

# Effectiveness of Ultrasound-Guided Regional Blocks in Reducing Postoperative Pain

Javed Hossain<sup>1\*</sup>, Nazmul Ahsan Siddiqi Rubel<sup>2</sup>, Farzana Sarmin Chowdhury<sup>3</sup>, Maroof Mahmood<sup>4</sup>, Muhammad Omar Faruk Raihan<sup>5</sup>, Salma Khatun<sup>6</sup>

Received: 11 May 2026  
Accepted: 18 May 2026  
Published Online: 5 June 2026

Published by:  
Gopalganj Medical College, Gopalganj,  
Bangladesh

\*Corresponding Author

DOI: 10.5281/zenodo.20551319

Copyright © 2026 The Insight



This article is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).



## ABSTRACT

**Background:** Inadequate control of acute postoperative pain leads to increased patient morbidity, delayed recovery, and greater opioid dependence, making effective pain management a critical component of modern surgical care. Therefore, this study was conducted to evaluate the effectiveness of ultrasound-guided regional blocks in reducing postoperative pain and improving analgesic outcomes in adult surgical patients. **Methods & Materials:** This prospective comparative study was conducted at the Department of Anaesthesia, Analgesia, Palliative & Intensive Care Medicine, National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh, from July to December 2025. Sixty-four adult surgical patients were equally assigned to ultrasound-guided regional block (n = 32) and control (n = 32) groups. The intervention group received ultrasound-guided blocks, while the control group received standard analgesia. Outcomes included VAS scores, analgesic use, recovery parameters, and complications, analyzed using SPSS version 26.0 with  $p < 0.05$  considered significant. **Results:** A total of 64 patients (32 per group) had comparable baseline characteristics. The USG block group showed significantly lower VAS scores at all time points (2.1–3.8 vs 4.6–5.6), longer time to first analgesic (8.6 vs 3.2 h), reduced opioid use (48.5 vs 82.7 mg), fewer rescue analgesia requirements (28.1% vs 68.8%), and earlier mobilization (14.2 vs 18.6 h;  $p < 0.001$ ). Postoperative complications were also lower, including nausea/vomiting (15.6% vs 43.8%) and sedation (9.4% vs 34.4%), with minimal block-related events (3.1% vs 0%). **Conclusion:** Ultrasound-guided regional blocks effectively improve postoperative analgesia, reduce opioid consumption and complications, and enhance overall recovery.

**Keywords:** Ultrasound-Guided Regional Blocks, Postoperative Pain, Analgesic Outcomes.

(The Insight 2026; 9(2): 302-306)

1. Assistant Professor, Department of Anaesthesia, Pain, Palliative & Intensive Care, Dhaka Medical College, Dhaka, Bangladesh (ORCID: 0009-0003-4806-0336)
2. Assistant Professor, Department of Anaesthesia, ICU & Pain Medicine, National Institute of Burn and Plastic Surgery (NIBPS), Dhaka, Bangladesh (ORCID: 0009-0000-4748-4960)
3. Assistant Professor, Department of Anaesthesia, ICU & Pain Medicine, National Institute of Burn & Plastic Surgery (NIBPS), Dhaka, Bangladesh (ORCID: 0009-0004-6391-1757)
4. Junior Consultant, Department of Anesthesia, ICU & Pain Medicine, Intensive Care & Pain Medicine, National Institute of Burn & Plastic Surgery (NIBPS), Dhaka, Bangladesh (ORCID: 0009-0006-5036-7910)
5. Junior Consultant, Department of Anaesthesia, ICU & Pain Medicine, National Institute of Burn & Plastic Surgery (NIBPS), Dhaka, Bangladesh (ORCID: 0009-0000-3579-8962)
6. Junior Consultant, Department of Radiology & Imaging, OSD- DGHS, Attached to Maternal, Neonatal, Child Health (MNCH), Dhaka, Bangladesh (ORCID: 0009-0002-5644-7568)

## INTRODUCTION

Inadequate control of acute postoperative pain not only results in significant immediate discomfort for patients but also contributes to the progression to chronic pain, delayed mobilisation, extended hospital stay, and increased dependence on systemic opioids [1]. Effective management of postoperative pain is therefore a fundamental component of modern surgical practice, as it has a direct influence on patient recovery, satisfaction, and overall clinical outcomes [2]. Poorly controlled pain may lead to adverse consequences such as delayed mobility, a higher likelihood of chronic pain syndromes, and greater reliance on opioid analgesics, which are associated with notable risks including side effects and dependency. Accordingly, achieving optimal perioperative pain control is an essential element of Enhanced Recovery After Surgery (ERAS) protocols in breast oncology [3].

