



## Research Article

# Retrospective evaluation of analgesia approaches in patients undergoing thoracic surgery over the last one year: A single-center study

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## ABSTRACT

**Objective:** Providing adequate analgesia after thoracic surgery plays an important role in preventing pulmonary complications while accelerating postoperative recovery. This study aimed to retrospectively evaluate the effectiveness of analgesia approaches applied to patients who underwent thoracic surgery at Atatürk University Research Hospital in the last year. This study aimed to retrospectively evaluate the effectiveness of analgesia approaches applied to patients who underwent thoracic surgery at Atatürk University Research Hospital in the last year by comparing different analgesia methods in terms of rescue analgesia requirements.

**Method:** This retrospective study was conducted by examining the archive files of patients who underwent thoracic surgery between 2024-2025. Patients were classified according to the analgesia methods applied. The analgesic method used was compared according to the type of surgery applied and the need for rescue analgesia.

**Results:** Intravenous opioid was determined as the most frequently used analgesia method in the analyzed patient group. Rescue analgesia requirement was observed to be the lowest in patients who underwent epidural analgesia. In patients who underwent paravertebral block, it was observed that effective analgesia was provided and the need for rescue analgesia decreased.

**Conclusion:** Epidural analgesia and paravertebral block stand out as effective methods in analgesia management after thoracic surgery. However, the specific advantages and complication risks of each method should be considered. Secondary objectives of this study include analyzing the relationship between analgesia selection and surgical type (VATS and thoracotomy) and determining the choice of analgesia method and its rationale. It is thought that the findings of this study will contribute to the determination of optimal analgesia strategies after thoracic surgery.

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## 1. Introduction

Thoracic surgery is one of the surgical procedures that cause severe pain in the postoperative period and therefore requires effective analgesia management [1]. Because minimally invasive techniques provide a more comfortable recovery process, methods such as video-

assisted thoracoscopic surgery (VATS) are preferred over open thoracotomy for many thoracic surgery procedures [2]. Inadequate pain control may lead to decreased patient comfort, increased pulmonary complications, impaired respiratory functions, and prolonged recovery [3]. Therefore, effective management of pain in the post-thoracic surgery period is of critical importance

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not only to increase patient satisfaction but also to prevent complications and improve the treatment process [4]. Multimodal analgesia approaches are widely used in postoperative pain management among patients undergoing thoracic surgery. Methods such as epidural analgesia, plane blocks, and combination of intravenous opioid and non-opioid drugs have been developed [1]. However, the efficacy, safety and effects of these methods on patient outcomes are reported with different results in the literature. Therefore, retrospective evaluations aimed at understanding the success of these methods in clinical applications provide important information on analgesia management [5]. This study aims to retrospectively evaluate analgesia approaches in patients undergoing thoracic surgery. The effectiveness of analgesia methods applied in the last year and their effects on patient outcomes are analyzed, and the aim is to demonstrate the success of current practices and develop recommendations that can guide future clinical approaches.

Systematic analyses of regional anesthesia techniques applied for analgesia after thoracic surgery at Atatürk University Medical Faculty Education and Research Hospital are insufficient. Determining the effectiveness of analgesic methods used according to the type of surgery and the need for rescue analgesia are important in terms of identifying deficiencies in current practices.

This study aims to retrospectively examine the frequency and effectiveness of regional anesthesia techniques in patients undergoing thoracic surgery. It is aimed that the data obtained will guide the arrangements that will increase patient safety and satisfaction, contribute to the development of educational strategies and form the basis for evidence-based practices.

The primary objective of this study was to compare the effectiveness of different postoperative analgesia techniques by evaluating the need for rescue analgesia in patients undergoing thoracic surgery. Secondary objectives included analyzing the relationship between analgesia selection and surgical type (VATS vs. thoracotomy) and determining the distribution and rationale for analgesia method selection.

