DEXMEDETOMIDINE AS AN ADJUVANT TO LEVOBUPIVACAINE ON INTRATHECAL ANESTHESIA IN LOWER ABDOMINAL SURGERIES: A RANDOMIZED CONTROLLED TRIAL

Maha Ismail Youssef, Magda Saad Abdelazez *, Sahar Ali Marzouk, Mona Hussam Eldin, Bassant Mohamed Abdelhamid

Article History: Received: 10.04.2023 **Revised:** 08.05.2023 **Accepted:** 13.05.2023

Abstract

Background: Dexmedetomidine (DEX) has analgesic, sedative, and anesthetic-sparing effects. DEX, as an adjunct to local anesthetic, has evoked a special interest in pain control. This work aimed to assess the impact of the addition of DEX to levobupivacaine in neuraxial anesthesia and sedation changes versus levobupivacaine alone in patients planned for lower abdominal surgeries.

Methods: This randomized controlled study was carried out on 58 patients aged from 28 and 56 years old, both sexes, I, II, III American Association of Anesthesiology (ASA) physical status scheduled for lower abdominal surgeries lasted for maximum duration 2hrs. Patients were categorized into 2 equal groups; the control group: received 3mL of 0.5% levobupivacaine +0.5mL normal saline, and the combined group: received 3mL of 0.5% levobupivacaine +0.3ml (5µg) DEX maximum duration (1.5-2)hr.

Results: The mean time of onset of sensory and motor block was significantly earlier in the combined group compared to the control group. The mean time duration of sensory and motor block was significantly increased in the combined group compared to the control group. The mean time of total duration of sensory block and analgesia was considerably longer in the combined group than in the control group. The quality of recovery was significantly higher in the combined group than in the control group.

Conclusions: Adding DEX to intrathecal levobupivacaine reduces the sensory and motor block onset time, prolongs the block duration with no significant adverse effects, and provides adequate surgical anesthesia for lower abdominal surgeries.

Keywords: Dexmedetomidine, levobupivacaine, intrathecal anesthesia, lower abdominal surgeries

Anesthesiology. Surgical Intensive Care and Pain Management Department, Faculty of Medicine, Cairo University, Cairo, Egypt

DOI: 10.48047/ecb/2023.12.si4.815

1. INTRODUCTION

Lower abdominal surgeries are usually conducted under either general or regional anesthesia, although regional anesthesia is often preferable since it reduces the complications and hazards of general anesthesia including airway and respiratory problems [1].

Recently, spinal anesthesia is a highly prevalent regional anesthesia technique for its superior blockade, rapid onset, reduced failure rate with a lower incidence of venous thromboembolism and pulmonary compromise (especially in patients with advanced pulmonary disease), early hospital discharge, and cost-effectiveness [1].

However, pain management postoperatively is a meaningful challenge since intrathecal local anesthetic (LA) medications administered alone were only effective for a short period; hence, early intervention with analgesics is frequently required postoperatively. Over the years, several adjuvants, including opioids, neostigmine, ketamine, and 2 adrenergic agonists, have been utilized to enhance postoperative analgesia [2].

Understanding the pharmacology of medication interactions and consequences of LA has recently changed a clinician's viewpoint due to a focus on patient safety. The use of LA has become better as a result of the development of more recent agents (eg; Ropivacaine and Levobupivacaine) [3].

Levobupivacaine (LB), a more recent amide LA, is developing as a viable option to hyperbaric bupivacaine (BVC) due to its lower toxicity to the central nervous and cardiovascular systems [4].

Dexmedetomidine (DEX), is a selective agonist for the α 2 receptor, centrally acting, and quickly rising as an additive to spinal anesthesia with prolonged sensory, and motor block, hemodynamic stability, superior intraoperative pain relief, and decreased need for rescue analgesics in 24 hours, all of which enable for a lower dose of LA to be used with fewer

adverse effects [5-7]. It also has been used with LA for subarachnoid, caudal, brachial plexus, and peripheral nerve blocks [7].

Increased interest in locoregional pain reduction has been prompted by the addition of DEX to LA [8, 9]. The maximum effect of intraperitoneally administered DEX is seen within 15 minutes, with a delay of less than 5 minutes. Its use in maxillofacial procedures has been facilitated by the fact that it provides controlled hypotension (as a result of its central, and peripheral sympatholytic activity), is easily administered, suppresses the respiratory drive to a negligible degree, and has lower adverse reactions while preserving adequate organ perfusion [10-12].

