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Original Article

Comparing the efficacy of Dexmedetomidine versus Fentanyl adjutants in lower limb orthopedic surgeries

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ABSTRACT

Objective: *to compare the effectiveness of dexmedetomidine versus fentanyl as adjuvants to hyperbaric bupivacaine surgeries of lower limb orthopedic.*

Methods: *This randomized controlled trial, approved by the committee of ethics Ghulam Muhammad Mahar Medical College, Sukkur, Pakistan, began patient enrollment in May 2023 and concluded in April 2024. Main outcomes of the study were rescue analgesia time and secondary outcomes include total consumption of nalbuphine in twenty-four hours and VAS score at 1, 6, 12 and 24 hours.*

Results: *Rescue analgesia time in dexmedetomidine was greater than fentanyl, 422.44±14.63 minutes and 311.39±7.86, respectively (p<0.001). The average total nalbuphine was lower in Group D as compared to the Group F, 7.88±1.84 mg/24 hours and 18.72±2.91 mg/24 hours, respectively (p<0.001). Whereas the frequency of rescue analgesia in Group D was lower than the Group F, 2.22±0.43 /24 hours and 3.72±0.46 /24 hours, respectively (p<0.001). Comparison of VAS score was significant at 6 and at 12 hours, (p<0.001).*

Conclusion: *The study findings indicate that intrathecal administration of dexmedetomidine is a promising alternative to fentanyl as an adjuvant in unilateral spinal anesthesia.*

Keywords: *Dexmedetomidine, Fentanyl, Orthopedic surgery, Rescue analgesia, Pain*

1. INTRODUCTION

Spinal anesthesia in low volume and doses anesthetics is best choice for lower limb surgeries[1]. It is associated with reduced incidence of hemodynamic instability and more beneficial in old age patients, helps in fast recovery and inhibits the unessential contralateral limb paralysis[2]. However, sensory and motor blockade and onset of action is slower as compare to bilateral spinal anesthesia[3].

Adjuvant medication with local anesthetic is trending now, as many drugs have ability to improve quality and effect of spinal anesthesia in adjuvant form[4]. Opioid drugs like sufantanil, morphine and fentanyl can increase block duration and analgesia. α2 adrenergic agonists, including dexmedetomidine (DEX) and clonidine, can provide additional analgesia and sedation while reducing the required dose of local anesthetics[5]. Additionally, magnesium sulfate, midazolam, ketamine and neostigmine, can also be used to enhance the effects of spinal anesthesia, contributing to better pain management and overall effectiveness of the anesthetic block[6].

Fentanyl, a highly potent synthetic opioid, stands out for its lipophilic nature, leading to a rapid onset and short half-life[7]. Despite its strength, fentanyl carries a minimal risk of causing respiratory depression. It is commonly used as an adjuvant in regional anesthesia due to its effectiveness[8]. When administered intravenously, fentanyl provides significant pain relief while maintaining the function of dorsal root axons and the integrity of somatosensory evoked potentials[9]. Moreover, fentanyl does not interfere with nociceptive afferent input from A and C fibers, ensuring targeted pain relief without compromising sensory pathways[10].

Dexmedetomidine (DEX) acts as an agonist for α2-adrenergic receptors in both the peripheral and central nervous systems[11]. When administered intrathecally, α2-adrenoceptor agonists like DEX produce analgesic effects primarily by inhibiting neurotransmitter release from C-fibers and causing hyperpolarization of postsynaptic neurons in the spinal cord's dorsal horn[12]. Activation of these α2 receptors in the brain and spinal cord suppresses neuronal firing, leading to physiological responses such as hypotension, bradycardia, sedation, and enhanced analgesia[13].

This study offers valuable contribution into optimizing unilateral spinal anesthesia for lower limb surgery by comparing the effects of adding DEX versus fentanyl to bupivacaine. These findings can help clinicians enhance postoperative pain management while reducing medication use and minimizing adverse effects.

2. METHODOLOGY

This randomized controlled trial, approved by the committee of ethics Ghulam Muhammad Mahar Medical College, Sukkur, Pakistan, began patient enrollment in May 2023 and concluded in April 2024. Main outcomes of the study were rescue analgesia time and secondary outcomes include total consumption of nalbuphine in twenty-four hours and VAS score at 1, 6, 12 and 24 hours.

