Breast Surgery

Regional Pain Blocks and Perioperative Pain Control in Patients Undergoing Breast Implant Removal With Capsulectomy

Jacob Y. Katsnelson, MD[●]; David A. Goodman, MD;
Casey K. Paterson, MD; and Brian R. Buinewicz, MD

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Abstract

Background: Demand for breast implant removal is on the rise, with more than 36,000 explants performed in 2020, an increase of 7.5% from previous years. Postoperative (PO) analgesia is an important consideration in this patient group due to scar tissue surrounding the implant and the potential for extensive dissection during capsulectomy.

Objectives: The authors sought to compare perioperative pain control between three different types of ultrasound (US)-guided regional anesthetic techniques in patients undergoing implant removal with capsulectomy.

Methods: The authors reviewed all patients who received an US-guided block and underwent breast implant removal with capsulectomy at their outpatient surgical center over a 2-year period. They compared intraoperative (IO), PO opioid requirement, and patient-reported pain on the first postoperative day (POD1) between 3 different block techniques using chi-square analysis. A P-value of <.05 was considered statistically significant.

Results: A total of 352 patients were included. Twenty-six patients (7.4%) underwent a serratus plane (SP) block, 13 (3.7%) underwent an erector spinae combined with pectointercostal fascial plane (ES + PIFP) block, and 313 (88.9%) underwent an erector spinae combined with pectoral nerve (ES + PECS1) block. ES + PECS1 was associated with less IO and PO opioid use compared with SP and ES + PIFP (1.9% vs 19.2% vs 61.5%, $P < .001$ for IO, 26.8% vs 34.6% vs 38.5% PO, $P < .001$). The ES + PECS1 block was associated with mild pain on POD1 compared with the other 2 regional block techniques ($P = .001$).

Conclusions: Regional pain blocks, and specifically the ES block, offer effective pain control for patients undergoing breast implant removal with capsulectomy, demonstrating high patient satisfaction in the PO period with low opioid requirements.

Level of Evidence: 3

3

Therapeutic

Drs Katnelson and Paterson are resident physicians; and Dr Buinewicz is a plastic surgeon, Department of Surgery, Abington Memorial Hospital-Jefferson Health, Abington, PA, USA. Dr Goodman is an anesthesiologist, Department of Anesthesia, Abington Memorial Hospital-Jefferson Health, Abington, PA, USA.

Corresponding Author:
Dr Jacob Y. Katsnelson, Department of Surgery, Abington Memorial Hospital-Jefferson Health, 1200 Old York Road, Price Medical Office Building, Suite 604, Abington, PA 19001, USA.
E-mail: jykatsnelson@gmail.com; Instagram: @jykatsmd

The ongoing national opioid epidemic has spurred changes to perioperative pain management practices toward the incorporation of multimodal anesthesia and to minimize reliance on opioid-based analgesic regimens.[1,2] In plastic surgery, recent literature on reducing opioid prescriptions has focused on both inpatient and elective procedures.[3,4] With the increased availability and portability of ultrasound (US) technology, regional block techniques pose a promising strategy for perioperative pain control in patients undergoing plastic surgery procedures in the outpatient setting.[5–7] Recent courses offered through professional societies have shown that competence in the use of these techniques can be readily acquired by plastic surgeons.[8] Breast implant removal constitutes one of the most common plastic surgery procedures performed on an outpatient basis, with demand steadily increasing in recent years due to more patients presenting with safety concerns or symptoms they ascribe to their implants.[9–12]

A variety of factors, including increased awareness of implant complications, has led to this steady upward trend in implant removal.[11,13–16] One such complication recently highlighted in the media is the incidence of breast implant illness (BII), a controversial and incompletely understood constellation of multisystemic symptoms ascribed to breast implants.[17,18] The diagnosis and management of BII is currently of particular interest within the plastic surgery community, as many patients are electing to have their implants removed with capsulectomy when feasible.[19,20] While the optimal management for BII is still unknown, capsulectomy is frequently requested by these patients, and potentially leads to more substantial symptom improvement related to local musculoskeletal symptoms when these patients have associated capsular contracture.[19,21] Postoperative (PO) pain related to capsulectomy should be included in the discussion when counseling these patients, as removal of the posterior capsule can involve extensive dissection along the chest wall and intercostals.[22] Additionally, PO analgesia can be difficult in these patients due to scar tissue surrounding the implant and the potential for extensive dissection during capsulectomy.[23]

The increasing availability of US to image fascial planes has led to increased precision in targeting specific nerves through novel US-guided regional block techniques, while avoiding inadvertent injury to surrounding structures.[8,24] Regional blocks can provide effective and durable analgesia to patients undergoing breast surgery, though evidence supporting a specific indication for each block has been limited.[25,26] The pectoral nerve I (PECS1) block, commonly used in subpectoral or dual-plane breast reconstruction, primarily targets medial and lateral pectoral nerves which innervate the pectoral musculature.[5,7,24,27] The serratus plane (SP) block is performed more frequently for axillary procedures, targeting the lateral cutaneous branches of the T3 to T9 intercostal nerves, long thoracic nerve, and thoracodorsal nerve between the latissimus dorsi and serratus anterior muscles.[6,24] The pectointercostal fascial plane (PIFP) block, as described by de la Torre et al in 2014,[28] targets the anterior cutaneous branches of the T2 to T6 intercostal nerves between the external intercostal and pectoralis major muscles and has been used in both breast and thoracic procedures.[29,30] The erector spinae (ES) block is a relatively new technique, first described in 2016,[31] and involves the deposition of long-acting local anesthetic deep to the ES muscle at the tip of the T4 vertebral transverse process with the interfascial spread of local anesthetic targeting the ventral and dorsal ramii of the thoracic spinal nerves.[24,32,33] ES has particularly been found to be effective for blocking the posterior chest wall, with significant analgesic effects reported in breast and thoracic surgery patients.[34–37]