In nerve blocks, combining LB and DEX has demonstrated consistently higher effects in the transverse abdominis and brachial plexus; nevertheless, their utility in lower abdominal operations is still being researched [13-15].

Hence, this research was conducted to compare the results of neuraxial anesthesia with and without DEX in cases having lower abdominal operations in terms of the onset and duration of motor, and sensory block and the changes in hemodynamics and sedation.

2. PATIENTS AND METHODS

This randomized controlled trial was carried out on 58 patients aged from 28 and 56 years old, both sexes, I, II, and III American Association of Anesthesiology (ASA) physical status undergoing lower abdominal surgeries of maximum duration 2hrs.

After approval from the Ethical and Research Committee of the Anesthesia Department at Kasr Al Ainy Hospital, Faculty of Medicine, Cairo University, Egypt, and the consent of the patient was obtained, the study was conducted.

Exclusion criteria were patient taking α2- adrenergic agonist, uncontrolled cardiac disease, labile hypertension, heart block/dysrhythmia, bleeding tendency, allergic to any of the drugs used in the study, difficulty in communication, body weight more than 120kg or height less than 150cm.

Randomization:

Patients were randomly assigned into two groups by the computer-generated random number that was placed in sealed envelopes in a parallel manner (n=29): control group: patients received 3mL (15mg) of 0.5% LB +0.5mL normal saline, and the combined group: patients received 3mL (15mg) of 0.5% LB + 0.3ml (5µg) DEX maximum duration (1.5-2) hr.

Full history, full general examination, and routine laboratory evaluation were done. All patients fasted for a suitable period (6 h for food and 4 h for water) before the operation.

Common side effects of surgery, such as altered sense and limb weakness, were discussed with the patient in the preoperative room, along with the anesthetic method and dosage. However, they were assured that there would be no pain once it was given.

An Intravenous (IV) line was inserted in the peripheral vein Ringer's solution of 15ml/kg was given to each patient; all patients received 4L of oxygen by face mask.

In the operative room, all patients were fully monitored for Heart rate (HR), temperature, peripheral oxygen saturation (SpO2), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean blood pressure (MBP).

Under strict sterile conditions, the patient was seated, and the back was sterilized with iodine. 3mL of 2% lidocaine was injected subcutaneously and into deeper ligaments in L3/L4 or L4/L5. A spinal needle 25G pencil point spinal needle was introduced. After confirmatory aspiration of cerebrospinal fluid anesthetic solution was injected according to the study groups for each patient.

Record the vital signs each 5min for 20min, then every 30min in the post-anesthesia care unit (PACU) till 110min then every 2hr till 12hr.

The onset of sensory blockade (the time elapsing from the injection of local analgesic solution until complete sensory loss) was measured by pricking the skin on both midclavicular line sides. Block reaching time to T10 dermatome.

Time to motor blockade onset was measured using a modified Bromage scale10 (with 0 indicating full leg and foot mobility, 1 indicating limited knee flexion but unrestricted foot movement, 2 indicating restricted knee flexion but unrestricted foot movement, and 3 indicating no leg or foot movement at all). time to motor block onset, Bromage score, and regression to Bromage 0 was also tracked.

If there was no complete motor block (Bromage 0) after 15 min, it means failed block.

Duration of sensory block (time elapsed from injection of local analgesic solution until two segments regression T12) and assessed by pain prick test every 5 min after one and 30 min of LA injection in both lower limbs.

Duration of motor block (time elapsing from the injection of local analgesic solution until complete regain motor power BS 0) was assessed by asking the patient to move his limbs.

When the SBP dropped by more than 20% from baseline, or to less than 90 mm Hg, the patient was given 10 mg of intravenous ephedrine. In cases of bradycardia (defined as a heart rate of 50 or fewer beats/ min), 0.6 mg of atropine was injected.

After complete motor and satisfactory sensory level block at T10, the surgeons were allowed to start the different surgeries. After completing the surgery, the patients were transferred to PACU with full monitoring every 30min and check for sensory and motor recovery.

