

Comparison of Intravenous Tramadol versus Intravenous Dexamethasone for Prevention of Shivering after Spinal Anaesthesia in Cesarean Section Patients

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Abstract:

Background: Spinal anaesthesia is widely used for caesarean section because it provides rapid onset, reliable sensory and motor blockade, minimal fetal drug exposure and avoids airway manipulation associated with general anaesthesia. However, post-spinal anaesthesia shivering remains a common and distressing perioperative complication. Shivering may increase oxygen consumption, carbon dioxide production and metabolic demand, cause maternal discomfort and interfere with haemodynamic and physiological monitoring. Pregnancy itself is associated with increased oxygen consumption and reduced functional residual capacity, making prevention of excessive metabolic stress particularly important. Pharmacological agents including tramadol and dexamethasone have therefore been investigated for prevention of perioperative shivering.

Aim: To compare the efficacy of intravenous tramadol and intravenous dexamethasone in preventing post-spinal anaesthesia shivering in patients undergoing caesarean section.

Methods: This prospective, quasi-experimental comparative study was conducted in the Department of Anesthesiology of a tertiary care teaching hospital over 18 months. Ninety patients were assessed for eligibility, of whom 12 were excluded, resulting in 78 patients in the final analysis. Participants were divided equally into Group T (n=39), receiving intravenous tramadol 1 mg/kg, and Group D (n=39), receiving intravenous dexamethasone 0.15 mg/kg. Study medication was administered 15 minutes before spinal anaesthesia. Spinal anaesthesia was performed using 0.5% hyperbaric bupivacaine at the L3–L4 or L4–L5 interspace. Incidence, severity and onset of shivering, heart rate, blood pressure, oxygen saturation, adverse effects and neonatal Apgar scores were recorded. Data were analysed using GraphPad Prism version 5, with $p < 0.05$ considered statistically significant.

Results: Baseline demographic and clinical characteristics were comparable. Mean age was 27.6 ± 4.1 years in Group T and 28.1 ± 4.3 years in Group D ($p=0.58$). Mean body weight was 64.2 ± 7.5 kg and 63.4 ± 7.8 kg, respectively ($p=0.64$). Shivering occurred in 7 patients (17.9%) receiving tramadol compared with 13 patients (33.3%) receiving dexamethasone ($p=0.11$). Grade 0 shivering occurred in 82.1% and 66.7%, respectively. Mean onset time among patients who developed shivering was 28.4 ± 9.1 minutes in Group T and 22.1 ± 8.3 minutes in Group D ($p=0.09$). Haemodynamic parameters and oxygen saturation were comparable. Nausea occurred in 25.6% versus 10.3% ($p=0.07$), vomiting in 10.3% versus 2.6% ($p=0.17$), sedation in 12.8% versus 2.6% ($p=0.09$), and hypotension in 35.9% versus 38.5% ($p=0.82$), respectively. Neonatal Apgar scores were comparable.

Conclusion: Intravenous tramadol demonstrated a numerical reduction in the incidence and severity of post-spinal shivering and delayed onset compared with dexamethasone, although these differences were not statistically significant. Dexamethasone demonstrated a numerically more favourable profile with respect to nausea, vomiting and sedation. Both agents showed comparable haemodynamic stability and immediate neonatal outcomes.

Keywords: spinal anaesthesia; caesarean section; shivering; tramadol; dexamethasone; obstetric anaesthesia; thermoregulation.

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Introduction

Spinal anaesthesia is one of the most commonly used regional anaesthetic techniques for cesarean section. It provides rapid onset of anaesthesia, reliable sensory and motor blockade and satisfactory operative conditions while allowing the mother to remain conscious during delivery. It also avoids the airway manipulation and potential respiratory complications associated with general anaesthesia. These advantages have made spinal anaesthesia a preferred technique for cesarean delivery in modern obstetric practice [1].

