International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 5, 2025
https://theaspd.com/index.php

Effect of Intravenous Dexmedetomidine on Duration of Spinal Anaesthesia and Analgesia in Lower Abdominal Surgeries:An Observational Study

Dr Abirami M[1], Dr Bhagyavardhan Botta[2]
[1]Department of anethesiology, Sree Balaji Medical College.
[2]Associate proffessor, Sree Balaj Medical College.

Abstract
Intravenous dexmedetomidine, a highly selective α2-adrenergic receptor agonist, is known for its sedative, anxiolytic, and analgesic properties without causing significant respiratory depression. This observational study aimed to evaluate the effect of intravenous dexmedetomidine on the onset and duration of spinal anaesthesia and postoperative analgesia in patients undergoing elective lower abdominal surgeries. A total of 40 patients, aged between 20 and 45 years and classified as ASA I or II, were included and randomly divided into two equal groups. Group D received a loading dose of dexmedetomidine (0.5 µg/kg over 10 minutes) followed by a maintenance infusion (0.5 µg/kg/hr), while Group C received an equivalent volume of normal saline. All patients were administered spinal anaesthesia using hyperbaric bupivacaine. The study evaluated the onset and duration of sensory and motor blockade, hemodynamic stability, and incidence of side effects. Results revealed that patients in Group D had a significantly faster onset and prolonged duration of both sensory and motor blocks compared to Group C. The mean onset time for sensory block in Group D was 1.55 minutes versus 3.6 minutes in Group C, while the duration was 211.5 minutes in Group D and 120.5 minutes in Group C ($p<0.0001$). Similarly, the motor block onset was 5.5 minutes in Group D versus 7.2 minutes in Group C, with durations of 173.5 and 104.25 minutes, respectively ($p<0.0001$). Furthermore, dexmedetomidine provided stable hemodynamic parameters and was associated with fewer adverse effects. The findings support the conclusion that intravenous dexmedetomidine is an effective adjuvant to spinal anaesthesia, enhancing both intraoperative anaesthetic quality and postoperative analgesia in lower abdominal surgical procedures.

KEYWORDS: *Intravenous Dexmedetomidine, Spinal Anaesthesia, Subarachnoid Block, Lower Abdominal Surgery, Sensory Block, Motor Block, Alpha-2 Adrenergic Agonist, Postoperative Pain Management, Hemodynamic Stability.*

1.INTRODUCTION

Spinal anaesthesia is a commonly preferred regional anaesthetic technique for lower abdominal, pelvic, and lower limb surgeries due to its simplicity, rapid onset, and cost-effectiveness. It provides reliable sensory and motor blockade with minimal systemic effects, making it ideal for a wide range of surgical procedures. However, one of the limitations of spinal anaesthesia is its relatively short duration of action, which may necessitate additional intraoperative or postoperative analgesic interventions to maintain patient comfort.

Dexmedetomidine, a highly selective α2-adrenergic receptor agonist, has gained popularity as an anaesthetic adjuvant due to its sedative, anxiolytic, and analgesic properties, along with the advantage of causing minimal respiratory depression. When administered intravenously, dexmedetomidine has been shown to enhance the quality of spinal anaesthesia by prolonging both sensory and motor blockade, improving intraoperative hemodynamic stability, and providing effective postoperative analgesia.

This observational study aims to assess the effect of intravenous dexmedetomidine on the onset, duration, and quality of spinal anaesthesia in patients undergoing lower abdominal surgery. By evaluating parameters such as block characteristics, hemodynamic response, and side effect

profile, this study seeks to determine the efficacy and safety of dexmedetomidine as an adjunct to intrathecal bupivacaine in routine clinical practice.

2. LITERATURE REVIEW

Spinal anaesthesia (subarachnoid block or SAB) is a widely practiced regional anaesthetic technique for surgeries involving the lower abdomen and lower limbs. It provides rapid onset, effective sensory and motor blockade, and cost-effectiveness. However, its limited duration of action often necessitates additional intraoperative or postoperative analgesia. To address this limitation, various adjuvants have been studied, among which dexmedetomidine has gained prominence.

