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Rethinking Radical Mastectomy Anesthesia: Combined Erector Spinae Plane and Pectoral Nerve Block Type II Blocks in Bullous Chronic Obstructive Pulmonary Disease Without Positive-Pressure Ventilation

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Abstract

Breast surgery with axillary dissection is traditionally performed under general anesthesia with positive-pressure ventilation. However, in patients with bullous chronic obstructive pulmonary disease (COPD), mechanical ventilation may increase the risk of barotrauma and pneumothorax. We report the case of a 75-year-old male with moderate COPD and a large pulmonary bulla who underwent modified radical mastectomy with axillary dissection using combined erector spinae plane and pectoral nerve block type II, associated with sedation and preservation of spontaneous ventilation. The procedure was completed without conversion to general anesthesia, opioid administration, or respiratory complications. Intraoperative oxygen saturation remained between 96% and 99%, and capnography demonstrated preserved spontaneous ventilation without clinically significant carbon dioxide retention. Postoperative pain scores remained low, without opioid requirement during the first 24 hours. This case illustrates a possible physiology-guided anesthetic alternative in carefully selected high-risk patients when avoidance of positive-pressure ventilation is clinically desirable. However, limitations related to anatomical coverage variability and the possible need for significant sedation should be recognized.

Categories: Pain Management, Anatomy, Anesthesiology

Keywords: oncoplastic breast surgery, opioid-sparing analgesia, precision anesthesia, translational and precision medicine, ultrasound-guided regional anesthesia

Introduction

Breast surgery with axillary dissection is commonly performed under general anesthesia with positive-pressure ventilation and is associated with substantial nociceptive burden and risk of persistent postoperative pain [1,2]. Thoracic regional anesthesia techniques have increasingly been incorporated into multimodal perioperative strategies for breast surgery [3,4].

In patients with advanced pulmonary disease, particularly bullous chronic obstructive pulmonary disease (COPD) or emphysema, positive-pressure ventilation may increase the risk of barotrauma, bulla rupture, and pneumothorax [5-8]. In these situations, preservation of spontaneous ventilation may become an important perioperative objective.

The erector spinae plane (ESP) block and pectoral nerve block type II (PECS II) have gained increasing attention as analgesic adjuncts in breast surgery [9-15]. The ESP block may provide thoracic analgesia through interfascial spread toward dorsal and, variably, ventral rami [10], whereas the PECS II block contributes to analgesia of the lateral thoracic wall and axillary region by targeting interfascial planes involving the pectoral and serratus compartments [9].

Despite their growing popularity, interfascial plane blocks present important anatomical limitations. Their spread may be inconsistent, particularly regarding anterior chest wall coverage and axillary dissection, which may also involve contributions from lower cervical roots beyond T2-T6 dermatomes. Consequently, these techniques are generally considered analgesic adjuncts rather than definitive anesthetic approaches for major breast surgery.

Here, we report a case in which combined ESP and PECS II blocks associated with sedation were used as the

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primary anesthetic strategy for a modified radical mastectomy with axillary dissection in a patient with substantial pulmonary risk and a clinical recommendation to avoid positive-pressure ventilation whenever feasible.

This report is reported in accordance with the CARE guidelines. Ethical approval was obtained from the Institutional Research Ethics Committee (approval number: 8,278,821), and written informed consent was obtained from the patient.

Case Presentation

A 75-year-old male (78 kg, American Society of Anesthesiologists class III) with left breast adenocarcinoma (Figures 1, 2) was scheduled for a modified radical mastectomy with axillary dissection. His medical history was notable for moderate COPD, chronic atrial arrhythmia, and a 25-pack-year smoking history.



FIGURE 1: Preoperative view of the left breast showing the ulcerated neoplastic lesion and surgical skin markings before modified radical mastectomy with axillary dissection.

