
# A Comparative Study Between Dexmedetomidine and Dexamethasone as an Intrathecal Adjuvant for Prevention of Perioperative Shivering in Cesarean Section

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**Abstract**

Perioperative shivering is a common complication following spinal anesthesia for cesarean section, affecting patient comfort and increasing metabolic demands. This prospective, randomized, double-blind study compared intrathecal dexmedetomidine versus dexamethasone as adjuvants to bupivacaine for preventing shivering. One hundred twenty parturients undergoing elective cesarean section were randomly allocated into three groups (n=40 each): Group B received 12.5mg hyperbaric bupivacaine alone, Group BD received bupivacaine plus 5µg dexmedetomidine, and Group BX received bupivacaine plus 4mg dexamethasone. The primary outcome was incidence of perioperative shivering. Secondary outcomes included shivering severity, onset and duration of block, hemodynamic parameters, core temperature changes, and neonatal outcomes. Shivering incidence was significantly lower in Group BD (15%) and Group BX (17.5%) compared to Group B (47.5%) ($p<0.001$). No significant difference existed between BD and BX groups (p=0.762). Both adjuvant groups showed prolonged sensory block duration (BD: 198±26min, BX: 176±22min vs B: 148±19min; $p<0.001$). Group BD had higher incidence of bradycardia (22.5% vs 7.5% in BX and 5% in B; p=0.034). Neonatal outcomes were comparable across groups. Both dexmedetomidine and dexamethasone effectively reduce perioperative shivering when used as intrathecal adjuvants, with dexmedetomidine providing longer analgesia but more bradycardia.

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## Introduction

Cesarean section is one of the most frequently performed surgical procedures globally, with spinal anesthesia being the preferred anesthetic technique due to its rapid onset, reliability, and superior safety profile for both mother and neonate [1]. Despite these advantages, perioperative shivering remains a significant concern, occurring in 40-60% of patients undergoing neuraxial anesthesia [2]. This involuntary muscular activity not only causes considerable patient discomfort but also increases oxygen

consumption by up to 600%, potentially leading to adverse maternal and fetal outcomes [3].

The pathophysiology of perioperative shivering during spinal anesthesia is complex and multifactorial. The primary mechanism involves thermoregulatory responses to perioperative hypothermia. Spinal anesthesia induces sympathetic blockade, resulting in peripheral vasodilation and redistribution of body heat from the core to the periphery [4]. This redistribution, combined with exposure to cold operating room environments and administration of room-temperature intravenous fluids, leads to a significant decrease in core body temperature. Additionally, neuraxial blockade directly impairs thermoregulatory control by preventing vasoconstriction and shivering below the level of the block [5].

Non-thermoregulatory mechanisms also contribute to perioperative shivering. These include pain, direct effects of local anesthetics on the spinal cord, systemic absorption of local anesthetics, and psychological factors such as anxiety and fear [6].

The recovery from spinal anesthesia itself may trigger shivering as a result of differential block regression and restoration of thermoregulatory responses. Various strategies have been employed to prevent and treat perioperative shivering. Non-pharmacological methods include maintaining normothermia through active warming, increasing ambient temperature, and warming intravenous fluids. Pharmacological interventions have traditionally relied on systemic medications such as meperidine, tramadol, and nefopam [7]. However, systemic administration of these drugs in the obstetric population raises concerns about placental transfer and potential neonatal effects.

The use of intrathecal adjuvants to enhance spinal anesthesia quality while potentially preventing shivering has gained considerable attention. These adjuvants offer the advantage of achieving therapeutic effects with smaller doses, thereby minimizing systemic absorption and placental transfer [8]. Among the various adjuvants studied, dexmedetomidine and dexamethasone have emerged as promising candidates.

Dexmedetomidine, a highly selective α2-adrenergic agonist, has demonstrated efficacy in prolonging spinal anesthesia and providing postoperative analgesia when administered intrathecally [9]. Its anti-shivering properties are attributed to its action on α2 receptors in the hypothalamus and spinal cord, which modulate thermoregulatory responses and reduce the shivering threshold. Studies have shown that intrathecal dexmedetomidine doses of 5-10μg effectively reduce shivering without significant maternal or neonatal adverse effects [10].

Dexamethasone, a potent synthetic corticosteroid, has been extensively used as an adjuvant in regional anesthesia to prolong block duration and improve postoperative analgesia [11]. Recent evidence suggests that intrathecal dexamethasone may also possess anti-shivering properties, possibly through its anti-inflammatory effects and modulation of central thermoregulatory pathways. The optimal dose of intrathecal dexamethasone for cesarean section appears to be 4mg, balancing efficacy with safety [12].

