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A comparative study of ultrasonography versus anatomical landmark guided techniques for erector spinae plane block in unilateral inguinal hernia surgeries

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ABSTRACT

Background: Hernia surgery can cause immense pain and discomfort postoperatively. Erector spinae plane block (ESPB) is a relatively new method of treating pain associated with various surgical procedures. EPSB can be administered under ultrasonography (USG) guidance or guided by anatomical landmarks. **Aims and Objectives:** To compare the efficacy of the USG-guided technique with the anatomical landmark-guided technique for ESPB in unilateral inguinal hernia surgeries for post-operative analgesia, number of doses of rescue analgesia, hemodynamic variations, side effects, and patient satisfaction. **Materials and Methods:** This prospective, randomized, and comparative study involving 84 patients aged 18–65 years belonging to the American Society of Anesthesiologists grade I and II and fulfilling the inclusion criteria were randomized into two groups. Group UESPB received USG-guided ESPB, and Group LESPB received landmark-guided ESPB followed by a subarachnoid block. Postoperatively, pain assessment was done using a Numerical Rating Scale (NRS) score, and time to first rescue analgesic and total analgesic requirements were recorded. **Results:** Group UESPB patients experienced significantly lower NRS scores at 2 h, 8 h, and 24 h ($P<0.05$) following surgery as compared to group LESPB. The mean time for request of the first rescue analgesic in Group UESPB was 11.80 ± 3.84 h, and in Group LESPB was 9.80 ± 2.01 h, and the difference was statistically significant ($P=0.003$). Total post-operative analgesic consumption in 24 h in group UESPB was 114.2 ± 37.91, which was lower than that in group LESPB (137.5 ± 28.28 mg, $P=0.002$). **Conclusion:** UESPB provides improved analgesia and reduced analgesic consumption in the post-operative period as compared to the landmark-guided technique.

Key words: Anatomical landmark guidance; Erector spinae plane block; Hernia surgery; Ultrasound guidance

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INTRODUCTION

Inguinal hernia repair is one of the most frequently performed surgeries. It is typically carried out either under regional anesthesia, neuraxial anesthesia, or general anesthesia. Hernia surgery can cause immense pain postoperatively, which can cause a lot of discomfort to the patients.[1] For the management of post-operative pain, multimodal analgesia involving opioids, non-steroid anti-inflammatory medications, local infiltration, and regional anesthesia

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techniques such as transversus abdominis plane block[2] and erector spinae plane block (ESPB) are frequently used.

ESPB is a relatively new method of treating acute and chronic pain as well as the pain associated with various surgical procedures.[3] The ESBP is a simple regional anesthesia procedure that has a variety of clinical uses. Its application in thoracic and truncal surgery has been studied in various recent studies.[4-6] It is now widely regarded as an alternate analgesic option to paravertebral blocks and thoracic epidural analgesia, particularly in cases when both procedures are contraindicated.[7,8]

ESPB is an inter-fascial plane block where a local anesthetic is injected in a plane below the erector spinae muscle group. The dorsal and ventral rami of the spinal nerves are blocked, resulting in a multi-dermatomal sensory block of the anterior, posterior, and lateral abdominal walls.[5]

It is carried out as a single injection block, or a catheter may be inserted for ongoing pain relief.[9] Besides the landmark-guided technique, ultrasound guidance is frequently used to perform this block. However, literature comparing the efficacy of these two techniques in the Indian population is scarce, which prompted us to conduct this study. In this study, we compared the efficacy of the anatomical landmark-guided technique of ESPB to the ultrasonography (USG)-)-guided technique for treating acute post-operative pain in unilateral inguinal hernia surgeries.

Aims and objectives

The objectives of this study was to compare the duration of postoperative analgesia, number of doses of rescue analgesia, hemodynamic variations, side effects and patient satisfaction between ultrasonography and anatomical landmark guided 2ESP block in unilateral inguinal hernia surgeries.

MATERIALS AND METHODS

This study is a prospective, randomized, comparative study conducted in a tertiary care teaching hospital over a period of 1 year from the date of approval of the Institutional Ethics Committee.

A total of 84 patients aged 18–65 years with American Society of Anesthesiologists (ASA) grade I and II were enrolled. Patients were explained the procedure of block and written consent was taken. Patients posted for unilateral inguinal hernia repair under spinal anesthesia formed the study population. Patients with known allergies to amide local anesthetics, coagulopathy, or injection site skin infection were excluded from the study (Figure 1).

