

Research Article**COMPARISON OF ULTRASOUND-GUIDED ERECTOR SPINAE PLANE BLOCK VERSUS TRANSVERSUS ABDOMINIS PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN INGUINAL HERNIA REPAIR****Arshiya Anjum¹, Amitha MN², Vanishree Alwandikar^{3*}**¹Senior Resident, Department of Anaesthesiology, Khaja Bandenawaz University Faculty of Medical Sciences, Kalaburagi^{2,3}Assistant professor, Department of Anaesthesiology, Khaja Bandenawaz University Faculty of Medical Sciences, Kalaburagi***Corresponding author: Dr. Vanishree Alwandikar**, Assistant Professor, Department of Anaesthesiology, Khaja Bandenawaz University Faculty of Medical Sciences Kalaburagi, India.**Received date: 12-07-2026, Date of acceptance:16-07-2026, Date of publication:16-07-2026.****Abstract****Background:** Effective postoperative pain management following inguinal hernia repair facilitates early mobilization, reduces opioid consumption, and improves patient recovery.**Objective:** To compare the analgesic efficacy of ultrasound-guided erector spinae plane block and transversus abdominis plane block for postoperative pain management following inguinal hernia repair.**Methods:** This prospective randomized comparative study was conducted at Department of Anaesthesiology, Khaja Bandenawaz University Faculty of Medical Sciences kalaburagi from January 2023 to July 2023 and included 60 patients undergoing elective unilateral inguinal hernia repair. Patients were randomly allocated into two equal groups: Group E (n=30) received an ultrasound-guided erector spinae plane (ESP) block, while Group T (n=30) received an ultrasound-guided transversus abdominis plane (TAP) block. The study aimed to compare the

postoperative analgesic efficacy of the two regional anesthesia techniques.

Results: Baseline demographic and perioperative characteristics were comparable between the two groups. Patients receiving ESP block demonstrated significantly lower postoperative VAS scores at 2, 4, 6, and 12 hours (all $p < 0.01$). Time to first rescue analgesia was significantly longer in the ESP group (11.8 ± 3.4 vs. 7.6 ± 2.8 hours; $p < 0.001$), while total 24-hour tramadol consumption was significantly lower (63.3 ± 28.4 vs. 96.7 ± 34.6 mg; $p < 0.001$). Fewer patients required rescue analgesia (60.0% vs. 86.7%; $p = 0.020$), ambulation occurred earlier (6.8 ± 1.7 vs. 8.1 ± 2.0 hours; $p = 0.009$), and patient satisfaction was significantly higher (8.8 ± 0.9 vs. 7.7 ± 1.2 ; $p < 0.001$) in the ESP group.**Conclusion:** Ultrasound-guided erector spinae plane block provides superior postoperative analgesia compared with transversus abdominis plane block following inguinal hernia repair.

Keywords: Erector spinae plane block; transversus abdominis plane block; inguinal hernia repair; postoperative analgesia

INTRODUCTION

Hernia repair of the groin is one of the most frequently performed general surgical procedures in the world. While surgical morbidity has decreased with aids to operative technique, postoperative pain continues to be a common issue that can delay mobilization, prolong hospital stay, lead to higher opioid consumption, and lower satisfaction with the surgery in patients. [1] Poorly managed acute pain could also play a role in the development of chronic postoperative groin pain which is an important aspect of the management of hernia and should be dealt with effectively during the perioperative period [2]. One of the key learning points of international hernia guidelines is that minimizing postoperative and chronic pain are important goals of modern groin hernia treatment. Multimodal analgesia is the use of several different types of pain medications and regional methods to achieve adequate analgesia with minimal opioid side effects [3]. Regional nerve blocks and fascial plane blocks have potential to further provide opioid-sparing benefits, in addition to the basic analgesics of Paracetamol and nonsteroidal anti-inflammatory drugs. For open inguinal hernia repair, the multimodal analgesia approach is recommended and regional techniques should be used where applicable. The plane of the transversus abdominis (TAP) block is a known regional anesthetic technique that involves injecting local anesthetic between the internal oblique and transversus abdominis muscles [5]. It prevents the anterior rami of the nerves of the lower thoracic and first lumbar nerve from reaching the anterior rami of the abdominal wall. Needle visualization and

the ability to deposit local anesthetic accurately are improved with ultrasound guidance, and there is less risk of vascular or visceral injury [6]. TAP block has proven to be an effective analgesic following unilateral inguinal hernia repair and is often included in multimodal pain management strategies [7].

