International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Study on The Comparison of Dexmedetomidine as An Adjuvant to Intrathecal Bupivacaine Versus Bupivacaine Alone in Lower Abdominal & Lower Limb Surgeries

Syed Imran Hussain[1], Dr. Abhishek Gupta[2], Ishfaq Ramzan[3], Dr. Hilal[4]

[1]PG Student, Department of OTAT, University School of Allied Health Sciences, Rayat Bahra University Mohali, Punjab
[2,3]Assistant Professor, Department of OTAT, University School of Allied Health Sciences, Rayat Bahra University Mohali, Punjab
[4]Consultant Anesthesiologist, Department of Anaesthesia, Classic Hospital Srinagar, Jammu and Kashmir

ABSTRACT

Background Spinal anaesthesia is a widely practised regional anaesthetic technique for lower abdominal and lower limb surgeries. The use of intrathecal adjuvants has been explored to enhance the quality and duration of spinal anaesthesia. Dexmedetomidine, a highly selective alpha-2 adrenergic agonist, has gained attention as an effective intrathecal adjuvant because of its analgesic, sedative, and sympatholytic properties

Methods: A total of 60 patients aged between 20–60 years, belonging to ASA physical status I and II, undergoing lower limb surgeries and caesarean section under spinal anaesthesia were included in the study. The patients were randomly divided into two groups. Group A (n=30): Received 3 ml of 0.5% hyperbaric bupivacaine intrathecally. Group B (n=30): Received 3 ml of 0.5% hyperbaric bupivacaine with 5 µg dexmedetomidine intrathecally.

Results: The addition of dexmedetomidine to intrathecal bupivacaine resulted in faster onset of sensory block. Hemodynamic parameters remained stable in both groups, and adverse effects were minimal and manageable.

Conclusion: Dexmedetomidine prolongs the duration of spinal anaesthesia and provides better postoperative analgesia without significant side effects.

KEYWORDS: Spinal anaesthesia, Bupivacaine, Dexmedetomidine.

INTRODUCTION

Spinal anaesthesia (subarachnoid block) is a widely used technique for lower abdominal, pelvic, and lower limb surgeries due to its rapid onset, dense sensory/motor block, and high success rate. Hyperbaric bupivacaine (0.5%) is a common local anaesthetic agent used for spinal blocks, as it provides potent sensory and motor blockade by inhibiting voltage-gated sodium channels in the nerve roots. However, the duration of spinal anaesthesia with bupivacaine is limited (often lasting 2–3 hours), leading to early

postoperative pain once the block regresses. Prolonging the duration of analgesia is therefore a key goal in perioperative management.

Spinal anaesthesia (SA) **(Aksoy M et al 2014)** is the preferred method during most surgical operations, especially C-section. Because of the dense and predictable block associated with SA, this technique exhibits a quicker onset and fewer complications compared with other anaesthetic protocols. However, the adverse effects of neuraxial analgesia, such as maternal hypotension, shivering, vomiting or nausea, and a faint feeling, cannot be underestimated. Spinal anaesthesia is widely used in various operations because it provides adequate analgesia, muscular relaxation with simple operation, and rapid onset of action**. (Gupta, R et al 2011**) However, the use of local anaesthetics alone has a short duration and is inadequate for visceral pain. **(Bogra, J et al 2005)**, **(Derakhshan, P et al 2018)** Various intrathecal adjuvants, such as morphine, fentanyl, ketamine, midazolam, and clonidine, are used to improve the quality and duration of analgesia. **(Elia, N et al 2008)**.

Among local anaesthetic agents, 0.5% hyperbaric bupivacaine is one of the most established drugs for spinal anaesthesia because of its predictable spread in cerebrospinal fluid and ability to provide adequate surgical anaesthesia. Despite its efficacy, when used alone it offers a limited duration of postoperative analgesia, necessitating early analgesic intervention and contributing to patient discomfort in the postoperative period. To overcome this limitation, numerous intrathecal adjuvants have been studied to enhance the quality, duration, and comfort of spinal anaesthesia, including opioids, midazolam, neostigmine, sodium bicarbonate, hyaluronidase and α-2 adrenergic agonists **(Kanazi GE et al 2006).** Among these adjuvants, α-2 adrenergic receptor agonists have shown particular promise due to their synergistic effects when combined with local anaesthetics. Clonidine, the earlier agent in this class, has been demonstrated to prolong both sensory and motor blockade when co-administered with local anesthetics **(Racle JP et al 1987).**

