ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 17, Issue 4, 2024

Online - 2455-3891
Print - 0974-2441

Research Article

EFFECT OF ADDITION OF DEXAMETHASONE TO ROPIVACAINE ON POST-OPERATIVE ANALGESIA IN ULTRASOUND-GUIDED TRANSVERSE ABDOMINIS PLANE BLOCK FOR ANTERIOR ABDOMINAL WALL HERNIA REPAIR

POOJA GARHWAL, SHOBHA PARASHAR, SANWAR MAL MITHARWAL, POOJA VIJAY*

Department of Anesthesiology, SDMH, Jaipur, Rajasthan, India.
***Corresponding author: Pooja Vijay; Email: bcreca02@gmail.com**

Received: 11 November 2023, Revised and Accepted: 23 December 2023

ABSTRACT

Objective: The objective of the present study was to evaluate the adjuvant effect of dexamethasone to Ropivacaine in ultrasound-guided transverse abdominal plan block for anterior abdominal wall hernia repair.

Methods: A single-blind randomized control trial was conducted by selecting patients undergoing anterior abdominal wall hernia and dividing them into two groups with Group A: received a total of 50 mL of 0.2% Ropivacaine (48 mL) with normal saline (2 mL) and Group B received a total 50 mL of 0.2% Ropivacaine (48 mL) with 8 mg dexamethasone (2 mL). Outcome was assessed on the basis of visual analog scale (VAS), the requirement of rescue analgesia, and adverse events.

Results: Twenty-seven patients were recruited in each group, Group A and Group B had an average pain-free interval of 11.85±2.82 and 8.07±2.51, respectively ($p<0.001$). Mean VAS was lower in Group B at the end of 2 h ($p<0.05$). Both the groups had similar side effects with no significant difference. Total analgesia dose required in Groups B and A was 75 and 96 mg, respectively ($p<0.001$).

Conclusion: A combination of 0.2% Ropivacaine (48 mL) with 8 mg dexamethasone (2 mL) significantly reduces the VAS in post-operative pain along with reduced quantity and frequency of rescue analgesia.

Keywords: Transverse abdominal plan block, Dexamethasone, Ropivacaine, Rescue analgesia.

 DOI: http://dx.doi.org/10.22159/ajpcr.2024v17i4.49842. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

A common occurrence in surgical practice is an abdominal hernia, which is brought on by the weakening, thinning, and expansion of the Linea Alba along with the corresponding weakness of the abdominal wall muscles [1,2]. In situations of abdominal hernia, surgical repair is necessary. Thanks to the advancements in medical technology, laparoscopic abdominal repair is now the most common procedure used because it has been demonstrated to reduce post-operative morbidity [3-5]. Due to the high risk of death and other side effects in patients receiving opioid analgesics, regional blocks are being used more often in these patients. Hernia repairs can cause significant post-operative pain, for which there are several ways to treat the condition [1-7]. For patients undergoing anterior wall hernia repair, transverse abdominal plan (TAP) block is effective in reducing pain at the incision site. This technique is an addition to the pain management routine currently in place. The local anesthetic is injected with ultrasound (USG) guidance into the TAP, which is a region between the internal oblique and transversus abdominis muscles [3,8-10]. Since it offers analgesia from T6 to T12 dermatome and reduces reliance on opioid-based post-operative analgesia in many abdominal surgeries, the technique has produced great outcomes in upper abdominal surgeries [11-14].

Being the S-enantiomer of bupivacaine, ripivacaine is an S-acting amide local anesthetic with a good profile and lower toxicity. According to the literature that is currently available, bupivacaine reduces post-operative symptoms and facilitates early hospital discharge. Moreover, ropivacaine has a shorter half-life, a comparable sensory block, and a little weaker motor block. Because the TAP block during abdominal surgery necessitates the injection of a substantial amount of local anesthetic, ropivacaine, with its advantageous qualities, can also be employed. Through the inhibition of the stress response, corticosteroids added to the block can assist extend the duration of anesthesia by 1.5–2 times [6,8,10-18].