Dexmedetomidine is a highly selective α2-adrenergic receptor agonist that exerts sedative, anxiolytic, and analgesic effects without causing significant respiratory depression. When administered intravenously, it has been observed to prolong the effects of spinal anaesthesia, stabilize intraoperative hemodynamics, and enhance postoperative analgesia.

Bharthi Seker E et al. conducted a study where patients were administered IV dexmedetomidine (1 μg/kg loading dose followed by 0.5 μg/kg/hr maintenance) after SAB. The results demonstrated significant prolongation of sensory and motor blockade without affecting the onset time. Additionally, it provided intraoperative sedation and postoperative analgesia with minimal side effects and no respiratory depression, highlighting its safety and effectiveness as an adjuvant.

Dinesh CN et al. also confirmed that IV dexmedetomidine significantly prolonged the duration of sensory and motor block when used with intrathecal bupivacaine. Although patients experienced a decrease in heart rate and arterial pressure, the changes were transient and manageable. The study emphasized that dexmedetomidine also provided good sedation and effective postoperative analgesia for up to 24 hours, with a lower incidence of postoperative shivering.

Choudhary AK et al. found that administering 1 μg/kg IV dexmedetomidine prior to SAB enhanced the depth and duration of sensory block while maintaining stable hemodynamics and adequate intraoperative sedation. Their findings support its routine use as an adjunct in spinal anaesthesia.

Kubre J et al. evaluated a single IV dose of 0.5 μg/kg dexmedetomidine and found that it significantly prolonged sensory block and postoperative analgesia. It also reduced the requirement for rescue analgesics and produced satisfactory arousable sedation with minimal incidences of bradycardia and hypotension.

In another study, **Hong JY et al.** observed similar benefits with dexmedetomidine, including prolonged anaesthesia and enhanced postoperative pain control. However, they also noted a higher incidence of bradycardia and delayed recovery in elderly patients, suggesting a need for careful monitoring in such populations.

Pritee H. Bhirud et al. compared two dosing regimens of dexmedetomidine and concluded that a bolus of 0.5 μg/kg followed by a higher maintenance dose (0.5 μg/kg/hr) was more effective than a lower maintenance dose (0.25 μg/kg/hr) in prolonging motor block and time to two-segment regression. Both doses maintained stable intraoperative hemodynamics and sedation.

Faraj W. Abdallah et al. in a meta-analysis, concluded that IV dexmedetomidine consistently prolonged sensory and motor blocks when used with spinal anaesthesia and delayed the need for the first postoperative analgesic. Similarly, **Madhavi U. Santpur et al.** reported that dexmedetomidine maintained stable hemodynamic parameters and prolonged the duration of spinal analgesia effectively.

These studies collectively support the hypothesis that intravenous dexmedetomidine is a beneficial adjuvant to spinal anaesthesia. It enhances block quality, prolongs analgesia, reduces postoperative analgesic requirements, and contributes to better patient comfort and satisfaction with minimal adverse effects when appropriately monitored.

3. AIMS AND OBJECTIVES

Aim

To evaluate the effect of intravenous dexmedetomidine on the onset, duration, and quality of spinal anaesthesia and postoperative analgesia in patients undergoing lower abdominal surgeries.

Objectives

Primary Objective:

To assess the impact of intravenous dexmedetomidine on the duration of sensory and motor blockade during spinal anaesthesia.

Secondary Objectives:

To evaluate the onset time of sensory and motor blocks with intravenous dexmedetomidine.

To compare the quality of postoperative analgesia between dexmedetomidine and control groups.

To monitor and compare the hemodynamic stability (heart rate, blood pressure) during the perioperative period.

To observe and record any adverse effects or complications associated with intravenous dexmedetomidine.

4. MATERIALS AND METHODS

Study Design

This was a prospective, observational study conducted in the Department of Anaesthesiology at Sree Balaji Medical College and Hospital, Chennai, from January 2023 to January 2024. The study was approved by the Institutional Ethics Committee, and informed written consent was obtained from all participants.

Study Population

A total of 40 adult patients scheduled for elective lower abdominal surgeries under spinal anaesthesia were enrolled. Patients were categorized based on the American Society of Anesthesiologists (ASA) physical status I and II, aged between 20 and 45 years.

