e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.4.5

International Journal of Pharmaceutical Quality Assurance 2025; 16(4); 22-27

Original Research Article

Efficacy of Intravenous Tramadol and Low Dose Ketamine in Prevention of Post Spinal Anesthesia Shivering in Lower Segment Cesarean Section

Richa Ahirwar[1], R.P. Kaushal[2], Yashwant Dhawale[3], Vandana Pandey[4]

[1]Junior Resident, Department of Anaesthesiology, Gandhi Medical College, Bhopal, Madhya Pradesh, India

[2]Professor and Head, Department of Anaesthesiology, Gandhi Medical College, Bhopal, Madhya Pradesh, India

[3]Professor, Department of Anaesthesiology, Gandhi Medical College, Bhopal, Madhya Pradesh, India

[4]Assistant Professor, Department of Anaesthesiology, Gandhi Medical College, Bhopal, Madhya Pradesh, India

Received: 04-02-2025 / Revised: 03-03-2025 / Accepted: 02-04-2025

Corresponding Author: Dr. Vandana Pandey

Conflict of interest: Nil

Abstract:

Introduction: Shivering is defined as spontaneous, involuntary, and repetitive muscular activity that commonly occurs during and after spinal anesthesia (SA). While generally not life-threatening, untreated post-spinal shivering (PSS) can lead to significant complications. These complications include exacerbation of wound pain, delayed wound healing, increased metabolic demand, elevated oxygen consumption, and hemostatic dysfunction. This is particularly concerning for patients with low cardiac reserve or arterial hypoxia.

Methodology: In this prospective observational study, 40 patients who are candidates for subarachnoid block undergoing surgeries with American Society of Anesthesiologist (ASA) I or II, between 18 to 60 years, who are scheduled for lower segment cesarean section . A total of 40 patients were included and divided into two groups: Group K will get low-dose intravenous ketamine (0.2 mg/kg) and Group T will get tramadol (0.5 mg/kg) in preventing post-spinal shivering in parturient undergoing cesarean delivery under SA.

Result: significant reduction in the incidence of shivering in the ketamine group (25%) compared to the tramadol group (55%) with a p-value of 0.048.

Conclusion: Low-dose intravenous ketamine(0.2mg/kg) is more effective than tramadol(0.5mg/kg) in reducing post-spinal shivering, with a lower incidence of intraoperative side effects.

Keywords: Ketamine, Tramadol, Spinal, Anesthesia, Shivering.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Shivering is defined as spontaneous, involuntary, and repetitive muscular activity that commonly occurs during and after spinal anesthesia (SA)[1]. While generally not life-threatening, untreated post-spinal shivering (PSS) can lead to significant complications[2]. These complications include exacerbation of wound pain, delayed wound healing, increased metabolic demand, elevated oxygen consumption, and hemostatic dysfunction. This is particularly concerning for patients with low cardiac reserve or arterial hypoxia. The review of 21 studies found that the median incidence of shivering associated with neuraxial anesthesia was 55%, with a range from 40% to 64%.[1]

Various pharmacological agents have been explored for the prevention and treatment of PSS [3,4]. Tramadol, an opioid analgesic, works by inhibiting the neuronal uptake of noradrenaline and serotonin in the spinal cord, which enhances the secretion of hydroxyl tryptamine (HT) and resets the body's thermoregulatory center[3,5,7] Ketamine, a non-competitive NMDA receptor antagonist, also plays a role in thermoregulation by inhibiting norepinephrine uptake, helping to reduce heat redistribution from the core to the periphery.[7]

This study aims to compare the efficacy of low-dose intravenous ketamine (0.2 mg/kg) and tramadol (0.5 mg/kg) in preventing post-spinal shivering in patients undergoing cesarean delivery under spinal anesthesia. By evaluating the incidence of shivering, hemodynamic stability, sedation levels, and any adverse effects, this research intends to determine the more effective and safer option for minimizing PSS in this clinical setting.

Methodology

This is a prospective observational study. After Institutional Ethical Committee approval, written

informed consent was received from 90 patients American Society of Anesthesiologist (ASA) I and II aged 18–60 years, who were undergoing for surgery under subarachnoid anesthesia from October 2023 to December 2023 at Gandhi medical college, Bhopal.