In this study, we evaluated perioperative pain control using these regional block techniques in a cohort of patients who underwent implant removal with capsulectomy at our ambulatory surgical center. We sought to compare the efficacy of each block technique by comparing opioid requirements intraoperatively, postoperatively, and patient-reported pain on the first postoperative day (POD1) based on the type of regional block used.

METHODS

We performed a retrospective review of patients who underwent the removal of bilateral breast implants with capsulectomy at our outpatient surgical center from January 2018 to May 2020. Permission for the study was obtained by our institutional review board with a waiver of the need for individual consent (IRB#19-039). Surgeries were performed by a single plastic surgeon, the senior author of our study, and included a total capsulectomy with dissection of capsule off the intercostal fascia and periosteum of ribs when safely possible. Each patient received a regional anesthetic block by a board-certified anesthesiologist under US guidance. The blocks performed included serratus plane (SP), and a combination of ES with pectointercostal fascial plane (PIFP) or pectoral nerve block (PECS1) blocks.

All regional blocks were performed with 30 mL of 0.5% bupivacaine, with 15 mL per side injected into the desired fascial plane. Procedures were performed after induction of general anesthesia and placement of a laryngeal mask airway. For PECS1, PIFP, and SA blocks, the patient was positioned supine on the operating table. For ES blocks, the patient was placed into right lateral decubitus position. US guidance was then used to identify the appropriate landmarks for each block as seen in Figures 1-4. To perform the PECS1 block, the US probe was positioned ~2 cm below the clavicle between the thoracoacromial artery and the acromion, with injection between the pectoralis major and minor muscles (Figure 1). For ES blocks, the T4 level
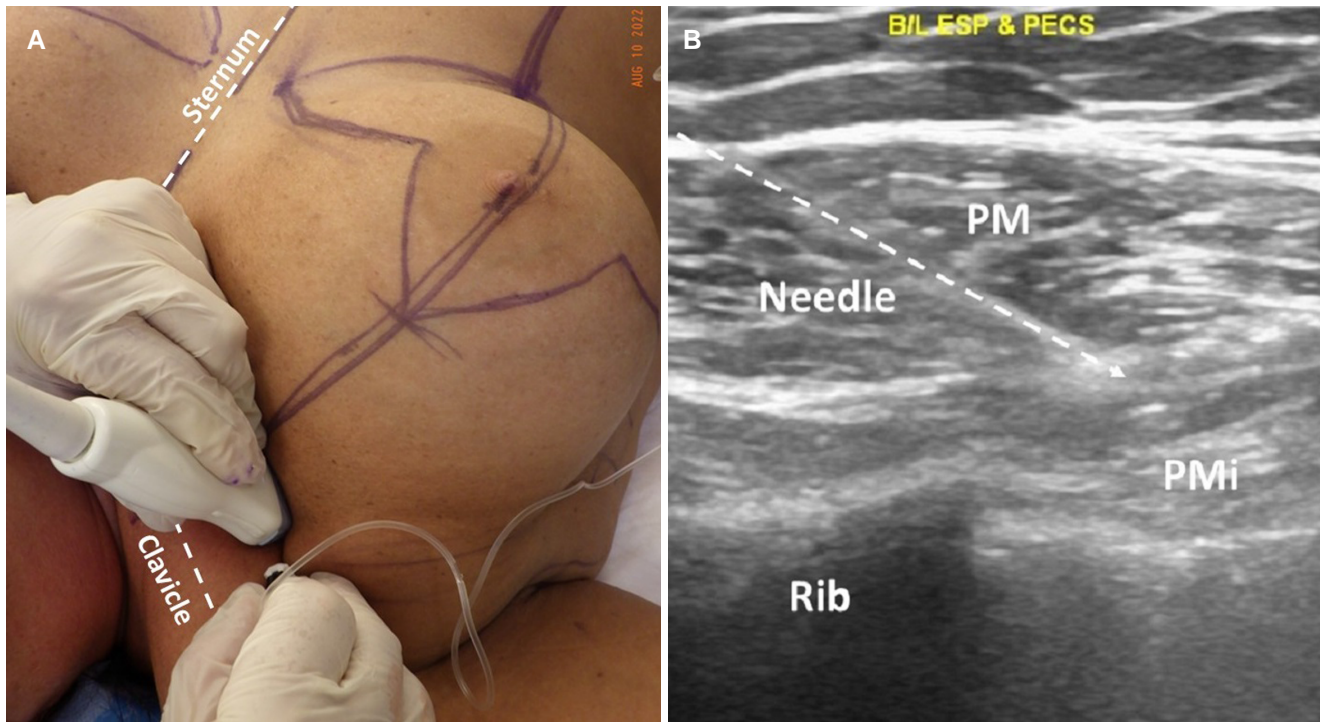
Figure 1. Pectoral nerve (PECS1) block. (A) Ultrasound probe position and needle insertion with patient supine. (B) Ultrasound image showing injection in the plane between pectoralis major (PM) and pectoralis minor (PMi).
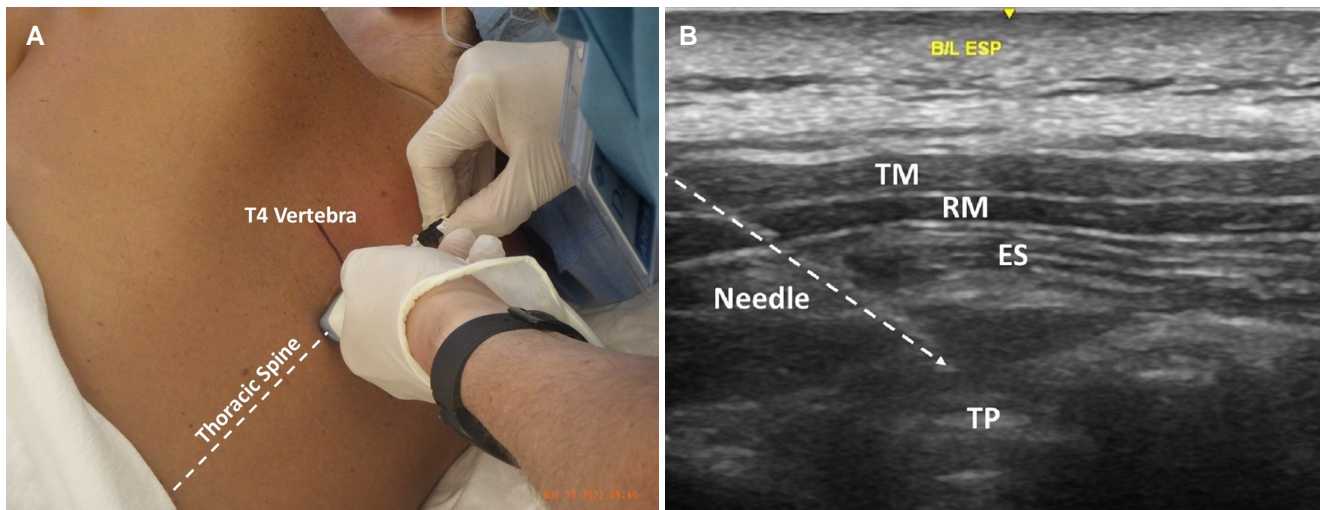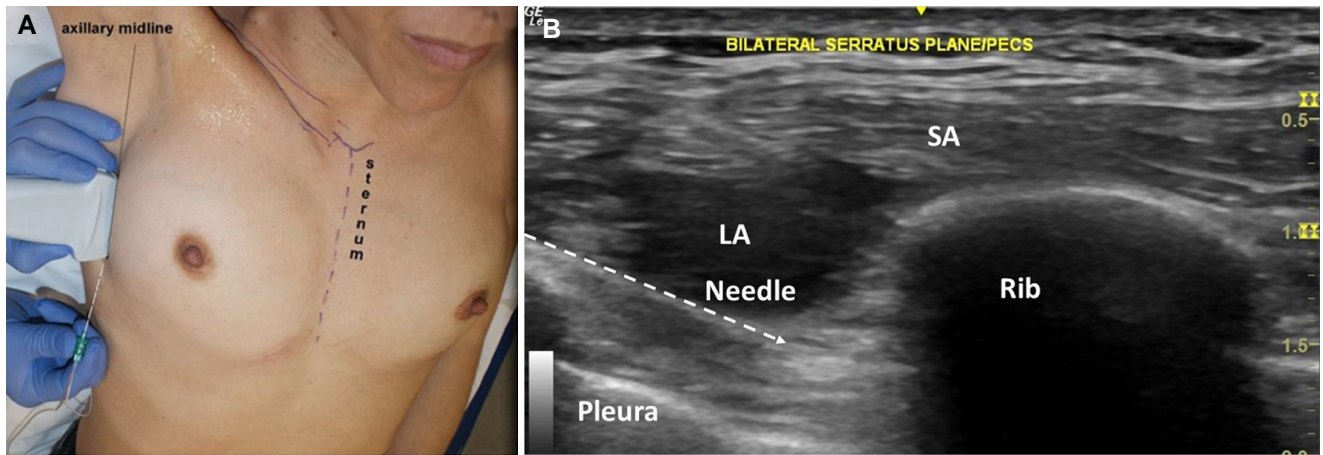

Figure 2. Erector spinae (ES) block. (A) Ultrasound probe position and needle insertion with patient in the right lateral decubitus. (B) Ultrasound image showing injection deep to trapezius (TM), rhomboid major (RM), and ES, and just anterior to transverse process of T4 (TP).

