

# Paravertebral Block in Thoracotomy—Comparison between Single-Shot and Catheter Methods

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## Abstract

**Aim:** Thoracic paravertebral block is increasingly used as a method of postoperative analgesia in thoracic surgery. We aimed to compare two different methods of implementation: paravertebral thoracic block with a catheter placed in the epidural space, and a single injection of anesthetic at the end of surgery. **Methods:** We randomized 60 patients undergoing VATS, in 17 (group A) single-dose paravertebral block, and in another 21 (group B) catheter technique and postoperative infusion of local anesthetic were used, and in the latter, the control group (C) of 22 patients, analgesia was performed according to a standardized protocol with non-steroidal analgesics and opioids as needed. In all patients, in the early postoperative 48 hours, we measured the intensity of pain and opioid consumption. **Results:** There were no statistically significant differences between the collected preoperative data in the three groups of patients. There were no significant differences in subjective pain sensations in the early postoperative period (up to 12 hours). However, the number of opioids used was significantly lower in groups A and B compared to the control group, and in group B (with catheter technique) after the 12th to 48th hour after surgery there was almost no need for strong analgesics. **Conclusion:** Continuous infusion of local anesthetic in the area of the surgical incision provides much better pain relief than a single paravertebral block in the area of the incision.

## Keywords

Thoracic Paravertebral Block, Pain Management, VATS

## 1. Introduction

The thoracic paravertebral block (TPVB) has been in a real renaissance [1] [2] in

recent years. The first injection of a local anesthetic into the space around the vertebrae through which the sensory spinal nerves pass was used more than 100 years ago by Hugo Sellheim in 1905 [3], using the technique of abdominal surgery [4] [5]. Over the years, many other authors [6] [7] [8] [9] have improved and described the methodology, and today TPVB is used successfully in a wide range of surgical interventions (**Table 1**).

Contraindications to TPVB are 5 absolute: proven allergy to local anesthetics, infection at the puncture site, empyema of the underlying pleura, tumor covering the paravertebral area, and relative: coagulation disorders.

The advantages of TPVB over other similar methods of analgesia are: easy-to-learn technique [10], safety and ease of performance before epidural puncture [11] can be performed in patients who are sedated and on mechanical ventilation [12], in thoracic surgery catheter placement provides long-term pain relief without high risks to the patient's health [13], in contrast to intrapleural administration of a local anesthetic, TPVB provides the same level of analgesia with much less anesthetic [14]. In addition to these benefits, TPVB patients can be moved early [15], require much less nursing care, have stable hemodynamics [16], have no pelvic congestion [17], and require far fewer opioids [18] for analgesia than standard anesthesia techniques.

## 2. Study Design and Patient Selection

Before conducting our study, we received permission from the ethics committee and informed consent from all patients. Our study is one-centered, conducted in the period 2019-2021 in the University Hospital "St. Marina"—Pleven in patients, who underwent video-assisted thoracoscopy (VATS).

Data was collected from three groups of patients, randomized via random number generator, who underwent video assisted thoracoscopy (VATS). After the surgery, the patients in group A underwent a single paraverberal block according to the classical method with loss of resistance: after selecting the appropriate dermatome for analgesia, in the lateral position of the patient under aseptic measures, with a Tuohy needle puncture of 2 - 3 cm lateral to the spinous process of the respective vertebra. The advancement of the needle in depth is

**Table 1.** Indications TPVB (by M. Karmakar 5).

Postoperative analgesia	Surgical anesthesia
Thoracic surgery	Breast surgery
Breast surgery	Hernioplasty
Cholecystectomy	Management of chronic pain
Kidney surgery	Analgesia in malignant processes
VATS	Various
Microinvasive cardiac procedures	Rib Fractures
Appendectomy	Pain relief for closed abdominal injuries

perpendicular to the skin until we reach the transverse growth of the lower vertebra. After reaching bone density, the needle is pulled out slightly into the subcutaneous tissue and redirected over the transverse process of the vertebrae, gradually advancing in depth till loss of resistance (usually 1 - 1.5 cm from the upper edge of the process). Upon reaching the paravertebral space, after aspiration we injected a solution of local anesthetic—Ropivacain 25%, without adjuvant, at a dose of 0.3 ml/kg as a bolus (in group A), and in group B we placed a catheter with a tip protruding 2.5 - 3 cm over the tip of the needle, and we started an infusion of Ropivacain, 25%, without adjuvant at a rate of 0.1 mg/kg/h with continuous infusion through the inserted catheter. In group C, analgesia was performed with NSAIDs such as Ibuprofen, Paracetamol, Metamizol, and opioids such as Fentanil, Tramadol. Pain measurement was performed with a tenpoint visual analog scale (VAS), in which 0 meant no pain and 10-unbearable pain. Detection of pain was performed on the 1st, 6th, 12th, 24th and 48 hours and the results, as well as the consumption of painkillers, were recorded in spreadsheets, and the variables were subsequently subjected to computer analysis using MS Exel 2021 ver.16.55 and IBM SPSS for macOS, version 26.0 (IBM Corp., Armonk, NY, USA), which was used for all statistical estimates. P values less than 0.05 are considered statistically significant.

