Effect of dexmedetomidine and fentanyl on hemodynamic changes and block profile following spinal anesthesia with ropivacaine among patients with femoral fractures undergoing lower limb surgery

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Abstract

The aim of this study was to compare the effect of dexmedetomidine and fentanyl on hemodynamic changes and block characteristics following spinal anesthesia with ropivacaine among patients with femoral fractures undergoing lower limb surgery**.** In this double-blind clinical trial, 64 patients who were candidates for lower limb surgery. Patients were divided into two groups based on the block pattern. In the first group, dexmedetomidine was prescribed. In the second group, fentanyl with ropivacaine was prescribed. Sensory and motor blocks at or above the T8 dermatome in each group were measured. Furthermore, the sensory block was evaluated every 1 minute after anesthesia with a needle (pin prick method) and also the motor block was evaluated every 5 minutes by the bromage scale. There was a statistically significant difference between the two groups in terms of the time for achieving sensory block to T8 or higher dermatome ($p = 0.0001$). The time elapsed until the onset of motor block was shorter in the dexmedetomidine group, and dexmedetomidine had a shorter time for achieving sensory block to T8 or higher dermatome than fentanyl. A statistically significant difference was found in terms of the time elapsed until the motor block and the time for achieving sensory block to the T8 dermatome or higher ($p <0.05$). The time elapsed until the onset of motor block was shorter in the dexmedetomidine group, and dexmedetomidine had a shorter time for achieving sensory block to T8 or higher dermatome than fentanyl. Our findings revealed a statistically significant difference in terms of the duration of sensory block for reaching the T12 to L1 dermatome and the duration of obtaining bromide scores 0 and 1 ($p = 0.0001$). The time for achieving sensory block to dermatome T12 to L1 and the time of obtaining bromage scales of 0 and 1 were longer in dexmedetomidine group ($p = 0.0001$). Pain in dexmedetomidine group was less than fentanyl group in 2 to 8 hours after surgery ($p <0.05$). The duration of analgesia was longer in the dexmedetomidine group ($p = 0.001$). In summary, it can be suggested that adding dexmedetomidine to the anesthetic ropivacaine may be beneficial.

Key Words: Dexmedetomidine; fentanyl; ropivacaine; spinal; hemodynamic changes; block characteristics.

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Regional anesthesia or conduction anesthesia is a common method of anesthesia in which only part of the body intended for surgery is anesthetized.[1,2] Spinal anesthesia with spinal nerve block is performed in the subarachnoid space by anesthetic solution as introduced in 1898 by Bier.[3] This method has advantages such as rapid onset of action, less discomfort for the patient, lower dose of the required drug and optimal sensory and motor block.[1,4] Dual alpha (2)-adrenergic agonist receptors in the spinal cord improve postoperative pain. Both dexmedetomidine and fentanyl are effective in this area. There are different types of these two drugs, such as oral, spinal, epidural, which increase the duration of anesthesia of the spinal block.[5] Dexmedetomidine is an Alpha-2 Adrenergic Agonists, the infusion of which reduces heart rate, systemic vascular resistance, and

blood pressure. It helps to stabilize the patient's hemodynamic status and has a strong anesthetic and analgesic effect, result in the reduction of the need for opioids and their complications, leading reductio of the stress response and improvement of the quality of recovery.[6,7] The analgesic effects of dexmedetomidine appear to be due to the activation of alpha2-adrenergic receptor at the posterior horn surface of the spinal cord and the inhibitory effect on the release of substance P.[8]
Fentanyl is 75 to 125 times more potent than morphine and is used for analgesia and anesthesia in a variety of ways. The faster onset of action of fentanyl than morphine indicates its higher fat solubility, which facilitates its passage through the blood–brain barrier (BBB).[9]
In 2016, Andersen et al. [10] reported that dexmedetomidine had greater analgesia in the postoperative period and longer duration of sensory and motor block with minimal side effects. Studies on the effect of adding dexmedetomidine on ropivacainehave shown that dexmedetomidine was capable of increasing the duration of the block and speeding up the onset of the block.[11]
Jagtap et al. (2014)[12] and Chaudhary et al. (2014)[13] stated that fentanyl could increase the duration of motor block in patients. Ropivacaine is short acting agent and has a short onset effect like lidocaine, but the side effects of lidocaine such as horsetail syndrome have not been seen in ropivacaine, so its use is increasing day by day. On the other hand, its onset of action is shorter than bupivacaine and is very important in anesthesia.[1] Ravipati et al. conducted a study comparing dexmedetomidine and fentanyl with ropivacaine in lower limb surgery,[9] where high doses of dexmedetomidine were used. In our study, this dose was reduced and we were looking for the drug with the lowest dose and maximum effect. If a drug can be found with minimal hemodynamic changes and increased duration of block and pain, it can be used to reduce pain and create more stable conditions during anesthesia in the operating room. On the other hand, by adding adjuvant to ropivacaine, in addition to starting its good effect by using these two drugs, we also aimed to achieve a suitable and good effect length and to provide better analgesia for patients.
Therefore, we decided to conduct a study comparing the effects of dexmedetomidine and fentanyl on hemodynamic changes and block characteristics in spinal anesthesia with pivocaine in lower limb orthopedic surgery.

