

Comparison of Thoracic Epidural Block Versus Erector Spinae Plane Block for Post-Operative Pain Relief in Thoracotomies

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ABSTRACT

Objective: To Compare post-operative analgesic effectiveness of thoracic epidural block with erector spinae plane block in patients with thoracotomies.

Study Design: Randomized Controlled Trial (IRCT20231113060036N1).

Place and Duration of Study: Department of Anesthesia, Combined Military Hospital, Rawalpindi Pakistan, from Jul to Dec 2023.

Methodology: The patients were divided into the thoracic epidural block group (Group-T) (n=20) and the erector spinae block group (Group-E) (n=20). Primary variables measured were mean time to first rescue analgesia, total dose of intravenous analgesia needed in 24 hours and median pain scores at 1, 3, 6, 12 and 24 hours and patient satisfaction for pain relief on the Likert scale 24 hours after intervention.

Results: Mean time for first dose of added rescue analgesia was 178.15±10.51 minutes in Group-T versus 320.35±15.23 minutes in Group-E ($p<0.001$). Total added intravenous analgesia post-surgery in 24 hours was 14.45±1.09 mg in Group-T versus 10.15±1.26 mg in Group-E ($p<0.001$). When assessed after 3-hours post-surgery, median scores were 5.00 (IQR=0.00) in Group-T versus 3.00 (IQR=0.00) in Group-E ($p<0.001$).

Conclusion: The Erector Spinae Plain Block provides effective and comparable analgesia compared to Thoracic Epidural Block with less opioid requirement and a better adverse effect profile.

Keywords: Analgesia, Block, Epidural, Erector Spinae, Thoracic, Thoracotomies.

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INTRODUCTION

Thoracic surgeries pose unique challenges to the anesthetist both in the pre- and per-operative phases. Altered lung compliance, one-lung ventilation and hemodynamic compromise necessitate strict monitoring and vigilance.¹ With extensive surgeries, pain relief is one of the fundamental reasons for patients' morbidity and poor recovery in the HDU/ICUs post-operatively.² The thoracic cage is supplied with an extensive nerve supply and conventional methods of pain relief by oral or the intravenous route are not adequate for effective in major surgeries.³ With the advent of regional anesthesia and specific nerve blocks, conventional methods are being abandoned if the novel methods prove superior and more compliant for patients.

The use of intravenous opioids and NSAIDs has largely been abandoned as first-line or mainstream treatment for major thoracic surgeries.⁴ Paravertebral nerve block along with thoracic epidural block have

been the mainstream and first line pain relief modalities in major thoracic surgeries.⁵ The thoracic paravertebral block provide adequate pain relief covering whole of the thoracic area with considerable success.⁶ Thoracic epidural blocks are equally effective for pain relief but the catheter in situ for top-ups and associated adverse effect profile requires vigilant monitoring and patient compliance.⁷ Secondly, critically ill patients and patients with coagulopathy or spine deformities are some of the limitations for both procedures.⁸ With the advent of nerve block targeting specific areas and nerve supplies, newer blocks may prove to be equally effective with a more conducive adverse effect profile which needs to be tested in our demographic setups since literature is scarce.

The aim of this study was to compare the post-operative analgesic effectiveness of thoracic epidural block when compared with erector spinae plane block in patients' post-thoracotomies.

METHODOLOGY

This randomized controlled trial was carried out at the Department of Anesthesiology, Combined Military Hospital, Rawalpindi Pakistan, from June 2023

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to December 2023 after approval from the ethical review board (vide letter no. 494) with trial registry (IRCT20231113060036N1). A pilot study was carried out at our institute before the start of the trial including 10 participants for each intervention. Mean difference between both groups to time to first rescue analgesia came out to be 177.23±13.65 minutes. Sample size was then calculated keeping the confidence interval at 95%, power of test at 80% with population variance at 10,000. Minimum sample size came out to be 6 patients for each group. We assessed 55 patients for the trial with 40 patients meeting the trial criteria which were randomized into 20 patients in each group according to the inclusion criteria and sample size furnished. Non-probability consecutive sampling was done. Patients were randomized into two groups by lottery method (Figure).

