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Comparative Efficacy of Intravenous Dexmedetomidine and Tramadol in the Treatment of Post-Spinal Anaesthesia Shivering: A Prospective Randomized Double-Blind Study

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ABSTRACT

Background: Post-spinal anaesthesia shivering is a common perioperative complication that causes patient discomfort, increases metabolic demand, and may adversely affect haemodynamic stability. Dexmedetomidine and tramadol are widely used for its treatment, but their comparative efficacy and safety remain uncertain.
Methods: This prospective, randomized, double-blind study included 100 patients (ASA I–II), aged 18–60 years, who developed Grade 3 or 4 shivering following spinal anaesthesia for elective lower abdominal, pelvic, or lower-limb surgeries. Patients were randomly allocated to receive either intravenous dexmedetomidine 0.5 µg/kg (n=50) or intravenous tramadol 0.5 mg/kg (n=50). The primary outcome was time to complete cessation of shivering. Secondary outcomes included haemodynamic parameters, recurrence of shivering, sedation, and adverse effects.
Results: Both groups were comparable in baseline characteristics. The mean time to cessation of shivering was 217.82 ± 33.05 seconds in the tramadol group and 208.56 ± 31.24 seconds in the dexmedetomidine group (p=0.15). Complete control of shivering was achieved in 98% and 100% of patients, respectively, within 10 minutes. Haemodynamic parameters remained comparable between the groups. Nausea and vomiting were more frequent with tramadol (8.0%; p=0.041), whereas hypotension (10.0%; p=0.022) and bradycardia (14.0%; p=0.006) occurred more commonly with dexmedetomidine.
Conclusion: Both dexmedetomidine and tramadol were effective in controlling post-spinal anaesthesia shivering with comparable efficacy. Dexmedetomidine was associated with fewer gastrointestinal adverse effects but a higher incidence of bradycardia and hypotension. Drug selection should therefore be individualized according to the patient's haemodynamic status and clinical profile.

Keywords*: Post-spinal anaesthesia shivering; Dexmedetomidine; Tramadol; Spinal anaesthesia; Randomized controlled trial; Haemodynamic stability.*

INTRODUCTION

Post-spinal anaesthesia shivering (PSAS) is a common and distressing complication of neuraxial anaesthesia, with a reported incidence of 40–70%, while systematic reviews estimate a median incidence of approximately 55%.[1] Shivering is an involuntary oscillatory contraction of skeletal muscles that primarily represents a thermoregulatory response to hypothermia, although non-thermoregulatory mechanisms may also contribute in the perioperative period.[2] Normal core body temperature (36.5–37.5°C) is maintained by hypothalamic regulation through a balance between heat production and heat loss.[3]Spinal anaesthesia disrupts thermoregulation by producing sympathetic blockade, peripheral vasodilatation, and inhibition of vasoconstriction, leading to rapid redistribution of core heat to peripheral tissues and a fall in core temperature.[4] Additional factors such as a cool operating room environment, unwarmed intravenous fluids, surgical exposure, reduced metabolic heat production, postoperative pain, and inflammatory mediators further increase the risk of shivering.[3,4] Kurz et al. demonstrated that neuraxial anaesthesia lowers the vasoconstriction and shivering thresholds, thereby impairing the body's ability to maintain normothermia.[5]Although rarely life-threatening, PSAS causes

considerable patient discomfort and significant physiological stress. Shivering increases oxygen consumption by 100–400%, elevates carbon dioxide production, metabolic rate, catecholamine release, and cardiac workload, potentially precipitating hypoxaemia, myocardial ischaemia, and delayed recovery in vulnerable patients.[6,7] It also interferes with electrocardiography, pulse oximetry, and blood pressure monitoring, increases intraocular and intracranial pressure, aggravates postoperative pain, and may delay recovery from anaesthesia.[8] Therefore, prompt recognition and treatment are essential for optimal perioperative care.[9]Management of PSAS includes non-pharmacological measures such as forced-air warming, warming blankets, warmed intravenous fluids, and maintenance of operating room temperature. However, these methods may not always be practical, making pharmacological therapy the preferred approach.[7] Several drugs, including pethidine, clonidine, ketamine, nefopam, magnesium sulphate, tramadol, and dexmedetomidine, have been evaluated, with tramadol and dexmedetomidine emerging as the most commonly used agents.[9,10]

