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# Intravenous Dexmedetomidine as an Adjunct to Spinal Anesthesia for Lower-Extremity Orthopedic Surgery: A Randomized Controlled Study

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## ABSTRACT

**BACKGROUND:**
Intravenous dexmedetomidine may prolong spinal anesthesia but can reduce heart rate and blood pressure. This study evaluated its effect on sensory and motor block characteristics and perioperative hemodynamics during lower-extremity orthopedic surgery.

**METHODS:**
In this single-center randomized controlled study, 25 adults with American Society of Anesthesiologists physical status I-II undergoing lower-extremity surgery under spinal anesthesia were allocated by sealed-envelope selection to dexmedetomidine (Group D; n=12) or saline control (Group C; n=13). All patients received 10 mg intrathecal isobaric bupivacaine. Group D received intravenous dexmedetomidine 1 g/kg over 10 minutes followed by 0.2 g/kg/h; Group C received volume-matched 0.9% saline. Sensory block was assessed by pinprick, motor block by the Bromage scale, and heart rate and blood pressure at prespecified perioperative time points. Between-group comparisons used the Mann-Whitney U test.

**RESULTS:**
Median sensory block onset was 1.0 versus 1.2 minutes (p=0.040) and motor block onset was 2.0 versus 2.5 minutes (p=0.025) in Groups D and C, respectively. Sensory block duration was 125 versus 85 minutes (p<0.001), and motor block duration was 102.5 versus 65 minutes (p=0.002). Heart rate was lower in Group D after the spinal technique and at 15 minutes, 40 minutes, the end of infusion, and 40 minutes after infusion (all p<0.05). Between-group blood pressure differences did not meet the prespecified p<0.05 threshold. No severe hemodynamic events were reported in the source study.

**CONCLUSIONS:**
Intravenous dexmedetomidine was associated with longer sensory and motor block duration and modestly faster block onset, but also with lower perioperative heart rate. Given the small sample, absence of reported blinding, and multiple time-point comparisons, these findings should be confirmed in larger, prospectively registered trials.

**KEYWORDS**

dexmedetomidine; spinal anesthesia; bupivacaine; lower-extremity surgery; sensory block; motor block

**HOW TO CITE**

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The author declares no conflicts of interest.

### AUTHOR CONTRIBUTIONS

Alfonso Gutierrez was responsible for study conception, methodology, investigation, data collection, data analysis and interpretation, and preparation and revision of the manuscript.

### DATA AVAILABILITY

The data supporting the findings of this study are not publicly available because they contain participant clinical information. Deidentified data may be available from the corresponding author upon reasonable request, subject to institutional and ethical requirements.

### ETHICS

Approved

### CONSENT

Not Applicable

### TRIAL REGISTRATION

Not registered

# Intravenous Dexmedetomidine as an Adjunct to Spinal Anesthesia for Lower-Extremity Orthopedic Surgery: A Randomized Controlled Study

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## ABSTRACT

Background: Intravenous dexmedetomidine may prolong spinal anesthesia but can reduce heart rate and blood pressure. We evaluated its effects on sensory and motor block characteristics and perioperative hemodynamics during lower-extremity orthopedic surgery.

Objective: To determine whether intravenous dexmedetomidine used with intrathecal bupivacaine alters block onset, block duration, heart rate, and blood pressure compared with saline control.

Methods: In this single-center randomized controlled study, 25 adults with ASA physical status I-II undergoing lower-extremity surgery under spinal anesthesia were allocated by sealed-envelope selection to dexmedetomidine (Group D; n=12) or saline control (Group C; n=13). All received 10 mg intrathecal isobaric bupivacaine. Group D received dexmedetomidine 1 µg/kg over 10 minutes followed by 0.2 µg/kg/h. Sensory block, motor block, heart rate, and blood pressure were assessed at prespecified times. Between-group comparisons used the Mann-Whitney U test.