The total analgesic duration (time lapsing from the LA injection until the first call to analgesia assessed by numerical rating scale (NRS)) was assessed 30min from the beginning of the operation then every 2hr till 12hr post-operative. If NRS was >4, paracetamol 1gm iv infusion was given, and the duration of analgesia was recorded at this point.

The QoR-40 score was used to evaluate the quality of recovery. Patients were asked to rate 40 items across five categories on a 5-point Likert scale. A score of 40 indicates poor recovery quality, whereas a score of 200 indicates excellent recovery.

The 1ry outcome was the quality of recovery. The 2ry outcome parameters were total duration of analgesia, onset, and duration of sensory and motor block, highest sensory level, and hemodynamic.

Sample Size Calculation:

G*Power 3.1.9.2 (Universitat Kiel, Germany) was used for sample size calculation. Our primary outcome was the quality of recovery. According to a previous study [16], the sample size calculation required a minimum of 25 patients in each group at α error of 0.05, effect size of 1.03, and 95% power of the study. So, we enrolled 29 patients in each group to overcome the possible dropouts.

STATISTICAL ANALYSIS:

Statistical analysis was done by SPSS v26 (IBM Inc., Chicago, IL, USA). All normally distributed continuous data were presented as mean and standard deviations. Categorical data were expressed as median (IRQ) or frequency (percentage). T-tests were used for the analysis of continuous data. Chi-square or Fisher exact tests were used to compare the categorical data. Repeated measure ANOVA was used for intragroup hemodynamic data. A P value of <0.05 was considered significant.

3. RESULTS

74 patients were screened for inclusion in the trial; 11 did not match the requirements, and 5 declined to participate. Patients who remained were assigned at random equally into two groups, which were followed up and analyzed statistically. Figure (1).