## 2. Materials and Methods

The necessary ethics committee approval (B.30.2.ATA.0.01.00/790) was obtained for the conduct of the study. The study included a one-year period (January 1, 2024 - December 31, 2024) of patients undergoing thoracic surgery. The recorded file information of adult patients undergoing elective thoracic surgery was examined. Patients between the ages of 18 and 90 and whose American Society of Anesthesiologists (ASA) physical status was 1-4 were included in the study. The groups excluded from the study were those under the age of 18 - over the age of 90, patients who underwent emergency surgery, and those with missing data. A case follow-up form was prepared in advance for the study. This form includes demographic information (age, gender, height, weight) of the patients, as well as ASA physical status, diagnoses, types of operations performed, types of anesthesia, operation times, intraoperative an-

algnesia methods, selected postoperative analgesia types, rescue analgesia needs, times of rescue analgesia need, and hospital stay. After accessing the archive files, demographic information and diagnoses of the patients were obtained from the anamnesis files. In addition, diseases and ASA scores were obtained from the premedication file. Information on the type of anesthesia, intraoperative opioid use and analgesia management was collected from the anesthesia follow-up form filled during the operation. Postoperative data were obtained from doctors' orders and nurse follow-up forms. Finally, hospital stay was obtained from the epicrisis file.

### 2.1. Our clinic's patient management in thoracic surgery operations

The primary surgical approach of the thoracic surgery clinic includes VATS. As a routine practice of our clinic, all patients who will undergo elective surgery are evaluated preoperatively by anesthesiologists in the outpatient clinic. General anesthesia was applied to our patients during surgery. All patients receive 1 gr paracetamol and 50 mg dexketoprofen iv (intravenous) intraoperatively. In order for patients to have a comfortable postoperative period, regional analgesia techniques are used, except for contraindications. As a routine practice of our clinic, thoracic epidural analgesia (TEA) is used as an intraoperative and postoperative analgesic method in thoracotomy cases. For intraoperative analgesia, patients were given analgesic fluid at 60-minute intervals. Epidural fluid contains 20 mg bupivacaine and 50 mcg fentanyl and is mixed with physiological saline to make a total of 20 ml. Depending on the patient's hemodynamics, this fluid is administered as 5-7 ml or 10 ml. Various regional analgesia techniques are used in VATS. The most common regional analgesia techniques used in our clinic routinely are thoracic paravertebral block (TPVB), erector spinae plane block (ESPB), and serratus anterior plane block (SAPB), although other plane blocks (e.g., external oblique intercostal (EOI) plane block, pectoserratus plane block, interpectoral plane block) are also used rarely. As a routine practice in our clinic, all regional analgesia techniques are performed under general anesthesia and at the end of the operation, approximately 30 minutes before extubation. These techniques are performed at levels determined by the scope of the surgery and the needs of the patient. As a routine practice of our clinic, our approach to postoperative analgesia management is: If an epidural is placed in patients, a bolus of 10 ml fluid is administered every 12 hours for postoperative pain control. The fluid content includes 2 mg morphine and 30 mcg fentanyl. As a routine practice in our clinic, PCA is applied to patients who cannot receive regional analgesia technique for any reason. In PCA, the basal infusion is set to 20 mcg fentanyl per hour and the patient bolus is set to 20 mcg fentanyl. As a routine practice of our clinic, the toxic dose of the local anesthetic to be administered is calculated to avoid local anesthesia systemic toxicity (LAST) in patients who will undergo local anesthesia. Analgesic plane block is performed with 40 ml of 0.25% bupivacaine, provided that the calculated toxic dose is not exceeded. For multimodal

analgesia in the postoperative period, 1 g of paracetamol every 6 hours and 50 mg of dexketoprofen every 8 hours are administered intravenously to patients, and 50 mg of intravenous tramadol is administered as rescue analgesia to patients with a visual analog scale (VAS) value of 4 and above.

