e-ISSN: 0975-9506, p-ISSN:2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.8.24

International Journal of Pharmaceutical Quality Assurance 2025; 16(8); 138-142

Original Research Article

Comparison of Subcutaneous Dexmedetomidine Versus Clonidine as an Adjuvant to Spinal Anaesthesia in Lower Limb Surgeries: A Randomized Double Blind Control Trial

Sabarni Sanyal[1], Debabanhi Barua[2], Sujata Dalai[3]

[1]Ex. Senior Resident, MD Anaesthesiology, Department of Anaesthesiology, Medical College Kolkata, West Bengal 700073

[2]Assistant Professor, MD, Department of Anaesthesiology, Medical College Kolkata, West Bengal 700073

[3]Professor and Head of the Department, Raiganj Government Medical College and Hospital, Raiganj, West Bengal 733134

Received: 25-06-2025 / Revised: 23-07-2025 / Accepted: 06-08-2025

Corresponding Author: Dr. Sabarni Sanyal

Conflict of interest: Nil

Abstract:

Introduction: Lower limb surgeries can be performed under local nerve block, regional anesthesia, or general anesthesia. Central neuraxial blockade is preferred due to its ease of administration, high success rates, and quick onset. Spinal anesthesia has a short duration, but adjuvants like fentanyl, morphine, and alpha2 agonists are used to prolong block duration and improve patient satisfaction.

Aims and Objective: The study aimed to compare the effectiveness of subcutaneous dexmedetomidine and subcutaneous clonidine as adjuvants to intrathecal 0.5% hyperbaric bupivacaine in spinal anaesthesia for patients undergoing elective lower limb surgeries, including orthopaedic and plastic surgeries.

Methods and Materials: November 2019 to October 2020. Total 92 Patients aged 20-60 years of age who were undergoing elective lower limb surgeries (orthopaedic and plastic surgeries) attending Medical College, Kolkata.]

Result: In Group-C, the mean Time to first analgesic requirement (mean± s.d.) Of patients was 246.8261 ± 10.4271. In Group-D, the mean Time to first analgesic requirement (mean± s.d.) Of patients was 270.3478 ± 12.9430. Difference of mean Time to first analgesic requirement with both Group was statistically significant ($p<0.0001$).

Conclusion: The study found that both clonidine and dexmedetomidine provide effective and safe anesthesia in elective lower limb orthopaedic and plastic surgery, with dexmedetomidine providing longer postoperative analgesia duration.

Keywords: Dexmedetomidine, Clonidine, Spinal Anesthesia, Lower Limb Surgeries, Randomized Controlled Trial.

Introduction

Lower limb surgeries may be performed under local nerve block or regional anaesthesia (spinal or epidural) or general anaesthesia, but central neuraxial blockade is the preferred mode of anaesthesia [1]. Central neuraxial block especially subarachnoid block has gained popularity because of its ease of administration, high success rates, ability to provide good operative conditions, quick onset and better safety for patients which has rendered it as a very important technique in modern anaesthesia. [1] Spinal anaesthesia was introduced into clinical practice by Augustus Bier in 1898 [1]. Spinal anaesthesia with local anaesthetic (LA) alone has short duration of action. The short duration of action creates lots of difficulties for surgeon's anaesthesiologist and the patient as the duration of spinal anaesthesia sometimes falls short than the duration of surgery. Local anaesthesia with 0.5% heavy bupivacaine in subarachnoid block is widely accepted regional anaesthetic technique for its quick and effective form of regional anaesthesia with dense block [2]. Major limitation of subarachnoid block by bupivacaine is limited duration of action (2-2.5 hours). [3] In recent years, use of adjuvants has gained popularity with the aim of prolonging the duration of block, better success rate, patient satisfaction, decrease resource utilization compared with general anaesthesia and faster recovery. [3] Adequate pain management is essential to facilitate rehabilitation and adequate functional recovery enabling patients to return to their normal activity more quickly. Different types of additives

like fentanyl [4], morphine [5], preservative free midazolam [6], preservative free ketamine [7], alpha2 agonists like- clonidine [8,9] , dexmedetomidine [10,11] are used to improve the onset of subarachnoid block and to prolong the duration of subarachnoid block. Alpha 2 agonists like clonidine and dexmedetomidine are being used for their additive effects to bupivacaine for prolonged regional block but haemodynamic instability like- bradycardia, hypotension are common problem of them. They have also been used in spinal anaesthesia in intrathecal and intravenous route [12, 13, 14, and 15]. The study aimed to compare the effectiveness of subcutaneous dexmedetomidine and subcutaneous clonidine as adjuvants to intrathecal 0.5% hyperbaric bupivacaine in spinal anaesthesia for patients undergoing elective lower limb surgeries, including orthopaedic and plastic surgeries.