Results: Median sensory block onset was 1.0 versus 1.2 minutes ($p=0.040$), and motor block onset was 2.0 versus 2.5 minutes ($p=0.025$), in Groups D and C. Sensory block duration was 125 versus 85 minutes ($p<0.001$), and motor block duration was 102.5 versus 65 minutes ($p=0.002$). Heart rate was lower in Group D at several post-spinal time points. Between-group blood pressure differences did not meet the prespecified $p<0.05$ threshold.

Conclusion: Intravenous dexmedetomidine was associated with longer sensory and motor block duration and modestly faster onset, but also with lower perioperative heart rate. Larger, prospectively registered trials are needed to confirm efficacy and safety.

Keywords: dexmedetomidine; spinal anesthesia; bupivacaine; lower-extremity surgery; sensory block; motor block; hemodynamics.

## INTRODUCTION

Spinal anesthesia is widely used for lower-extremity surgery, but the duration of sensory and motor blockade is finite and may not cover longer procedures or early postoperative analgesic needs. Intravenous dexmedetomidine, a highly selective α2-adrenoceptor agonist, provides sedative, sympatholytic, and analgesic-sparing effects with relatively limited respiratory depression, making it a clinically relevant adjunct during regional anesthesia [1,2].

dexmedetomidine prolonged sensory and motor block and delayed the first analgesic request, while increasing transient reversible bradycardia without a clear increase in hypotension [3]. Subsequent randomized studies have generally confirmed prolonged block duration, although effects on block onset and hemodynamics have varied according to dose and protocol [4-7].

The present study evaluated whether intravenous dexmedetomidine, administered as a loading dose followed by a low-dose maintenance infusion, was associated with changes in the onset and duration of spinal sensory and motor block and perioperative heart rate and blood pressure in adults undergoing lower-extremity orthopedic surgery.

## METHODS

### Study design and setting

This was a single-center, randomized, controlled, parallel-group study conducted at Hospital General Nacional “Dr. Ángel Larralde” between June and August 2025. Participants were prospectively assigned to an active intravenous intervention or saline control.

### Participants

Eligible participants were adults aged 18-65 years with American Society of Anesthesiologists (ASA) physical status I or II, body mass index ≤30 kg/m², scheduled for lower-extremity orthopedic procedures under spinal anesthesia, and willing to provide written informed consent. The study enrolled 25 participants using a nonprobability volunteer sample.

Exclusion criteria were refusal to participate; ASA physical status III or higher; pregnancy; first- or second-degree atrioventricular block; unexplained hypotension; conversion to or combination with another anesthetic technique; refusal of spinal anesthesia; allergy to α2-agonists; hemodynamic instability; planned surgery shorter than 1 hour or longer than 3 hours; renal disease; or abnormal coagulation testing.

### Randomization and study groups

After enrollment, each participant selected a sealed envelope indicating group assignment. Twelve participants were assigned to the dexmedetomidine group (Group D) and 13 to the saline control group (Group C). The study documentation did not describe generation of the allocation sequence, allocation concealment beyond the sealed-envelope procedure, or blinding of participants, clinicians, or outcome assessors.

### Anesthetic protocol

Thirty minutes before spinal anesthesia, participants received the study center's standard preanesthetic regimen: intravenous ketoprofen 100 mg, omeprazole 40 mg, dexamethasone 8 mg, metoclopramide 10 mg, and cefazolin 2 g. Baseline systolic blood pressure, diastolic blood pressure, and heart rate were recorded in the operating room.

Group D received intravenous dexmedetomidine 1 µg/kg over 10 minutes before spinal anesthesia, followed by a continuous infusion of 0.2 µg/kg/h in 0.9% saline beginning with the anesthetic technique. Group C received an equivalent-volume 0.9% saline infusion. Spinal anesthesia was performed using a midline approach with a 25-gauge Quincke needle; after confirmation of cerebrospinal fluid, 10 mg of isobaric bupivacaine was administered intrathecally. Hypotension or bradycardia could be treated with intravenous ephedrine 5-10 mg and/or atropine 0.02 mg/kg according to clinical judgment.

