Health Tech Asmnt Act. 9(4). doi: 10.18502/htaa.v9i4.20668

Research Article

Comparison of Efficacy of Ultrasound-Guided Transversus Abdominis Plane Block with Ilioinguinal and Iliohypogastric Nerve Block for Postoperative Pain Relief in Open Inguinal Hernia Surgeries: A Randomized Clinical Study

Swarna Banerjee[1], Vaddadi Ravitej[1], Sumita Swain[1*], Bikash Parida[2], Somadatta Das[2]

[1]Department of Anaesthesiology, Institute of Medical Sciences and SUM Hospital, Siksha O Anusandhan Deemed to be University, Bhubaneswar-751003, India.
[2]Department of Radiodiagnosis, Institute of Medical Sciences and SUM Hospital, Siksha O Anusandhan Deemed to be University, Bhubaneswar-751003, India.

*Corresponding Author: Sumita Swain, Department of Anaesthesiology, Institute of Medical Sciences and SUM Hospital, Siksha O Anusandhan Deemed to be University, Bhubaneswar-751003, India. Email: sumitabikash2015@gmail.com

Received 2025 March 8; Accepted 2025 August 20.

Abstract

Background: Transverse abdominis plane (TAP) blocks and ultrasound-guided (USG) ilioinguinal/iliohypogastric (II/IH) nerve blocks (NBs) are frequently utilized for postoperative analgesia following inguinal hernia repair (IHR). This study evaluated the effectiveness of II/IH NBs as postoperative analgesics in patients having IHR surgeries.

Methods: This randomized, controlled, double-blind study was conducted at a tertiary care teaching hospital in eastern India. Overall, 60 patients satisfying the inclusion criteria were selected and randomly divided into groups S, T, and I. All patients received spinal anaesthesia (SA). Patients in group S received only SA, while patients in group T received a TAP block immediately after SA. Finally, patients in group I received II/IH NB post-SA.

Results: The time to first rescue dose was the highest in the SA with the II/IH block group (283±17.1), followed by SA with the TAP block group (266.3±22.1) and SA alone (127±20.8). All differences were statistically significant at $P<0.05$. Group S received the highest number of rescue analgesia doses. Furthermore, patients in groups T and I needed almost a similar number of rescue doses ($P=0.17$).

Conclusion: There was no significant difference in the mean duration of surgery in all three groups. Moreover, the visual analog scale (VAS) score for pain was similar in all three groups at different observation points, except at 2 hours and 6 hours post-surgery. At 2 hours post-surgery, patients belonging to group S had significantly higher VAS scores.

Keywords: USG-Guided Block; Transversus Abdominis; Ilioinguinal; Iliohypogastric; Inguinal Hernia

1. Background

Appropriate postoperative analgesia and strong anaesthetic standards are necessary for open inguinal hernia surgery, which is increasingly being performed as a daycare procedure (1). The incidence of postoperative pain is as much as 60%, and up to 54% of this pain further progresses to chronic pain (2). Various therapeutic approaches are present for the management of this type of pain. While nonsteroidal anti-inflammatory drugs and opioids are part of normal routine pain management, adverse effects (e.g., nausea, vomiting, urine retention, pruritus, and respiratory depression) are typically linked with these drugs (2).

Regional NB techniques help to offer relief from postoperative pain. Analgesic adjuncts, such as the ultrasound-guided (USG) transversus abdominis plane (TAP) block and ilioinguinal and iliohypogastric (II/IH) nerve blocks (NBs), are administered following neuraxial anaesthesia. The TAP block results in sensory blocking for the skin and muscles of the anterior abdominal wall because it involves drug deposition in the neuro-fascial plane, which runs from T7 to L1, between the internal oblique and the transversus abdominis muscle (3). This block is, therefore, utilized for postoperative analgesia following procedures for hernia repair. The commonly used USG II/IH NB considerably lessens postoperative discomfort after surgery (3). Less drug is required in the II/IH block (10 mL per side), whereas 20–30 mL is necessary in the TAP block. In addition, the II/IH nerve arises from the L1 nerve. It innervates the skin in the inguinal region, whereas the TAP block covering T7-L1 occasionally spares the L1 dermatome (2). Moreover, TAP is a compartment block, and the spread of local anesthetics is relatively large from T7 to L1 dermatomes. It should be noted that local anaesthetics only spread around the target nerve (L1) following the II/IH block (target specific) (4). Performing these blocks with the help of USG is safe and has higher success rates. Both interventions help reduce the usage of opioids and their side effects and decrease the postoperative visual analog scale (VAS) score of pain (5). Hernia surgeries are mainly conducted under spinal anaesthesia (SA). The length and effectiveness of postoperative analgesia in patients after open inguinal hernia operations, however, have not been well documented in previous research.

