

Prophylactic Tramadol versus Dexmedetomidine for Prevention of Shivering during Spinal Anaesthesia

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Abstract

Introduction: Shivering is a frequent and distressing complication of spinal anesthesia. It is not only unpleasant to the patient but also delays recovery by increasing oxygen consumption and aggravating pain.

Aim: To compare tramadol and dexmedetomidine in prevention of shivering during spinal anesthesia and also to compare their adverse reactions.

Patients and Methods: 60 American Society of Anesthesiologists I and II adults undergoing lower limb surgeries under spinal anesthesia were allocated into Group T and Group D, who received intravenous (IV) tramadol 1 mg/kg and IV dexmedetomidine 0.5 µg/kg respectively 5 min prior to subarachnoid block. Perioperative incidence and grade of shivering, level of sedation, hemodynamic parameters, and adverse reactions like pruritus, nausea/vomiting were recorded.

Results: The incidence of shivering was highest at 30 min, 60 min in Group T (6.6%), and at 120 min in Group D (10%). But there was no statistically significant difference between the incidence of shivering in the two groups at any point in time. Intraoperative sedation scores were significantly higher in Group D at 30 min and in Group T at 45 min till the post-operative period. The incidence of side effects was lower in Group D.

Conclusion: Dexmedetomidine may emerge as an alternative to tramadol for prophylaxis of postspinal shivering in short duration cases, with a better sedation profile and fewer adverse effects.

Keywords: Dexmedetomidine, Shivering during spinal anesthesia, Tramadol

INTRODUCTION

Shivering is common in as many as 40-60% of patients undergoing spinal anaesthesia.^{1,2} Shivering, apart from causing discomfort to the patient increases oxygen demand, hampers patient monitoring, increases catecholamine levels subjecting the patient to a higher risk of cardiovascular complications and increases intracranial and intraocular pressure.¹⁻⁴

Various pharmacologic agents that have been used for prophylaxis and treatment of postspinal shivering range from opioids like fentanyl, tramadol⁴⁻⁸ meperidine,^{7,8} anticholinergics physostigmine, analgesic nefopam, N-methyl-d-aspartate (NMDA) receptor antagonist ketamine,⁸ and the latest being α_2 blockers clonidine⁹⁻¹² and dexmedetomidine.¹³⁻¹⁷

Tramadol has established its place in the management of postspinal shivering, and dexmedetomidine is being increasingly used for this purpose.

PATIENTS AND METHODS

After approval from institutional ethical committee and obtaining consent, 60 American Society of Anesthesiologists I and II patients aged between 18 and 60 and height 150-170 cm. Undergoing lower limb short surgical procedures were enrolled for this prospective, randomized double-blind cohort study.

Unwilling patients, pregnant patients, procedures requiring transfusion of blood or blood products, obese (body mass index >30 kg/m²) and those with established contraindications to spinal anesthesia were excluded from the study.

Patients having sensory block <T10, 15 min after subarachnoid block or having visual analogue scale (VAS) >6 intraoperatively were offered general anesthesia and excluded from the study.

Patients were randomly allocated into two groups. Patients of Group T ($n = 30$) received intravenous (IV) tramadol 1 mg/kg and patients of Group D ($n = 30$) received IV dexmedetomidine 0.5 μ g/kg, 5 min prior to subarachnoid block.

The operating room temperature was kept at $22^{\circ}\text{C} \pm 2^{\circ}\text{C}$. No preloading was done. IV fluids were administered at room temperature. Anesthetic equipment and emergency drugs were kept ready at hand. In the operating room, standard monitoring was done including level of consciousness, electrocardiogram, SPO_2 , respiratory rate and non-invasive blood pressure. A standard blanket was used to cover the patients, chest and upper limbs. Then the study drugs were injected 5 min prior to giving spinal anesthesia.

With all aseptic precautions, subarachnoid block was performed in L3-4 space in sitting a position, with 25 G disposable Quinke's spinal needle with 0.5% hyperbaric bupivacaine 15 mg at a rate of 0.2 ml/s.

The level of spinal block was determined by pinprick at the midaxillary line after 5 min following spinal anesthesia. When a block of T10 level was achieved, patients were prepared for operation.

All cases were screened for shivering if any, and graded with a five point scale validated by Crossly and Mahajan, where 0 = No shivering, 1 = piloerection or peripheral vasoconstriction but no visible shivering, 2 = muscular activity in only one muscle group, 3 = muscular activity in more than one muscle group, 4 = whole body shivering.

Level of sedation was assessed by a five point ordinal scale where 0 = Awake and alert, 1 = resting with eyes closed, 2 = drowsy and responsive to verbal stimuli, 3 = drowsy and responsive to physical stimuli, 4 = unarousable.

Perioperative nausea and vomiting were assessed using four-point ordinal scale where 0 = no nausea/vomiting, 1 = nausea, 2 = retching, 3 = vomiting. IV metoclopramide 10 mg was given as rescue drug for nausea, vomiting. The incidence of itching was also noted in both the groups.

