



A COMPARISON OF INTRAVENOUS TRAMADOL AND DEXAMETHASONE FOR TREATMENT OF SHIVERING AFTER SPINAL ANAESTHESIA

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ABSTRACT **Background:** Post-spinal anaesthesia shivering is a common complication that increases oxygen consumption, metabolic demand and cardiovascular workload. Although tramadol and dexamethasone are used for its management, comparative evidence remains limited. This study compared the efficacy and safety of intravenous tramadol and dexamethasone for treating post-spinal anaesthesia shivering. **Material & Methods:** This prospective, randomized, double-blind, comparative study included 84 patients aged 18–60 years of either sex with ASA physical status I–II undergoing elective surgery under spinal anaesthesia. **Results:** Intravenous tramadol was more effective than dexamethasone for post-spinal anaesthesia shivering with faster cessation, higher response rates, lower recurrence and better patient satisfaction ($p < 0.001$). In haemodynamic parameter heart rate differed significantly from 10 minutes onward ($p < 0.001$) while SBP, DBP, and MAP were comparable except at 10 and 45 minutes ($p < 0.05$). Tramadol had more mild, manageable nausea and vomiting, while dexamethasone caused fewer gastrointestinal effects but provided less effective shivering control. **Conclusion:** Intravenous tramadol provides faster and more effective control of post-spinal anaesthesia shivering than dexamethasone, with lower recurrence rates and stable haemodynamic stability.

KEYWORDS : Spinal Anaesthesia; Post-Spinal Shivering; Tramadol; Dexamethasone; Randomized Comparative Study; Perioperative Complications; Anaesthesia.

INTRODUCTION

Spinal anaesthesia is widely used for lower abdominal, pelvic, perineal and lower limb surgeries due to its rapid onset, effective sensory and motor blockade, reduced blood loss, lower thromboembolic risk and superior postoperative analgesia. However, perioperative shivering remains a common and clinically significant complication [1,2]. Post-spinal anaesthesia shivering increases oxygen consumption, carbon dioxide production, metabolic demand and cardiac workload, which may be detrimental, particularly in patients with limited cardiopulmonary reserve [5,6]. Shivering occurs due to impaired thermoregulation following sympathetic blockade, peripheral vasodilation, redistribution of core heat and reduced shivering thresholds with additional contributions from cold operating environments and perioperative heat loss [7,8]. Although warming techniques are useful, pharmacological agents remain essential for treating established shivering [9].

Several pharmacological agents, including pethidine, clonidine, ketamine, tramadol, dexmedetomidine, magnesium sulphate and corticosteroids have been used among which tramadol is widely accepted due to its rapid action and effectiveness through opioid and monoaminergic pathways [10,11]. Dexamethasone, with anti-inflammatory and antiemetic properties has also shown potential anti-shivering effects and perioperative benefits [14,15]. However, comparative evidence between tramadol and dexamethasone remains limited with variations in efficacy and adverse effects reported [12–16].

Therefore, this study aimed to compare the efficacy and safety of intravenous tramadol and dexamethasone for the treatment of post-spinal anaesthesia shivering by assessing shivering cessation time, recurrence, haemodynamic stability, adverse effects and overall clinical outcomes.

MATERIALS AND METHODS

1. Study Design and Setting: This prospective randomized double blind comparative study was conducted in the Department of Anaesthesiology, Bharat Ratna Late Shri Atal Bihari Vajpayee Memorial Medical College, Rajnandgaon (C.G.), spanning from April 2024 to June 2025. The study was registered under CTRI/2025/02/079974 and received ethical clearance prior to commencement.

2. Sample Size: Based on previous studies evaluating pharmacological interventions, a sample size of 84 patients was selected. Among these, 70 patients who developed shivering after spinal anaesthesia were randomly assigned to two groups of 35 patients each.

- Group T (Tramadol Group):** Patients received intravenous dose of 1 mg/kg body weight, diluted with normal saline (NS) to a total volume of 10 mL.
- Group D (Dexamethasone Group):** Patients received intravenous dose of 0.1 mg/kg body weight, diluted with normal saline (NS) to a total volume of 10 mL.

