Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i6.6778

COMPARISON OF DEXMEDETOMIDINE VERSUS FENTANYL IN UNILATERAL SPINAL ANESTHESIA, IN LOWER LIMB ORTHOPEDIC SURGERIES: RANDOMIZED CONTROL TRIAL

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ABSTRACT

OBJECTIVE: To investigate the impact of intrathecal bupivacaine and Dexmedetomidine and fentanyl on the strength and duration of blocks during lower limb orthopedic procedures.

BACKGROUND: While general, neuroaxial, or local anesthesia can be used for lower limb surgeries, neuroaxial block is the recommended method. Quick onset and cost-effectiveness are all provided by spinal block.

STUDY DESIGN: A randomized controlled trial

PLACE AND DURATION: This study was conducted in Liaquat University of Medical and Health Sciences Jamshoro from March 2023 to March 2024

METHODOLOGY: A total of 60 persons who were booked for lower limb surgery due to any indication were randomly assigned to two groups (A and B) consisting of thirty patients each, using single blind randomization. Group A received 2.5 milliliters of hyperbaric bupivacaine plus 25 micrograms of fentanyl (0.5 milliliter) and group B received 2.5 milliliters of hyperbaric bupivacaine plus 10 micrograms of DEX (0.5 milliliters) of unilateral spinal anesthesia. SPSS version 26.0 was used to enter and analyze the data.

RESULTS: According to our findings, the mean duration of the surgery was 2.44 ± 0.62 and 2.14 ± 0.43 for A and B group. The mean age of the participants was 45.67 ± 5.22 and 43.5 ± 6.76. Mean BMI of the participants was 27.12 ± 3.12 and 26.9 ± 3.71 for A and B group respectively. Time to rescue analgesia, frequency of analgesic demand, and total nalbuphine dosage differed significantly between the two groups.

CONCLUSION: In lower limb procedures, intrathecal Dexmedetomidine (10 µg) appears to be a more effective option than fentanyl (25 µg) for achieving desirable results in unilateral spinal anesthesia, with fewer side effects and better post-operative analgesia.

KEYWORDS: Spinal Anesthesia, intrathecal bupivacaine Fentanyl, Dexmedetomidine

INTRODUCTION

While general, neuroaxial, or local anesthesia can be used for lower limb surgeries, the block of neuroaxial is also recommended. It is a cost-effective treatment with a rapid onset, and lower risk of infection. Post-operative analgesic treatment is necessary since post-operative pain is a substantial problem due to the short duration of action of the drugs used [1,2].It has been possible to extend analgesia while minimizing side effects by combining different types of analgesics with local anesthetics. [3].

Adjuvants have been used in spinal anesthesia to improve analgesia both during and after surgery, including opioids, α2 agonists, neostigmine, and vasoconstrictors [1, 2]. α2 agonists that target α2 receptors include clonidine and Dexmedetomidine. [4].

Dexmedetomidine is a frequently used analgesic and anesthetic. It has analgesic, sedative, and neuroprotective qualities [5]. Dexmedetomidine has been used in conjunction with other drugs to extend analgesia in subarachnoid and epidural blocks [6, 7].

Pain is commonly treated with fentanyl. In order to enhance anesthesia and analgesia, intrathecal fentanyl is usually used in conjunction with other local anesthetics. It has improved spinal anesthesia while reducing side effects associated with anesthetic drugs, such as itchiness, nausea, and vomiting [8].

In order to improve analgesia and lengthen the duration of the block, fentanyl and Dexmedetomidine have used as adjuvants to local anesthetics in a variety of situations [9, 10, 11]. Dexmedetomidine was reported to be more efficacious in one experiment including lower limb surgery [12]. Thus, the goal of this study is to determine how well intrathecal bupivacaine combined with Dexmedetomidine and fentanyl works for lower limb orthopedic procedures in terms of block strength and duration.

