Archives of Anesthesiology and Critical Care (In Press); x(x): xx-xx.

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Research Article

Comparison of the Efficacy between Bilateral Ultrasound Guided Erector Spinae Block versus Incision Site Infiltration for Duration of Analgesia in Lumbar Spinal Surgery Using Levobupivacaine: A Prospective, Randomized Comparative Study

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ARTICLE INFO

Article history:
Received 11 June 2024
Revised 30 June 2024
Accepted 14 July 2024

Keywords:
Erector spinae block;
Ultrasound;
Levobupivacaine;
Wound infiltration

ABSTRACT

Background: There are increasing number of patients undergoing lumbar spine surgeries. Many modalities have been developed to manage post operative pain. More recently, erector spinae plane blocks found to be effective in reducing post operative pain. The purpose of this study was to compare the analgesic efficacy of ultrasound guided Erector spinae block with wound infiltration using levobupivacaine in lumbar spine surgeries under general anaesthesia.

Methods: A prospective randomized single blinded study was carried out in 50 patients of ASA grade I and II, aged 20 to 60 years scheduled for elective lumbar spine surgeries. Under USG guidance, group A received bilateral erector spinae block at L2 with 20 ml of 0.125% levobupivacaine on each side and Group B received incision site infiltration with 40 ml 0.125% levobupivacaine. Patients were evaluated primarily for duration of analgesia using VAS score.

Results: Both groups were statistically comparable with respect to all demographic variables, ASA grading and duration of surgery. The duration of analgesia was prolonged in group A when compared to group B (496 ± 36.2 v/s 55±10.6) (P=0.0016). VAS score and total rescue analgesia requirement were higher in group B.

Conclusion: Erector spine block is more effective in providing post-operative analgesia compared to local site infiltration in patients undergoing spine surgeries following general anaesthesia using Inj Levobupivacaine 0.125% as local anaesthetic.

Introduction

Spine surgeries are a generally accepted therapeutic options for people with spine pathology. However, postoperative pain and discomfort are the most prevalent consequences of these surgeries [1]. Furthermore, Spine surgery is among the most agonizing surgical strategies, making pain management particularly difficult [2]. This pain is caused by surgical trauma to the afferent neuron in various tissues such as ligaments, nerve root sleeves, intervertebral discs, dura, muscles, facet joint capsules, and fascia.

Sufficient pain management following spine surgery is crucial for patients during post operative period because it allows for earlier ambulation, enhanced functional recovery and early discharge [3]. It also enhances patient contentment and prevents persistent pain.

The authors declare no conflicts of interest.

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Opioids are the most commonly used analgesics for postoperative pain. However, they can produce dizziness, pruritus, nausea, vomiting, and respiratory depression. As a result, the preferable approach is to improve analgesia while minimizing opioid use [4-5].

There are various non-opioid strategies for managing postoperative pain in these patients, one of which involves local surgical site wound infiltration. Several studies indicate that this technique may reduce the need for analgesics following spine surgery.

Fascial plane blocks can also be used in conjunction with other pain treatment techniques. Erector spinae plane block [7] is an interfascial block that Forero originally identified in 2016. The erector spinae block is performed by injecting a local anesthetic deep into the erector spinae muscle at the tip of the transverse process, allowing it to disperse within the cranio-caudal fascial plane [8]. This technique has gained popularity for postoperative pain management in various surgeries including abdominal, thoracic, breast, and spinal procedures, owing to its safety and feasibility under ultrasound guidance [9-11].

Levobupivacaine is an amide local anesthetic and the isolated S (-) enantiomer of racemic bupivacaine. It is linked to fewer cardiovascular and central nervous system side effects than bupivacaine. Given its lower cardiotoxicity, levobupivacaine seems to be a viable alternative to bupivacaine [12]. Clinical trials comparing levobupivacaine and racemic bupivacaine in epidural and infiltration anesthesia have found that both are equally effective.