Methods and Materials

Study Design/ Experiment Design: It is an Institution based randomized double blinded study.

Study Setting and Timelines: Study was conducted for 8 months and next 2 months were for statistical analysis and another of 2 months for thesis writing and submission.

Place of Study: Elective orthopaedic and plastic surgery operation theatre of Medical College, Kolkata.

Period of Study: November 2019 to October 2020(Nov-June is for study, July-august for statistical analysis; September- October for thesis writing)

Study Population: Patients aged 20-60 years of age who were undergoing elective lower limb surgeries (orthopaedic and plastic surgeries) attending Medical College, Kolkata.

Sample size: 92 (Group-C: 46 and Group-D: 46).

Case, Control required or not: Not required.

Inclusion Criteria

- Patients aged 20-60years.
- Sex: Both males and females.
- Lower limb orthopaedic and plastic surgeries (surgeries will be performed under spinal anaesthesia).
- Duration of operation is less than 3hours.

Exclusion Criteria

- Patient refusal.
- Localized sepsis.
- Those patients who have previous history of allergy in bupivacaine, dexmedetomidine and clonidine.
- Patients with any cardiovascular or pulmonary diseases.
- Patients with spine deformity (kyphosis, lordosis, scoliosis, spina bifida etc.).
- Raised intracranial pressure.
- Patients with bleeding diathesis.

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5).

Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

Result

Table 1: Distribution of mean time to first analgesic requirement (min) between group C and group D

		Number	Mean	SD	Minimum	Maximum	Median	P-value
Time to first analgesic requirement (min)	Group- C	46	246.826	10.427	230	260	246	<0.0001
	Group- D	46	270.348	12.943	240	286	276	

Table 2: Distribution of mean time to achieve peak sensory block (min) between group C and group D

		Number	Mean	SD	Minimum	Maximum	Median	P-value
Time to achieve peak sensory block (Min)	Group-C	46	9.3913	0.6228	8	10.5	9.45	0.0675
	Group- D	46	8.9957	1.4775	6.5	10.5	7.5	

Table 3: Distribution of mean time to achieve t10 sensory block (min) between group C and group D

		Number	Mean	SD	Minimum	Maximum	Median	P value
Time to achieve t10 sensory block (Min)	Group- C	46	7.3043	0.477	6.5	8	7.25	0.0506
	Group- D	46	6.4783	1.8618	3.5	8	4.25	

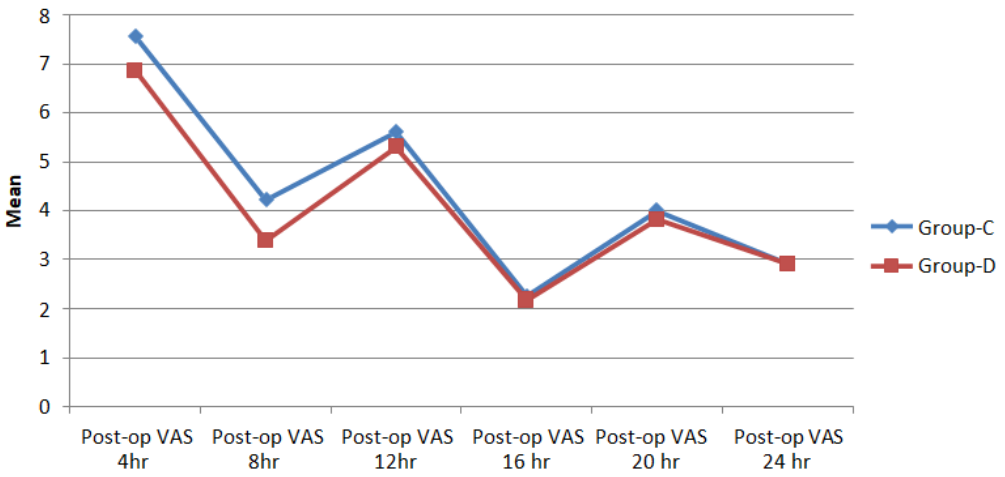

Figure 1: Association of mean postoperative VAS score between group C and group D