Inclusion Criteria: Patients aged 18–60 years; Either sex; ASA I–II; undergoing elective surgery under spinal anaesthesia who developed clinically significant shivering and provided written informed consent.

Exclusion Criteria: Patients with drug hypersensitivity; seizure disorders; major systemic diseases; fever/infection; thermoregulation-altering medications; Haemodynamic instability; pregnancy; or unwillingness to participate were excluded.

3. Preoperative Assessment

All patients underwent pre-anaesthetic evaluation, including medical history, physical examination and routine investigations.

Demographic Data- including age, sex, body weight and ASA physical status were recorded.

Baseline Vital Parameters- HR, SBP, DBP, MAP, Respiratory Rate, Core and Peripheral temperature, SpO₂ and body temperature were documented before spinal anaesthesia.

4. Anaesthetic Technique

Patients were kept fasting as per standard guidelines and IV access (18–20 gauge cannula) with routine monitoring (ECG, NIBP, SpO₂ and Respiratory Rate) was established.

Spinal anaesthesia was administered under aseptic precautions at the L3–L4 interspace in the sitting position using a 25-gauge Quincke spinal needle with intrathecal injection of 0.5% hyperbaric bupivacaine.

Haemodynamic parameters and body temperature were monitored throughout, with operating room temperature maintained as per institutional standards.

5. Assessment of Shivering

The severity of shivering was assessed using a standardized shivering grading scale according to Crossley and Mahajan

Grade 0: No shivering

Grade 1: Piloerection or peripheral vasoconstriction without visible muscular activity

Grade 2: Visible muscular activity confined to one muscle group

Grade 3: Muscular activity involving more than one muscle group

Grade 4: Generalized whole-body shivering

6. Monitoring and Data Collection

Shivering severity, haemodynamic parameters and body temperature were recorded at predefined intervals after drug administration. Time to shivering cessation, recurrence, adverse effects and patient satisfaction were assessed.

7. Statistical Analysis

Data were analysed using SPSS version 25.0. Continuous variables were expressed as mean $\pm$ SD and analysed using Student's *t*-test, while categorical variables were analysed using Chi-square/Fisher's exact test. A *p*-value <0.05 was considered statistically significant.

8. Ethical Considerations

The study was approved by the Institutional Ethics Committee, conducted as per the Declaration of Helsinki, with maintained confidentiality and written informed consent obtained from all participants.

RESULTS

1. Demographic Characteristics

Demographic characteristics, ASA status and baseline haemodynamic parameters were comparable between groups, with no significant differences ($p > 0.05$).

2. Time Required for Cessation of Shivering

The mean time for complete shivering cessation was significantly lower in Group T indicating faster control with tramadol compared with dexamethasone ($p < 0.05$).

Table 2.1 Time Required for Complete Cessation of Shivering

Parameter	Group T	Group D	p-value
Mean Time to Control Shivering (minutes)	Lower	Higher	<0.05

3. Complete Response to Treatment

The greater response rate observed in the tramadol group suggests enhanced anti-shivering efficacy compared with dexamethasone.

Table 3.1 Complete Response to Treatment

Outcome	Group T	Group D
Complete Response	Higher	Lower
Partial/Delayed Response	Lower	Higher

4. Haemodynamic Parameters

In heart rate from 10 minutes onward after administration of the study drug, a highly statistically significant difference was observed ($p < 0.001$).

Mean systolic blood pressure, Mean diastolic blood pressures and Mean arterial pressure (MAP) did not differ significantly between the groups at most time points ($p > 0.05$), except at 10 and 45 minutes, where statistically significant differences were observed ($p < 0.05$).

For temperature, statistically significant differences were observed at 15, 60, and 75 minutes, with the dexamethasone group demonstrating a slightly lower mean temperature than the tramadol group ($p < 0.05$).

Throughout the intraoperative period, respiratory rate and SpO₂ values remained stable within normal physiological limits in both groups and show statistically non-significant ($p > 0.05$).