Materials and Methods

In this double-blind clinical trial study, 64 patients who were candidates with femoral fractures undergoing lower limb surgery were selected in Valiasr Hospital of Arak. After obtaining informed written consent and having inclusion criteria, they were included in the study. Inclusion criteria included: 18-60 years old, American Society of Anesthesiologists. (ASA) class of I and II, patients of both sexes, candidates for orthopedic lower extremity surgery, patient refuses to perform spinal anesthesia, failure to perform spinal anesthesia, no history of using beta-blockers and alpha-2 agonists and calcium channel blockers, no cardiovascular problems, no pregnancy, no coagulation disorders, no local infection in the spinal area, no history of allergy to dexmedetomidine and fentanyl and ropivacaine, no arrhythmia, lack of mental and psychological problems, lack of peripheral and central neuropathy. Exclusion criteria were patient dissatisfaction, failure of the block, surgeries of more than 120 minutes, patients who developed cardio-respiratory arrest during the operation. All patients were hospitalized for at least one day before surgery and fasted for 8 hours.
After recording the demographic information, two venous routes were installed in different places, one for injecting the studied drugs and the other for prescribing serum and other drugs. Before performing the procedure, the number of heart rate and mean arterial blood pressure (by NIBP) (non-invasive monitoring of arterial blood pressure) and arterial blood oxygen saturation were measured. In all patients upon arrival in the operating room, 10 mL/kg Crystalloid serum (Ringer) was administered in supine position. After receiving serum and recording basic vital signs, patients were divided into two groups based on a pattern block of 0.5 (Molten, Italy). In the first group, dexmedetomidine (5 micrograms with ropivacaine (3-4 cc; 15-20 mg) (D) was prescribed (Hospira, USA). In the second group, fentanyl (F) in the amount of 20 micrograms with ropivacaine was prescribed (3-4 mL; 15-20 mg) by spinal method in the L3-L4 or L4.
In the first 15 minutes, mean arterial blood pressure, heart rate and oxygen saturation percentage were recorded

Table 1. *Comparison of mean and standard deviation of sensory block in the two groups.*

Group Sensory block	Dexmedetomidine SD ±Mean	Fentanyl SD ±Mean	P value
Time elapsed until sensory block begins (minutes)	1.25±0.567	1.59±0.910	0.07
Time to reach the sensory block to the T8 or higher dermatome	5.43±3.13	9.71±3.93	0.0001

every 5 minutes for both groups, and then at 30, 60, 45, and 90 minutes in the operating room and in recovery by anesthesia resident (hypotension < 20%; bradycardia < 45 beats per minute, and oxygen saturation < 92%). If the conditions were stable, appropriate treatment was performed and recorded.[11]

Sensory and motor blocks at or above the T8 dermatome in each group were measured and recorded by an anesthesia specialist. The sensory block was evaluated every 1 minute after anesthesia with a needle (pin prick method) and also the motor block was evaluated every 5 minutes by the bromage scale.[10]

Pain was measured based on VAS scale in recovery and at 2, 4 and 8 hours after surgery by an anesthesia specialist. In this scale, the number zero indicates the lowest value and 10 indicates the highest value. Patients were given 0.5 (mg/kg /IM) pethidine (meperidine) if VAS was > 3 at any time after surgery, and the total amount of drug administration and time of administration were recorded.[14] Besides, in addition to recording the bromage scales of 0 and 1, the times for sensory block to achieve T12 and L1 dermatome levels were recorded. If there was complication such as nausea, vomiting, wavering, bradycardia, hypotension, and dizziness, all were recorded. Appropriate treatment was performed according to the severity of the complication.