### Outcomes and measurements

Sensory block was assessed by pinprick and motor block by the Bromage scale. Sensory and motor onset times were recorded. Sensory block duration was measured from block establishment until the first return of nociceptive sensation, and motor block duration until regression to Bromage grade I. Heart rate and systolic and diastolic blood pressure were recorded at baseline, during the spinal anesthetic technique, immediately after the subarachnoid block, 15 and 40 minutes after initiation of the study infusion, at the end of the infusion, and 40 minutes after infusion discontinuation in the post-anesthesia care unit.

### Ethics

The protocol was reported as approved by the Bioethics Committee of Hospital General Nacional “Dr. Ángel Larralde.” The study was conducted in accordance with the Declaration of Helsinki and the Venezuelan Code of Ethics for Life. All participants provided written informed consent, and confidentiality was maintained through alphanumeric coding and anonymization. An ethics approval number was not provided in the source documentation.

### Statistical analysis

Data were entered in Microsoft Excel and analyzed using SPSS version 22.0. Quantitative and ordinal variables were summarized as medians and minimum-maximum ranges. Between-group comparisons were performed using the Mann-Whitney U test. A two-sided p value $<0.05$ was considered statistically significant. No a priori sample-size calculation or multiplicity adjustment was reported.

### Participant characteristics

Twenty-five participants were analyzed: 12 in Group D and 13 in Group C. Each group included three women. Age was reported by sex rather than as an overall group summary (Table 1).

**Table 1. Participant characteristics**

| Characteristic | Group D (n=12) | Group C (n=13) |
|---|---|---|
| Female sex, n (%) | 3 (25.0) | 3 (23.1) |
| Male sex, n (%) | 9 (75.0) | 10 (76.9) |
| Age among women, y, median (min-max) | 37 (34-60) | 30 (18-47) |
| Age among men, y, median (min-max) | 32 (19-55) | 33 (20-43) |

## Sensory and motor block

Dexmedetomidine was associated with modestly faster sensory and motor block onset and substantially longer sensory and motor block duration (Table 2).

**Table 2. Sensory and motor block characteristics**

| Outcome | Group D median (min-max) | Group C median (min-max) | p value |
|---|---|---|---|
| Sensory block onset, min | 1.0 (0.5-1.5) | 1.2 (0.70-1.8) | 0.040 |
| Motor block onset, min | 2.0 (1.0-3.5) | 2.5 (2.0-4.0) | 0.025 |
| Sensory block duration, min | 125 (75-155) | 85 (55-117) | <0.001 |
| Motor block duration, min | 102.5 (60-145) | 65 (40-109) | 0.002 |

## Blood pressure

Blood pressure was generally lower in Group D at several post-baseline time points, but none of the between-group comparisons met the prespecified $p<0.05$ significance threshold. Systolic blood pressure at 40 minutes yielded $p=0.050$ and was treated as borderline rather than statistically significant (Table 3).

**Table 3. Perioperative systolic and diastolic blood pressure**

| Time point / parameter | Group D median (min-max) | Group C median (min-max) | p value |
|---|---|---|---|
| Baseline SBP, mmHg | 130 (100-142) | 121 (102-140) | 0.052 |
| Baseline DBP, mmHg | 82 (65-95) | 71 (62-100) | 0.300 |
| During technique SBP, mmHg | 120 (105-135) | 118 (100-140) | 0.935 |
| During technique DBP, mmHg | 71 (62-89) | 75 (60-85) | 0.940 |
| Post-spinal SBP, mmHg | 108 (74-125) | 115 (100-125) | 0.325 |
| Post-spinal DBP, mmHg | 68.5 (44-77) | 65 (50-82) | 0.703 |
| 15 min SBP, mmHg | 104 (69-164) | 111 (98-124) | 0.107 |
| 15 min DBP, mmHg | 64.5 (30-107) | 70 (50-80) | 0.368 |
| 40 min SBP, mmHg | 101.1 (92-158) | 115 (100-135) | 0.050 |
| 40 min DBP, mmHg | 67 (52-109) | 80 (61-95) | 0.703 |
| End infusion SBP, mmHg | 100 (99-145) | 117 (97-130) | 0.075 |
| End infusion DBP, mmHg | 66.5 (55-79) | 74 (47-84) | 0.252 |
| 40 min post-infusion SBP, mmHg | 112.5 (100-151) | 120 (103-130) | 0.072 |
| 40 min post-infusion DBP, mmHg | 62.5 (50-80) | 74 (55-90) | 0.056 |