Tramadol is a centrally acting analgesic that exerts its anti-shivering effect through weak μ-opioid receptor agonism and inhibition of norepinephrine and serotonin reuptake, thereby modulating hypothalamic thermoregulation.[11] It has demonstrated rapid and effective control of post-anaesthetic shivering but is frequently associated with nausea and vomiting.[9,12] Dexmedetomidine, a highly selective α_2-adrenergic agonist, suppresses shivering by reducing the vasoconstriction and shivering thresholds through central α_2-receptor activation. It also provides sedation and analgesia without significant respiratory depression but may cause bradycardia and hypotension.[10,13]Although several randomized trials have compared dexmedetomidine and tramadol for PSAS, differences remain regarding the speed of shivering control, haemodynamic effects, sedation, recurrence, and adverse-effect profile.[9,10] Therefore, the present prospective randomized double-blind study was undertaken to compare the efficacy and safety of intravenous dexmedetomidine and tramadol in the treatment of post-spinal anaesthesia shivering by evaluating shivering cessation time, treatment success, haemodynamic changes, recurrence, sedation, adverse effects, and overall clinical effectiveness.

MATERIALS AND METHODS

The present study was a hospital-based, prospective, randomized, double-blind, controlled trial conducted over a period of two years.The study was conducted in the Department of Anaesthesiology at Jawaharlal Nehru Hospital and Research Centre, Bhilai, Durg, Chhattisgarh.The study was carried out between October 2017 and October 2019.

Study Population

Patients of either gender undergoing spinal anaesthesia for elective lower abdominal, pelvic, and lower limb surgeries were enrolled in the study.

Inclusion Criteria

Patients fulfilling the following criteria were included:

- Age between 18 and 60 years.
- American Society of Anesthesiologists (ASA) physical status I or II.
- Patients developing shivering of Grade 3 or Grade 4 following spinal anaesthesia.
- Patients undergoing surgery under spinal anaesthesia.

Exclusion Criteria

Patients with any of the following conditions were excluded:

- History of convulsions.
- Hypothyroidism or hyperthyroidism.
- Cardiopulmonary disorders.
- Neuromuscular disorders.
- Known allergy to the study drugs.
- Psychiatric illness.
- Urinary tract infection.
- Severe diabetes mellitus with autonomic neuropathy.

Sample Size

The sample size was calculated using data from a previous study (JMSCR. 2017;5(4):20338–20344). The calculation was based on the difference in the mean time required for control of shivering between the dexmedetomidine and tramadol groups.

The sample size was estimated using the formula:

$$N = \frac{2(Z_{\alpha/2} + Z_{\beta})^2 \times SD^2}{D^2}$$

where:

- $Z\alpha = 1.96$ at 95% confidence level
- $Z\beta = 0.84$ at 80% power
- D = Difference in mean time for control of shivering (14.08 − 8.74 = 5.34 minutes)
- SD^2 = Pooled variance (85.32)

The minimum calculated sample size was 47 patients per group. To improve the reliability of the study and compensate for possible exclusions, 50 patients were included in each group, resulting in a total sample size of 100 patients.

Randomization and Group Allocation
Eligible patients were randomly allocated into two equal groups using computer-generated random numbers.

Group Dm (Dexmedetomidine Group) (n = 50):
Patients received intravenous dexmedetomidine 0.5 µg/kg diluted to 5 mL with normal saline.

Group T (Tramadol Group) (n = 50):
Patients received intravenous tramadol 0.5 mg/kg diluted to 5 mL with normal saline.

Blinding
The study was conducted in a double-blind manner. Identical coded syringes containing the study medications were prepared by an anaesthesiologist who was not involved in patient management or data collection. Both the patients and the observer responsible for recording study parameters remained blinded to the allocated treatment throughout the study.

Preoperative Assessment
Approval from the Institutional Scientific and Ethics Committee was obtained before commencement of the study. Written informed consent was obtained from all participants.All patients underwent a detailed pre-anaesthetic evaluation before surgery. Routine laboratory investigations including complete haemogram, chest radiograph, electrocardiography, serum creatinine, blood urea, serum electrolytes, and coagulation profile were performed.Patients were kept fasting overnight before surgery. Premedication consisted of oral alprazolam 0.5 mg administered on the night before surgery and oral ranitidine given both on the night before and on the morning of surgery.