was identified as a landmark with probe placement 2 to 3 cm lateral to the spine and US visualization of the trapezius, rhomboid major and ES muscles (Figure 2). The needle was then advanced by US guidance until the T4 process was contacted, and local anesthetic was subsequently injected deep into the ES muscles, with the spread

of the local anesthetic in a cranial to caudal distribution confirming the correct plane. SP blocks were administered at the level of the fourth rib in the midaxillary line, with the needle positioned at a direct 90° angle (Figure 3). The PIFP block was performed by injecting in the plane between the pectoralis major and external intercostal muscle, with

Figure 3. Serratus plane (S) block. (A) Ultrasound probe position and needle insertion with patient supine at the midaxillary line. (B) Ultrasound image showing injection deep to serratus anterior muscle (SA), and anterior to the fourth rib, with interfascial spread of local anesthetic (LA). Reproduced from de la Torre et al.[28] by permission of Oxford University Press on behalf of The Aesthetic Society.
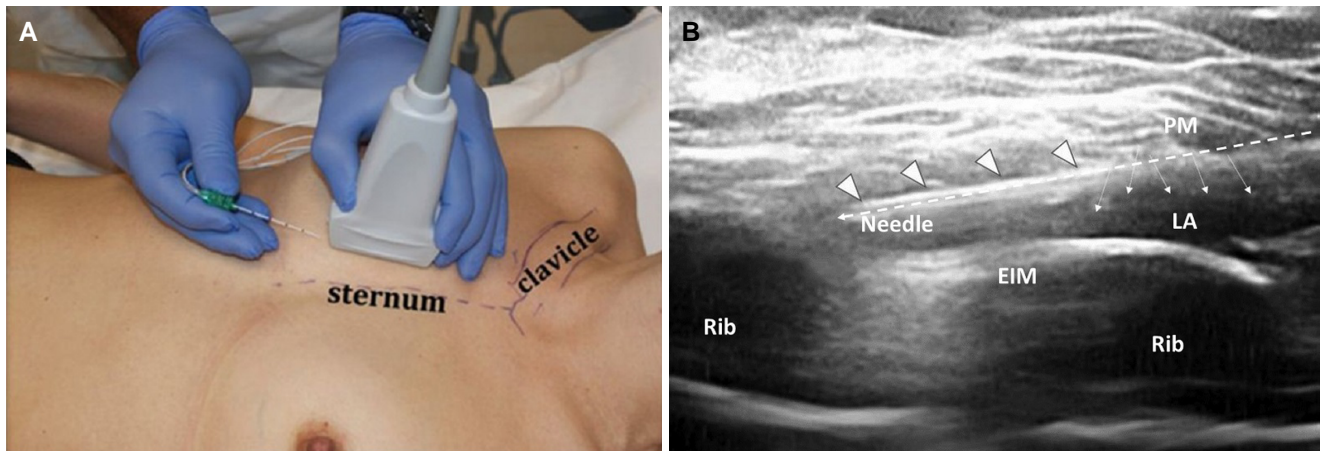
Figure 4. Pectointercostal fascial plane (PIFP) block. (A) Ultrasound probe position and needle insertion with patient supine 2 to 3 cm lateral to the sternal border. (B) Ultrasound image showing injection deep to pectoralis major (PM), superficial to external intercostal muscle (EIM), with spread of local anesthetic (LA) indicating injection in the correct plane. Reproduced from de la Torre et al.[28] by permission of Oxford University Press on behalf of The Aesthetic Society.

injection about 2 to 3 cm lateral to the border of the sternum (Figure 4).

A subgroup of patients who received ES + PECS1 blocks additionally received either preoperative 100 mg gabapentin or a preoperative cocktail consisting of 1000 mg acetaminophen, 100 mg celecoxib, 100 mg gabapentin, and intraoperative (IO) 15 mg ketamine (10 mg at beginning of the case and 5 mg at the end) as part of an enhanced recovery (ERAS) protocol. IO opioids administered during anesthesia and PO opioids administered in the postanesthesia recovery unit were recorded. Patient-reported pain was evaluated on the first postoperative day (POD1) by phone follow-up and recorded based on the visual

analog pain scale (None: 0, Min: 1-2, Mild: 3-5, Mod: 6-8, Severe: 9-10).

Opioid requirements and POD1 pain were compared between patients who received SP alone, ES with PIFP, and ES with PECS1. All analysis was performed using chi-square analysis with a *P*-value of <.05 considered statistically significant.

RESULTS

A total of 352 patients were included in the retrospective analysis. Three hundred and twenty-two patients (91.4%) had submuscular and 30 patients (8.5%) had a

Type of Nerve Block Performed
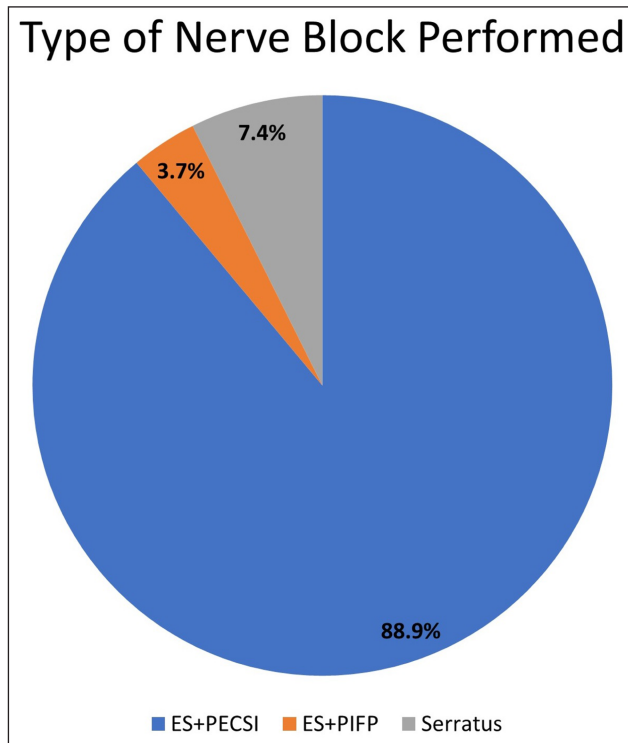
Figure 5. Distribution by type of block used. ES, erector spinae; PECS1, pectoral nerve; PIFP, pectointercostal fascial plane.