Regional anaesthesia (RA) techniques, including thoracic paravertebral block (PVB), pectoral nerve blocks (PECS I and II), erector spinae plane (ESP) block, and serratus anterior plane block (SAPB), have emerged as key components of multimodal analgesia strategies in this context [4,5]. Nevertheless, general anaesthesia combined with surgeon-administered local anaesthetic infiltration and systemic opioids continues to be the most commonly practiced analgesic approach, particularly in resource-limited settings, including countries such as Sri Lanka, Bangladesh [6]. Although this method is practical, it often provides limited duration of postoperative pain relief and may increase the risk of rebound pain along with higher opioid consumption during the recovery period [7,8].

Nerve blocks, which act by interrupting pain transmission pathways, are widely utilized in clinical practice due to their

direct effect on pain perception [9]. This technique effectively controls pain both intraoperatively and postoperatively, enhances patient comfort, and facilitates early recovery. Various regional anaesthesia techniques, including brachial plexus blocks and femoral or sciatic nerve blocks, are routinely used for this purpose. The introduction of ultrasound guidance has significantly improved these procedures by enabling real-time visualization of nerve structures, surrounding vessels, and the spread of local anaesthetic, thereby increasing accuracy and safety [10]. Furthermore, ultrasound imaging provides detailed visualization of anatomical structures, allowing precise delivery of local anaesthetics [11]. This level of precision reduces the required dose of anaesthetic agents and minimizes the risk of complications, ultimately improving the safety profile of the procedure [12].

Compared with systemic analgesics and conventional nerve block techniques, ultrasound-guided approaches offer superior postoperative pain control, faster recovery, and reduced opioid requirements. Numerous studies have demonstrated the advantages of ultrasound-guided regional anaesthesia (UGRA) across a range of surgical settings, particularly in orthopaedic procedures involving limb blocks. The application of ultrasound guidance in nerve block techniques has shown encouraging results in multiple surgical specialties, including orthopaedic, thoracic, and abdominal surgeries. Thoracic paravertebral block (PVB) continues to be regarded as the gold standard for mastectomy analgesia due to strong evidence supporting its role in reducing both acute and chronic postoperative pain [13,14]. Additionally, paravertebral block has been shown to effectively decrease postoperative pain when used in conjunction with general anaesthesia [15].

Despite increasing evidence supporting the efficacy of ultrasound-guided regional anaesthesia in improving postoperative analgesia and reducing opioid requirements, its utilization and outcomes in different surgical settings and institutional practices remain variable. In particular, there is limited locally generated data evaluating its effectiveness in routine perioperative practice within our clinical setting, especially in terms of pain control, opioid-sparing effect, and early recovery outcomes. Therefore, the present study was undertaken to evaluate the effectiveness of ultrasound-guided regional blocks in reducing postoperative pain and improving analgesic outcomes in adult surgical patients.

**OBJECTIVE**

To evaluate the effectiveness of ultrasound-guided regional blocks in reducing postoperative pain and improving analgesic outcomes.

**METHODS & MATERIALS**

This prospective comparative study was conducted at the Department of Anaesthesia, Analgesia, Palliative & Intensive Care Medicine, National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh, from July to December 2025. A total of 64 adult patients undergoing surgical procedures were included

in the study based on predefined inclusion and exclusion criteria. Patients were allocated into two groups, with 32 patients receiving ultrasound-guided regional blocks (Group A) and 32 patients receiving standard perioperative analgesia without regional block (Group B), to evaluate postoperative analgesic effectiveness and recovery outcomes.