Thus, this prospective randomized controlled clinical study aims to compare the duration of postoperative analgesic efficacy of the II/IH NB with the TAP block for

patients undergoing open inguinal hernia repair (IHR) under spinal anaesthesia.

2. Methods

This study was conducted using a randomized, controlled, double-blind design in an eastern Indian tertiary care teaching hospital. After receiving clearance from the Institutional Ethics Committee (reference No. DMR/IMS.SH/SOA/180470/2021 and CTRI registry No. CTRI/2021/09/036352), the study was performed from 2020 to 2021. According to the American Society of Anaesthesiologists (ASA), the study comprised male patients aged 18–60 years who were scheduled for elective primary unilateral open IHR surgery and had physical status grades I or II (6). VAS scores were monitored for 48 hours after surgery at 0 hours, 2 hours, 4 hours, 8 hours, 16 hours, 20 hours, 24 hours, and 48 hours at rest (VAS-R) and movement (VAS-M). Individuals were excluded from the study if they declined to participate in the research, had appointments for bilateral or repeated IHR, had a body mass index of 40 kg/m^2, or had poorly controlled systemic conditions (diabetes, hypertension, coronary artery disease, and neuromuscular illnesses). Similarly, the study did not include patients with a local infection at the site of the block or hypersensitivity to local anaesthetic drugs. The enrolled patients were randomized to either TAP or II/IH, or the control group (only spinal anesthesia) based on a sequence of computer-generated random numbers. The sealed opaque envelope method was used for the allocation concealment. The treating anesthesiologist, who was not involved in the study, opened the envelope and administered anesthesia to the patient. Additionally, the patient and the data analyzer were blinded to the study groups.

The trial included 60 patients. Group T patients (n = 20) underwent SA and the TAP block with 20 mL of 0.2% ropivacaine under USG (Figure 1a). The patients of group I (n = 20) received SA and II/IH NB with 20 mL of 0.2% ropivacaine (Figure 1b). Finally, patients included in group S (n = 20) underwent SA only (Figure 2).

Statistical Analysis

All data were entered into Microsoft Excel software and analyzed using the Statistical Package for the Social Sciences (IBM-SPSS), version 20. In all three groups, continuous variables, including age, duration of surgery, hemodynamic parameters, oxygen saturation (SpO_2), VAS scores at different time points (both at rest and on movement), time of first rescue analgesia, and number of rescue doses, were summarized as means and standard deviations or medians with interquartile range depending on distribution. The continuous variables between the groups were compared using the analysis of variance test. *P*-values less than 0.05 were considered statistically significant.

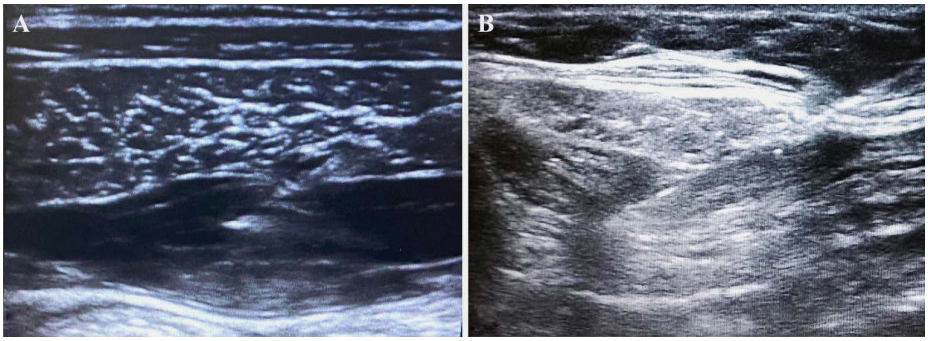

Figure 1. (A) Transversus Abdominis Plane Block and (B) Ilioinguinal and Iliohypogastric Nerve Block