For conducting a double-blind study, the data were measured and recorded by an anesthesia specialist who was unaware of the groupings. Preparation of drugs in each group was done by an anesthesiologist. A specialist performed a spinal block who was unaware of the medications in each syringe. Then the data were analyzed by Statistical Package for the Social Sciences (SPSS) software version 20.

Results

In this double-blind clinical trial, 64 patients who were candidates for orthopedic femoral surgery in the lower extremity under spinal anesthesia were randomly divided into two groups including dexmedetomidine and fentanyl. The minimum age was 18 years and the maximum was 60 years. The mean total age was 49.64±13.6136 years. In general, study population consisted of 27 (42.2%) females and 37 (57.8%) males. The duration of surgery and the percentage of oxygen saturation and heart rate were not statistically significant between the two groups ($p<0.05$) (Figure 1). The mean duration of surgery was 115.23±11.14 minutes.

Based on the data presented in the Table 1, a statistically significant difference was found between the two groups in terms of blood pressure from 45 to 120 minutes after the start of surgery ($p <0.05$). Blood pressure was lower in the dexmedetomidine group than in the fentanyl group. According to the results of the two groups, no statistically significant difference was found in the time elapsed from application of spinal anesthesia, until the sensory block ($p = 0.07$). There was a statistically significant difference between the two groups in terms of the time for achieving sensory block to T8 or higher dermatome ($p = 0.0001$). The time of getting to the T8 or higher dermatome was also found to be shorter in the dexmedetomidine group than in fentanyl.

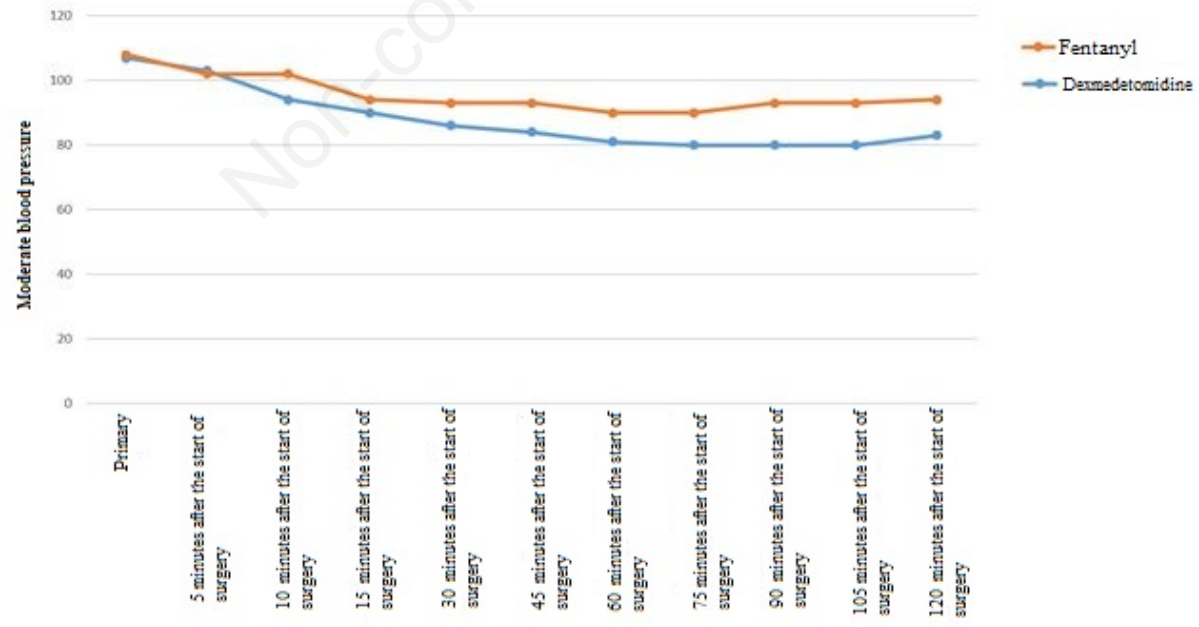

Fig 1. *Comparison of mean and standard deviation of blood pressure in the two groups.*

