tissue injury and subsequent inflammatory changes following surgery can initiate a cascade of events that lead to peripheral and central sensitization, which in turn can modify neural networks at the spinal or supraspinal level and change sensorial input or experience for that patient. The uncontrolled perioperative pain can cause lasting changes in the central nervous system through the above mechanism of neural plasticity and elicit persistent hyperalgesia with or without allodynia. Thus, anesthetic techniques that can control first surgical and then postoperative pain consecutively may have an extended positive impact on this patient population. A large meta-analysis comparing conventional anesthesia to regional and/or local anesthesia for a variety of surgeries, including but not limited to thoracotomies and mastectomies, showed that for these surgeries, the risk of developing chronic pain appears to be decreased with the use of epidural and paravertebral nerve blocks respectively compared to conventional anesthesia [24]. Because of its simplicity, superior safety profile, and effectiveness for both anesthesia and analgesia, we believe that the pectoralis block should be part of the anesthetic plans for any breast surgery, specifically considering its role in preventing the development of chronic pain.

One important consideration in the efficacy of the Pecs block is the ultrasound and block technique. Different techniques that have been demonstrated in other studies which include placement of the ultrasound probe in the transverse position and advancement of the needle from medial to lateral direction; utilization of two needle punctures for Pecs 2 blocks; identification of and injection within the vicinity of the pectoral branch of the acromiothoracic artery; and targeting the space between the 2nd and 3rd ribs versus the 3rd and 4th ribs. Given that the Pecs block is considered a field block deposited in the interfascial space, these differences can affect the spread of the local anesthetic and, thus, distribution to the involved nerves. In our series, five different anesthesiologists performed the Pecs 2 blocks, all highly effective for surgery, which indicates its potential for wider application due to relative technical ease and versatility. In addition, there may be a prolongation of pain relief and improved benefit with the implementation of a continuous regional catheter or additives in local anesthetic.

Conclusion

One major limitation of our series is that it only includes a small number of patients in an ongoing new practice of PSH. The impact on the long-term disability free survival, if any, are years away from realization. However, our small case series does provide scientific evidence to support future randomized, controlled prospective studies, to determine its impact on a wide range of quality clinical outcomes such as postoperative pain, PONV, length of hospital stay, perioperative cost, post-discharge emergency room returns, hospital readmissions, as well as chronic pain development and cancer recurrence.

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