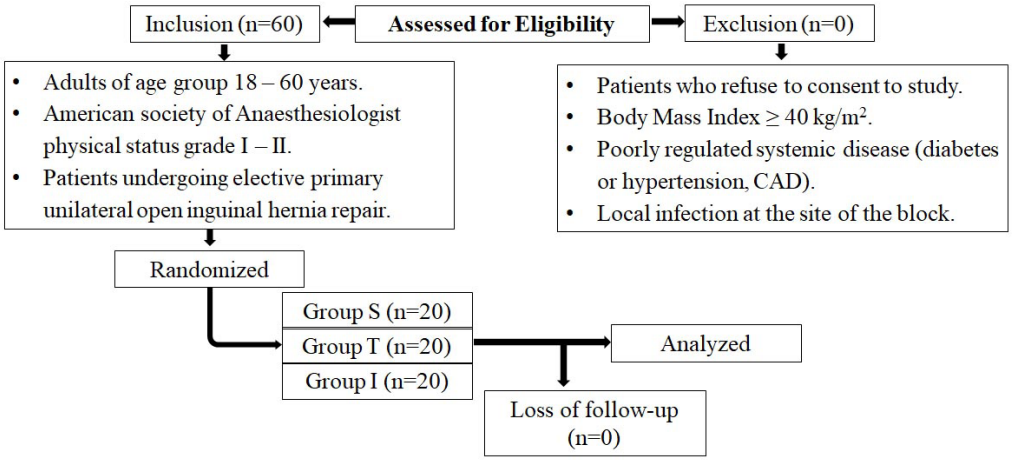

Figure 2. Flow Chart of Consolidated Standards of Reporting Trials. *Note*. CAD: Coronary artery disease

3. Results

In the present study, the mean duration of surgery was 78.5±12.2, 80±14.2, and 79.2±11.4 in groups S, T, and I, respectively. Patients' demographic parameters (e.g., age, weight, gender, and ASA ratio) were considered and comparable in all the study groups and ASA grades. The duration of surgery ranged from 60 minutes to 120 minutes. Likewise, the three groups' hemodynamic parameters, mean arterial pressure, and heart rate (HR) were comparable at baseline. SpO_2 was also comparable at baseline in the groups (P=0.66). At 30 minutes, the SA with the II/IH block group demonstrated significantly lower mean arterial pressure than that with the TAP block group (P=0.04). At 30 minutes, the SA group with the II/IH block showed considerably lower diastolic blood pressure (DBP) than the SA group with the TAP block group (P=0.016). At 4 hours, the SA with II/IH block group revealed significantly higher DBP than the SA alone group (P=0.009). Baseline hemodynamic parameters and SpO_2 were analyzed. The hemodynamic parameters, such as systolic (SBP) and DBP, mean arterial pressure, and HR, were comparable at baseline in the three groups. SBP was higher in the three groups. On the other hand, mean DBP was similar in all three groups at all time points, except at 30 minutes post-surgery. Moreover, mean HR was similar in all three groups at all time points, except soon after the surgery. Immediately after the surgery, the SA alone group displayed a significantly higher HR than the SA with II/IH block.

The VAS score was similar in all three groups at all time points, except at 2 hours and 6 hours after surgery. After 2 hours, the VAS score of the SA group was noticeably higher than that of both groups (P=0.001, Figure 3). At 6 hours, the VAS score of the SA with the TAP block group was significantly higher than that of both groups (P=0.02, Table 1).

