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Original Research Article

COMPARISON OF PROPHYLACTIC DOSE OF TRAMADOL AND DEXAMETHASONE IN PREVENTING SHIVERING IN PATIENTS UNDERGOING SUBARACHNOID BLOCK

BUTT MR[1*], JAVED HM[1], ASHFAQ MA[1], IQBAL A[1], ZAHID MM[2], KHALID M[1]

[1]*Department of Anesthesiology, Aziz Bhatti Shaheed Teaching Hospital, Gujrat, Pakistan*
[2]*Department of surgery, Aziz Bhatti Shaheed Teaching Hospital, Gujrat, Pakistan*
**Correspondence author email address: noorbutt32@gmail.com*

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Abstract: *This study aimed to assess the prophylactic efficacy of Tramadol and Dexamethasone in preventing shivering following spinal anesthesia. A total of 162 patients aged 18 to 60, with ASA physical status I or II, undergoing various surgical procedures, were randomly assigned to receive intravenous normal saline (Group C), intravenous tramadol at a dose of 1 mg/kg (Group T), or intravenous dexamethasone at a dose of 0.1 mg/kg (Group D). The occurrence of shivering, its impact, and the onset of dizziness, nausea, and perspiration were documented. Baseline demographics, body temperature, type of operation, sensory blockade level, duration of surgery, and anesthesia were comparable among patients. Shivering was observed in 42 out of 162 patients (25.92%). Shivering occurred in 24 patients in the placebo group, 11 in Group D, and 7 in Group T. A statistically significant difference was found between Group T and Group C ($p = 0.004$). However, there was no significant difference between Group T and Group D ($p = 0.771$). Hallucination was reported in 1 patient (1.85%) in Group T. In conclusion, tramadol at a dose of 1 mg/kg effectively reduces shivering induced by spinal anesthesia compared to a placebo. Nevertheless, our study did not find a statistically significant difference between intravenous tramadol at 1 mg/kg and intravenous Dexamethasone at 0.1 mg/kg.*

Keywords: Shivering, Spinal Anesthesia, Prophylaxis, Tramadol, Dexamethasone

Introduction

Patients undergoing spinal anesthesia commonly experience perioperative shivering, with an estimated incidence of 60% (Renaningtyastutik et al., 2022). Several factors contribute to the drop in body temperature, including the cool environment of the operating theater, impaired autonomic thermoregulatory control under general anesthesia, and the administration of cold intravenous fluids (Bindu et al., 2017). In addition to patient discomfort, shivering during the perioperative or postoperative period has significant physiological effects, such as a threefold increase in oxygen consumption, elevated intracranial and intraocular pressure, and heightened sympathetic activity (Yun et al., 2017). Furthermore, shivering can lead to surgical complications, incision stretching, displacement of blood clots, increased postoperative bleeding, and enhanced pain perception (Heravi, 2022).

One non-thermoregulatory cause of post-anesthesia shivering is stimulating the inflammatory response during surgery, producing cytokines that promote vasodilation and heat loss. Dexamethasone's anti-inflammatory properties may alleviate post-anesthesia shivering by reducing the temperature disparity between the skin and the core. Dexamethasone's regulatory effect on immunological reactions can also contribute to its anti-shivering effects (Layton et al., 2023).

Conversely, tramadol inhibits the reuptake of neurotransmitters such as noradrenaline and serotonin. Its anti-shivering effects are attributed to its actions in the noradrenergic and serotoninergic pathways. Moreover, tramadol possesses analgesic properties (Igweagu, 2014).

This study aimed to evaluate and compare the effectiveness of two intravenous medications, intravenous tramadol and intravenous dexamethasone, in reducing shivering commonly observed during spinal anesthesia.

