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Original Research Article

# The Role of Intravenous Ondansetron in Reducing Postspinal Shivering in Elective Lower Segment Cesarean Sections

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**Abstract:**

**Introduction:** Elective lower segment cesarean section (LSCS) performed under spinal anesthesia often leads to postoperative shivering, causing discomfort and potential complications. Intravenous ondansetron, known for its antiemetic properties, has shown promise in reducing shivering. In this study, we investigate the efficacy of ondansetron in preventing postspinal shivering during LSCS, aiming to enhance the perioperative experience for parturients.

**Material and Methods:** This prospective interventional study assessed the efficacy of intravenous ondansetron in preventing postspinal shivering during elective lower segment cesarean sections (LSCS) under spinal anesthesia. One hundred pregnant patients were divided into two groups: ondansetron (Group S, n=50) and control (Group C, n=50). Group S received 4 mg of intravenous ondansetron preoperatively, while Group C did not receive preoperative medication. Shivering incidence, severity, and complications were recorded, and the Bedside Shivering Assessment Scale was used for assessment. Statistical analysis included Z-tests and Chi-square tests ($P < 0.05$).

**Results:** This study included 100 subjects divided into two groups: Group S (n=50) receiving intravenous ondansetron for preventing postspinal shivering during cesarean sections, and Group C (n=50) as the control. Baseline characteristics were similar between groups ($P > 0.05$). Key surgical and physiological parameters showed no significant differences. However, Group S exhibited significantly reduced shivering severity ($P = 0.001$) and a lower incidence of nausea and vomiting ($P = 0.001$) compared to Group C.

**Conclusion:** Intravenous Ondansetron demonstrates efficacy in reducing postspinal shivering and the incidence of nausea and vomiting during elective lower segment cesarean sections under spinal anesthesia, potentially improving the perioperative experience for parturients.

**Keywords:** Postspinal shivering, Ondansetron, Cesarean sections, Anesthesia



## Introduction

Lower segment cesarean section (LSCS) is one of the most common surgical procedures performed worldwide, providing a safe delivery option for both the mother and the new-born. [1] However, despite advances in anesthesia techniques, postoperative shivering remains a distressing and uncomfortable complication frequently encountered in the obstetric population undergoing spinal anesthesia for LSCS. [2] Postspinal shivering is not only discomforting for the parturient but can also lead to complications such as increased oxygen consumption, maternal discomfort, and potential interference with the surgical procedure. [3] Moreover, it poses a unique challenge during cesarean sections, as medications used for its management must ensure the safety of both the mother and the neonate. [4] Over the years, various pharmacological and non-pharmacological interventions have been explored for the prevention and management of postspinal shivering. [5,6]

Among these interventions, intravenous ondansetron, a serotonin (5-HT3) receptor antagonist primarily used to alleviate nausea and vomiting, has recently gained attention for its potential effectiveness in reducing postoperative shivering. [7]

Ondansetron's ability to modulate the central thermoregulatory system, particularly in the hypothalamus, has sparked interest in its use as a prophylactic agent against shivering. [8] As postspinal shivering not only compromises patient comfort but also has physiological implications, investigating the efficacy of ondansetron in preventing shivering during LSCS is a subject of

paramount importance. [9] The study aims to review the current body of literature, consolidate available evidence, and critically analyze the efficacy of intravenous ondansetron as a preventive measure against postspinal shivering during lower segment cesarean section. Through this exploration, we seek to contribute valuable insights to the clinical management of obstetric patients undergoing LSCS, ultimately enhancing the overall quality of care and patient experience in this crucial surgical context.

## Material and Methods

This prospective interventional study was done to assess the efficacy of intravenous ondansetron in preventing postspinal shivering during elective lower segment cesarean section (LSCS) under spinal anesthesia. The study obtained ethical approval, and informed consent was collected from a total of 100 pregnant patients, who were then divided into two groups: the ondansetron group S (n=50) and the control group C (n=50). In the ondansetron group, patients received a preoperative dose of 4 mg of intravenous ondansetron just before undergoing spinal anesthesia. Conversely, the control group did not receive any additional medication before spinal anesthesia.