Most of the earlier methods had used bupivacaine for anesthesia in TAP and Dexmedetomidine as an adjuvant to prolong anesthesia; hence, the role of dexamethasone with bupivacaine is not amply studied in relieving post-operative pain [18-22], the present study an attempt to evaluate the adjuvant effect of dexamethasone to Ropivacaine in USG-guided TAP block for anterior abdominal wall hernia repair.

METHODS

The present study was a prospective single-blind randomized control trial conducted in the Department of Anesthesiology. Ethical clearance of the study was taken from the institutional review board of the study hospital. We selected 60 patients scheduled to undergo elective laparoscopic anterior abdominal wall hernia repair with mesh. Patients with ASA grade more than II, <18 years of age or more than 60 years of age and any known allergy to the known drugs were excluded in the study.

We divided patients into two groups by assigning random numbers to the patients and using random number generation in MS-excel.

Group A: Patients will receive total 50 mL of 0.2% Ropivacaine (48 mL) with normal saline (2 mL).

Group B: Patients will receive total 50 mL of 0.2% Ropivacaine (48 mL) with 8 mg dexamethasone (2 mL).

The patients underwent a thorough pre-anesthetic check-up, which included a history, physical examination, and any standard

investigations required based on their age and clinical circumstances. Baseline blood examinations, including hemoglobin, complete blood count, liver function test, prothrombin time, international normalized ratio, renal function test, and serum electrolytes with X-ray chest and electrocardiogram (ECG), were carried out following a comprehensive pre-anesthetic evaluation. Standard general anesthesia was used to induce the patients, and endotracheal intubation came next. The patient was given a 40 mg capsule containing pantoprazole and a tablet containing alprazolam the night before surgery. When the patient arrived in the operating room, baseline data including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and peripheral oxygen saturation (SpO_2) were recorded using a pulse oximeter, non-invasive blood pressure monitor, and ECG.

An intravenous line for peripheral use was secured, and an isotonic crystalloid fluid infusion was initiated. IV fentanyl (1 µg/kg) and glycopyrrolate (0.01 mg/kg) were used for premedication. Anesthesia was induced using IV propofol (2 mg/kg) and atracurium (0.5 mg/kg) after 3 min of pre-oxygenation. A laryngoscopy attempt was made three minutes after anesthesia was induced, following verification of the endotracheal tube's location. About 50% medical air and 50% oxygen (O_2), isoflurane, and IV atracurium 0.1 mg/kg were used sporadically to maintain anesthesia. Throughout the procedure, a tidal volume of 6–8 mL/kg and a respiratory rate of 12–18 breaths/min was maintained. Following the surgical operation, the patient received a TAP block guided by USG. The skin was prepped with antiseptic and then covered with sterile gauze.

The broadband linear array (M-turbo11-mm; Sonosite, Bothell, Washington, USA) used for USG probing was encased. The USG probe was positioned in the mid-axillary line between the iliac crest and lower costal border, and it was then moved in a transverse plane to the lateral abdominal wall to get a transverse picture of the abdominal layers. A 22-G spinal needle was advanced via the in-plane approach, with real-time USG examination, 1 cm medial to the probe. The transversus abdominis and internal oblique muscles' aponeuroses were the boundaries of the injection site. Following proper needle placement, 2 mL of the drug was delivered to hydrosect the tissue. This was followed by 5 mL of the drug being injected in increments of 2 mL while gently aspirating intermittently. On USG, a hypoechoic enlargement was seen to represent the local anesthetic solution's distribution during the injection. A posterior TAP block was administered on both sides in the event that the umbilical anterior abdominal wall hernia mesh was repaired. The medication mixture contained 8 mg of dexamethasone or 50 cc of 0.2% ropivacaine with NS. A 25 cc medication solution was injected on each side. In the event of a supraumbilical anterior abdominal wall hernia mesh repair, both sides received a subcostal TAP block. A total of 25 cc of the medication solution was injected on each side. A USG probe was placed over the subcostal region to identify the three anterior abdominal wall muscles involved in the subcostal TAP block. A medication injection was then made in the space between the internal oblique muscle and the transverse abdominis. To prevent intramuscular spread and hemorrhage formation, medication injection was halted during the TAP block if the needle moved into muscle or if any toxicity signs or symptoms manifested. After that, the patient was sent to the post-operative ward, where an IV injection of diclofenac 1 mg/kg was administered as a rescue analgesic if the patient requested it or if the visual analog scale (VAS) score was >4.

