

# Comparison of Thoracic Epidural and Paravertebral Block for Postoperative Pain Control in Patients with Thoracotomy

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Epidural and  
Paravertebral  
Block for  
Postoperative  
Pain with  
Thoracotomy

## ABSTRACT

**Objective:** To compare post-operative analgesic effect and complications of thoracic epidural and paravertebral block in thoracotomy patients.

**Study Design:** Randomized clinical trial study

**Place and Duration of Study:** This study was conducted at the Lady Reading Hospital in Peshawar from November 2022 to October 2023.

**Methods:** Overall, 380 patients were included in this study both genders. Patients were divided into two groups (TPVB and TEA) by lottery method. There were 306 patients received TPVB and 74 patients received TEA. Both groups, TEB or PVB as applicable, had their respective interventions applied 30 minutes before end of surgery, with the time duly recorded.

**Results:** VAS score at 1 hour of thoracotomy was  $3.96 \pm 1.13$  in TPVB group and  $4.16 \pm 1.22$  in TEA group, at 2 hours it was  $3.54 \pm 0.81$  and  $3.44 \pm 1.21$ , at 6 hours  $3.08 \pm 0.93$  and  $3.09 \pm 0.98$ , at 12 hours  $2.46 \pm 0.66$  and  $2.41 \pm 0.69$ , at 24 hours it was  $1.97 \pm 0.28$  and  $1.98 \pm 0.31$  in TPVB and TEA group, respectively.

**Conclusion:** Management of postoperative pain in thoracotomy patients, it was noted that preemptive thoracic paravertebral block (TPVB) and thoracic epidural analgesia (TEA) resulted in similar Visual Analog Scale (VAS) scores and supplemental analgesic requirements.

**Key Words:** Thoracic epidural analgesia, Thoracic paravertebral block, Visual analogue score, Thoracotomy, Complications

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## INTRODUCTION

Thoracotomy inflicts substantial trauma and a major contributor to severe acute pain during the postoperative period<sup>1</sup>. Inadequately managed acute pain following thoracotomy can elevate postoperative morbidity and extend hospitalization durations. Failure to effectively address thoracotomy-related pain may lead to the onset of chronic pain, impeding patients' ability to resume normal activities for an extended period<sup>2,3</sup>.

Various analgesic methods, including plane blocks, thoracic epidural analgesia (TEA), intercostal nerve blocks, pleural blocks and thoracic paravertebral block

(TPVB), have been proposed for thoracotomy pain management<sup>4</sup>. While the risk of spinal hematoma is comparatively lower in patient of normal coagulation with for block applications<sup>5</sup>. Despite this, thoracic epidural analgesia (TEA) continues to be regarded as the gold standard technique for managing post-thoracotomy pain<sup>6,7</sup>.

The paravertebral space, extending on either side of the vertebral column in a wedge-shaped manner, houses structures such as the dorsal ramus, spinal nerve, sympathetic chain, rami communicantes<sup>8</sup>. When a local anesthetic is administered to the paravertebral space, it induces sympathetic or somatic block, unilateral analgesia, making it a suitable choice for providing anesthesia during unilateral surgical procedures in the thoracic region<sup>9,10</sup>. The TPVB technique can be applied bilaterally or unilaterally, offering the advantage of avoiding contralateral sympathetic block, unlike TEA, and minimizing the risk of hypotension while maintaining blood pressure<sup>11</sup>.

Study aimed to assess and compare the effectiveness as well as the occurrence of side effects associated with the TEA and TPVB methods applied for analgesia management after thoracotomy analgesia in the context of postoperative acute pain.

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**METHODS**

This study conducted at Lady Reading Hospital in Peshawar from November 2022 to October 2023 was initiated after Ethical approval. Data of patients who underwent elective thoracic surgery at the hospital were recorded on a pre-designed performa. Inclusion criteria comprised individuals aged 18 to 80, having undergone thoracotomy, and receiving either thoracic epidural analgesia (TEA) or thoracic paravertebral block (TPVB) for postoperative pain management.

Exclusions were made for patients those operated under emergency conditions, or individuals with pre-existing chronic pain who constantly used analgesics. "Catheter failure," defined as catheter dislocation, postoperative kinking, and epidural catheter occlusion. The patients were divided into TPVB and TEA, using a lottery method.