### 3. Results

The demographic characteristics and preoperative condition of the patients did not differ significantly (**Table 2**).

Significant statistical differences between the three study groups were not found, except for the ratio of men (38): women (22). The indications for the application of VATS procedures for diagnostic and therapeutic purposes in the subjects are the following (**Table 3**).

In total, in the three groups of follow-ups, the average duration of thoracic drainage was 1.7 days, and the average postoperative hospital stay was 3 days.

After the operation, according to our study protocol, with the same technique and needle, in group A, we placed a bolus dose of local anesthetic in the paravertebral space, in group B, we placed a catheter and started a long infusion of local

**Table 2.** Demographic variables in the three studied groups of people.

Variables	Group A	Group B	Group C	P
	n = 17	n = 21	n = 22	
Men	11	13	14	
Women	6	8	8	
Age (years)	67.6 ± 13	69.3 ± 11	69.3 ± 11	0.51
Height (cm)	170 ± 5	171 ± 9	168 ± 7	0.47
Weight (kg)	68 ± 7	66 ± 9	72 ± 9	0.69
BMI	28	27	27	0.25

anesthetic, and group C was control, in this group of patients the anesthesia was conventional, using opioid and non-opioid analgesics. Then, on the 1st, 6th, 12th, 24th and 48th hours, we visited the patient and checked the level of pain through the visual analog scale (VAS). The results obtained are summarized in **Table 4**.

If they experienced pain, patients in all three groups were anesthetized as follows (**Table 5**).

From the experienced pain and the corresponding need for analgesics, the results clearly showed that paravertebral block analgesia (groups A and B) is many times better and provides patient comfort after VATS compared to standard anesthesia with non-steroidal and/or opioid analgesics (control group). With the use of catheter technique and constant infusion of a local anesthetic, the analgesia is stable and patients do not experience pain even after 24 hours, when single-dose patients begin to experience pain.

**Table 3.** Indications for VATS in the subjects.

Indication	Group A (n = 17)	Group B (n = 21)	Group C (n = 22)
Biopsy	8	11	9
Pleural effusion	4	6	5
Empyem	4	3	6
Spontaneous pneumothorax	1	1	2

**Table 4.** VAS points on average for the respective groups of subjects by periods.

Hour	Group A	Group B	Group C
1	2	2	5
6	4	2	8
12	4	1	7
24	3	2	6
48	2	2	3

**Table 5.** Consumption of analgesics after surgery.

Consumption	Group A		Group B		Group C	
	0 - 24 hours	After 24 <sup>th</sup> hour	0 - 24 hours	After 24 <sup>th</sup> hour	0 - 24 hours	After 24 <sup>th</sup> hour
Fentanyl	0	0	0	0	4	1
Tramadol	2	6	0	0	12	6
Metamizol	5	7	2	8	20	8
Paracetamol	8	10	4	10	10	14
Ibuprofen	3	8	2	11	22	18

## 4. Discussion

Analgesia after operations in the area of the thoracic cell has always been a challenge [19] to the anesthesiologist. In a number of hospitals, painkillers with NSAIDs and opioids are preferred, due to ease of application, and the method has proven itself in the past, but it has quite a few side effects, as well as increased staff workload—and not providing enough comfort to patients. Piraccini *et al.* [20] reported that TPVB is better than intravenous analgesia in pain control and preservation of postoperative lung function. Our results confirm this. In our study, we did not observe unwanted side effects (e.g. nausea, vomiting, drowsiness, atrial arrhythmia, hypotension, and pneumonia) in any group of our patients. In reviewing the scientific literature, we found that in addition to TPVB, serratus anterior plane block (SAPB) also gave good results for pain management after VATS. It was proven in two meta-analyses, exploring analgesic efficacy by adding SAPB to general anesthesia, that combining SAPB with general anesthesia provides more effective postoperative analgesia in VATS [21] [22]. In determining the design of our study and discussing the techniques we will use for analgesics, we followed Gupta *et al.* [23], who in 2017 performed a comparison between SAPB and TPVB under the direction of ultrasound in patients undergoing a modified radical mastectomy under general anesthesia. Like us, the authors of this study recorded morphine consumption, first analgesia time, and VAS in the postoperative period. At the end of the study, while VAS results were similar, it was determined that morphine consumption was higher in the SAPB group. There was no significant difference between the two groups in terms of the time of the first analgesia after surgery. Our study similarly did not have a significant difference between the groups in terms of the time of the first analgesia. Despite the relatively small group of patients studied, the thoracic paravertebral block was associated with a significant reduction in pain within 6 hours after surgery and a decrease in the consumption of analgesics in the first hours, but did not show a significant impact on pain outcomes after the 24th hour. The latter is not even necessary when using a catheter technique and constant infusion of a local anesthetic in the paravertebral space. This not only improves the quality of life of patients, but is also a great relief for medical staff and patient care.

## 5. Conclusion

We strongly recommend the inclusion of TPVB in the standard anesthesia protocols for VATS. This technique is safe, easily executable, and increases patient comfort, which contributes to satisfaction with overall surgical intervention.

## Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

## Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki, and

approved by the Ethics Committee.

## Conflicts of Interest

The author declares no conflict of interest.

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