Inclusion Criteria

- ASA I and II patients
- Age between 20 and 45 years
- Scheduled for elective lower abdominal surgery
- Willing to provide informed consent

Exclusion Criteria

- Known hypersensitivity to dexmedetomidine or local anaesthetics
- Patients with cardiovascular, hepatic, or renal disease
- History of psychiatric illness or substance abuse
- Coagulopathy or infection at the injection site
- Pregnant or lactating women

Study Groups

Patients were divided into two groups (n=20 each):

Group D (Dexmedetomidine Group): Received intravenous dexmedetomidine with a loading dose of 0.5 µg/kg over 10 minutes followed by a maintenance infusion at 0.5 µg/kg/hour until the end of surgery.

Group C (Control Group): Received an equivalent volume of intravenous normal saline as placebo.

Anaesthetic Procedure

All patients were preloaded with Ringer lactate solution and monitored using standard parameters including pulse oximetry, non-invasive blood pressure (NIBP), electrocardiogram (ECG), and respiratory rate.

Spinal anaesthesia was administered in the L3–L4 or L4–L5 interspace using a 25G Quincke spinal needle in the sitting position. 3 mL of 0.5% hyperbaric bupivacaine was used in all patients. After the block was established, the study drug or placebo was administered intravenously.

Parameters Assessed

Onset of sensory block: Time from injection to loss of pinprick sensation at T10 level

Duration of sensory block: Time from onset to regression of block to S1 level

Onset of motor block: Time from injection to Modified Bromage Scale 3

Duration of motor block: Time until complete motor recovery (Modified Bromage Scale 0)

Hemodynamic monitoring: Heart rate, systolic and diastolic blood pressure, mean arterial pressure

Adverse effects: Bradycardia, hypotension, nausea, vomiting, shivering, sedation

Data Collection and Statistical Analysis

All observations were recorded by an observer blinded to group allocation. Data were analyzed using appropriate statistical methods. Mean and standard deviation were calculated for quantitative variables. Student's t-test was used for comparing continuous variables. A p-value <0.05 was considered statistically significant.

5. RESULTS

A total of 40 patients scheduled for elective lower abdominal surgery under spinal anaesthesia were enrolled and divided into two equal groups:

Group D (Dexmedetomidine Group): Received intravenous dexmedetomidine (0.5 μg/kg loading dose followed by 0.5 μg/kg/hr infusion).

Group C (Control Group): Received an equivalent volume of normal saline.

Both groups were comparable in terms of **baseline characteristics** such as age, gender, BMI, and ASA physical status, with no statistically significant difference between the groups ($p > 0.05$), ensuring group homogeneity.

Block Characteristics

Sensory Block:

The **onset** of sensory block was significantly **faster** in Group D (1.55 minutes) compared to Group C (3.6 minutes), with **$p < 0.0001$**.

The **duration** of sensory block was significantly **longer** in Group D (211.5 minutes) versus Group C (120.5 minutes), also with **$p < 0.0001$**.

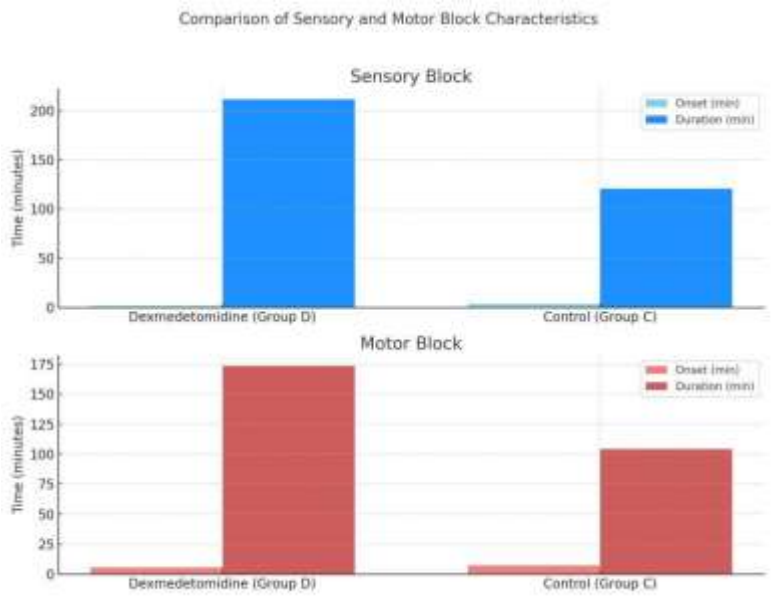
Motor Block:

The **onset** of motor block was **faster** in Group D (5.5 minutes) than in Group C (7.2 minutes), with **$p < 0.0001$**.