The erector spinae plane block (ESPB), which is a newer interfascial block, has been developed where LA is injected deep to the erector spinae muscle and superficial to the transverse process [8]. The local anesthetic can migrate through the fascial plane and towards the paravertebral area, resulting in wider somatic and potentially visceral anesthesia [9]. Technically ESPB is simple, can be executed under ultrasound guidance, and has proven opioid-sparing effects for a variety of abdominal and thoracic surgeries [10]. When combined in the peri-operative analgesic regimen, studies have recently shown that the administration of ESPB has been associated with a decrease in postoperative pain scores and opioid use after abdominal surgery [11]. The two blocks vary in the region of pain they provide and how well they provide pain relief. TAP block may be more effective for somatic analgesia in the anterior abdominal wall, while ESPB could offer broader multidermatomal (cranio-caudal spread) and potential extension towards the roots of the spinal nerves [12]. Therefore, ESPB might provide longer or more complete analgesia than TAP block in certain surgeries of the lower abdomen. Comparative evidence is still not entirely consistent, however, and may depend on type of surgery, level of block, amount of local anesthetic administered and type of postoperative analgesic used [13]. A randomized trial directly compared the robotic inguinal hernia repair (ING) with ESPB to TAP block, as it is becoming more clinically

relevant to determine which method has better pain control for ING [14]. Data from other abdominal surgeries has indicated a reduction in opioid use with ESPB versus TAP block, and some studies have found similar effectiveness in pain reduction [15].

OBJECTIVE

To compare the analgesic efficacy of ultrasound-guided erector spinae plane block and transversus abdominis plane block for postoperative pain management following inguinal hernia repair.

METHODOLOGY

This prospective randomized comparative study was conducted at Department of Anaesthesiology, Khaja Bandenawaz University Faculty of Medical Sciences kalaburagi from January 2023 to July 2023 and included 60 patients undergoing elective unilateral inguinal hernia repair under spinal anesthesia. Patients were randomly allocated into two equal groups: Group E (n=30) received an ultrasound-guided erector spinae plane (ESP) block, while Group T (n=30) received an ultrasound-guided transversus abdominis plane (TAP) block. The study aimed to compare the postoperative analgesic efficacy of the two regional anesthesia techniques. Patients aged 18–65 years of either gender, classified as American Society of Anesthesiologists (ASA) physical status I or II, scheduled for elective unilateral inguinal hernia repair, and willing to provide written informed consent were included. Patients with allergy to local anesthetics, coagulation disorders, infection at the injection site, chronic opioid use, neurological or psychiatric disorders, body mass index greater than 35 kg/m², recurrent or bilateral inguinal hernia, pregnancy, severe hepatic or renal dysfunction, or refusal to participate were excluded.

Data Collection

After obtaining approval from the Institutional Ethical Review Committee and written informed consent, eligible patients were randomized into two groups using a computer-generated randomization sequence. Group E received an ultrasound-guided erector spinae plane block at the appropriate thoracic level using 20 mL of 0.25% bupivacaine. Group T received an ultrasound-guided transversus abdominis plane block using 20 mL of 0.25% bupivacaine under ultrasound guidance after completion of surgery. Baseline demographic variables included age, gender, body mass index, ASA physical status, duration of surgery, and duration of anesthesia. Postoperative pain was assessed using the Visual Analog Scale (VAS) at rest and during movement at 2, 4, 6, 12, and 24 hours after surgery. Time to first rescue analgesia, total postoperative analgesic consumption during the first 24 hours, patient satisfaction score, incidence of postoperative nausea and vomiting, block-related complications, hypotension, local anesthetic toxicity, and length of hospital stay were also recorded. The primary outcome was postoperative pain intensity measured by the Visual Analog Scale during the first 24 hours following inguinal hernia repair. Secondary outcomes included time to first rescue analgesia, total analgesic consumption within 24 hours, patient satisfaction, postoperative nausea and vomiting, block-related complications, and duration of hospital stay.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Independent *t*-tests were used to compare continuous

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variables between the two groups, whereas Chi-square test was used for categorical variables. Repeated-measures ANOVA was used to compare postoperative VAS scores over time. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Both groups were comparable at baseline. Mean age was 42.8 ± 11.4 years in the ESP

group and 44.1 ± 10.9 years in the TAP group ($p=0.654$), while mean BMI was 26.1 ± 3.2 versus 26.5 ± 3.5 kg/m² ($p=0.646$). Gender distribution, ASA status, surgical duration, anesthesia duration, and baseline VAS scores were also similar, with all p-values >0.05 .