subglandular implant position. Preoperatively, 26 patients (7.4%) underwent an SP block, 13 (3.7%) had an ES + PIFP block, and 313 (88.9%) had an ES + PECS1 block (Figure 5). There were no identified or reported complications such as pneumothorax, hypotension, or vascular injury in any block group. Ninety-seven patients (27.8%) required opioids postoperatively in the recovery unit, and 19 patients (5.4%) required opioids intraoperatively. The percentage of patients who received IO or PO narcotics based on the type of regional block is demonstrated in Figure 6. Overall, ES + PECS1 was associated with less IO and less PO opioid use compared with SP and ES + PIFP ($P < 0.001$).

On POD1, 228 patients were able to be contacted for pain assessment. Twenty-six patients (11.4%) reported no pain, 84 patients (36.8%) reported mild pain, 48 reported minimal pain (21.1%), 65 had moderate pain (28.5%), and 5 patients had severe pain (2.2%). One hundred and twenty-four patients did not have follow-up information available or could not be reached within the follow-up period. The distribution of POD1 pain by the type of block performed is shown in Figure 7. The ES + PECS1 block was associated with mild pain on POD1 compared with the other 2 regional block techniques ($P = .001$).

In a subgroup analysis of the 313 patients who underwent an ES + PECS1 block, 63 patients (20%) received gabapentin preoperatively and 72 patients (23%) received a combination of preoperative cocktail consisting of acetaminophen, celecoxib, gabapentin, as well as IO ketamine during anesthesia as part of an ERAS protocol. Only six patients (1.9% of ES-PECS1) required IO opioids in this subgroup. Patients who received either the preoperative cocktail with gabapentin or gabapentin alone had a lower PO narcotic requirement in the recovery unit compared to the no adjunct group (25% vs 12.7% vs 32.6%, $P < .001$) (Figure 8). However, there was no statistically significant difference in PO narcotic requirement between the gabapentin only and preoperative cocktail groups ($P = .07$). There was also no significant association between the level of pain reported on POD1 and patients who received the preoperative cocktail alone, gabapentin, or no adjunct ($P = 0.932$, Figure 9).

DISCUSSION

In recent years, there has been a significant shift in perioperative pain control toward multimodal and nonopioid pain adjuncts among patients undergoing plastic surgery procedures.[38,39] Preoperative and IO regional nerve blocks, nonsteroidal anti-inflammatory medications, and longer-acting local anesthetic infusion pumps at the time of implant insertion have become common practice for pain control in the setting of implant-based breast reconstruction.[3,4,40] Regional blocks have been shown to have a positive impact on Quality of Recovery measures, pain scores, and opioid use postoperatively,[3] and their adoption by the plastic surgery community has been on the rise.[26] While the variety of targeted interfascial nerve blocks has increased substantially with wider availability and use of portable US in recent years, there is a paucity of data on the utility of specific US-guided blocks for patients undergoing plastic surgery procedures in the outpatient setting.[8,25] We sought to characterize the efficacy of several of these newer block techniques, especially the ES block, in patients undergoing implant removal with capsulectomy at our practice.