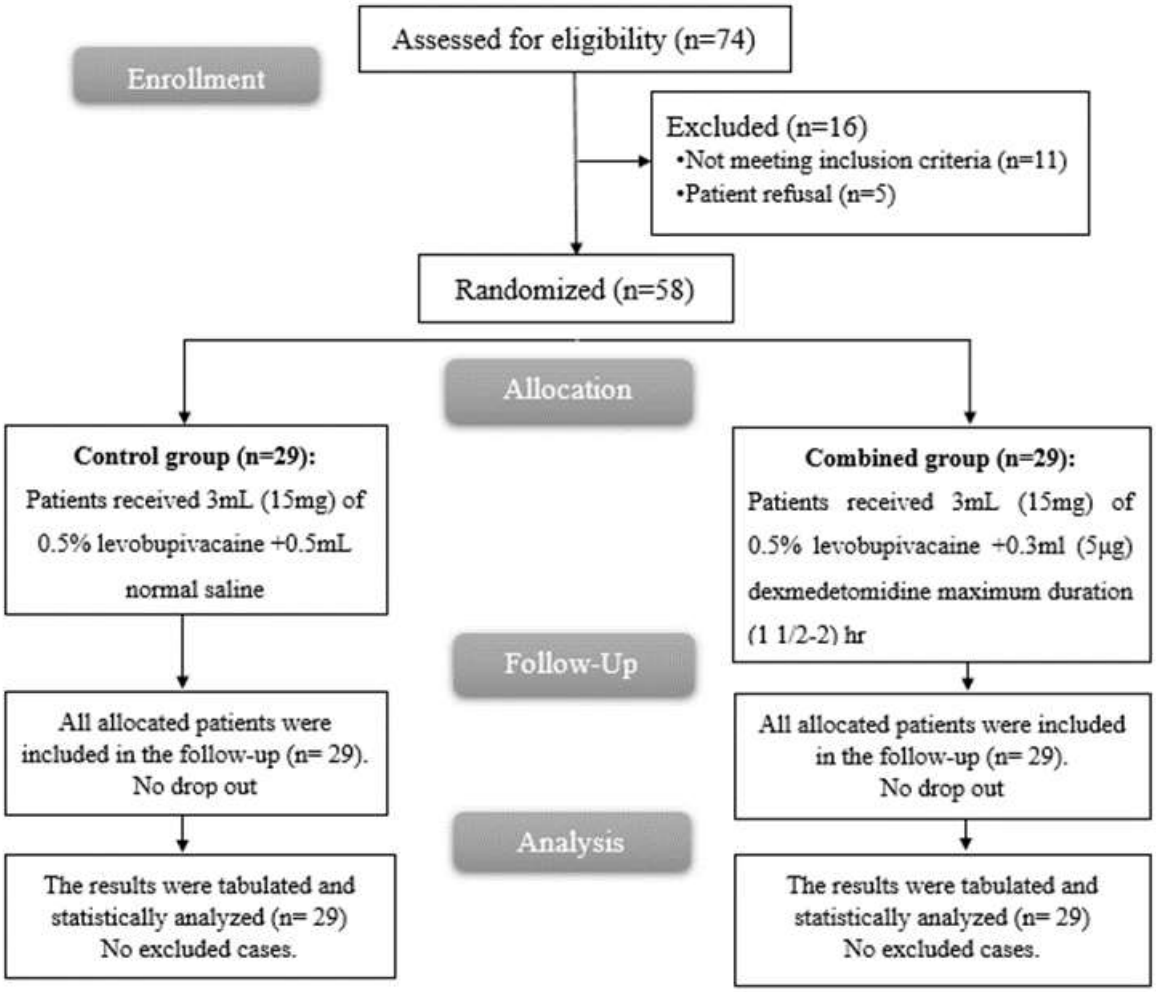

Figure (1): CONSORT flowchart of the studied patients

Demographic data was insignificantly different between both groups. **Table (1)**

Table (1): Demographic data in both groups

		Control group (n = 29)	Combined group (n = 29)	p-value
Age		40.5±13.4	38.9±11.7	0.62
Sex	**Male**	23 (79.31%)	19 (65.52%)	0.240
	Female	6 (20.69%)	10 (34.48%)	
Weight (kg)		71.69 ± 6.99	74.97 ± 8.77	0.121
Height (m)		1.72 ± 0.08	1.74 ± 0.06	0.290
BMI (kg/m^2)		24.45 ± 3.26	24.95 ± 3.54	0.580
ASA physical status	**I**	6 (20.69%)	8 (27.59%)	0.607
	II	13 (44.83%)	14 (48.28%)	
	III	9 (31.03%)	7 (24.14%)	

Data are shown as mean±SD or frequency (percentage). BMI: Body mass index, ASA: American Society of Anesthesiology.

Sensory block onset time, time for sensory block to reach t10 and the onset time of motor block were considerably earlier in the combined group than the controls while motor block duration was considerably prolonged in the combined group than in controls. Two-segment dermatome regression time and level of thoracic sensory block showed no considerable variation between the two groups. **Table (2).**

Table (2): Sensory and motor variables in both groups

	Control group (n = 29)	Combined group (n = 29)	p-value
Two-segment dermatome regression time (mins)	123.1±41.2	139.3±54.3	0.21
Sensory block onset time (mins)	4.7±3.1	2.4±2.5	0.004*
Time for the sensory block to reach T10 (mins.)	3.03±2.3	1.4±1.4	0.001*
Sensory block duration (mins.)	295.9±82.4	365.4±96.4	0.49
Motor block onset time (mins.)	6.8±3.7	3.7±2.9	0.001*
Motor block duration (mins.)	249.3±81.4	319.7±92.2	0.003*
Sensory block level (thoracic level)			
T3	1 (3.4%)	0 (0.0%)	0.75
T4	5 (17.2%)	5 (17.2%)	
T5	3 (10.3%)	2 (6.9%)	
T6	9 (31%)	12 (41%)	
T8	2 (6.9%)	7 (24.1%)	
T10	9 (31%)	3(10.3%)	

Data are shown as mean±SD or frequency (percentage). *: P <0.05 is statistically significant.

The MBP was insignificantly different at all time measurements between both groups. **Figure (2).**