Despite growing interest in these adjuvants, direct comparative studies evaluating their relative efficacy for preventing perioperative shivering in cesarean section are limited. Understanding their comparative effectiveness, safety profiles, and impact on maternal and neonatal outcomes is crucial for evidence-based clinical decision-making. This study aims to compare the efficacy of intrathecal dexmedetomidine versus dexamethasone as adjuvants to hyperbaric bupivacaine for preventing perioperative shivering in elective cesarean section.

## Materials and Methods

### Trial Design and Regulatory Approvals

This prospective, randomized, double-blind, controlled clinical trial was conducted at a tertiary care hospital from February 2023 to January 2024. The study protocol received approval from the Institutional Ethics Committee (IEC/2023/022) and was registered with the Clinical Trials Registry (CTRI/2023/02/049876). Written informed consent was obtained from all participants. The study adhered to the Declaration of Helsinki principles and CONSORT guidelines.

### Participants

Inclusion criteria included: ASA physical status II parturients aged 20-40 years with singleton term pregnancy (37-42 weeks) scheduled for elective cesarean section under spinal anesthesia, height 150-175cm, and body weight 50-90kg. Exclusion criteria comprised: contraindications to spinal anesthesia, known allergy to study drugs, pre-existing cardiac disease or arrhythmias, thyroid disorders, baseline temperature <36°C or >37.5°C, chronic analgesic use, and refusal to participate.

### Sample Size Calculation

Based on a pilot study showing 45% shivering incidence with bupivacaine alone, assuming 50% reduction with adjuvants ($\alpha$=0.05, $\beta$=0.20), 36 patients per group were required. Accounting for 10% dropout, 40 patients per group were recruited.

### Patient Allocation and Blinding Methods

Computer-generated block randomization (blocks of 6) was used. Allocation concealment employed sealed opaque envelopes. An anesthesiologist not involved in patient care prepared study drugs in identical syringes. Patients, attending anesthesiologists, and outcome assessors remained blinded.

### Interventions

Patients were allocated to three groups:

- Group B: 2.5ml hyperbaric bupivacaine 0.5% (12.5mg)
- Group BD: 2.5ml hyperbaric bupivacaine 0.5% + dexmedetomidine 5μg (0.5ml)
- Group BX: 2.5ml hyperbaric bupivacaine 0.5% + dexamethasone 4mg (0.5ml)

### Perioperative Anesthetic Management

Standard monitoring included ECG, NIBP, SpO2, and core temperature (tympanic membrane). After establishing intravenous access, patients received 10ml/kg Ringer's lactate. Spinal anesthesia was performed at L3-4 interspace using 25G Quincke needle in sitting position. Study drug was injected over 10-15 seconds. Patients were positioned supine with left uterine displacement.

### Shivering Assessment

Shivering was assessed using the Bedside Shivering Assessment Scale [13]:

0: No shivering

1: Mild shivering (peripheral vasoconstriction/piloerection)

2: Moderate shivering (visible muscular activity in one group)

3: Severe shivering (generalized muscular activity)
Shivering ≥2 was treated with intravenous meperidine 12.5mg.

**Assessment Variables**
Primary outcome: Incidence of perioperative shivering (intraoperative and 2 hours postoperatively) Secondary outcomes: Shivering severity, time to shivering onset, sensory/motor block characteristics, hemodynamic parameters, core temperature changes, neonatal Apgar scores, maternal satisfaction (10-point scale), and adverse effects.

**Statistical Analysis**
Analysis used SPSS 25.0. Continuous data: mean ±SD, analyzed by ANOVA with post-hoc Tukey test. Categorical data: frequencies/percentages, analyzed by chi-square/Fisher's exact test. $P<0.05$ considered significant.

## Results

**Participant Characteristics**
Of 132 screened patients, 120 were randomized with no dropouts (Figure 1). Groups were comparable regarding demographic and obstetric characteristics (Table 1).