Methods

On approval from Institutions Ethical committee, a randomized prospective single blinded study was done after CTRI registration (CTRI/2023/10/059119) in 50 patients belonging to ASA grade I and II, aged between 20 to 60 years, posted for single level lumbar discectomy. The study adhered to the guidelines of the Helsinki Declaration, and written informed consent was obtained from all participants. Patients with local anesthetic hypersensitivity, bleeding disorders, seizure disorder, neurological diseases, liver disease, renal disease, uncontrolled diabetes mellitus, pregnant & lactating women were not included in the study. With respect to previous study by Samir Warhan et al [1], based on assumption that the Erector spinae block will increase the duration of analgesia with a power of 95% and significance level of 5%, we selected 25 patients in each group for our study. Patients were randomly allocated into two groups of 25 each by single blinded open envelope technique into group A and group B. Group A patients received erector spinae block with 20 ml of 0.125% Levobupivacaine on each side at the level of second lumbar vertebra (L2). Group B Patients received 40 ml of 0.125% Levobupivacaine infiltration over the surgical incision before extubation. All patients underwent detailed pre-anesthetic assessment on the day before surgery. All patients were informed about the procedure and instructed on how to interpret the Visual Analogue Scale (VAS). Fasting guidelines were observed. Oral alprazolam (0.25 mg) and ranitidine (150 mg) were administered the night before surgery. Additionally, an intravenous dose of ranitidine (50 mg) was given 30 minutes prior to surgery.

Once the patients were transferred to the operating theatre, standard ASA monitors were applied, including heart rate, non-invasive blood pressure, ECG, and oxygen saturation (SpO_2). Another wide bore intravenous 18G cannula was secured and intravenous fluids were started as per the requirements. Patients were placed in supine position. They were adequately preoxygenated and premedicated with Inj Midazolam 0.01mg/kg and Inj Glycopyrrolate 0.2mg and were induced with Inj Fentanyl 1-2mcg/kg, Inj Propofol 2mg/kg and Inj. Vecuronium 0.1mg/kg. After obtaining adequate muscle relaxation, laryngoscopy was done and intubated with appropriate size endotracheal tube. Bilateral airway entry was confirmed, and the patients were turned to prone position. Hemodynamic parameters were continuously monitored at regular intervals throughout the procedure.

At the end of surgery, under strict aseptic conditions, counting above from L4 vertebrae from the tuffiers line, and under ultrasound guidance (M-turbo USG system manufactured by Fujifilm SONOSITE, Inc., USA) L2 vertebrae was identified using curvilinear probe. The probe was then positioned to locate the L2 transverse process. Using an 18G Tuohy needle attached to a 10 cm extension line, 20 ml of 0.125% levobupivacaine was injected below the fascia of the erector spinae via an in-plane technique on both sides. To confirm needle tip placement, 2-3 ml of normal saline was first administered, followed by the injection of the study drug in this plane (Figure 1).

After the block was completed, the patient was positioned supine and extubated following reversal of residual neuromuscular blockade with neostigmine (0.05 mg/kg) and glycopyrrolate (0.01 mg/kg). Patients were then transferred to the post-anesthesia care unit for monitoring of hemodynamic parameters, assessment of postoperative pain, sedation, nausea, and vomiting. at the intervals 0,1,2,4,6,8,12,16,20,24 hrs.

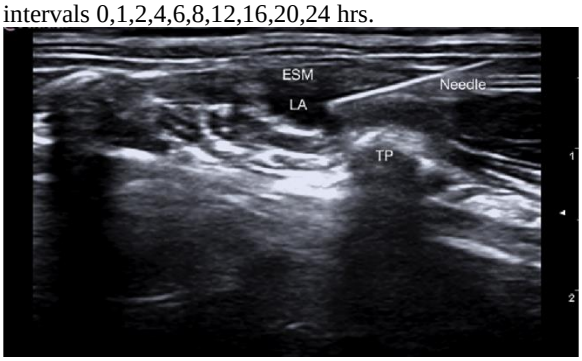

Figure 1- Ultrasound image of erector spinae block

Patients were evaluated postoperatively for the duration of analgesia and pain was assessed using a standard 10 cm linear VAS scale. Assessment of pain score started 20 min after extubation which is considered as zero time. Total duration of analgesia was taken as starting from zero time till the time when first analgesic request was made. When the VAS score reached 4 or higher, intravenous paracetamol (1 g) was administered as a rescue analgesic. The total number of paracetamol doses given within 24 hours was recorded. Patients were excluded from the study if the block was ineffective.

Adverse events, including respiratory depression, hypoxemia, bradycardia, sedation, hypotension, nausea, and vomiting, were recorded if observed. Bradycardia, defined as a heart rate of less than 50 bpm, was treated with intravenous atropine (0.6 mg). Hypotension was defined as a blood pressure drop of more than 20% from baseline and was managed with 6 mg boluses of intravenous ephedrine. Intraoperative and postoperative hemodynamics were monitored at regular intervals. Pain was assessed using the VAS scale, and if the VAS score exceeded 4, intravenous paracetamol (1 g) was administered as a rescue analgesic. The requirement for rescue analgesia in the postoperative period was recorded and analyzed for both groups.