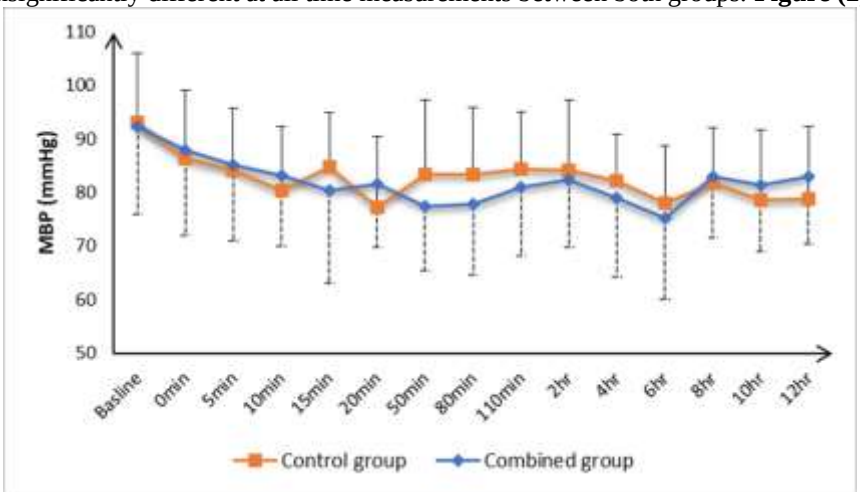

Figure (2): Mean blood pressure (MBP) of the studied groups

The HR measurements were insignificantly different between both groups at all measurements. **Figure (3)**

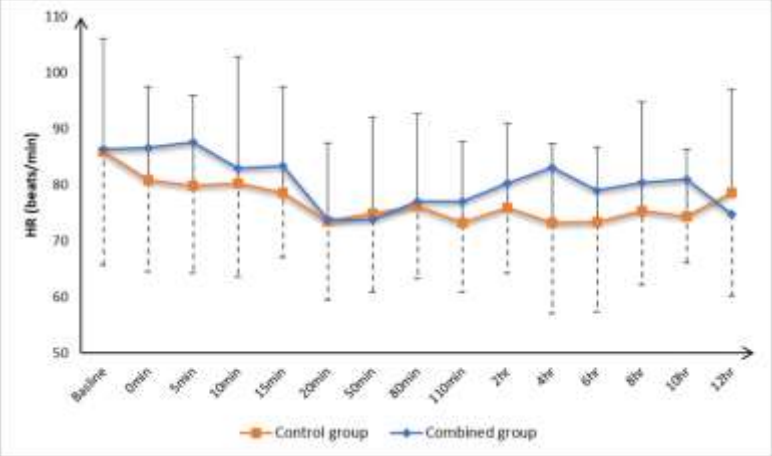

Figure (3): Heart rate (HR) of the studied groups

NRS at 8 hrs showed a statistically significant reduction in the combined group contrasted to controls (p-value = 0.001) and were insignificant at other time intervals. **Table (3)**

Table (3): NRS of the studied groups

Variable	Control group (n = 29)	Combined group (n = 29)	p-value
4 hrs	0 (0 – 1)	0 (0-0)	0.146
6 hrs	1(1-3)	1 (0-1)	0.051
8 hrs	2(1-3)	1 (1-2)	0.001*
10 hrs	2(2-3)	2 (1-3)	0.07
12 hrs	1(1-2)	2 (1-2)	0.06

Data are shown as median (IRQ). * P < 0.05 is statistically significant

Request time for a call for analgesia and quality of recovery was higher significantly in the combined group than the control group (value <0.001 and 0.02 respectively). **Table (4)**

Table (4): Time for the first request for analgesia (hrs) and quality of recovery

	Control group (n = 29)	Combined group (n = 29)	p-value
Request time for Call for Analgesia (hrs)	6.24±0.57	8.34±0.97	<0.001*
Quality of recovery	158.2 ± 21.31	169.3 ± 16.44	0.02*

Data are shown as mean±SD. * P < 0.05 is statistically significant.

4. DISCUSSION

Spinal anesthesia is an established method for lower abdominal procedures. LB is helpful for spinal anesthesia. However, several studies have found that intrathecal LB has some side effects, such as hypotension and bradycardia [4]. A possible limitation of spinal anesthesia is the short postoperative analgesia. Subarachnoid block analgesia has been prolonged with the intrathecal administration of several adjuvants [17].

Different dosages of DEX (3, 5, and 10 μg) have been attempted intrathecally with acceptable outcomes of prolonged sensory and motor block with maintained hemodynamics [18]. DEX as an adjuvant to epidural local anesthetics has been compared to clonidine and fentanyl and demonstrated to delay the onset of blocking the motor and sensory impulses with extended sensory postoperative analgesia with decreased needs of local anesthetics [19]. When administered as an adjunct to the intrathecal local anesthetics or by peripheral nerve blocks, it has been shown to provide longer-lasting sensory analgesia after surgery than fentanyl and clonidine alone [20].