METHODOLOGY

Sixty patients scheduled for lower limb surgery owing to any indication were included in the trial using single blind randomization. Nonetheless, the trial was not open to individuals with concomitant conditions such untreated coagulopathy, drug addiction, allergy to the investigational medications, heart failure, neuropathy, uncontrolled hypertension, or any condition that would preclude them from receiving spinal anesthetic.

The secondary outcomes used in the study to evaluate the efficacy of two medications were the time to two-segment regression from the highest sensory level, the time from injection to Bromage III (in a blocked limb).

Thirty patients each group were randomly assigned, dividing all of the patients into two groups (A and B). For unilateral spinal anesthesia, Group B also got 2.5 ml of hyperbaric bupivacaine plus 10 µg DEX (0.5 ml) in addition to 2.5 ml of hyperbaric bupivacaine plus 25 µg fentanyl (0.5 ml).

In accordance with group assignment, intrathecal hyperbaric bupivacaine + adjuvant was administered to every patient. For an hour, blood pressure was measured every five minutes. A 27G hypodermic needle was used to examine sensory block, and a Bromage scale was used to evaluate motor block

Following surgery, each patient was kept in the post-anesthesia care unit (PACU), where they were monitored by an anesthetist who was not aware of the study's methodology. Both on the ward and in the PACU, pain was assessed using the visual analogue scale (VAS). Nalbuphine at a dose of 0.1 mg/kg was used to provide analgesia if the VAS score was higher than three. The entire dose was noted. SPSS version 26.0 was used to enter and analyze the data.

RESULTS

According to our findings, the mean duration of the surgery was 2.44 ± 0.62 and 2.14 ± 0.43 for A and B group. The mean age of the participants was 45.67 ± 5.22 and 43.5 ± 6.76, Mean BMI of the participants was 27.12 ± 3.12 and 26.9 ± 3.71 for A and B group respectively. The sociodemographic details including gender, type of surgery and ASA classification are listed in Table I.

Our findings revealed no appreciable difference between the two groups in terms of the greatest sensory level, time to attain, or time to reach Bromage III, as indicated in Table II. Table III illustrates the significant differences between the two groups' total nalbuphine dose, frequency of analgesic demand, and periods to restore analgesia.

Table. I Description of Sociodemographic Details of the Study Participants

Variable		Group B (n=30)		Group A (n=30)		P-value
Numerical Variables						
Duration of surgery (h)		2.14 ± 0.43		2.44 ± 0.62		0.09
BMI (kg/m2)		26.9 ± 3.71		27.12 ± 3.12		0.29
Age (y)		43.5 ± 6.76		45.67 ± 5.22		0.07
Categorical Variables						
Gender	Female	12	40.00	13	43.33	0.23
	Male	18	60.00	17	56.67	
Type of surgery	Lateral malleolus fracture	5	16.67	7	23.33	0.12
	Fracture of Tibia and Fibula	11	36.67	9	30.00	
	Total knee replacement	6	20.00	5	16.67	
	Fracture of femur	8	26.67	9	30.00	
ASA	ASA I	25	83.33	22	73.33	0.685
	ASA II	5	16.67	8	26.67	

Table II: Comparison of the Block Characteristics Among study Participants

Block characteristics		Group B (n = 30)		Group A (n = 30)		P-value
Highest sensory level	T4	5	16.67	4	13.33	0.521
	T5	4	13.33	6	20.00	
	T6	8	26.67	7	23.33	
	T7	5	16.67	5	16.67	
	T8	8	26.67	8	26.67	
Time taken to reach the highest sensory level (min)		5.22 ± 0.23		6.14 ± 1.32		0.091
Time taken to two-segment regression (min)		132.7 ± 24.6		112.82 ± 17.9		0.046
Time taken for sensory regression to S1(min)		395.23 ± 55.41		210.23 ± 34.76		0.03

Time taken to reach Bromage III (blocked side) (min)	12.12 ± 1.44	11.89 ± 1.23	0.12
Time taken to regression to Bromage 0 (blocked side) (min)	356.23 ± 42.2	225.554 ± 35.76	0.01