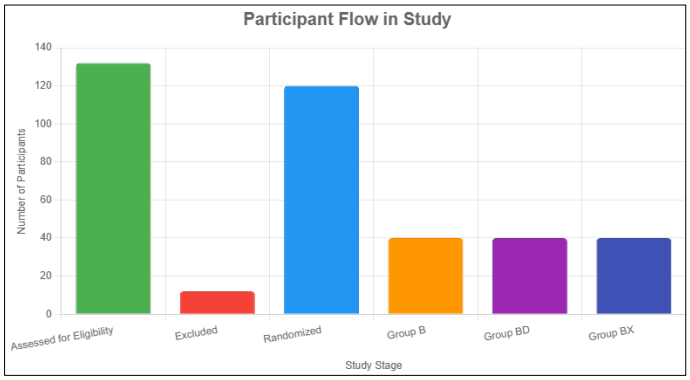


**Fig 1:** CONSORT Flow Diagram

**Table 1:** Demographic and Baseline Characteristics

| Parameter | Group B (n=40) | Group BD (n=40) | Group BX (n=40) | P value |
|---|---|---|---|---|
| Age (years) | 29.2±4.8 | 28.7±5.1 | 29.5±4.6 | 0.754 |
| Weight (kg) | 72.4±8.6 | 73.1±7.9 | 71.8±8.2 | 0.792 |
| Height (cm) | 161.3±5.7 | 162.1±6.1 | 160.8±5.9 | 0.628 |
| Gestational age (weeks) | 38.9±0.8 | 39.1±0.7 | 38.8±0.9 | 0.234 |
| Baseline temperature (°C) | 36.9±0.2 | 36.8±0.3 | 36.9±0.2 | 0.187 |
| Surgery duration (min) | 48.3±7.2 | 49.1±6.8 | 47.6±7.5 | 0.655 |

**Main Study Finding**
Shivering incidence was significantly lower in adjuvant groups: 6/40 (15%) in BD, 7/40 (17.5%) in BX versus 19/40 (47.5%) in B ($p<0.001$). No significant difference between BD and BX groups (p=0.762).

**Additional Study Findings**
Shivering severity was reduced in adjuvant groups with fewer grade 2-3 episodes (Table 2). Time to shivering onset was delayed in BD (42.3±8.6min) and BX (38.7±7.4min) versus B (22.4±6.2min) groups ($p<0.001$).

**Table 2:** Shivering Characteristics

| Parameter | Group B | Group BD | Group BX | P value |
|---|---|---|---|---|
| Shivering incidence, n (%) | 19 (47.5) | 6 (15.0) * | 7 (17.5) * | <0.001 |
| **Shivering grade, n (%)** | | | | |
| Grade 0 | 21 (52.5) | 34 (85.0) | 33 (82.5) | <0.001 |
| Grade 1 | 6 (15.0) | 3 (7.5) | 4 (10.0) | 0.562 |
| Grade 2 | 8 (20.0) | 2 (5.0) | 2 (5.0) | 0.034 |
| Grade 3 | 5 (12.5) | 1 (2.5) | 1 (2.5) | 0.073 |
| Time to onset (min) | 22.4±6.2 | 42.3±8.6* | 38.7±7.4* | <0.001 |
| Meperidine required, n (%) | 13 (32.5) | 3 (7.5) * | 3 (7.5) * | 0.002 |

*$P<0.05$ versus Group B

Block characteristics showed prolonged sensory and motor block duration in adjuvant groups, with BD showing longest duration (Table 3).

**Table 3:** Block Characteristics and Hemodynamic Parameters

| Parameter | Group B | Group BD | Group BX | P value |
|---|---|---|---|---|
| Block onset to T6 (min) | 5.2±1.3 | 4.8±1.1 | 4.9±1.2 | 0.314 |
| Sensory block duration (min) | 148±19 | 198±26*† | 176±22* | <0.001 |
| Motor block duration (min) | 132±17 | 174±23*† | 158±20* | <0.001 |
| Hypotension, n (%) | 11 (27.5) | 14 (35.0) | 12 (30.0) | 0.756 |
| Bradycardia, n (%) | 2 (5.0) | 9 (22.5) * | 3 (7.5) | 0.034 |
| Maximum ΔT from baseline (°C) | -1.1±0.3 | -0.9±0.4 | -1.0±0.3 | 0.052 |

*$P<0.05$ versus Group B, †$P<0.05$ versus Group BX

Core temperature decreased similarly across groups. Maternal satisfaction was higher in adjuvant groups (BD: 8.8±0.9, BX: 8.6±1.0 vs B: 7.1±1.2; $p<0.001$). Neonatal Apgar scores were comparable with all scores ≥8 at 5 minutes.

## Discussion

This study demonstrates that both intrathecal dexmedetomidine and dexamethasone significantly reduce perioperative shivering incidence in cesarean section, with comparable efficacy between the two adjuvants. The reduction from 47.5% to approximately 15-17.5% represents a clinically meaningful improvement in patient comfort and perioperative care quality.

The anti-shivering mechanism of dexmedetomidine involves α2-adrenergic receptor activation in the hypothalamus and spinal cord, reducing the shivering threshold and modulating thermoregulatory responses [14]. Our findings align with previous studies showing 60-80% reduction in shivering with intrathecal dexmedetomidine. The 5μg dose used provided optimal balance between efficacy and side effects, particularly bradycardia.

Dexamethasone's anti-shivering properties, though less established, likely involve anti-inflammatory effects and central thermoregulatory modulation. The comparable efficacy to dexmedetomidine suggests corticosteroids may represent a valuable alternative, particularly given their favorable cardiovascular profile. The 4mg dose effectively prevented shivering without significant adverse effects.