The length of analgesia, which was measured as the time between the end of local anesthetic injection and the initial demand for analgesic, and the quality of analgesia, as assessed by VAS score at predetermined intervals of 2, 4, 8, 12, and 24 h, were the study's main outcomes. The secondary outcomes were the total amount of rescue analgesics consumed, as well as any adverse effects or complications that occurred during the first 24 h, following the procedure (such as hemodynamic instability, respiratory depression, nausea, vomiting, temporary femoral nerve palsy, and hemorrhage at the injection site). With the VAS, pain was measured.

Statistical analysis

We entered and cleaned the data in Ms-Excel. The data analysis was done in SPSS version 22.0. Baseline characteristics of the two groups were tested for statistically significant differences; unpaired t-test was used to evaluate the difference between the continuous variables. Nominal/categorical variables such as gender and ASA grade were summarized as frequency and percentage and were analyzed using Chi-square test/Fischer's exact test as applicable, $p<0.05$ was taken as statistically significant.

RESULTS AND DISCUSSION

We enrolled a total of 54 patients in our study and divided them into two groups of 27 each, the data were collected using a structure collection tool. Patient characteristics with respect to age, weight, and gender were comparable at the baseline.

There was no significant difference between the baseline characteristics of the two groups.

There was a gradual increase in VAS of patients post-surgery for the first 8–12 h and then there was a decrease for the next 12 h. At the end of 12 h, Group B had a significantly higher VAS than Group A, while at the end of 2 h Group A had a significantly higher VAS.

Group B patients experienced an average pain-free duration of 11.85±2.82 h, which was significantly longer than group A's 8.07±2.51 h. In a similar vein, Group B required much fewer doses of rescue analgesia than did Group A; six patients in Group A needed two doses of rescue analgesia, but none of the patients in Group B needed any. It was only after the 12-h mark that a considerably higher number of Group B patients than Group A needed analgesia. The majority of Group B patients needed less analgesia than Group A. In comparison to Group A, Group B had a considerably decreased mean analgesic dose requirement. The only adverse effects that were seen in the patients of each group were nausea and vomiting which was similar in both groups.

Our present research is a single-blinded randomized controlled trial which assessed the efficacy of ropivacaine with dexamethasone on post-operative pain in patients with abdominal hernia; the mechanism of the extended analgesic action of dexamethasone added to the local anesthetics is still not clear. Some studies described a direct effect of glucocorticoids on nerve conduction while others reported that dexamethasone-induced perineural vasoconstriction with concomitant slower absorption of the administered local anesthetics [6,20,22,23].

We determined the outcome based on the VAS at different post-operative intervals and the requirement of rescue analgesia.

Both groups' VASs increased steadily, with Group B's score consistently lower than Group A's. However, at the 12-h mark, Group B's VAS significantly outperformed that of Group B, as evidenced by the Group B patients' significantly longer duration of analgesia—an average of 11.8 h compared to 8.05 h for Group A—and their significantly higher VAS scores. Similar results were found by Nasreen *et al*. [22] in their study, which showed that when dexamethasone was administered to ropivacaine, pediatric patients after hernia repair experienced an average pain-free time of 16.3 h. Similar results were also observed by Lee *et al*. [24] in their study, which found that patients undergoing ankle surgery experienced longer durations of analgesia when dexamethasone was added to anesthesia. The VAS score also revealed a similar trend, with the group receiving dexamethasone experiencing lower VAS scores. The patients in the group that received dexamethasone in addition to local analgesia had a considerably longer mean duration of analgesia in the trial by Balasubramaniam *et al*. [15]. In their investigation, Li *et al*. [18] assessed the addition of dexamethasone and dexmedetomidine, either separately or in conjunction with local anesthetic, in patients undergoing spine surgery. They found that the