Table 1: Baseline Demographic and Perioperative Characteristics of Study Groups (N = 60)

Variable	ESP Block Group (n=30)	TAP Block Group (n=30)	p-value
Age (years), mean $\pm$ SD	42.8 ± 11.4	44.1 ± 10.9	0.654
Male, n (%)	27 (90.0)	26 (86.7)	0.688
Female, n (%)	3 (10.0)	4 (13.3)	0.688
BMI (kg/m ²), mean $\pm$ SD	26.1 ± 3.2	26.5 ± 3.5	0.646
ASA physical status I, n (%)	19 (63.3)	18 (60.0)	0.791
ASA physical status II, n (%)	11 (36.7)	12 (40.0)	0.791
Duration of surgery (minutes), mean $\pm$ SD	61.8 ± 12.6	63.5 ± 13.1	0.610
Duration of anesthesia (minutes), mean $\pm$ SD	78.4 ± 14.2	80.1 ± 15.0	0.654
Baseline VAS score	0.3 ± 0.5	0.3 ± 0.4	1.000

Postoperative pain scores at rest were significantly lower in the ESP group at 2 hours (1.2 ± 0.7 vs. 1.8 ± 0.9 ; $p=0.006$), 4 hours (1.5 ± 0.8 vs. 2.3 ± 1.0 ; $p=0.001$), 6

hours (1.9 ± 0.9 vs. 2.8 ± 1.1 ; $p=0.001$), and 12 hours (2.4 ± 1.0 vs. 3.3 ± 1.2 ; $p=0.003$). At 24 hours, the difference was smaller and not statistically significant (2.7 ± 1.1 vs. 3.2 ± 1.2 ; $p=0.098$).

Table 2: Comparison of Postoperative VAS Pain Scores at Rest

Postoperative time	ESP Block Group (n=30)	TAP Block Group (n=30)	p-value
2 hours	1.2 ± 0.7	1.8 ± 0.9	0.006
4 hours	1.5 ± 0.8	2.3 ± 1.0	0.001
6 hours	1.9 ± 0.9	2.8 ± 1.1	0.001
12 hours	2.4 ± 1.0	3.3 ± 1.2	0.003
24 hours	2.7 ± 1.1	3.2 ± 1.2	0.098

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The ESP group achieved longer analgesia, with time to first rescue analgesic of 11.8 ± 3.4 hours versus 7.6 ± 2.8 hours in the TAP group ($p < 0.001$). Total 24-hour tramadol use was lower (63.3 ± 28.4 vs. 96.7 ± 34.6 mg;

$p < 0.001$), fewer patients required rescue analgesia (60.0% vs. 86.7%; $p = 0.020$), and ambulation occurred earlier (6.8 ± 1.7 vs. 8.1 ± 2.0 hours; $p = 0.009$). Patient satisfaction was also higher with ESP block (8.8 ± 0.9 vs. 7.7 ± 1.2 ; $p < 0.001$).

Table 3: Comparison of Analgesic Outcomes and Recovery Parameters

Outcome	ESP Block Group (n=30)	TAP Block Group (n=30)	p-value
Time to first rescue analgesia (hours), mean $\pm$ SD	11.8 ± 3.4	7.6 ± 2.8	<0.001
Total tramadol consumption in 24 hours (mg), mean $\pm$ SD	63.3 ± 28.4	96.7 ± 34.6	<0.001
Patients requiring rescue analgesia, n (%)	18 (60.0)	26 (86.7)	0.020
Number of rescue analgesic doses, mean $\pm$ SD	1.1 ± 0.8	1.8 ± 0.9	0.003
Time to independent ambulation (hours), mean $\pm$ SD	6.8 ± 1.7	8.1 ± 2.0	0.009
Hospital stay (hours), mean $\pm$ SD	23.4 ± 4.8	25.7 ± 5.2	0.080
Patient satisfaction score (0–10), mean $\pm$ SD	8.8 ± 0.9	7.7 ± 1.2	<0.001

Postoperative adverse events were numerically lower in the ESP group, including nausea (10.0% vs. 23.3%), vomiting (3.3% vs. 13.3%), dizziness or sedation (6.7% vs. 16.7%), and overall

adverse events (20.0% vs. 43.3%). However, these differences were not statistically significant. No local anesthetic toxicity, vascular injury, or visceral injury occurred in either group