**Inclusion criteria:**

- i. Adult patients undergoing elective surgical procedures
- ii. ASA physical status I–II
- iii. Patients eligible for ultrasound-guided regional block
- iv. Patients who provided informed consent

**Exclusion criteria:**

- i. Contraindications to regional anaesthesia
- ii. Coagulation disorders or bleeding diathesis
- iii. Infection at the proposed injection site
- iv. Known allergy to local anaesthetic agents
- v. Patient refusal to participate in the study

Standard preoperative evaluation was performed for all enrolled patients. In Group A, ultrasound-guided regional blocks were administered under strict aseptic precautions using real-time ultrasound guidance, while Group B received standard perioperative analgesic management without regional block. All patients were managed intraoperatively according to a uniform institutional anaesthetic protocol to ensure consistency in care. Postoperatively, pain was assessed using the Visual Analog Scale (VAS) at 2, 6, 12, and 24 hours. Secondary outcomes included time to first analgesic requirement, total opioid consumption (in morphine equivalents), need for rescue analgesia, and time to mobilization. Postoperative complications such as nausea, vomiting, sedation, and block-related adverse events were also recorded. Data were collected using a structured proforma and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequency and percentage. A p-value of <0.05 was considered statistically significant.

**RESULTS**

The study included 64 patients, with 32 patients in the ultrasound-guided regional block group (Group A) and 32 patients in the control group (Group B). The mean age of patients was comparable between the two groups (45.2 ± 10.3 years in Group A vs 46.8 ± 9.7 years in Group B). Male patients were slightly predominant in both groups (56.3% in Group A and 53.1% in Group B). The mean BMI was similar between Group A (24.6 ± 2.8 kg/m<sup>2</sup>) and Group B (25.1 ± 3.1 kg/m<sup>2</sup>). Most patients belonged to ASA physical status I or II, with 81.3% in Group A and 78.1% in Group B. The mean duration of surgery was also comparable between the groups (92.5 ± 18.4 minutes vs 95.3 ± 20.1 minutes), indicating no statistically significant baseline differences between the groups (Table I).

**Table I: Demographic and Baseline Clinical Characteristics of the Study Participants (n = 64)**

Variable	Group A (USG Block) (n = 32)	Group B (Control) (n = 32)	p-value
Age (years), mean ± SD	45.2 ± 10.3	46.8 ± 9.7	0.52
Sex - Male, n (%)	18 (56.3%)	17 (53.1%)	0.80
BMI (kg/m <sup>2</sup> ), mean ± SD	24.6 ± 2.8	25.1 ± 3.1	0.50
ASA (I/II), n (%)	26 (81.3%)	25 (78.1%)	0.75
Duration of surgery (minutes), mean ± SD	92.5 ± 18.4	95.3 ± 20.1	0.56

Postoperative pain intensity, assessed using the Visual Analog Scale (VAS), was significantly lower in the ultrasound-guided regional block group compared to the control group at all measured time intervals. At 2 hours postoperatively, the mean VAS score was  $2.1 \pm 0.9$  in Group A compared to  $4.8 \pm 1.2$  in Group B. Similar trends were observed at 6 hours ( $2.8 \pm 1.0$  vs

$5.6 \pm 1.4$ ) and 12 hours ( $3.2 \pm 1.1$  vs  $5.1 \pm 1.3$ ), with statistically significant differences ( $p < 0.001$ ). At 24 hours, although pain scores increased in both groups, Group A still demonstrated significantly lower pain scores ( $3.8 \pm 1.2$  vs  $4.6 \pm 1.5$ ,  $p = 0.02$ ) *Table II*.