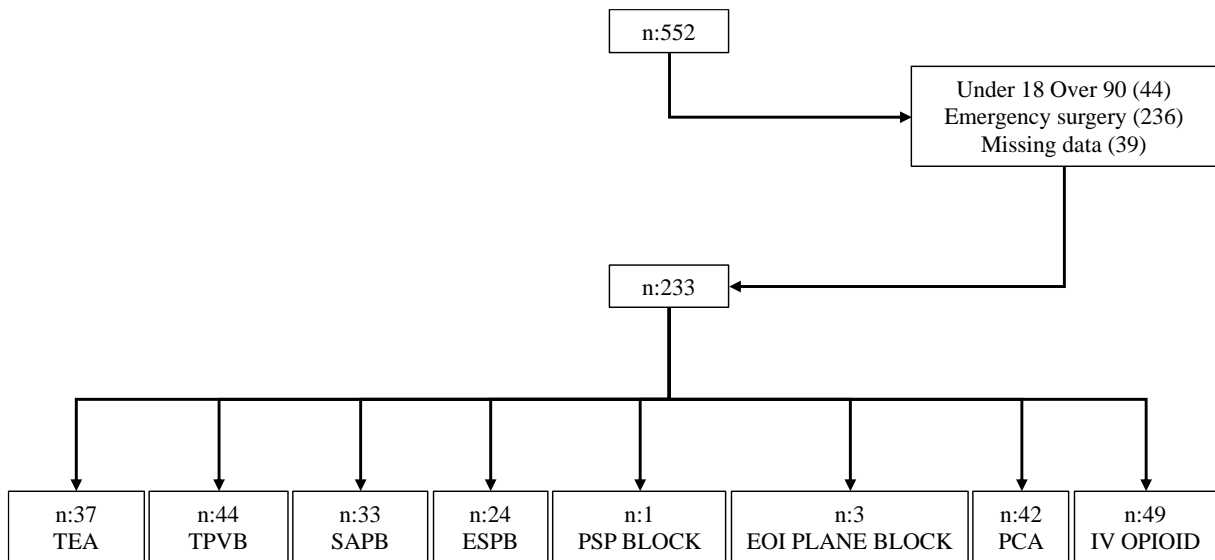
In our clinic, the management of postoperative analgesia in patients who have undergone thoracic surgery and who do not receive regional analgesia or PCA is left to the surgical team. These patients are ordered to receive 100 mg tramadol intravenously twice a day during the postoperative period. In our study, this patient group is defined as the group receiving IV opioid treatment.

### 3. Results

A total of 552 patients underwent thoracic surgery at our center during the specified date range. 319 patients who underwent emergency thoracic surgery under the

age of 18 or over the age of 90 and whose data were incomplete for the study were not included in the study. A total of 233 patients' data were included in the review for our study (Figs. 1-4).

Of the patients, 50.6% were female, 49.4% were male, and their mean age was determined as  $48.96 \pm 17.85$  years. The mean body weight was  $73.27 \pm 15.90$  kg, and the height was  $167.24 \pm 10.92$  cm. The most common diagnoses were mass or malignancy at a rate of 47.6%, followed by hydatid cyst at 10.7%, pleural effusion at 7.3%, and pectus excavatum at 6.4%. Other diagnoses such as pneumothorax, thymoma, empyema, bronchiectasis, diaphragmatic hernia, and interstitial lung disease were seen at lower rates. 86.3% of the patients underwent VATS and 13.7% underwent thoracotomy. The mean surgical time was calculated as  $168.65 \pm 69.24$  minutes. When intraoperative analgesia methods were evaluated, fentanyl was applied to 70% of the patients, remifentanyl to 15%, and epidural analgesia to 15% (Table 1).



TEA: Thoracic Epidural Analgesia; TPVB: Thoracic Paravertebral Block; SAPB: Serratus Anterior Plane Block; ESPB: Erector Spinae Plane Block; PSP: Pectoserratus Plane; EOI: External Oblique Intercostal; PCA: Patient Controlled Analgesia; IV: Intravenous

Fig. 1. Flowchart.