We found that patients who underwent the ES + PECS1 block had the lowest IO and PO opioid requirement relative to those who received the ES + PIFP and SA blocks. These patients also were more likely to report mild pain (3-5 on analog pain scale) on POD1 compared with the other 2 blocks. Based on these findings, we believe that the combined ES + PECS1 regional block offers an excellent opportunity to employ consistent, predictable multimodal pain control and limit opioid use in patients undergoing breast implant removal and capsulectomies. Though a relatively novel technique, the ES block is relatively easy to perform under US guidance and can even be done with minimal or no sedation preoperatively.[31,37] After learning and adopting the technique in our practice, bilateral ES blocks with a PECS1 add an additional 5 to 10 min to our procedure
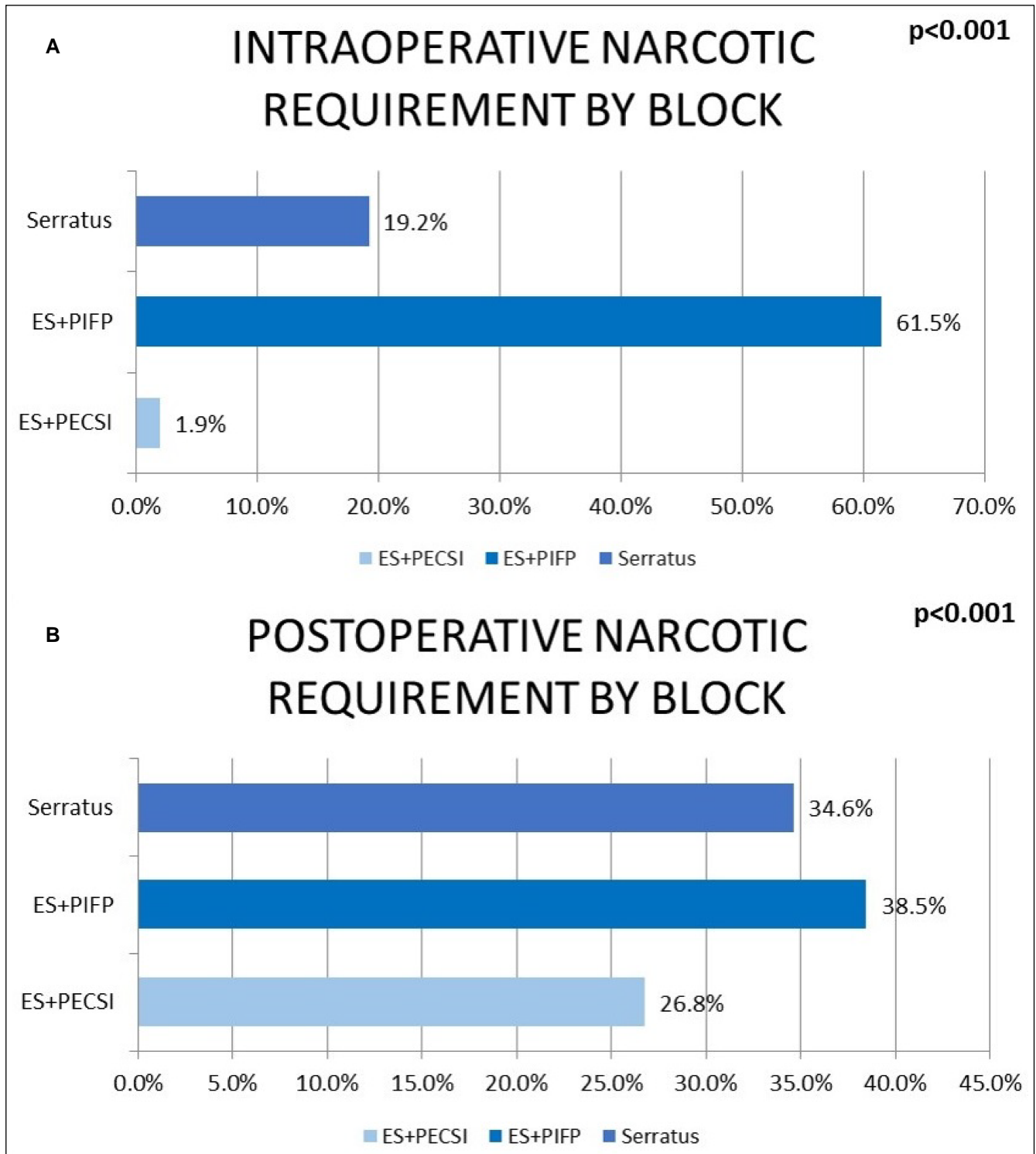
Figure 6. (A) Intraoperative and (B) postoperative narcotic requirements by regional block technique. ES, erector spinae; PECS1, pectoral nerve; PIFP, pectointercostal fascial plane.