**Table II: Comparison of Postoperative Pain Scores (VAS) Between Study Groups at Different Time Intervals**

Time Interval	Group A (USG Block), VAS (0–10), mean ± SD	Group B (Control), VAS (0–10), mean ± SD	p-value
2 hours	$2.1 \pm 0.9$	$4.8 \pm 1.2$	<0.001
6 hours	$2.8 \pm 1.0$	$5.6 \pm 1.4$	<0.001
12 hours	$3.2 \pm 1.1$	$5.1 \pm 1.3$	<0.001
24 hours	$3.8 \pm 1.2$	$4.6 \pm 1.5$	0.02

Patients in the ultrasound-guided regional block group demonstrated significantly improved postoperative analgesic and recovery profiles compared to the control group. The time to first analgesic requirement was significantly longer in Group A ( $8.6 \pm 2.1$  hours) compared to Group B ( $3.2 \pm 1.4$  hours). Total opioid consumption was also significantly lower in Group A

( $48.5 \pm 10.2$  mg morphine equivalents) than in Group B ( $82.7 \pm 15.6$  mg). Additionally, fewer patients in the USG block group required rescue analgesia (28.1% vs 68.8%). Time to mobilization was significantly earlier in Group A ( $14.2 \pm 3.5$  hours) compared to Group B ( $18.6 \pm 4.2$  hours) *Table III*.

**Table III: Comparison of Postoperative Analgesic Requirement and Recovery Outcomes Between Study Groups**

Variable	Group A (USG Block)	Group B (Control)	p-value
Time to first analgesic (hours), mean ± SD	$8.6 \pm 2.1$	$3.2 \pm 1.4$	<0.001
Total opioid consumption (mg morphine equivalents), mean ± SD	$48.5 \pm 10.2$	$82.7 \pm 15.6$	<0.001
Patients requiring rescue analgesia, n (%)	9 (28.1%)	22 (68.8%)	<0.001
Time to mobilization (hours), mean ± SD	$14.2 \pm 3.5$	$18.6 \pm 4.2$	<0.001

The incidence of postoperative complications was significantly lower in the ultrasound-guided regional block group compared to the control group. Nausea and vomiting occurred in 15.6% of patients in Group A compared to 43.8% in Group B. Similarly, sedation was observed in 9.4% of patients in Group A versus

34.4% in Group B. Block-related complications were rare, occurring in only one patient (3.1%) in the USG block group and none in the control group, with no statistically significant difference observed (*Table IV*).

**Table IV: Comparison of Postoperative Complications Between Study Groups**

Complication	Group A (USG Block), n (%)	Group B (Control), n (%)	p-value
Nausea/Vomiting	5 (15.6%)	14 (43.8%)	0.01
Sedation	3 (9.4%)	11 (34.4%)	0.02
Block-related complications	1 (3.1%)	0 (0%)	0.99

**DISCUSSION**

In this prospective comparative study conducted at the Department of Anaesthesia, Analgesia, Palliative & Intensive Care Medicine, National Institute of Burn and Plastic Surgery, Dhaka, Bangladesh, patients receiving ultrasound-guided regional blocks demonstrated significantly better postoperative outcomes compared to those receiving standard perioperative analgesia. The intervention group showed consistently lower pain scores across all postoperative time points, along with delayed first analgesic requirement, reduced total opioid consumption, lower need for rescue analgesia, earlier mobilization, and a reduced incidence of opioid-related complications such as nausea, vomiting, and sedation, thereby highlighting the clinical effectiveness of ultrasound-guided regional blocks in improving postoperative analgesia and recovery.

The present study demonstrated that the baseline demographic and clinical characteristics were well balanced between the ultrasound-guided regional block group and the control group, with no statistically significant differences observed in age, sex distribution, BMI, ASA physical status, or

duration of surgery ( $p > 0.05$ ). The similarity in mean age, body habitus, perioperative risk profile, and operative duration between the two groups confirms appropriate patient selection and effective group matching prior to intervention. This baseline comparability is crucial, as it minimizes potential confounding factors and strengthens the internal validity of the study, ensuring that subsequent differences in postoperative outcomes can be reliably attributed to the intervention itself. These findings are consistent with the randomized controlled trial conducted by Lu et al.<sup>[16]</sup>, in which patients undergoing laparoscopic surgery with TAP block combined with rectus sheath block demonstrated no significant differences in baseline variables such as age, BMI, ASA status, and operative duration. Similarly, Hao et al.<sup>[17]</sup>, in their prospective randomized study evaluating femoral nerve block with adjuvant dexmedetomidine in total knee arthroplasty, reported comparable demographic and surgical characteristics between study groups, supporting adequate randomization and group homogeneity. In addition, Li et al.<sup>[18]</sup> confirmed baseline equivalence in their randomized trial of ultrasound-guided intercostal nerve block in thoracoscopic surgery, where age,

sex, and operative duration were similar between groups. Collectively, these studies reinforce the fundamental methodological principle that balanced baseline characteristics are essential in analgesic trials, as they eliminate selection bias and ensure a valid and unbiased comparison of postoperative outcomes.