Table 2. *Comparison of mean and standard deviation of motor block in the two groups.*

Variable Motion block	Dexmedetomidine SD ±Mean	Fentanyl SD ±Mean	P value
Time elapsed until the start of the movement block (minutes)	2.15±1.48	3.03±1.75	035/0
Time to reach the motor block up to the T8 dermatome or higher	6.12±4.32	9.43±5.61	01/0

A statistically significant difference was found in terms of the time elapsed until the motor block and the time for achieving sensory block to the T8 dermatome or higher ($p < 0.05$). The time elapsed until the onset of motor block was shorter in the dexmedetomidine group, and dexmedetomidine had a shorter time for achieving sensory block to T8 or higher dermatome than fentanyl (Table 2).

Our findings revealed a statistically significant difference in terms of the duration of sensory block for reaching the T12 to L1 dermatome and the duration of obtaining bromide scores 0 and 1 ($p = 0.0001$). The time for achieving sensory block to dermatome T12 to L1 and the time of obtaining bromage scales of 0 and 1 were longer in dexmedetomidine group (Table 3).

According to the results, there was a statistically significant difference between the two groups in terms of pain 2 to 8 hours after surgery ($p < 0.05$).

No statistically significant difference was found between the two groups in terms of drug use during 24 hours ($p = 0.297$) (Table 4).

Furthermore, a statistically significant difference was found between the two groups in terms of duration of analgesia ($p = 0.001$). The duration of analgesia was longer in the dexmedetomidine group (Table 4).

Discussion

In this double-blind clinical trial, 64 patients, who were candidates with femoral fractures undergoing lower limb surgery, were randomly divided into two groups including dexmedetomidine and fentanyl. There was no statistically significant difference between the two groups in terms of heart rate, oxygen saturation percentage, duration of surgery and average drug consumption, time elapsed until sensory block ($p < 0.05$). The time for achieving sensory block to T8 or higher dermatome in the dexmedetomidine group was shorter than fentanyl ($p = 0.0001$). The time elapsed until the onset of motor block was found to be shorter in the dexmedetomidine group and dexmedetomidine had a shorter time for achieving sensory block to T8 or higher dermatome, when compared with fentanyl ($p < 0.05$). The duration of sensory block for reaching the T12 to L1 dermatome and the duration of obtaining bromide scores of 0 and 1 were longer in the dexmedetomidine group ($p = 0.0001$). Pain in dexmedetomidine group was less than fentanyl group in 2 to 8 hours after surgery ($p < 0.05$).

The duration of analgesia was longer in the dexmedetomidine group ($p = 0.001$). In general, pain, time elapsed to the onset of motor and sensory block, time for achieving motor block to T8 dermatome were also found to be less in dexmedetomidine group. The time for achieving sensory block to T12 and L1 dermatomes and the time of obtaining bromage scales (0 and 1) was found to be longer in dexmedetomidine group. Dexmedetomidine helps to stabilize the patient's hemodynamic status and has a strong anesthetic and analgesic effect that reduces the need for opioids, their complications and the stress response, while is able to improve the quality of recovery.[7] The analgesic effects of dexmedetomidine appear to be due to the activation of alpha2 adrenergic receptors on the posterior horn surface of the spinal cord and the inhibitory effect on the release of substance P.[8] Radbin et al.[6] administered a combination of Ketamine with bupivacaine epidurally for pain management in femoral fractures. They stated that the effect of dexmedetomidine was greater than that of ketamine, where it was capable of the prolonging

Table 3. *Comparison of mean and standard deviation of block quality in the two groups.*

Group Block quality	Dexmedetomidine SD ±Mean	fentanyl SD ±Mean	P value
Duration of sensory block reaching dermatome T12 to L1	207.00±22.96	171.12±40.85	0001/0
Time to get Bromide score 0 and 1	201.15±24.19	169.84±40.02	0001/0