Patients undergoing surgery under subarachnoid anesthesia, aged between 18 to 60 years, and with ASA grade I and II were included in the study. Exclusion criteria included refusal by the patient, allergies to the study drugs, and a history of cardiovascular disease, hypertension, psychosis, antepartum haemorrhage, or fetal distress.

Standard monitoring was established to track non-invasive blood pressure (NIBP), electrocardiograph (ECG), temperature, and peripheral arterial oxygenation (SpO2%). The temperature of the operating room was maintained between 21°C and 23°C. Spinal anesthesia was performed at the L3-L4 or L4-L5 level using a midline approach with a 25-gauge Quincke spinal needle, and 2 mL of hyperbaric 0.5% bupivacaine was injected intrathecally in all patients. Each patient received 3-4 L/min of oxygen via a simple face mask.

For the prevention of post-spinal shivering, after confirming hemodynamic stability, an intravenous prophylactic dose of either ketamine (0.25 mg/kg) or tramadol (0.5 mg/kg) was administered. The severity of shivering was assessed throughout the surgery at 10-minute intervals for up to 60 minutes. Axillary body temperature was also monitored and recorded using a standard non-invasive monitor every 10 minutes for 60 minutes. During the intraoperative period, adverse effects such as nausea, vomiting, sedation, and hypotension were monitored and documented every 10 minutes for the same duration.

Key parameters observed included heart rate, mean arterial pressure, pulse oximetry, temperature, grade of shivering, and degree of sedation, all recorded every 10 minutes for one hour. Additionally, the Apgar score was assessed at 1 and 5 minutes.

Shivering was graded using a scale similar to that validated by Tsai and Chu.

Grade of shivering	Clinical sign
0	No shivering
1	Piloerection or Peripheral vasoconstriction or piloerection, but no obvious shivering
2	Muscular activity in only one muscle group
3	Muscular activity in more than one muscle group, but not generalized
4	Shivering involving the whole body

- The degree of sedation was assessed on Ramsay sedation scale where

Awake and anxious, agitated, or restless	**1**
Awake, cooperative, accepting ventilation, oriented, or tranquil	**2**
Awake, responds only to commands	**3**
Asleep, brisk response to light, glabella tap, or loud nois	**4**
Asleep, sluggish response to light, glabella tap, or loud noise	**5**
Asleep, no response to light, glabella tap, or loud noise	**6**

Observation Table

Table 1: Demographic Profile of Patients

Parameter	Group T(N=20)	Group K(N=20)
Age (Year)	25±5	26±7
Weight (Kg)	69±8	65±13
Height(M)	166±12	165±14

Data are presented as mean±SD. A Kruskal–Wallis (H) test, chi-square test. p,0.05 is statistically significant. Group K = ketamine (0.2 mg/kg IV), group T = tramadol (0.5 mg/kg IV) and group S = saline (5 mL saline)

Table 2: Hemodynamic changes

Hemodynamic parameter	Group K	Group T	P-Value
Baseline MAP(Mean ± SD)	93.28 ± 6.61	95.55 ± 7.35	0.061
After 10 mins	86.62 ± 5.03	86.33 ± 6.18	0.553
After 20 mins	83.75 ± 4.46	80.40 ± 5.51	0.001
After 30 mins	83.41 ± 4.23	79.28 ± 4.62	0.001
After 40 mins	83.41 ± 4.23	80.40 ± 5.51	0.001
After 50 mins	83.64 ± 4.47	79.51 ± 4.88	0.001

After 60 mins	83.91 ± 4.18	80.00 ± 4.71	0.001
Baseline HR(Mean ± SD)	81.41 ± 10.02	80.89 ± 9.48	0.546
After 10 mins	80.45 ± 10.00	78.49 ± 10.74	0.032
After 20 mins	80.22 ± 10.66	76.97 ± 10.84	0.001
After 30 mins	80.42 ± 10.90	77.11 ± 10.57	0.001
After 40 mins	81.09 ± 10.84	78.52 ± 10.94	0.007
After 50 mins	82.52 ± 10.43	80.84 ± 12.68	0.100
After 60 mins	85.59 ± 11.88	85.20 ± 13.48	0.727

Data are presented as mean ± SD. Kruskal–Wallis (H) test. p,0.05 is statistically significant. Group K = ketamine (0.2 mg/kg IV), group T = tramadol (0.5 mg/kg IV)

There was no significant difference among both two groups as shown in baseline hemodynamic data

Table 3: Incidence of shivering

Parameter	Group T (n=20)	Group K (n=20)	p-value
Shivering (%) No	09 (46.3)	15(75)	0.048
Yes	11 (53.7)	05(25)	

Data are presented as median (IQR), numbers (percentage). Chi-square test, Kruskal–Wallis (H) test. p,0.05 is significant. Group K = ketamine (0.2 mg/kg IV), group T = tramadol (0.5 mg/kg IV).

