ORIGINAL ARTICLE

Comparative Study Between Ultrasound Guided Rhomboid Intercostal Plane Block and Erector Spinae Plane Block for Post-Operative Analgesia in Video-Assisted Thoracoscopic Operations

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Abstract

Background: ***Resection of mediastinal tumors and wedges are now possible with the use of video-assisted thoracoscopic surgery (VATS), which has been expanding over the years. After surgery, the lungs can be removed with the help of current VATS, which is widely used. Early ambulation, reduced surgical trauma, and reduced costs are all possible outcomes of the VATS.***

Aim and objectives: ***For the purpose of contrasting the two plane blocks—the rhomboid intercostal and the erector spinae—in providing postoperative analgesia during video-assisted thoracoscopic interventions.***

Patients and methods: ***This prospective randomized double blinded study was conducted on 60-patients scheduled for VATS at Al-Azhar University Hospitals (Sayed Galal and Al-Hussien), from March 2023 till December 2024.***

Results: ***Although there was no statistically significant distinction between the two groups at baseline, the ESPB group's heart rate was significantly lower than the RIB group's at 15 minutes, 30 minutes, 45 minutes, and at the procedure's completion (P-value<0.05). At baseline, there was no significant distinction between the two groups, but after 15 minutes, 30 minutes, 45 minutes, and at the end of the procedure, the ESPB group's mean arterial blood pressure was considerably lower than the RIB group's (P-value<0.05).***

Conclusion: ***Pain score, total opioid consumption, time to initial analgesia rescue, and patient satisfaction with RIB's improved hemodynamic stability were all comparable between ESPB and RIB during VATS procedures.***

Keywords: VATS; RIB; ESPB; Post-operative analgesia

1. Introduction

With the steady expansion of video-assisted thoracoscopic surgery (VATS), it is now possible to remove tumors from the mediastinum and wedges from the operating field. Nowadays, many people use VATS to retrieve their lungs after surgery. The VATS has the ability to reduce expenses and surgical trauma, and allow for early ambulation. Common areas of discomfort include the incision site, elastic tissues, and intercostal muscles; overall, the pain is about average.[1]

Patients recovering from VATS benefit greatly from postoperative pain treatment since it shortens their hospital stay, decreases their need for narcotic analgesics, and optimizes their recovery.[2]

For efficient chest pain relief, perform the ultrasound-guided erector spinae plane block (ESPB) at the level of the T5 transverse process. Local anesthetics are applied craniocaudally over several levels, enter the thoracic paravertebral area anteriorly, and then block the dorsal and ventral rami of spinal nerves as well as the rami communicantes that carry sympathetic fibers.[3]

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In 2016, it was suggested that a rhomboid intercostal block (RIB) could be an option to paravertebral blocks and thoracic epidurals for chest wall analgesia. Analgesia following thoracic and mastectomies procedures has been effectively treated with rhomboid intercostal blocks in multiple subsequent occurrences. Rhomboid intercostal block reduced opioid intake following mastectomy, according to a randomized controlled experiment conducted in 2020.[4]

The aim of this study was to compare the effectiveness of rhomboid intercostal plane block to erector spinae plane block for postoperative analgesia in video-assisted thoracoscopic operations(VATS).

2. Patients and methods

Sixty patients slated for VATS at Al-Azhar University Hospitals (Sayed Galal and Al-Hussien) between March 2023 and December 2024 were the subjects of this prospective randomized double-blind trial.

Inclusion criteria:

Male and female patients between the ages of 18 and 50 who are scheduled for video-assisted thoracoscopic procedures and who are members of the American Society of Anesthesiologists (ASA) I and II.

Exclusion criteria:

Patients who refuse treatment, have a body mass index (BMI) of greater than 35 kg/m2, have a local infection at the block site, are contraindicated for regional anesthetic procedures due to coagulopathy, have a history of local anesthetic allergy, hemodynamic instability, or psychological disorders.