Anaesthetic Technique
On arrival in the operating theatre, standard monitoring including electrocardiography (ECG), heart rate (HR), non-invasive blood pressure (NIBP), oxygen saturation (SpO_2), and axillary body temperature was established, and baseline values were recorded.An 18-gauge intravenous cannula was secured. Patients were preloaded with Ringer's lactate solution at 10 mL/kg before spinal anaesthesia, followed by maintenance fluids at 6 mL/kg/hour.Spinal anaesthesia was administered under strict aseptic precautions using 15 mg of 0.5% hyperbaric bupivacaine through a 25-gauge Quincke spinal needle at either the L3–L4 or L4–L5 intervertebral space.The operating room temperature was maintained between 24°C and 25°C. Supplemental oxygen was administered through a face mask at 4 L/min. Patients were covered with surgical drapes during surgery and a cotton blanket postoperatively. No active warming devices were used. Intravenous fluids were administered at room temperature.The use of intraoperative opioids was not permitted. Episodes of hypotension (mean arterial pressure <20% below baseline), bradycardia (heart rate <60 beats/min), and nausea or vomiting were managed with intravenous mephentermine, atropine, and ondansetron, respectively. The total volume of intravenous fluids and use of rescue medications were recorded.

Study Procedure
Vital parameters including heart rate, non-invasive blood pressure, oxygen saturation, body temperature, and continuous ECG were monitored throughout surgery.
Measurements were recorded:

- Every 1 minute for the first 5 minutes after spinal anaesthesia.
- Every 5 minutes for the subsequent 30 minutes.
- Every 15 minutes thereafter until completion of surgery.

Patients who developed shivering of Grade 3 or Grade 4 received the allocated study drug according to the randomization schedule. Dexmedetomidine (0.5 µg/kg) or tramadol (0.5 mg/kg) was administered as a slow intravenous injection.
The following observations were recorded:

- Time from spinal anaesthesia to onset of shivering (T_0).
- Severity of shivering.
- Time required for complete cessation of shivering following administration of the study drug.
- Ramsay sedation score.

- Haemodynamic parameters including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation at 5, 10, and 15 minutes after administration of the study drug (T_5, T_{10}, and T_{15}).

Failure of treatment was defined as persistence of shivering beyond 15 minutes after administration of the study drug. Recurrence of shivering was monitored until the patient left the operating theatre.Patients with recurrence of shivering or treatment failure received an additional dose of the allocated study drug (dexmedetomidine 0.5 µg/kg or tramadol 0.5 mg/kg).The duration of surgery was also recorded.

Outcome Measures

Primary Outcome

- Time required for complete control of post-spinal anaesthesia shivering.

Secondary Outcomes

- Time to onset of shivering after spinal anaesthesia.
- Change in shivering grade following treatment.
- Haemodynamic parameters (HR, SBP, DBP, MAP, and SpO_2).
- Ramsay sedation score.
- Recurrence of shivering.
- Treatment failure.
- Duration of surgery.
- Incidence of adverse effects including nausea, vomiting, hypotension, bradycardia, and dizziness.

Assessment Scales

Ramsay Sedation Score

Sedation was assessed using the Ramsay Sedation Scale:

- Grade 1: Anxious, agitated, or restless.
- Grade 2: Cooperative, oriented, and tranquil.
- Grade 3: Responded to commands only.
- Grade 4: Brisk response to glabellar tap or loud auditory stimulus.
- Grade 5: Sluggish response to glabellar tap or loud auditory stimulus.
- Grade 6: No response (unconscious).

Shivering Grade

Shivering severity was assessed using the following grading system:

- Grade 0: No shivering.
- Grade 1: Piloerection or peripheral vasoconstriction without visible shivering.
- Grade 2: Muscular activity confined to one muscle group.
- Grade 3: Muscular activity involving more than one muscle group but not generalized.
- Grade 4: Generalized shivering involving the whole body.