Despite its advantages, spinal anaesthesia is associated with several physiological changes and complications. Hypotension, bradycardia, nausea, vomiting, pruritus, post-dural puncture headache, hypothermia and shivering may occur following spinal blockade. Among these complications, perioperative shivering is particularly important because it can cause considerable maternal discomfort and may interfere with monitoring and communication [2,3].

Hypothermia during spinal anaesthesia is multifactorial. Sympathetic blockade causes vasodilatation below the level of the block, resulting in redistribution of heat from the central compartment toward peripheral tissues. Spinal anaesthesia also interferes with afferent thermal input from blocked dermatomes and alters normal thermoregulatory responses. Exposure to the relatively cool operating-room environment and administration of intravenous fluids that are not warmed may further contribute to reduction in core body temperature.

Shivering is an involuntary oscillatory muscular activity that represents an attempt by the body to increase heat production. Although physiologically protective, perioperative shivering may become clinically significant. It increases metabolic activity, oxygen consumption and carbon dioxide production and may substantially increase cardiopulmonary workload [4]. In patients with limited cardiopulmonary reserve, these changes may have greater clinical significance.

The reported incidence of shivering following spinal anaesthesia for cesarean section varies considerably. Published studies have reported rates ranging approximately from 30% to 60%, depending upon the patient population, definition and grading of shivering, anaesthetic technique, operating-room temperature and preventive measures used [5,6].

The clinical consequences of shivering extend beyond subjective discomfort. Vigorous shivering may increase oxygen consumption and carbon dioxide production by approximately 100–400%. It can therefore increase cardiac workload and oxygen demand. Shivering may also produce artefacts in

electrocardiography and interfere with non-invasive blood-pressure measurement and pulse oximetry. Maternal anxiety and discomfort may be increased, particularly during an operation in which the patient is awake.

The obstetric population presents additional considerations. Pregnancy is associated with increased basal oxygen consumption and reduced functional residual capacity. Consequently, increased oxygen requirements during significant shivering may be less well tolerated. Shivering can also interfere with maternal–neonatal interaction immediately after delivery, including communication, skin-to-skin contact and initiation of breastfeeding.

Prevention and treatment of shivering may be achieved using non-pharmacological and pharmacological methods. Non-pharmacological approaches include maintaining an appropriate operating-room temperature, covering exposed body surfaces, using forced-air warming and warming intravenous fluids. Pharmacological agents have also been investigated because thermoregulatory mechanisms are complex and thermal measures alone may not always prevent shivering.

Several drugs have been studied for prevention or treatment of post-spinal shivering, including opioids, α_2 -agonists, serotonin antagonists and other centrally acting drugs. Among these, tramadol has attracted considerable interest because of its combined opioid and monoaminergic actions.

Tramadol is a centrally acting analgesic with weak μ -opioid receptor agonist activity and inhibition of serotonin and norepinephrine reuptake. Its antishivering effect is believed to involve central monoaminergic pathways involved in thermoregulation. By influencing serotonergic and noradrenergic transmission, tramadol may alter the hypothalamic thermoregulatory threshold and suppress shivering. Previous studies have reported beneficial effects of tramadol for prevention of shivering following spinal anaesthesia [7,8].

However, tramadol is not without adverse effects. Nausea, vomiting, dizziness and sedation may occur because of its central effects. In obstetric patients, excessive sedation or nausea may reduce maternal comfort and interfere with interaction with the newborn. Thus, the balance between antishivering efficacy and adverse effects is important when selecting a prophylactic drug.

Dexamethasone is a long-acting corticosteroid commonly used because of its anti-inflammatory, antiemetic and analgesic-sparing properties. Its potential role in prevention of perioperative shivering has also been investigated. Corticosteroids

may influence thermoregulation through reduction of inflammatory mediator release and modulation of central pathways involved in temperature regulation. Dexamethasone has therefore been evaluated as a pharmacological option for reducing postoperative and post-spinal shivering [9,10].

Previous studies have suggested that prophylactic corticosteroids may reduce the incidence and severity of perioperative shivering. However, differences in dose, timing of administration, patient characteristics and anaesthetic technique make comparison between individual studies difficult. The relative efficacy of dexamethasone and tramadol remains clinically relevant.