## Heart rate

Baseline heart rate was similar between groups. Heart rate was lower in Group D at every subsequent time point; the difference during the anesthetic technique was $p=0.050$ and did not meet the prespecified $p<0.05$ threshold, while differences after the technique, at 15 and 40 minutes, at the end of infusion, and 40 minutes post-infusion were statistically significant (Table 4).

| | | | |
|---|---|---|---|
| Baseline | 70 | 75 | 0.913 |
| During anesthetic technique | 65 | 75 | 0.050 |
| Immediately post-spinal | 62 | 72 | 0.049 |
| 15 min | 62 | 70 | 0.025 |
| 40 min | 60 | 71 | 0.001 |
| End of infusion | 58.5 | 75 | 0.005 |
| 40 min post-infusion | 60 | 80 | 0.003 |

No severe hemodynamic events such as severe hypotension or cardiac arrest were reported. However, adverse events and rescue-medication use were not tabulated systematically.

## DISCUSSION

In this small randomized controlled study, intravenous dexmedetomidine added to spinal anesthesia was associated with substantially longer sensory and motor block duration and modestly faster block onset. The principal hemodynamic finding was a sustained reduction in heart rate after spinal anesthesia, whereas blood pressure differences did not meet the study's prespecified $p<0.05$ threshold.

The approximately 40-minute difference in median sensory block duration and 37.5-minute difference in median motor block duration are directionally consistent with prior evidence. Abdallah et al. reported in a meta-analysis of seven randomized trials that intravenous dexmedetomidine prolonged sensory block by approximately 38% and motor block by approximately 21%, while also delaying the first request for analgesia [3]. Randomized studies by Kılıç and Aydın, Sekar et al., Thakkar et al., and Chahal et al. likewise support prolongation of spinal block or postoperative analgesic duration with intravenous dexmedetomidine [4-7].

The faster onset observed in this study should be interpreted cautiously. Sekar et al. found no significant difference in sensory or motor onset, and a 2025 randomized trial by Chahal et al. also reported similar onset times between groups [5,7]. Because the current sample included only 25 participants and tested numerous outcomes and time points without a reported multiplicity adjustment, the onset findings may be more susceptible to random variation.

The lower heart rate in the dexmedetomidine group is pharmacologically plausible. Dexmedetomidine reduces central sympathetic activity through α2-adrenoceptor agonism, and bradycardia and hypotension are recognized dose-related effects [1,2]. The 2013 meta-analysis found a 3.7-fold increase in transient reversible bradycardia with intravenous dexmedetomidine, without a significant increase in hypotension [3]. This pattern resembles the present findings, in which heart-rate differences were more consistent than blood-pressure differences.

The maintenance infusion of 0.2 μg/kg/h was relatively low compared with several later randomized protocols using 0.5 μg/kg/h [5-7]. A 2018 randomized study also used a 0.2 μg/kg/h infusion during spinal anesthesia and documented lower hemodynamic measures and improved block-related outcomes, although its protocol was not identical to the present study [4].

These findings do not establish a definitive safety advantage or justify routine adoption of dexmedetomidine for all patients undergoing spinal anesthesia. The study was small, adverse events were not systematically tabulated, and clinically important outcomes such as sedation scores, oxygen saturation, postoperative pain, opioid consumption, and time to first rescue analgesia were not reported. Larger studies with prespecified primary outcomes are needed to determine the optimal dose and the balance between prolonged block and cardiovascular effects.