Statistical Analysis

The collected data were entered into Microsoft Excel and analysed using SPSS version 26statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Continuous variables were compared using the independent Student's *t*-test, whereas categorical variables were analysed using the Chi-square test or Fisher's exact test, wherever appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 100 patients undergoing elective lower abdominal, pelvic, and lower-limb surgeries under spinal anaesthesia were included in the study. The patients were randomly allocated into two equal groups: Group T, which received intravenous tramadol, and Group Dm, which received intravenous dexmedetomidine.The mean age of patients was 39.56 ± 13.21 years in Group T and 40.30 ± 12.49 years in Group Dm. The mean body weight was 55.82 ± 4.78 kg and 56.18 ± 6.89 kg in Group T and Group Dm, respectively. Neither age nor weight differed significantly between the groups.Males constituted 56.0% of Group T and 68.0% of Group Dm, while females constituted 44.0% and 32.0%, respectively. ASA Grade I patients accounted for 68.0% of Group T and 52.0% of Group Dm, whereas ASA Grade II patients accounted for 32.0% and 48.0%, respectively. The differences in sex distribution and ASA physical status were not statistically significant. Thus, both groups were comparable with respect to their baseline demographic and clinical characteristics (Table 1).In Group T, the highest proportion of patients belonged to the age group of 21–30 years, accounting for 32.0% of participants, followed by the 41–50-year age group at 28.0%. In Group Dm, the highest proportion of patients belonged to the 51–60-year age group at 28.0%, followed by the 21–30-year age group at 26.0%.Abdominal surgeries were performed

in 38.0% of patients in Group T and 34.0% in Group Dm. Lower-limb surgeries accounted for 36.0% of procedures in both groups, while urological or pelvic surgeries accounted for 26.0% in Group T and 30.0% in Group Dm. The distribution of surgical procedures was comparable between the groups (p=0.88) (Table 2 and Figure 1).The mean preoperative axillary temperature was 37.15 ± 0.25°C in Group T and 37.12 ± 0.25°C in Group Dm. At the onset of shivering, the temperature decreased to 36.02 ± 0.21°C in Group T and 36.10 ± 0.21°C in Group Dm.A gradual increase in temperature was observed after administration of the study drugs. At 15 minutes, the mean temperature was 36.71 ± 0.15°C in Group T and 36.75 ± 0.16°C in Group Dm. No statistically significant difference was observed between the two groups at the preoperative stage or at T0, T5, T10, and T15 (Table 3 and Figure 2).The mean systolic blood pressure at T0 was 124.66 ± 11.83 mmHg in Group T and 125.72 ± 10.97 mmHg in Group Dm. A gradual decline in systolic blood pressure was observed in both groups during the observation period. At T15, the mean systolic blood pressure was 120.44 ± 8.28 mmHg in Group T and 117.64 ± 11.28 mmHg in Group Dm. The intergroup differences were not statistically significant at any time interval.

The mean diastolic blood pressure at T0 was 80.16 ± 11.73 mmHg in Group T and 82.24 ± 10.68 mmHg in Group Dm. At T15, it was 75.26 ± 7.87 mmHg and 72.40 ± 9.32 mmHg, respectively. No significant difference was observed between the groups.Similarly, mean arterial pressure remained comparable throughout the observation period. At T0, the mean arterial pressure was 94.98 ± 10.88 mmHg in Group T and 96.52 ± 9.95 mmHg in Group Dm, while at T15 it was 90.73 ± 7.26 mmHg and 89.96 ± 10.63 mmHg, respectively.The mean heart rate at T0 was 77.38 ± 11.70 beats/minute in Group T and 81.58 ± 10.53 beats/minute in Group Dm. At T15, it was 74.84 ± 9.59 beats/minute in Group T and 71.96 ± 7.68 beats/minute in Group Dm. The differences in heart rate between the two groups were not statistically significant at any recorded interval. Overall, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate remained comparable between the two groups throughout the observation period (Table 4).The mean oxygen saturation at T0 was 97.74 ± 1.12% in Group T and 97.88 ± 1.22% in Group Dm. Oxygen saturation remained stable and comparable between the groups throughout the observation period. At T15, the mean SpO_2 was 99.38 ± 0.73% in Group T and 99.16 ± 0.96% in Group Dm.At 5 minutes after administration of the study drug, complete cessation of shivering, represented by Grade 0 shivering, was observed in 33 patients (66.0%) in Group T and 35 patients (70.0%) in Group Dm. At 10 and 15 minutes, Grade 0 shivering was observed in 49 patients (98.0%) in Group T and all 50 patients (100.0%) in Group Dm. The differences in shivering grades between the groups were not statistically significant.The mean time required for cessation of shivering was 217.82 ± 33.05 seconds in Group T and 208.56 ± 31.24 seconds in Group Dm. Although the time to cessation was numerically shorter in the dexmedetomidine group, the difference was not statistically significant (p=0.15) (Table 5).Nausea and vomiting occurred in four patients (8.0%) in Group T and in none of the patients in Group Dm. This difference was statistically significant (p=0.041).Hypotension was observed in five patients (10.0%) in Group Dm and in none of the patients in Group T, with a statistically significant difference (p=0.022). Bradycardia occurred in seven patients (14.0%) in Group Dm and was absent in Group T; this difference was also statistically significant (p=0.006). Dizziness was not observed in either group.Thus, nausea and vomiting were more commonly associated with tramadol, whereas hypotension and bradycardia were more frequently associated with dexmedetomidine (Table 6 and Figure 3).