A direct comparison between these two drugs is particularly important in cesarean section patients. The ideal prophylactic drug should reduce shivering without causing clinically important hypotension, respiratory depression, sedation, nausea or vomiting and should not adversely affect the newborn. The present study was therefore undertaken to compare intravenous tramadol and intravenous dexamethasone for prevention of post-spinal anaesthesia shivering in patients undergoing cesarean section [11].

Aim: To compare the efficacy of intravenous tramadol and intravenous dexamethasone in preventing post-spinal anaesthesia shivering in patients undergoing cesarean section.

Material and Methods

Study Design: The study was a prospective, quasi-experimental comparative study designed to evaluate and compare the effectiveness of intravenous tramadol and intravenous dexamethasone in preventing shivering following spinal anaesthesia for cesarean section. The study was conducted in the Department of Anesthesiology of a tertiary care teaching hospital. The study was conducted over a period of 18 months amongst female patients scheduled for cesarean section under spinal anaesthesia.

Sample Size: Ninety patients were assessed for eligibility. Twelve patients were excluded according to the study criteria, leaving 78 patients for final analysis.

The final study population consisted of:

- **Group T:** 39 patients receiving intravenous tramadol.
- **Group D:** 39 patients receiving intravenous dexamethasone.

The sample-size calculation was based on previously reported effectiveness rates of tramadol and dexamethasone for prevention of post-spinal shivering, with a confidence level of 95% and power of 80%.

Inclusion Criteria: Patients fulfilling the following criteria were included:

1. Female patients aged 18 years or above.
2. Patients scheduled for elective or emergency cesarean section.
3. Patients undergoing spinal anaesthesia.
4. ASA physical status I–III.
5. Patients willing to provide written informed consent.

Exclusion Criteria: Patients were excluded if they had:

1. Neuromuscular disorders.
2. Known allergy or hypersensitivity to tramadol or dexamethasone.
3. Severe renal or hepatic impairment.
4. Contraindications to spinal anaesthesia.
5. Refusal to participate.

Preoperative Assessment: A detailed pre-anaesthetic evaluation was performed. Relevant history, general examination and systemic examination were carried out. Baseline heart rate, blood pressure, oxygen saturation and temperature were recorded.

Study Drug Administration: Patients were allocated into two groups,

Group T: Patients received intravenous tramadol at a dose of 1 mg/kg and

Group D: Patients received intravenous dexamethasone at a dose of 0.15 mg/kg.

The study medication was administered 15 minutes before spinal anaesthesia.

Spinal Anaesthesia: Spinal anaesthesia was performed under strict aseptic precautions using 0.5% hyperbaric bupivacaine. The drug was administered at either the L3–L4 or L4–L5 intervertebral space, with the patient in the sitting position.

Following confirmation of an adequate sensory and motor block, cesarean section was commenced.

Monitoring: Patients were monitored continuously for:

- Heart rate.
- Non-invasive blood pressure.
- Oxygen saturation.
- Clinical evidence of shivering.
- Adverse effects.

The incidence, severity and onset time of shivering were documented.

Assessment of Shivering: Shivering was assessed using the four-point grading system employed in the original study. The occurrence of Grade 0 through Grade IV shivering was recorded.

The onset time of shivering was recorded in patients who developed shivering.

Assessment of Adverse Effects: Patients were monitored for: Nausea, Vomiting, Sedation, Hypotension and other clinically relevant perioperative events.

Neonatal Assessment: Neonatal condition was assessed using Apgar scores at 1 minute and 5 minutes following delivery.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using GraphPad Prism version 5. Quantitative variables were expressed as

mean and standard deviation where appropriate. Qualitative variables were expressed as frequencies and percentages. Appropriate statistical tests were used for comparison between groups. A p-value <0.05 was considered statistically significant.

Ethical Considerations: Institutional Ethics Committee approval was obtained before commencement of the study. Written informed consent was obtained from all participants, and confidentiality of patient information was maintained.