In this study, adding DEX to LB fastened the onset, Patients undergoing lower abdominal procedures under spinal anesthetic had substantially lower NRS scores, longer sensory and motor block durations, and more time to first rescue analgesia required compared to the control group. There was hemodynamic stability with no complications in both studied groups.

α2 adrenoceptors are presented over the main neurons' afferent terminals in the spinal cord's

superficial lamina and the brainstem's pain nuclei. This suggests that α2 agonists have analgesic effects in the central as well as the peripheral ways [21].

Harmonious to our results, Hazra et al., [1] observed that the duration of maximum sensory blocking, T10 dermatome, and time to first required rescue analgesia were considerably lower in the DEX combined with the BVC group than the control group in lower abdominal surgeries.

Patil et al. [22] reported that in patients undergoing surgery to remove impacted third molars, the pain score was reduced considerably in the combined group than in the control group, with a significantly delayed pain sensation, and they required fewer analgesics. The anti-inflammatory and local vasoconstriction properties of DEX are reliable for its analgesic effectiveness and prolonged effective action.

In this regard, Kataria et al. [13] demonstrated that the combined group had a quick onset and longer duration of sensory and motor blocking, and a longer extent of postoperative analgesia than the controls in cases that underwent infra umbilical surgeries.

According to the present study, DEX enhanced postoperative analgesia, decreasing the first postoperative dosage need. The synergism of DEX and LB and the efficacy of DEX in eliminating visceral discomfort are attributed to the enhanced analgesia in the combination group [13]. This was in agreement with previous research performed by Eid et al.,[23] Basuni and Ezz, [24] Kim et al. [25], and Amer et al. [26].

As observed by Esmaolu et al. [27] and Amer et al. [26], 10% of cases in the control group and the combined group exhibited hypotension, while 3% of cases in the control group and 13% of cases in the combined group exhibited bradycardia. These variations were not statistically significant ($P > 0.05$) between groups.

Sinha et al. [17] reported that in patients having an abdominal hysterectomy, the addition of DEX to LB was related to a shorter period to attain the peak sensory level for spinal anesthesia.

In consistency with our results, Shaikh and Rohini [28] indicated that infra-umbilical procedures improved more from the addition of DEX as an adjuvant to hyperbaric spinal BVC, with a significantly earlier start of motor block and a longer motor blocking duration and complete analgesia in the DEX group than the BVC group.

As reported by Xia et al. [29], combined with 2 ml of 0.75% hyperbaric BVC, 5 µg of DEX has been demonstrated to increase the motor and sensory block duration in patients undergoing spinal anesthetic for cesarean delivery.

In line with our results, Nallam et al. [30] highlighted that administering DEX as an adjuvant to LB leads to significantly longer analgesic duration and prolongs the sensory and motor block duration with lower analgesic requirements in supraclavicular brachial plexus block.

In agreement with the study, Basuni and Ezz [24] found that patients who received DEX in addition to low-dose LB for knee arthroscopy had a considerably longer pain-free duration and a significantly lower VAS score than those in the LB group.

In contrast, Dar et al. [31] found indicated no statistically significant delay in the onset of sensory and motor block between the BVC group and the combined group in cases that underwent lower limb surgeries. despite using the dose as in our study and the same number of patients. Different surgical procedures and individual differences may account for the contradictory results.

The study that was done by Esmaoğlu, et.al [27] explained that the motor and sensory blocking onset times are decreased and block duration is increased when intrathecally administered DEX is added to LB for spinal anesthesia.

Kim, et al. [25] studied 54 elderly individuals undergoing transurethral prostatectomy who were given intrathecal DEX or low-dose BVC spinal anesthesia, and the outcomes were compared. They found that sensory block occurred earlier in the DEX group with longer sensory block duration and total analgesia than in the BVC group.

In line with this study, Abdelhamid and El-lakany, [32] studied intrathecal DEX to BVC on 62 patients. They revealed that the sensory blocking duration was significantly increased in the DEX group than BVC group (p-value <0.0001).

Our study has some limitations as the study was conducted at a single location and had a limited sample size, and the results may differ elsewhere. Additionally, more studies using different doses and concentrations of these LAs and the effect of different additives on the post-operative outcome are recommended. Also, further trials for longer follow-up periods are needed.