Data was processed in MS excel/analyzed using SPSS software version 26. Demographic & hemodynamic data analysis was done by Student t-test. An unpaired t-test was used to assess onset and duration of sensory and motor blockade, duration of analgesia. Results were considered statistically significant with a p-value of less than 0.05, and highly significant with a p-value of less than 0.001.

Results

Fifty patients were selected for the study and were classified into two groups, Group A- received 20 ml of 0.125% Levobupivacaine for erector spinae block and Group B received 40 ml of 0.125% Levobupivacaine infiltration over the surgical incision site. No patients were omitted from the study (Figure 2).

Both the groups were comparable with respect to demographic variables like age, sex, weight, height, ASA grading and duration of surgery (Table 1, 2, 3).

According to our observations duration of analgesia was found to be longer in Group A (496±36.2) when compared to Group B (55±10.6) ($p<0.005$) (Table 4).

Rescue analgesic requirement was found to be more in Group B (2.3±1.45) when compared to Group A (0.74±1.12) ($p=0.032$) (Table 4).

Group A had lower VAS scores compared to Group B. ($p=0.0036$) (Table 5).

No apparent local anesthetic toxicity was noted in either of the groups. We did not encounter any significant hemodynamic disturbances or adverse effects in either of the groups (Figure 3, 4, 5).

Table 1- Demographic variables

Variable	Group A	Group B	P value
Age (in yrs.)	35.6 ± 6.1	36.1 ± 7.2	0.42
Weight (in kgs)	55.6 ± 4.7	56.9 ± 3.7	0.25
Height (in cms)	161.9 ± 5.92	162.2 ± 3.2	0.1
Duration of surgery (in mins)	96 ± 4.16	97 ± 3.04	
			0.43

Table 2- Gender distribution between two groups.

Sex	Group A		Group B		P value
	Count	%	Count	%	
Male	13	52%	13	52%	1
Female	12	48%	12	48%	

Table 3- ASA distribution.

Sex	Group A		Group B		P value
	Count	%	Count	%	
Class I	13	52%	6	24%	0.862
Class II	12	48%	19	76%	

Table 4- Total duration of analgesia and rescue analgesic requirement between the two groups.

Variable	Group A	Group B	P value
Total duration of analgesia post-surgery (minutes)	496 ± 36.2	55 ± 10.6	0.0016
Rescue analgesic requirement (paracetamol in grams)	0.32 ± 0.13	0.8 ± 0.12	0.032

Table 5- VAS score comparison between two groups

Time	Group A	Group B	P value
0 hours	2.18 ± 0.48	2.26 ± 0.16	0.36
1 hour	1.4± 0.54	3.2±1.2	0.37
2 hours	2.36± 1.2	6.2 ± 0.76	0.0026
4hours	3.06± 0.68	7.12± 0.34	0.0018
8 hours	2.32±1.14	8.0 ± 2.56	0.0024
12 hours	5.76±0.68	9.2±2.18	0.0032
24 hours	6.2±0.3	8.5±1.7	0.0033

