

# COMPARISON OF EFFECTIVENESS BETWEEN ONDANSETRON AND KETAMINE IN PREVENTING SHIVERING IN PARTURIENTS UNDERGOING CESAREAN SECTION UNDER SPINAL ANESTHESIA

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## Abstract

**Objective:** To compare the efficacy of Ondansetron and ketamine on post-spinal anesthesia shivering in cesarean section.

**Methods:** In this randomized controlled trial, we included 120 patients who underwent elective cesarean section under spinal anesthesia in Services Hospital, Lahore. The study was conducted from September 2024 to February 2025. The parturients were randomly assigned to two groups: one receiving ondansetron (Group 1) and the other receiving Ketamine at a dose of 0.25 mg/kg (Group 2). Frequency and severity of shivering was noted for each patient.

**Results:** The average age of patients was  $30.7 \pm 5.4$  years. The average body mass index (BMI) was  $26.2 \pm 3.6$  Kg/m<sup>2</sup>. Shivering occurred in 9 individuals (15.0%) from Group O and in 7 individuals (11.7%) from Group K, with a *p*-value of 0.59. Additionally, when evaluating shivering severity, 5 participants (8.3%) in Group O and 2 participants (3.3%) in Group K exhibited Grade I shivering, while 4 participants (6.7%) in Group O and 5 participants (8.3%) in Group K reported Grade II shivering (*p*-value 0.48).

**Conclusion:** Both ondansetron and ketamine are equally effective for preventing shivering in patients undergoing cesarean section under spinal anesthesia.

## INTRODUCTION

Cesarean delivery is among the most frequently performed surgical interventions worldwide. For both planned and emergency procedures, spinal anesthesia is often the technique of choice due to its quick onset, limited exposure of the fetus and mother to drugs, and its generally high effectiveness.<sup>1</sup> A common issue encountered during these procedures is perioperative shivering, which can affect up to 54% of women undergoing spinal anesthesia for Cesarean sections.<sup>2,3</sup> Shivering is recognized as an involuntary, rhythmic contraction of skeletal muscles that occurs in response to a drop in core temperature.<sup>4</sup> The application of

spinal anesthesia has been shown to lower the threshold

for shivering, which is often associated with hypothermia and vasoconstriction occurring above the anesthetic level.<sup>5</sup> While shivering can serve beneficial thermoregulatory functions, it is commonly regarded as an uncomfortable experience that can lead to several adverse consequences. These include a heightened demand for oxygen and increased production of carbon dioxide, as well as rising intraocular and intracranial pressure. Additionally, shivering can elevate sympathetic nervous system activity, which may increase the risk of



myocardial ischemia, raise pain levels, and contribute to bleeding complications.<sup>6, 7</sup> Furthermore, this involuntary muscle activity can interfere with monitoring procedures such as non-invasive blood pressure measurements, electrocardiograms, and pulse oximetry.<sup>8</sup> Spinal anesthesia can result in hypothermia due to the dilation of blood vessels and the redistribution of body heat. While shivering is frequently observed in patients who experience a drop in body temperature during surgical procedures, the connection between shivering and body temperature is not always straightforward. Additionally, other factors unrelated to temperature regulation may contribute to shivering. These factors could include conditions such as sepsis, allergic reactions to medications, and reactions to blood transfusions.<sup>10</sup> Various pharmacologic and non-pharmacologic interventions have been explored to prevent and manage shivering after spinal anesthesia. Despite this, there is no universally agreed-upon best method for preventing or treating this condition.<sup>11</sup> Medications such as ketamine and ondansetron are frequently employed to mitigate post-spinal anesthesia shivering, especially in patients undergoing cesarean sections. The primary objective of this study was to evaluate and compare the effectiveness of ondansetron and ketamine in controlling shivering following spinal anesthesia.

#### METHODS:

In this randomized controlled trial, we included 120 patients who underwent elective cesarean section under spinal anesthesia in Services Hospital, Lahore. The study was conducted from September 2024 to February 2025. This study involved enrolling women who were in their term pregnancy and scheduled for cesarean delivery using spinal anesthesia. Participants were between 18 and 38 years old and classified as ASA II according to the American Society of Anesthesiologists standards. Women were excluded if they had any allergies or adverse reactions to the medications used in the study, experienced complicated pregnancies, or had pre-existing conditions such as heart disease, hypertension, gestational diabetes, postpartum hemorrhage, or if the spinal anesthesia failed or was