The patients were randomly allocated into one of the two study groups (42 patients each) using a sealed envelope technique, which was opened by the anesthesiologist just before performing the block, and the patients were allocated to the group accordingly.

Group U received USG-guided, and Group L received landmark-guided ESBP (LESBP).

A day before surgery, a detailed pre-anesthetic checkup was done, including a general physical examination along with

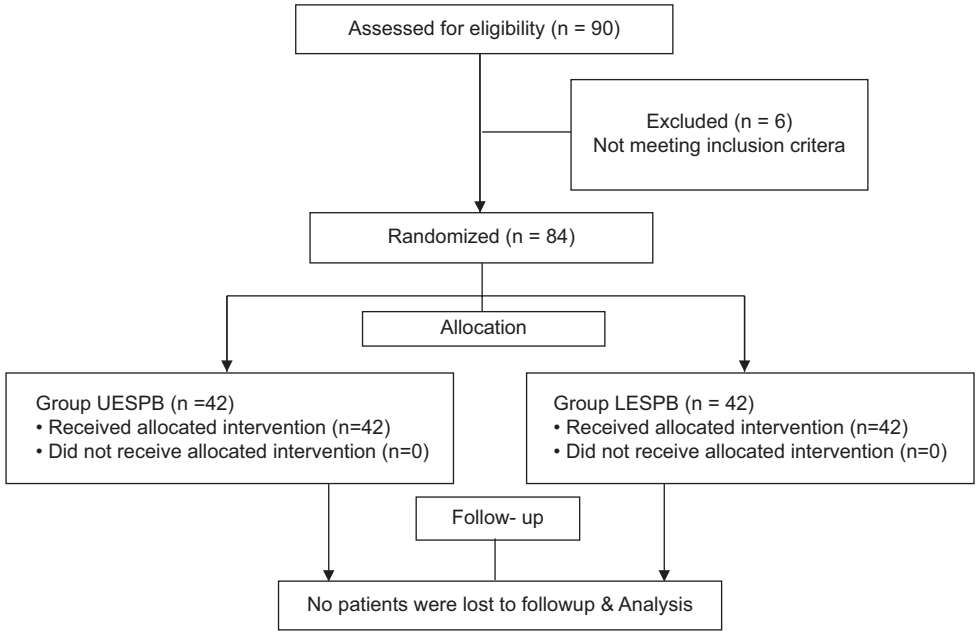


Figure 1: Study participant's selection flow chart

proper systemic examination, assessment of the airway, and local examination of the thoracolumbar spine. Relevant investigations were reviewed. The Numerical Rating Scale (NRS) was explained to the patients to determine the level of analgesia in the post-operative period. It was carried on a straight scale with a 0–10 cm line (no pain at all-maximum pain imaginable). Patients were asked to restrict solids and fluids by mouth for 8 h and 2 h, respectively, before surgery.

Patients were shifted to the operation theater, and a multipara monitor was attached. Baseline respiratory rate, heart rate, non-invasive systolic and diastolic blood pressure, peripheral oxygen saturation, and electrocardiography were recorded, and continuous monitoring was started. An intravenous line was secured with an 18 G cannula.

The patient was made comfortable in a sitting position with the help of a pillow. Then, ESPB was given in a sitting position under full aseptic precautions at the level of the 10th thoracic vertebra on the ipsilateral side of surgery.

In patients belonging to Group UESPB (USG-guided ESPB technique) to A convex ultrasound 3–15 Hz frequency transducer was placed in a longitudinal parasagittal orientation 3 cm lateral to the T10 spinous process. The erector spinae muscle was identified as superficial to the tip of the T10 transverse process. The patient's skin was anesthetized with an injection of 1% lignocaine. A 23 gauge 10 cm spinal needle was inserted using an in-plane superior to inferior approach to place the tip into the fascial plane on the deeper aspect of the erector spinae muscle. The location of the needle tip was confirmed by visible fluid spread lifting the erector spinae muscle off the bony shadow of the transverse process.