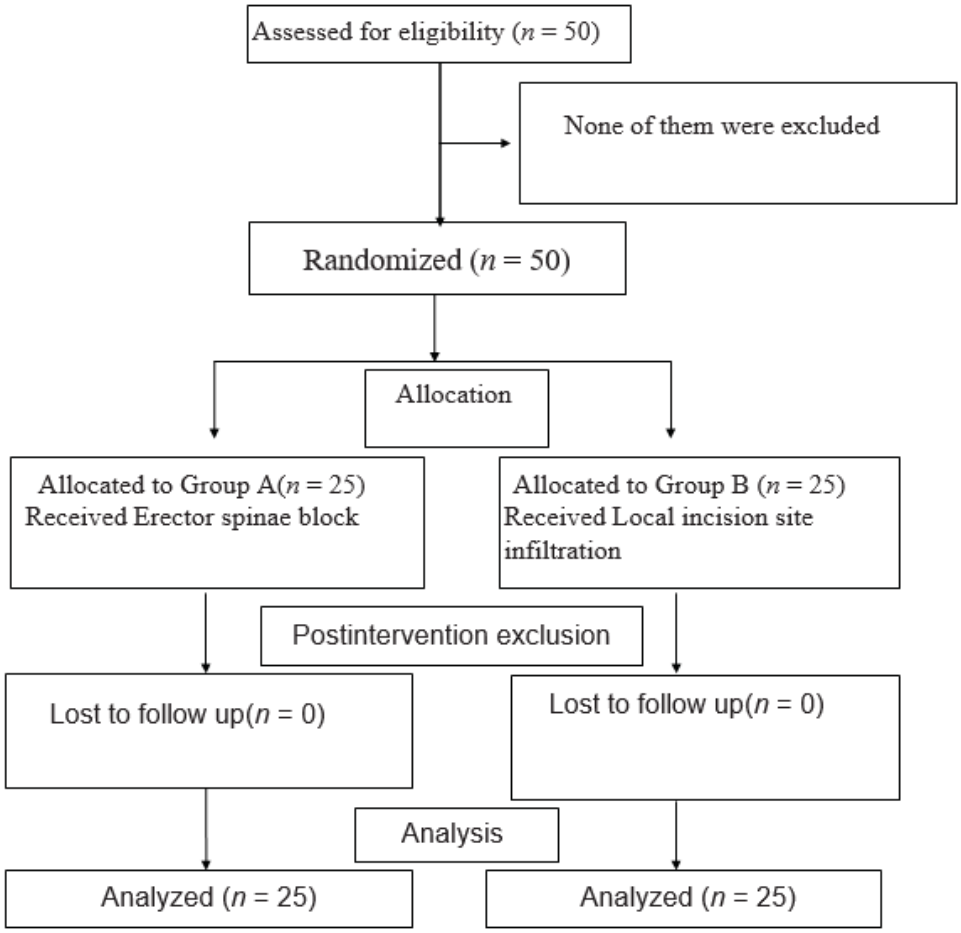

Figure 2- Consort flow diagram

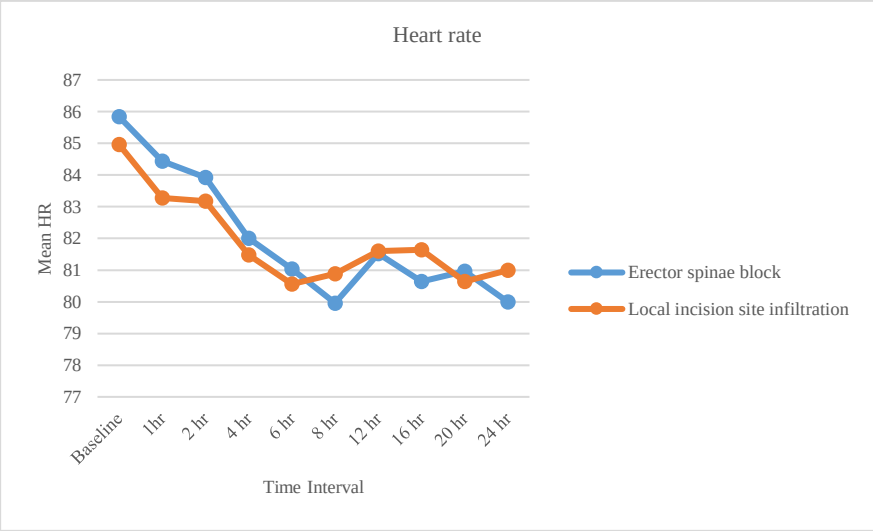

Figure 3- Mean heart rate comparison

Figure 4- Mean Systolic blood pressure comparison

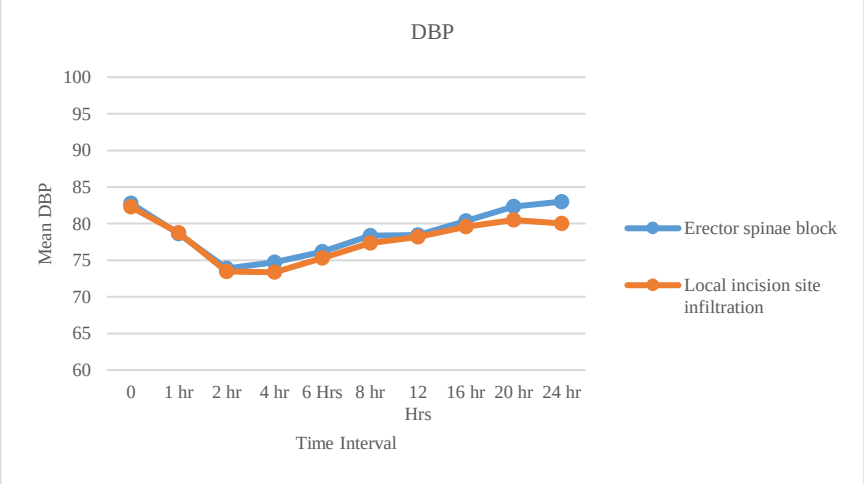

Figure 5- Mean Diastolic blood pressure comparison

Discussion

The ESP block can provide regional analgesia for a wide range of surgeries in the anterior, posterior, and lateral thoracic and abdominal areas, as well as for the treatment of acute and chronic pain disorders [13]. The erector spinae plane (ESP) block is a paraspinal fascial plane block in which a needle is inserted between the erector spinae muscle and the transverse processes. A local anesthetic is delivered here, namely to the dorsal and ventral rami of the thoracic and abdomen spinal nerves.

Our randomized single blinded study has shown that analgesia achieved post-operatively was superior when erector spinae block was given compared to surgical incision site infiltration. We used Levobupivacaine in our study as it is cardio-stable and minimally neurotoxic.

In our study we compared 20ml of 0.125% Levobupivacaine for erector spinae block on either side and 40 ml 0.125% Levobupivacaine for surgical site skin infiltration. The longevity of analgesia was prolonged by using Levobupivacaine for erector spinae block. Rescue analgesic requirement was lower in patients in whom erector spinae block was given.

Amr Samir Wahdan et al [1] conducted a prospective randomized controlled experiment to assess the effect of bilateral ultrasound-guided erector spinae blocks on postoperative pain and opioid use following lumbar spine surgery. The primary endpoint was the total amount of morphine used during the operation and within the first 24 hours post-operatively. Secondary outcomes included the time between the first request for rescue analgesia and the occurrence of adverse events. The ESPB group consumed considerably less morphine during the intraoperative and first 24 postoperative hours than the control group ($P< 0.001$). This study concluded that bilateral ultrasound guided-ESPB is an effective strategy for pain management during lumbar spine operations.