converted to general anesthesia. Additionally, women requiring urgent delivery or blood transfusions during the procedure were excluded. Following the acquisition of informed consent from each participant, the research team gathered comprehensive data, including demographic details, medical histories, and medications. The parturients were then randomly assigned to two groups: one receiving ondansetron (Group 1) and the other receiving Ketamine at a dose of 0.25 mg/kg (Group 2), with each group comprising 60 women. After establishing intravenous access with an 18-gauge cannula, all participants were infused with 10 ml/kg of Ringer's Lactate over 15 minutes, followed by a maintenance infusion of 2 ml/kg. Using strict aseptic techniques, a subarachnoid block was performed with the patient in a sitting position, employing a 25-gauge Quincke needle. A dose of 0.75% hyperbaric Bupivacaine, ranging from 1.6 to 2 ml, was injected at the L4-L5 interspace.

A parturient was promptly positioned in a supine posture with a slight head-down tilt, using a wedge placed under the right hip to optimize circulation. Oxygen therapy was administered at a rate of 4 liters per minute through a simple facemask to ensure adequate oxygenation. Continuous monitoring of blood pressure was conducted on a minute-by-minute basis until it stabilized. The effectiveness of the spinal anesthesia block was evaluated using both the pinprick test and the Bromage scale, targeting a sensory block at levels T4 to T6 and a motor block reaching Bromage grade 3.

The patient received no premedication or active warming methods prior to the procedure. An independent anesthesiologist prepared the medications for the study, loading them into 5 mL coded syringes. Subsequently, a designated anesthesiologist administered the respective study drugs to each group intravenously as a bolus over a two-minute interval immediately following spinal anesthesia (SA).

During surgery and the first hour of recovery, the occurrence and severity of shivering were documented every five minutes. The assessment utilized a scale comparable to the one validated by Tsai and Chu. Following the delivery of the baby, an intravenous bolus of 5 IU of oxytocin was administered, followed by a

continuous infusion of 20 IU in 500 mL of normal saline..

During instances of resistant shivering, a dose of 0.5 mg/kg of tramadol was administered intravenously immediately after clamping the umbilical cord. If the patient's heart rate dropped below 50 beats per minute, a 0.5 mg dose of atropine was given IV. In cases where blood pressure decreased by more than 20% from the baseline or systolic blood pressure fell below 100 mmHg, a bolus dose of phenylephrine ranging from 40 to 120 micrograms was administered IV. Additionally, if the patient experienced nausea, a 10 mg dose of metoclopramide was provided IV.

The data was analyzed using SPSS software version 21. Age was presented as mean ± SD. Gender, parity, and efficacy were reported as counts and percentages. Efficacy was compared between both groups using the chi-square test.

**RESULTS:**

The baseline characteristics of the participants showed an average age of 30.7 years with a

standard deviation of 5.4 years. The average body mass index (BMI) was 26.2 ± 3.6 kg/m<sup>2</sup>. Regarding gravidity, 38 participants were classified as primigravida, representing 31.7% of the group, while 82 participants were classified as multigravida, accounting for 68.3% of the total (Table 1).

Table 2 showed a comparison of the frequency of shivering between two groups, Group O and Group K, each consisting of 60 participants. Shivering occurred in 9 individuals (15.0%) from Group O and in 7 individuals (11.7%) from Group K, with a p-value of 0.59. Additionally, when evaluating the severity of shivering, 5 participants (8.3%) in Group O and 2 participants (3.3%) in Group K exhibited Grade I shivering, while 4 participants (6.7%) in Group O and 5 participants (8.3%) in Group K reported Grade II shivering. Importantly, no participants in either group experienced Grade III shivering (p-value 0.48) [Table 2].

**Table 1. Baseline Characteristics.**

Age (Y)	30.7±5.4
BMI (Kg/m <sup>2</sup> )	26.2±3.6
<b>Gravidity</b>	
Primigravida	38 (31.7%)
Multigravida	82 (68.3%)

**Table 2. Comparison of the Frequency of Shivering Between the Groups.**

	Group O (N=60)	Group K (N=60)	P-value
<b>Shivering (%)</b>			
Yes	09 (15.0%)	07 (11.7%)	0.59
No	51 (85.0%)	53 (88.3%)	
<b>Severity of Shivering (%)</b>			
Grade O	51 (85.0%)	53 (88.3%)	0.48
Grade I	05 (8.3%)	02 (3.3%)	
Grade II	04 (6.7%)	05 (8.3%)	
Grade III	00 (%)	00 (%)	