In Group-C, the mean Time to first analgesic requirement (mean± s.d.) of patients was 246.8261 ± 10.4271. In Group-D, the mean Time to first analgesic requirement (mean± s.d.) of patients was 270.3478 ± 12.9430. Difference of mean Time to first analgesic requirement with both Group was statistically significant (p<0.0001). In Group-C, the mean Time to achieve peak sensory block (mean± s.d.) of patients was 9.3913 ± .6228. In Group-D, the mean Time to achieve peak sensory block (mean± s.d.) of patients was 8.9957 ± 1.4775. Difference of mean Time to achieve peak sensory block with both Group was not statistically significant (p=0.0675). In Group-C, the mean Time to achieve t10 sensory block (Min) (mean± s.d.) of patients was 7.3043 ± .4770. In Group-D, the mean Time to achieve t10 sensory block (Min) (mean± s.d.) of patients was 6.4783 ± 1.8618. Difference of mean Time to achieve t10 sensory block (Min) with both Group was not statistically significant (p=0.0506). Difference of mean Post-op VAS 4hr with Group was statistically significant (p=0.0043). Difference of mean Post-op VAS 8hr with Group was statistically significant (p=0.0094). Difference of mean postoperative VAS score not statistically significant in 8hour,12 hour, 16 hour, 20hour and 24 hour as the p values are >0.05.

Discussion

Spinal anaesthesia provides excellent anaesthesia and analgesia for lower limb surgeries. In our present study, we have tried to compare the effects of subcutaneous dexmedetomidine and subcutaneous clonidine when they were used as an adjuvant to intrathecal hyperbaric bupivacaine. We selected total 92 patients who were posted for elective lower limb orthopaedic and plastic surgeries. They were randomly divided into group C and group D, and each group contained total 46 patients. The aim of our study was to compare the onset of sensory and motor block, the duration of sensory and motor block, duration of post operative analgesia, intraoperative and postoperative haemodynamics between C and D groups.

Group C patients were given intrathecal hyperbaric bupivacaine 15mg and then injection clonidine subcutaneously (1microgram/kg which was diluted with normal saline to make 1ml solution).

Group D patients were given intrathecal hyperbaric bupivacaine 15mg, and then, injection dexmedetomidine subcutaneously (0.5microgram/kg which was diluted with normal saline to make 1 ml solution).

Our study shows no significant difference between the two groups in demographic parameters like age, sex, height, weight and ASA status.

Modified Bromage Score Description

1. The patient is able to move the hip, knee and ankle
2. The patient is unable to move the hip but is able to move the knee and ankle
3. The patient is unable to move the hip and knee but able to move the ankle
4. The patient is unable to move the hip, knee and ankle

When we assessed parameters like time to achieve T10 sensory block, time to achieve peak sensory block and mean time to achieve modified Bromage scale 3- we found no difference between group C and group D, as the p values were >0.05. Our findings are comparable to the study done by Srinibas et al [16] they did not find any improvement of onset of sensory and motor block in their study when they compared effects between subcutaneous dexmedetomidine and subcutaneous clonidine as an adjuvant to intrathecal hyperbaric bupivacaine.

We did not find any statistically significant difference (p value>0.05) between the group C and group D, when we compared the mean time of re-

gression to S1 segment, mean time to regression of modified Bromage scale 1. We also compared intraoperative haemodynamics – systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR) and oxygen saturation (SPO2), between group C and group D. It was monitored every 3 minutes for first 30 minutes and every 5 minutes for next 60 minutes. Both group C and group D showed no statistically significant difference in these parameters ($p > 0.05$).

we also compared postoperative haemodynamics systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate and oxygen saturation (SBP, DBP, MAP, HR, SPO2) for every 20 minutes for 180 minutes. It was concluded that there was so statistically significant difference between group C and group D.

