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Research Article

Comparison of Levobupivacaine and Levobupivacaine with Dexmedetomidine in lowerlimb Surgeries under Spinal Anaesthesia

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ABSTRACT

Background: Spinal anaesthesia is widely employed for lower limb surgeries due to its rapid onset and dense neural blockade. Levobupivacaine, a long-acting amide local anaesthetic, provides effective anaesthesia with a better cardiovascular safety profile. Dexmedetomidine, a selective α2-adrenergic agonist, has been investigated as an intrathecal adjuvant to prolong and intensify the effects of local anaesthetics. This study aimed to compare the onset, duration, and hemodynamic effects of intrathecal levobupivacaine alone versus levobupivacaine combined with dexmedetomidine.

Materials and Methods: A prospective, randomized, double-blind study was conducted on 60 ASA I–II patients undergoing elective lower limb surgeries under spinal anaesthesia. Patients were randomly assigned to two groups: Group 1 (n=30) (Levobupivacaine): Received 2.5 ml of 0.5% Hyperbaric levobupivacaine (12.5mg). Group 2 (n=30) (Levobupivacaine + Dexmedetomidine): Received 2.5 ml of 0.5% Hyperbaric levobupivacaine (12.5 mg) with 6 mcg dexmedetomidine. Dexmedetomidine was drawn using a 1 ml syringe calibrated into 50 divisions (each equal to 2 mcg), and 3 divisions were used to deliver the 6 mcg dose. Total volume remained 2.5 ml in both groups. Parameters assessed included onset time and duration of sensory and motor block, time to surgical anaesthesia, and hemodynamic changes. Motor block was assessed using the modified Bromage scale (0 = no paralysis to 3 = complete block).

Results: Group 2 demonstrated a significantly faster onset of sensory block (2.8 ± 0.6 min) and motor block (3.6 ± 0.5 min) compared to Group 1 (4.1 ± 0.7 min and 5.0 ± 0.6 min, respectively; $p < 0.001$). Time to surgical anaesthesia was also shorter in Group 2 (4.2 ± 0.8 min) than in Group 1 (5.7 ± 0.9 min).

The duration of sensory block in Group 2 was 240 ± 22 minutes, significantly longer than Group 1 (150 ± 18 minutes; $p < 0.001$). Similarly, motor block duration was prolonged in Group 2 (210 ± 20 min) versus Group 1 (120 ± 20 min; $p < 0.001$).

Hemodynamic parameters, including heart rate and mean arterial pressure, remained within clinically acceptable limits in both groups, with no statistically significant differences requiring intervention.

Conclusion: The addition of 6 mcg dexmedetomidine to intrathecal levobupivacaine significantly enhances block characteristics by accelerating onset and prolonging both sensory and motor blockade without compromising hemodynamic stability. It is a safe and effective adjuvant for spinal anaesthesia in lower limb surgeries.

Keywords: *Levobupivacaine, Dexmedetomidine, Intrathecal Anaesthesia, Lower Limb Surgery, Sensory Block, Motor Block, Bromage Scale, Hemodynamics*

Introduction

Spinal anaesthesia is extensively employed for infraumbilical procedures, including lower limb surgeries, due to its rapid onset, reliable sensory and motor blockade, and minimal systemic side effects (1). The choice of local anaesthetic and the

use of intrathecal adjuvants significantly influence the quality and duration of the block, postoperative analgesia, and patient outcomes (2).

Levobupivacaine, the S-enantiomer of racemic bupivacaine, is a long-acting amide local anaesthetic that has gained popularity for spinal anaesthesia due to its reduced potential for cardiotoxicity and neurotoxicity (3,4). Its pharmacological profile is comparable to that of bupivacaine in terms of sensory and motor blockade, but with improved safety, particularly in patients with cardiovascular risk factors (5).

To further enhance the efficacy of spinal anaesthesia, various intrathecal adjuvants have been explored. Dexmedetomidine, a highly selective α2-adrenergic receptor agonist, exhibits sedative, analgesic, and sympatholytic properties, making it a promising additive to neuraxial blocks (6). When used intrathecally, dexmedetomidine acts at the dorsal horn of the spinal cord, inhibiting nociceptive transmission and prolonging both sensory and motor blockade without significant respiratory depression (7,8). Its synergistic action with local anaesthetics improves block characteristics, reduces intraoperative analgesic requirements, and may offer prolonged postoperative pain relief (9,10).