**DISCUSSION:**

Preventing shivering during cesarean sections performed under spinal anesthesia involves a combination of physical and pharmacological strategies. Physical approaches focus on

maintaining normal body temperature through various methods such as the use of forced-air warming blankets, warm water blankets, and warming of intravenous fluids. Increasing the operating room temperature and utilizing

passive insulators like heated cotton blankets also contribute. However, these physical interventions can be cumbersome, costly, and often only partially effective in preventing shivering.<sup>12</sup> A wide variety of medications are accessible for both preventing and managing shivering. These include opioids, N-methyl-D-aspartate receptor antagonists, magnesium sulfate, alpha-2 adrenergic agonists, cholinomimetics, and biogenic amines such as serotonin acting on 5-HT<sub>3</sub> receptors.<sup>13, 14</sup>

Ketamine functions primarily as a competitive antagonist of the N-methyl-D-aspartate (NMDA) receptor. It is effective in managing shivering that occurs after spinal anesthesia. The drug may also help maintain body heat by reducing the redistribution of heat from the core to the periphery. This is achieved through its stimulation of the central sympathetic nervous system and by blocking the reuptake of norepinephrine into postganglionic sympathetic nerve endings. Additionally, ketamine exhibits properties as a  $\kappa$ -opioid receptor agonist.<sup>15, 16</sup>

Ondansetron is a commonly used medication that blocks serotonin receptors, specifically 5-HT<sub>3</sub> antagonists, primarily employed to prevent nausea and vomiting. It is considered safe for use during pregnancy and surgical procedures.<sup>17</sup> Research indicates that it may also help reduce shivering caused by anesthesia, effective in both general and regional anesthesia contexts. Its benefits in obstetric anesthesia are notable due to its minimal side effects, such as sedation, blood pressure drops, or heart rate slowing, and it poses little risk to newborns. The exact way ondansetron prevents shivering remains uncertain, but it is believed to work centrally within the brain, possibly by inhibiting serotonin activity in the preoptic anterior hypothalamic area, which regulates body temperature.<sup>18</sup>

In an investigation, researchers discovered that a dose of 0.2 mg/kg of ketamine was more effective than 0.5 mg/kg of tramadol in preventing shivering during cesarean deliveries performed under spinal anesthesia. In the study by Kumar et al., the incidence of shivering was 33% in ketamine group, which was significantly lower compared to this study. Incidence of nausea and vomiting is markedly reduced with

this study drug i.e. less than 20%, and no effect on APGAR score was noted.<sup>19</sup>

A recent study by Browning et al. found that administering 8 mg of intravenous ondansetron did not reduce post-spinal anesthesia shivering in women undergoing cesarean sections when compared to a placebo.<sup>20</sup> Interestingly, this finding contrasts with a prior supportive study where a higher dose of 8 mg was used, yet the results regarding effectiveness differed. Nallam et al. reported that the same dosage of 8 mg IV ondansetron effectively prevented shivering after spinal anesthesia in cesarean deliveries, with only a 10% incidence rate, significantly lower than the 59.1% observed in the study by Jouryabi et al. Overall, ondansetron demonstrates a favorable safety profile, with minimal adverse effects, notably less than 15% incidence of nausea and vomiting. Additionally, neonatal outcomes, as measured by APGAR scores at 1 and 5 minutes, remained within normal ranges.<sup>18, 21</sup>

#### CONCLUSION:

Both ondansetron and ketamine are equally effective for preventing shivering in patients undergoing cesarean section under spinal anesthesia.

#### REFERENCES

1. Kumar K, Lin C, Symons T, Railton C. Narrative Review on Perioperative Shivering during Caesarean Section under Neuraxial Anaesthesia. *Rom J Anaesth Intensive Care*. 2022;29(1):41-6.
2. Zheng G, Zhang J, Liu J, Chen C, Zhang L, Cao F. A meta-analysis of randomized controlled trials: efficiency and safety of ondansetron in preventing post-anesthesia shivering during cesarean section. *Arch Gynecol Obstet*. 2023;307(1):223-31.
3. Nasution MP, Fitriati M, Veterini AS, Kriswidyatomo P, Utariani A. Preoperative perfusion index as a predictor of post-anaesthetic shivering in caesarean section with spinal anaesthesia. *J Perioper Pract*. 2022;32(5):108-14.
4. Askri MR, Maqbool S, Imran-ul-Hassan S, Ashraf A, Awan K, Liaqat M, editors.