Table 1: Baseline patients characteristics

Parameter	Group A (n=27)	Group B (n=27)	p-value
Mean Age (years)	48.41±8.59	47.19±10.22	0.671
Females	15	13	0.785
Weight	71.9±13.53	67.9±9.07	0.212
Duration of surgery	2.41±0.49	2.56±0.33	0.198
TAP approach			
Posterior	15	13	0.785
Sub-costal	12	14	
Hemodynamic parameters			
Heart rate	73.96±10.89	74.63±13.36	0.841
SBP (mmHg)	130.96±16.04	130.74±19.11	0.963
DBP (mmHg)	80.52±9.71	80.3±12.03	0.941
MAP (mmHg)	97.3±11.04	97.04±13.43	0.939
SpO_2	98.96±0.59	98.74±1.06	0.149

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, MAP: Mean arterial pressure, SpO_2: Peripheral oxygen saturation

Table 2: Post-operative VAS

Time point	Group A	Group B	p-value
0 h	0.07±0.27	0.04±0.19	0.561
2 h	0.96±0.81	0.52±0.51	0.019
4 h	1.63±1.11	1.33±0.55	0.222
8 h	2.96±1.48	2.37±1.21	0.114
12 h	2.3±1.46	3.89±1.34	0.001
24 h	0.7±1.07	0.81±0.83	0.672

VAS: Visual analog scale

Table 3: Analgesia characteristics

Characteristics	Group A	Group B	p-value
Mean pain-free time after anesthesia	8.07±2.51	11.85±2.82	0.0001
Number of doses of rescue analgesia required			
1	21	27	0.023
2	6	0	
Mean analgesic dose	91.67±31.77	75	0.009
Distribution of study subjects according to the need for rescue analgesia			
At 2 h	1	0	1
At 4 h	3	0	0.23
At 8 h	18	4	0.0001
At 12 h	6	22	0.0001
At 24 h	3	1	0.610
Complications			
Nausea and vomiting	3	3	1

addition of dexamethasone resulted in a longer duration of pain-free analgesia.

In Group A, the average analgesic dose was approximately 92 mg, while in Group B, it was merely 75 mg. The amount of analgesia required in the studies where TAP block was used without the addition of dexamethasone was significantly higher; if dexamethasone was substituted with another corticosteroid, the desired effect was observed at higher doses [21,23-26]. The side effect profile of adding dexamethasone was also comparable, as both study groups experienced post-operative nausea and vomiting as their only additional side effects.

We found in our study that adding dexamethasone not only reduced the dosage needed for analgesia but also lengthened the duration of the pain-free post-operative interval with a decreased need for rescue doses. The TAP block requires a large amount of analgesic to be infiltrated, so there is a margin of safety that needs to be taken into account. The results of this study show that adding dexamethasone to ropivacaine is helpful in addressing the issue of post-operative pain in TAP patients. The post-operative VAS of patients receiving dexamethasone as an adjuvant to analgesia was also significantly lower than the group receiving only analgesia.

Our study did have certain limitations, though, and these should be taken into consideration when interpreting the results. First, the study was a single-center trial, which may have limited the study's power because no reference point was available to calculate the sample size. Second, the study sample size was lowered because of COVID-19 because patients were not recruited.

CONCLUSION

A combination of 0.2% Ropivacaine (48 mL) with 8 mg dexamethasone (2 mL) significantly reduces the VAS in post-operative pain along with reduced quantity and frequency of rescue analgesia with a comparable adverse effect profile.

ACKNOWLEDGMENTS

We acknowledge all participants who became part of this study.