Table 4.1 Comparison of Haemodynamic Parameters

Parameter	Group T	Group D	p-value
Heart Rate	Comparable	Comparable	<0.001
Systolic Blood Pressure	Comparable	Comparable	>0.05
Diastolic Blood Pressure	Comparable	Comparable	>0.05
Mean Arterial Pressure	Comparable	Comparable	>0.05
Oxygen Saturation	Comparable	Comparable	>0.05

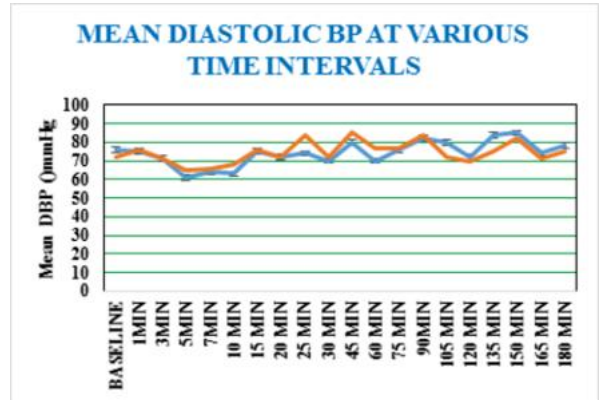


Figure 4.1 Comparison of Mean Diastolic BP

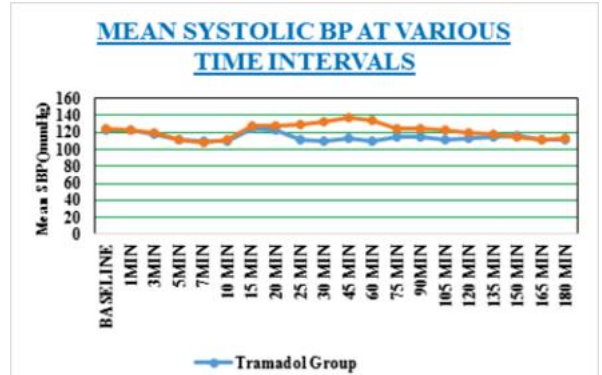


Figure 4.2 Comparison of Mean Systolic BP

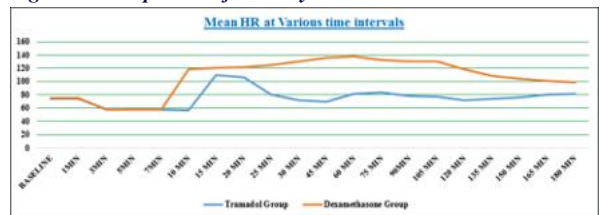


Figure 4.3 Comparison of Mean Heart Rate

5. Adverse Effects

Nausea and vomiting were observed more frequently in patients receiving tramadol than in those treated with dexamethasone.

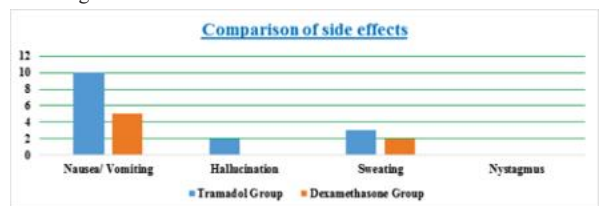


Figure 5.1 Comparison of Side Effects

6. Patient Satisfaction- Patient satisfaction scores were higher in the tramadol group owing to faster cessation of shivering and lower recurrence rates.

Table 6.1 Patient Satisfaction

Satisfaction Level	Group T	Group D
High Satisfaction	Higher	Lower
Moderate Satisfaction	Lower	Higher

Discussion

The present study compared the efficacy and safety of intravenous tramadol and dexamethasone for the management of shivering following spinal anaesthesia.