In their study, Zhen Zhang et al. [14] compared bilateral ultrasound-guided erector spinae plane block (ESPB) with surgical site infiltration for postoperative analgesia in lumbar spinal fusion surgery. They concluded that, compared to wound infiltration, bilateral ultrasound-guided ESPB reduced short-term opioid consumption in patients after lumbar spinal fusion surgery, aligning with the findings of our study. Additionally, they found that patients in the ESPB group had significantly lower cumulative doses of demanded PCA boluses.

In a similar study, Hironobu Ueshima et al. [15] conducted a retrospective analysis to evaluate the effectiveness of the erector spinae block for lumbar spine surgery. They found that the Numeric rating scale pain scores in the erector spinae group (E group) were significantly lower at 1, 2, 4, 6, 12, and 24 hours post-surgery, as well as on the morning of postoperative day 2, compared to the general anaesthesia group (G group), with all time points showing $p<0.05$. Additionally, the amount of fentanyl administered as a bolus (40 μg) in the E group was less than that in the G group (100 μg) during the first 24 hours after surgery ($p<0.05$). The study concluded that the erector spinae plane block provided effective postoperative analgesia for 24 hours in patients undergoing lumbar spine surgeries.

Prashant Lomate et al. [16] compared the efficacy of the erector spinae plane block (Group II) and peritubal infiltration of levobupivacaine (Group I) for postoperative analgesia following percutaneous nephrolithotomy. The study found that patients who received the erector spinae block had a significantly longer time to first rescue analgesic request. Additionally, VAS scores (both at rest and during movement) at the eight- and twelve-hour marks were significantly lower in Group II ($P < 0.05$). Analgesic demand was also lower in Group II (2.97 ± 0.49 vs. 1.00 ± 1.05), with total analgesic consumption in the first 24 hours being lower in Group II (148.33 ± 24.51 mg vs. 51.92 ± 45.78 mg).

There are few limitations in our study. We have selected only patients belonging to patients ASA I and ASA II. Further research is required with large sample size to evaluate the efficacy of erector spinae block over local wound site infiltration as there are limited human clinical trials.