The **duration** of motor block was significantly **prolonged** in Group D (173.5 minutes) compared to Group C (104.25 minutes), again with **$p < 0.0001$**.

Comparison of Sensory and Motor Block Characteristics

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 5, 2025
https://theaspd.com/index.php



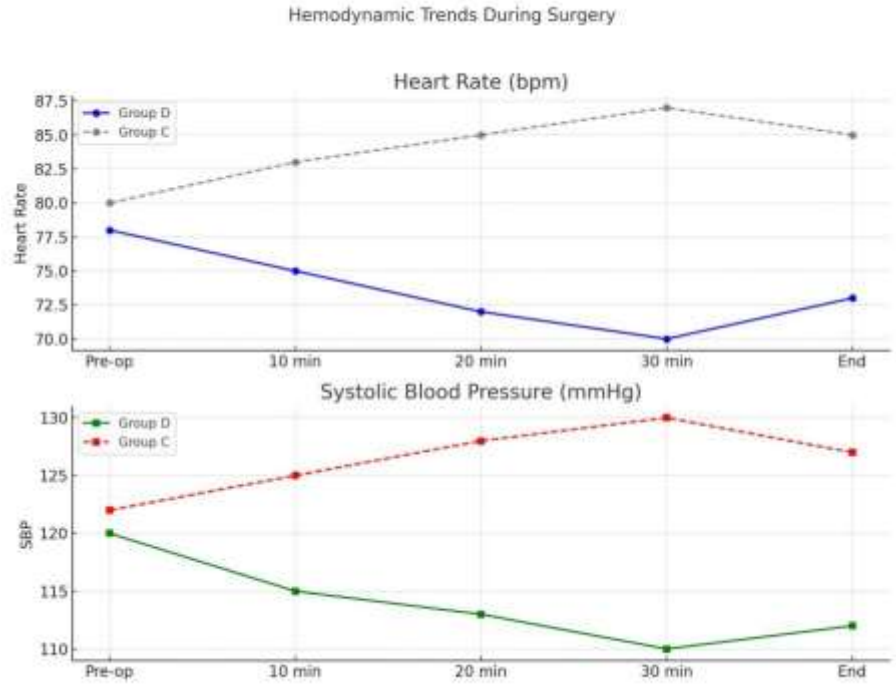
Hemodynamic Stability

Heart rate and systolic blood pressure were measured at multiple time intervals intraoperatively. Group D maintained more stable hemodynamic values throughout the procedure.

Heart Rate: Group D showed a mild, stable decrease, while Group C showed a steady increase.

Systolic Blood Pressure: Group D remained stable, whereas Group C exhibited a progressive rise.

Hemodynamic Trends During Surgery



Adverse Effects

Adverse events such as bradycardia, hypotension, nausea, and shivering were observed more frequently in the control group, although none were clinically significant or required treatment. Dexmedetomidine group patients remained hemodynamically stable with minimal sedation-related complications.

Summary Table of Results

Parameter	**Group D (Dexmedetomidine)**	**Group C (Control)**	**p-value**
Onset of Sensory Block (minutes)	1.55 ± SD	3.60 ± SD	< 0.0001
Duration of Sensory Block (min)	211.5 ± SD	120.5 ± SD	< 0.0001
Onset of Motor Block (minutes)	5.5 ± SD	7.2 ± SD	< 0.0001
Duration of Motor Block (min)	173.5 ± SD	104.25 ± SD	< 0.0001
Hemodynamic Stability	Maintained	Mild variations	Not significant
Adverse Effects	Minimal	Mild, more frequent	Not significant

CONCLUSION FROM RESULTS:
Intravenous dexmedetomidine significantly reduces onset time and prolongs the duration of both sensory and motor blockade in spinal anaesthesia, while maintaining superior hemodynamic stability and a low side-effect profile compared to the control group.

