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RESEARCH ARTICLE
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THORACIC PARAVERTEBRAL BLOCK FOR BREAST SURGERY IN A PATIENT WITH PATENT FORAMEN OVALE, BIDIRECTIONAL SHUNT, AND SEVERE PULMONARY ARTERY HYPERTENSION: A CASE REPORT

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ABSTRACT

Background:** Thoracic paravertebral block (PVB) is a regional anesthetic technique that provides effective analgesia and anesthesia for unilateral breast surgeries. Patients with severe pulmonary artery hypertension (PAH) and patent foramen ovale (PFO) with bidirectional shunt are at high risk from general anesthesia (GA) due to risk of right heart failure and paradoxical embolism.

Case Presentation:** A 27-year-old female with severe PAH, bidirectional PFO, and left breast abscess requiring wide local excision was managed using ultrasound-guided left thoracic paravertebral block at T4–T5 and T5–T6 levels. The procedure provided adequate surgical anesthesia, stable hemodynamics, and excellent postoperative analgesia without opioid use.

Conclusion:** Thoracic PVB can be a safe and effective anesthetic method in high-risk patients with severe PAH and PFO undergoing unilateral breast surgery where GA may pose significant risks.

INTRODUCTION

Thoracic paravertebral block is a well-established regional anesthetic technique targeting spinal nerves as they exit the vertebrae, commonly employed for unilateral breast and thoracic wall surgeries including mastectomy, wide local excision, and reconstruction. Its use as a sole anesthetic technique offers benefits including reduced postoperative nausea and vomiting and hemodynamic stability.Patients with severe pulmonary artery hypertension and PFO with bidirectional shunting face high perioperative risk due to potential increases in pulmonary vascular resistance (PVR), risking right ventricular failure, hypoxemia, and paradoxical embolism. General anesthesia and positive pressure ventilation may worsen these risks through fluctuations in systemic and pulmonary vascular resistance.

This case report illustrates the successful use of ultrasound-guided thoracic paravertebral block to provide surgical anesthesia and stable hemodynamics in a patient with severe PAH and PFO undergoing breast surgery.

CASE REPORT

A 27-year-old female presented with pain and swelling in the left breast for one week, diagnosed clinically as a left breast abscess and scheduled for wide local excision. She had a prior history of gestational hypothyroidism but was not currently on medication.

Physical examination revealed a BMI of 32 kg/m² (class I obesity), stable vitals, and normal systemic examination. The patient was NYHA functional class II with dyspnea on exertion. Airway evaluation showed Mallampati class II, adequate mouth opening, and cervical mobility.

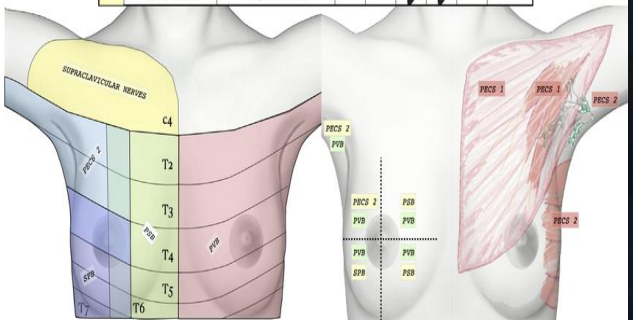
Laboratory investigations revealed hemoglobin of 10.8 g/dL and thyroid function tests indicating elevated TSH with normal T3 and T4 levels. Electrocardiogram showed sinus rhythm with T wave inversion in leads III and V1–V5. Echocardiography demonstrated good left ventricular function (EF 66.5%), dilated right atrium, right ventricle, and pulmonary arteries, severe tricuspid regurgitation, severe pulmonary artery hypertension, and a stretched open patent foramen ovale with bidirectional shunting.