It can be said that intraoperative and postoperative haemodynamic parameters were comparable between group C and group D.

Uusalo P et al [17] did a study to compare intravenous and subcutaneous dexmedetomidine for pharmacokinetics, cardiovascular, sympatholytic, and sedative effects. Cardiovascular, sympatholytic and sedative effects were significantly lower in subcutaneous dexmedetomidine than intravenous routes.

The mean duration of postoperative analgesia is defined by the time for use of first rescue analgesic. When the mean duration of first analgesic requirements were compared between group C and group D, we found the p value was statistically significant ($p < 0.0001$). In group C, mean time of first analgesic requirement were (mean± s.d.) of patients was 246.8261 ± 10.4271 minutes.

In Group-D, the mean Time to first analgesic requirement (mean± s.d.) of patients was 270.3478 ± 12.9430 minutes. Similar result was also found by Srinibas et al [16] in their study. In their study [16], mean duration of postoperative analgesia was 838.10±348.22 minutes in group D (the group receiving subcutaneous dexmedetomidine with intrathecal hyperbaric bupivacaine) and 816.67±230.48 minutes in group C (the group receiving subcutaneous clonidine with intrathecal hyperbaric bupivacaine). In their study, they concluded that mean duration of postoperative analgesia was prolonged in group receiving subcutaneous dexmedetomidine than group receiving subcutaneous clonidine, and total paracetamol consumption was also less in group D. The results were comparable to that of a study conducted by Reddy et al [13], where they compared the efficacy of intravenous dexmedetomidine and clonidine premedication for prolongation of the spinal anaesthesia with bupivacaine. This study also concluded that premedication with intravenous dexmedetomidine is superior to intravenous clonidine to provide intraoperative sedation and postoperative analgesia during bupivacaine spinal anaesthesia.

Annamalai A et al (2013) [12] also found in their study that intravenous dexmedetomidine when used as an adjuvant to hyperbaric bupivacaine spinal anaesthesia prolonged the time for request of first analgesia.

Hasoor et al performed a study [14] where they compared effect of intravenous infusion of dexmedetomidine and placebo in patients undergoing spinal anaesthesia with intrathecal bupivacaine. The intravenous infusion of dexmedetomidine supplementation with intrathecal bupivacaine prolonged the duration of postoperative analgesia.

In this study, mean Visual Analogue Scale (VAS) score was compared between group C and group D, post operatively, for every 4 hour upto 24 hour.

This study found that mean VAS score difference was statistically significant between group C and group D in first 4hour and 8 hour. Difference of mean Post-op VAS 4hr was statistically significant ($p=0.0043$) between group C and group D. Difference of mean Post-op VAS 8hr was statistically significant ($p=0.0094$) between group C and group D. The difference of mean time of first analgesic requirement was statistically significant. In group D, it was (270.33478+/-12.9430) minutes and in group C it was (246.8261 ± 10.4271) minutes. So, the mean VAS score was also significantly lower in group D in 4hour and 8 hour than group C. Mean VAS score difference between group C and group D in 12hour, 16hour, 20 hour and 24hour was statistically insignificant. ($p > 0.05$).

Conclusion

Our conclusion from the study is both subcutaneous administration of clonidine after intrathecal administration of hyperbaric bupivacaine and subcutaneous administration of dexmedetomidine after intrathecal administration of hyperbaric bupivacaine in elective lower limb orthopaedic and plastic surgery provides effective and safe anaesthesia with haemodynamic stability. However, among the two drugs, subcutaneous dexmedetomidine with intrathecal hyperbaric bupivacaine gives longer duration of postoperative analgesia.