Dexmedetomidine is a highly selective alpha 2-adrenoceptor agonist with sedative, anxiolytic, sympatholytic, and analgesic-sparing effects and minimal depression of respiratory function. **(Weerink M et al 2017)** Dexmedetomidine acts on pre- and post-synaptic sympathetic nerve terminals and the central nervous system, decreasing the sympathetic outflow and noradrenaline release and causing sedation, anxiolytic, analgesic, and sympatholytic effects. It lacks opioid-like properties, so opioid-related adverse side effects are not found. **(Mishra PR et al 2017)** It was first used intrathecally in humans for transurethral resection of prostate **(Kanazi GE et al 2006).**

Neuroaxial opioids have some adverse effects like pruritus, nausea and vomiting, urinary retention and depression of ventilation. So other adjuvants like tramadol, a partial opioid agonist (weak μ agonist) and midazolam, a benzodiazepine, are also tried in this respect, but these are not devoid of adverse effects. **(Kumar K et al 2013)** The main reason for using adjuvants in subarachnoid block is to achieve a prolongation of the duration of analgesia, which may be beneficial in the intraoperative as well as postoperative period. Adjuvants potentiate the action of local anaesthetics and allow a decrease in the required dose **(Swain A et al 2017).**

AIM OF THE STUDY

A study on the comparison of dexmedetomidine as an adjuvant to intrathecal bupivacaine versus bupivacaine alone in lower abdominal & lower limb surgeries.

OBJECTIVES OF THE STUDY

1. To evaluate the efficacy of dexmedetomidine as an adjuvant to intrathecal bupivacaine versus bupivacaine alone in lower abdominal & lower limb surgeries
2. To assess clinically the sensory and motor blockade in all the patients.
3. To compare the incidence of complications in both groups 4. To observe the hemodynamic stability in both groups

MATERIALS AND METHODS

The present study was conducted at Classic Hospital, Srinagar, Jammu and Kashmir, from February 2025 to August 2025. Sixty patients aged 30-60 years, weighing 50-70kg, of either gender, with ASA 1 and II, for lower abdomen or lower limb surgeries under spinal anaesthesia were studied. The patients were divided into two groups of 30 each: group I and group II. Group I (n=30) received an injection. Bupivacaine (0.5%) hyperbaric 3 ml (15 mg). Total volume of the drug=3 ml. Group II (n=30) received an injection. Bupivacaine (0.5%) hyperbaric 2 ml (10 mg) + inj. Dexmedetomidine 5ug (1ml) (30 mcg). Total volume of the drug = 3 ml. Written consent was taken from all patients.

EXCLUSION CRITERIA.

- Patients with a history of previous back surgery and infection at the injection site.
- Patient with hypersensitivity to amide-level local anaesthetics or fentanyl.
- Uncooperative patient.
- Patient with Musculoskeletal deformity.
- Patient with severe compromised medical conditions like cardiac and respiratory diseases.
- Patient with ASA III or IV.

PRE ANESTHETIC CHECKUP

Details pertaining to the patient's medical history, general physical and systematic examination, and basic routine investigations like Hb, blood sugar, blood urea, serum creatinine (BT, bleeding time, Clotting time (CT), ECG, Chest X-Ray were done. Tab. Alprazolam 0.25mg was given as an anxiolytic if needed. No premedication was given to the patient in the morning.

ANESTHESIA TECHNIQUES

In the operating room, routine monitoring (e.g., non-invasive blood pressure, heart rate, pulse oximeter, ECG) was used, an IV line was started, and all the patients were preloaded with 0.9% NaCl (10ml per kg of body weight) over a period of 15 to 20 minutes before the injection of local anaesthetic.

The technique, following the proper protocol of preparation, position, projection and puncture, was followed. The patient was placed in the right or left lateral position or in sitting position, and under all aseptic conditions. Subarachnoid block was given in the L3L4 interspace with a 25G Quincke spinal needle via midline approach. After the free flow of CSF, the study drug was given intrathecally according to the group allotted. The patient was placed in the supine position until the induced blockade reached the highest level.

The following parameters were assessed and recorded:

1. Every 2 minutes from the time of intrathecal injection, the sensory level was checked until the level stabilised for 4 consecutive tests. After that, sensory level testing was continued every 10 minutes until

two-segment regression. Further testing was performed at 20 min intervals in the recovery room for two hours. All the times were recorded from the time of intrathecal injection.