The time to first rescue dose was the highest in the SA and II/IH block group, followed by SA with the TAP block group and SA alone (Figure 4). All differences were statistically significant at P-values less than 0.05 (Table 2).

The SA group received the highest number of rescue doses compared to both groups. SA combined with the TAP block or II/IH block required a similar number of rescue doses (P=0.001, Table 3). Moreover, the incidence of side effects among the three groups was comparable (P=0.86).

4. Discussion

Among the most common surgeries, IHR surgeries are usually performed on a day-care basis. Addressing postoperative pain is essential as it attenuates the stress response. Additionally, this stress response will cause

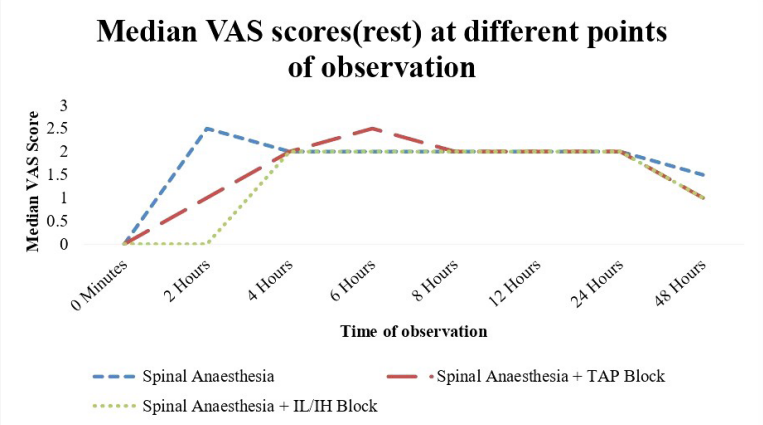

Figure 3. Median VAS Scores (Rest) at Different Points of Observation. *Note*. VAS: Visual analog scale

Table 1. VAS of Pain at Rest and at Different Points of Observation

Duration	Spinal anaesthesia (n=20)	Spinal anaesthesia+TAP block (n=20)	Spinal anaesthesia+II/IH Block (n=20)	P value
VAS score of pain at rest (median with IQR)				
0 minutes	0 (0, 0.5)	0 (0, 1)	0 (0, 1)	0.83
2 hours	2.5 (2, 4)	1 (0, 1)	0 (0, 1)	0.001
4 hours	2 (1, 2)	2 (1, 3)	2 (1, 2)	0.30
6 hours	2 (1, 2)	2.5 (2, 3.5)	2 (1.5, 3)	0.02
8 hours	2 (2, 3)	2 (2, 3)	2 (1, 2)	0.16
12 hours	2 (1.5, 3)	2 (1, 2)	2 (1, 2.5)	0.37
24 hours	2 (1, 2.5)	2 (1, 2)	2 (1, 2)	0.36
48 hours	1.5 (1, 2)	1 (1, 2)	1 (1, 2)	0.37

Note. VAS: Visual analog scale; TAP: Transverse abdominis plane; II/IH: Ilioinguinal/iliohypogastric; IQR: Interquartile range.

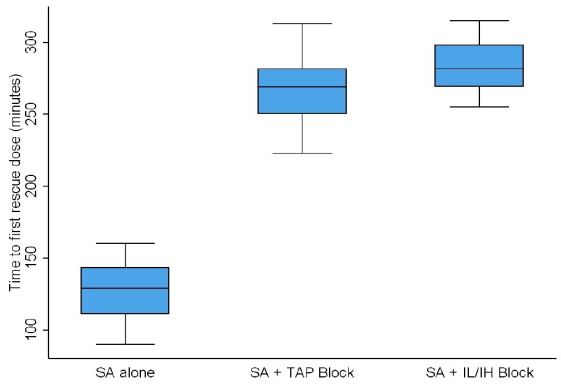

Figure 4. Boxplot of Time to the First Dose of Rescue Analgesia in Each Intervention. *Note*. SA: Spinal anaesthesia; TAP: Transverse abdominis plane; II/IH: Ilioinguinal/iliohypogastric

Table 2. Time of First Rescue Analgesia Dose in the Study Groups

Groups	Mean	SD	P value
Spinal anaesthesia (n = 20)	127.0	20.8	
Spinal anaesthesia + TAP block (n = 20)	266.3	22.1	0.001
Spinal anaesthesia + II/IH block (n = 20)	283.2	17.1	

Note. SD: Standard deviation.