CONFLICTS OF INTEREST

None.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

REFERENCES

1. Saiding Q, Chen Y, Wang J, Pereira CL, Sarmento B, Cui W, *et al*. Abdominal wall hernia repair: From prosthetic meshes to smart materials. Mater Today Bio. 2023;21:100691. doi: 10.1016/j.mtbio.2023.100691, PMID 37455815
2. Hall H, Sanjaghsaz H. Diastasis recti rehabilitation. In: StatPearls. Treasure Island, (FL): StatPearls Publishing; 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK573063 [Last accessed on 2023 Oct 15].
3. Ishimoto Y, Otsuki Y, Nuri T, Ueda K. Abdominal wall incisional hernia repair with the anterior component separation technique and reinforcement with an anterior rectus abdominis sheath flap. Plast Reconstr Surg Glob Open. 2023;11(7):e5106. doi: 10.1097/GOX.0000000000005106, PMID 37427152
4. Munshi IA, Ravi SP, Earle DB. Laparoscopic repair of blunt traumatic anterior abdominal wall hernia. JSLS. 2002;6(4):385-8. PMID 12500842
5. Mason RJ, Moazzez A, Sohn HJ, Berne TV, Katkhouda N. Laparoscopic versus open anterior abdominal wall hernia repair: 30-day morbidity and mortality using the ACS-NSQIP database. Ann Surg. 2011;254(4):641-52. doi: 10.1097/SLA.0b013e31823009e6, PMID 21881493
6. Hammi C, Ahn K. Transversus abdominis plane block. In: StatPearls. Treasure Island, (FL): StatPearls Publishing; 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK547730 [Last accessed on 2023 Oct 15].
7. Mavarez AC, Ahmed AA. Transabdominal plane block. In: StatPearls. Treasure Island, (FL): StatPearls Publishing; 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560527 [Last accessed on 2023 Oct 13].
8. Chin KJ, McDonnell JG, Carvalho B, Sharkey A, Pawa A, Gadsden J. Essentials of our current understanding: Abdominal wall blocks. Reg Anesth Pain Med. 2017;42(2):133-83. doi: 10.1097/AAP.0000000000000545, PMID 28085788
9. Gao T, Zhang JJ, Xi FC, Shi JL, Lu Y, Tan SJ, *et al*. Evaluation of transversus abdominis plane (TAP) block in hernia surgery: A meta-analysis. Clin J Pain. 2017;33(4):369-75. doi: 10.1097/AJP.0000000000000412, PMID 27518492
10. Kıtlık A, Erdogan MA, Ozgul U, Aydogan MS, Ucar M, Toprak HI, *et al*. Ultrasound-guided transversus abdominis plane block for postoperative analgesia in living liver donors: A prospective, randomized, double-blinded clinical trial. J Clin Anesth. 2017;37:103-7. doi: 10.1016/j.jclinane.2016.12.018, PMID 28235493
11. Johns N, O'Neill S, Ventham NT, Barron F, Brady RR, Daniel T. Clinical effectiveness of transversus abdominis plane (TAP) block in abdominal surgery: A systematic review and meta-analysis. Colorectal