All the data collected was analyzed using Chi-square test wherever applicable, $P < 0.05$ was considered significant.

Intraoperative fluid management was done in relation to body weight of the patient and intraoperative losses. All

patients were given oxygen by Hudson's face mask at a rate of 4 L/min. This monitoring continued in the post-operative period till 2 h after subarachnoid block. Recovery room temperature was at $22 \pm 2^{\circ}\text{C}$. The time for first post-operative analgesic was noted. We used it diclofenac 75 mg as analgesic. Adverse events like bradycardia (heart rate [HR] <50 bpm), hypotension (mean arterial pressure [MAP] <30% of pre-operative value), respiratory depression (respiratory rate <8/min), urinary retention were also noted and recorded.

RESULTS

Demographic parameters like age, body weight, height, pre-operative hemodynamic data and duration of surgeries were statistically comparable in each group (Table 1). HRs were significantly lower in Group D 15 and 30 min following spinal anesthesia (Table 2). However, there was no evidence of severe bradycardia (HR <50 bpm) or severe tachycardia (HR >100 bpm) in any of our patients. MAP was significantly lower in Group D than Group T till 60 min after spinal, but comparable thereafter (Table 3). There was no evidence of clinically significant hypotension in any of our patients.

There was no significant respiratory depression in any of our patients. Intraoperative SPO_2 was within normal range. All patients were normothermic during our procedure.

Regarding pain, none of our patients recorded VAS score more than 30 mm intraoperatively. The time of requirement

Table 1: Demographic and baseline hemodynamic parameters of patients

Characters	Group T (n=30)	Group D (n=30)	P value
Age (years)	38.1 \pm 6.4	36.6 \pm 8.1	0.4294
Height (cm)	161.2 \pm 9	160.5 \pm 9.7	0.7730
Weight (kg)	66.5 \pm 12.1	63.8 \pm 10.1	0.3520
MAP (mm Hg)	94.2 \pm 9	96.1 \pm 8.6	0.4066
HR (bpm)	78.4 \pm 3.4	78.6 \pm 2.7	0.8017
Duration of surgery (min)	54.2 \pm 6.2	52.1 \pm 8.1	0.2641

MAP: Mean arterial pressure, HR: Heart rate

Table 2: Perioperative HR at different intervals

	Group T	Group D	P value
Intraoperative			
0	78 \pm 3.4	78.6 \pm 2.7	0.0826
15	73.3 \pm 2.7	70 \pm 1.8	0.0001 s
30	70.1 \pm 2.3	68 \pm 2.1	0.0005 s
45	70.4 \pm 2.1	66.1 \pm 4.2	0.0001 s
60	69.6 \pm 3.1	68.2 \pm 3.8	0.1233
Post-operative			
90	69.2 \pm 0.95	68.1 \pm 2.1	0.137 s
120	70.2 \pm 1.5	70.1 \pm 3.1	0.8762

HR: Heart rate

of rescue analgesic was 150 ± 18.2 min in Group T and 156 ± 20.1 min in Group D.

Overall incidence of shivering was 9/60 (15%), mostly belonging to Grade 1. Only one patient in Group D had Grade 2 shivering 60 min following spinal anesthesia but subsided with the use of blanket. Rescue treatment for shivering was not required in any of our patients.

The incidence of shivering was highest at 30 min, 60 min in Group T (6.6%), and at 120 min in Group D (10%). But there was no statistically significant difference between the incidence of shivering in the two groups at any point in time (Table 4).

Intraoperative sedation scores were significantly higher in Group D at 30 min. Whereas the sedation scores were significantly higher in Group T at 45 min. And thereafter till the post-operative period (Table 5).

The HR and MAP were found to be significantly lower in Group D at 15, 30, 45 min intraoperatively (Tables 2 and 3), but none of the patients had bradycardia (HR <50 bpm) or hypotension (MAP <30% of pre-operative value).

The incidence of nausea, vomiting was significantly higher in Group T, with 20 patients having Grade 2, requiring treatment. Pruritus was complained by five patients in

Group T. Group D was devoid of these side effects (Table 6).

We did not come across any other adverse effect like bradycardia, hypotension, respiratory depression or urinary retention in any of our patients.

DISCUSSION

The incidence of shivering under regional anesthesia has been reported to be as high as 56%.^{1,3} The pharmacological armamentarium against shivering ranges from opioids like fentanyl, tramadol^{4,8} meperidine,^{7,8} anticholinergics physostigmine, analgesic nefopam, NMDA receptor antagonist ketamine,⁸ and the latest being $\alpha 2$ blockers clonidine^{10,11} and dexmedetomidine.^{13,16,17} The choice of agent depends on the sedative properties and the adverse effect profile of the drug, thereby facilitating early recovery and discharge of the patient.

Tramadol is a centrally acting opioid with predominant action over μ receptors and minimal action over ϵ , κ and δ receptors. It's antishivering properties are attributed to inhibition of reuptake of norepinephrine and serotonin, hence activating the descending inhibitory spinal pathways.