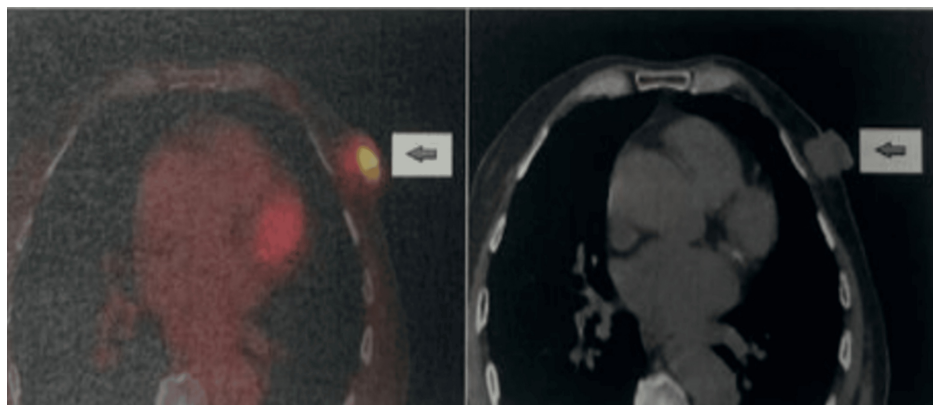


FIGURE 2: Preoperative positron emission tomography-computed tomography and chest computed tomography demonstrating a hypermetabolic lesion in the left breast (arrows).

Preoperative chest computed tomography demonstrated diffuse bilateral paraseptal emphysema and a pulmonary bulla measuring approximately 5 cm. Spirometry showed a moderate obstructive ventilatory pattern. Given the elevated pulmonary risk and the potential for barotrauma or pneumothorax, the pulmonology team recommended avoiding positive-pressure ventilation whenever feasible.

The patient was receiving chronic anticoagulation with a direct oral anticoagulant, which was discontinued five days before surgery without bridging therapy. After multidisciplinary discussion, a regional anesthesia strategy associated with sedation and preservation of spontaneous ventilation was planned.

Upon arrival in the operating room, standard monitoring was initiated, including electrocardiography, noninvasive blood pressure monitoring, pulse oximetry, and nasal capnography. Supplemental oxygen at 3 L/minute was administered via a nasal cannula.

An ultrasound-guided combined regional anesthetic technique was then performed. With the patient in the sitting position, a T4 ESP block was administered after identification of the transverse process and erector spinae muscle, using 20 mL of anesthetic solution consisting of 10 mL of 1% lidocaine and 10 mL of 0.5% ropivacaine (Figure 3). Subsequently, with the patient in the supine position, a PECS II block was performed at the level of the third rib, including interpectoral and pectoroserratus injections, using a total volume of 40 mL composed of 20 mL of 1% lidocaine and 20 mL of 0.5% ropivacaine (Figure 4).