.

Grade 2= muscular activity in only one muscle group, grade 3= muscular activity in more than one muscle group, but not generalized, grade 4= shivering involving the whole body.

Table 4: Apgar score

Apgar scores (minutes)	Group T (n=20)	Group K (n=20)	p-value
1 minute	8 (2)	8 (2)	0.381
5 minutes	9 (1)	9 (0)	0.103
Time to extraction	6 (3)	7 (2)	0.208

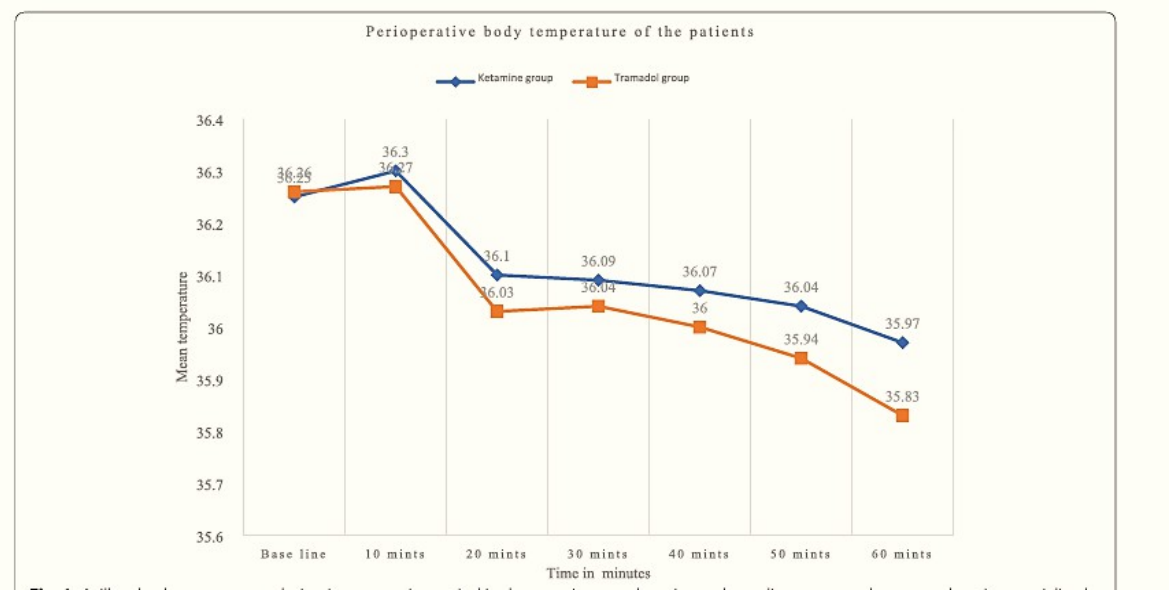

Figure 1: Perioperative body temperature of the patients

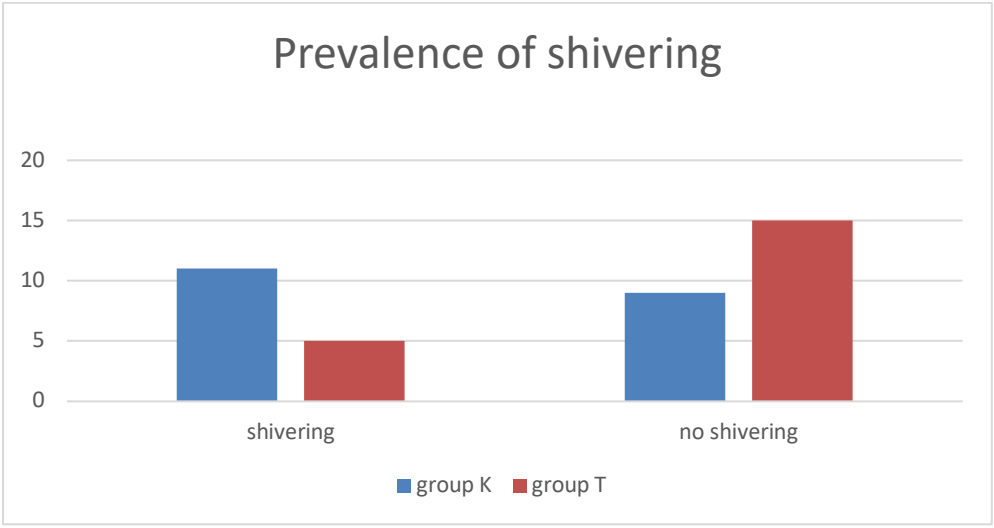

Figure 2: Prevalence of shivering

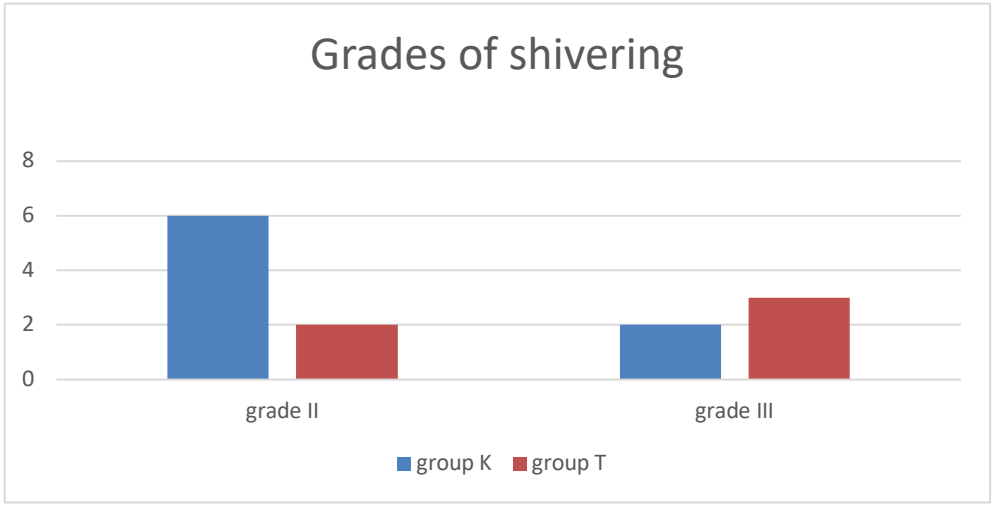

Figure 3: Grades of shivering

Table 5: Ramsay Sedation Scale

Grade	Group T (n=20)	Group K (n=20)
I	10	4
II	7	7
III	3	9
IV	0	0
V	0	0
VI	0	0

The Ramsay sedation score was less than 3 in all patients in both groups.

Table 6: Adverse effects

Complications	Group T (n=20)	Group K (n=20)
Hypotension	5	2
Nausea & vomiting	3	1
Bradycardia	0	0
Hallucination	0	0

Statistical Analysis: A total of 40 patients were included in the study and divided into two groups: ketamine (Group K) and tramadol (Group T). Shivering was graded using a validated scale, and hemodynamic parameters, sedation levels, and adverse effects were monitored throughout the procedure. The results revealed a significant reduction in the incidence of shivering in the

ketamine group (25%) compared to the tramadol group (55%), with a p-value of 0.048. The ketamine group also exhibited fewer episodes of nausea and vomiting and higher sedation levels compared to the tramadol group. Additionally, the Ramsay sedation score was less than 3 in all patients in both groups.

Discussion

A total of 40 parturient who underwent cesarean delivery under SA were enrolled in this study. Of these patients, 20 were allocated to the tramadol group (Group T), 20 to the ketamine group (Group K).

Sociodemographic characteristics (age, weight and height) and ASA physical status were comparable among the groups (Table 1). There was no difference in recorded baseline hemodynamic data (mean arterial pressure) and pulse rate. (Table 2).