In patients belonging to Group LESPB (anatomical LESBP technique), the spinous process of the T10 vertebra and a point 3 cm lateral to it was marked at the appropriate level before performing the block. Under all aseptic precautions, the patient's skin was anesthetized with an injection of 1% lignocaine, and then the needle (23G-gauge, 8–10 cm quincke's spinal needle) was inserted perpendicular to the skin in all planes to contact the transverse process of the vertebra. At this point, the needle tip would lie between the erector spinae muscle and the transverse process. After negative aspiration, local anesthetic was injected in 3–5 mL aliquots. 20 mL of injection bupivacaine 0.5% was used for analgesia. The drug injected in this plane spreads in the longitudinal axis to both the cephalad and caudal direction over several levels as the erector spinae fascia extends from the nuchal fascia to the sacrum.

After ESBP, a spinal block was given with the help of a 25 gauge quincke's spinal needle using injection bupivacaine 0.5% (H) 3 mL at L3-L4 subarachnoid space under all aseptic precautions.

The patient was made supine, and surgery was allowed to proceed after achieving a sensory level till T8. Vital parameters were recorded throughout the surgery.

In post-operative periods, pain intensity was evaluated by NRS score (0=no pain, 10=worst pain imaginable) at 0, 30 min, 1, 2, 4, 8 12, 24, h and injection diclofenac sodium 1.5 mg/kg IV in 100 mL NS over 30 min was given as rescue analgesic when NRS (it was the duration of analgesia) ≥4. The time interval from the administration of the block to the first request for rescue analgesic drug, the total number of doses of analgesic, and the total dose of analgesic required in 24 h was noted. The duration of analgesia was taken as time from giving the block to the request for the first dose of rescue analgesic (NRS ≥4). Patients having pain within 3 h of administration of spinal block were considered to have failed ESPB and were excluded from the study.

Any post-operative adverse event, including nausea, vomiting, hypotension, headache, and backache in the first 24 h was recorded and treated accordingly. Patients were interviewed 24 h after the procedure, and the response of the patient was graded using a satisfaction scale.

The primary outcome of the study was to study the duration of post-operative analgesia in each group. The secondary objectives of the study are to determine the number of doses of rescue analgesia, to calculate the total dose of rescue analgesia in each group, and to record the patient acceptance.

Inclusion criteria

Unilateral inguinal repair under spinal anesthesia, ASA grade I and II, patient aged 18–65 years.

Exclusion criteria

Patient refusal, the patient having hypersensitivity toward local anesthetics drugs, infection at the site of block, uncorrected bleeding disorder, the patient having neurological/psychiatric illness, patient with polytrauma/head injury, any contraindications of spinal anesthesia, patients with obstructed/strangulated hernia.

Statistical analysis

The data were entered into the Microsoft Excel sheet from the customized pro forma for analysis. Minitab 17.0 was used for calculating the P-values. A comparison of means between the two groups was done using an unpaired t-test. The categorical data were analyzed using the Chi-square test. Descriptive statistics was presented in the form of numbers and percentages. $P<0.05$ was taken as statistically

significant. The final data were presented in the form of tables and graphs.

RESULTS

In the present study, both groups were comparable with respect to demographic characteristics (age distribution and Body Mass Index) and ASA grade distribution, as shown in Table 1.

Table 2 shows the comparison of mean NRS between the two groups.

In Group UESPB and Group LESPB, the mean NRS at the immediate post-operative period was 1.24±0.79 and 1.21±0.42, respectively. Then, there was a slight rise in NRS score throughout the post-operative period till 24 h in both groups.

The mean NRS was comparable between the two groups at all times except at 2, 8, and 24 h when the difference was significant (P<0.05).

Table 3 shows the comparison of the mean time for a request for first rescue analgesia between the two groups.

The mean time for a request for first rescue analgesia in Group UESPB was 11.80±3.84 h and in Group LESPB was 9.80±2.01 h and found to be statistically significant (P=0.003).

Table 1: Demographic parameters

Characteristic	Group UESPB	Group LESPB	P-value
Age	45.15±12.44	46.25±15.73	0.172
BMI	22.7±3.6	24.1±3.0	0.770
ASA Grade 1/2	26/16	30/12	0.354

ASA: American Society of Anesthesiologists, BMI: Body mass index, UESPB: Ultrasonography guided erector spinae plane block, LESPB: Landmark guided erector spinae plane block

Table 2: Comparison of mean NRS score post-operative between the two groups

NRS score	UESPB	LESPB	Unpaired t-test
	Mean±SD	Mean±SD	P-value
0 min	1.24±0.43	1.21±0.42	0.797
30 min	1.4±0.50	1.52±0.51	0.28
1 h	2.33±0.72	2.42±0.59	0.51
2 h	2.35±0.48	2.64±0.48	0.007
4 h	3.02±0.26	2.95±0.21	0.178
8 h	2.97±1.09	3.45±0.63	0.015
12 h	3.73±0.58	3.69±0.46	0.727
24 h	3.30±0.68	3.59±0.54	0.033