### Limitations

This study has several limitations. It was single-center and included only 25 volunteers without a reported a priori sample-size calculation, limiting precision and external validity. Although allocation used sealed envelopes, sequence generation, concealment procedures, and blinding were not described. Repeated between-group testing at multiple perioperative time points was performed without a reported multiplicity adjustment. The study did not provide a CONSORT-style participant flow, systematic adverse-event counts, rescue-medication use, oxygen saturation, sedation, postoperative pain, opioid consumption, or longer-term outcomes. No prospective trial-registration information was provided. In addition, some source-table values were internally inconsistent; values that could not be reconciled reliably were not reproduced in this report.

Among 25 ASA I-II adults undergoing lower-extremity orthopedic surgery under spinal anesthesia, intravenous dexmedetomidine 1 μg/kg followed by 0.2 μg/kg/h was associated with longer sensory and motor block duration and modestly faster block onset compared with saline. Heart rate was lower at several perioperative time points, while between-group blood pressure differences were not statistically significant under the prespecified $p<0.05$ threshold. Larger, prospectively registered and adequately powered trials are required before firm conclusions regarding efficacy and safety can be drawn.

## DECLARATIONS

Ethics approval and consent to participate: The protocol was reported as approved by the Bioethics Committee of Hospital General Nacional “Dr. Ángel Larralde.” All participants provided written informed consent. The approval identifier was not provided in the source documentation.

Consent for publication: Not applicable; only aggregate, deidentified participant data are reported.

Funding: The author declares no funding.

Conflicts of interest: The author declares no conflicts of interest.

Data availability: The data supporting the findings of this study are not publicly available because they contain participant clinical information. Deidentified data may be available from the corresponding author upon reasonable request, subject to institutional and ethical requirements.

Author contributions: Alfonso Gutiérrez was responsible for study conception, methodology, investigation, data collection, data analysis and interpretation, and preparation and revision of the manuscript.

## REFERENCES

1. Weerink MAS, Struys MMRF, Hannivoort LN, Barends CRM, Absalom AR, Colin P. Clinical pharmacokinetics and pharmacodynamics of dexmedetomidine. Clin Pharmacokinet. 2017;56(8):893-913. doi:10.1007/s40262-017-0507-7.

2. Naaz S, Ozair E. Dexmedetomidine in current anaesthesia practice: a review. J Clin Diagn Res. 2014;8(10):GE01-GE04. doi:10.7860/JCDR/2014/9624.4946.

3. Abdallah FW, Abrishami A, Brull R. The facilitatory effects of intravenous dexmedetomidine on the duration of spinal anesthesia: a systematic review and meta-analysis. Anesth Analg. 2013;117(1):271-278. doi:10.1213/ANE.0b013e318290c566.

4. Kılıç ET, Aydın G. Effects of dexmedetomidine infusion during spinal anesthesia on hemodynamics and sedation. Libyan J Med. 2018;13(1):1436845. doi:10.1080/19932820.2018.1436845.

5. Sekar EB, Vijayaraghavan U, Sadiqbasha AM. Effect of intravenous dexmedetomidine on spinal anesthesia. Cureus. 2021;13(6):e15708. doi:10.7759/cureus.15708.

6. Thakkar PD, Patel DR, Shah UD, Gupta S, Dudhani R, Mirchandani B. Effect of intravenous dexmedetomidine on characteristics of spinal anaesthesia with hyperbaric bupivacaine: a prospective study. J Popul Ther Clin Pharmacol. 2024;31(2):890-895. doi:10.53555/jptcp.v31i2.4299.

7. Chahal S, Bhalotra AR, Singh R, Dhiman S, Singh S. Effect of intravenous dexmedetomidine on sensory block duration in spinal anesthesia for lower limb surgery: a randomized controlled trial. Braz J Anesthesiol. 2025;75(6):844672. doi:10.1016/j.bjane.2025.844672.

8. Gertler R, Brown HC, Mitchell DH, Silvius EN. Dexmedetomidine: a novel sedative-analgesic agent. Proc (Bayl Univ Med Cent). 2001;14(1):13-21. doi:10.1080/08998280.2001.11927725.