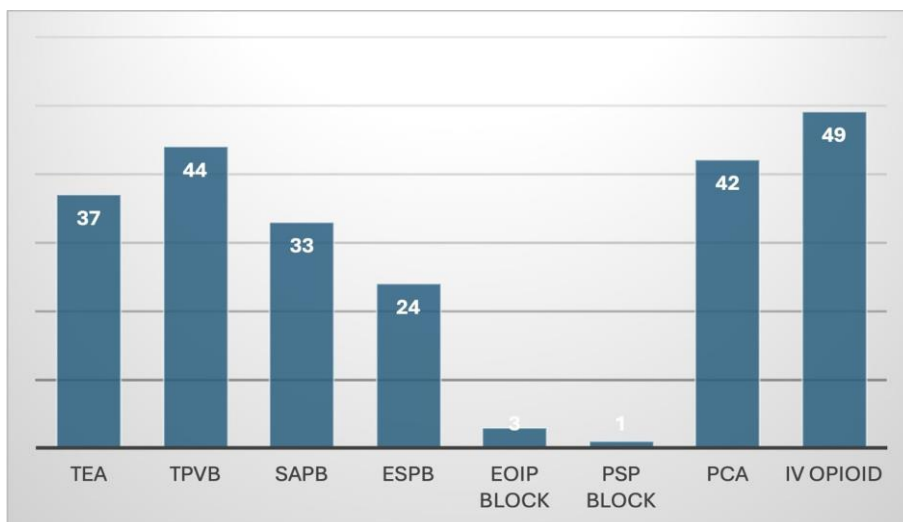
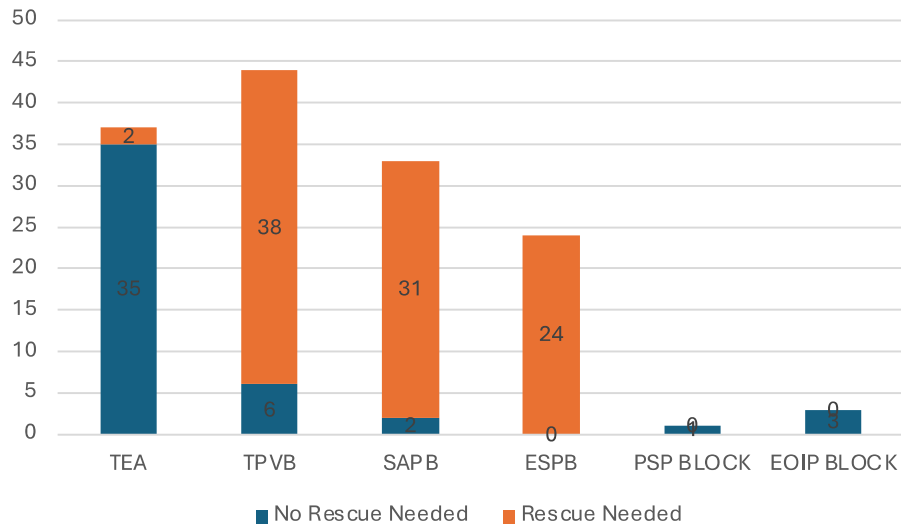


Fig. 2. Postoperative analgesia distribution.

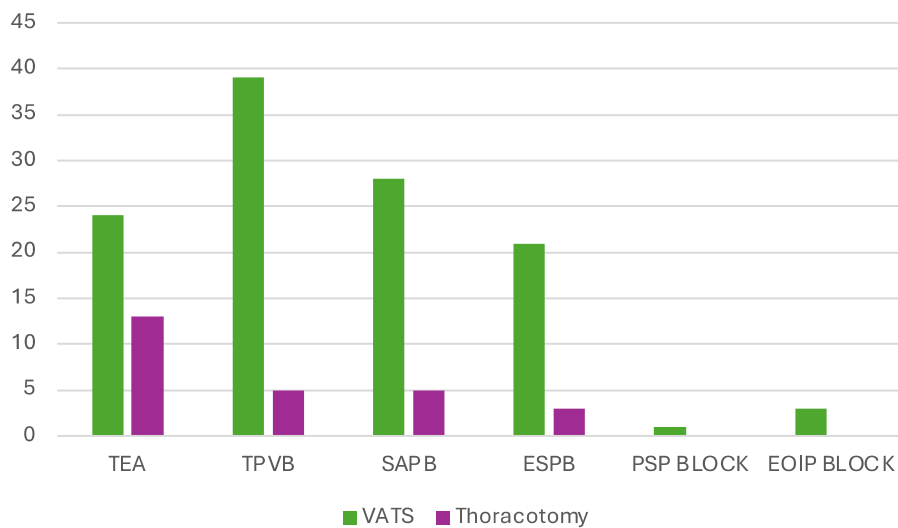
**Table 1.** General characteristics of the patients.

Total patients	233 (100)
Gender	
• Female	118 (50.6)
• Male	115 (49.4)
Age (years)	48.96 ± 17.85
Weight (kg)	73.27 ± 15.90
Height (cm)	167.24 ± 10.92
ASA	
• 1	69 (29.6)
• 2	89 (38.2)
• 3	59 (25.3)
• 4	16 (16)
Diagnosis	
• Mass, malignancy	111 (47.6)
• Hydatid cyst	25 (10.7)
• Pleural effusion	17 (7.3)
• Pectus excavatum	15 (6.4)
• Thymoma	14 (6.0)
• Pneumothorax	13 (5.6)
• Esophageal duplication cyst	10 (4.3)
• Empyema	3 (1.3)
• Bronchiectasis	7 (3.0)
• Diaphragmatic eventration	2 (0.9)
• Diaphragmatic hernia	7 (3.0)
• Hyperhidrosis	4 (1.7)
• Interstitial lung disease	2 (0.9)
• Esophageal diverticulum	2 (0.9)
• Paracardiac cyst	1 (0.4)
Type of surgery	
• VATS	201 (86.3)
• Thoracotomy	32 (13.7)
Surgical duration	168.65 ± 69.24
Intraoperative analgesia	
• Fentanyl	163 (70)
• Remifentanyl	35 (15)
• Epidural analgesia	35 (15)
Type of postoperative analgesia	
• TEA	37 (15.9)
• TPVB	44 (18.9)
• SAPB	33 (14.2)
• ESPB	24 (10.3)
• EOI PLANE BLOK	3 (1.3)
• PSP BLOCK	1 (0.4)
• PCA	42 (18)
• IV OPIOID	49 (21)
Need for rescue analgesia (Yes/No)	186 (79.2) / 47 (20.2)
Time to first postoperative opioid requirement (hours)	12.08 ± 9.85
Duration of hospital stay (days)	8.96 ± 4.75