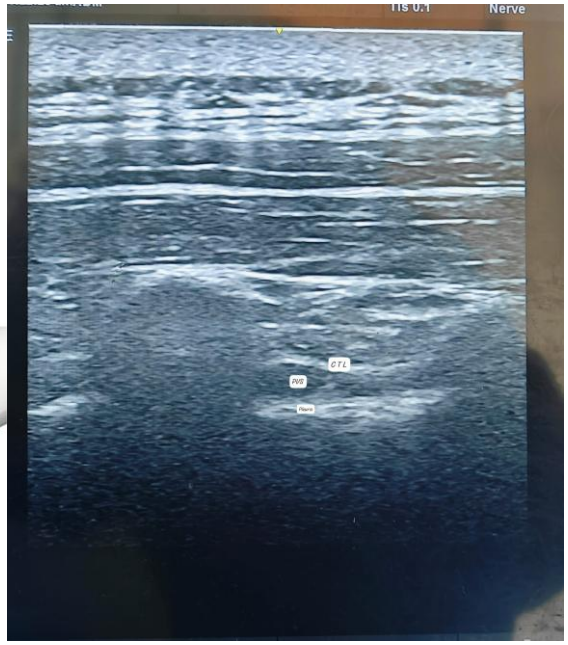
Given the high risk of anesthesia-related right heart failure and paradoxical embolism under general anesthesia due to severe PAH and PFO, the anesthetic plan was to perform a left thoracic paravertebral block as primary anesthetic.

Under aseptic conditions, ultrasound-guided left paravertebral block was performed at T4–T5 and T5–T6 levels using a 23-gauge spinal needle and a total of 26 mL of local anesthetic mixture (17 mL of 0.5% bupivacaine, 7 mL of 2% lignocaine, and 2 mL dexamethasone). Supplemental oxygen was provided via face mask at 6 L/min. Adequate sensory blockade was achieved and the procedure proceeded uneventfully.

Throughout the surgery, the patient remained hemodynamically stable with no requirement for conversion to general anesthesia or additional analgesics. Postoperative analgesia was excellent with no opioid requirement, and the patient experienced no respiratory complications.

	Anatomical involvement	Innervation	PVB	PECS 1	PECS 2	SPB	PSB	Local infiltration
	Lumpectomy							✓
	Axillary skin	Intercostobrachial nerve (T1-T2)	✓		✓			✓
	Deep axillary structures				✓			
	Skin and gland							
Mastectomy	Infraclavicular region	Supraclavicular nerves (C3-C4)						✓
Mastectomy	Upper outer quadrant	Lateral cutaneous branches T2-T4	✓		✓			✓
Mastectomy	Lower outer quadrant	Lateral cutaneous branches T4-T6	✓			✓		✓
Mastectomy	Upper inner quadrant	Anterior cutaneous branches T2-T4	✓				✓	✓
Mastectomy	Lower inner quadrant	Anterior cutaneous branches T4-T6	✓				✓	✓
	Muscles							
Implants	Pectoralis major muscle	Lateral and medial pectoral nerves		✓	✓			
Implants	Pectoralis minor muscle	Medial pectoral nerves		✓	✓			
Implants	Serratus anterior	Long thoracic nerves			✓	✓		





DISCUSSION

Severe pulmonary artery hypertension increases perioperative mortality risk primarily through right ventricular failure precipitated by increases in pulmonary vascular resistance, while PFO with bidirectional shunt introduces risk of paradoxical embolism and hypoxemia.

General anesthesia, especially induction and positive pressure ventilation, can exacerbate these risks by causing significant swings in pulmonary and systemic vascular resistance and reducing right ventricular output. Regional anesthesia techniques such as thoracic paravertebral block avoid airway manipulation and positive pressure ventilation, thereby maintaining stable hemodynamics.

Thoracic PVB provides dense unilateral analgesia and anesthesia suited for breast surgery, with less hypotension and fewer systemic effects compared to thoracic epidural anesthesia. Its use in patients with severe cardiopulmonary disease is well supported by evidence favoring opioid-sparing and hemodynamic stability.

This case exemplifies the effective use of ultrasound-guided thoracic PVB in a patient with severe pulmonary hypertension and PFO. Careful planning, ultrasound guidance, appropriate dosing, and meticulous avoidance of factors that increase PVR (hypoxia, hypercarbia, acidosis, pain) contributed to the successful outcome.

CONCLUSION

Ultrasound-guided thoracic paravertebral block represents a valuable anesthetic alternative to general anesthesia in patients with severe pulmonary artery hypertension and patent foramen ovale undergoing unilateral breast surgery. Tailored anesthetic planning and vigilant perioperative management are essential for optimal patient outcomes.

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