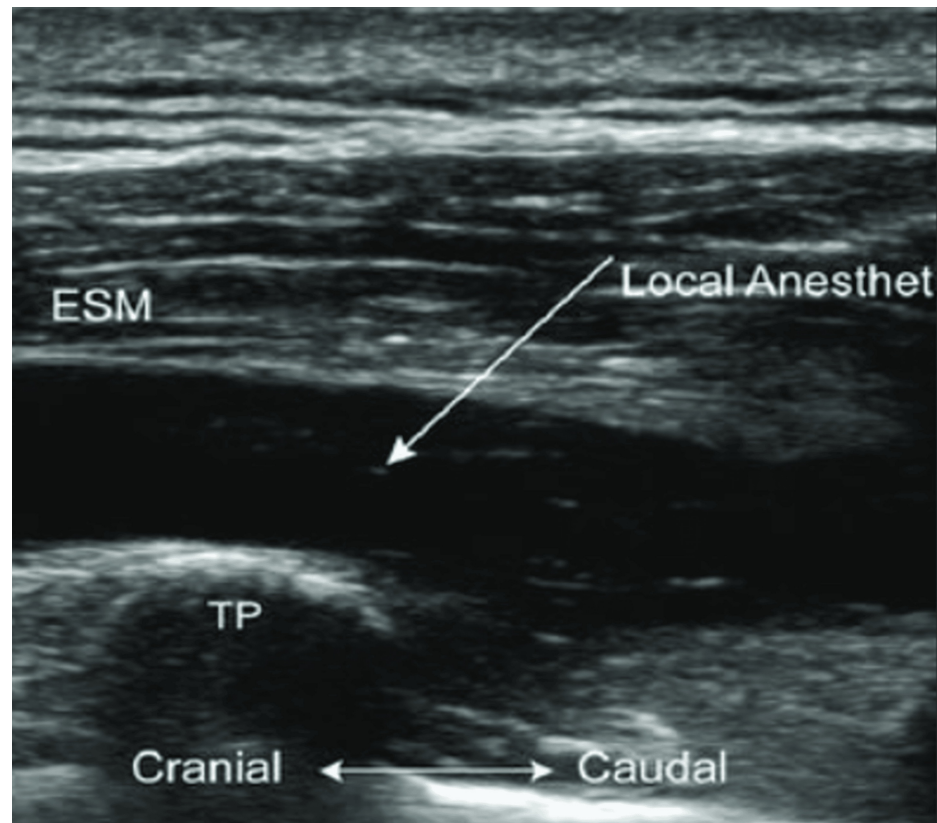


FIGURE 3: Ultrasound-guided erector spinae plane block performed at the thoracic level, demonstrating needle positioning and interfascial spread of the local anesthetic deep to the erector spinae muscle adjacent to the transverse process.

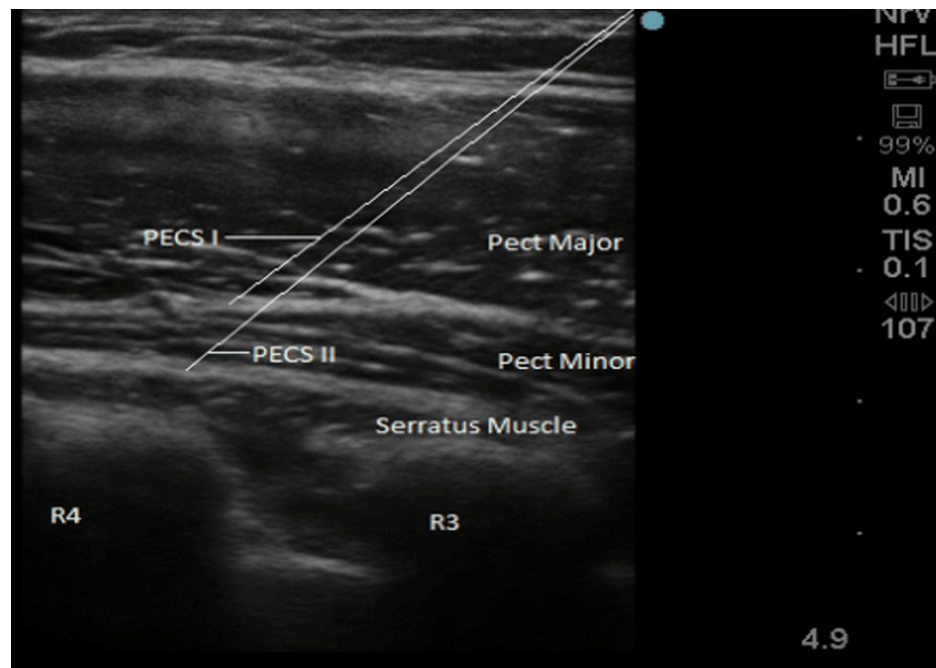


FIGURE 4: Ultrasound-guided pectoral nerve block type II block demonstrating local anesthetic deposition in two interfascial planes: initially, between the pectoralis major and pectoralis minor muscles (interpectoral plane), targeting the medial and lateral pectoral nerves; and, subsequently, between the pectoralis minor and serratus anterior muscles, typically at the level of the third or fourth rib, aiming to block the lateral cutaneous branches of the intercostal nerves (T2–T6).

The selection of ESP and PECS II blocks instead of a thoracic epidural or paravertebral block was based on the intention to minimize pleural manipulation and reduce procedural invasiveness in a patient with significant structural pulmonary vulnerability.

The total administered dose corresponded to 300 mg of lidocaine (3.8 mg/kg) and 150 mg of ropivacaine (1.9 mg/kg), remaining within conservative safety limits. Incremental injections with repeated aspiration and continuous monitoring for local anesthetic systemic toxicity (LAST) were maintained throughout the procedure. No adjuvants were added to the anesthetic mixture.