Results

Table 1: Severity Grades of Post-Spinal Anesthesia Shivering in the Two Study Groups

Shivering Grade	Group T n (%)	Group D n (%)
Grade 0	32 (82.1)	26 (66.7)
Grade I	3 (7.7)	5 (12.8)
Grade II	2 (5.1)	4 (10.3)
Grade III	2 (5.1)	3 (7.7)
Grade IV	0 (0.0)	1 (2.6)

The severity distribution of post-spinal anesthesia shivering favoured Group T, with a higher proportion of patients remaining free from shivering (Grade 0) compared with Group D. Mild-to-moderate shivering grades were observed more frequently in Group D, and one patient in Group D

developed Grade IV shivering, whereas no patient in Group T demonstrated the highest severity grade. These findings suggest that intravenous tramadol may be associated with a lower severity profile of shivering than intravenous dexamethasone.

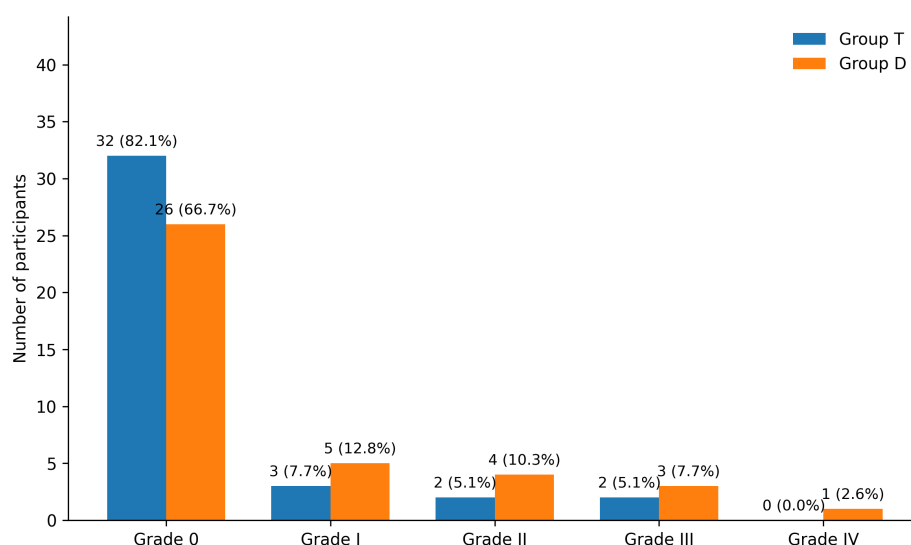


Figure 1: Severity Grades of Post-Spinal Anesthesia Shivering in the Two Study Groups

Table 2: Comparison of Heart Rate at Different Perioperative Time Intervals Between the Two Study Groups

Time Interval	Group T (beats/min)	Group D (beats/min)
Baseline	89.1 ± 10.6	88.4 ± 9.9
5 minutes	96.4 ± 12.3	95.1 ± 11.8
15 minutes	92.6 ± 11.2	92.1 ± 10.8
End of surgery	88.7 ± 9.8	88.3 ± 9.6

Heart rate values remained comparable between the two study groups throughout the perioperative

period. Both groups showed a transient increase at 5 minutes after spinal anesthesia, followed by a

gradual return toward baseline by the end of surgery. The close similarity in heart rate trends indicates that neither intervention was associated with clinically

meaningful differences in perioperative chronotropic response.