Methodology

From June 2022 to March 2023, a randomized controlled trial was conducted at Aziz Bhatti Hospital in Gujrat. The hospital's review board approved the research project. One hundred sixty-two patients scheduled for elective surgeries under spinal

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anesthesia were randomly assigned to one of three groups. Group T received intravenous tramadol at 1 mg/kg, Group D received intravenous dexamethasone at 0.1 mg/kg, and Group C received 0.9% normal saline as a placebo. Each group consisted of an equal number of patients. Eligible patients were between 18 and 60 years old and classified as ASA physical status I or II. Patients with a history of ischemic heart disease, behavioral or psychological disorders, epilepsy, glaucoma, or allergies to the research drugs were excluded. Patients with 36.5 or 38.0 degrees Celsius baseline body temperatures were also excluded.

Before spinal anesthesia, patients were seated, and the procedure was performed using a 27-gauge spinal needle in the L3-L4 or L4-L5 interspaces with an aseptic technique. Spinal anesthesia was achieved using a mixture of 12.5 mg (2.5 ml) of 0.5% hyperbaric bupivacaine and 25 micrograms of fentanyl. After spinal anesthesia, patients in Groups D, T, and C received intravenous doses of Dexamethasone 0.1 mg/kg, tramadol 1 mg/kg, and normal saline, respectively. Additional oxygen at a rate of 6 liters per minute was delivered through a simple face mask during and after the surgery. The operating room was maintained at a constant temperature of 18 to 20 degrees Celsius. Sensory level and regression time were assessed using pinprick testing, while the motor block was evaluated using the modified Bromage scale. The desired motor and sensory blocks were defined as Bromage scale 3 and T6, respectively. Shivering was monitored at five-minute intervals for one hour during the procedure.

The shivering intensity was assessed using a scale: 0 indicated no shivering, 1 indicated piloerection without noticeable shivering, 2 indicated shivering in one muscle group, 3 indicated shivering in multiple muscle groups, and 4 indicated generalized shivering. The administered drugs had potential side effects, including hallucinations, nausea, vomiting, nystagmus, and sweating. Hallucinations were reported when patients experienced imaginary sights, sounds, smells, tastes, or sensations. Patients experiencing nausea and vomiting received intravenous metoclopramide at 10 milligrams. Patients were observed in the recovery area for thirty minutes, during which the observer monitored the specified parameters while remaining unaware of the study drugs. The incidence of adverse drug reactions and shivering within the first 60 minutes after drug administration was examined using the Chi-square test. Differences between groups were analyzed using ANOVA with Bonferroni correction. Statistical analysis was performed using SPSS version 21, with a significance level of $p < 0.05$.

Results

There were 162 patients in the experiment. The mean age of the group was 51.45 ± 11.25 years. The total number of males in the study population was 108 (Figure 1). Each group had fifty-four patients full filling the inclusion criteria. Information on demographics is shown in Table 1. The three groups did not differ in terms of age, gender, ASA categorization, or kind of procedure, as shown in following Figure 2.