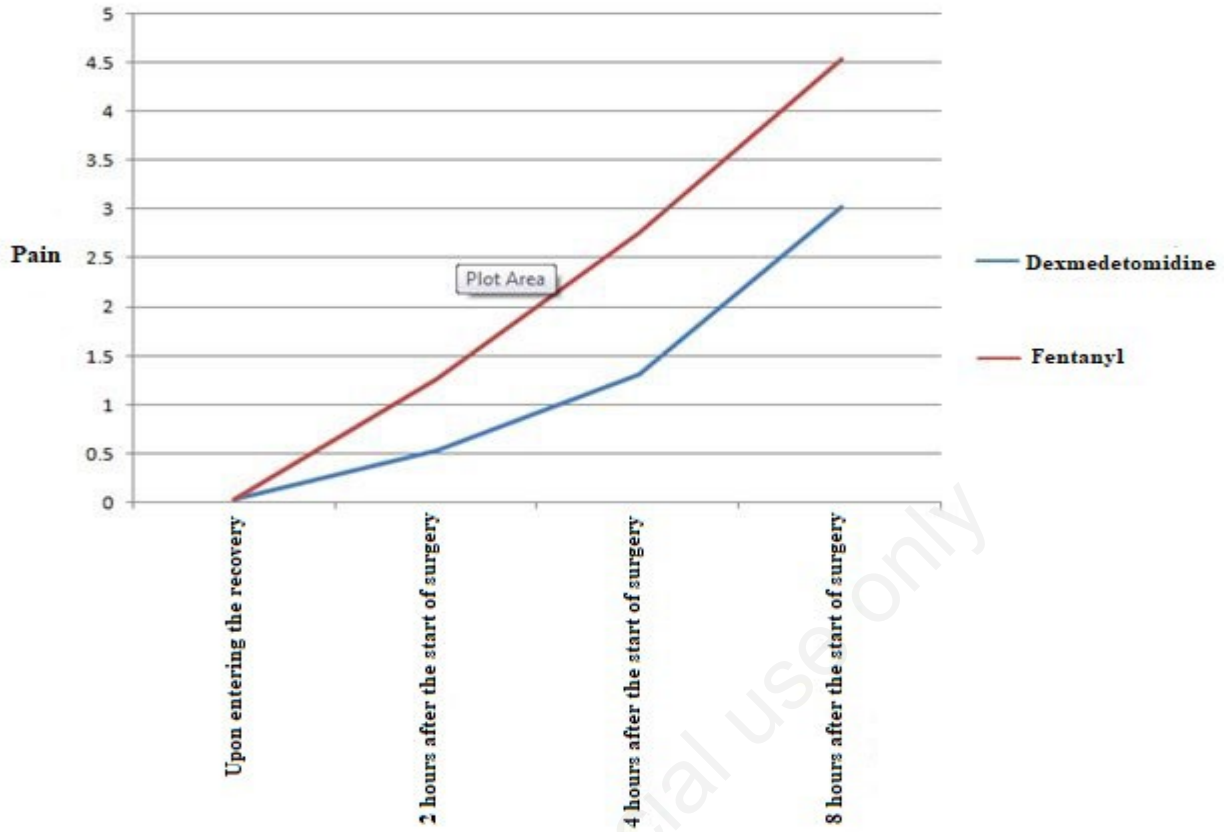

Fig 2. *Comparison of mean pain in the two groups.*

analgesia. Despite the differences in the drugs used and the type of analgesia, their results were in consistent with our study and the duration of analgesia was found to be longer in the dexmedetomidine group. Taher-Baneh et al. performed spinal anesthesia in lower limb surgery, where the duration of sensory and motor block was high in the dexmedetomidine and fentanyl groups, and pain was also reduced in both groups, although fentanyl was more effective than dexmedetomidine.[7]

In our study, dexmedetomidine was more effective, which could be due to the dose of fentanyl. 20 µg of fentanyl was given in our study while Taher-Baneh et al. prescribed 25 µg of fentanyl with bupivacaine. Rahimzadeh et al. reported that dexmedetomidine was capable of increasing the duration of sensory, motor block, and the duration of analgesia, and reducing pain.[8] Our results are in line with those study. Kamali et al., 2018 evaluated the tramadol and dexmedetomidine for postoperative pain with spinal anesthesia. They stated that there was no difference between tramadol and dexmedetomidine and both were more effective than placebo in managing pain.[15] Their results were different from our study, which could be due to differences in the drugs used in the two studies.