Conclusion

Our study demonstrated that the erector spinae block provides superior analgesia compared to surgical site infiltration with levobupivacaine as the local anesthetic. Duration of analgesia was prolonged with a group in which erector spinae block was given. Rescue analgesic requirement was more in the group which received local surgical site infiltration. Hereby, we conclude that erector spinae block with levobupivacaine provides better post operative analgesia as compared to local surgical site infiltration for patients undergoing lumbar spine surgeries.

References

[1] Wahdan, A. S., Radwan, T. A., Mohammed, M. M., Abdalla Mohamed, A., & Salama, A. K. Effect of bilateral ultrasound-guided erector spinae blocks on postoperative pain and opioid use after lumbar spine surgery: A prospective randomized controlled trial. Egyptian Journal of Anaesthesia. 2021, 37(1):100–106.

[2] Gerbershagen HJ, Aduckathil S, van Wijck AJ, Peelen LM, Kalkman CJ, Meissner W. Pain intensity on the first day after surgery: a prospective cohort study comparing 179 surgical procedures. Anesthesiology. 2013; 118(4):934-44.

[3] Bajwa SJS, Haldar R. Pain management following

spinal surgeries: an appraisal of the available options. J Craniovertebr Junction Spine. 2015; 6:105–110.

[4] Rizkalla JM, Holderread B, Awad M, Botros A, Syed IY. The erector spinae plane block for analgesia after lumbar spine surgery: a systematic review. J Orthop. 2021; 24:145–150.

[5] Yayik AM, Cesur S, Ozturk F, Ahiskalioglu A, Ay AN, Celik EC, et al. Postoperative analgesic efficacy of the ultrasound- guided erector spinae plane block in patients undergoing lumbar spinal decompression surgery: a randomized controlled study. World Neurosurg. 2019; 126: e779–e785.

[6] Ozyilmaz K, Ayoglu H, Okyay RD, Yurtlu S, Koksal B, Hanci V, et al. Postoperative analgesic effects of wound infiltration with tramadol and levobupivacaine in lumbar disk surgeries. J Neurosurg Anesthesiol. 2012; 24:331–335.

[7] Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The erector spinae plane block. A novel analgesic technique in thoracic neuropathic pain. Reg Anesth Pain Med. 2016; 41:621–7.

[8] De Cassai A, Bonvicini D, Correale C, Sandei L, Tulgar S, Tonetti T. Erector spinae plane block: A systematic qualitative review. Minerva Anestesiol 2019; 85:308‑19.

[9] Swisher MW, Wallace AM, Sztain JF, Said ET, Khatibi B, Abanobi M, et al. Erector spinae plane versus paravertebral nerve blocks for postoperative analgesia after breast surgery: a randomized clinical trial. Reg Anesth Pain Med. 2020; 45(4):260–6.

[10] Chin KJ, Malhas L, Perlas A. The erector spinae plane block provides Visceral Abdominal Analgesia in bariatric surgery: a report of 3 cases. Reg Anesth Pain Med. 2017; 42(3):372–6.

[11] Gurkan Y, Aksu C, Kus A, Yorukoglu UH. Erector spinae plane block and thoracic paravertebral block for breast surgery compared to IVmorphine: a randomized controlled trial. J Clin Anesth. 2020; 59:84–8.

[12] Foster RH, Markham A: Levobupivacaine: a review of its pharmacology and use as a local anaesthetic. Drugs. 2000; 59 (39):551-79.

[13] Oh SK, Lim BG, Won YJ, Lee DK, Kim SS. Analgesic efficacy of erector spinae plane block in lumbar spine surgery: A systematic review and meta-analysis. J Clin Anesth. 2022; 78:110647.

[14] Zhang Z, Zhu RL, Yue L, Li X, Ma JH, Kong H, et al. Bilateral ultrasound-guided erector spinae plane block versus wound infiltration for postoperative analgesia in lumbar spinal fusion surgery: a randomized controlled trial. Eur Spine J. 2023; 32(1):301-312.

[15] Ueshima H, Inagaki M, Toyone T, Otake H. Efficacy of the Erector Spinae Plane Block for Lumbar Spinal Surgery: A Retrospective Study. Asian Spine J. 2019; 13(2):254-257

[16] Lomate P, Jadhav VR, Yadav A. Comparison of the efficacy of erector spinae plane block and peritubal infiltration of levobupivacaine for postoperative analgesia following percutaneous nephrolithotomy. J Anaesthesiol Clin Pharmacol 2021; 37:574-9.