After taking consent patients a total of 26 patients having age 21-56 years, both gender, ASA status I, II, and planned for elective orthopedic lower limb surgery. Patients with BMI above 35 kg/m^2, heart failure, coagulation disorder, uncontrolled diabetes and hypertension, hypersensitivity to study drugs and who refuse to give consent were excluded.

Randomization of patients was done by randomly in group D and group F. Patients in group D were given 10µg (0.5ml) dexmedetomidine as adjuvant in bupivacaine 2.5 ml, in other group F fentanyl 25µg (0.5ml) in bupivacaine 2.5

ml. All medication was delivered by an anesthesiologist having 5 years' experience in anesthesia and is unknown to study drugs. SPSS version 27.1 was used for data analysis. Test of significance were t test and chi squre test with significant p value of 0.05 or below.

3. RESULTS

A total of 36 patients, were included in our study. In both the groups, equal numbers of patients were included as 18 (50.0%) in each. The mean age, gender, BMI, ASA status, surgical time were almost equal, in Group D and Group F, (p>0.050). (Table. 1).

Type of surgery was depicted in figure. I. Pott`s fracture was the most common surgery type in Group D 5 (27.7%) whereas total knee replacement was the most common type of surgery in Group F 5 (27.7%), (p>0.050). (Figure. 1).

The comparison of requirement of analgesia was shown in table. 2. The mean time to rescue analgesia in Group D was greater than the Group F, 422.44±14.63 minutes and 311.39±7.86, respectively. (p<0.001). The average total nalbuphine was lower in Group D as compared to the Group F, 7.88±1.84 mg/24 hours and 18.72±2.91 mg/24 hours, respectively. (p<0.001). Whereas the frequency of rescue analgesia in Group D was lower than the Group F, 2.22±0.43 /24 hours and 3.72±0.46 /24 hours, respectively. (p<0.001). (Table. 2). Comparison of VAS score was significant at 6 and at 12 hours, (p<0.001). (Table. 3).

Table-1: Basic characteristics of study

Variable	Group D	Group F	p-value
Age (years)	40.56±5.38	42.72±5.61	0.928
BMI (kg/m^2)	26.77±1.39	27.39±1.68	0.244
Gender			
Male	8 (44.4)	11 (61.1)	0.317
Female	10 (55.6)	7 (38.9)	
ASA			
I	14 (77.8)	15 (83.3)	0.674
II	4 (22.2)	3 (16.7)	
Duration of surgery (hours)	3.51±0.68	3.33±0.63	0.449
Mean±S.D, N (%)			

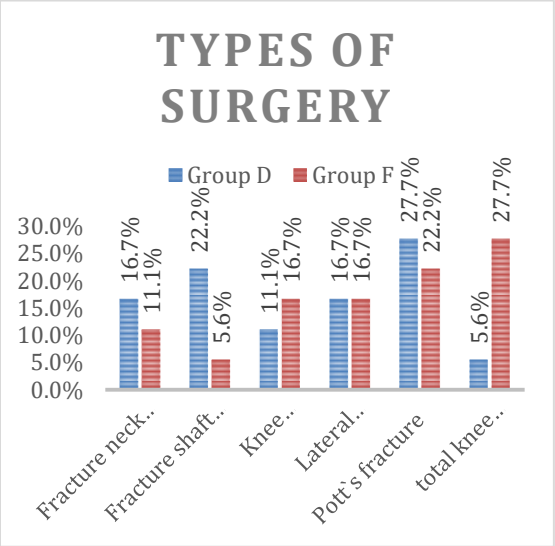
Table. 2: Comparison of analgesic requirement

Requirement of analgesia	Group D	Group F	p-value
Time to rescue analgesia (minutes)	422.44±14.63	311.39±7.86	<0.001
Total nalbuphine (mg) / 24 hours	7.88±1.84	18.72±2.91	<0.001
Frequency of rescue analgesia / 24 hours	2.22±0.43	3.72±0.46	<0.001
Mean±S.D			

Table-3: Comparison of post operative VAS score

Post operative VAS score	Group D	Group F	p-value
At 1 hour	2.07±1.66	2.09±0.26	0.823
At 6 hours	4.78±0.36	3.39±0.74	<0.001
At 12 hours	3.13±0.41	4.48±1.05	<0.001
At 24 hours	3.35±0.63	3.75±0.64	0.069
Mean±S.D			