Randomization and blindness:

Using computer-generated numbers, sixty patients were divided into two equal groups, and each patient's allocation code was sealed in an opaque envelope: Patients in Group I (n=30) had a 20 mL block of 0.25% bupivacaine applied to the rhomboid intercostal plane; patients in Group II (n=30) had a 20 mL block applied to the erector spinae plane; and patients in both groups received a maximum dose of 2 mg/kg of bupivacaine. No one was informed about the study's methods, including the patient or scorer.

Preoperative:

Here are the things that all sufferers had to endure:

We gathered sociodemographic data, including sex, age, weight, height, and BMI. A full medical history, including taking a temperature, taking a pulse, and measuring blood pressure (both systolic and diastolic).

Clinical evaluations included a full blood count (CBC), evaluation of liver and renal function, and coagulation profile testing. Patients were also taught how to use a numerical rating scale to document their pain levels.

Operative:

RIB group:

The following structures were observed: the trapezius muscle, rhomboid muscle, third and fourth ribs, intercostal muscle, and pleura; these were obtained by positioning a linear probe medial to the medial border of the scapula and rotating the transducer such that the cranial end was slightly directed medially and the caudal end somewhat laterally. An ultrasound beam was used to guide the craniocaudal advancement of a 22-gauge needle, which was then used to inject 20 mL of 0.25% bupivacaine into the fascial layer adjacent to the rhomboid and intercostal muscles. The maximum dose was 2 mg/kg. Ultrasound verified that the local anesthetic had spread cephalocaudally.

ESPB Group:

To scan the trapezius, rhomboid major, and erector spinae muscles just superficial to the hyperechoic transverse process, an HF linear ultrasonic transducer was placed 3 cm laterally to the spinous process. A 22-gauge needle was advanced parallel to the ultrasound beam in a cephalad-to-caudal route to complete the transverse procedure. The proper placement of the needle tip in the fascial plane deep to the muscle is confirmed by hydrolocation with 2 mL of saline, which lifts the erector spinae off the transverse process without causing muscular distention with caudal and cranial spread. Twenty milliliters of 0.25% bupivacaine were given at the maximum dosage (2 mg/kg).

Surgical Procedures:

For patients who already had one trochlear port implanted, the procedure involved making a single incision ranging from 3.0 to 4.0 cm in the fourth or fifth intercostal area of the anterior axillary line. The next stop in the process was the trochal port. To install a thoracic drainage tube, the incision was closed prior to the skin of the fourth or fifth intercostal segment. We administered noradrenaline infusion to patients with intraoperative hypotension, which was defined as a 20% fall from baseline value or a mean arterial pressure less than 65 mmHg, and atropine to those with bradycardia, whose heart rates were less than 50 beats per minute. This lobectomy was also executed by the same surgical crew.

Postoperative:

At last, the anesthetics were stopped and the extubation was performed. To the post-anesthesia

care unit (PACU) the cases were transported. Subsequently, the ward received the cases. Administer 1 gram of paracetamol intravenously every 8 hours to both cases. The patient was given morphine (3 mg IV) as a rescue medication if the NRS was more than 3. Within the first twenty-four hours after surgery, we tracked how much morphine was used and how long it took for the first rescue analgesia to be administered. Prior to, during, and after surgery, patients were evaluated in the postoperative care unit (PACU) for pain (as determined by NRS), heart rate (HR), and metabolic acidosis (MAP).

At 0,2, 4, 6, 8, 10, 12, and 18 hours, the patient's pain was recorded using the NRS for pain. After a patient's recovery from general anesthesia, we can say that they reached the "zero" point in time. Side effects include sick stomach, vomiting, low blood pressure (MAP<20% of baseline readings, treated with 5 mg of ephedrine intravenously and/or normal saline intravenously), and slow heart rate (HR<60 beats/min, treated with 0.6 mg of atropine intravenously).

Primary outcome:

Postoperative pain score by NRS, and total analgesic consumption.

Secondary outcome:

The incidence of opioid-related side effects like postoperative nausea and vomiting(PONV), and patient satisfaction.