5. CONCLUSION

The addition of DEX to intrathecal LB reduces the time of sensory and motor block onset with increased block duration without generating a serious side effect, providing adequate surgical anesthesia for lower abdominal surgeries.

Financial support and sponsorship: Nil

Conflict of Interest: Nil

6. REFERENCES

1. Hazra R, Mistry M, Maitra S, Mondal K. Effects of intrathecal dexmedetomidine coadministered with hyperbaric bupivacaine in the lower abdominal surgery: results of a double-blind,

randomized, and controlled trial between two different doses. Asian J Med Sci. 2023; 14:25-31.
2. Bhure A, Jagtap N. A comparison of intrathecal dexmedetomidine and fentanyl as an adjuvant to isobaric levobupivacaine for lower limb orthopedic surgery. Indian J Clin Anaesth. 2019; 6:89-96.
3. Lui KC, Chow YF. Safe use of local anesthetics: prevention and management of systemic toxicity. Hong Kong Med J. 2010; 16:470-5.
4. Singh A, Gupta A, Datta PK, Pandey M. Intrathecal levobupivacaine versus bupivacaine for inguinal hernia surgery: a randomized controlled trial. Korean J Anesthesiol. 2018; 71:220-5.
5. Kurhekar P, Kumar SM, Sampath D. Comparative evaluation of intrathecal morphine and intrathecal dexmedetomidine in patients undergoing gynecological surgeries under spinal anaesthesia: A prospective randomised double blind study. Indian J Anaesth. 2016; 60:382-7.
6. Khandelwal M, Rao H, Kumar P, Bafna U, Beniwal S. Comparative study of morphine or dexmedetomidine as intrathecal adjuvants to 0.5% hyperbaric bupivacaine in infraumbilical surgeries. Indian Journal of Pain. 2019; 33:156.
7. Mahendru V, Tewari A, Katyal S, Grewal A, Singh MR, Katyal R. A comparison of intrathecal dexmedetomidine, clonidine, and fentanyl as adjuvants to hyperbaric bupivacaine for lower limb surgery: A double blind controlled study. J Anaesthesiol Clin Pharmacol. 2013; 29:496-502.
8. Vorobeichik L, Brull R, Abdallah FW. Evidence basis for using perineural dexmedetomidine to enhance the quality of brachial plexus nerve blocks: a systematic review and meta-analysis of randomized controlled trials. Br J Anaesth. 2017; 118:167-81.
9. Pan L, Wu H, Liu H, Yang X, Meng Z, Cao Y. Dexmedetomidine as an adjunct to local anesthetics in nerve block relieved pain more effectively after TKA: a meta-analysis of randomized controlled trials. J Orthop Surg Res. 2020; 15:577.
10. Dcruz TM, Patel C, Masih A, Shaik I. A comparative study evaluating the efficacy of lignocaine and dexmedetomidine with lignocaine and adrenaline in third molar surgery. J Maxillofac Surg. 2020:1-5.
11. Alizargar J, Etemadi Sh M, Kaviani N, Wu SV, Jafarzadeh K, Ranjbarian P, et al. Injection of Lidocaine Alone versus Lidocaine plus Dexmedetomidine in Impacted Third Molar Extraction Surgery, a Double-Blind Randomized Control Trial for Postoperative Pain Evaluation. Pain Res Manag. 2021; 2021:6623792.
12. Nalawade SH, Nilesh K, Kumar CDM, Punde PA, Patil PB. A clinical comparative study of dexmedetomidine as an adjuvant to 2% plain lignocaine and 2% lignocaine with 1:200,000 adrenaline as local anesthetic agents for surgical removal of impacted mandibular third molars. Natl J Maxillofac Surg. 2021; 12:255-61.
13. Kataria AP, Jarewal V, Kumar R, Kashyap A. Comparison of levobupivacaine and levobupivacaine with dexmedetomidine in infraumbilical surgeries under spinal anesthesia. Anesth Essays Res. 2018; 12:251-5.
14. Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. Anesth Analg. 2010; 111:1548-51.
15. Biswas S, Das RK, Mukherjee G, Ghose T. Dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block: a randomized double-blind prospective study. Ethiop J Health Sci. 2014; 24:203-8.
16. Morrison SG, Dominguez JJ, Frascarolo P, Reiz S. A comparison of the electrocardiographic cardiotoxic effects of racemic bupivacaine, levobupivacaine, and ropivacaine in anesthetized swine. Anesth Analg. 2000; 90:1308-14.
17. Sinha M, Kumar M, Dubey I, Singha SK, Karim HMR, Karoo K. Comparison of morphine and dexmedetomidine as adjuvants to isobaric levobupivacaine for spinal anesthesia in patients undergoing abdominal hysterectomy. Anesth Essays Res. 2021; 15:188-93.
18. Rai A, Bhutia MP. Dexmedetomidine as an Additive to Spinal Anaesthesia in Orthopaedic Patients Undergoing Lower Limb Surgeries: A Randomized Clinical Trial Comparing Two Different Doses of Dexmedetomidine. J Clin Diagn Res. 2017; 11:9-12.
19. Elshahawy ME, Taman HI, Elawady MS, Farid AM. Comparison of Dexmedetomidine Versus Dexamethasone as Adjuvants to Intrathecal Bupivacaine in Emergency Orthopedic Lower Limb Operations. Egypt J Hosp Med. 2022; 88:2382-7.
20. Swain A, Nag DS, Sahu S, Samaddar DP. Adjuvants to local anesthetics: Current understanding and future trends. World J Clin Cases. 2017; 5:307-23.
21. Bahari Z, Meftahi GH. Spinal α (2) - adrenoceptors and neuropathic pain modulation; therapeutic target. Br J Pharmacol. 2019; 176:2366-81.
22. Patil SM, Jadhav A, Bhola N, Hingnikar P, Kshirsagar K, Patil D. Does dexmedetomidine combined with levobupivacaine in inferior alveolar nerve blocks among patients undergoing impacted third molar surgery control