Figure. 1



4. DISCUSSION

Agonists of alpha 2 adrenergic receptors or opioids are most commonly using adjuvants to intrathecal short acting local anesthesia agents to increase spinal anesthesia duration and quality of anesthesia drug. Dexmedetomidine or Fentanyl are common α2 agonists utilized agents[14]. In this research it was reported that dexmedetomidine prolong the time to rescue analgesia significantly when compared with fentanyl. Furthermore, total

nalbuphine dose and frequency for pain after surgery was also less significantly in dexmedetomidine group as compare to fentanyl.

Study by Ghaly et al,[15] reported that patients who received dexmedetomidine had longer of rescue analgesia time then fentanyl. Rescue analgesia duration was 295.93 ± 36.72 minutes in fentanyl group and 409.63 ± 74.60 minutes in the dexmedetomidine group (P = 0.000).

These findings align with the outcomes observed in studies conducted by Gupta et al[16] and Rahimzadeh et al.,[17] and compared the use of 5 µg intrathecal dexmedetomidine and 25 µg fentanyl as addition to bupivacaine in patients undergoing lower abdominal surgeries and lower limb surgeries, respectively.

Rescue analgesia time was much prolong in dexmedetomidine group and VAS score was also better as compared to fentanyl in present study. This finding aligns with the results of Mostafa et al.,[18] who observed that VAS scores were notably lower in the group receiving intrathecal DEX 5 µg compared to the group receiving $MgSo^4$ 50mg for pain control after surgical intervdention and to managr stress following cesarean delivery.

Yektaş et al[19] examined the impact of combining 4µg and 2µg of dexmedetomidine with hyperbaric intrathecal bupivacaine for cases of inguinal hernia repair under spinal anesthesia. They observed that the group receiving 4 µg experienced a longer mean time to the onset of pain. Similarly, Rai et al[20] reported that in orthopedic patients undergoing lower limb surgeries, the addition of 5 µg of DEX to spinal anesthesia was more effective in extending the time to rescue analgesia compared to 3 µg.

Another study by Taher-Baneh et al[21] reported that calf surgeries which were planned for elective procedure under spinal anesthesia required minimum amount of rescue analgesia for relief of pain for 24 hours in both dexmedetomidine and fentanyl group were same, as there was not minimum difference.

5. CONCLUSION

The study findings indicate that intrathecal administration of dexmedetomidine is a promising alternative to fentanyl as an adjuvant in unilateral spinal anesthesia. This approach provides superior postoperative analgesia and is associated with fewer side effects.

6. REFERENCES

1. Akbari GA, Erdi AM, Asri FN. Comparison of Fentanyl plus different doses of dexamethasone with Fentanyl alone on postoperative pain, nausea, and vomiting after lower extremity orthopedic surgery. European Journal of Translational Myology. 2022 Jul 7;32(2):10397.
2. Xiong C, Han CP, Zhao D, Tang ZH, Zhang YF, Wang J. Comparing the effects of dexmedetomidine and dexamethasone as perineural adjuvants on peripheral nerve block: A PRISMA-compliant systematic review and meta-analysis. Medicine. 2021 Aug 27;100(34):e27064.
3. Hashemi N, Modir H, Moshiri E, Moradi AH, Almasi-Hashiani A. Effects of adding dexmedetomidine, fentanyl, and verapamil to 0.5% ropivacaine on onset and duration of sensory and motor block in forearm surgeries: a randomized controlled trial. Medical Gas Research. 2021 Apr 1;11(2):47-52.
4. Dalal ST, Ninave S. Postsurgical analgesic efficacy of epidural nalbuphine in lower abdominal surgeries. J Evolution Med Dent