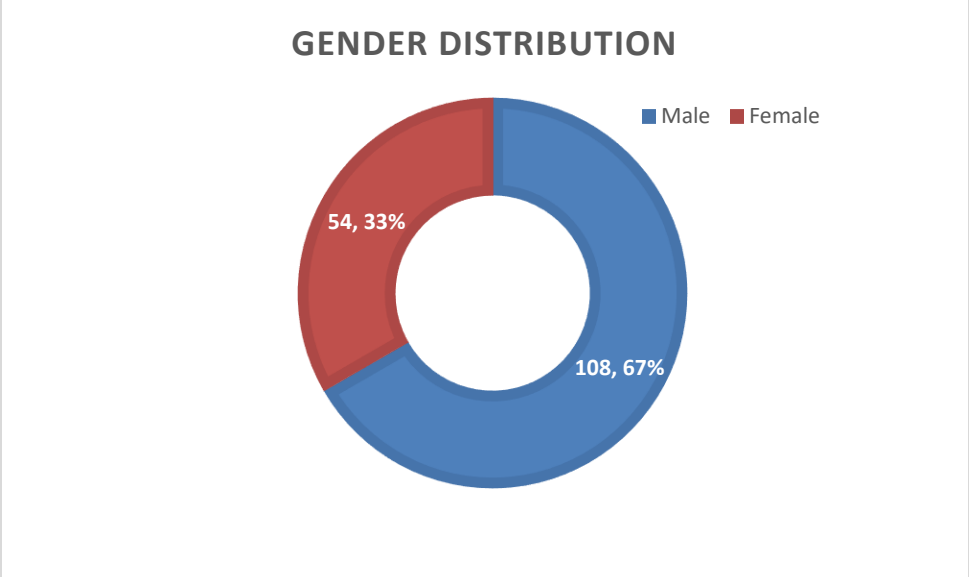

Figure 1 Gender distribution of the study population

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Table 1Demographic details:

Variables	Groups		
	Group D (n=54)	**Group T (n=54)**	**Group C (n=54)**
Age (Years)	48.7±12.3	51.3±12.7	54.9±13.8
Gender (n, %)			
Male	32(59.25)	36(66.66)	40(74.04)
Female	22(40.74)	18(33.33)	14(25.92)
ASA (n, %)			
Class I	15(27.77)	29(53.70)	34(62.96)
Class II	39(72.22)	25(46.29)	20(37.04)

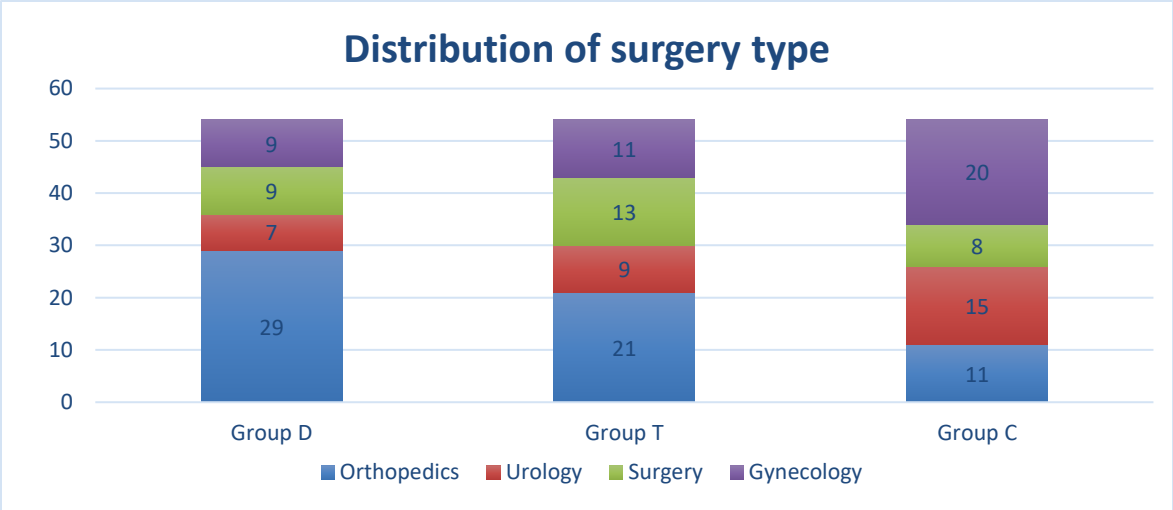

Figure 2 Distribution of surgery type in the study population

25.92 percent (42/162) of the patients experienced shivering. As shown in Table 2, the placebo group had 44.44% of patients experiencing shivering during the first 60 minutes of observation, followed by Group A with 20.37% and Group B with 12.96%.

Table 2 Comparison of shivering between the groups

Shivering	Group D	Group T	Group C	Total
Yes	11(20.37)	7(12.96)	24(44.44)	42(25.92)
No	43(79.63)	47(87.04)	30(55.55)	120(74.08)

According to a later analysis, the difference between Group B and Group C was statistically significant (p = 0.004). When Group A and Group B were examined statistically, there was no difference between them (p = 0.771). No patients showed Grade 4 shivering, according to the study in Table 3.