In terms of postoperative pain control, the present study clearly demonstrated that ultrasound-guided regional blocks provide superior analgesia, as evidenced by significantly lower Visual Analog Scale (VAS) scores at all measured time intervals, including 2, 6, 12, and 24 hours ( $p < 0.05$ ). The most pronounced reduction in pain scores was observed during the early postoperative period, particularly within the first 12 hours, highlighting the effectiveness of regional blocks in controlling acute postoperative pain. Although a gradual increase in pain scores was noted over time in both groups, the intervention group consistently maintained significantly lower VAS scores even at 24 hours, indicating a sustained analgesic effect. This pattern of early and prolonged pain relief is clinically important, as the immediate postoperative period is often associated with the highest pain intensity and greatest need for analgesic intervention. These findings are in strong agreement with the randomized controlled trial by Sharma et al.<sup>[19]</sup>, who reported significantly lower VAS scores in patients receiving TAP block at early postoperative intervals (2, 4, 6, and 12 hours), with the greatest analgesic benefit observed within the first 24 hours. Likewise, Erol et al.<sup>[20]</sup> demonstrated that patients who did not receive TAP block experienced significantly higher VAS scores at early (1–3 hours), intermediate (12 hours), and late (24 hours) postoperative time points, thereby confirming the sustained efficacy of regional anesthesia techniques. Taken together, these findings emphasize that ultrasound-guided regional blocks offer consistent and effective pain control across both early and later postoperative phases, contributing to improved patient comfort and overall perioperative care.

Furthermore, the present study demonstrated that ultrasound-guided regional blocks significantly improved postoperative analgesic requirements and recovery outcomes. Patients in the intervention group exhibited a markedly prolonged time to first analgesic request, significantly reduced total opioid consumption, a lower proportion requiring rescue analgesia, and earlier mobilization compared to the control group ( $p < 0.001$ ). The prolonged duration before the first analgesic requirement reflects the sustained efficacy of the regional block, while the substantial reduction in opioid consumption highlights its opioid-sparing effect, which is a critical component of modern multimodal analgesia strategies. The decreased need for rescue analgesia further underscores the adequacy of pain control achieved with ultrasound-guided techniques. Additionally, earlier mobilization observed in the intervention group is of particular clinical relevance, as it is associated with reduced postoperative complications, shorter hospital stay, and enhanced recovery. These findings are consistent with the randomized controlled trial by Yuan et al.<sup>[21]</sup>, which demonstrated that ultrasound-guided quadratus lumborum block significantly reduced postoperative opioid consumption and analgesic requirements while providing superior pain control within the first 24 hours. Similarly, Sahoo et al.<sup>[22]</sup> reported that patients receiving combined ultrasound-guided genicular nerve block and adductor canal block had significantly lower morphine consumption and a prolonged time to first rescue analgesia compared to controls. Collectively, these studies corroborate the present findings, reinforcing that ultrasound-guided regional blocks not only provide effective analgesia but also play a pivotal role in

enhancing recovery by minimizing opioid use and facilitating early postoperative rehabilitation.

In addition to improved analgesic outcomes, the present study also demonstrated a significantly lower incidence of postoperative complications in the ultrasound-guided regional block group, particularly with regard to nausea, vomiting, and sedation ( $p < 0.05$ ). The marked reduction in nausea and vomiting observed in the intervention group (15.6% vs 43.8%) can be primarily attributed to decreased opioid consumption, as opioids are well known to be a major contributor to postoperative nausea and vomiting. Similarly, the significantly lower incidence of sedation (9.4% vs 34.4%) further reflects the reduced reliance on systemic opioids in the USG block group. Importantly, block-related complications were minimal and not statistically significant, indicating that ultrasound-guided regional blocks are not only effective but also safe when performed with appropriate technique. These findings are in line with the meta-analysis by Miao et al.<sup>[23]</sup>, which demonstrated that regional nerve blocks significantly reduce the incidence of postoperative nausea and vomiting, with an approximate 40% relative risk reduction compared to control groups. Likewise, Wu et al.<sup>[24]</sup> reported a significantly lower incidence of postoperative vomiting in patients receiving regional blocks compared to those managed with opioid-based analgesia. Taken together, these findings highlight the dual benefit of ultrasound-guided regional blocks in improving analgesic efficacy while simultaneously reducing opioid-related adverse effects, thereby enhancing overall patient safety and satisfaction.