Table 1. Comparison of Baseline Demographic Characteristics Between the Two Groups

Variable	Group T: Tramadol (n=50)	Group Dm: Dexmedetomidine (n=50)	p-value
Age (years), Mean ± SD	39.56 ± 13.21	40.30 ± 12.49	0.77
Weight (kg), Mean ± SD	55.82 ± 4.78	56.18 ± 6.89	0.76
Male, n (%)	28 (56.0%)	34 (68.0%)	0.21
Female, n (%)	22 (44.0%)	16 (32.0%)	
ASA Grade I, n (%)	34 (68.0%)	26 (52.0%)	0.10
ASA Grade II, n (%)	16 (32.0%)	24 (48.0%)	

Table 2. Comparison of Age Distribution and Type of Surgery Between the Groups

Variable	Group T (n=50)	Group Dm (n=50)	p-value
Age group, n (%)			
≤20 years	3 (6.0%)	2 (4.0%)	
21–30 years	16 (32.0%)	13 (26.0%)	
31–40 years	5 (10.0%)	11 (22.0%)	
41–50 years	14 (28.0%)	10 (20.0%)	
51–60 years	12 (24.0%)	14 (28.0%)	
Type of surgery, n (%)			**0.88**
Abdominal surgery	19 (38.0%)	17 (34.0%)	
Lower-limb surgery	18 (36.0%)	18 (36.0%)	
Urological/pelvic surgery	13 (26.0%)	15 (30.0%)	

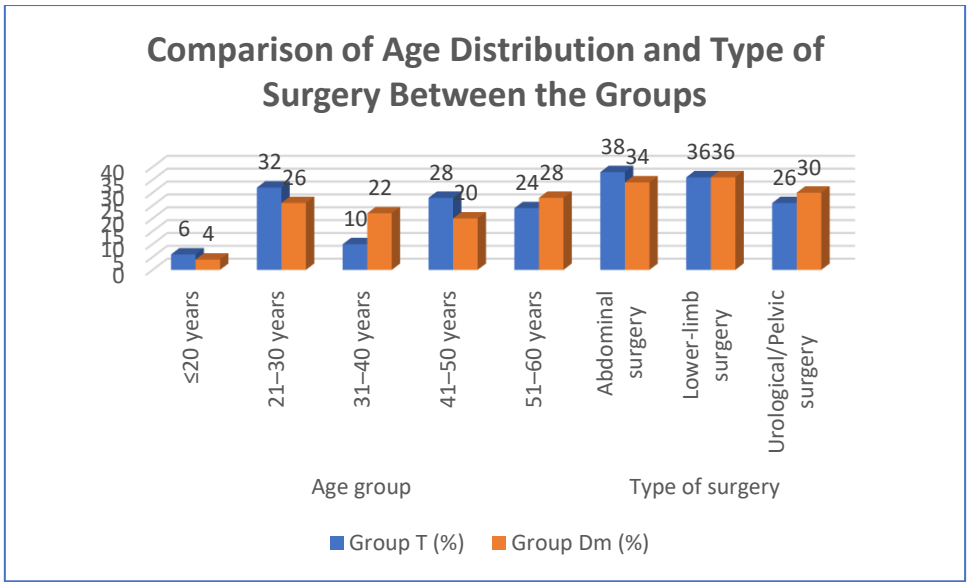

Figure 1 Comparison of Age Distribution and Type of Surgery Between the Groups

Table 3. Comparison of Axillary Temperature at Different Time Intervals

Time interval	Group T, Mean ± SD (°C)	Group Dm, Mean ± SD (°C)	p-value
Preoperative	37.15 ± 0.25	37.12 ± 0.25	0.58
T0: Onset of shivering	36.02 ± 0.21	36.10 ± 0.21	0.06
T5: 5 minutes	36.34 ± 0.18	36.34 ± 0.22	0.92
T10: 10 minutes	36.60 ± 0.18	36.57 ± 0.20	0.46
T15: 15 minutes	36.71 ± 0.15	36.75 ± 0.16	0.27