time, which we feel is relatively insubstantial in light of reduced IO and PO opioid requirements and more rapid emergence from anesthesia. Thus, we believe it is an important tool for safe and effective analgesia during outpatient procedures that can be rapidly adapted into the plastic surgeon's arsenal similar to the PECS1 IO block.
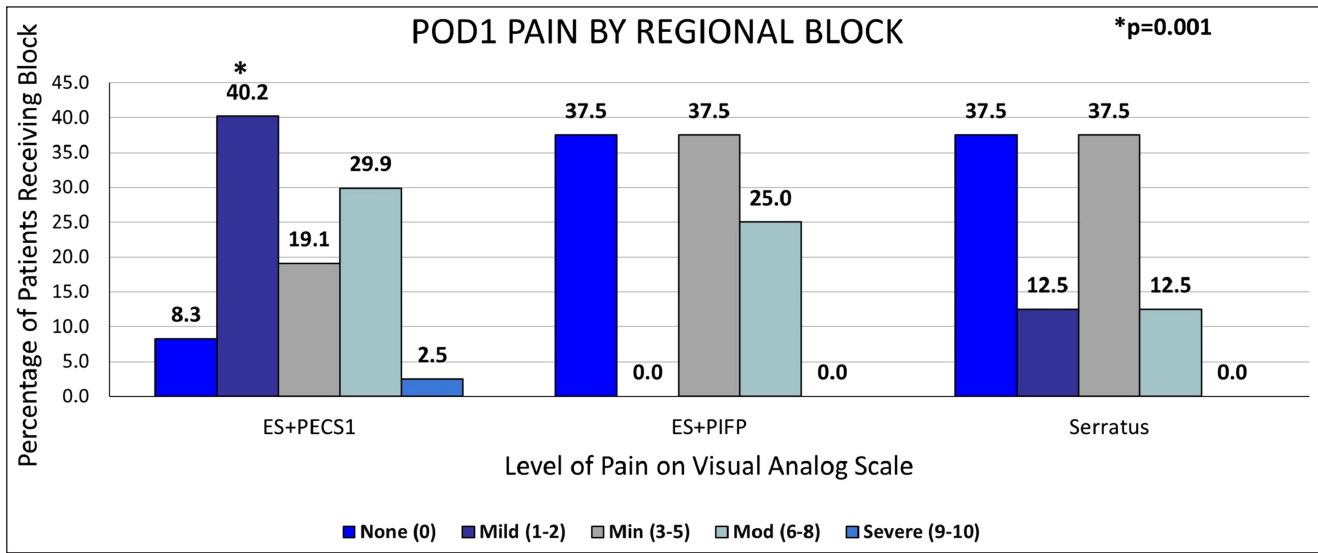
Figure 7. Patient-reported pain on postoperative day 1 (POD1) by type of regional block. ES, erector spinae; PECS1, pectoral nerve; PIFP, pectointercostal fascial plane.
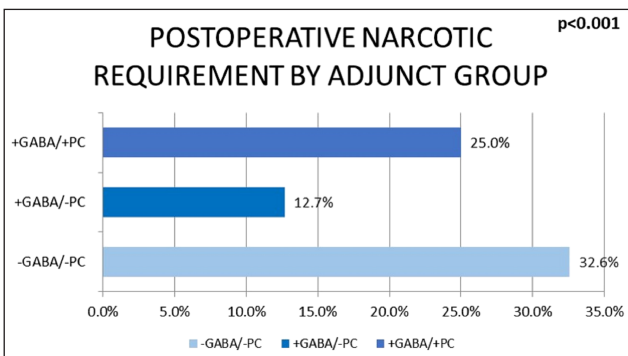
Figure 8. Postoperative narcotic requirements by adjunct group. +GAB, with gabapentin; −GABA, without gabapentin; +PC, with preoperative cocktail; −PC = without preoperative cocktail.

We hypothesized that the efficacy of the ES block technique compared to more familiar blocks such as isolated PECS1 lies in its ability to affect a multidermatomal distribution, allowing spread over multiple levels of intercostal nerves and effectively blocking the posterior chest wall, which is crucial in the setting of extensive dissection along the chest wall as frequently required during capsulectomy.[33] Additionally, because it targets spinal nerve roots and has both transforaminal and epidural spread, the ES block is thought to provide more extensive regional anesthesia with the same quantity of local anesthesia as compared to isolated thoracic interfascial blocks such as the PECS and serratus blocks.[41]

We additionally found that patients undergoing the ES + PECS1 block had lower IO and PO opioid requirements and reported less pain on POD1 when the block was combined with a preoperative pain adjunct regimen of acetaminophen, celecoxib, gabapentin, and ketamine. This subgroup highlights the role gabapentin plays in significantly reducing PO narcotic requirements, possibly through its role in potentiating the duration of regional anesthetic.[42,43] Gabapentin has been thoroughly researched in a wide breadth of surgical specialties and found to be an efficacious adjunctive pain agent in the context of limiting PO opioid requirements and has a well-documented synergistic effect with opioid-based medications.[44] Though we were unable to demonstrate added benefit from the addition of other adjuncts such as acetaminophen and celecoxib to gabapentin in our subgroup analysis, these data are likely limited by the relatively small number of patients who received adjunct treatment overall and should be more extensively studied.

There are several limitations that should be considered in this analysis. The key limitations include the retrospective nature of the data and lack of the control group. This is because all patients undergoing outpatient implant removal in our practice have received some form of regional analgesia in the past, whether an intraoperatively administered PECS1 block alone or preoperative US-guided block. Our main purpose was to study the effect of adding an ES block to these previously utilized thoracic block techniques and to streamline a pathway that would offer optimal pain control while minimizing opioid reliance. Patient-reported pain is a subjective measure, and therefore admittedly difficult to quantify between different treatment groups. Additionally, inclusion of morphine milligram equivalents for opioid requirements would be useful to quantitate