Sci. 2020 Jan 27;9(04):216-2.
5. Shukla P, Anand S, Chaurasia RC, Loha S, Yadav G. Section: Anesthesiology. Int J Acad Med Pharm. 2024;6(1):1269-74.
6. Batham NS, Hardia H, Sahoo T, Jain A, Agrawal A. To study and compare the effect of fentanyl and dexmedetomidine in epidural anesthesia in lower limb orthopedic surgeries when given as an adjuvant to 0.5% bupivacaine. Int J Acad Med Pharm. 2023;5(2):1340-6.
7. Shin HJ, Woo Nam S, Kim H, Yim S, Han SH, Hwang JW et al. Postoperative delirium after dexmedetomidine versus propofol sedation in healthy older adults undergoing orthopedic lower limb surgery with spinal anesthesia: a randomized controlled trial. Anesthesiology. 2023 Feb 1;138(2):164-71.
8. Fatima N, Kumar A, Sarfraz M, Akhtar MK, Kumar B. Comparative Study of Dexmedetomidine and Fentanyl for Epidural Analgesia in Lower Limb Orthopaedic Surgeries. European Journal of Cardiovascular Medicine. 2023 Jul 1;13(3):1593-1599.
9. Tawadros SI, Abd El Mageed AM, El WA, Salama MG, Amin AM. Dexmedetomidine vs. fentanyl as adjuvants to hyperbaric bupivacaine for unilateral spinal anesthesia in lower limb orthopedic surgeries: a randomized trial. Anaesthesia, Pain & Intensive Care. 2023 Jun 7;27(4):456-63.
10. Kumar P, Chawla D, Kaur S, Bindra TK, Gupta A, Garg S. To compare the effects of intrathecaldexmedetomidine and fentanyl as anadjuvant to ropivacaine in orthopaedic lower limb surgeries. Int J Med Res Pharm Sci. 2020;7(3):1-0.
11. Agrawal D, Sinha N, Singh SK. Comparison of intrathecal dexmedetomidine and intrathecal fentanyl as an adjuvant to bupivacaine during spinal anaesthesia for lower limb orthopedic surgery. Asian Journal of Medical Sciences. 2023 Jun 1;14(6):57-62.
12. Sharma GV. Comparative study of dexmedetomidine and fentanyl as an adjuvant to bupivacaine for epidural Anaesthesia in lower limb Orthopedic surgeries. IJMA. 2020;3(2):111-4.
13. Saiyad JH, Patel SK, Patel US. A comparison of dexmedetomidine and fentanyl as an adjuvant to intrathecal hyperbaric bupivacaine in elective lower limb surgeries. National Journal of Medical Research. 2021 Dec 31;11(04):125-30.
14. Makhni R, Attri JP, Jain P, Chatrath V. Comparison of Dexmedetomidine and Magnesium Sulfate as Adjuvants with Ropivacaine for Spinal Anesthesia in Infraumbilical Surgeries and Postoperative 2017;11(1):206-210.
15. Ghaly SI, Shafik AM, AlTaher WAMM, Motawashleh MG, Alansary AM. Dexmedetomidine vs. fentanyl as adjuvants to hyperbaric bupivacaine for unilateral spinal anesthesia in lower limb orthopedic surgeries: a randomized trial.Anaesth. pain intensive care 2023;27(4):456−463.
16. Gupta R, Verma R, Bogra J, Kohli M, Raman R, Kushwaha JK. A Comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to Bupivacaine. J Anaesthesiol Clin Pharmacol. 2011;27(3):339-343.
17. Rahimzadeh P, Faiz SHR, Imani F, Derakhshan P, Amniati S. Comparative addition of

dexmedetomidine and fentanyl to intrathecal bupivacaine in orthopedic procedure in lower limbs. BMC Anesthesiol. 2018;18(1):62.

18. Mostafa MF, Herdan R, Fathy GM, Hassan ZEAZ, Galal H, Talaat A, Ibrahim AK. Intrathecal dexmedetomidine versus magnesium sulfate for postoperative analgesia and stress response after cesarean delivery; randomized controlled double-blind study. Eur J Pain. 2020;24(1):182-191.

19. Yektaş A, Belli E. The effects of 2 µg and 4 µg doses of dexmedetomidine in combination with intrathecal hyperbaric bupivacaine on spinal anesthesia and its postoperative analgesic characteristics. Pain Res Manag. 2014;19(2):75 81.

20. 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. 2017;11(4):UC09-UC12.

21. Taher-Baneh N, Ghadamie N, Sarshivi F, Sahraie R, Nasseri K. Comparison of fentanyl and dexmedetomidine as an adjuvant to bupivacaine for unilateral spinal anesthesia in lower limb surgery: a randomized trial. Braz J Anesthesiol. 2019;69(4):369 376.