In the TEA group, patients were prepared in aseptic environment, and skin anesthesia injected. The epidural space was accessed between T5-T7 using an 18-Gauge Tuohy needle. A four-centimeter segment of the catheter was intentionally positioned within the epidural space. To omit the risk of vascular and intrathecal injection, a test dose comprising 5 µg/ml (1:200,000) adrenaline and 3 ml of 2% lidocaine was administered, and subsequent assessment involved placing patients in the supine position and evaluating the bilateral block through a pin-prick test.

During the surgical procedure, epidural analgesia was achieved by combining 67.5 ml of 0.5% bupivacaine, 200 ml of saline, and morphine 10 mg/ml. During the initial 24-hour postoperative period, a 0.125% bupivacaine infusion was given epidurally through an elastomeric pump at a constant rate of 4 ml/h as part of our study comparing its effectiveness with thoracic paravertebral block (TPVB). Patients in the TPVB group underwent ultrasound-guided paravertebral block placement 2-3 cm lateral to T5 spinous process under general anesthesia. Patients received 1g of paracetamol every 8 hours. Patient satisfaction was categorized as satisfied, moderately satisfied, or unsatisfied.

Data analyses were conducted using SPSS for Windows, version 27.0 after analysis  $p < 0.05$  was considered for all statistical analyses.

**RESULTS**

Overall, 380 patients were included in this study both genders. There were 306 (80.5%) patients received TPVB and 74 (19.5%) patients received TEA. The demographics and baseline characteristics of both the groups were almost equal ( $p > 0.050$ ). (Table. 1).

The distribution of VAS score, additional analgesic requirements and satisfaction level of both the study groups was almost equal ( $p > 0.050$ ). (Table. 2).

The side effects, nausea-vomiting, bradycardia, hypotension, headache, itching, sweating and

respiratory depression, were more common in the patients, who received TEA as compare to the patients who received TPVB, ( $p < 0.001$ ). (Table. 3).

**Table No. 1: Demographics and baseline characteristics of both the study groups**

Variable	TPVB 306 (80.5%)	TEA 74 (19.5%)	p-value
Age (years)	58.52±10.25	60.63±12.42	0.342
Sex			
Male	220 (71.9)	54 (73.0)	0.85
Female	86 (28.1)	20 (27.0)	3
BMI (kg/m <sup>2</sup> )	26.21±3.48	27.82±3.52	0.174
ASA			
II	98 (32.0)	20 (27.0)	0.40
III	208 (68.0)	54 (73.0)	4
Diagnosis			
Lung cancer	217 (70.9)	59 (79.7)	0.093
Bronchiectasis	38 (12.4)	9 (12.2)	
Hydatid Cyst	12 (3.9)	5 (6.8)	
Pleural thickening/effusion	11 (3.6)	1 (1.4)	
Interstitial Lung Disease	19 (6.2)	0 (0.0)	
Other	9 (2.6)	0 (0.0)	
Operation type			
Thoracotomy	224 (73.2)	55 (74.3)	0.845
VATS + Thoracotomy	82 (26.8)	19 (25.7)	
Operation			
Lung Resection	164 (53.6)	44 (59.5)	0.635
Pneumonectomy	75 (24.5)	15 (20.3)	
Exploration-Decortication	40 (13.1)	7 (9.5)	
Other	27 (8.8)	8 (10.8)	
Duration of Anesthesia	270.33±15.26	268.28±16.52	0.306

**Table No. 2: Distribution of VAS score, additional analgesic requirements and satisfaction level of both the study groups**

Variable	TPVB 306 (80.5%)	TEA 74 (19.5%)	p-value
VAS at 1 hour	3.96±1.13	4.16±1.22	0.197
VAS at 2 hours	3.54±0.81	3.44±1.21	0.342
VAS at 6 hours	3.08±0.93	3.09±0.98	0.944
VAS at 12 hours	2.46±0.66	2.41±0.69	0.524
VAS at 24 hours	1.97±0.28	1.98±0.31	0.796
Additional Analgesic Requirements	61 (19.9)	18 (24.3)	0.404
Satisfaction level			
Moderate	77 (25.2)	13 (17.6)	0.168
Fully satisfied	229 (74.8)	61 (82.4)	

