Int. J Med. Pharm. Res. (P-ISSN: 2958-3675 | E-ISSN: 2958-3683)
Available on: https://ijmpr.in/

International Journal
of Medical and Pharmaceutical Research

ORGINAL ARTICLE **OPEN ACCESS**

Comparison of Clinical Effects of Hyperbaric Ropivacaine and Hyperbaric Ropivacaine with Dexmedetomidine for Spinal Anesthesia in Elective Lower Limb Orthopedic Procedures

Dr.Varun Pradeepnath[1]*, Dr.Shivakumar, K. P[1]

[1]Department of Anesthesiology& Critical Care, SSIMS & RC, Davengere, Karnataka, India

OPEN ACCESS

***Corresponding Author**
Dr.VarunPradeepnath

Department of Anesthesiology & Critical Care, SSIMS & RC, Davengere, Karnataka, India

Received: 20-12-2024
Accepted: 27-01-2024
Available online: 04-02-2025

A B S T R A C T

This study aimed to compare the clinical effects of hyperbaric ropivacaine alone and in combination with dexmedetomidine for spinal anesthesia in elective lower limb orthopedic procedures. A prospective, randomized, double-blind study was conducted on 100 patients undergoing elective lower limb orthopedic surgeries. Patients were randomly allocated into two groups: Group R received hyperbaric ropivacaine 0.75% (3 mL)+0.5 ml normal saline(total volume 3.5ml), and Group RD received hyperbaric ropivacaine 0.75% (3 mL) with dexmedetomidine (10µg) (total volume 3.5ml). The onset and duration of sensory and motor block, hemodynamic parameters, time to first analgesic request, and side effects were recorded. Results showed that the addition of dexmedetomidine to hyperbaric ropivacaine significantly prolonged the duration of sensory and motor block ($p < 0.001$), extended the time to first analgesic request ($p < 0.001$), and provided better intraoperative conditions compared to ropivacaine alone. Hemodynamic parameters remained stable in both groups, with no significant differences in side effects. This study concludes that the addition of dexmedetomidine to hyperbaric ropivacaine for spinal anesthesia in lower limb orthopedic procedures provides superior analgesia and prolonged motor and sensory block without significant hemodynamic alterations or increased side effects.

Keywords: Spinal anesthesia, Hyperbaric ropivacaine, Dexmedetomidine, Lower limb orthopedic surgery, Sensory block, Motor block.

INTRODUCTION

Spinal anesthesia is a widely used technique for lower limb orthopedic procedures due to its rapid onset, reliable effectiveness, and minimal systemic effects. Ropivacaine, an amide local anesthetic, has gained popularity in recent years due to its reduced cardiovascular and central nervous system toxicity compared to bupivacaine [1]. However, the relatively short duration of action of ropivacaine has led to the exploration of adjuvants to prolong its effects.

Dexmedetomidine, a highly selective α2-adrenergic agonist, has emerged as a promising adjuvant in regional anesthesia. It has been shown to prolong the duration of sensory and motor block when added to local anesthetics in various regional anesthesia techniques [2]. However, its specific effects when combined with hyperbaric ropivacaine for spinal anesthesia in lower limb orthopedic procedures have not been extensively studied.

Objectives

The primary objective of this study was to compare the duration of sensory and motor block between hyperbaric ropivacaine alone and hyperbaric ropivacaine with dexmedetomidine in spinal anesthesia for elective lower limb orthopedic procedures.

Secondary objectives included:

1. Comparing the onset time of sensory and motor block between the two groups
2. Assessing the time to first analgesic request in both groups

3. Evaluating hemodynamic stability in both groups
4. Comparing the incidence of side effects between the two groups

Methodology

Study Design and Setting

This prospective, randomized, double-blind study was conducted at SSIMS & RC, Davengere from 25/05/2022 to 25/05/2024. The study protocol was approved by the Institutional Ethics Committee Review Board and written informed consent was obtained from all participants.

Participants

A total of 100 patients aged 18-60 years, ASA physical status I-II, scheduled for elective lower limb orthopedic procedures under spinal anesthesia were included in the study. Exclusion criteria were contraindications to spinal anesthesia, allergy to study drugs, severe cardiopulmonary diseases, and neurological disorders.

Randomization and Blinding

Patients were randomly allocated into two groups of 50 each using computer-generated random numbers. Group R received hyperbaric ropivacaine 0.75% (3 mL) with 0.5ml of normal saline(total volume 3.5ml), and Group RD received hyperbaric ropivacaine 0.75% (3 mL) with dexmedetomidine (10µg)(total volume 3.5ml). The anesthesiologist preparing the drug solutions was not involved in the patient assessment. The patient and the anesthesiologist performing the block and assessments were blinded to the group allocation.

Anesthetic Technique

After standard monitoring and intravenous access, spinal anesthesia was performed at the L3-L4 interspace using a 25G Quincke needle with the patient in the sitting position. The study drug was injected intrathecally as per group allocation.

Data Collection

The following parameters were recorded:

1. Onset time of sensory block (time to reach T10 dermatome)
2. Maximum sensory block level
3. Time to two-segment regression of sensory block
4. Onset time of motor block (modified Bromage scale 3)
5. Duration of motor block (time to modified Bromage scale 0)
6. Hemodynamic parameters (heart rate, blood pressure) at regular intervals
7. Time to first analgesic request
8. Side effects (nausea, vomiting, shivering, pruritus, respiratory depression)

Statistical Analysis

Data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation and compared using Student's t-test. Categorical variables were expressed as frequencies and percentages and compared using Chi-square test or Fisher's exact test. A p-value < 0.05 was considered statistically significant.