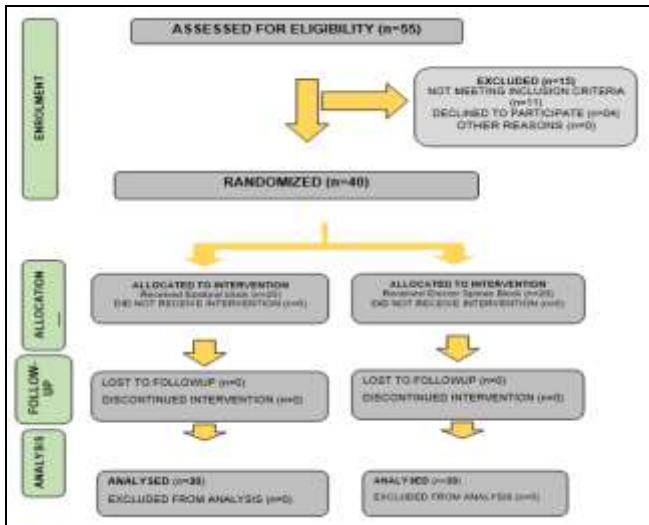


Figure: Phases of The Randomized Controlled Trial

Inclusion Criteria: All male and female patients between ages 25-75 years presenting in the operating room for elective thoracotomies were included in the study.

Exclusion Criteria: Patients with metastatic disease, major cardiac or respiratory disease, low ejection fraction, post chemotherapy, allergy to Lignocaine or Bupivacaine, patients with advanced polytrauma causing hemodynamic instability, patients with oxygen saturation less than 92% after supplemental oxygen or patients unwilling to be included in the trial were excluded.

The study method included all patients as per the inclusion criteria furnished. The patients were divided into the Thoracic Epidural Block Group (Group-T)

(n=20) and the Erector Spinae Block Group (Group-E) (n=20). Once randomized into the two groups, an informed written consent was taken and patients in both groups were explained in detail about the procedure and possible complications. Standard monitoring was attached and recorded.

One large 18 G intravenous line was passed in both groups, and all patients were pre-loaded with 500ml of 0.9% Normal Saline solution before the start of procedure in the recovery room. Injection Ondansetron 4mg and Injection Midazolam 0.02mg/kg were given as anti-emetic and anxiolytic respectively. Patients in the epidural block group were placed in the sitting position on the operating table, and an 18 G Tuohy needle was used for placement of the epidural catheter in the T3-6 epidural space under aseptic measures and confirmation of epidural space by hanging drop method. The catheter was secured at the 5 cm position and anti-septic dressing was applied and the catheter attached to the delivery port and secured in place. An initial bolus of 2% Lignocaine (10ml), 0.5% Bupivacaine (5ml) with NaHCO₃ 1ml was given. A continuous infusion of 1% Lignocaine at 5ml/hr was started post-operatively in the HDU/ICU for the next 24 hours.

In the erector spinae block group, patients were kept in the semi-lateral position according to patient comfort and the block was performed using a standard 22 G 75mm insulated block needle. Patients in Group-E received 0.5% Bupivacaine 5ml with 2% Lignocaine 5ml and 4mg Dexamethasone diluted in distilled water to make a total volume of 15 ml and given according to block guidelines under ultrasound guidance furnished by NYSORA.⁹ A 20 G catheter was placed in situ and a continuous infusion of 1% Lignocaine at 2.5 ml/hr was started post-operatively for the next 24 hours.

Post-procedure, patients were kept in the high dependency unit (HDU) and observed for post-operative pain at 1, 3, 6, 12 and 24 hours using the standard Visual Analog Scale.¹⁰ Time for first rescue analgesia was noted between both groups and 0.5mg/kg of Nalbuphine was administered once pain on the visual analog scale (VAS) reached >5 and total dose given in 24 hours was calculated. Patient satisfaction was evaluated and recorded at 24 hours after surgery on a 7-point Likert scale. (1-Extremely to 7-Extremely satisfied).

Primary variables measured were mean time to first rescue analgesia, total dose of intravenous

analgesia needed in 24 hours and median pain scores at 1, 3, 6, 12 and 24 hours and patient satisfaction for pain relief on the Likert scale 24 hours after intervention. Secondary variables observed were the side effects profile including nausea/vomiting, hypotension, and sedation post-procedure.

Independent samples t-test was used to compare means between both groups. Median values for pain scores were compared using the Mann Whitney U test. Demographic data were statistically described in terms of mean and SD, frequencies, and percentages when appropriate. A *p*-value of ≤ 0.05 was considered statistically significant. All statistical calculations were performed using Statistical Package for Social Sciences 26:00.