Measurements:

Details on the patient, including their age, gender, weight, and ASA diagnosis. Blood pressure, pulse rate, oxygen saturation, and end-tidal carbon dioxide are all important vital indicators to monitor. The total amount of fentanyl used during the operation was 1µg/kg intravenously given as a rescue opioid in case the fluctuations in systolic blood pressure and heart rate reached 20% or higher of the baseline values. Quantity of analgesics taken in the first twenty-four hours and timing of first rescue analgesic administration (morphine). Every group had its own failure rate. Patients were deemed to have had a failed block and removed from the research if they needed more than two doses of morphine during the first hour following surgery.

The Numeric Rating Scale (NRS), which ranges from 0 to 10, was used to assess postoperative pain. A score of 10 would indicate the most excruciating agony the patients had ever experienced, while a score of 0 would indicate complete absence of pain.[5] (Jensen & McFarland, 1993).

Ethical considerations:

Informed consent from patients after approval from the Ethical Committee of the Faculty of Medicine, Al-Azhar University.

Sample Size:

Bliss et al.,[6] The following assumptions were taken into account when using Epi Info STATCALC to determine the sample size: A power of 80% and a two-sided confidence level of -95%. Odds ratio computed=1.115, with a margin of error of 5%. After reviewing the Epi-Info results, a maximum sample size of 53 was selected. Therefore, in order to account for potential cases of dropout during follow-up, the sample size was raised to 60 participants.

Statistical analysis:

We used SPSS v26 (IBM Inc., Chicago, IL, USA) to complete the statistical analysis. To determine if the data was normally distributed, the Shapiro-Wilks test and histograms were employed. We used an unpaired Student's t-test to compare the two groups for quantitative parametric variables, which were given as means and standard deviations (SD). The median and interquartile range (IQR) were used to present quantitative non-parametric data, which were examined using the Mann-Whitney test. When applicable, the Chi-square test or Fisher's exact test was used to assess qualitative variables, which were reported as percentages and frequencies. Statistical significance was determined by a two-tailed P-value<0.05.

3. Results

Out of 81 patients that were evaluated for eligibility, 13 did not fulfill the requirements, and 8 declined to take part in the trial. Two equal groups, each with 30 patients, were formed from the remaining patients through random assignment. We statistically examined all allocated patients that were followed up with.

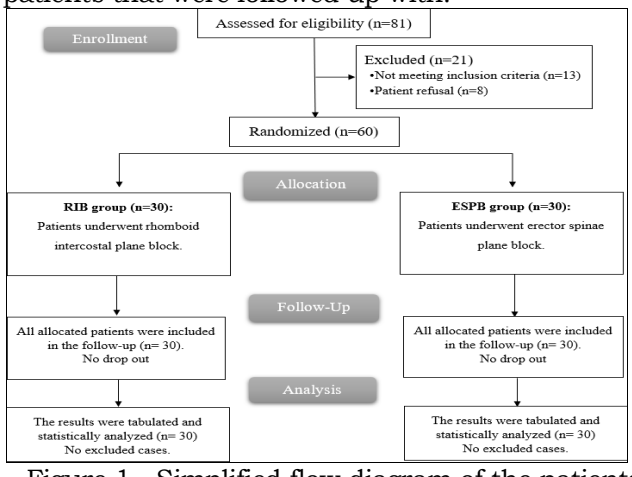

Figure 1. Simplified flow diagram of the patients who were enrolled.

Table 1. Information on the demographics and length of operation for the groups under study.