A study by Andersen et al., 2017, assessed the effective mechanism of dexmedetomidine when added to ropivacaine as an adjuvant. They indicated that dexmedetomidine was capable of increasing block duration.[10] The results of our study were consistent with Andersen et al. (2017)[10] and Ravipati et al. (2017)[9] showed a study to compare dexmedetomidine and fentanyl with ropivacaine in lower limb surgery. They stated that dexmedetomidine increases the duration of block and early onset of sensory and motor block, where

Table 4. *Comparison of mean and standard deviation of drug use and analgesia duration in the two groups.*

Group Variable	Dexmedetomidine SD ±Mean	Fentanyl SD ±Mean	P value
Drug use (mg)	7.37±3.12	9.15±5.31	297/0
Drug use (mg)	7.61±1.20	6.00±2.22	001/0

there was no need for sedation during surgery.[9] The results of Ravipati et al.'s study were consistent with our study. The time for achieving sensory block to the T12 and L1 dermatome levels and the time of obtaining bromage scales of 0 and 1 were longer in dexmedetomidine group.

In other research by Hu X et al., (2016)[14] aimed at adding dexmedetomidine to a mixture of lidocaine and ropivacaine to increase block duration. They showed that the addition of dexmedetomidine to lidocaine and ropivacaine increased the duration of sensory and motor blocks and accelerated them.[14] The results of abovementioned study were consistent with our study. In another study by Sharma et al., 2016, evaluated the effect of adding dexmedetomidine to ropivacaine 0.2% for femoral block. They stated that the addition of dexmedetomidine was able to increase the duration of postoperative analgesia and the duration of the block.[16] The findings of the study by Sharma et al. were in line with our study. In a study by Jagtap et al. 2014, conducted a comparing ropivacaine-fentanyl and bupivacaine-fentanyl for lower extremity surgery. They stated that ropivacaine was capable of reducing the duration of motor block and that the other factors were not different in the two groups.[12] Fentanyl was also effective in our study, but the effect of dexmedetomidine was greater. Chandhuri et al., 2014 reported the effects of ropivacaine and fentanyl, where adding fentanyl to ropivacaine had the benefit of increasing the duration of motor block and did not alter hemodynamic conditions and complications.[13] Fentanyl was also found to be effective in our study, but the effect of dexmedetomidine was found to be greater.

In conclusion, based on the data presented herein, pain, time elapsed to the onset of motor and sensory block, time for achieving motor block to T8 dermatome level were found to be less in the dexmedetomidine group.

The time for achieving sensory block to T12 and L1 dermatome levels and the time of obtaining bromage scales (0 and 1) were recorded to be longer in dexmedetomidine group. Thus, it can be suggested that adding dexmedetomidine to the anesthetic ropivacaine may be beneficial.

List of acronyms

ASA - American Society of Anesthesiologists
BBB - blood–brain barrier
NIBP - non-invasive monitoring of arterial blood pressure
SPSS - Statistical Package for the Social Sciences

Contributions of Authors

All authors have read and approved the final edited typescript.

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Conflict of Interest

The authors declare no financial, personal, or other conflicts of interest.

Ethical Publication Statement

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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References

1. Miller R. Spinal, epidural and caudal anesthesia. Miller's Anesthesia. Churchill Livingstone: Elsvier; 2015:1611-2-4-5. https://aneskey.com/spinal-epidural-and-caudal-anesthesia-2/.
2. Kamali A, Zareei A, Moshiri E, Farokhi F. Comparing the Effect of Adding Ketamine and Neostigmine to Bupivacaine 0.25 % for Epidural Analgesia among Patients Candidated for Elective Femoral Fracture Surgery. International Journal of Medical Research&Health Sciences. 2016;5 (11):63-7. https://www.ijmrhs.com/abstract/.
3. Larson MD. Tait and Caglieri. The first spinal anesthetic in America. Anesthesiology. 1996 Oct;85(4):913-9. doi: 10.1097/00000542-199610000-00028.
4. Pazuki S KA, Shahrokhi N, Jamilian M. Comparison of the Effects of Intrathecal Midazolam and Tramadol with the Conventional Method of Postoperative Pain and Shivering Control after Elective Cesarean Section. Biomed Pharmacol J. 2016;9(3): 995-1003. DOI : https://dx.doi.org/10.13005/bpj/1039
5. Pankaj K, Rajan PS. Alpha 2 agonists in regional anaesthesia practice: Efficient yet safe?. Indian J Anaesth. 2014;58(6):681-683. doi:10.4103/0019-5049.147127.
6. Radbin T, Kamali A, Yazdi B, Pazouki S, Hadi H, Rakei S. Efficacy of dexmedetomidine and