RESULTS

A total of 40 patients were analyzed after being randomized into Group-T (Thoracic Epidural Block Group) (n=20) and Group-E (Erector Spinae Block Group) (n=20). Mean age of patients in Group-T was 52.20±8.37 years versus 58.35±8.66 years in Group-E (*p*=0.028). Mean weight was 67.65±6.23 kg in Group-T versus 67.70±4.49 kg in Group-E (*p*=0.977). Gender distribution showed that there were 15(75%) males versus 05(25%) females in Group-T versus 16(80%) males versus 04(20%) females in Group-E (Table-I).

Table-I: Comparison of Age and Weight Characteristics Among Groups (n=40)

Variable(s)	Group-T (n=20)	Group-E (n=20)	<i>p</i> -value
Mean Age (Years)	52.20±8.37	58.35±8.66	0.028
Mean Weight (Kg)	67.65±6.23	67.70±4.49	0.977
Gender n(%)			
Male	15(75%)	16(80%)	-
Female	05(25%)	04(20%)	-

Table-II: Comparison of Primary Variables Among Both Groups (n=40)

Variable(s)	Group-T (n=20)	Group-E (n=20)	<i>p</i> -value
Duration of Surgery (Minutes)	170.15±7.61	169.25±7.49	0.709
Mean Time to First Dose Rescue Analgesia (Minutes)	178.15±10.51	320.35±15.23	<0.001
Mean Dose of Analgesia Given In 24 Hours (Mg/24 Hr)	14.45±1.09	10.15±1.26	<0.001
Mean HDU Stay (Hours)	47.45±3.23	47.50±3.15	0.961
Median Patient Satisfaction Score for Pain Relief (24 Hrs) (Likert Scale)	5.00 (IQR=1.00)	6.50 (IQR=1.00)	<0.001

Mean duration of surgery (thoracotomy) was 170.15±7.61 minutes in Group-T versus 169.25±7.49 minutes in Group-E (*p*=0.709). Mean time for first dose of added rescue analgesia was 178.15±10.51 minutes in Group-T versus 320.35±15.23 minutes in Group-E (*p*<0.001). Total added intravenous analgesia post-

surgery in 24 hours was 14.45±1.09 mg in Group-T versus 10.15±1.26 mg in Group-E (*p*<0.001). Mean HDU stay post-surgery was 47.45±3.23 hours in Group-T versus 47.50±3.15 hours in Group-E (*p*=0.961). Subjective patient satisfaction assessed on the Likert scale showed median scores of 5.00 (IQR=1.00) in Group-T versus 6.50 (IQR=1.00) in Group-E (*p*<0.001) (Table-II).

Median pain scores between both groups assessed using the Visual Analog Scale at 1-hour post-surgery were 3.00 (IQR=1.00) in Group-T versus 3.00 (IQR=1.00) in Group-E (*p*=1.000). When assessed after 3-hours post-surgery, median scores were 5.00 (IQR=0.00) in Group-T versus 3.00 (IQR=0.00) in Group-E (*p*<0.001). Assessment done at 6-hour post-surgery showed median pain scores of 4.50 (IQR=1.00) in Group-T versus 4.00 (IQR=1.00) in Group-E (*p*=0.445). Median pain scores at 12-hours post-surgery were 5.00 (IQR=1.00) in Group-T versus 4.50 (IQR=1.00) in Group E (*p*=0.081). Scores at 24-hour interval post-surgery were 5.00 (IQR=1.00) versus 5.00 (IQR=1.00) between Group-T and Group-E respectively (*p*=0.461) (Table-III).

Analysis of the adverse effect profile showed that nausea/vomiting was seen in 05(25%) patients in Group-T versus 04(20%) patients in Group-E. Hypotension was seen in 09(45%) patients in Group-T versus 01(05%) patient in Group-E. There was no incidence of sedation/drowsiness in both groups (Table-IV).