		RIB GROUP (N=30)	ESPB GROUP (N=30)	P-VALUE
AGE (YEARS)	Mean±SD	35.63±9.14	32.03±8.1	0.112
	Range	21-50	20-47	
SEX	Male	11(36.67%)	13(43.33%)	0.598
	Female	19(63.33%)	17(56.67%)	
WEIGHT (KG)	Mean±SD	77.87±8.03	80.33±8.18	0.243
	Range	61-94	59-97	
HEIGHT (CM)	Mean±SD	164.63±5.99	166.17±6.06	0.329
	Range	154-175	155-178	
BMI (KG/M^2)	Mean±SD	28.86±3.65	29.16±3.18	0.733
	Range	20.1-34.6	21.2-33.6	
ASA PHYSICAL STATUS	I	18(60%)	24(80%)	0.091
	II	12(40%)	6(20%)	
DURATION OF SURGERY (MIN)	Mean±SD	49.67±8.9	51.67±7.91	
	RANGE	30-60	35-60	0.361

ASA:American society of anesthesiologists.

There was no statistically significant difference between the groups with respect to age, sex, height, weight, body mass index, ASA physical status, or length of operation, table 1.

Table 2. Heart rate of the studied groups.

	RIB GROUP (N=30)	ESPB GROUP (N=30)	P-VALUE
BASELINE	83.3±9.88	78.87±9.93	0.088
15MIN	80.27±11.18	74.73±9.61	0.044*
30MIN	79.15±11.3	73.13±9.66	0.035*
45MIN	75.47±11.02	68.9±7.98	0.04*
AT END OF SURGERY	78.87±10.18	73.5±9.08	0.035*

P-value <0.05 indicates significance.

The ESPB group's heart rate was considerably lower than the RIB group's at 15 minutes, 30 minutes, 45 minutes, and the conclusion of surgery (P-value<0.05), whereas the two groups' baseline heart rates were not statistically different, table 2; figure 2.

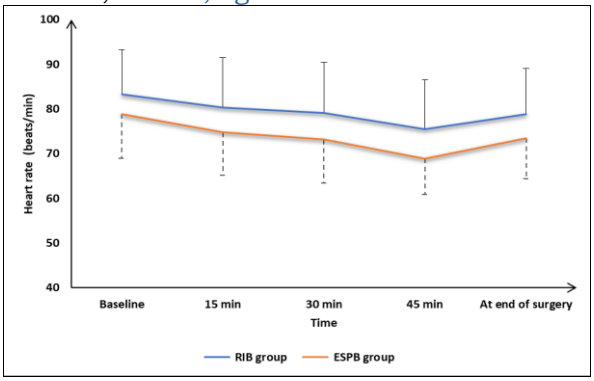

Figure 2. Heart rates of the groups under study.

Table 3. The groups under study's mean arterial blood pressure.

	RIB GROUP (N=30)	ESPB GROUP (N=30)	P-VALUE
BASELINE	97.73±12.87	93.87±11.17	0.219
15MIN	95.4±12.76	88.67±11	0.033*
30MIN	96.44±11.9	87.77±12.63	0.01*
45MIN	95.71±12.37	86.1±13.33	0.029*
AT END OF SURGERY	100.77±10.52	93.17±12.55	0.014*

*:significant as P-value<0.05.

The ESPB group's mean arterial blood pressure was considerably lower than the RIB group's at 15 minutes, 30 minutes, 45 minutes, and the conclusion of surgery (P-value<0.05), whereas the two groups' baseline arterial blood pressures were not significantly different, table 3; figure 3.

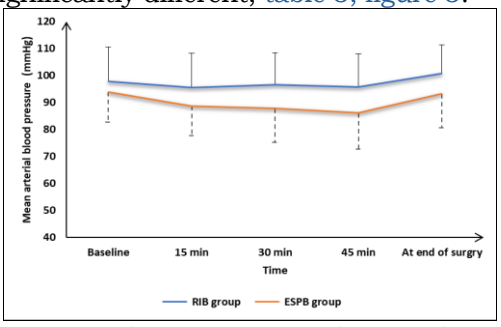

Figure 3. The groups under study's mean arterial blood pressure.

Table 4. NRS of the studied groups.

	RIB GROUP (N=30)	ESPB GROUP (N=30)	P-VALUE
BASELINE	1(0-1)	0(0-1)	0.609
2H	1(1-1)	1(0-1)	0.169
8H	3(2-4)	2(1.25-4)	0.158
12H	2(1.25-3.75)	2(1-2.75)	0.383
18H	4(3-6)	4(3-4)	0.166
24H	4(3-4)	3(2.25-4)	0.247

NRS was insignificantly different at baseline, 2h, 8h, 12h, 18h and 24hr between both groups, table 4; figure 4.