ketamine addition to bupivacaine 0.25% by epidural method in reducing postoperative pain in patients undergoing femur fracture surgery. J Family Med Prim Care. 2021 Feb;10(2):832-837. doi: 10.4103/jfmpc.jfmpc_1506_20. Epub 2021 Feb 27.
7. Taher-Baneh N, Ghadamie N, Sarshivi F, Sahraie R, Nasseri K. Comparação de fentanil e dexmedetomidina como adjuvante à bupivacaína para raquianestesia unilateral em cirurgia de membros inferiores: estudo randômico [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 Jul-Aug;69(4):369-376. Portuguese. doi: 10.1016/j.bjan.2019.03.005. Epub 2019 Jul 27.
8. 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 Jun 6;18(1):62. doi: 10.1186/s12871-018-0531-7.
9. Ravipati P, Isaac GA, Reddy PN, Krishna L, Supritha T. A Comparative Study between Intrathecal Isobaric Ropivacaine 0.75% Plus Dexmedetomidine and Isobaric Ropivacaine 0.75% Plus Fentanyl for Lower Limb Surgeries. Anesth Essays Res. 2017 Jul-Sep;11(3):621-626. doi: 10.4103/0259-1162.206857.
10. Andersen JH, Grevstad U, Siegel H, Dahl JB, Mathiesen O, Jæger P. Does Dexmedetomidine Have a Perineural Mechanism of Action When Used as an Adjuvant to Ropivacaine?: A Paired, Blinded, Randomized Trial in Healthy Volunteers. Anesthesiology. 2017 Jan;126(1):66-73. doi: 10.1097/ALN.0000000000001429.
11. Giovannitti JA Jr, Thoms SM, Crawford JJ. Alpha-2 adrenergic receptor agonists: a review of current clinical applications. Anesth Prog. 2015;62(1):31-39. doi:10.2344/0003-3006-62.1.31
12. Jagtap S, Chhabra A, Dawoodi S, Jain A. Comparison of intrathecal ropivacaine-fentanyl and bupivacaine-fentanyl for major lower limb orthopaedic surgery: A randomised double-blind study. Indian J Anaesth. 2014 Jul;58(4):442-6. doi: 10.4103/0019-5049.138985.
13. Chaudhary A, Bogra J, Singh PK, Saxena S, Chandra G, Verma R. Efficacy of spinal ropivacaine versus ropivacaine with fentanyl in transurethral resection operations. Saudi J Anaesth. 2014 Jan;8(1):88-91. doi: 10.4103/1658-354X.125951.
14. Hu X, Li J, Zhou R, Wang Q, Xia F, Halaszynski T, Xu X. Dexmedetomidine Added to Local Anesthetic Mixture of Lidocaine and Ropivacaine Enhances Onset and Prolongs Duration of a Popliteal Approach to Sciatic Nerve Blockade. Clin Ther. 2017 Jan;39(1):89-97.e1. doi: 10.1016/j.clinthera.2016.11.011. Epub 2016 Dec 10.
15. Kamali A, Shokrpour M, Aminloo R, Pazuki S. Comparing the effect of adding dexmedetomidine and tramadol to lidocaine 5% in elongating the period of post-operative analgesia in spinal anesthesia. Biomed Res 2018 ; 29 (3): 454-459. https://www.alliedacademies.org/abstract/
16. Sharma B, Rupal S, Swami AC, Lata S. Effect of addition of dexmedetomidine to ropivacaine 0.2% for femoral nerve block in patients undergoing unilateral total knee replacement: A randomised double-blind study [published correction appears in Indian J Anaesth. 2016 Jul;60(7):529]. Indian J Anaesth. 2016;60(6):403-408. doi:10.4103/0019-5049.183392.

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