VATS: Video Assisted Thoracoscopic Surgery; TEA: Thoracic Epidural Analgesia; TPVB: Thoracic Paravertebral Block; SAPB: Serratus Anterior Plane Block; ESPB: Erector Spinae Plane Block; PSP: Pectoserratus Plane; EOI: External Oblique Inter-costal; PCA: Patient Controlled Analgesia; IV: Intravenous.



**Fig. 3.** Rescue analgesia requirement.



**Fig. 4.** Analgesia choice based on surgery type.

When we look specifically at ASA-4 patients, we see that all of these patients were diagnosed with a mass or malignancy. Of these 16 patients, 10 underwent VATS and 6 underwent thoracotomy. When we look at the analgesia management of these patients, 6 underwent PCA, 5 underwent epidural analgesia, and 5 underwent TPVB. When we look at rescue analgesia needs, it was observed that 12 patients, except for the 4 patients who underwent epidural analgesia, required rescue analgesia.

The most frequently used technique among postoperative analgesia methods was TPVB at a rate of 18.9%. This was followed by TEA at a rate of 15.9%, SAPB at a rate of 14.2%, and ESPB at a rate of 10.3%. PSP block at a rate of 0.4% and EOI plane block at a rate of 1.3% were applied less frequently. PCA was preferred at a rate of 18% and intravenous opioid administration at a rate of 21%. While 79.2% of the patients required additional rescue analgesia, the first opioid requirement occurred after an average of  $12.08 \pm 9.85$  hours. The average hospital stay was calculated as  $8.96 \pm 4.75$  days (Table 1).

When the effect of postoperative analgesia methods on the need for additional analgesia was evaluated, it was seen that 94.6% of the patients who underwent TEA did not require additional analgesia. In contrast, 86.4% of the patients who underwent TPVB, 93.9% of the patients who underwent SAPB and all of the patients who underwent ESPB required rescue analgesia. No additional analgesia was required in a single patient who underwent PSP block, and no additional analgesia was required in any of the three patients who underwent external oblique block (Table 2).

When the types of postoperative analgesia applied were evaluated according to the surgical method, it was seen that epidural analgesia was mostly used in patients who underwent thoracotomy (40.6%). In contrast, the most frequently preferred regional analgesia method in patients who underwent VATS was TPVB with a rate of 19.4%. It was determined that fascial plane blocks such as SAPB and ESPB were mostly preferred in VATS patients and were used less in patients who underwent thoracotomy. Methods such as EOI block and PSP block were applied quite rarely (Table 3).

**Table 2.** Comparison of postoperative analgesia type and rescue analgesia need.

Count of patients		Type of postoperative analgesia					
		TEA	TPVB	SAPB	ESPB	PSP blok	EOI plane blok
Need for rescue analgesia	No	35	6	2	0	1	3
	Yes	2	38	31	24	0	0

TEA: Thoracic Epidural Analgesia; TPVB: Thoracic Paravertebral Block; SAPB: Serratus Anterior Plane Block; ESPB: Erector Spinae Plane Block; PSP: Pectoserratus Plane; EOI: External Oblique Intercostal.

**Table 3.** Relationship between type of surgery and type of postoperative analgesia applied.

Count of patients		Type of postoperative analgesia					
		TEA	TPVB	SAPB	ESPB	PSP blok	EOI plane blok
Type of surgery	VATS	24	39	28	21	1	3
	Thoracotomy	13	5	5	3	0	0

VATS: Video Assisted Thoracoscopic Surgery; TEA: Thoracic Epidural Analgesia; TPVB: Thoracic Paravertebral Block; SAPB: Serratus Anterior Plane Block; ESPB: Erector Spinae Plane Block; PSP: Pectoserratus Plane; EOI: External Oblique Intercostal.