Dexmedetomidine acts by blocking $\alpha 2$ receptors at the locus ceruleus of the brainstem and spinal cord thus causing sedation and analgesia. The mechanism for antishivering and diuretic actions is yet to be established.

Table 3: Perioperative MAP at different intervals

	Group T	Group D	P value
Intraoperative			
0	94.2±9	96.1±8.6	0.4066
15	79.6±10.4	75.3±5.1	0.0466 s
30	78.6±8.2	72.1±8.8	0.0045 s
45	80.5±6.7	75.4±6.8	0.0049 s
60	87.1±6.3	82.6±7.2	0.0126 s
Post-operative			
90	90.1±5.2	87.1±6.8	0.5968
120	92.2±6.1	90.2±7.1	0.2467

MAP: Mean arterial pressure

Table 4: Perioperative shivering score at different intervals (number of patients expressed as per shivering score 0/1/2/3/4)

	Group T	Group D	P value
Intraoperative			
0	30/0/0/0/0	30/0/0/0/0	>0.05
15	30/0/0/0/0	30/0/0/0/0	>0.05
30	28/2/0/0/0	29/1/0/0/0	>0.05
45	29/1/0/0/0	28/2/0/0/0	>0.05
60	28/2/0/0/0	29/1/0/0/0	>0.05
Post-operative			
90	28/2/0/0/0	29/0/1/0/0	>0.05
120	28/2/0/0/0	27/3/0/0/0	>0.05

Table 5: Perioperative sedation score at different intervals (number of patients expressed as per sedation score 0/1/2/3/4)

	Group T	Group D	P value
Intraoperative			
0	30/0/0/0/0	29/1/0/0/0	>0.05
15	20/8/2/0/0	25/4/1/0/0	>0.05
30	20/10/0/0/0	18/12/0/0/0	<0.05
45	13/12/5/0/0	22/8/0/0/0	<0.05
60	22/8/0/0/0	30/0/0/0/0	<0.05
Post-operative			
90	20/9/0/0/0	30/0/0/0/0	<0.05
120	23/7/0/0/0	30/0/0/0/0	<0.05

Table 6: Incidence of nausea/vomiting and pruritus in different groups

Nausea/vomiting	Group T	Group D
Grade 0	6	30
Grade 1	4	0
Grade 2	20	0
Grade 3	0	0
Pruritus	5	0

In our study, the maximum incidence of shivering was 6.6% in Group T and 10% in Group D, with no significant difference between the two groups at any point in time.

Dexmedetomidine in a dose of 1 µg/kg was used for prevention of post-operative shivering by Karaman *et al.*¹⁴ as intraoperative infusion in patients undergoing general anesthesia. The incidence of shivering was 10% in the dexmedetomidine group as compared to 46.6% in the placebo group. The incidence of bradycardia requiring atropine was more (6.6%) in the dexmedetomidine group.

Bajwa *et al.*¹⁵ found that dexmedetomidine in a dose of 1 µg/kg decreased the incidence of shivering (5%) as compared to placebo group (42.5%) in patients undergoing laparoscopic surgery under general anesthesia. Dryness of the oral mucosa was the main side effect observed in 35% of patients.

Bozgeyik *et al.*¹⁷ compared the ability of preventing shivering of preemptive tramadol in a dose of 100 mg and dexmedetomidine in a dose of 0.5 µg/kg during spinal anesthesia. The dose of tramadol was not titrated as per weight. The shivering scores at 20 min were significantly lower in both tramadol and dexmedetomidine when compared to placebo. No comparison was done between the tramadol and dexmedetomidine group. There was no significant difference between the placebo, tramadol and dexmedetomidine group at 30 min and post-operatively. In our study, the incidence of shivering was not found to be significantly different between the tramadol and dexmedetomidine groups.

Bozgeyik *et al.*¹⁷ found their patients had higher sedation score at 5, 10, 15, 20, 30 min in the dexmedetomidine group. In our study sedation with dexmedetomidine was significantly more at 30 min whereas patients receiving tramadol remained more sedated in the post-operative period.

Bozgeyik *et al.*¹⁷ have not compared the hemodynamic parameters or the incidence of side effects. In our study, we found that the incidence of side effects was higher in tramadol group.

CONCLUSION

Dexmedetomidine and tramadol are comparable for prophylaxis of postspinal shivering. Though the hemodynamic profile remained more stable in patients receiving tramadol, no adverse hemodynamic events (MAP

<60 mm Hg or HR <30% of pre-operative value) were seen in patients receiving dexmedetomidine. The sedation scores were lower in most patients receiving dexmedetomidine and the duration of sedation shorter than tramadol. The incidence of adverse effects like nausea/vomiting and pruritus was higher in patients receiving tramadol.

Dexmedetomidine may emerge as an alternative to tramadol for prophylaxis of postspinal shivering in short duration cases, with a better sedation profile and fewer adverse effects.

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