Although the benefits of dexmedetomidine in combination with bupivacaine and ropivacaine are well documented, literature evaluating its use with levobupivacaine remains relatively sparse, particularly in the context of spinal anaesthesia for lower limb surgeries (11,12). Furthermore, the impact of dexmedetomidine on intraoperative hemodynamic stability must be thoroughly evaluated to ensure its safety in clinical practice (13).

The present study was designed to compare the onset and duration of sensory and motor blockade, time to surgical anaesthesia, and hemodynamic changes between intrathecal levobupivacaine alone and levobupivacaine combined with 6 mcg dexmedetomidine in patients undergoing elective lower limb surgeries under spinal anaesthesia.

Materials and Methods

Study Population

Sixty adult patients aged between 18 and 60 years, belonging to the American Society of Anesthesiologists (ASA) physical status I or II, and scheduled for elective lower limb surgeries under spinal anaesthesia were enrolled. Exclusion criteria included patient refusal, known hypersensitivity to study drugs, contraindications to spinal anaesthesia, and history of significant cardiovascular, renal, hepatic, or neurological disorders.

Randomization and Group Allocation

Patients were randomly divided into two equal groups (n = 30 each) using a computer-generated randomization list. Group allocation was concealed in sealed opaque envelopes, opened just before drug administration.

- Group 1 (Levobupivacaine Group): Received 2.5 ml of 0.5% hyperbaric levobupivacaine (12.5 mg) intrathecally.
- Group 2 (Levobupivacaine + Dexmedetomidine Group): Received 2.5 ml of 0.5% hyperbaric levobupivacaine (12.5 mg) combined with 6 mcg dexmedetomidine. The dexmedetomidine (100 mcg/ml) was carefully measured using a 1 ml syringe divided into 50 units, where each unit represented 2 mcg. Three such units were drawn to obtain the required 6 mcg dose. Total injected volume remained 2.5 ml in both groups.

Both the anaesthesiologist administering the drugs and the observer recording the outcomes were blinded to group assignments.

Anaesthetic Technique

All patients were preloaded with 10 ml/kg of Ringer's lactate solution 15 minutes prior to the procedure. Standard monitoring including ECG, non-invasive blood pressure, and pulse oximetry was applied. Under strict aseptic precautions, spinal anaesthesia was administered in the sitting position at the L3–L4 interspace using a 25G Quincke spinal needle. Following intrathecal injection, patients were positioned supine. Sensory and motor block levels were assessed every 2 minutes until adequate anaesthesia was achieved.

Parameters Assessed

- Onset of sensory block: Time from injection to loss of pinprick sensation at the T10 dermatome.
- Onset of motor block: Time to achieve a modified Bromage score of 3.
- Time to surgical anaesthesia: Interval from drug administration to attainment of adequate sensory and motor block suitable for surgery.
- Duration of sensory block: Time from onset to regression to the S1 dermatome.
- Duration of motor block: Time from onset to return to Bromage score 0.
- Hemodynamic parameters: Heart rate and mean arterial pressure were recorded at baseline, then at 5-minute intervals for the first 30 minutes, followed by 15-minute intervals until the end of surgery.

Motor block was evaluated using the modified Bromage scale:

- Score 0: Full movement of legs and feet
- Score 1: Inability to raise extended leg, can move knees and feet

- Score 2: Inability to raise leg and flex knees, can move feet
- Score 3: Complete motor block of lower limbs

Any adverse events, including bradycardia (HR < 50 bpm), hypotension (MAP < 65 mmHg), nausea, vomiting, or excessive sedation, were documented and managed appropriately.

Statistical Analysis

Data were analyzed using SPSS version 25.0. Continuous variables were presented as mean ± standard deviation (SD) and compared using the unpaired Student's t-test. Categorical variables were analyzed using the Chi-square test or Fisher's exact test where appropriate. A p-value of <0.05 was considered statistically significant.

Results

A total of 60 patients were included in the study, with 30 participants in each group. The demographic profiles of patients in both groups were statistically comparable, with no significant difference in age, weight, or gender distribution (Table 1).