**Table No. 3: Distribution of side effects between both the study groups**

Variable	TPVB 306 (80.5%)	TEA 74 (19.5%)	p- value
Nausea-vomiting	14 (18.9)	26 (35.1)	<0.001
Hypotension	8 (2.6)	13 (17.6)	<0.001
Bradycardia	26 (8.5)	19 (25.7)	<0.001
Headache	1 (0.3)	4 (5.4)	<0.001
Itching	2 (0.7)	8 (10.8)	<0.001
Sweating	1 (0.3)	6 (8.1)	<0.001
Respiratory depression	1 (0.3)	5 (6.8)	<0.001

## DISCUSSION

Thoracotomy, considered one of the most painful surgical procedures, poses a significant risk of postoperative pulmonary complications, including pulmonary embolism, pain-related atelectasis, and pneumonia. Inadequate treatment of this pain can lead to heightened postoperative morbidity and an extended hospital stay<sup>12</sup>. After thoracotomy effective pain management can hinder these complications.

The distribution of VAS score, additional analgesic requirements and satisfaction level of both the study groups was almost equal, in a study Zengin et al<sup>13</sup> reported that preemptive thoracic paravertebral block (TPVB) combined with postoperative intravenous patient-controlled analgesia (PCA) and postoperative complications were less frequent when compared to TEA, while both approaches exhibited similar Visual Analog Scale (VAS) scores and additional analgesic requirements. Consequently, the findings suggest that TPVB, especially when coupled with postoperative IV PCA, may serve as a favorable alternative for preventing acute pain following thoracotomy.

Studies conducted by Karmakar et al<sup>14</sup> and Yeung et al<sup>15</sup> concluded that thoracic Epidural Analgesia (TEA), a regional analgesia technique, continues to serve as the gold standard for managing post-thoracotomy pain; however, recent studies suggest that Thoracic Paravertebral Block (TPVB), increasingly utilized in recent years, may offer a comparable or even superior analgesic effect compared to TEA.

The analgesic effect of thoracic paravertebral block (TPVB) arises from unilateral somatic and sympathetic block effects, providing pain relief across both upper and lower dermatomes within the application area. This includes achieving pain control along the thoracotomy line comparable to thoracic epidural analgesia (TEA)<sup>16</sup>. Our study demonstrated similar pain scores between TPVB and TEA, along with comparable rates of additional analgesic use, aligning with existing literature and supporting the efficacy of TPVB as an effective method for acute pain management following thoracotomy.

In this study side effects, nausea-vomiting, hypotension, bradycardia, headache, itching, sweating and respiratory depression, were more common in the patients, who received TEA as compare to the patients who received TPVB, the differences were statistically significant, ( $p < 0.001$ ). The use of thoracic epidural analgesia (TEA) is restricted due to the potential emergence of undesired complications, including bradycardia, hypotension, urinary retention, nausea-vomiting, and which may arise as a consequence of sympathetic block<sup>17</sup>.

In this study additional analgesic requirement were needed in 19.9% patients in TPVB group and 24.3% in TEA group. In recent years, the acceleration of postoperative recovery, particularly in thoracic surgery, has emerged as a significant concern, with a focus on Enhanced Recovery After Surgery (ERAS) protocols. These protocols prioritize opioid-free and low complication rate analgesia strategies to support optimal patient outcomes and recovery<sup>18</sup>.

A study was conducted by Mukherjee et al<sup>19</sup> and reported that patients who received PVB for postoperative analgesia had better pain relief compared to those who received TEB. Additionally, improvement with PVB not only occurred immediately after surgery but also lasted for a longer duration. Another author found that patients who received paravertebral bupivacaine plus fentanyl experienced superior pain relief however, there were no significant differences observed in supplementary analgesic requirements between the two groups.

Another study, randomly assigned 45 patients to paravertebral infusion of bupivacaine, blocks in intercostal region, thoracic epidural injection, revealing no significant differences in respiratory depression, pain reduction, or adverse events after 20 hours of block.

## CONCLUSION

In terms early postoperative pain management following thoracotomy, it was noted that preemptive thoracic paravertebral block (TPVB) and thoracic epidural analgesia (TEA) resulted in similar Visual Analog Scale (VAS) scores and supplemental analgesic requirements. However, patients receiving TPVB exhibited fewer postoperative complications compared to those with TEA, suggesting that TPVB could be a viable alternative for preventing acute pain after thoracotomy.

### Author's Contribution:

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