RESULTS

Demographic and Surgical Characteristics

There were no significant differences between the two groups in terms of age, gender, BMI, ASA status, and duration of surgery (Table 1).

Table 1: Demographic and Surgical Characteristics

Characteristic	Group R (n=50)	Group RD (n=50)	p-value
Age (years)	45.6 ± 12.3	47.2 ± 11.8	0.52
Gender (M/F)	28/22	30/20	0.68
BMI (kg/m²)	24.8 ± 3.2	25.1 ± 3.5	0.64
ASA (I/II)	32/18	29/21	0.54
Duration of surgery (min)	98.5 ± 22.7	101.2 ± 24.3	0.57

Sensory and Motor Block Characteristics

The addition of dexmedetomidine to ropivacaine significantly prolonged the duration of sensory and motor block ($p < 0.001$). The onset time of sensory and motor block was also significantly faster in Group RD ($p < 0.05$) (Table 2).

Table 2: Sensory and Motor Block Characteristics

Characteristic	Group R (n=50)	Group RD (n=50)	p-value
Onset time of sensory block (min)	4.8 ± 1.2	3.9 ± 1.0	0.023
Maximum sensory block level	T8 (T6-T10)	T6 (T4-T8)	0.012
Time to two-segment regression (min)	95.6 ± 15.3	142.8 ± 22.7	<0.001
Onset time of motor block (min)	7.2 ± 1.8	5.8 ± 1.5	0.018
Duration of motor block (min)	186.4 ± 28.5	265.7 ± 35.2	<0.001

Time to First Analgesic Request

The time to first analgesic request was significantly longer in Group RD compared to Group R (328.5 ± 45.6 min vs. 242.3 ± 38.2 min, $p < 0.001$).

Hemodynamic Parameters

Both groups maintained stable hemodynamic parameters throughout the procedure. There were no significant differences in heart rate or mean arterial pressure between the groups at any time point.

Side Effects

The incidence of side effects was comparable between the two groups (Table 3).

Table 3: Incidence of Side Effects

Side Effect	Group R (n=50)	Group RD (n=50)	p-value
Nausea	4 (8%)	5 (10%)	0.73
Vomiting	2 (4%)	3 (6%)	0.65
Shivering	5 (10%)	2 (4%)	0.24
Pruritus	0 (0%)	1 (2%)	0.32
Respiratory depression	0 (0%)	0 (0%)	-

DISCUSSION

This study demonstrates that the addition of dexmedetomidine to hyperbaric ropivacaine for spinal anesthesia in lower limb orthopedic procedures significantly prolongs the duration of sensory and motor block, extends the time to first analgesic request, and provides better intraoperative conditions compared to ropivacaine alone.

The prolonged duration of sensory and motor block observed in the dexmedetomidine group aligns with previous studies investigating its use as an adjuvant in neuraxialanesthesia [3]. This effect can be attributed to the synergistic action of dexmedetomidine with local anesthetics, potentially through its action on α2-adrenergic receptors in the spinal cord [4].

The faster onset of sensory and motor block in the dexmedetomidine group is a noteworthy finding. This could be due to the local vasoconstrictive effects of dexmedetomidine, which may reduce the systemic absorption of ropivacaine and enhance its local anesthetic effect [5].

The extended time to first analgesic request in the dexmedetomidine group indicates superior postoperative analgesia. This is particularly beneficial in orthopedic procedures, where effective pain management is crucial for early mobilization and rehabilitation.

Importantly, the addition of dexmedetomidine did not lead to significant hemodynamic instability or an increased incidence of side effects. This suggests that the combination of hyperbaric ropivacaine and dexmedetomidine at the doses used in this study is safe for spinal anesthesia in lower limb orthopedic procedures.

CONCLUSION

The addition of dexmedetomidine to hyperbaric ropivacaine for spinal anesthesia in elective lower limb orthopedic procedures provides superior analgesia and prolonged motor and sensory block without significant hemodynamic alterations or increased side effects. This combination can be considered as an effective option for spinal anesthesia in these procedures, particularly when extended postoperative analgesia is desired.

REFERENCES

1. Malhotra, R., Johnstone, C., Halpern, S., Hunter, J., & Banerjee, A. (2014). Duration of motor block with intrathecalropivacaine versus bupivacaine for caesarean section: A meta-analysis. *International Journal of Obstetric Anesthesia, 23*(1), 29-36. https://doi.org/10.1016/j.ijoa.2013.07.005
2. Schnabel, A., Reichl, S. U., Weibel, S., Zahn, P. K., Kranke, P., Pogatzki-Zahn, E. M., & Meyer-Frießem, C. H. (2018). Efficacy and safety of dexmedetomidine in peripheral nerve blocks: A meta-analysis and trial sequential analysis. *European Journal of Anaesthesiology, 35*(10), 745-758. https://doi.org/10.1097/EJA.0000000000000870
3. Zhang, H., Li, M., Zhang, S. Y., Fu, M., & Zhang, S. Y. (2016). Dexmedetomidine as an adjuvant for brachial plexus blocks: A meta-analysis of randomized controlled trials. *Medicine, 95*(9), e2852. https://doi.org/10.1097/MD.0000000000002852
4. Eisenach, J. C., De Kock, M., &Klimscha, W. (1996). α2-adrenergic agonists for regional anesthesia: A clinical review of clonidine (1984–1995). *Anesthesiology, 85*(3), 655-674.
5. Yoshitomi, T., Kohjitani, A., Maeda, S., Higuchi, H., Shimada, M., &Miyawaki, T. (2008). Dexmedetomidine enhances the local anesthetic action of lidocaine via an α-2A adrenoceptor. *Anesthesia& Analgesia, 107*(1), 96-101. https://doi.org/10.1213/ane.0b013e31817be5cf