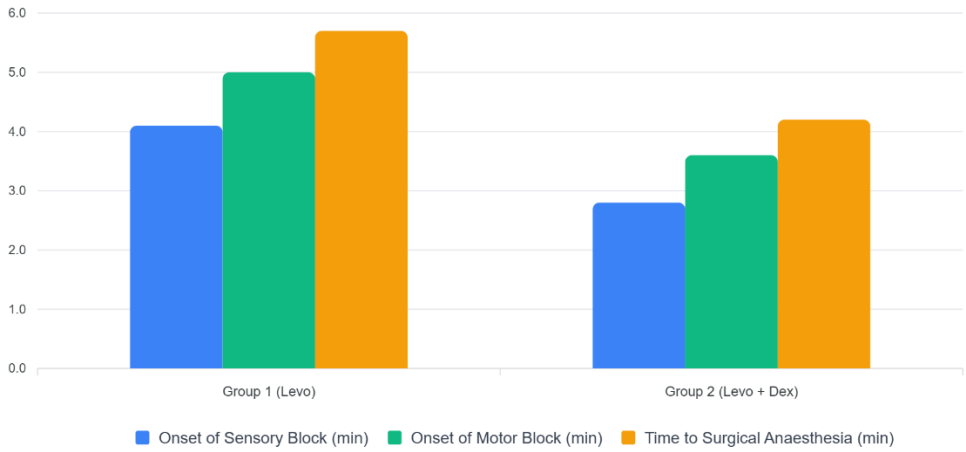
Table 1: *Demographic Characteristics of Study Participants*

Parameter	Group 1 (Levo) Mean ± SD	Group 2 (Levo + Dex) Mean ± SD	p-value
Age (years)	38.6 ± 9.5	39.2 ± 10.1	0.72
Weight (kg)	67.2 ± 7.8	66.4 ± 8.1	0.68
Male:Female	17:13	18:12	0.80

There was a statistically significant reduction in the onset time of both sensory and motor block in Group 2 compared to Group 1 ($p < 0.001$). The time to attain surgical anaesthesia was also faster in the group receiving dexmedetomidine (Table 2).

Table 2: *Onset Times and Surgical Anaesthesia*

Parameter	Group 1 (Levo) Mean ± SD	Group 2 (Levo + Dex) Mean ± SD	p-value
Onset of Sensory Block (min)	4.1 ± 0.7	2.8 ± 0.6	<0.001
Onset of Motor Block (min)	5.0 ± 0.6	3.6 ± 0.5	<0.001
Time to Surgical Anaesthesia (min)	5.7 ± 0.9	4.2 ± 0.8	<0.001

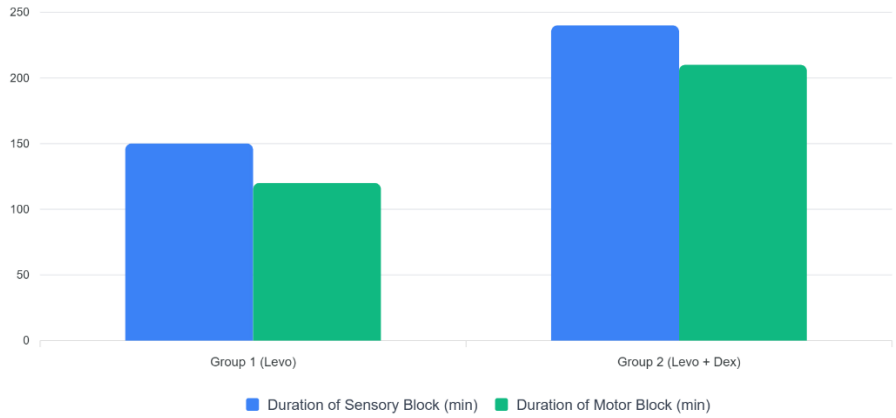


Graph 1. Onset Times and Surgical Anaesthesia

The duration of sensory and motor blockade was significantly prolonged in Group 2. In Group 1, the sensory block lasted for an average of 150 ± 18 minutes, while in Group 2 it extended to 240 ± 22 minutes. Similarly, motor block duration was 120 ± 20 minutes in Group 1 and 210 ± 20 minutes in Group 2, showing a significant enhancement with dexmedetomidine (Table 3).