Twenty minutes after block placement, sensory assessment demonstrated predominant reduction of thermal and pinprick sensation in the lateral thoracic and axillary regions (approximately T2–T6 dermatomes), with partial involvement of the anterior chest wall. The possibility of incomplete surgical coverage was recognized before incision, and contingency planning for supplemental sedation or conversion to general anesthesia was maintained throughout the procedure.

Sedation was initiated with midazolam (total dose 5 mg), followed by target-controlled infusion of propofol (target concentration 1–2 µg/mL), titrated to maintain a Richmond Agitation-Sedation Scale (RASS) score between –2 and –3. Capnography was continuously monitored through a nasal sampling line integrated into the oxygen cannula.

The surgical procedure lasted approximately two hours (Figure 5). During surgery, oxygen saturation remained between 96% and 99%, respiratory rate ranged from 12 to 18 breaths/minute, and end-tidal carbon dioxide values ranged from 32 to 38 mmHg, demonstrating preserved spontaneous ventilation without clinically significant carbon dioxide retention. Hemodynamic parameters remained stable, and vasopressor support was not required.

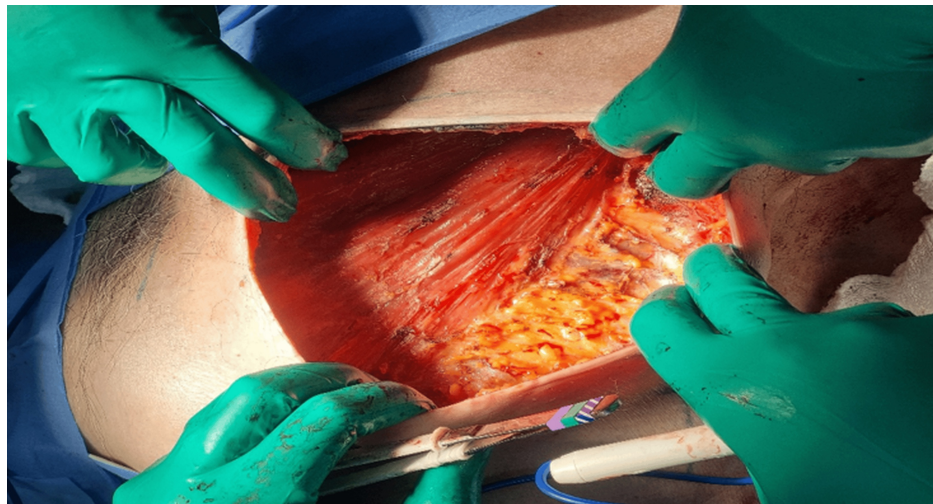


FIGURE 5: Intraoperative view after en bloc tumor resection, showing the surgical bed and exposure of the chest wall muscular layers.

No intraoperative opioids were administered, and conversion to general anesthesia was not necessary. Nevertheless, we acknowledge that moderate-to-deep sedation likely contributed substantially to intraoperative comfort and tolerance of surgical manipulation.

At the conclusion of the surgery, the patient was transferred to the post-anesthesia care unit awake, oriented, and hemodynamically stable. Postoperative pain scores ranged from 1 to 3 on the numerical rating scale during the first 12 hours. Analgesia was maintained with dipyrone and nonsteroidal anti-inflammatory drugs, without opioid requirement during the first 24 hours. No respiratory complications, neurological deficits, or clinical signs of LAST were observed.

Discussion

This case illustrates a potential individualized anesthetic alternative using combined ESP and PECS II blocks associated with sedation in a carefully selected high-risk patient undergoing breast surgery. In the present scenario, the primary anesthetic objective extended beyond analgesia alone and included preservation of spontaneous ventilation in a patient with significant bullous pulmonary disease.

Thoracic epidural anesthesia and paravertebral block remain established regional anesthesia techniques for breast surgery and may provide more reliable surgical anesthesia for extensive thoracic procedures [13,14]. In addition, regional thoracic techniques have long been associated with improved perioperative analgesia and opioid-sparing effects in thoracic surgery settings [16]. However, in patients with severe bullous emphysema or structural pulmonary vulnerability, concerns related to pleural puncture, procedural invasiveness, and potential respiratory complications may influence anesthetic planning. In this context, interfascial plane blocks may represent less invasive alternatives that can potentially reduce pleural manipulation while preserving spontaneous ventilation.