postoperative morbidity? J Dent Anesth Pain Med. 2022; 22:145-53.
23. Eid H, Shafie MA, Youssef H. Dose-related prolongation of hyperbaric bupivacaine spinal anesthesia by dexmedetomidine. Ain Shams j Anesthesiol. 2011; 4:83-95.
24. Basuni AS, Ezz HAA. Dexmedetomidine as supplement to low-dose levobupivacaine spinal anesthesia for knee arthroscopy. Egypt J Anaesth. 2014; 30:149-53.
25. Kim JE, Kim NY, Lee HS, Kil HK. Effects of intrathecal dexmedetomidine on low-dose bupivacaine spinal anesthesia in elderly patients undergoing transurethral prostatectomy. Biol Pharm Bull. 2013; 36:959-65.
26. Mahmoud MA, Rashwan DA, Shaker MA. Comparative study of two doses of Intrathecal Dexmedetomidine versus fentanyl as adjuvant to hyperbaric bupivacaine spinal anesthesia. J Med Sci. 2015; 4:2450-64.
27. Esmaoğlu A, Türk S, Bayram A, Akın A, Uğur F, Ulgey A. The effects of dexmedetomidine added to spinal levobupivacaine for transurethral endoscopic surgery. Balkan Med J. 2013; 30:186-90.
28. Shaikh SI, Dattatri R. Dexmedetomidine as an adjuvant to hyperbaric spinal bupivacaine for infra-umbilical procedures: A dose related study. Anaesthesia, Pain & Intensive Care. 2019; 12:180-5.
29. Xia F, Chang X, Zhang Y, Wang L, Xiao F. The effect of intrathecal dexmedetomidine on the dose requirement of hyperbaric bupivacaine in spinal anaesthesia for caesarean section: a prospective, double-blinded, randomized study. BMC Anesthesiol. 2018; 18:74.
30. Nallam SR, Chiruvella S, Karanam S. Supraclavicular brachial plexus block: Comparison of varying doses of dexmedetomidine combined with levobupivacaine: A double-blind randomised trial. Indian J Anaesth. 2017; 61:256-61.
31. Dar FA, Bhat HA, Javeed T, Najar MR. The effects of dexmedetomidine added to spinal bupivacaine for lower limb surgery. IOSR J Dent Med Sci. 2014; 13:17-20.
32. Abdelhamid SA, El-lakany MH. Intrathecal dexmedetomidine: useful or not. J Anesth Clin Res. 2013; 4:351.