Table 3. Number of Rescue Doses in the Study Groups

Groups	Median	IQR	P value
Spinal anaesthesia (n = 20)	2	2, 2	
Spinal anaesthesia + TAP block (n = 20)	1	1, 2	0.001
Spinal anaesthesia + II/IH block (n = 20)	1	1, 1.5	

Note. IQR: Interquartile range; TAP: Transverse abdominis plane; II/IH: Ilioinguinal/iliohypogastric.

the release of pituitary hormones that are catabolic and immunosuppressive, leading to the activation of the sympathetic nervous system. Moreover, this pain is maximum on the day of surgery and the first postoperative day (7). It is noteworthy that regional NB procedures effectively reduce postoperative pain, allowing patients to walk around more quickly and be discharged sooner. During the postoperative phase, multimodal analgesia techniques include the TAP and II/IH blocks, which work well and are the least complicated to implement (8).

TAP and II/IH blocks using the landmark technique have a 28–45% failure rate, including complications from intraneural, intravascular, and intraperitoneal injections (9). Wang et al in their meta-analysis compared USG II/IH nerve or TAP blocks and found that they are associated with improved perioperative analgesia in patients following inguinal surgery compared with landmark-based techniques (10). The parameters of the three groups were similar and significantly comparable at all observation times. These findings are in line with those of the study of Kamal et al, investigating the USG TAP block versus the II/IH block in 60 patients undergoing hernia surgery for postoperative analgesia and reporting stable hemodynamic parameters for 24 hours post-surgery (11).

Our findings revealed that the VAS score was similar in all three groups for pain at rest. At 2 hours postoperatively, patients belonging to group S who received only SA had significantly higher VAS scores than other groups and required rescue analgesics. At 6 hours postoperatively, the VAS score of group S patients was significantly higher than that of the other groups, which contradicts the findings of Aveline et al; they examined the VAS scores during rest and movement in 273 patients after open inguinal hernia surgery in a daycare setting (12) and noted that the median VAS pain scores at rest were lower in the USG TAP groups at 4 hours, 12 hours, and 24 hours. They concluded that the USG TAP block was superior to the blind II/IH NB. However, this study did not consider the accuracy of the block when comparing the USG versus the blind block (12). Sundaram et al analyzed the VAS movement score 24 hours and 48 hours after the surgery in groups receiving the IH NB (group 1, n = 30) or TAP block (group 2, n = 30) and observed similar VAS scores at 16 hours and 24 hours postoperatively (13). However, VAS scores at 2 hours and further up to 8 hours were significantly lower in the group receiving the II/IH NB compared to the group receiving the TAP block.

The time for rescue analgesia was significantly longer in the patients of group I (283 ± 17.1) compared with those of group T (266 ± 22.1). All differences were statistically significant. In a study, patients receiving the II/IH NB along with SA (n = 30) had a longer duration for rescue analgesia (5.900 ± 1.881 hours) compared to another group of patients (n = 30) who received the TAP block (3.766 ± 1.754 hours) (14). The number of required rescue doses was the highest in the control group, where patients received only SA, compared to the other groups. The other groups receiving blocks had almost similar numbers of rescue analgesia doses. In a study by Kamal et al, the average dose of diclofenac tablet as rescue analgesia was 200 ± 35.96 mg and 172.5 ± 34.96 mg in patients receiving the TAP block and patients who received II/IH, respectively (11). Compared to the USG TAP block, they found that the USG IIN/IHN block lowers the need for postoperative analgesics. These findings do not match the results related to the TAP block and II/IH NB for postoperative pain relief in patients undergoing inguinal herniorrhaphy (15). No discernible variation among the research cohorts was observed regarding the need for supplementary analgesic dosage.