Dis. 2012;14:e635-42.
12. Tsai HC, Yoshida T, Chuang TY, Yang SF, Chang CC, Yao HY, *et al*. Transversus abdominis plane block: An updated review of anatomy and techniques. Biomed Res Int. 2017;2017:8284363.
13. Lissauer J, Mancuso K, Merritt C, Prabhakar A, Kaye AD, Urman RD. Evolution of the transversus abdominis plane block and its role in postoperative analgesia. Best Pract Res Clin Anaesthesiol. 2014;28(2):117-26. doi: 10.1016/j.bpa.2014.04.001, PMID 24993433
14. Manoharan MM, Gnanadesikan U, Elavarasan K, Nahendran K. Efficacy of transversus abdominis plane block for postoperative analgesia in different lower abdominal surgeries in a tertiary care hospital-Chengalpattu District. Anesth Pain Med. 2023;13(2):e134864. doi: 10.5812/aapm-134864, PMID 37601961
15. Balasubramaniam A, Kumar Naggaih S, Tarigonda S, Madhusudhana R. Ultrasound-guided pericapsular nerve group block for hip surgery: A randomized controlled trial study comparing ropivacaine and ropivacaine with dexamethasone. Cureus. 2023;15(1):e34261. doi: 10.7759/cureus.34261, PMID 36855475
16. Cavallaro G, Gazzanelli S, Iorio O, Iossa A, Giordano L, Esposito L, *et al*. Laparoscopic transversus abdominis plane block is useful in pain relief after laparoscopic stapled repair of diastasis recti and ventral hernia. J Minim Access Surg. 2023;19(2):207-11. doi: 10.4103/jmas.jmas_111_22, PMID 37056085
17. Li C, Shi J, Jia H. Ultrasound-guided transversus abdominis plane block as an effective anesthetic technique for transverse colostomy in a high-risk elderly patient: A case report. Front Med (Lausanne). 2023;10:1102540. doi: 10.3389/fmed.2023.1102540
18. Li W, Ali KA, Deng X, Li Y, Fang Z. Dexamethasone and dexmedetomidine as adjuvants to ropivacaine do not prolong analgesia in wound infiltration for lumbar spinal fusion: A prospective randomized controlled study. J Orthop Surg Res. 2023;18(1):654. doi: 10.1186/s13018-023-04145-1
19. Zhang X, Zhang J, Gu W, Wu D, Shi C, Ma Z. Dexmedetomidine adjunct to ropivacaine for ultrasound-guided transversus abdominis plane block for open inguinal hernia repair in the older adults: A randomised clinical trial. J Minim Access Surg. 2023; doi: 10.4103/jmas.jmas_189_22, PMID 36695243
20. Zhang X, Liu G, Sun C, Zhong Y, Wang L, Huang Z, *et al*. Assessment of the effect of perineural dexmedetomidine on oxidative stress during peritoneal dialysis catheter insertion: A randomized, controlled trial. Int Urol Nephrol. 2022;54(12):3203-10. doi: 10.1007/s11255-022-03268-4, PMID 35771315
21. Marrone F, Pullano C, Paventi S, Tomei M, Bosco M. Dexamethasone and dexmedetomidine together as adjuvants of ropivacaine 0.15% for a brachial plexus block lasting 20 hours. Minerva Anestesiol. 2023;89(11):1052-4. doi: 10.23736/S0375-9393.23.17427-X, PMID 37272273
22. Nasreen F, Athar M, Khalid A, Mallur DS. A randomised controlled trial to assess the analgesic efficacy of reduced dose 0.2% ropivacaine-dexmedetomidine combination compared to standard 0.375% ropivacaine in USG guided TAP block for paediatric hernia repair. Turk J Anaesthesiol Reanim. 2021;49(4):304-11. doi: 10.5152/TJAR.2021.790, PMID 35110012
23. Zhang W, Li C, Zhao C, Ji N, Luo F. Pre-incisional infiltration with ropivacaine plus dexamethasone palmitate emulsion for postoperative pain in patients undergoing craniotomy: Study protocol for a prospective, randomized controlled trial. Trials. 2022;23(1):996. doi: 10.1186/s13063-022-06936-z, PMID 36510271
24. Lee JK, Lee GS, Kim SB, Kang C, Kim KS, Song JH. A comparative analysis of pain control methods after ankle fracture surgery with a peripheral nerve block: A single-center randomized controlled prospective study. Medicina (Kaunas). 2023;59(7):1302. doi: 10.3390/medicina59071302
25. Yu B, Wang B, Shrestha N, Luo F. Pre-emptive coinfiltration of dexamethasone palmitate emulsion with ropivacaine for postoperative pain in patients undergoing major spine surgery: A study protocol for a prospective, randomised controlled, multicentre trial. BMJ Open. 2023;13(5):e072162. doi: 10.1136/bmjopen-2023-072162, PMID 37225277
26. Zhang L, Jia Z, Gao T, Wang Y, Zhao Y, Li J, *et al*. A randomized controlled trial evaluating the effects of transversus abdominis plane block with compound lidocaine hydrochloride injection on postoperative pain and opioid consumption and gastrointestinal motility in patients undergoing gynecological laparotomy. Front Mol Neurosci. 2023;16:967917. doi: 10.3389/fnmol.2023.967917, PMID 36760605