The overall incidence of post-spinal shivering was 16 out of 40 (40%) and a significant difference was observed regarding the incidence of shivering in both groups with a p-value of 0.048. The severity of shivering proportion in grades two and three was much higher in tramadol than in the ketamine group (fig 3), and the over-all distribution of post-spinal shivering was high in the tramadol group (Fig. 3)

The incidence of nausea and vomiting was statistically highly significant in tramadol group (table 5) and the intraoperative sedation was more marked in the ketamine group as compared to the tramadol group (table 4). [2,7]

Ketamine works primarily as a NMDA receptor antagonist, reducing the excitability of neurons involved in thermoregulation and directly inhibiting noradrenergic and serotonergic pathways. This makes it a strong contender for preventing shivering by modulating several central nervous system pathways that govern temperature regulation.[7]

Tramadol, on the other hand, works more through opioid receptors and by inhibiting the reuptake of serotonin and norepinephrine, making it an effective treatment for post-spinal shivering, though it may be less effective than ketamine in directly affecting thermoregulatory pathways. Tramadol is also more likely to cause side effects like nausea and vomiting compared to ketamine, which is an important consideration for patient care.

Tramadol is also associated with a higher incidence of nausea and vomiting compared to ketamine.

Other articles reported the incidence of nausea and vomiting [9,10]. The incidence of nausea and vomiting is significantly higher in the tramadol group (27.8%) compared to the ketamine group (11.9%).

The limitation of this study is smaller sample size can lead to unpowered studies, making it harder to detect true effects or differences between groups.

Conclusion

The prophylactic administration of low-dose IV ketamine (0.2 mg/kg) or 0.5 mg/kg IV tramadol is effective in reducing shivering in patients having lower segment cesarean section under SA.

The magnitude of shivering in this study was 25% in the Ketamine group and 55% in tramadol group. Low dose ketamine showed better outcome than tramadol in reducing frequency and incidence of shivering after spinal anesthesia. In addition, Low dose ketamine has a low incidence of intraoperative nausea and vomiting when compared to tramadol.

References

1. Crowley LJ, Buggy DJ. Shivering and neuraxial anesthesia. Reg Anesth Pain Med. 2008;33(3):241–252.
2. Mittal, Gupta G, Katyal K, Kaushal S, Sandeep. Randomised double-blind comparative study of dexmedetomidine and tramadol for post-spinal anaesthesia shivering. Indian Journal of Anaesthesia 58(3):p 257262, May–Jun 2014
3. Abdelrahman RS. Prevention of shivering during regional anesthesia: comparison of midazolam, midazolam plus ketamine, tramadol, and tramadol plus ketamine. Life Sci J. 2012;9(2):132–139.
4. Talakoub R, Meshkat SN. Tramadol versus meperidine in the treatment of shivering during spinal anesthesia in cesarean section. J Res Med Sci. 2006;11(3):151–155.
5. Verma A, Bhandari D, Dhande P, Jain S, Tidke S. Comparative evaluation of dexmedetomidine and tramadol for attenuation of post-Spinal anaesthesia shivering. J Clin Diagn Res. 2018;12
6. Lopez M. Post anaesthetic shivering – from pathophysiology to prevention. Romanian Journal of Anaesthesia and Intensive Care 2018 Vol 25 No 1,73-81.
7. Urmila Keshari, Kalpit Dubey R.P. Kaushal, Ajay Kumar Yadav To Compare The Efficacy of IV Ketamine, IV Tramadol, IV Dexmedetomidine for Post Spinal Shivering Management International Journal of Pharmaceutical Quality Assurance 2025; 16(3); 19-23
8. Ramesh K, Bhushanam KN, Sharma BA, Kumar SSS. A clinical comparative study between intra venous dexmedetomidine and tramadol for control of post spinal anesthesia shivering. J Dent Med Sci. 2019;18:26–31.
9. Lema GF, Gebremedhn EG, Gebregzi AH, Desta YT, Kassa AA. Efficacy of intravenous tramadol and low-dose ketamine in the prevention of post-spinal anesthesia shivering following cesarean section: a double-blinded,

randomized control trial. Int J Women's Health. (2017) 9:681–88. 10.2147/IJWH.S139655

10. Wason R, Jain N, Gupta P, Gogia AR. Randomized double-blind comparison of prophylactic ketamine, clonidine and tramadol for the control of shivering under neuraxial anaesthesia. Indian J Anaesth. (2012) 56:370–75. 10.4103/0019-5049.100821