Table 3: *Duration of Sensory and Motor Block*

Parameter	Group 1 (Levo) Mean ± SD	Group 2 (Levo + Dex) Mean ± SD	p-value
Duration of Sensory Block (min)	150 ± 18	240 ± 22	<0.001
Duration of Motor Block (min)	120 ± 20	210 ± 20	<0.001



Graph 2. Duration of Sensory and Motor Block

Throughout the intraoperative period, hemodynamic parameters remained stable in both groups. Although Group 2 exhibited slightly lower heart rate and mean arterial pressure at specific intervals, the differences were not clinically significant and did not require pharmacologic intervention (Table 4).

Table 4: *Intraoperative Hemodynamic Parameters*

Time Point	HR (bpm) Group 1	HR (bpm) Group 2	MAP (mmHg) Group 1	MAP (mmHg) Group 2
Baseline	82 ± 6	81 ± 7	92 ± 8	91 ± 9
15 min	79 ± 5	75 ± 6	88 ± 7	85 ± 6
30 min	77 ± 4	73 ± 5	86 ± 6	83 ± 5
60 min	75 ± 4	71 ± 4	84 ± 5	82 ± 4

In summary, the addition of dexmedetomidine significantly improved the quality of block (Tables 2 and 3) and maintained hemodynamic stability throughout the procedure (Table 4), without increasing adverse effects.

Discussion

This study evaluated the efficacy and safety of adding 6 mcg dexmedetomidine to intrathecal levobupivacaine for lower limb surgeries. The findings demonstrated that the addition of dexmedetomidine significantly accelerated the onset, prolonged the duration of both sensory and motor blockade, and maintained intraoperative hemodynamic stability without significant adverse events.

Levobupivacaine, the pure S-enantiomer of bupivacaine, offers comparable anaesthetic potency with a reduced risk of cardiotoxicity and neurotoxicity (1,2). It is widely regarded as a safer option in spinal anaesthesia, especially for patients with cardiovascular comorbidities (3). Several studies have reported satisfactory anaesthetic and analgesic profiles with isobaric levobupivacaine in spinal anaesthesia (4,5).

The incorporation of dexmedetomidine as an intrathecal adjuvant has gained traction due to its desirable pharmacodynamic profile. Being a highly selective α2-adrenergic receptor agonist, dexmedetomidine acts by inhibiting the release of substance P in the dorsal horn and producing analgesia and sedation without causing significant respiratory depression (6,7). In the present study, the onset of sensory and motor block was significantly earlier in the dexmedetomidine group, which concurs with previous studies involving dexmedetomidine combined with bupivacaine or ropivacaine (8,9).

Prolongation of the duration of sensory and motor block in Group 2 aligns with findings from Kanazi et al., who demonstrated similar enhancement when 3–5 mcg of dexmedetomidine was added to spinal bupivacaine (10). This effect is attributed to the synergistic action of dexmedetomidine on spinal cord α2-receptors, which hyperpolarize nerve tissues and reduce nociceptive transmission (11). Other studies have confirmed that intrathecal dexmedetomidine prolongs both block duration and postoperative analgesia (12,13).

Our results showed a significantly longer duration of sensory block (240 vs. 150 minutes) and motor block (210 vs. 120 minutes) with dexmedetomidine. Similar findings were reported by Mahendru et al. and Gupta et al., supporting the role of dexmedetomidine in extending the clinical effects of spinal anaesthetics (14,15).

Importantly, the use of dexmedetomidine did not lead to major hemodynamic disturbances in this study. Although a mild reduction in heart rate and mean arterial pressure was observed, it did not necessitate therapeutic intervention. This suggests that low-dose intrathecal dexmedetomidine (≤10 mcg) is generally well tolerated from a cardiovascular standpoint (9,12). This aligns with the findings of Shukla et al. and Elcicek et al., who reported minimal hemodynamic changes with doses up to 10 mcg (13,14).

The use of a fixed dose of 6 mcg dexmedetomidine without volume alteration ensured consistency and minimized confounding factors in our study. Similar dosing strategies have been employed in other trials to achieve an optimal balance between efficacy and safety (11,15).

This study supports the growing body of evidence suggesting that dexmedetomidine is an effective and safe adjuvant to levobupivacaine for spinal anaesthesia, especially in infraumbilical surgeries.