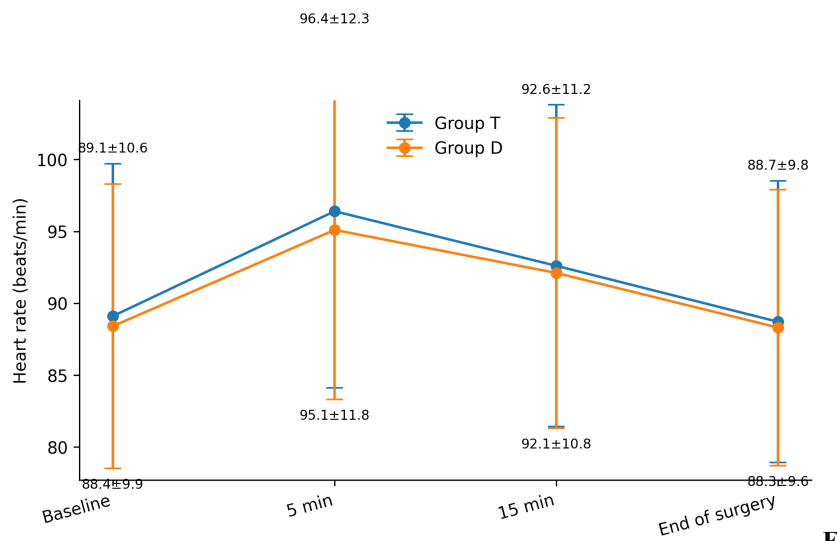


Figure 2: Comparison of Heart Rate at Different Perioperative Time Intervals Between the Two Study Groups

Table 3: Comparison of Mean Arterial Pressure at Different Perioperative Time Intervals Between the Two Study Groups

Time Interval	Group T (mmHg)	Group D (mmHg)
Baseline	92.3 ± 8.5	92.9 ± 8.1
Intraoperative average	81.8 ± 10.2	81.0 ± 10.6
Postoperative	89.5 ± 8.2	89.1 ± 8.6

Mean arterial pressure showed a comparable perioperative profile in both study groups. A decline was observed intraoperatively in both groups, with postoperative values approaching baseline measurements. The absence of any notable

intergroup divergence suggests that both intravenous tramadol and intravenous dexamethasone maintained similar overall hemodynamic stability with respect to mean arterial pressure.