Table III: Comparison of the Analgesic Requirements

Analgesic requirement	Group B (n = 30)	Group A (n = 30)	P-value
Time taken to Rescue Analgesia (min)	390.24 ± 55.8	295.93 ± 42.31	0.02
Total Nalbuphine (mg) used per 24 h	12.22 ± 2.43	15.45 ± 3.1	0.045
Frequency of Rescue Analgesia (per 24 h)	2.23 ± 1.11	2.82± 0.65	0.23

DISCUSSION

Comparing fentanyl's effectiveness in terms of the requirement for analgesic rescue after surgery was the aim of the current investigation. Gupta et al. and Rahimzadeh et al. conducted studies evaluating intrathecal DEX 5 µg and fentanyl 25 µg as adjuvants to bupivacaine in patients scheduled for lower leg and lower abdomen surgeries, respectively. Consistency is shown in these studies [13, 14]. In a Mostafa et al. study, the combination of DEX 5 µg and magnesium sulfate 50 mg for postoperative analgesia and stress response following cesarean delivery resulted in considerably lower VAS ratings compared to the group that received magnesium sulfate alone.

Additionally, compared to individuals receiving magnesium Sulphate, a greater number of patients in the DEX group required a second dose of analgesia, and Group D had a noticeably longer period between the initial requests for postoperative analgesia. [15].

Mazy et al. examined the efficacy of DEX + fentanyl in comparison to DEX alone as adjuvants to bupivacaine in patients enduring longer-than-4-hour orthopedic procedures. They found that there were no significant variations in the VAS scores between the two groups [16].

Yektaş and Belli examined the effects of intrathecal hyperbaric bupivacaine combined with 2 µg and 4 µg of DEX on spinal anesthesia in individuals having elective inguinal hernia surgery. It was discovered that the group receiving 4 µg experienced a greater mean time to pain onset compared to the other group. [17].

In orthopedic patients undergoing lower limb surgeries, Rai and Bhutia discovered that 5 µg DEX was more efficient than 3 µg under spinal anesthesia [18]. Taher-Baneh et al. report that a study of patients undergoing unilateral spinal anesthesia for elective calf surgery revealed that the amount of meperidine used in both groups' 24-hour pain management regimens as a rescue medication was equal and did not significantly differ. [19].

In contrast to these results, Rahimzadeh and colleagues found that patients receiving fentanyl had significantly higher reductions in SBP and DBP than patients receiving DEX. They surmised that the differences in these outcomes were caused by the drug response of each individual, their demographic profile, and the volume of intrathecal injected anesthetia [6]. In comparison to DEX 5 µg, Kalbande et al. found that fentanyl 25 µg caused significantly bigger and steeper decreases in HR, SBP, and DBP [20].

Our results showed that there was no statistically significant difference in the highest sensory level, the time it took to achieve Bromage III on the blocked side, or the time it took to reach the highest sensory level between the two groups depending on block characteristics.

These differences were statistically significant.

Furthermore, intrathecal DEX 5μg delayed the time to the first analgesic request and increased the durations of both sensory and motor block, as well as expedited their onsets, according to the meta-analysis of Liu et al. [21].

Contrary to the results of this study, Taher-Baneh et al. found that intrathecal fentanyl 5μg improved the quality and duration of sensory and motor block in the dependent limb more than DEX5μg [11]. DEX induces a hypnotic state similar to that of ordinary sleep by activating neurotransmitters that block the descending noradrenergic inhibitory circuit, hence reducing histamine [16].

CONCLUSION

Our study has concluded that out of the two choices in the study , the intrathecal Dexmedetomidine (10 μg) seems works better to achieve desired outcomes as an alternative to fentanyl (25 μg) in lower limb surgeries having least side effects and improved post-operative analgesia.

CONFLICT

The authors declared no any conflict of interest.

FUNDING

There was no any funding involved

PERMISSION

It was taken

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