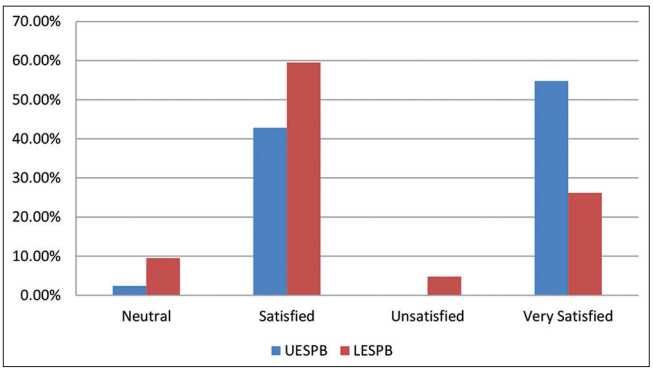
NRS: Numerical rating scale, UESPB: Ultrasonography guided erector spinae plane block, LESPB: Landmark guided erector spinae plane block

Table 4 shows the comparison of the total mean dose of rescue analgesia. In group UESPB, the total mean dose of rescue analgesia was 114.2±37.91 mg diclofenac whereas, in group LESPB, the total mean dose of rescue analgesia was 137.5±28.28 mg diclofenac which was significantly higher than group UESPB.

Table 5 and Graph 1 shows the comparison of patient acceptance in both groups.

In Group UESPB, 23 (54.76%) were very satisfied, 17 (40.50%) were satisfied, and the remaining 1 (2.38%) was neutral.

In Group LESPB, 11 (26.19%) were very satisfied, 25 (59.50%) were satisfied, 4 (9.52%) were neutral, and the remaining 2 (4.80%) were unsatisfied.



Graph 1: Bar diagram shows the comparison of patient acceptance in both groups

Table 3: Comparison of mean time taken for the request for first rescue analgesia between the two groups

Parameter	Group	No. of patients	Mean	P-value
Time of first dose of rescue analgesia (in hours) (NRS >4)	UESPB LESPB	42 42	11.80±3.84 9.80±2.01	0.003

NRS: Numerical rating scale, UESPB: Ultrasonography guided erector spinae plane block, LESPB: Landmark guided erector spinae plane block

Table 4: Comparison of total mean dose of rescue analgesia in both groups

Parameter	Group	Mean±Standard deviation (mg)	P-value
Total mean dose of rescue analgesia (mg)	UESPB LESPB	114.2±37.91 137.5±28.28	0.002

UESPB: Ultrasonography guided erector spinae plane block, LESPB: Landmark guided erector spinae plane block

Table 5: Comparison of patient acceptance in both groups

Patient acceptance	UESPB		LESPB		Chi-square test
	No. of patient	%	No. of patient	%	P-value
Unsatisfied	0	0.00	2	4.80	0.0001
Neutral	1	2.38	4	9.52	
Satisfied	18	42.85	25	59.50	
Very satisfied	23	54.76	11	26.19	

UESPB: Ultrasonography guided erector spinae plane block, LESPB: Landmark guided erector spinae plane block

Table 6: Comparison of adverse effects in both groups

Adverse effect	UESPB		LESPB		Chi-square test
	No. of patients	%	No. of patient	%	P-value
Local pain	3	7.10	3	7.10	0.696
Nausea/vomiting	2	4.76	4	9.52	
None	37	83.33	35	83.33	

UESPB: Ultrasonography guided erector spinae plane block, LESPB: Landmark guided erector spinae plane block

There was a statistically significant difference between the two groups in terms of patient acceptance (P=0.0001), with group UESPB exhibiting better patient acceptance than group LESPB.

The above Table 6 shows the comparison of adverse effects observed in each group. The incidence of local pain was the same in both groups. Incidence of nausea/vomiting was more in group LESPB; however, the difference was not statistically significant.