POD1 PAIN BY ADJUNCT GROUP   p=0.932
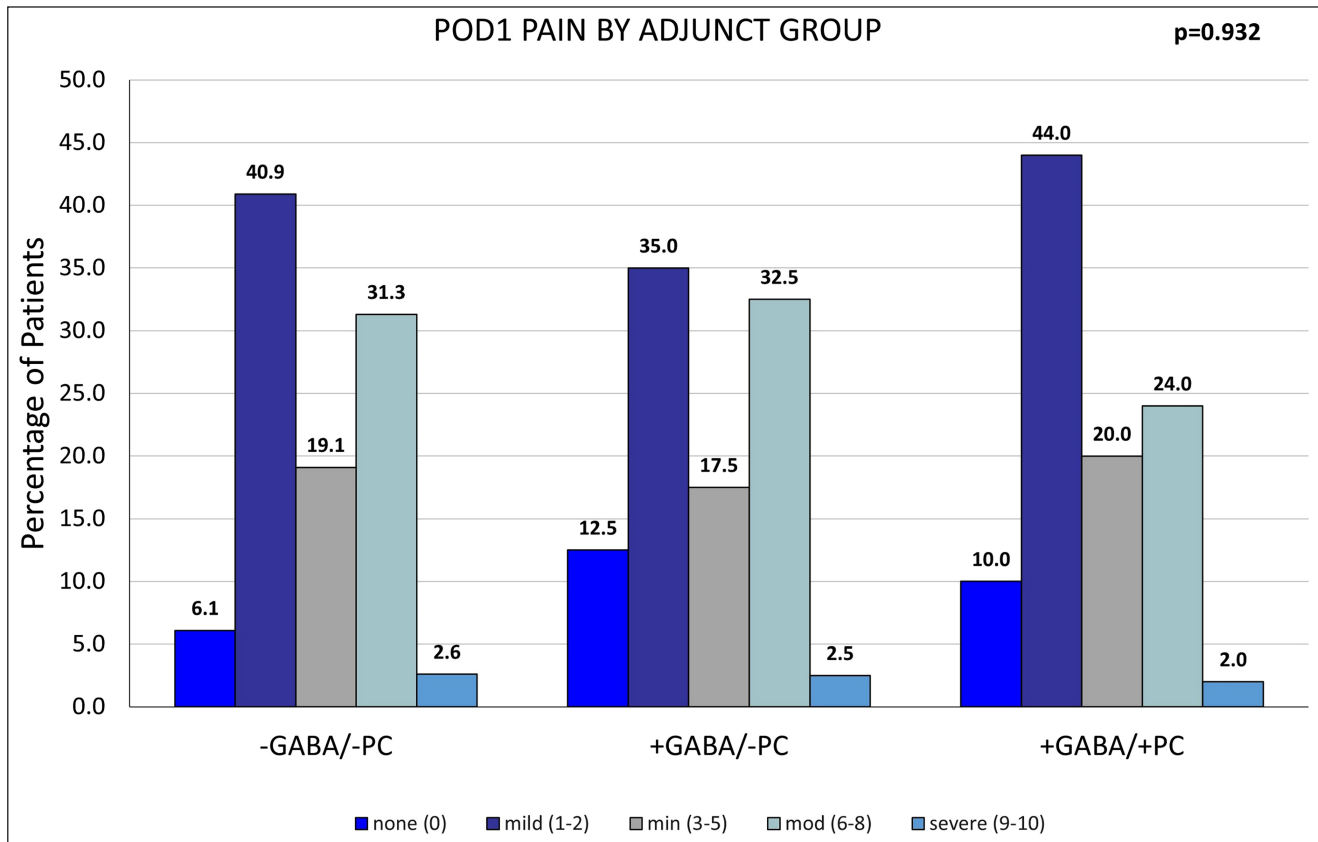
Figure 9. Patient-reported pain on postoperative day 1 (POD1) by adjunct group. +GAB, with gabapentin; −GABA, without gabapentin; +PC, with preoperative cocktail; −PC = without preoperative cocktail.

differences in efficacy between the block techniques. Follow-up data on POD1 pain were only available for 65% of our patients, as a large number could not be reached within this short-term interval. We did not stratify patients by potentially important patient and operative variables such as co-morbidities, prior breast surgery, prior use of pain medications, implant location, additional procedures performed such as mastopexy or fat grafting, or operative time. Most patients undergoing implant removal with capsulectomy did not have a concurrent mastopexy performed as there was inadequate breast issue; however, 97 patients (27.5%) had a concurrent mastopexy when there was ptosis present along with sufficient breast tissue. One of the strengths of our analysis, however, is that the procedures were performed by a single surgeon with years of experience in this operative procedure, and blocks were performed by a single anesthesiologist with extensive training in US-guided techniques. Nonetheless, the complexity of capsular dissection and degree of violation of the pectoral fascia is likely variable on a case-by-case basis and cannot easily be accounted for when considering opioid requirements or reported pain. A total capsulectomy was performed in all patients when possible.

Future research into regional block techniques in this patient population should include controlled studies, comparing ES with isolated thoracic wall blocks or oral pain regimens alone. Patient stratification by implant location (prepectoral vs subpectoral) in a cohort with a larger number of subglandular implants could also be studied to assess its impact on subjective post-capsulectomy pain, as prior research suggests that prepectoral implant placement is associated with less PO pain due to less muscle spasm. It is evident that further opportunities exist in plastic surgery for safe, reliable, and consistent techniques for multimodal pain control in patients undergoing outpatient procedures, such as implant removal and capsulectomy. Such techniques are likely to play an increasing role in the development of ERAS protocols, all with the intent of minimizing narcotic requirements in the setting of a national opioid epidemic.

CONCLUSIONS

We conclude that US-guided ES blocks combined with thoracic wall blocks offer a potent and durable option for pain control

patients who undergo breast implant removal with capsulectomy. This can effectively result in less overall opioid requirements and higher patient satisfaction in the elective postoperative plastic surgical setting. Combining regional pain blocks with other multimodality adjuncts, as evidenced by our subgroup analysis, can further improve PO pain control and assist with decreasing the opioid requirement in the elective setting. This increasingly common procedure provides an opportunity for examining nonnarcotic pain control regimens and further facilitates the development of ERAS protocols for elective breast surgery in the plastic surgery realm.

Disclosures

Funding

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