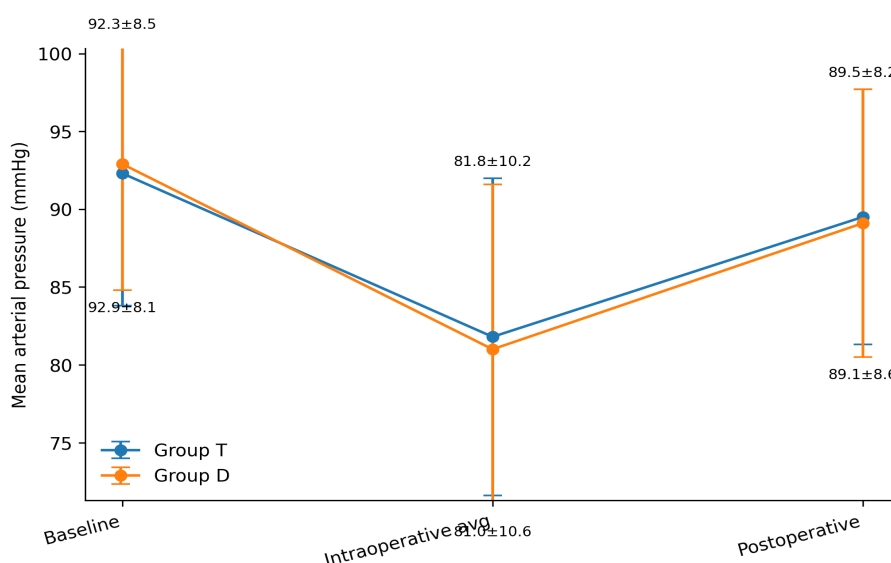


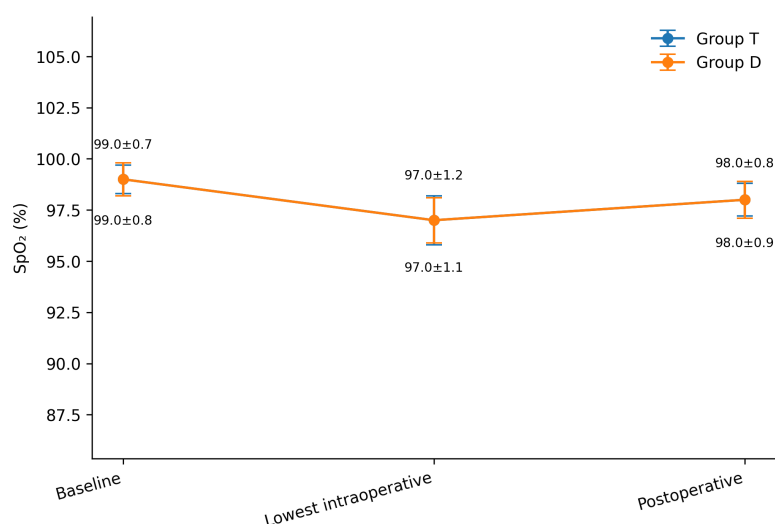
Figure 3: Comparison of Mean Arterial Pressure at Different Perioperative Time Intervals Between the Two Study Groups

Table 4: Comparison of Oxygen Saturation (SpO₂) Between the Two Study Groups

Parameter	Group T	Group D
Baseline SpO ₂ (%)	99 ± 0.7	99 ± 0.8
Lowest intraoperative SpO ₂ (%)	97 ± 1.2	97 ± 1.1
Postoperative SpO ₂ (%)	98 ± 0.8	98 ± 0.9

Oxygen saturation remained well preserved in both groups throughout the perioperative period. Baseline, lowest intraoperative, and postoperative SpO₂ values were nearly identical between Group T and Group D, with no clinically meaningful

desaturation observed in either group. These findings indicate that both study interventions were not associated with adverse effects on perioperative oxygenation.

**Figure 4: Comparison of Oxygen Saturation (SpO₂) Between the Two Study Groups****Table 5: Comparison of side effects amongst two groups:**

Incidence of	Group T	Group D	P value
Nausea	10 (25.6%)	4 (10.3%)	0.07
Vomiting	4 (10.3)	1 (2.6)	0.17
Sedation	5 (12.8)	1 (2.6)	0.09
Hypotension	14 (35.9)	15 (38.5)	0.82

Table 6: Comparison of Neonatal Apgar Scores Between the Two Study Groups

Parameter	Group T	Group D	p-value
Apgar score at 1 minute	8.1 ± 0.5	8.0 ± 0.6	0.42
Apgar score at 5 minutes	9.1 ± 0.4	9.0 ± 0.4	0.33

Neonatal outcomes, as assessed by Apgar scores at 1 and 5 minutes, were comparable between the two study groups. Mean Apgar scores were high in both groups, and the intergroup differences at 1 minute ($p = 0.42$) and 5 minutes ($p = 0.33$) were not statistically significant. These findings suggest that neither intravenous tramadol nor intravenous dexamethasone adversely affected immediate neonatal condition.

Discussion

Post-spinal anaesthesia shivering remains a clinically relevant problem during cesarean section. Although generally transient, shivering can produce substantial maternal discomfort and increase metabolic requirements. Its prevention is therefore

an important component of perioperative obstetric anaesthesia.

The present study compared two pharmacological agents with different mechanisms of action: tramadol and dexamethasone. The principal finding was that tramadol produced a numerically lower incidence of shivering than dexamethasone. Shivering occurred in 17.9% of patients receiving tramadol compared with 33.3% receiving dexamethasone. However, the difference was not statistically significant, with a p-value of 0.11.

The numerical reduction in shivering observed with tramadol is consistent with its proposed pharmacological mechanism. Tramadol acts as a weak μ -opioid receptor agonist while also inhibiting

serotonin and norepinephrine reuptake. These monoaminergic pathways have an important role in central thermoregulation. Modulation of these pathways may alter the shivering threshold and reduce the likelihood of involuntary muscular activity.

Previous studies have also reported beneficial effects of tramadol. Amucheazi et al. reported reduction of shivering with tramadol in patients undergoing cesarean section under subarachnoid block. Zohari Nobijari et al. also reported the effectiveness of tramadol for prevention of post-spinal shivering [7,8].