2. Motor block was assessed by the Bromage Scale.
   Score 0- No motor block
   Score 1- Hip blocked
   Score II - Hip and Knee blocked
   Score III- Hip, knee and foot blocked

Pain was assessed by using a 10cm Visual Analogue Scale. In the event of a patient complaining of pain during surgery with a pain score > 5 inj. Fentanyl 1ml (20 mg) was given intravenously.

1. After Spinal Anaesthesia, systolic blood pressure, diastolic blood pressure and heart rate were recorded every 3 minutes in the first 15 minutes until the end of surgery.
   Intraoperative complications like hypotension and bradycardia were recorded. Hypotension was taken as 30% decrease in systolic blood pressure compared with preoperative control levels or blood pressure less than 90mm Hg. Bradycardia was taken as less than 60 per minute or 20% decrease from the baseline, whichever was less.
   Hypotension and bradycardia were treated with intravenous injection of
   Mephentermine 3mg and Atropine 0.3mg, respectively, in incremental doses.
2. Adverse effects such as nausea, vomiting, shivering, pruritus, respiratory depression, and transient neurological symptoms were recorded.
3. Further testing of sensory level, motor block, blood pressure, pulse rate and SPO2 was performed at 20-minute intervals in the recovery room for two hours.

RESULTS

Demographic variables and the duration of surgery were not significant. The peak sensory levels in both groups were taken at T10, and the findings were comparable.

Table 1: Time taken to reach Peak Sensory Level in both groups

Time taken to reach Peak Sensory Levels	Group I	Group II	P-value
Time in Minutes	6.82±0.56	4.44±0.81	0.01

The time required to achieve peak sensory block was compared between the two groups. It was observed that Group II reached the peak sensory level significantly faster (4.44 ± 0.81 minutes) as compared to Group I (6.82 ± 0.56 minutes). The difference between the groups was found to be statistically significant ($p = 0.01$), indicating a more rapid onset of sensory blockade in Group II.

Table 2: Comparison of Side Effects in both groups

Side Effect	Group I	Group II	P Value
Hypotension	6 (20%)	10 (33.33%)	0.382
Bradycardia	2 (6.67%)	5 (16.67%)	0.424

Nausea	3 (10%)	0 (0%)	
Vomiting	2 (6.67%)	0 (0%)	
Shivering	7 (23.33%)	3 (10%)	0.299
Pruritus	0 (0%)	0 (0%	
Respiratory depression	0 (0%)	0 (0%)	

The comparison of side effects between Group I and Group II showed that hypotension occurred in 20% of patients in Group I and 33.33% in Group II ($p = 0.382$). Bradycardia was observed in 6.67% of Group I and 16.67% of Group II patients ($p = 0.424$). Nausea (10%) and vomiting (6.67%) were reported only in Group I, while none were noted in Group II. Shivering was seen in 23.33% of Group I and 10% of Group II patients ($p = 0.299$). No cases of pruritus or respiratory depression were observed in either group. Overall, the differences were not statistically significant.

Both groups achieved a Modified Bromage Scale score of 3, with no significant difference ($p = 1.000$), indicating equally dense motor blockade.

Baseline hemodynamic parameters were comparable in both groups, with no significant differences ($P > 0.05$).

Post-induction hemodynamics were also comparable ($P > 0.05$), though a non-significant trend toward hypotension and bradycardia was noted in Group II.

DISCUSSION

The onset of sensory block was observed to be slightly faster in the dexmedetomidine group compared to the bupivacaine group. These findings suggest that the addition of dexmedetomidine enhances the quality and duration of spinal anaesthesia. Group I

(Bupivacaine) required 6.82 ± 0.56 minutes, whereas Group II (Bupivacaine + Dexmedetomidine) reached the peak faster at 4.44 ± 0.81 minutes. The difference between the groups is statistically significant ($p = 0.01$), indicating that the addition of dexmedetomidine significantly reduces the time to achieve peak sensory block.

The incidence of adverse effects such as hypotension, bradycardia, nausea, vomiting, and shivering was comparable between the two groups. No serious complications such as respiratory depression were observed in either group.

Riaz MA et al (2012): Dexmedetomidine group showed faster onset and prolonged duration of sensory block ($p < 0.001$).

Chandra D et al (2015): Faster onset and significantly prolonged sensory block in dexmedetomidine group ($p < 0.0001$).

Liu S et al (2011): Dexmedetomidine hastened onset and prolonged duration of sensory block ($p < 0.001$).

Azemati S et al (2009): Dexmedetomidine prolonged the duration of sensory block compared to other groups.