The prolonged block duration observed with both adjuvants has important clinical implications. Extended analgesia reduces early postoperative opioid requirements, facilitating maternal recovery and early ambulation. Dexmedetomidine provided superior block prolongation, consistent with its known local anesthetic-potentiating effects [15].

Hemodynamic differences between adjuvants merit consideration. The higher bradycardia incidence with dexmedetomidine (22.5% vs 7.5%) reflects its sympatholytic properties. While manageable, this requires vigilant monitoring and may influence adjuvant selection in patients with pre-existing bradycardia or conduction abnormalities.

The absence of neonatal adverse effects with either adjuvant is reassuring. Maintained Apgar scores indicate minimal placental transfer or fetal effects at the doses used. This safety profile is crucial given concerns about potential neurotoxicity with neuraxial adjuvants [16].

Our findings support integrating these adjuvants into multimodal approaches for cesarean section anesthesia. The choice between dexmedetomidine and dexamethasone should consider individual patient factors, with dexamethasone potentially preferred in patients at risk for bradycardia, while dexmedetomidine may benefit those requiring prolonged analgesia.

Study limitations include single-center design, fixed dosing without dose-response evaluation, and limited follow-up duration. Future research should investigate optimal dosing, combination therapy potential, and long-term outcomes including chronic pain development [17].

## Conclusion

Both intrathecal dexmedetomidine (5μg) and dexamethasone (4mg) effectively prevent perioperative shivering in cesarean section with comparable efficacy. Dexmedetomidine provides superior block prolongation but increased bradycardia risk, while dexamethasone offers similar anti-shivering benefits with better hemodynamic stability. These findings support individualized adjuvant selection based on patient characteristics and clinical priorities.

## References


1. Rong LQ, Nickles AV, Shen N, *et al*. Spinal anesthesia for cesarean delivery: A review of current practice. Anesthesiol Clin. 2021;39(3):549-564.
2. Nath MP, Garg R, Talukdar T. Perioperative shivering: A review. Indian J Anaesth. 2018;62(12):916-923.
3. Lopez MB. Postanaesthetic shivering - from pathophysiology to prevention. Rom J Anaesth Intensive Care. 2018;25(1):73-81.
4. Sessler DI. Temperature monitoring and perioperative thermoregulation. Anesthesiology. 2021;134(1):111-118.
5. Kurz A. Thermal care in the perioperative period. Best Pract Res Clin Anaesthesiol. 2008;22(1):39-62.
6. Buggy DJ, Crossley AW. Thermoregulation, mild perioperative hypothermia and postanaesthetic shivering. Br J Anaesth. 2000;84(5):615-628.
7. Zhou C, Zhu Y, Liu Z, Ruan L. Effect of dexmedetomidine on postoperative shivering: A meta-analysis of randomized controlled trials. PLoS One. 2019;14(7):e0218991.
8. Gadre A, Shribhagwan S. Intrathecal adjuvants for cesarean section: A review. Anaesth Pain Intensive Care. 2020;24(5):571-581.
9. Gupta K, Jain M, Gupta PK, *et al*. Dexmedetomidine as an intrathecal adjuvant for postoperative analgesia. Indian J Anaesth. 2011;55(4):347-351.
10. Qi X, Chen D, Li G, *et al*. Comparison of intrathecal dexmedetomidine with morphine as adjuvants in cesarean sections. Biol Pharm Bull. 2016;39(9):1455-1460.
11. Albrecht E, Kern C, Kirkham KR. A systematic review and meta-analysis of perineural dexamethasone for peripheral nerve blocks. Anaesthesia. 2015;70(1):71-83.
12. Rahangdale R, Kendall MC, McCarthy RJ, *et al*. The effects of perineural versus intravenous dexamethasone on sciatic nerve blockade outcomes. Anesth Analg. 2014;118(5):1113-1119.
13. Badjatia N, Strongilis E, Gordon E, *et al*. Metabolic impact of shivering during therapeutic temperature modulation. Stroke. 2008;39(12):3242-3247.
14. Mittal G, Gupta K, Katyal S, Kaur S. Randomised double-blind comparative study of dexmedetomidine and tramadol for postspinal anaesthesia shivering. Indian J Anaesth. 2014;58(3):257-262.
15. Abdallah FW, Brull R. Facilitatory effects of perineural dexmedetomidine on neuraxial and peripheral nerve block. Br J Anaesth. 2013;110(6):915-925.
16. Sanders RD, Xu J, Shu Y, *et al*. Dexmedetomidine attenuates isoflurane-induced neurocognitive impairment in neonatal rats. Anesthesiology. 2009;110(5):1077-1085.
17. Eisenach JC, Pan PH, Smiley R, *et al*. Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression. Pain. 2008;140(1):87-94.