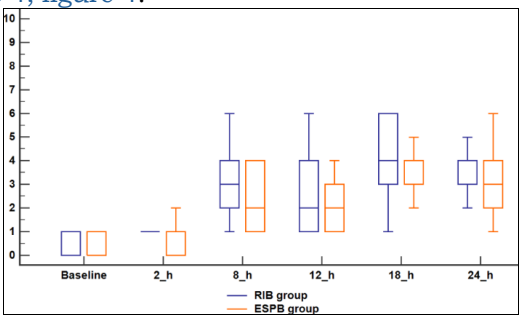

Figure 4. NRS of the studied groups.

Table 5. Failure rate of the groups under study, total amount of morphine taken in the first 24 hours after surgery, and time to first request rescue analgesia.

		RIB GROUP (N=30)	ESPB GROUP(N30)	P-VALUE
TIME TO FIRST REQUEST OF RESCUE ANALGESIA (H)	Mean±SD	8.17±1.56	8.87±1.31	
	Range	6-10	8-12	0.064
TOTAL AMOUNT OF MORPHINE CONSUMED DURING THE FIRST POSTOPERATIVE 24 HOURS (MG)	Mean±SD	10.17±2.28	8.97±2.75	
	RANGE	6-15	4-15	0.071

*:significant as P-value<0.05.

Failure rate, total morphine intake during the first 24 hours after surgery, and time to first request rescue analgesia were not significantly different between the two groups, table 5; figures 5&6.

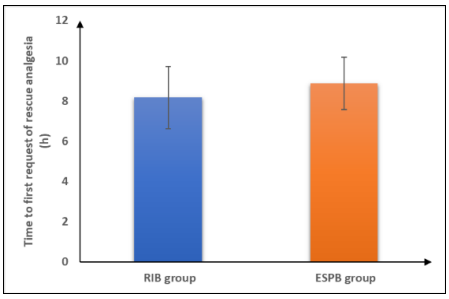

Figure 5. Time to first request of rescue analgesia of the groups under study.

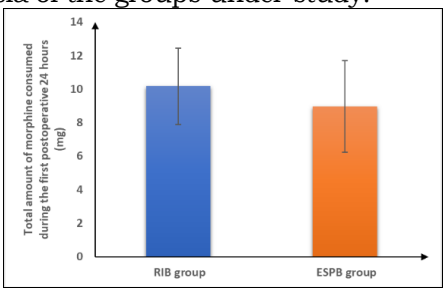

Figure 6. Total amount of morphine consumed during
the first postoperative 24hours of the groups under study.

Table 6. Total intraoperative fentanyl consumption of the groups under study.

		RIB GROUP (N=30)	ESPB GROUP (N=30)	P-VALUE
NUMBER OF PATIENTS NEEDED FENTANYL		5(16.67%)	3(10%)	0.706
TOTAL INTRAOPERATIVE FENTANYL CONSUMPTION (µG)	Mean±SD RANGE	72±10.95 60-80	83.33±11.55 70-90	0.214

Number of patients needed fentanyl and Total intraoperative fentanyl consumption were insignificantly different between both groups, table 6; figures 7&8.

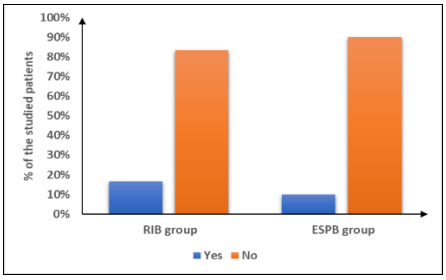

Figure 7. Number of patients needed fentanyl of the groups under study.