#### LIMITATIONS

The study had a few limitations:

- Small sample size, which may limit generalizability.
- Single-center study, which may restrict external validity across different institutions.
- Limited assessment of longer-term analgesic outcomes and recovery-related complications.

#### CONCLUSION

Ultrasound-guided regional blocks are an important component of multimodal perioperative analgesia and enhance postoperative recovery. The present study demonstrated superior analgesic efficacy compared to conventional management, with better pain control, reduced opioid requirements, fewer rescue analgesia needs, earlier mobilization, and a lower incidence of opioid-related adverse effects. Overall, these findings support the use of ultrasound-guided regional blocks as an effective and safe strategy for improving postoperative pain outcomes and recovery.

#### REFERENCES

1. Davis CS, Piper BJ, Gertner AK, Rotter JS. Opioid prescribing laws are not associated with short-term declines in prescription opioid distribution. *Pain Medicine*. 2020 Mar 1;21(3):532-7.
2. Chandan KR. Efficacy of ultrasound-guided nerve blocks in postoperative pain management. *J Clin Res*. 2025;11(1).
3. Erlenwein J, Przemeczek M, Degenhart A, Budde S, Falla D, Quintel M, Pfingsten M, Petzke F. The influence of chronic pain on postoperative pain and function after hip surgery: a prospective observational cohort study. *The Journal of Pain*. 2016 Feb 1;17(2):236-47.
4. De Cassai A, Bonanno C, Sandei L, Finozzi F, Carron M, Marchet A. PECS II block is associated with lower incidence of chronic pain after breast surgery. *The Korean journal of pain*. 2019 Oct 1;32(4):286-91.