DISCUSSION

Inguinal hernia surgery is associated with significant post-operative pain. Appropriate post-operative pain management is associated with fewer post-operative complications and reduced length of hospital stay. ESPB is currently popular and is used in routine anesthetic practice for spine surgery, cholecystectomy, gastric hernia repair, mastectomy, and analgesia for rib fractures.[4,5] The present study was undertaken to evaluate and compare the use of ultrasound-guided ESBP versus anatomical LESPB in providing post-operative analgesia after unilateral inguinal surgeries.

In our study, patients belonging to group UESPB experienced significantly lower NRS scores at 2 h, 8 h, and 24 h following surgery as compared to group LESPB. This might be attributable to the greater precision provided by USG guidance, which facilitates to visualize the drug spread in the right anatomical plane. The deposition of local anesthetic in the paravertebral space blocks both rami of thoracic spinal nerves (dorsal and ventral) as well as rami communicants.[10] Moreover, the fascial plane underlying the erector spinae muscle allows for marked craniocaudal spread, resulting in multi-dermatomal coverage following a single injection. This allows for the application of ESPB for thoracic as well as abdominal surgeries.

Similar results were found in the study done by Hamed et al.,[11] who performed ESBP for post-operative analgesia in patients undergoing total abdominal hysterectomy. In a case series, Goel et al.[8] found the landmark-based technique to be equally effective as the USG-guided technique. However, their study was limited to four patients.

The mean time for request of first rescue analgesia was considerably more approximately in Group UESPB 11.8 h than in Group LESPB (11.8 h vs. 9.80 h). The total post-operative analgesic consumption in 24 h in group UESPB was approximately 114 mg of diclofenac. In Group LESPB, it was 137 mg of diclofenac, which was significantly more than the UESPB Group. Sahin et al.[12] reported the cumulative dose of patient-controlled analgesia with tramadol was higher in the general anesthesia group than in the USG-guided erector spinae plane (ESP) group (212 mg vs. 107.3 [36.9 mg]) in patients undergoing lumbar spinal stenosis surgeries.

Ibrahim[13] compared the oblique subcostal transversus abdominis plane (OSTAP) block with the EPSB for opioid consumption during the first 24 h after laparoscopic cholecystectomy and discovered that the mean duration of analgesia was around 384 min in the ESP group as compared to 343 min in OSTAP group, which was significant. Pataudi et al.[14] also found that the mean amount of rescue analgesic (Diclofenac in mg) was considerably higher in the control group as compared to the ESPB Group (210.00 mg vs. 135 mg, respectively). The result of our studies confirms these findings.

Better analgesia in the UESPB Group translated into better patient acceptance and higher satisfaction. An indwelling

catheter can also be inserted by this technique, extending the duration of analgesia and further reducing the systemic analgesic requirements. Improved patient satisfaction was also reported by Tsui et al.[15] in lumbar spine surgery patients receiving UESPB. However, the main advantage of the landmark-guided technique is its procedural simplicity.

In the present study, hemodynamic parameters were comparable in the two groups. The autonomic blockade that accompanies the epidural technique is not seen with the ESPB. This offers better hemodynamic stability. The incidence of nausea/vomiting was more in group LESPB; however, the difference was statistically not significant. There were no other major adverse events in either of the two groups which establishes the safety of this analgesic technique. Similar to our findings, Goel et al. and Pataudi et al. did not report any major adverse event in landmark guided as well as UESPB techniques. As there are no structures at risk of needle injury near the block site, ESPB offers safety even when given without USG guidance.

There were certain drawbacks to our study. There was the absence of a control group. The researchers were not blinded to the study which might give rise to bias. The study was confined to unilateral hernioplasty surgery. There is a need for larger, multicentric trials to validate our results.

Limitations of the study

There are certain limitations of our study. First of all, in our study, spinal anesthesia was given after the block, making proper assessment of successful block difficult; second, the requirement of rescue analgesia was not noted beyond 24 h, although some patients had the duration of analgesia extended beyond 24 h. More studies with larger sample sizes will be more helpful to further validate our results.

CONCLUSION

The USG-guided technique is superior to the landmark-guided technique, with a longer duration of post-operative analgesia, reduced analgesic consumption in the post-operative period, and improved patient satisfaction. The landmark-guided technique might be a useful alternative in those settings where a USG machine is not available. Further studies are warranted to support these observations.