Reference

1. Brull Richard, Macfarlane J.R. Alan, Chan W.S. Vincent. Chapter 45. Miller's anesthesia. 9th edition, page no:1413.
2. Chin Adrian, Zundert Van Andre.Spinal Anesthesia. Chapter 23. Hadzic's Textbook of Regional Anesthesia and Acute Pain Management. 2nd edition,page no: 328-369.
3. Spinal, Epidural and Caudal Blocks. Chapter 45. Morgan and Mikhail's Clinical Anesthesiology. 6th edition. page no:

4. Bogra Jaishri, Arora Namita, Srivastava Pratima. Synergistic effect of intrathecal fentanyl and bupivacaine in spinal anesthesia for cesarean section. BMC Anesthesiology.2005;5:5.
5. Hassett P, Ansari B, Gnanamoorthy P, Kinirons B, Laffey JG. Determination of The Efficacy and Side-effect Profile of Lower Doses of Intrathecal Morphine In Patients Undergoing Total Knee Arthroplasty. BMC Anesthesiol. 2008 Sep 24; 8:5.
6. Shadangi Bijaya Kumar, Garg R, Pandey R, Das T. Effects of intrathecal midazolam in spinal anaesthesia: a prospective randomised case control study. Singapore Med J. 2011;52(6):432-435.
7. Basuni Sobhy Ahmed. Addition of low-dose ketamine to midazolam and low-dose bupivacainc inrpror, es hemodynamics and post operalive analgcsia durirrg spinal anesthesia ibr ccsarean section. J Anesthesiol Clin Pharmacol.20l6 Jan-Mar;32(1):44- 48.
8. Agarwal Deepti, Chopra Manish, Mohta Medha, Sethi Kumar Ashok. Clonidine as an adjuvant to hyperbaric bupivacaine for spinal anesthesia in elderly patients undergoing lower limb orthopaedic surgeries. Saudi J Anaesth. 2014, Apr;8(2):209- 214.
9. Singh RB, Chopra N, Choubey S, Tripathi RK, Prabhakar, Mishra A. Role of Clonidine as adjuvant to intrathecal bupivacaine in patients undergoing lower abdominal surgery: A randomized control study. Anesth Essays Res. 2014;8(3):307- 312. doi:10.4103/0259-1162.143119.
10. Rai Arati, Bhutia Pincho Meyong. Dexmedetomidine as an additive to spinal anaesthesia in orthopaedic patients undergoing lower limb surgeries: a randomized clinical trial comparing two different doses of dexmedetomidine. Journal of Clinlcal and Diagnostic Research. 2017 Apr; 11(4): UC09–UC12. doi: 10.7860/JCDR/2017/26241.9654.
11. Rahimzadeh Poupak, Faiz Reza Hamid Seyed, Imani Farhad, Derakhshan Pooya, Amniati Saeed. Comparative addition of dexmedetomidine and fentanyl to intrathecal bupivacaine in orthopedic procedure in lower limbs. BMC Anesthesiol 2018, 62 (2018). doi:10.1186.
12. Annamalai Anbarasu, Singh Sanjeev, Singh Arti, Mahrous Ehab Deigheidy. Can intravenous dexmedetomidine prolong bupivacaine intrathecal spinal anesthesia. J Anesth Clin Res 2013,4: 12.doi:10.4172/2155-6148.1000372.
13. Reddy VS, Shaik NA, Donthu B, Reddy Sannala VK, Jangam V. Intravenous dexmedetomidine versus clonidine for prolongation of bupivacaine spinal anesthesia and analgesia: A randomized double-blind study. J Anaesthesiol Clin Pharmacol. 2013;29(3):342-347.
14. Harsoor S, Rani DD, Yalamuru B, Sudheesh K, Nethra S. Effect of supplementation of low dose intravenous dexmedetomidine on characteristics of spinal anaesthesia with hyperbaric bupivacaine. Indian J Anaesth. 2013 May;57(3):265-9.
15. Rekhi Kaur Balwinder, Kaur Tejinderpal, Arora Divya, Dugg Pankaj. Comparison of intravenous dexmedetomidine with midazolam in prolonging spinal anaesthesia with ropivacaine. Journal of Clinical and Diagnostic Research.2017;11(2).
16. Srinivas B Divya, Lakshminarasimhaih Geetha. Comparison of subcutaneous dexmedetomidine versus clonidine as an adjuvant to spinal anesthesia: a randomized double blind control trial. Local Reg Anesth. 2019;12: 29-36.
17. Uusalo P, Al-Ramahi D, Tilli I, Aantaa RA, Scheinin M, Saari TI. Subcutaneously administered dexmedetomidine is efficiently absorbed and is associated with attenuated cardiovascular effects in healthy volunteers. European Journal of Clinical Pharmacology. 2018 Aug;74(8):1047-1054.