Table-III: Comparative Median VAS (Visual Analog Scale) Scores Post-Procedure Between Both Groups (n=40)

Variable	Group-T (n=20)	Group-E (n=20)	<i>p</i> -value
VAS At 1 Hour Post Procedure	3.00 (IQR=1.00)	3.00 (IQR=1.00)	1.000
VAS At 3 Hour Post Procedure	5.00 (IQR=0.00)	3.00 (IQR=0.00)	<0.001
VAS At 6 Hour Post Procedure	4.50 (IQR=1.00)	4.00 (IQR=1.00)	0.445
VAS At 12 Hour Post Procedure	5.00 (IQR=1.00)	4.50 (IQR=1.00)	0.081
VAS At 24 Hour Post Procedure	5.00 (IQR=1.00)	5.00 (IQR=1.00)	0.461

VAS: Visual Analogue Scale

Table-IV: Comparative Frequency of Side Effects Between Both Groups (n=40)

Variable(s)	Group- T n (%) (n=20)	Group-E n (%) (n=20)
Nausea/Vomiting	05(25%)	04(20%)
Hypotension	09(45%)	01(05%)
Sedation Post Procedure	00(0%)	00(0%)

DISCUSSION

This study aimed to establish the analgesic effectiveness of the erector spinae block when compared with thoracic epidural block. The results of our study concluded that the Erector Spinae Plain

Block provides effective and comparable analgesia compared to Thoracic Epidural Block with less opioid requirement and a better adverse effect profile.

The erector spinae block was first demonstrated by Forero *et al.*, in 2016 and has since found widespread acceptance since it is easy to administer, has a very favorable adverse effect profile and can be employed in a wide range of surgical procedures as a post-operative analgesia option.¹¹ Not only is it effective for thoracic surgeries but also has indication in upper abdominal surgeries.¹² Literature states that it is not as effective as the paravertebral block but its ease of use, less chances of failure and very few incidences of pneumothorax make it more suitable for majority of thoracic procedures.¹³ Thoracic epidural blocks have long been used for pain relief since thoracic surgeries are associated with considerable pain with pain scores reaching 7-8 on the Visual Analog Scale.¹⁴ They are still being used extensively but the newer regional techniques for targeted nerve blocks for the thoracic region are proving to be better alternatives as evidenced by literature.¹⁵ Our study aimed for the comparison to offer results in our institutional setup and propose these novel techniques to a wider patient demographic.

Majority of the patients presenting for thoracotomies and randomized for the trial consisted of males pre-dominantly. The mean time to first dose of rescue analgesia was considerably prolonged in the erector spinae group. Since it is an interfascial plane block, the retention of local anesthesia in the space and slow absorption with added infusion rate explains the prolonged pain relief.¹⁶ Even though literature states that the block can provide analgesia from 8-24 hours,⁹ we have not seen the effect and requirement of added analgesia was needed beyond 6 hours in majority of the cases in our study. This is still twice the time when compared to the thoracic epidural block group. Results comparing the rescue analgesia time between ESP block and TEA showed similar findings done by Broek *et al.*,¹⁷ and Kukreja *et al.*¹⁸ The total dose of rescue analgesia was comparable between both groups in these studies but in our study, more dose was required in the TEA group.

When comparing the median pain scores on the Visual Analog Scale, we found that our scores were similar for both groups during the first few hours and increased in the TEA group after 3 hours and ESP group after 6 hours. This is in-line with the rescue dose of analgesia which was required in both these

groups at the same timings when the scores started to increase. A study done by Singh *et al.*,¹⁹ and Diwan *et al.*,²⁰ compared both the treatment modalities for multiple rib fractures and concluded that there was a statistically significant difference in median pain scores at 3,6,12 and 24 hours but it was clinically comparable. The median scores were considerably less than in our study but since they used IV paracetamol along with infusions, it may be the reason for a slightly better pain control.

Patient satisfaction on the Likert scale showed some interesting subjective patient opinions. Majority of the patients were comfortable with respect to pain scores in both groups, but the patients in the TEA block group found the in-situ catheter to be more cumbersome affecting mobility and patient comfort. Comparison of the adverse effect profile showed that the frequency of hypotension was seen in nearly half of the patients in the thoracic epidural group requiring continuous and vigilant monitoring with more episodes of nausea/vomiting as well.

LIMITATION OF STUDY

The expertise required for successfully doing the block requires practice and expertise of pain consultants not widely available in our present setups.

RECOMMENDATIONS

The study recommends the use of ESP block as an equally effective alternative to thoracic epidural block providing comparable pain relief with the added advantage of less opioid requirement and a better adverse effect profile.

CONCLUSION

The ESP block provides effective and comparable analgesia compared to thoracic epidural block with less opioid requirement and a better adverse effect profile.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SH & AYZ: Data acquisition, data analysis, critical review, approval of the final version to be published.

MRI & GS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MI & SAMR: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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