Table 3 Grading of shivering among patients

Grades (n, %)	Group D	Group T	Group C	Total
Grade 4	0 (0)	0 (0)	0 (0)	0 (0)
Grade 3	3(5.55)	1(1.85)	4(7.40)	8(4.93)
Grade 2	3(5.55)	2(3.70)	12(22.22)	17(10.49)
Grade 1	5(9.25)	4((7.40)	8(14.81)	17(10.49)

Five, nine, and two patients in groups A, B, and C reported experiencing nausea and vomiting. Table 4 demonstrates that none of the sweating, nausea, and vomiting outcomes were statistically significant.

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Table 4 Comparison of side effects

Side Effects	Group D	Group T	Group C	P-value
Nausea/Vomiting	5(9.25)	9(16.66)	2(3.70))	0.456
Hallucination	0 (0)	1(1.85)	0 (0)	0.354
Sweating	4(7.40)	7(12.96)	0 (0)	0.329
Nystagmus	0 (0)	0 (0)	0 (0)	0.643

Discussion

Shivering, an involuntary rhythmic contraction of skeletal muscles, is a common response to hypothermia (Blondin and Haman, 2018). Disturbances in thermoregulatory control can cause hypothermia due to anesthesia, a cold operating room environment, and surgical factors leading to significant heat loss. Prompt management of hypothermia is crucial as it is a medical emergency (McSwain et al., 2015). Intraoperative hypothermia triggers shivering as a thermogenic response to restore normal body temperature, irrespective of the underlying cause. Tramadol, a synthetic opioid, exhibits varying degrees of temperature regulation. Its mechanism of action involves inhibiting the reuptake of serotonin and norepinephrine in the spinal cord, resulting in enhanced serotonin release (Flecknell et al., 2015). Baldo and Rose have reported that tramadol exerts anti-shivering effects through its actions on kappa opioids and alpha-2 adrenoceptors (Baldo and Rose, 2020). Previous studies have demonstrated the efficacy of tramadol doses ranging from 0.5 to 3 milligrams per kilogram in reducing postoperative shivering (Avais et al., 2022; Khan et al., 2022). Shivering incidence with tramadol has been reported between 8.8% and 16% in previous research (Beck et al., 2020). In our study, the incidence of shivering with tramadol was 12.96%, consistent with prior findings. Prophylactic administration of 1 mg/kg tramadol significantly reduced shivering compared to normal saline.

In a study by McSwain et al., examining patients undergoing cardiopulmonary bypass under general anesthesia, dexamethasone (0.3-0.6 mg/kg) effectively prevented postoperative shivering (McSwain et al., 2015). Our study observed a shivering incidence of 20.37% with dexamethasone, despite using a lower dose (0.1 mg/kg) to maintain efficacy with minimal adverse effects. This aligns with the findings of our study. Another randomized controlled trial conducted by Asaad et al. investigated ENT surgery patients under general anesthesia using 0.15 mg/kg dexamethasone to reduce postoperative shivering, consistent with our study's outcomes (Asaad et al., 2011). According to our study, tramadol demonstrated a slight advantage over dexamethasone in preventing postoperative shivering. However, it was associated with a slightly higher incidence of side effects such as nausea and vomiting, consistent with the results reported by G Alice Vinathi (Vinathi and Latha, 2018). In our placebo group, 44% of participants experienced at least one episode of shivering, which is comparable to the incidence reported by Sagir et al. (reference) at 55% in their control group. One limitation of our study was the lack of core temperature monitoring. However, the axillary temperature can be a surrogate measure without significant core temperature variations.

Conclusion

Compared to the placebo group, the 1mg/kg tramadol efficiently reduces shivering brought on by spinal anesthesia. However, when we compared it to IV 0.1 mg/kg dexamethasone, we were unable to detect a statistically significant difference in terms of lowering shivering in patients receiving spinal anesthesia; however, Dexamethasone had fewer adverse effects than tramadol.

Conflict of interest

The authors declared the absence of a conflict of interest.

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