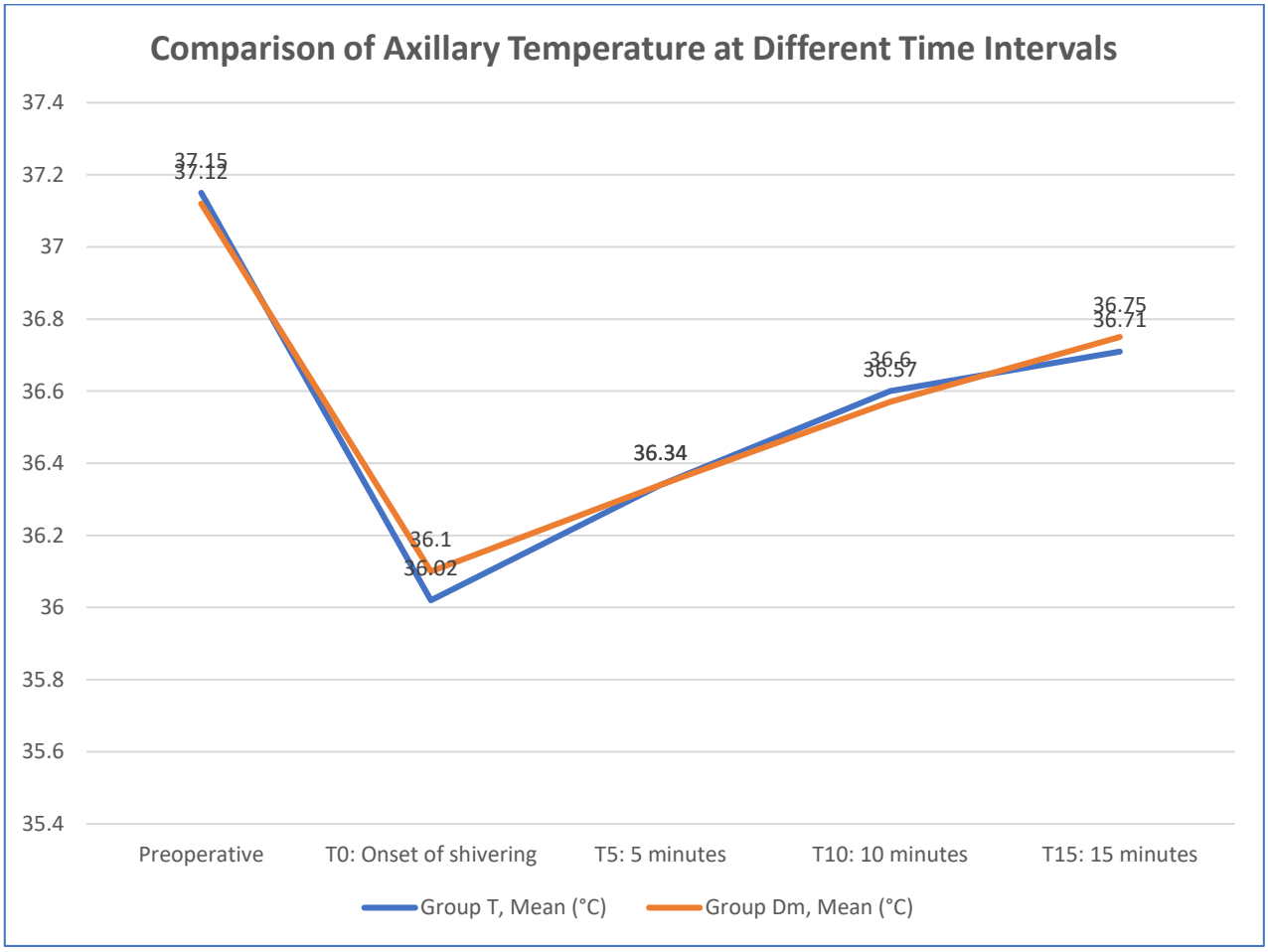

Figure 2 Comparison of Axillary Temperature at Different Time Intervals

Table 4. Comparison of Haemodynamic Parameters Between the Groups

Parameter	Time	Group T, Mean ± SD	Group Dm, Mean ± SD	p-value
Systolic BP (mmHg)	T0	124.66 ± 11.83	125.72 ± 10.97	0.64
	T5	122.46 ± 9.24	120.00 ± 11.78	0.25
	T10	120.64 ± 8.24	117.32 ± 11.61	0.10
	T15	120.44 ± 8.28	117.64 ± 11.28	0.16
Diastolic BP (mmHg)	T0	80.16 ± 11.73	82.24 ± 10.68	0.36
	T5	77.56 ± 8.65	76.94 ± 11.32	0.76
	T10	75.44 ± 7.42	74.86 ± 10.46	0.75
	T15	75.26 ± 7.87	72.40 ± 9.32	0.10
Mean arterial pressure (mmHg)	T0	94.98 ± 10.88	96.52 ± 9.95	0.46
	T5	92.82 ± 8.38	91.34 ± 11.20	0.46
	T10	91.10 ± 7.12	90.48 ± 10.74	0.74
	T15	90.73 ± 7.26	89.96 ± 10.63	0.67
Heart rate (beats/min)	T0	77.38 ± 11.70	81.58 ± 10.53	0.06
	T5	75.16 ± 9.69	73.04 ± 10.36	0.29
	T10	74.04 ± 9.53	71.94 ± 8.01	0.24
	T15	74.84 ± 9.59	71.96 ± 7.68	0.10

Table 5. Comparison of Oxygen Saturation and Shivering Outcomes

Variable	Group T (n=50)	Group Dm (n=50)	p-value
SpO_2, Mean ± SD (%)			
T0	97.74 ± 1.12	97.88 ± 1.22	0.55
T5	98.46 ± 1.03	98.34 ± 1.15	0.59
T10	99.10 ± 0.97	98.88 ± 1.10	0.29
T15	99.38 ± 0.73	99.16 ± 0.96	0.20
Grade 0 shivering, n (%)			
T5	33 (66.0%)	35 (70.0%)	0.67
T10	49 (98.0%)	50 (100.0%)	0.31
T15	49 (98.0%)	50 (100.0%)	0.31
Time to cessation of shivering (seconds), Mean ± SD	217.82 ± 33.05	208.56 ± 31.24	0.15