The present study further demonstrated that the proportion of patients without shivering was greater in the tramadol group. Grade 0 shivering occurred in 82.1% of patients receiving tramadol compared with 66.7% receiving dexamethasone. Higher grades were numerically more frequent in the dexamethasone group. Importantly, Grade IV shivering was not observed in Group T, whereas one patient in Group D developed Grade IV shivering.

These findings suggest that tramadol may have an advantage not only in reducing the occurrence of shivering but also in reducing its severity. Nevertheless, because the study was not powered to demonstrate statistical significance for each grade, these observations should be regarded as trends rather than definitive evidence of superiority.

The mean onset of shivering was also later with tramadol. Among patients who developed shivering, the mean onset was 28.4 ± 9.1 minutes with tramadol compared with 22.1 ± 8.3 minutes with dexamethasone. The p-value was 0.09. Although this did not reach statistical significance, the approximately six-minute numerical difference may have practical relevance during the intraoperative period.

Dexamethasone has also been investigated as a prophylactic anti shivering drug. Corticosteroids may influence the inflammatory and thermoregulatory responses associated with surgery and anaesthesia. Previous studies have suggested a beneficial role for prophylactic steroids in reducing perioperative shivering [9,10].

Misra et al., in a systematic review and meta-analysis, reported beneficial effects of prophylactic corticosteroids on perioperative shivering. Ashoor et al. also evaluated dexamethasone and reported a potentially beneficial effect in patients undergoing procedures under spinal anaesthesia [9,10]. The findings of the present study do not contradict these observations; rather, they demonstrate that, within this particular study population and dosing regimen, tramadol produced a greater numerical reduction in shivering.

The absence of statistical significance for the primary outcome is important. The difference between 17.9% and 33.3% represents an absolute difference of 15.4 percentage points, but the p-value of 0.11 means that the present study cannot establish a statistically significant superiority of tramadol. A larger sample may be necessary to determine whether this numerical difference represents a true treatment effect.

Haemodynamic stability is an important consideration in patients undergoing cesarean section under spinal anaesthesia. Spinal blockade itself causes sympathetic inhibition and peripheral vasodilatation and therefore may result in hypotension. An antishivering drug that substantially worsens hypotension would be less desirable.

In the present study, heart rate and blood pressure were comparable between groups. Both groups experienced a reduction in blood pressure during the intraoperative period, followed by recovery after surgery. This pattern is consistent with the expected haemodynamic effects of spinal anaesthesia.

The incidence of hypotension was 35.9% in the tramadol group and 38.5% in the dexamethasone group. The difference was not statistically significant ($p=0.82$). Thus, the study drugs appeared comparable with regard to this clinically important outcome.

Oxygen saturation was similarly preserved. Baseline and postoperative oxygen saturation values were almost identical, and the lowest intraoperative values were 97% in both groups. No clinically significant oxygen desaturation was recorded. This is reassuring because severe shivering can increase oxygen consumption and potentially worsen oxygenation in vulnerable patients.

An important difference emerged in the adverse-effect profile. Nausea was numerically more frequent in patients receiving tramadol. It occurred in 25.6% of Group T compared with 10.3% of Group D, with a p-value of 0.07. Vomiting occurred in 10.3% versus 2.6%, and sedation in 12.8% versus 2.6%.

Although none of these differences reached statistical significance, the consistent numerical pattern favoured dexamethasone. The higher incidence of nausea and vomiting with tramadol may be explained by its central opioid and monoaminergic effects. Sedation is also a recognized consequence of centrally acting analgesics.

Dexamethasone, in contrast, has established antiemetic properties and is frequently used to reduce postoperative nausea and vomiting. Therefore, the lower frequency of nausea and

vomiting in Group D is pharmacologically plausible.

These findings demonstrate that selection of an antishivering drug should not be based exclusively on efficacy. A drug that produces slightly better shivering prevention but more nausea and sedation may not necessarily be preferred in every patient. In obstetric anaesthesia, maintaining maternal comfort and alertness is particularly important because the mother is awake and may wish to interact with the newborn immediately after delivery.