The primary outcome measure was the incidence of postspinal shivering, assessed and graded using a 5-item scale. Shivering episodes graded as III or IV, persisting for at least 3 minutes, was considered positive. The effectiveness of prophylaxis was determined by the incidence of shivering.

Additionally, potential complications were recorded and managed as follows: Hypotension, defined as a 20% decrease from baseline or a mean arterial pressure (MAP) <60 mmHg, was managed with 6 mg of intravenous ephedrine. Bradycardia, defined as a 20% decrease from baseline or an absolute heart rate (HR) <50 beats/min, was treated with a 0.5 mg intravenous bolus of atropine. Patients experiencing refractory nausea or vomiting were provided with 10 mg of intravenous metoclopramide as rescue medication.

**Assessment of Shivering Grades:** Shivering severity was assessed using the Bedside Shivering Assessment Scale, a reliable and validated tool designed to quantify shivering.

This scale categorizes shivering into four distinct grades based on clinical observation:

**Table 1: The Bedside Shivering Assessment Scale [10]**

| Scale | Definition |
|---|---|
| Score 0 (None) | No shivering noted on palpation of the masseter, neck, or chest wall. |
| Score 1 (Mild) | Shivering localized to the neck and/or thorax only. |
| Score 2 (Moderate) | Shivering involves gross movement of the upper extremities, in addition to the neck and thorax. |
| Score 3 (Severe) | Shivering involves gross movements of the trunk and upper and lower extremities. |

The sample size calculation was based on previous research findings by Nallam et al. [11], resulting in a total of 50 patients allocated to each group. The significance level (α) was set at 0.05, and the study's statistical power (1− β) was targeted at 0.80. Statistical analysis was performed using SPSS version 22.1. Quantitative data were expressed as mean ± standard deviation, while categorical data were presented as numbers and percentages. Comparisons between the two groups were conducted using Z-tests and Chi-square tests, with a significance threshold set at $P < 0.05$.

Patients were Premedicated with 150 mg of ranitidine orally prior to the surgery. Standard monitoring procedures encompassed heart rate (HR), electrocardiogram (ECG), non-invasive blood pressure (NIBP), respiratory rate, peripheral oxygen saturation (SpO2), and temperature. Peripheral intravenous access was established using an 18-gauge cannula. Before spinal anesthesia, all patients received a preloading intravenous infusion of warm Ringer's lactate solution at a rate of 10 ml/kg. Spinal anesthesia was administered with a 25-gauge Quincke needle at the L3–L4 or L4–L5 interspaces using hyperbaric 0.5% bupivacaine (12.5 mg). Pre- or intra-operative opioid administration, except for tramadol as a rescue anti-shivering drug, was prohibited. Supplemental oxygen (3 L/min) was provided through a nasal cannula throughout the surgical procedure. Thermal insulation was maintained by employing surgical drapes and cotton blankets; no additional warming devices were utilized.

## Results

In this study, a total of 100 subjects were enrolled and divided into two groups for comparison: Group S (n=50) and Group C (n=50). Group S received intravenous ondansetron as a preventive measure against postspinal shivering during elective lower segment cesarean sections, while Group C served as the control group, receiving standard care without ondansetron administration.

Patient demographics and baseline characteristics were similar between Group S (n=50) and Group C (n=50). There were no significant differences in age ($P = 0.58$), weight ($P = 0.47$), ASA class distribution ($P = 0.26$), gestational age ($P = 0.23$),

heart rate (P = 0.33), or oxygen saturation (SpO2) levels (P = 0.15) between the two groups. (Table 2)

**Table 2: Baseline demographics and characteristics**

| Variables | Group S (n=50) | Group C (n=50) | P Value |
|---|---|---|---|
| Age | 24.5±6.3 | 25.8±5.4 | 0.58 |
| Weight | 57.6±7.3 | 58.3±4.6 | 0.47 |
| ASA Class I/II | 38/12 | 41/09 | 0.26 |
| Gestational age (wks) | 37.9±1.9 | 38.4±1.5 | 0.23 |
| Heart rate (bpm) | 85.4±16.4 | 91.4±15.3 | 0.33 |
| SpO2 (%) | 99.6±1.5 | 99.7±1.3 | 0.15 |