Table 6. Comparison of Adverse Effects Between the Groups

Adverse effect	Group T, n (%)	Group Dm, n (%)	p-value
Nausea/vomiting	4 (8.0%)	0 (0.0%)	0.041
Hypotension	0 (0.0%)	5 (10.0%)	0.022
Bradycardia	0 (0.0%)	7 (14.0%)	0.006
Dizziness	0 (0.0%)	0 (0.0%)	—

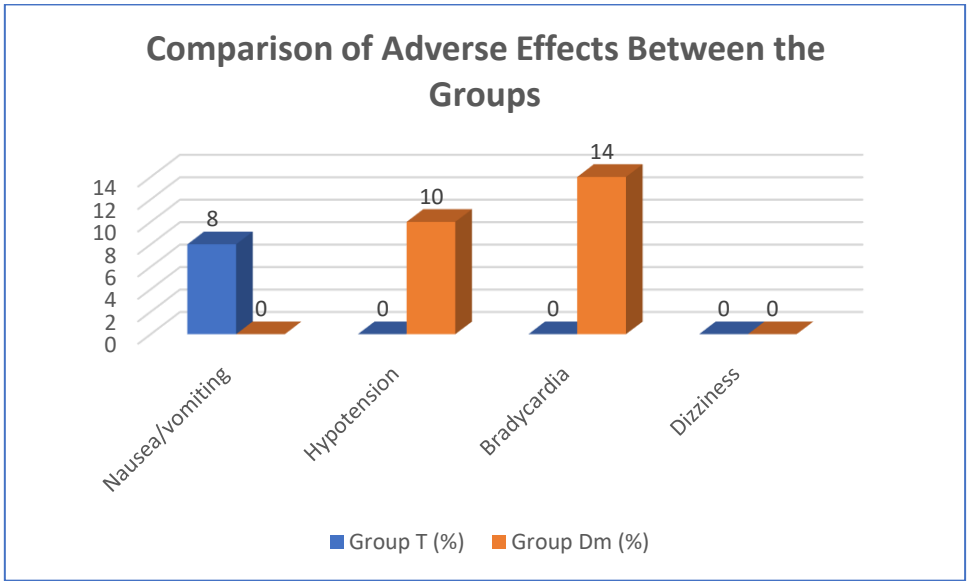

Figure 3 Comparison of Adverse Effects Between the Groups

DISCUSSION

The present prospective randomized double-blind study compared the efficacy and safety of intravenous tramadol (0.5 mg/kg) and dexmedetomidine (0.5 μg/kg) for the treatment of post-spinal anaesthesia shivering. Both drugs effectively controlled shivering with comparable efficacy and preserved haemodynamic stability. However, dexmedetomidine was associated with a higher incidence of bradycardia and hypotension, whereas tramadol caused more nausea and vomiting.
Baseline demographic and clinical characteristics were comparable between the two groups. Mean age (39.56 ± 13.21 vs. 40.30 ± 12.49 years), body weight (55.82 ± 4.78 vs. 56.18 ± 6.89 kg), sex distribution, and ASA physical status showed no significant differences, confirming successful randomization. Similar baseline comparability has been reported by Mittal G et al.[14] and Singla et al.[15], who also found no significant differences in demographic characteristics between tramadol- and dexmedetomidine-treated patients.