In our study, only nausea and vomiting were noticed as the side effects. There was no significant difference in the incidence of nausea or vomiting in all three groups. Hence, giving regional blocks to patients is relatively safe. These results conform to the findings of the study by Hosalli et al, comparing the TAP block and II/IH NB (6). Faiz et al concluded that better analgesia is achieved with the USG II NB as compared to the USG TAP block in 90 patients receiving either one of the blocks in a postoperative care unit after open inguinal hernia surgeries conducted under general or neuraxial anaesthesia (16).

5. Study Limitations

A more extensive study sample size would have demonstrated the validity of the research findings due to the low number of female patients undergoing this tertiary care teaching hospital, which included only male ASA I and II patients. Moreover, it was impossible to conduct a long-term evaluation of the patients or compare variations in chronic post-surgical pain.

6. Conclusion

Effective postoperative analgesia is provided to patients having IHR procedures under SA by the USG II/IH NB and the USG TAP block. When comparing the length of postoperative analgesia, the II/IH NB is more effective than the USG TAP block. This is evident in the lower VAS pain scores at two and six hours postoperatively, the longer duration of the first rescue analgesic, and the overall patient satisfaction.

Authors' Contribution

Conceptualization: Swarna Banerjee and Sumita Swain.
Data curation: Vaddadi Ravitej.
Formal analysis: Bikash Parida, Somadatta Das.
Funding acquisition: Swarna Banerjee, Sumita Swain.
Investigation: Swarna Banerjee, Vaddadi Ravitej, Sumita Swain.
Methodology: Swarna Banerjee, Vaddadi Ravitej, Sumita Swain.
Project administration: Swarna Banerjee, Sumita Swain.
Resources: Swarna Banerjee, Sumita Swain.
Software: Bikash Parida, Somadatta Das.
Supervision: Sumita Swain.
Validation: Swarna Banerjee, Sumita Swain, Bikash Parida.
Visualization: Bikash Parida, Somadatta Das.
Writing–original draft: Swarna Banerjee, Sumita Swain.
Writing–review & editing: Swarna Banerjee, Vaddadi Ravitej, Sumita Swain, Bikash Parida

Competing Interests: The authors declare they have no conflict of interests.

Ethical Approval: Approval for the study was obtained from the Institutional Ethics Committee (IEC) with Ref. No. DMR/IMS.SH/SOA/180470/2021. Informed consent was obtained before inclusion in the study. The patient's information was kept confidential.

Funding: This study received no financial support or sponsorship from any institutes.

Protocol Registration: CTRI registry No. CTRI/2021/09/036352.