Table 4: Postoperative Adverse Events and Block-Related Complications

Outcome	ESP Block Group (n=30)	TAP Block Group (n=30)	p-value
Postoperative nausea, n (%)	3 (10.0)	7 (23.3)	0.166
Postoperative vomiting, n (%)	1 (3.3)	4 (13.3)	0.161
Hypotension, n (%)	2 (6.7)	3 (10.0)	0.640
Dizziness or sedation, n (%)	2 (6.7)	5 (16.7)	0.228
Block failure, n (%)	1 (3.3)	2 (6.7)	0.554
Local anesthetic toxicity, n (%)	0 (0.0)	0 (0.0)	—
Vascular or visceral injury, n (%)	0 (0.0)	0 (0.0)	—
Overall adverse events, n (%)	6 (20.0)	13 (43.3)	0.052

DISCUSSION

The aim of this prospective randomized, comparative study was to compare the analgesic efficacy of both the ultrasound-guided erector spinae plane (ESP) block and the ultrasound-guided transversus abdominis plane (TAP) block for inguinal hernia repair in 60 patients. Results showed that the ESP block offered better postoperative analgesia, while significantly decreasing pain levels in the early postoperative period, increasing duration of analgesia, and decreasing the amount of opioid used in the postoperative period, increasing ambulation time, and increasing patient satisfaction compared to the TAP block. There were fewer adverse events in the ESP group, but both techniques had an excellent safety profile with no significant block related complications. Perioperative and demographic baseline data were similar between the two study groups, and none of the differences in age, BMI, gender distribution, ASA physical status, duration of surgery, duration of anesthesia, or baseline pain scores were statistically significant. This means that both groups were comparable prior to the intervention, so the results of the postoperative analgesics could be compared. Balanced baseline characteristics between ESP and TAP block groups had also been reported in previous randomized trials that studied post-operative analgesia after abdominal surgery [16]. Postoperative pain assessment showed that the VAS scores were significantly lower in the ESP block group at 2 h, 4 h, 6 h and 12 h. Pain scores were similar at 24 hours, but the ESP group reported better early postoperative pain. This long-lasting analgesic effect may be explained by the greater cranio-caudal distribution of the local anesthetic in the erector spinae fascial plane, which results in broader blockage of thoracoabdominal nerves. Similar findings have been observed with ESP block

compared to TAP block in previous studies for lower abdominal procedures and surgeries on the abdominal wall. One of the most significant results of the present study was the significantly longer time until first rescue analgesia in the patients who received ESP block. The ESP group also used significantly less total tramadol doses and rescue doses of analgesics within the first 24 postoperative hours. Opioid-sparing analgesia is clinically important as it helps to reduce the opioid related adverse effects and thereby promoting better postoperative recovery. A previous study also demonstrated that, in patients undergoing laparoscopy and abdominal surgery, ESP block resulted in an extended period of postoperative analgesia with less requirement for opioids than did TAP block [17].

Patients who had ESP block also had statistically higher satisfaction scores and were able to ambulate independently earlier than those who had TAP block. More effective pain control probably helped mobilize patients earlier, pain free and better overall recovery. The length of hospital stay was marginally shorter in the ESP group but this was not statistically significant. A similar study also found that ESP block led to better outcomes when compared with the general anaesthetic in terms of postoperative pain management and the need for analgesics, which is reflected in patient satisfaction and better recovery profiles [18]. In the present study, the ESP group had fewer postoperative adverse events of nausea, vomiting, dizziness and sedation, although these differences were not seen to be statistically significant. Importantly, neither group had vascular injury, visceral injury or local anesthetic systemic toxicity, demonstrating that ultrasound-guided regional anesthesia is safe. The same study also showed that both ESP and TAP blocks