Limitations

A limitation of the study is the relatively small sample size, which may limit the generalizability of the findings. Postoperative analgesic consumption and patient satisfaction scores were not assessed, which could provide additional insight into the extended analgesic benefits of dexmedetomidine.

Conclusion:

The addition of 6 mcg dexmedetomidine to intrathecal levobupivacaine significantly enhances the onset, prolongs the duration of sensory and motor block, and maintains stable hemodynamics, making it a safe and effective adjuvant for lower limb surgeries under spinal anaesthesia.

References

1. 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(1):251–5.
2. Bisui B, Samanta S, Ghoshmaulik S, Banerjee A, Ghosh TR, Sarkar S. Effect of Locally Administered Dexmedetomidine as Adjuvant to Levobupivacaine in Supraclavicular Brachial Plexus Block: Double-blind Controlled Study. Anesth Essays Res. 2017;11(4):981–6.
3. Bhati K, Saini N, Aeron N, Dhawan S. A Comparative Study to Evaluate the Efficacy of Dexmedetomidine and Clonidine to Accentuate the Perioperative Analgesia of Caudal 0.25% Isobaric Levobupivacaine in Pediatric Infraumbilical Surgeries. Cureus. 2022;14(8):e27825.
4. Attri JP, Kaur G, Kaur S, Kaur R, Mohan B, Kashyap K. Comparison of levobupivacaine and levobupivacaine with fentanyl in infraumbilical surgeries under spinal anaesthesia. Anesth Essays Res. 2015;9(2):178–84.
5. Iyer LS, Bhat SS, Nethra HN, Vijayakumar HN, Sudheesh K, Ramachandriah. A Comparative Study of Effect of 0.25% Levobupivacaine with Dexmedetomidine versus 0.25% Levobupivacaine in Ultrasound-Guided Supraclavicular Brachial Plexus Block. Anesth Essays Res. 2021;15(4):443–7.
6. 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(2):188–93.
7. Kame BS, Kumar VU, Subramaniam A. Spinal Anaesthesia for Urological Surgery: A Comparison of Isobaric Solutions of Levobupivacaine and Ropivacaine with Dexmedetomidine. Ethiop J Health Sci. 2023;33(1):65–72.
8. Shukla U, Singh D, Singh J, Yadav JBS. Comparative Study of Epidural Dexmedetomidine, Fentanyl, and Tramadol as Adjuvant to Levobupivacaine for Lower Limb Orthopedic Surgeries. Cureus. 2022;14(5):e25225.
9. Ghali AM, Shabana AM, El Btarny AM. The Effect of Low-Dose Dexmedetomidine as an Adjuvant to Levobupivacaine in Patients Undergoing Vitreoretinal Surgery Under Sub-Tenon's Block Anesthesia. Anesth Analg. 2015;121(5):1378–82.
10. Somsunder RG, Archana NB, Shivkumar G, Krishna K. Comparing Efficacy of Perineural Dexmedetomidine with Intravenous Dexmedetomidine as Adjuvant to Levobupivacaine in Supraclavicular Brachial Plexus Block. Anesth Essays Res. 2019;13(3):441–5.
11. Shashikala TK, Sagar SS, Ramaliswamy P, Hudgi VV. Comparing Effects of Intrathecal Adjuvants Fentanyl and Dexmedetomidine with Hyperbaric Ropivacaine in Patients Undergoing Elective Infraumbilical Surgeries: A Prospective, Double-Blind, Clinical Study. Anesth Essays Res. 2019;13(4):654–62.
12. Krishna K, Muralidhara KS, Santhosh MCB, Shivakumar G. Comparison of Different Doses of Clonidine as an Additive to Intrathecal Isobaric Levobupivacaine in Patients Undergoing Infraumbilical Surgeries. Anesth Essays Res. 2020;14(3):492–6.
13. Adel Elmaddawy AE, Diab DG, Farag MA. Levobupivacaine versus Levobupivacaine-Dexmedetomidine in Thoracic Paravertebral Block for Laparoscopic Sympathectomy. Anesth Essays Res. 2018;12(4):837–42.
14. 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(3):203–8.
15. Kaur H, Singh G, Rani S, Gupta KK, Kumar M, Rajpal AS, Aggarwal S. Effect of dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A randomized double-blind prospective study. J Anaesthesiol Clin Pharmacol. 2015;31(3):333–8.