Nevertheless, important anatomical and technical limitations should be recognized. The spread of interfascial plane blocks is inherently variable and may provide incomplete surgical coverage, particularly regarding the anterior chest wall and axillary region. Furthermore, axillary dissection may involve sensory contributions from lower cervical roots in addition to T2-T6 dermatomes. Consequently, ESP and PECS II blocks should not be interpreted as uniformly reliable surgical anesthesia techniques for all modified radical mastectomies.

Another important consideration relates to sedation. In the present case, sedation levels corresponding to RASS scores between -2 and -3 likely contributed substantially to intraoperative comfort and tolerance of surgical manipulation. Therefore, successful completion of surgery cannot be attributed exclusively to the regional blocks themselves. In selected patients, deeper sedation, supplemental local infiltration, rescue analgesia, or even conversion to general anesthesia may still become necessary.

The anesthetic mixture consisted of lidocaine and ropivacaine, aiming to balance onset time and block duration while maintaining conservative cumulative dosing and continuous monitoring for LAST. Although combining local anesthetics may theoretically optimize block characteristics, cumulative systemic exposure may also increase toxicity risk. For this reason, conservative dose selection, incremental administration, repeated aspiration, continuous monitoring, and readiness for management of LAST are essential.

In the present case, avoidance of positive-pressure ventilation was considered clinically relevant because of the patient's significant bullous emphysema and the associated theoretical risk of barotrauma and pneumothorax [5–8]. Preservation of spontaneous ventilation potentially minimized abrupt variations in transpulmonary pressure and maintained more physiological respiratory mechanics throughout the procedure. However, we recognize that this observation derives from a single clinical experience and cannot establish superiority over conventional anesthetic techniques.

The opioid-free postoperative course and low pain scores observed during the first 24 hours are noteworthy. Nevertheless, no causal conclusions regarding the reduction of chronic pain, improvement of long-term recovery, or superiority of the anesthetic technique can be established from an isolated case report.

Several limitations should be acknowledged. This report describes a single patient without long-term follow-up or direct comparison with conventional anesthetic approaches. In addition, the extent to which sedation compensated for incomplete sensory blockade cannot be fully determined. Interfascial plane blocks inherently present variability of spread and risk of partial failure, which should be considered during patient selection and perioperative planning. Moreover, objective intraoperative nociception monitoring was not available.

We do not propose this strategy as a replacement for conventional anesthetic techniques for modified radical mastectomy. Instead, this report should be interpreted as an illustrative and individualized approach applied in a carefully selected high-risk patient. Further studies are necessary to better define reproducibility, optimal patient selection, safety profile, and perioperative outcomes associated with this strategy.

Conclusions

This case illustrates a potential individualized anesthetic alternative for modified radical mastectomy in a carefully selected high-risk patient with significant bullous pulmonary disease. The combination of ESP and PECS II blocks associated with sedation allowed completion of extensive breast surgery while preserving spontaneous ventilation and avoiding intraoperative opioid administration and general anesthesia. The originality of this report lies not only in the use of multiple regional and interfascial techniques in combination but also in their application with the specific intention of providing primary surgical anesthesia rather than solely postoperative analgesia. In this context, regional anesthesia was used as a physiology-oriented anesthetic strategy in a patient in whom positive-pressure ventilation represented a relevant pulmonary concern. Nevertheless, important limitations related to anatomical coverage variability, potential block failure, and the contribution of moderate-to-deep sedation must be recognized. Therefore, this approach should not be interpreted as a replacement for conventional anesthetic techniques for modified radical mastectomy, but rather as an individualized strategy that may be considered in highly selected clinical scenarios. Further investigations are necessary to better define reproducibility, patient selection criteria, optimal block combinations, safety profile, and perioperative outcomes associated with combined interfascial regional anesthesia as a primary anesthetic approach for extensive breast surgery.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

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