The distribution of surgical procedures was similar between the groups (p=0.88), with lower abdominal, pelvic, and lower-limb surgeries equally represented, thereby minimizing procedure-related bias. Comparable findings were reported by Singla et al.[15], whose study included a similar spectrum of surgeries performed under spinal anaesthesia.
Both groups demonstrated a fall in axillary temperature at the onset of shivering followed by gradual normalization after treatment. No significant difference in temperature was observed between groups at any assessment point. At shivering onset, mean temperatures were 36.02 ± 0.21°C and 36.10 ± 0.21°C, increasing to 36.71 ± 0.15°C and 36.75 ± 0.16°C after 15 minutes in the tramadol and dexmedetomidine groups, respectively. Mittal G et al.[14] similarly reported comparable temperature trends, suggesting that both drugs suppress shivering by altering the thermoregulatory threshold rather than by immediate restoration of core temperature.

Haemodynamic parameters, including systolic and diastolic blood pressure, mean arterial pressure, heart rate, and oxygen saturation, remained stable throughout the study, with no statistically significant intergroup differences. Although dexmedetomidine produced a modest reduction in heart rate and blood pressure, these changes were clinically acceptable. Similar haemodynamic stability has been documented by Mittal G et al.[14].

The primary outcome, time to cessation of shivering, was comparable between groups. Mean shivering control time was 217.82 ± 33.05 seconds with tramadol and 208.56 ± 31.24 seconds with dexmedetomidine (p=0.15). Complete cessation of shivering by 10 minutes occurred in 98% and 100% of patients, respectively. In contrast, Mittal G et al.[14], Singla et al.[15], and Ganjoo et al.[16] reported significantly faster shivering control with dexmedetomidine than tramadol. The absence of a significant difference in the present study may reflect differences in patient characteristics, shivering severity, or treatment protocols.

The adverse-effect profile differed significantly between the two agents. Nausea and vomiting occurred in 8% of tramadol-treated patients but were absent in the dexmedetomidine group (p=0.041). Conversely, hypotension (10%) and bradycardia (14%) occurred only with dexmedetomidine. Similar findings have been reported by Mittal G et al.[14] and Singla et al.[15]. Furthermore, a recent meta-analysis of 13 randomized controlled trials involving 864 patients confirmed that dexmedetomidine significantly reduces nausea and vomiting but increases the risk of hypotension and bradycardia compared with tramadol.

Overall, the present findings demonstrate that both tramadol and dexmedetomidine are effective treatments for post-spinal anaesthesia shivering. While their efficacy was comparable, dexmedetomidine offered the advantage of fewer gastrointestinal adverse effects at the expense of increased bradycardia and hypotension. Therefore, drug selection should be individualized according to the patient's haemodynamic status and clinical risk profile.[14–16]

CONCLUSION

Both intravenous tramadol (0.5 mg/kg) and dexmedetomidine (0.5 μg/kg) were effective in the treatment of post-spinal anaesthesia shivering, with comparable efficacy in achieving rapid cessation of shivering. Although dexmedetomidine showed a numerically shorter time to shivering control, the difference was not statistically significant. Dexmedetomidine was associated with a higher incidence of bradycardia and hypotension, whereas tramadol produced more nausea and vomiting. Therefore, both agents are suitable therapeutic options for post-spinal anaesthesia shivering, and the choice of drug should be individualized based on the patient's haemodynamic status and risk of adverse effects.

Limitations

This study was conducted at a single tertiary care centre with a relatively small sample size, which may limit the generalizability of the findings. Only patients with ASA physical status I and II undergoing elective surgery under spinal anaesthesia were included; therefore, the results may not be applicable to high-risk patients or emergency surgical procedures. In addition, long-term postoperative outcomes and patient satisfaction beyond the intraoperative period were not evaluated.

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