Neonatal outcomes were comparable between the groups. The mean 1-minute Apgar score was 8.1 ± 0.5 in Group T and 8.0 ± 0.6 in Group D. At 5 minutes, scores were 9.1 ± 0.4 and 9.0 ± 0.4 , respectively. There was no statistically significant difference.

The absence of an observed difference in Apgar scores is reassuring. Both drugs, at the doses used in the study, were associated with satisfactory immediate neonatal outcomes. Nevertheless, Apgar score alone cannot fully assess neonatal drug exposure or longer-term neonatal effects, and future studies may incorporate additional neonatal parameters.

The present findings broadly support the concept that both tramadol and dexamethasone can be considered pharmacological options for prevention of post-spinal shivering. However, their relative benefits appear different. Tramadol showed a numerical efficacy advantage, whereas dexamethasone showed a numerical tolerability advantage.

The original rationale for comparing these two drugs was based on the need for an effective prophylactic agent with acceptable maternal and neonatal safety. Previous literature has established that shivering following spinal anaesthesia is multifactorial and may not always be prevented by temperature management alone. Pharmacological modulation of central thermoregulatory pathways therefore remains an important strategy [11].

The study has several strengths. It included equal numbers of patients in both treatment groups, evaluated multiple clinically relevant outcomes and maintained comparable baseline characteristics. The study assessed not only incidence but also severity and onset of shivering. Maternal haemodynamics, oxygenation, adverse effects and neonatal Apgar scores were also evaluated.

However, limitations should be considered. The sample size was relatively small, with only 39 patients in each group. The quasi-experimental design also limits the strength of causal inference compared with a large randomized controlled trial. Several outcomes showed numerical differences but did not achieve statistical significance. Therefore,

the study should not be interpreted as demonstrating definitive superiority of tramadol.

The p-values for shivering incidence, onset, nausea and sedation were 0.11, 0.09, 0.07 and 0.09, respectively. These results demonstrate trends that may warrant further investigation but cannot be described as statistically significant according to the predefined threshold of $p < 0.05$.

Future research should include larger randomized controlled trials with standardized temperature monitoring and consistent definitions of shivering. Studies could also evaluate maternal satisfaction, postoperative recovery, duration of shivering, rescue medication requirements and more comprehensive neonatal outcomes.

The findings of the present study nevertheless have practical relevance. When prevention of shivering is the primary concern, tramadol may be considered because of its numerical reduction in incidence and severity. When minimizing nausea, vomiting and sedation is considered more important, dexamethasone may be an attractive alternative.

The balance between efficacy and adverse effects is therefore central to individualized drug selection.

Conclusion

The present study compared intravenous tramadol 1 mg/kg with intravenous dexamethasone 0.15 mg/kg for prevention of shivering following spinal anaesthesia in patients undergoing cesarean section.

Tramadol was associated with a numerically lower incidence of shivering than dexamethasone (17.9% versus 33.3%). It was also associated with a greater proportion of patients remaining free from shivering, lower numerical severity and a later mean onset of shivering. However, none of these differences achieved statistical significance.

Dexamethasone was associated with numerically fewer episodes of nausea, vomiting and sedation. Haemodynamic parameters, hypotension and oxygen saturation were comparable between the two groups. Neonatal Apgar scores at 1 and 5 minutes were also comparable, indicating similar immediate neonatal outcomes.

Thus, both intravenous tramadol and intravenous dexamethasone may be considered useful pharmacological options for prevention of post-spinal anaesthesia shivering in cesarean section patients.

Tramadol may be preferred when prevention of shivering is the principal clinical objective, while dexamethasone may be considered when minimizing nausea, vomiting and sedation is a major priority. However, because the primary differences did not achieve statistical significance, definitive superiority of tramadol over dexamethasone cannot

be established from this study alone.

Larger, adequately powered randomized controlled studies are required to confirm the observed numerical trends and determine the optimal prophylactic agent for prevention of shivering during cesarean section under spinal anaesthesia.

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