Comparing Group S (n=50) to Group C (n=50), there were no significant differences in several key parameters. These included the duration of surgery (P = 0.67), time to shivering (P = 0.32), estimated blood loss (P = 0.12), core temperature (P = 0.31), and total intravenous fluid volume (P = 0.11) indicating that the administration of intravenous ondansetron did not lead to significant variations in surgical and physiological aspects when compared to the control group. (Table 3)

**Table 3: Intraoperative clinical characteristics**

| Parameters | Group S (n=50) | Group C (n=50) | P Value |
|---|---|---|---|
| Duration of surgery (min) | 59±13.5 | 58±11.8 | 0.67 |
| Time to shivering (min) | 2.3±3.4 | 1.9±2.7 | 0.32 |
| Estimated blood loss (ml) | 551±167.2 | 586±201 | 0.12 |
| Core temperature (‘C) | 36.3±0.6 | 36.5±0.5 | 0.31 |
| Total intravenous fluid (ml) | 2050±167 | 2234±189 | 0.11 |

In our study, significant differences were observed in shivering severity between Group S and Group C.

Group S exhibited reduced shivering severity, with 58% experiencing no shivering compared to 16% in Group C (P = 0.001). Mild shivering occurred in 16% of Group S patients versus 44% in Group C (P = 0.001). Additionally, moderate shivering was less frequent in Group S (20%) compared to Group C (30%) (P = 0.023), as was severe shivering (6% in Group S vs. 10% in Group C, P = 0.043).

Moreover, Group S had a lower incidence of nausea and vomiting (18%) compared to Group C (42%) (P = 0.001). (Figure 1)

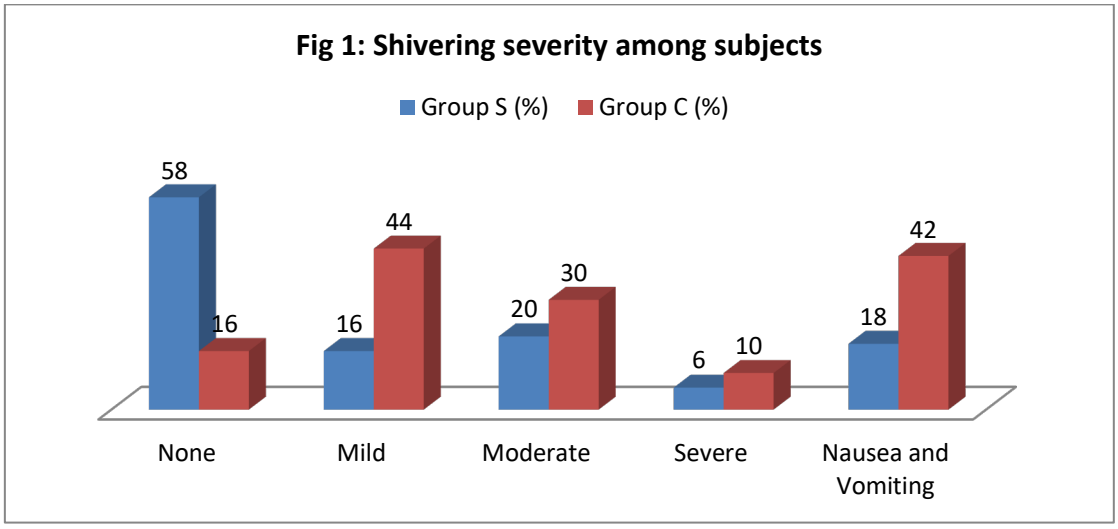


**Figure 1: Shivering severity among subjects**

## Discussion

The findings from our study reveal compelling insights into the impact of intravenous ondansetron on postspinal shivering during elective lower segment cesarean sections. Notably, the results indicate a statistically significant difference in the incidence of shivering, with Group S (ondansetron group) experiencing a lower shivering incidence compared to Group C (control group).

This reduction in shivering incidence in the ondansetron group aligns with previous studies that have explored Ondansetron’s potential as a prophylactic agent against postoperative shivering, particularly in obstetric patients undergoing cesarean delivery under spinal anesthesia.