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REFERENCES

1. Altinsoy S, Ozkan D, Akelma FK and Ergil J. Analgesic efficacy of ultrasound guided unilateral erector spinae plane block for laparoscopic inguinal hernia repair: A randomized controlled study. Turk J Med Sci. 2022;52(3):631-640.
https://doi.org/10.55730/1300-0144.5355
2. Tulgar S, Kapakli MS, Kose HC, Senturk O, Selvi O, Serifsoy TE, et al. Evaluation of ultrasound-guided erector spinae plane block and oblique subcostal transversus abdominis plane block in laparoscopic cholecystectomy: Randomized, controlled, prospective study. Anesth Essays Res. 2019;13(1):50-56.
https://doi.org/10.4103/aer.AER-194-18
3. Adhikary SD, Bernard S, Lopez H and Chin KJ. Erector spinae plane block versus retrolaminar block: A magnetic resonance imaging and anatomical study. Reg Anesth Pain Med. 2018;43(7):756-762.
https://doi.org/10.1097/AAP.0000000000000798
4. Hamilton DL and Manickam B. Erector spinae plane block for pain relief in rib fractures. Br J Anaesth. 2017;118(3):474-475.
https://doi.org/10.1093/bja/aex013
5. Chin KJ, Adhikary S, Sarwani N and Forero M. The analgesic efficacy of pre-operative bilateral erector spinae plane (ESP) blocks in patients having ventral hernia repair. Anaesthesia. 2017;72(4):452-460.
https://doi.org/10.1111/anae.13814
6. Scimia P, Ricci EB, Droghetti A and Fusco P. The ultrasound-guided continuous erector spinae plane block for postoperative analgesia in video-assisted thoracoscopic lobectomy. Reg Anesth Pain Med. 2017;42(4):537.
https://doi.org/10.1097/AAP.0000000000000616
7. Huang J and Liu JC. Ultrasound-guided erector spinae plane block for postoperative analgesia: A meta-analysis of randomized controlled trials. BMC Anesthesiol. 2020;20(1):83.
https://doi.org/10.1186/s12871-020-00999-8
8. Goel VK, Vadera HK and Mistry T. Landmark guided erector spinae plane block as a part of multimodal analgesia in thoracolumbar spine surgeries. Anaesth Pain Intensive Care. 2019;23(4):404-405.
https://doi.org/10.35975/apic.v23i4.1175
9. Chaudhary NK and Singh S. Continuous ultrasound-guidederector spinae plane block for post-operative pain management in lumbar spine surgery: A case series. Indian J Anaesth. 2018;62(8):638-639.
https://doi.org/10.4103/ija.IJA-160-18
10. Munoz F, Cubillos J, Bonilla AJ and Chin KJ. Erector spinae plane block for postoperative analgesia in pediatric oncological thoracic surgery. Can J Anaesth. 2017;64(8):880-882.
https://doi.org/10.1007/s12630-017-0894-0
11. Hamed MA, Goda AS, Basiony MM, Fargaly OS and Abdelhady MA. Erector spinae plane block for postoperative analgesia in patients undergoing total abdominal hysterectomy: A randomized controlled study original study. J Pain Res. 2019;12:1393-1398.
https://doi.org/10.2147/JPR.S196501
12. Sahin A, Baran O, Gültekin A, Şahin GG and Arar C. Ultrasound-guided erector spinae plane block for lumbar spinal stenosis surgery. Open J Anesthesiol. 2021;11(3):72-84.
https://doi.org/10.4236/ojanes.2021.113008
13. Ibrahim M. Erector spinae plane block in laparoscopic cholecystectomy, is there a difference? A randomized controlled trial. Anesth Essays Res. 2020;14(1):119-126.

https://doi.org/10.4103/aer.AER-144-19

14. Pataudi V, Deepika, Meera, Jonwal K, Jain N and Jain K. A study to assess the efficacy of erector spinae plane block (ESPB) for postoperative analgesia patients undergoing laparoscopic cholecystectomy under regional anaesthesia. Int J Med Sci Clin Res Rev. 2022;5(05):958-968.
https://doi.org/10.1093/bjs/znac039.106
15. Tsui BC, Fonseca A, Munshey F, McFadyen G and Caruso TJ. The erector spinae plane (ESP) block: A pooled review of 242 cases. J Clin Anaesth. 2018;53:29-34.
https://doi.org/10.1016/j.jclinane.2018.09.036

Authors' Contribution:
RP, RS, MB-Concept, design of study and literature research and experiment studies; **RP, RS** -Data acquisition, data analysis and statistical analysis; AS,AC-Manuscript preparation; **RP,AS,AC-**Manuscript editing and manuscript review.

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