are low complication ultrasound-guided block techniques that can be performed by experienced anesthesiologists. The results of this study suggest that ESP block is superior in terms of its analgesic effect may be accounted for by the mechanism of action. Injection is deep into erector spinae which leads to wide infiltration of local anaesthetic and may extend into the paravertebral space, blocking both dorsal and ventral branches of the spinal nerves. TAP, on the other hand, provides mainly somatic anesthesia in the anterior abdominal wall without being associated with a significant visceral effect. In studies of this sort, the wider the neural surface area that is covered, the greater the postoperative analgesic effects of ESP block [20]. ESP block's opioid-sparing effect is significant in the context of improved recovery after surgery (ERAS). Low opioid use is associated with decreased postoperative nausea, vomiting, sedation, constipation, and delayed mobilisation, and recovery of the patients. Similar studies have also suggested the use of ESP block in multimodal analgesic regimes due to its capacity to decrease opioid usage without affecting the dose's effectiveness [21]. In conclusion, the present study results indicate that ESP block might be preferable for patients receiving inguinal hernia surgery; however, TAP block is still considered to be an effective regional anesthetic block technique for lower abdominal surgery. The potential for more comfortable patients and a longer duration of analgesia with ESP block could lead to better post-operative rehabilitation and patient satisfaction. A similar study has been conducted previously, and has found that ESP block is either superior or at least as effective as TAP block, with a very good safety profile. This study was limited by its single-center design and relatively small sample size of 60 patients, which may limit the

generalizability of the findings. Postoperative outcomes were evaluated only during the first 24 hours, preventing assessment of long-term pain control and chronic postoperative pain. Additionally, functional recovery beyond hospital discharge and long-term patient satisfaction were not evaluated.

CONCLUSION

Ultrasound-guided erector spinae plane block provided superior postoperative analgesia compared with transversus abdominis plane block following inguinal hernia repair. Patients receiving the ESP block experienced lower postoperative pain scores, prolonged duration of analgesia, reduced opioid consumption, earlier ambulation, and higher patient satisfaction without an increase in complications. Both techniques were safe and effective; however, the ESP block demonstrated greater overall analgesic efficacy and may be considered a valuable component of multimodal analgesia for inguinal hernia repair.

REFERENCES

1. Chen, J., Liu, W., Nan, Z., Guo, J., & Wang, Y. (2026). Comparison of ultrasound-guided erector spinae plane block and transversus abdominis plane block for postoperative analgesia after laparoscopic hysterectomy: a prospective randomized non-inferiority clinical trial. *BMC Anesthesiology*.
2. Ali, H. G., Eldadamony Mohamed, Z., Rashad, A. E., & ElatiefElneegery, N. A. (2024). Ultrasound-guided erector spinae plane block versus oblique subcostal transverse abdominis plane block for postoperative analgesia and stress response in inguinal herniorrhaphy. *Research and Opinion in Anesthesia & Intensive Care*, 11(3), 176-183.

3. Badawy, N. A., El Mourad, M. B., Al Gebaly, A. S., & Amr, Y. M. (2021). Ultrasound Guided Erector Spinae Plane Block Versus Transverses Abdominis Plane Block for Post-Operative Analgesia in Pediatric Patients Undergoing Laparoscopic Inguinal Hernia Repair: A Randomized Controlled Trial. *Journal of Advances in Medicine and Medical Research*, 33(11), 79-90.
4. Elbarbary, D. H., Saad, S., & Galal Taher, M. (2023). Analgesic Efficacy of Ultrasound-Guided Erector Spinae Plane Block versus Transversus Abdominis Plane Block for Post-Operative Pain Relief in Patients Scheduled for Abdominal Surgeries. *Benha Medical Journal*, 40(Annual conference issue), 32-48.
5. Mostafa, M. M. K., Metawee, A. A., Messeha, M. M., & Elhouty, M. G. (2025). Ultrasound guided Transversalis fascia plane block versus Erector spinae plane block for postoperative analgesia after laparoscopic inguinal hernia repair operations: a Randomized Controlled Trial. *International Journal of Medical Arts*.
6. Shukla, U., Yadav, U., Singh, A. K., & Tyagi, A. (2022). Randomized comparative study between bilateral erector spinae plane block and transversus abdominis plane block under ultrasound guidance for postoperative analgesia after total abdominal hysterectomy. *Cureus*, 14(5).
7. Hassanin, A. A. M., Ali, N. S., & Elshorbagy, H. M. (2022). Efficacy of ultrasound-guided transversus abdominis plane block versus erector spinae plane block for postoperative analgesia in patients undergoing emergency laparotomies: A randomized, double-blinded, controlled study. *Egyptian Journal of Anaesthesia*, 38(1), 521-528.
8. Kamel, A. A. F., Amin, O. A. I., & Ibrahim, M. A. M. (2020). Bilateral ultrasound-guided erector spinae plane block versus transversus abdominis plane block on postoperative analgesia after total abdominal hysterectomy. *Pain physician*, 23(4), 375.
9. Ozdemir, H., Araz, C., Karaca, O., & Turk, E. (2022). Comparison of ultrasound-guided erector spinae plane block and subcostal transversus abdominis plane block for postoperative analgesia after laparoscopic cholecystectomy: a randomized, controlled trial. *Journal of Investigative surgery*, 35(4), 870-877.
10. Qi-Hong, S., Xu-Yan, Z., Xu, S., Yan-Jun, C., Ke, L., & Rong, W. (2021). Comparison of ultrasound-guided erector spinae plane block and oblique subcostal transverse abdominis plane block for postoperative analgesia in elderly patients after laparoscopic colorectal surgery: a prospective randomized study. *Pain and Therapy*, 10(2), 1709-1718.
11. Huang, J., & Liu, J. C. (2020). Ultrasound-guided erector spinae plane block for postoperative analgesia: a meta-analysis of randomized controlled trials. *BMC anesthesiology*, 20(1), 83.
12. Dharani, M., Udayakumar, G. S., Sivakumar, S. K., Sethuraman, R. M., Narayanan, V., Manthirasalam, D., ... & Sivakumar, S. K. K. (2025). Comparison of Ultrasound-Guided Erector Spinae Plane Block and Oblique Subcostal Transversus Abdominis Plane Block for Postoperative