Moreover, the study findings also demonstrate a significant difference in the severity of shivering between the two groups. Group S exhibited milder shivering episodes, as evidenced by lower shivering scores, when compared to Group C. This is a noteworthy outcome as it suggests that intravenous ondansetron not only reduces the likelihood of shivering but also diminishes the intensity of shivering when it does occur. These findings hold clinical relevance, as postspinal shivering can not only cause discomfort but also lead to increased oxygen consumption, potential cardiovascular complications, and interference with patient monitoring.

In our study, we observed significant differences in shivering severity between Group S (ondansetron group) and Group C (control group). Notably, 58% of patients in Group S experienced no shivering, compared to only 16% in Group C (P = 0.001). The reduction in shivering severity was further evident in the distribution of mild, moderate, and severe shivering, with Group S consistently exhibiting lower incidences (P = 0.001, P = 0.023, P = 0.043, respectively).

Comparing these findings to studies by Nallam et al. [11], Badawy and Mokhtar study [12], and Zheng et al. [13], our results align with the observed benefits of ondansetron in reducing shivering. Nallam et al. [11] reported a significant difference in Grade III shivering, with fewer cases in the ondansetron group compared to the control group (P = 0.001). Badawy et al.[12] also found a lower incidence of shivering in the ondansetron group, as well as a reduced need for meperidine and a lower incidence of nausea. Our study corroborates these trends, demonstrating the potential of ondansetron in minimizing shivering severity and reducing the incidence of nausea and vomiting.

Furthermore, Zheng et al.'s [13] meta-analysis, encompassing multiple studies, supports the effectiveness of intravenous ondansetron in preventing postanesthetic shivering (PAS). Our results are consistent with their findings, illustrating a significant reduction in shivering incidence in the ondansetron group compared to the control group. Interestingly, subgroup analysis by Zheng et al. [13] suggests that both 4 mg and 8 mg doses of ondansetron have comparable efficacy in preventing PAS, further highlighting the flexibility of ondansetron as a preventive measure.

Additionally, our study aligns with Zheng et al.'s [13] conclusion that intravenous ondansetron is associated with a lower incidence of hypotension, a notable advantage in perioperative management. Although we did not observe differences in bradycardia incidence, the overall consistency in findings across these studies [9,12,13] underscores the potential benefits of ondansetron in improving patient comfort and perioperative outcomes. Our study's outcomes are in line with previous research that underscores the importance of addressing postspinal shivering during surgery under regional anesthesia, which can affect a significant proportion of patients. [14]Additionally, Wang et al. [15] identified several risk factors for perioperative hypothermia, highlighting the complex nature of temperature regulation in surgical settings. This emphasizes the need for interventions like ondansetron in managing shivering.

A study by Marashi et al. [16 ]provided insights into the mechanisms behind 5-HT3-receptor antagonists like ondansetron in preventing shivering, further supporting our findings. Powell and Buggy's study on ondansetron doses highlights its versatility across different surgical contexts, while Rai et al.'s [17] work underscores its effectiveness in managing complications during cesarean delivery. A study by Meng Wang et al.'s [15] research aligns with our findings, particularly regarding the incidence of nausea, demonstrating ondansetron's potential to enhance maternal comfort during cesarean sections. Our study thus contributes to the growing body of evidence supporting ondansetron as an effective measure in improving perioperative care and patient comfort in diverse surgical scenarios.

Intriguingly, the study results also unveil a significant difference in the incidence of nausea and vomiting, with Group S reporting a lower occurrence of these distressing symptoms compared to Group C. This dual benefit of ondansetron, both in shivering reduction and the prevention of nausea and vomiting, underscores its potential as a valuable addition to the perioperative management of obstetric patients undergoing cesarean sections under spinal anesthesia.

## Conclusion

Intravenous ondansetron stands out as an effective and versatile approach to improve perioperative care for obstetric patients undergoing cesarean sections under spinal anesthesia. It significantly reduces the incidence and severity of postspinal shivering, offering a valuable addition to the management of such surgeries. Furthermore, ondansetron demonstrated the added benefit of lowering the occurrence of nausea and vomiting.

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