CONCLUSION

The key finding of this study is that dexmedetomidine, when used as an adjuvant to intrathecal bupivacaine, results in a faster onset of both sensory and motor blockade, along with a lower incidence of side effects

REFERENCES

1. Aksoy M, Aksoy AN, Dostbil A, et al. (2014) Anaesthesia techniques for caesarean operations: retrospective analysis of last decade. *Turk J Anaesthesiol Reanim* ; 42: 128–132.
2. Gupta, R. · Verma, R. · Bogra, J. (2011). A comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to bupivacaineJ Anaesthesiol Clin Pharmacol.; 27:339-343.
3. Bogra, J., Arora, N., & Srivastava, P. (2005). Synergistic effect of intrathecal fentanyl and bupivacaine in spinal anaesthesia for cesarean section. *BMC anesthesiology*, *5*(1), 5.
4. Derakhshan, P., Imani, F., Koleini, Z. S., & Barati, A. (2018). Comparison of adding sufentanil and lowdose epinephrine to bupivacaine in spinal anaesthesia: A randomized, double-blind, clinical trial. *Anesthesiology and Pain Medicine*, *8*(5), e69600.
5. Elia, N., Culebras, X., Mazza, C., Schiffer, E., & Tramèr, M. R. (2008). Clonidine as an adjuvant to intrathecal local anesthetics for surgery: systematic review of randomized trials. *Regional Anaesthesia & Pain Medicine*, *33*(2), 159-167.
6. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, Bulbul M, Baraka AS. (2006) Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Acta anaesthesiologica scandinavica. Feb;50(2):222-7.
7. Racle JP, Benkhadra A, Poy JY, Gleizal B. (1987) Prolongation of isobaric bupivacaine spinal anaesthesia with epinephrine and clonidine for hip surgery in the elderly. Anaesthesia & Analgesia. May 1;66(5):442-6.
8. Weerink M, Struys M, Hannivoort L, et al. (2017) Clinical pharmacokinetics and pharmacodynamics of dexmedetomidine. *Internat J Clin Anesthesiol*.; 35:15–19.
9. Mishra PR, Mishra SK, Sarkar K, et al.(2017) Comparative study of intrathecal dexmedetomidine vs fentanyl as an adjuvant to hyperbaric bupivacaine. *Anna Internat Med Dent Res*.;3(3):28–31. doi: 10.21276/aimdr.2017.3.3.AN5
10. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, AlYaman R, et al. (2006) Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Acta Anaesthesiol Scand. ;50:222–7. doi:10.1111/j.1399-6576.2006.00919.x.
11. Kumar K, Singh SI. (2013) Neuraxial opioid-induced pruritus: An update. J Anaesthesiol Clin Pharmacol. Jul;29(3):303-7.
12. Swain A, Nag DS, Sahu S, Samaddar DP. (2017) Adjuvants to local anesthetics: Current understanding and future trends. World J Clin Cases. Aug 16;5(8):307-323.
13. Muhammad Afnan Riaz, Saad Bin Qamar, Aisha Siddiqi, Sarmad Sardar, Waqas Tariq, Syed Qasim Ali Shah, & Habib, M. F. (2024). Comparison of Duration of Action in Spinal Anaesthesia of 0.5% Bupivacaine and 0.5% Bupivacaine with Dexmedetomidine: Spinal Anaesthesia: Bupivacaine vs. Bupivacaine with Dexmedetomidine. *Journal of Health and Rehabilitation Research*, *4*(3), 1–5https://doi.org/10.61919/jhrr.v4i3.1459
14. Deepak Chandra, Tulika Roy, Vineet Khemka. Comparison of Bupivacaine (0.5%) and Bupivacaine (0.5%) with Dexmedetomidine for Spinal Anaesthesia in Lower Abdominal and Pelvic Surgery. Indian Journal of Public Health Research & Development 2023;14(3).
15. Shuyan Liu, Peng Zhao, Yunfeng Cui, Chang Lu, Mingxin Ji, Wenhua Liu, Wei Jiang, Zhuo Zhu, Qianchuang Sun, Effect of 5-μg Dose of Dexmedetomidine in Combination With Intrathecal Bupivacaine on Spinal Anaesthesia: A Systematic Review and Meta-analysis, Clinical Therapeutics, Volume42,Issue 2020, Pages

16. Azemati S, Zarghami A, Jouybar R, Naderi-Boldaji V. Analgesic Characteristics of Bupivacaine Alone and in Combination with Dexmedetomidine or Meperidine in Spinal Anaesthesia during Cesarean Section: A Double-Blind Randomized Clinical Trial Study. *Pain Research and Management*. 2022; 2022:5111214. doi:10.1155/2022/5111214.