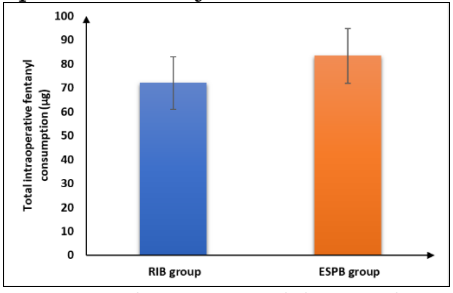

Figure 8. Total amount of fentanyl consumed by the groups under study during surgery.

4. Discussion

A new, less risky alternative to the thoracic epidural, the RIB block is a breeze to insert. On the medial aspect of the scapula, there is an area called the triangle of auscultation where the rib is utilized. The latissimus dorsi, the medial border of the scapula, and the lower border of the trapezius muscle define this area. The upper intercostal muscle plane and the area below the rhomboid muscles are both injected during RIB.[7]

Zhang et al.[8] randomized 90 patients into three groups: those who had a rhomboid intercostal block, those who had an erector spinae plane block, and those who had an ultrasound-directed serratus plane block. The dosage for each group was 20 mL of ropivacaine, which is 0.4% by volume. They discovered that there was little difference in the amount of opioids consumed by the two groups.

Also, Şimek et al.,[9] ESPB, RIB, and control (C) groups were the three groups into which 75 patients were assigned in a prospective randomized controlled research. Blockage was carried out in block groups using 20 milliliters of 0.25% bupivacaine while under general anesthesia. Other than the usual postoperative analgesia routine, no procedures were carried out in Group C. They discovered that there was no discernible difference in the number of patients requiring rescue analgesia between RIP and ESPB.

NRS did not substantially differ between the two groups in our study at the post-anesthesia care unit (PACU), 2 hours, 8 hours, 12 hours, 18 hours, and 24 hours.

In favor of our research, Zhang et al.,[8] indicated that, for active patients, the NRS was not significantly different between the RIB and ESP groups 48 hours following surgery.

Also, Guven et al.,[10] 60 patients were split into two groups of 30 individuals each (ESPB group and RIB group) and given 20 milliliters of a combination of LA and corticosteroid. The study was double-blind. They discovered that there was little difference in the NRS between the two groups.

Also, Şimek et al.,[9] demonstrated that the VAS scores of groups ESPB and RIB did not differ significantly.

According to our findings, Zhang et al.,[8] discovered that there was no discernible difference in the time to first postoperative analgesic requirement among the RIB and ESP groups.

Also, Şimek et al.,[9] revealed that there was no significant difference in the mean 24-hour opioid use between groups ESPB and RIB.

Patient satisfaction and postoperative nausea and vomiting (PONV) did not differ substantially

between the two groups in the current study. No patient in either group experienced nerve damage, hematoma formation, or local anesthetic toxicity.

Assisting with our research, Zhang et al.,[8] discovered that there was no discernible difference between the two groups' PONV and patient satisfaction.

Also, Şimek et al.,[9] discovered that the nausea-vomiting scores of the RIP, ESPB, and control groups did not differ significantly. Also, Jiang et al.,[11] discovered that there was no discernible difference in PONV between the two groups.

In the same way, Yang et al.,[12] There were two groups of patients: the control group and the ESPB group. A combination of 0.5μg/kg dexmedetomidine, 5mg of dexamethasone, 10mL of 0.7% ropivacaine, and 10mL of 1% lidocaine was given to the ESPB group. 20 mL of 0.9% saline was given to the control group. They demonstrated that the ESPB group consumed fewer opioids and rescue analgesics during surgery, and that their VAS scores during rest and coughing during the first 24 hours after surgery were lower than those of the control group.

Limitations: The study only included one center, and the sample size was modest. We didn't employ alternative kinds, amounts, or concentrations of anesthetic medications, nor did we use ESPB and RIB in other procedures.

4. Conclusion

Time to initial analgesic rescue, total opioid consumption, pain score, and patient satisfaction with RIB's greater hemodynamic stability were all similar between ESPB and RIB throughout VATS procedures.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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