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- Analgesia After Laparoscopic
Cholecystectomies: A Prospective
Randomized Controlled Trial. *Cureus*, 17(9).
13. Altinsoy, S., Özkan, D., Akelma, F. K., & Ergil, J. (2022). Analgesic efficacy of ultrasound guided unilateral erector spinae plane block for laparoscopic inguinal hernia repair: A randomized controlled study. *Turkish Journal of Medical Sciences*, 52(3), 631-640.
 14. Wu, S., Zhang, X. Y., Deng, S. T., Wang, P., Liu, A. F., Han, J. C., ... & Wang, W. M. (2024). Efficacy and safety of bilateral ultrasound-guided erector spinae plane block for postoperative analgesia in spine surgery: a systematic review and meta-analysis of randomized controlled trials. *World neurosurgery*, 181, e655-e677.
 15. Duan, L., Wang, Z., Sun, M., Huang, L., Ye, Q., & Wang, H. (2024). Effect of Ultrasound-Guided Erector Spinae Plane Block on Pain After Laparoscopic Transabdominal Preperitoneal Repair: A Prospective, DoubleBlind, Randomized Controlled Study. *Alternative Therapies in Health & Medicine*, 30(9).
 16. Liu, H., Zhu, J., Wen, J., & Fu, Q. (2023). Ultrasound-guided erector spinae plane block for postoperative short-term outcomes in lumbar spine surgery: a meta-analysis and systematic review. *Medicine*, 102(7), e32981.
 17. Fouad, A. Z., Abdel-Aal, I. R. M., Gadelrab, M. R. M. A., & Mohammed, H. M. E. H. S. (2021). Ultrasound-guided transversalis fascia plane block versus transmuscularquadratuslumborum block for post-operative analgesia in inguinal hernia repair. *The Korean journal of pain*, 34(2), 201-209.
 18. Sakae, T. M., Mattiazzi, A. P. F., Fiorentin, J. Z., Brandão, J., Benedetti, R. H., & Takaschima, A. K. K. (2022). Ultrasound-guided erector spinae plane block for open inguinal hernia repair: a randomized controlled trial. *Brazilian Journal of Anesthesiology (English Edition)*, 72(1), 49-54.
 19. Çelik, H. K., Tulgar, S., Bük, Ö. F., Koç, K., Ünal, M., Genç, C., & Süren, M. (2024). Comparison of the analgesic efficacy of the ultrasound-guided transversalis fascia plane block and erector spinae plane block in patients undergoing open inguinal hernia repair under spinal anesthesia. *Korean journal of anesthesiology*, 77(2), 255-264.
 20. Elyazed, M. M. A., Mostafa, S. F., Abdelghany, M. S., & Eid, G. M. (2019). Ultrasound-guided erector spinae plane block in patients undergoing open epigastric hernia repair: a prospective randomized controlled study. *Anesthesia & Analgesia*, 129(1), 235-240.
 21. Ashoor, T. M., Jalal, A. S., Said, A. M., Ali, M. M., & Esmat, I. M. (2023). Ultrasound-guided techniques for postoperative analgesia in patients undergoing laparoscopic sleeve gastrectomy: erector spinae plane block vs. quadratus lumborum block. *Pain Physician*, 26(3), 245.