- Prophylactic use of ketamine and tramadol for the prevention of intraoperative shivering in lower limb surgeries done in spinal anesthesia. *Medical Forum Monthly*; 2020.
5. Kabade SD, Venkatesh Y, Karthik S, Kumar VJKAJ. Comparative study of granisetron versus pethidine for the prevention of perioperative shivering under spinal Anesthesia. 2016:14-8.
  6. Fenta E, Kibret S, Hunie M, Tamire T, Fentie Y, Seid S, et al. The effects of intravenous tramadol vs. intravenous ketamine in the prevention of shivering during spinal anesthesia: A meta-analysis of randomized controlled trials. *Front Med (Lausanne)*. 2022;9:1011953.
  7. Gemechu AD, Gebremedhin TD, Andebiku AA, Solomon F, Sorsa A. The effect of ketamine versus tramadol on prophylactic post-spinal shivering in those patients undergoing orthopedic surgery: a prospective cohort study design, 2020. *BMC Anesthesiol*. 2022;22(1):361.
  8. Omar H, Aboella WA, Hassan MM, Hassan A, Hassan P, Elshall A, et al. Comparative study between intrathecal dexmedetomidine and intrathecal magnesium sulfate for the prevention of post-spinal anaesthesia shivering in uroscopic surgery; (RCT). *BMC Anesthesiol*. 2019;19(1):190.
  9. Lakhe G, Adhikari KM, Khatri K, Maharjan A, Bajracharya A, Khanal H. Prevention of Shivering during Spinal Anesthesia: Comparison between Tramadol, Ketamine and Ondansetron. *JNMA J Nepal Med Assoc*. 2017;56(208):395-400.
  10. Sessler DI. Perioperative thermoregulation and heat balance. *Lancet*. 2016;387(10038):2655-64.
  11. Ferrea G, Monks DT, Singh PM, Fedoruk K, Singh NP, Blake L, et al. Comparative efficacy of intravenous treatments for perioperative shivering in patients undergoing caesarean delivery under neuraxial anaesthesia: A systematic review and Bayesian network meta-analysis of randomised-controlled trials. *J Clin Anesth*. 2025;100:111680.
  12. Hernandez M, Cutter TW, Apfelbaum JL. Hypothermia and hyperthermia in the ambulatory surgical patient. *Clin Plast Surg*. 2013;40(3):429-38.
  13. Jayaraj A, Balachander H, Kuppusamy SK, Arusamy S, Rai Y, Siddiqui N. Comparison of meperidine, tramadol and fentanyl for post-spinal shivering prevention during cesarean delivery: A double-blind randomized controlled trial. 2019;45(11):2202-8.
  14. National Guideline A. NICE Evidence Reviews Collection. Prevention and management of hypothermia and shivering: Caesarean birth: Evidence review C. London: National Institute for Health and Care Excellence (NICE) Copyright © NICE 2021.; 2021.
  15. Kose EA, Honca M, Dal D, Akinci SB, Aypar U. Prophylactic ketamine to prevent shivering in parturients undergoing Cesarean delivery during spinal anesthesia. *J Clin Anesth*. 2013;25(4):275-80.
  16. Zhou Y, Mannan A, Han Y, Liu H, Guan HL, Gao X, et al. Efficacy and safety of prophylactic use of ketamine for prevention of postanesthetic shivering: a systematic review and meta analysis. *BMC Anesthesiol*. 2019;19(1):245.
  17. Hasan SH, Haji Qadir R, Mohammed HN. Fentanyl Versus Ondansetron for Shivering Prevention in Cesarean Section: A Comparative Study. *Cureus*. 2023;15(10):e46817.
  18. Nallam SR, Cherukuru K, Sateesh G. Efficacy of Intravenous Ondansetron for Prevention of Postspinal Shivering during Lower Segment Cesarean Section: A Double-Blinded Randomized Trial. *Anesth Essays Res*. 2017;11(2):508-13.
  19. Kumar M, Kumar A, Singh D, Saxena S. Prophylactic use of Midazolam, Ketamine, and Ketamine plus Midazolam for prevention of perioperative shivering during spinal anaesthesia in patients undergoing infraumbilical surgeries: a comparative

- study. *International Journal of Research in Medical Sciences*. 2017;5(9):3985-9.
20. Browning RM, Fellingham WH, O'Loughlin EJ, Brown NA, Paech MJ. Prophylactic ondansetron does not prevent shivering or decrease shivering severity during cesarean delivery under combined spinal epidural anesthesia: a randomized trial. *Reg Anesth Pain Med*. 2013;38(1):39-43.
21. Mohammadzadeh Jouryabi A, Sharami SH, Mansour Ghanaie M, Sedighinejad A, Imantalab V, Rafiee Sorouri Z, et al. Comparing the Effects of Low Dose of Ketamine, Tramadol, and Ondansetron in Prevention of Post Spinal Anesthesia Shivering in Cesarean Section. *Anesth Pain Med*. 2021;11(4):e116429.