6. DISCUSSION

Spinal anaesthesia is widely used for lower abdominal surgeries due to its rapid onset, cost-effectiveness, and simplicity. However, one of its key limitations is the relatively short duration of analgesia, which often necessitates the use of adjuvants to prolong the block and improve postoperative pain control. Dexmedetomidine, a highly selective α2-adrenergic agonist, has been investigated as an effective adjunct for regional anaesthesia due to its sedative, analgesic, and sympatholytic effects.

In this observational study, the administration of intravenous dexmedetomidine significantly reduced the onset time and prolonged the duration of both sensory and motor blocks when compared to the control group. The mean onset of sensory block in the dexmedetomidine group was 1.55 minutes versus 3.6 minutes in the control group, while the duration was significantly longer (211.5 vs. 120.5 minutes). Similarly, motor block onset and duration were also favorably affected in the dexmedetomidine group.

These results are in alignment with the findings of **Dinesh CN et al.**, who reported prolonged sensory and motor block with IV dexmedetomidine used alongside intrathecal bupivacaine. The current study also confirms the findings of **Bharthi Seker E et al.** and **Choudhary AK et al.**, who observed enhanced intraoperative sedation and better postoperative analgesia with minimal side effects.

Hemodynamically, the dexmedetomidine group demonstrated greater stability in both heart rate and systolic blood pressure, with only mild decreases that were clinically insignificant and required no intervention. This is consistent with previous literature, including studies by **Kubre J et al.** and **Pritee H. Bhirud et al.**, who found dexmedetomidine to be safe and well-tolerated in similar clinical scenarios.

Moreover, the incidence of adverse effects such as nausea, bradycardia, and hypotension was low in the dexmedetomidine group, indicating a favorable safety profile. The sedative effect of dexmedetomidine also contributed to improved intraoperative patient comfort without significant respiratory depression—a major advantage in regional anaesthesia.

7. CONCLUSION

This observational study concludes that intravenous dexmedetomidine is a safe and effective adjuvant to spinal anaesthesia. It significantly reduces the onset time and prolongs the duration of both sensory and motor blocks, enhances postoperative analgesia, and maintains stable intraoperative hemodynamics. Its use may improve surgical outcomes and patient comfort in lower abdominal surgeries. Therefore, intravenous dexmedetomidine can be recommended as a valuable adjunct to intrathecal bupivacaine for spinal anaesthesia in routine clinical practice.

8. REFERENCES

1. Bharthi Seker E, Vijayaraghavan U, Asha AM. Intravenous dexmedetomidine prolongs spinal anaesthesia. *Indian J Anaesth*. 2018;62(4):321–6.
2. Dinesh CN, Sai Tej NA, Yatish B, et al. The effect of intravenous dexmedetomidine on spinal anaesthesia: A prospective randomized study. *Anesth Essays Res*. 2017;11(2):301–5.
3. Choudhary AK, Prasad MK, Keshri R, Choudhary S. Evaluation of intravenous dexmedetomidine on subarachnoid block. *J Clin Diagn Res*. 2016;10(4):UC01–UC04.
4. Kubre J, Sethi A, Mahobia M, et al. Comparative study of intravenous dexmedetomidine with normal saline in patients undergoing lower abdominal surgeries. *J Evid Based Med Healthc*. 2017;4(40):2476–80.
5. Hong JY, Kim WO, Yoon Y, et al. Effects of intravenous dexmedetomidine on spinal anaesthesia and sedation. *Acta Anaesthesiol Scand*. 2012;56(3):382–7.
6. Bhirud PH, Chellam S, et al. Comparative study of different doses of IV dexmedetomidine as adjuvant in spinal anaesthesia. *Anesth Essays Res*. 2020;14(2):246–51.
7. Abdallah FW, Abrishami A, Brull R. The efficacy of IV dexmedetomidine as an adjuvant for spinal anaesthesia. *Br J Anaesth*. 2013;110(6):915–25.
8. Santpur MU, Kahalekar GM, Saraf N. Effects of IV dexmedetomidine on spinal anaesthesia: A randomized trial. *Int J Res Med Sci*. 2016;4(2):532–6.