#### 4. Discussion

These findings show that regional anesthesia techniques are widely used in the management of analgesia after thoracic surgery. Regional techniques such as epidural analgesia and paravertebral block have been observed to be effective in reducing opioid requirements. It shows that epidural analgesia is the most effective method in postoperative pain control. (Table-2) It is seen that epidural analgesia is at the forefront in patients who have undergone thoracotomy and less invasive regional techniques are at the forefront in VATS patients. (Table-3)

It has been observed that analgesia preference changes according to the type of surgery in postoperative pain management after thoracic surgery and TEA is the most commonly used analgesic method in patients undergoing thoracotomy. However, the more frequent use of analgesic methods such as TPVB and SAPB in VATS patients indicates that less invasive approaches are preferred in these patients. When evaluated in terms of rescue analgesia need, epidural analgesia stood out as the most successful method with the lowest additional analgesia need.

In this study, analgesia methods used in thoracic surgery operations performed in our hospital in the last year were evaluated retrospectively. Our findings show that the multimodal analgesia approach is widely adopted and that regional anesthesia techniques such as TEA and TPVB provide effective pain control.

Studies have shown that TEA and TPVB are the most powerful analgesia methods after thoracic surgery and reduce postoperative pulmonary complications [6,7]. In our study, we understand that postoperative pain scores were lower in patients who received epidural analgesia and that rescue analgesia was not required. However, it is also known that epidural analgesia may not be suitable for every patient due to side effects such as hypotension, urinary retention and motor block [8]. As an alternative

regional method, TPVB has been found to be effective in both providing pain control and reducing systemic opioid requirements [9]. In our study, it was observed that the need for opioids decreased in patients who underwent TPVB. Fascial plane blocks such as SAPB and ESPB are increasingly preferred because they are less invasive and have low complication risks [10, 11]. Our findings show that these blocks are also preferred, albeit slightly, in postoperative analgesia management. However, since regional anesthesia techniques cannot be applied in some patients, PCA or intravenous opioid applications have been used. It has been stated that opioid consumption is more controlled in patients using PCA, but opioid-related side effects can still be seen [12]. In our study, the need for rescue analgesia was 79.2%, indicating that some patients require additional pain management despite multimodal analgesia.

#### 5. Limitations

Our study has some limitations. First, it has a retrospective design and was performed with data obtained from retrospective patient records, which may lead to limitations such as missing records and incomplete reporting of some clinical variables. In addition, when evaluating the effectiveness of postoperative analgesia methods, pain scores (VAS scores) were not directly analyzed, which makes it difficult to clearly compare the differences between the methods. Chronic postoperative pain may develop in some patients after thoracic surgery [13]. Since there is no long-term follow-up data in our study, the effects of the applied analgesia methods on chronic postoperative pain could not be evaluated. However, the possible complications of analgesia methods were not discussed in detail, which provides limited information about their safety profiles. In addition, our study is a single-center study, and patient populations, protocols, and surgical approaches may differ from studies conducted in

different centers, which limits the generalizability of the results. Considering these limitations, future studies with a prospective design, larger patient groups, and long-term outcomes should be conducted.

## 6. Conclusions

TEA and TPVB stand out as effective methods in the management of analgesia after thoracic surgery. However, less invasive fascial plane blocks are also considered as safe and effective alternatives when patient-specific factors are taken into consideration. The widespread use of multimodal analgesia applications may both increase patient comfort and minimize opioid-related side effects by reducing opioid use. The findings of our study may contribute to clinical practices for the management of analgesia after thoracic surgery and help determine optimal analgesia strategies.

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### Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this manuscript.

### Author Contributions

All of the authors made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; were involved in drafting the manuscript or revising it critically for important intellectual content; and gave final approval of the version to be published.

### Data Availability

The datasets created and/or analyzed during the current study are not publicly available, but are available from the corresponding author upon reasonable request.

### Ethics Approval and Consent to Participate

This study was approved by the ethics committee of Atatürk University (B.30.2.ATA.0.01.00/790). Written informed consent was obtained from the participants. All methods were performed in accordance with relevant guidelines and regulations.

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