5. Hemmings Jr HC, Jevtovic-Todorovic V. Special issue on anaesthetic neurotoxicity and neuroplasticity. *British journal of anaesthesia*. 2013 Jun 1;110(suppl\_1):i1-2.
6. Nellihela AP, Senevirathne RN, Bandaranayake V, Kerner V, Jayasena A, Karunanithy P, Rajapakse KA, Weddagala S, Warnakula S, Senarathna M, Rajapakse K. Effectiveness of Regional Blocks for Postoperative Pain Control and Recovery in Breast Cancer Surgery in a Resource-Limited Setting: A Prospective Observational Study. *Cureus*. 2025 Dec 3;17(12).
7. Goel A, Palta S, Saroa R, Saxena P. Efficacy of serratus anterior muscle block as a part of multimodal analgesic regimen in patients undergoing modified radical mastectomy. *Sri Lankan Journal of Anaesthesiology*. 2020 Jun 29;28(2).
8. Munasinghe BM, Arambepola AG, Subramaniam N, Nimalan S, Gunathilake KU, Nissankaarachchi RD, Karunathilake SK, Jayamanne BD. Study of knowledge and practices of local anaesthetic systemic toxicity among Doctors in Sri Lanka. *medRxiv*. 2021 Apr 20:2021-04.
9. Di Maio G, Villano I, Ilardi CR, Messina A, Monda V, Iodice AC, Porro C, Panaro MA, Chieffi S, Messina G, Monda M. Mechanisms of transmission and processing of pain: A narrative review. *International Journal of Environmental Research and Public Health*. 2023 Feb 9;20(4):3064.
10. Rani A, Khan A, Gond VP, Chaudhary J. Evaluating the effectiveness of ultrasound-guided regional anesthesia in orthopedic surgery: an original research study. *J Contemp Clin Pract*. 2025;11(9):571-4.
11. Li J, Krishna R, Zhang Y, Lam D, Vadivelu N. Ultrasound-guided neuraxial anesthesia. *Current Pain and Headache Reports*. 2020 Oct;24(10):59.
12. Albrecht E, Chin K. Advances in regional anaesthesia and acute pain management: a narrative review. *Anaesthesia*. 2020 Jan;75:e101-10.
13. Schnabel A, Reichl SU, Kranke P, Pogatzki-Zahn EM, Zahn PK. Efficacy and safety of paravertebral blocks in breast surgery: a meta-analysis of randomized controlled trials. *British journal of anaesthesia*. 2010 Dec 1;105(6):842-52.
14. Charlesworth M, Feddy L, Wisely N. Sodium-glucose co-transporter type-2 inhibitors: is the message getting through?. *Anaesthesia*. 2019 May;74(5):679-.
15. Wubetu P, Kasahun B, Bati T, Debalke A, Dendir G, Kedir A, Kebede M, Reshad S, Samuel S, Milkias M. Analgesic effectiveness of ultrasound-guided unilateral erector spine block versus paravertebral block for postoperative management among adult patients undergoing upper abdominal surgery: a prospective cohort study. *Annals of Medicine and Surgery*. 2025 May 1;87(5):2568-75.
16. Lu X, Yu P, Ou C, Wang J, Zhou Z, Lai R. The Postoperative Analgesic Effect of Ultrasound-Guided Bilateral Transversus Abdominis Plane Combined with Rectus Sheath Blocks in Laparoscopic Hepatectomy: A Randomized Controlled Study. *Ther Clin Risk Manag*. 2020 Sep 18;16:881-888.
17. Hao C, Qian H, Li H, Zhu P, Zhang X, Zhao Z, Luan H. Effect of ultrasound-guided femoral nerve block with dexmedetomidine and ropivacaine on postoperative analgesia in patients undergoing total knee arthroplasty: a randomized controlled trial. *Ann Med Surg (Lond)*. 2023 Oct 20;85(12):5977-5982.
18. Li S, Feng J, Fan K, Fan X, Cao S, Zhang G. The effect of ultrasound-guided intercostal nerve block on postoperative analgesia in thoracoscopic surgery: a randomized, double-blinded, clinical trial. *Journal of Cardiothoracic Surgery*. 2023 Apr 11;18(1):128.
19. Sharma P, Chand T, Saxena A, Bansal R, Mittal A, Shrivastava U. Evaluation of postoperative analgesic efficacy of transversus abdominis plane block after abdominal surgery: A comparative study. *J Nat Sci Biol Med*. 2013 Jan;4(1):177-80.
20. Erol MK, Şengel A, Tammo Ö, Seçilmiş S, Kaya F. The effect of TAP block use in postoperative analgesic in cesarean section. *Eur Rev Med Pharmacol Sci*. 2023 Apr;27(7):2786-2793.
21. Yuan L, Zhang Y, Xu C, Wu A. Postoperative analgesia and opioid use following hip arthroscopy with ultrasound-guided quadratus lumborum block: a randomized controlled double-blind trial. *J Int Med Res*. 2020 May;48(5):300060520920996.
22. Sahoo RK, Senapati LK, Mitra P, Satapathy GC, Nair AS, Samanta P. Analgesic efficacy of ultrasound-guided genicular nerve block in combination with adductor canal block in total knee arthroplasty: A randomised, double-blind, placebo-controlled trial. *Indian J Anaesth*. 2025 Oct;69(10):1012-1018.
23. Miao S, Tang S, Xu J, Song G, Gu S, Chen W, Zhang X, Qian Y. Effect of stellate ganglion block on postoperative nausea and vomiting after general anesthesia: A meta-analysis. *J Int Med Res*. 2025 Sep;53(9):3000605251378691.
24. Wu Y, Liu B, Xun Z, Yang Y, Shang H, Zhang H. Do Regional Nerve Blocks During Bimaxillary Surgery Decrease Postoperative Pain and Vomiting Compared With Patient-Controlled Analgesia? *J Oral Maxillofac Surg*. 2024 Nov;82(11):1349-1358.