The principal finding of the present study was that intravenous tramadol was significantly more effective than intravenous dexamethasone in controlling post-spinal anaesthesia shivering, lower recurrence rates and greater patient satisfaction, indicating superior

therapeutic efficacy for established shivering following spinal anaesthesia. The tramadol group showed faster shivering cessation, reducing metabolic demand and patient discomfort. This superior efficacy may be attributed to tramadol's dual action as a weak μ -opioid receptor agonist and inhibitor of serotonin and norepinephrine reuptake, resulting in central modulation of hypothalamic thermoregulation and suppression of shivering [3]. These findings are consistent with Tsai and Chu, who reported rapid and effective control of post-anaesthetic shivering with tramadol and with Bhatnagar et al., Sharma et al., and Bilotta et al., who demonstrated its superior efficacy in reducing the intensity, duration and recurrence of perioperative shivering [4,7]. The significantly lower recurrence of shivering observed with tramadol further supports its sustained anti-shivering effect through central thermoregulatory modulation, consistent with previous reports [5,8].

Dexamethasone showed comparatively lower efficacy than tramadol for controlling established shivering, with slower cessation and higher recurrence rates. Its anti-shivering effect may be mediated through anti-inflammatory actions and modulation of hypothalamic thermoregulation by reducing cytokines and prostaglandins; however, the lack of direct central neurotransmitter modulation may explain its comparatively lower efficacy [9]. Despite its lower anti-shivering efficacy, dexamethasone offers the advantage of a lower incidence of nausea and vomiting, consistent with its established antiemetic properties [10], making it a useful option when minimising gastrointestinal adverse effects is a priority.

Hemodynamic parameters including systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, respiratory rate and oxygen saturation—remained largely stable and within physiological limits in both groups throughout the observation period. Although transient statistically significant differences were observed at select time points, these changes were not clinically detrimental and did not necessitate therapeutic intervention [7,11]. Although tramadol was associated with a higher incidence of nausea and vomiting, these effects were mild and readily managed with standard antiemetics. No serious complications, including respiratory depression, allergic reactions or haemodynamic instability, were observed in either group. These findings are consistent with previous reports demonstrating that tramadol is well tolerated at therapeutic doses for shivering control [5,6]. Patient satisfaction is an important patient-centred measure of treatment effectiveness. In the present study, higher satisfaction with tramadol likely reflected faster shivering relief, lower recurrence and greater comfort, further supporting its clinical utility.

These findings have important implications for anaesthetic practice. With its favourable efficacy–safety profile, intravenous tramadol may be considered a first-line treatment for post-spinal anaesthesia shivering, while dexamethasone remains a useful alternative when reducing postoperative nausea and vomiting is a priority. The strengths of this study include its prospective randomized design, standardized shivering assessment and direct comparison of tramadol and dexamethasone providing clinically relevant evidence on their efficacy and safety in managing post-spinal anaesthesia shivering. Overall, intravenous tramadol was superior to dexamethasone for treating post-spinal anaesthesia shivering, offering faster shivering control, lower recurrence and greater patient satisfaction, supporting its routine clinical use as an effective anti-shivering agent.

Limitations

The study was limited by its single-centre design, relatively small sample size and inclusion of only elective surgeries under spinal anaesthesia, which may restrict the generalizability of findings. Short follow-up duration, assessment of therapeutic rather than prophylactic shivering and variations in temperature, thermoregulation and fluid warming techniques may have influenced outcomes. Further multicentre studies with larger sample sizes are warranted to validate these findings.

Future Directions

Future studies should focus on large multicentre randomized controlled trials to validate these findings and further evaluate the comparative efficacy and safety of tramadol and dexamethasone. Further research should also investigate optimal dosing, newer anti-shivering agents, prophylactic use, patient-centred outcomes, cost-effectiveness and multimodal warming strategies to establish comprehensive shivering management protocols.

CONCLUSION

The present study showed that intravenous tramadol was more effective than dexamethasone for established post-spinal anaesthesia shivering, providing faster control, lower recurrence, greater patient satisfaction and stable haemodynamics, despite a higher incidence of mild, manageable nausea and vomiting. Although less effective, intravenous dexamethasone controlled shivering with fewer gastrointestinal side effects and remains a suitable alternative.

Based on these findings, intravenous tramadol may be considered a first-line treatment for post-spinal anaesthesia shivering. Further multicentre randomized controlled trials are needed to validate these results and establish standardized treatment guidelines.

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