References

1. Vaishnani B, Khokhar R, Chauhan M. A prospective study of 100 cases of day care surgery in inguinal hernia. Int Surg J. 2021;8(9):2685-9.
2. Zhou Y, Chen M, Zhang Y, Zhou H, Yu X, Chen G. Ilioinguinal/iliohypogastric nerve block versus transversus abdominis plane block for pain management following inguinal hernia repair surgery: a systematic review and meta-analysis of randomized controlled trials. Medicine (Baltimore). 2019;98(42):e17545. doi: 10.1097/md.0000000000017545.
3. Yarwood J, Berrill A. Nerve blocks of the anterior abdominal wall. Continuing Education in Anaesthesia Critical Care & Pain. 2010;10(6):182-6. doi: 10.1093/bjaceaccp/mkq035.
4. Sultan AA, Farrag SA, Helal SM, Hassan GA. Ultrasound-guided Ilioinguinal/Iliohypogastric nerve blocks versus transversus abdominis plane block as analgesia for inguinal hernia repair. Menoufia Med J. 2023;36(2):192-8. doi: 10.59204/2314-6788.1028.
5. Venkatraman R, Abhinaya RJ, Sakthivel A, Sivarajan G. Efficacy of ultrasound-guided transversus abdominis plane block for postoperative analgesia in patients undergoing inguinal hernia repair. Local Reg Anesth. 2016;9:7-12. doi: 10.2147/lra.S93673.
6. Hosalli V, Ayyanagouda B, Hiremath P, Ambi U, Hulkund SY. Comparative efficacy of postoperative analgesia between ultrasound-guided dual transversus abdominis plane and ilioinguinal/iliohypogastric nerve blocks for open inguinal hernia repair: an open label prospective randomised comparative clinical trial. Indian J Anaesth. 2019;63(6):450-5. doi: 10.4103/ija.IJA_153_19 .
7. Khedkar SM, Bhalerao PM, Yemul-Golhar SR, Kelkar KV. Ultrasound-guided ilioinguinal and iliohypogastric nerve block, a comparison with the conventional technique: an observational study. Saudi J Anaesth. 2015;9(3):293-7. doi: 10.4103/1658-354x.154730.
8. Haroutounian S. Postoperative opioids, endocrine changes, and immunosuppression. Pain Rep. 2018;3(2):e640. doi: 10.1097/pr9.0000000000000640.
9. Karan D, Swaro S, Mahapatra PR, Banerjee A. Effect of dexmedetomidine as an adjuvant to ropivacaine in ilioinguinal-iliohypogastric nerve blocks for inguinal hernia repair in pediatric patients: a randomized, double-blind, control trial. Anesth Essays Res. 2018;12(4):924-9. doi: 10.4103/aer.AER_169_18.
10. Wang Y, Wu T, Terry MJ, Eldrige JS, Tong Q, Erwin PJ, et al. Improved perioperative analgesia with ultrasound-guided ilioinguinal/iliohypogastric nerve or transversus abdominis plane block for open inguinal surgery: a systematic review and meta-analysis of randomized controlled trials. J Phys Ther Sci. 2016;28(3):1055-60. doi: 10.1589/jpts.28.1055.
11. Kamal K, Jain P, Bansal T, Ahlawat G. A comparative study to evaluate ultrasound-guided transversus abdominis plane block versus ilioinguinal iliohypogastric nerve block for post-operative analgesia in adult patients undergoing inguinal hernia repair. Indian J Anaesth. 2018;62(4):292-7. doi: 10.4103/ija.IJA_548_17.
12. Aveline C, Le Hetet H, Le Roux A, Vautier P, Cognet F, Vinet E, et al. Comparison between ultrasound-guided transversus abdominis plane and conventional ilioinguinal/iliohypogastric nerve blocks for day-case open inguinal hernia repair. Br J Anaesth. 2011;106(3):380-6. doi: 10.1093/bja/aeq363.
13. Sundaram A, Abzalon A, Balakrishnan V. Comparison of efficacy of ilioinguinal/iliohypogastric nerve block and transversus abdominis plane block for postoperative pain management in patients undergoing open inguinal hernia repair: a retrospective cohort study. J Evid Based Med Healthc. 2019;6(18):1405-8. doi: 10.18410/jebmh/2019/288.
14. Sujatha C, Zachariah M, Ranjan RV, George SK, Ramachandran TR, Pillai AR. Transversus abdominis plane block versus ilioinguinal/iliohypogastric nerve block with wound infiltration for postoperative analgesia in inguinal hernia surgery: a randomized clinical trial. Anesth Essays Res. 2017;11(4):976-80. doi: 10.4103/aer.AER_33_17.
15. Okur O, Tekgul ZT, Erkan N. Comparison of efficacy of transversus abdominis plane block and iliohypogastric/ilioinguinal nerve block for postoperative pain management in patients undergoing inguinal herniorrhaphy with spinal anesthesia: a prospective randomized controlled open-label study. J Anesth. 2017;31(5):678-85. doi: 10.1007/s00540-017-2378-3.
16. Faiz SH, Nader ND, Niknejadi S, Davari-Farid S, Hobika GG, Rahimzadeh P. A clinical trial comparing ultrasound-guided ilioinguinal/iliohypogastric nerve block to transversus abdominis plane block for analgesia following open inguinal hernia repair. J Pain Res. 2019;12:201-7. doi: 10.2147/jpr.S179506.